DeKalb County
GEORGIA

April 26, 2019

TO: All Bidders under Invitation to Bid (ITB) No. 18-101031

FROM: Department of Purchasing and Contracting, DeKalb County, Georgia

ADDENDUM NO. 2

Invitation to Bid (ITB) No. 18-101031, South River Trail: Phase 5 (PI#0009029) is hereby amended as follows and all documents are incorporated herein by reference:

1. Bridge Foundation Investigation Report for South River Trail Phase 5: (PI#0009029) for Bridge No. 1 and Bridge No.2.
2. Special Provision 502 revises the Boardwalk description and unit of measure to linear foot.
3. Revised Plan Sheets (85 sheets) - See Revision Summary (Drawing 03-001) issued in this addendum for a list of plan revisions.
4. Bidder's Price Form is revised to (a) correct Boardwalk descriptions (Line Items 502-1200 and 502-1500); (b) change the unit of measure from MBM to LF; and (c) increase the quantities from 4 to 5 on Line Item 163-0300- Construction Exit and Line Item 165-0101 – Maint. of Const Exit.
5. **The County received the following questions pertaining to this ITB. The questions and resulting answers appear below:**

   A. Question 1: There are a number of 14' pile sets on boardwalks #2 & #3. The Stringer Selection Table on sheet 38-0002 does not list 14' span stringer sizes. What stringer sizes would apply to these spans?

   B. **Answer:** Use the 18'-0" MAXIMUM SPAN L STRINGER SIZE for all spans over 12'-0" to 18'-0" maximum, as noted in the Stringer Selection Table on Drawing No. 38-0002.

   C. Question 2: There seems to be a lot of undercut excavation and rock fill. Will DeKalb County quantify and add to the bid or should we estimate add to grading complete?

   Answer: Bid all items necessary for Grading Complete, Lump Sum.

   D. Question 3: Who is responsible for repairing existing sewer line issues?

   Answer: See Bridge and Boardwalk notes and Special Provision Section 154 Vibration Monitoring for contractor responsibilities for construction near existing sewer lines. If the comment refers to current existing sewer line problems, please notify DeKalb County.

CH

E. Question 4: There are random patches of riprap on the project. Please clarify their purpose

Answer: Rip rap is shown at pipe outlets, ditch outlets, and under Boardwalk 2. In addition, Bridge Plans include rip rap quantities.

F. Question 5: Are the prefab bridges Corten steel or painted?

Answer: The type of structural steel for the pre-engineered bridge trusses is noted in Special Provision 534, paragraph 534.3.A.

6. It is the responsibility of each Bidder to ensure that he or she is aware of all addenda issued under this ITB.

7. Please sign and return this addendum with your bid submittal. You may call Beverly D. Williams, Sr. Procurement Agent, at 404-371-3648 before the bids are due to confirm the number of addenda issued.

8. All other conditions remain in full force and effect.

Beverly D. Williams
Beverly D. Williams, CPPO, CPPB
Sr. Procurement Agent
Department of Purchasing and Contracting

ACKNOWLEDGMENT

Date: _____

The above Addendum is hereby acknowledged:

_____
(Company Name)

_____
(Printed Name of Bidder's Authorized Signer)

_____ _____
(Signature of Bidder's Authorized Signer) (Title)

bdw: CH

DEPARTMENT OF TRANSPORTATION

STATE OF GEORGIA

INTERDEPARTMENTAL CORRESPONDENCE

FILE	CSTEE-0009-00(029), DeKalb County PI No. 0009029 South River Trial Phase 5 – Bridge No. 1	**OFFICE** **DATE**	Materials and Testing Forest Park, Georgia August 8, 2018

MONICA L. FLOURNOY A.A.A

FROM Monica L. Flournoy, P.E., State Materials Engineer

TO Kimberly Nesbitt, State Program Delivery Administrator
Attn: Mark Lawing, Project Manager

SUBJECT **Acceptance of Consultant's Bridge Foundation Investigation Report**

As requested, we have reviewed the Bridge Foundation Investigation Report that was written on June 22, 2018, and revised on July 26, 2018, by ECS Southeast, LLP of Marietta, Georgia. This Report is acceptable for use. Copies of this Report should be forwarded to the appropriate Offices by the Project Manager.

The consultant should provide a PDF of the accepted Report to this Office.

If additional information is needed, please contact Nicolas Sotolongo of the Geotechnical Bureau at 404-608-4729 (Direct) or 404-608-4720 (Main).

MLF: GEF: NLS

cc: Bill DuVall, P.E., State Bridge and Structural Engineer
Attn: Lyn Clements, P.E., Assistant State Bridge and Structural Engineer
Clayton Bennett, P.E., State Bridge Maintenance Engineer
Kathy Zahul, District Engineer, Chamblee
Christopher Raymond, Area Engineer, Chamblee
Robert Barnes, P.E., (RBarnes@ecslimited.com)
Jay Hornsby, P.G., (Jhornsby@ecslimited.com)

ECS Southeast, LLP

Report of Bridge Foundation Investigation

South River Trail Phase 5 – Bridge No. 1

DeKalb County, Georgia

CSTEE-0009-00(029)

P.I. No.: 0009029

ECS Project Number 10:9672

July 26, 2018
Revision No. 2

July 26, 2018
Revision No. 2

Mr. Jonathan McCaig
Path Foundation
1601 W. Peachtree Street
Atlanta, GA 30309

Reference: BFI Report – Bridge No. 1 over Unnamed Tributary
South River Trail Phase 5
DeKalb County, Georgia
P.I. No.: 0009029

ECS Project No. 10:9672

Dear Mr. McCaig:

ECS Southeast, LLP (ECS) is pleased to submit this revised Bridge Foundation Investigation (BFI) Report for the site referenced above. The attached report has been revised to incorporate the comments we received back from the Georgia Department of Transportation Office of Materials and Testing (OMAT) in their review correspondence dated July 11, 2018 as well as a follow up phone conversation with Mr. Nicolas Sotolongo of the OMAT Geotechnical & Environmental Bureau on July 26, 2018.

Thank you for the opportunity to provide geotechnical engineering services on this project. Should you have questions regarding our findings or need additional consultation, please do not hesitate to contact our office.

Sincerely,

ECS SOUTHEAST, LLP represented by:

Jay Hornsby, P.G.
Geotechnical Department Manager

Robert H. Barnes, P.E., P.G.
Principal Engineer
GA Registration No. 29715

Enclosure: BFI Data Form

Bridge Foundation Investigation (LRFD), Br. 1
CSTEE-0009-00(029), DeKalb County
PI No. 0009029
July 26, 2018
Revision No. 2

LOCATION (See Map) South River Trail Phase 5 over Cobbs Creek, Bridge No. 1. Bridge No. 1 consists of a 50-feet long pre-engineered pedestrian bridge over unnamed tributary #1. The bridge will be supported by two end bents (Bents 3 and 4). The approach to the bridge on both sides is boardwalk supported by Bents 1, 2, 5, and 6.

GENERAL INFORMATION

GEOLOGIC FORMATION Mica Schist/ Gneiss/ Amphibolite (pms3a) Formation of the Georgia Piedmont Region.

SUBSURFACE FEATURES The subsurface is comprised of various layers of: silty sand, sandy lean clay, and sand with silt overlaying partially weathered rock and bedrock.

Partially weathered rock (PWR) was noted at:

Bent	Boring	Elevation
Bent 3	B-13	734

Refusal is a designation applied to any material which cannot be further penetrated by the power auger and is normally indicative of very hard or very dense material such as boulders, rock lenses, or the upper surface of bedrock.

Auger refusal was encountered at:

Bent	Boring	Elevation
Bent 3	B-13	732
Bent 4	B-14	728

Groundwater was noted in the borings at:

Bent	Boring	Elevation
Bent 3	B-13	744
Bent 4	B-14	741

For additional information see the boring layout and boring logs.

SITE CLASSIFICATION We recommend a site class of D per AASHTO LRFD 3.10.3.1.

1.0 -- FOUNDATION RECOMMENDATIONS

Bents	Pile Footing (Type)
3 & 4 (Bridge)	H-Pile
1, 2, 5, and 6 (Boardwalk)	Timber

1.1 -- PILE PROPERTIES

Bents	Pile Type	Pile Size (in)	Nominal Compression Stress (ksi)	Nominal Tension Stress (ksi)	Maximum Factored Structural Resistance (kips)
3 & 4 (Bridge)	HP (50 ksi)	10 x 42	45.0	45.0	310

1.2 -- DESIGN LOADS

Bents	Maximum Factored Strength Limit State Load (kips)	Maximum Factored Service Limit State Load (kips)	Factored Extreme Event I Limit State Load (kips)
3 & 4 (Bridge)	99.6	68.9	65.9
1 & 6 (Boardwalk)	16.7	10.3	7.2
2 & 5 (Boardwalk)	33.9	20.8	14.3

2.0 -- FOUNDATION LOADS

2.1 – PILE FOUNDATION LOADS

Bents	Pile Type	Size (in)	Driving Resistance (kips)*
3 & 4	H-Pile (50 ksi)	10 x 42	153
1 & 6	Timber	10	48[A]
2 & 5	Timber	10	97[A]

[A] Timber piles installed by vibration methods; unfactored Nominal Pile Bearing Resistance (NPBR) required.

3.0 -- FOUNDATION ELEVATIONS

Bents	Minimum Tip	Estimated Tip
Bridge		
3	733	731
4	729	725
Boardwalk		
1	733	730
2	730	728
5	729	725
6	731	725

4.0 -- GENERAL NOTES

Elevations All elevations are based on plans prepared by Heath & Lineback Engineers.

Waiting Period None required.

Theoretical Scour Appears feasible for the material encountered.

As Built Foundation Information The as built foundation information should be forwarded to the Geotechnical Engineering Bureau and DeKalb County upon completion of the foundation system.

Special Problems The construction of temporary access roads/ working pads may be required to get the construction equipment and materials into the site. Soft subgrades were noted during the site visit. Access to the bridge location may be inundated during parts of the year.

4.1 -- PILE FOUNDATION NOTES

PDO

Bents 3 & 4 - Driving resistance after minimum tip elevations are achieved in conjunction with Special Provision 520 Piling for LRFD and Special Provision 523 Dynamic Pile Testing.

Perform one PDA test at the following locations:

Bent	Location
3	Left
4	Right

*** Nominal Bearing Resistance of Single Pile**

Driving resistance for Bents 3 and 4 is based on the following field verification method and resistance factor φ_{dyn} AASHTO LRFD 2014 (10.5.5.2.3-1):

Resistance Determination Method	Resistance Factor
Driving criteria established by dynamic testing of at least two piles per site condition, but no less than 2% of the production piles.	0.65

Nominal bearing resistance for the timber piles at Bents 1, 2, 5 and 6 is based on a side resistance and end bearing factor, φ_{stat}:

Resistance Determination Method	Resistance Factor
Side Resistance and End Bearing: Clay and Mixed Soils (α-method)	0.35

Drivability

A drivability analysis for Bents 3 & 4 has been completed on the above mentioned piles to their respective estimated tips with a Junttan HHK 4A hammer system.

Pilot Holes

Layers of very dense PWR or rock may be encountered above minimum tip elevation at Bents 3. Drill Pilot Holes only when the minimum tip elevation specified in the Plans cannot be attained by normal pile driving. Refer to Special Provision Section 520 Modified – Piling.

Pre-drilling

Pre-drilling may be required to achieve the Minimum Tip Elevations for the timber piles at Bents 2 and 5. If pre-drilling is used, it should be to the following elevation, and may be adjusted by the Engineer during construction:

Bent	Elevation
2	730
5	729

No separate payment will be made if the Contractor chooses to use pre-drilling. The maximum diameter of the pre-drilled hole should be

determined from the following table:

Pile Size	Maximum Pre-Drill Hole Size
10“	8“

Points Pile points are recommended for each pile to be driven at Bents 3 and 4 to insure adequate penetration into very dense weathered rock.

Special Problems Erratic pile lengths can be expected.

5.0 – QA / QC

This Report of Bridge Foundation Investigation has been prepared in accordance with generally accepted geotechnical engineering practice and GDOT requirements for Bridge Foundation Investigations. No warranty is expressed or implied. Furthermore, ECS assumes no liability for any third party’s usage of this report and its attachments without express written consent.

The evaluations presented in this report are based on the available project information, as well as on the results of the exploration. Should a change in the project criteria be made such as the location of the new construction, ECS should be notified to evaluate the changes and make new recommendations if warranted.

ECS SOUTHEAST, LLP represented by:

Prepared By: _____ **Reviewed By:** _____

Robert H. Barnes, P.E., P.G.
GA PE Registration No. 29715

Jay Hornsby, P.G.

Attachments:

- Special Provision 520 Modified - Piling (Pilot Holes)
- Special Provision 520 Piling (Option to Pre Drill)
- Special Provision 520 Piling for LRFD
- Special Provision 523 Dynamic Pile Testing
- Figure 1 – Site Vicinity Map
- Figure 2 – Boring Location Plan and Profile Section
- Reference Notes for Borings
- Boring Logs (B-13, B-14)
- Lab Summary Sheet
- Driller’s Hammer Energy Rating Report (Diedrich D-50 ATV Rig SN 380)
- Seismic Site Class Calculations (B-13, B-14)
- Nominal Pile Driving Resistance Calculation Sheets (Bents 3 and 4)
- APile analysis (Bents 1 through 6)
- GRLWEAP analysis (Bearing Chart and Data Sheets, Drive Chart and Data Sheets)

Attachments

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

PROJECT NO. CSTEE-0009-00(29), DeKalb County
P.I. NO. 0009029

SECTION 520 MODIFIED—PILING

Delete Sub-Section 520.3.05.B and substitute the following:

520.3.05.B. Drill Pilot Holes

Drill Pilot Holes only when the minimum tip elevation specified in the Plans cannot be attained by normal pile driving. Remove the driven piles that did not reach minimum tip elevations prior to drilling pilot holes and cut off any damaged sections as directed by the Engineer prior to reuse. Include the cost of pile removal and cut off in the bid price for pilot holes.

When pilot holes are required, drill them to the diameter and approximate depth specified on the Plans.

Backfill voids and holes with Class A or better concrete. Furnishing and placing backfill concrete is an incidental part of the work.

The following are not considered pilot holes:

- Holes created by spudding (punching)
- Holes dug to drive piling that is too long to fit leads
- Holes dug to replace a template (if permitted)

Where pilot holes are required in granular material and the material cannot be sealed off using "mudding" drilling methods, drill the pilot hole as follows:

1. Place a casing pipe with a large enough diameter around the boring device.
2. Hold the casing in position until the pilot hole is completed and the pile driving progresses deep enough into the hard material to keep loose material out of the pilot hole.

The use of casing is incidental to the work.

Office of Materials and Testing

Revised: November 15, 2003

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

PROJECT NO. CSTEE-0009-00(29), DeKalb County
P.I. NO. 0009029

SECTION 520—PILING

Add the following to Subsection 520.3.05.G:

At the Contractor's option, predrilling may be used to loosen dense soil layers to assist in the installation of piling. To predrill, drill an auger into the ground to the required elevation at the pile location. It is not necessary to remove all material or to provide casing. Use one of the following maximum auger diameters corresponding to the pile size:

Timber Pile Size	**Maximum Pre-drill Auger Size**
10" (254 mm)	8" (203 mm)

There will not be any separate payment made for predrilling.

Office of Materials and Testing

DEPARTMENT OF TRANSPORTATION STATE OF GEORGIA

SPECIAL PROVISION

PROJECT NO. CSTEE-0009-00(29), DeKalb County

P.I. NO. 0009029

SECTION 520—PILING

Delete Sub-Section 520.3.05.D.1 and substitute the following:

520.3.05.D.1. Determine Driving Resistance
Drive piles in one continuous operation. Determine the driving resistance of the piling based on the method specified in the plans, which will be one of the following methods (a – c):

a. Upon completion of the dynamic pile testing in accordance with Special Provision Section 523. The pile bearing will be determined by computing the penetration per blow with less than ¼-inch (6-mm) rebound averaged through 12 inches (305 mm) each of penetration. When it is considered necessary by the Engineer, the average penetration per blow may be determined by averaging the penetration per blow through the last 10 to 20 blows of the hammer. In soft material the driving resistance may be determined, at the Engineer's discretion, after delaying driving operations and performing pile re-strikes.

b. Upon completion of the loading test in accordance with Sub-Section 520.3.05.D.2.

c. Shall not be used when driving pile to hard rock. Using FHWA-modified Gates Formula as provided below:

$R_{ndr} = 1.75 (E_d)^{0.5} \log_{10} (10N_b) - 100$ (kips) U.S units

$R_{ndr} = 7 (E_d)^{0.5} \log_{10} (10N_b) - 550$ (kN) S.I. units

Where:

R_{ndr} = nominal pile driving resistance measured during pile driving

E_d = developed hammer energy. This is the kinetic energy in the ram at impact for a given blow. If ram velocity is not measured, it may be assumed equal to the potential energy of the ram at the height of the

stroke, taken as the ram weight times the actual stroke (ft-lb for U.S units, kN-m for S.I. units)

N_b = Number of hammer blows for 1.0 inch of pile permanent set (blows/in)

These resistance formulas apply only when:

- The hammer has a free fall.
- The head of the pile is not broomed, crushed, spalled, or excessively crimped.
- The penetration rate is reasonably uniform.

Determining driving resistance by formula is not a Pay Item. Provide the facilities for determining driving resistance by formula as an incidental part of the work.

Once the driving resistance has been determined by one of the methods noted above, do not continue to drive piles if the Engineer determines that the piles have reached practical refusal. Practical refusal is defined as 20 blows per inch with the hammer operating at the highest setting or setting determined by the Engineer and less than ¼-inch (6-mm) rebound per blow. The Engineer will generally make this determination within 2 inches (51 mm) of driving. However, the Engineer will not approve the continuation of driving at practical refusal for more than 12 inches (305 mm). When the required pile penetration cannot be achieved by driving without exceeding practical refusal, use other penetration aids such as jetting, spudding, predrilling or other methods approved by the Engineer.

d. **Wave Equation:** Use the Wave Equation Analysis for Piles (WEAP) program to evaluate the suitability of the proposed driving system chosen from the methods noted above (including the hammer, follower, capblock and pile cushions) as well as to estimate the driving resistance to achieve the pile bearing requirements and to evaluate pile driving stresses. Use the WEAP program to show that the hammer is capable of driving to a driving resistance equal 130% (1.3 times) the driving resistance shown in the Plans without overstressing the piling in compression or tension and without reaching practical refusal.

   Perform the WEAP analysis with personnel who are experienced in this type work, and have performed this analysis on a minimum of 15 projects. Provide a list of the qualifications and experience of the personnel to perform the WEAP analysis for this Project.

   The Engineer may modify the scour resistance shown in the plans if the dynamic pile test is used to determine the actual soil resistance through the scour zone. Also, the Engineer may make modifications in scour resistance when the Contractor proposes drilling and/or jetting to reduce the soil resistance in the scour zone.

A minimum of two weeks prior to beginning any pile driving operations, submit to the Engineer for evaluation and approval the following information on all of the proposed pile driving system(s) to be used on the Project including but not limited to:

i. Items on Pile Driving Equipment Data Sheet
ii. Other information on the driving system required by the Engineer
iii. A WEAP program output indicating the approximate depth or elevation where the pile will achieve the bearing required
iv. Valid Driving Criteria.

Valid driving criteria is defined as having the required hammer having a hammer set greater than 3 blows per inch and less than 10 blows per inch at the driving resistance for that pile.

If WEAP analyses show that the hammer(s) will overstress the pile, modify the driving system or method of operation as required to prevent overstressing the pile. Resubmit the modified pile driving system information and WEAP program output to the Engineer for re-evaluation. Do not begin pile driving operations until the Engineer has approved the qualifications of the personnel, the WEAP program output, and the pile driving system(s).

Approval of the pile driving system(s) is also based on satisfactory field trials with dynamic pile testing. Obtain approval from the Engineer for the pile driving system(s) based on satisfactory field performance.

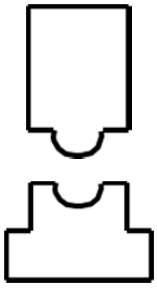
If piles require different hammer sizes, the Contractor may elect to drive with more than one size hammer or with a variable energy hammer, provided that the hammer is properly sized and cushioned, will not damage the pile, and will develop the required resistance.

For penetration of weak soils by concrete piles, use thick cushions and/or reduced stroke to control tension stresses during driving.

Pile Driving Data Form

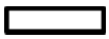
Contract ID:
PI Number:
County

Structure Name:
Structure No.:
Pile Driving Contractor:



Hammer

Manufacturer: _____ Model No. _____
Hammer Type: _____ Serial No. _____
Manufacturers Maximum Rated Energy: _____(ft-k)
Stroke at Maximum Rated Energy: _____(ft)
Range in Operating Energy: _____ to _____(ft-k)
Range in Operating Stroke: _____ to _____(ft)
Ram Weight: _____ (kips)
Modifications: _____



Striker Plate

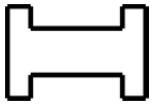
Weight: _____(kips) Diameter: _____(in)
Thickness: _____(in)

Hammer Cushion

Material 1
Name: _____
Area: _____(in^2)
Thickness/Plate: _____(in)
No. of Plates: _____

Material 2
Name: _____
Area: (in^2)
Thickness/Plate:_____(in)
No. of Plates: _____

Total Thickness of Hammer Cushion: _____(in)

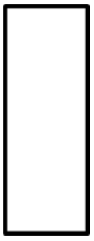


Helmet

Weight including inserts: _____(kips)

Pile Cushion

Material: _____
Area: _____(in^2) Thickness/Sheet: _____(in)
No. of Sheets: _____
Total Thickness of Pile Cushion: _____(in)



Pile

Pile Type: _____
Wall Thickness: _____(in) Taper: _____
Cross Sectional Area: ___(in^2) Weight/Meter: _____
Ordered Length: _____(ft)
Driving Resistance: _____(kips)
Description of Splice: _____
Driving Shoe/Closure Plate Description: _____

Submitted By: _____ Date: _____

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

PROJECT NO. CSTEE-0009-00(29), DeKalb County

P.I. NO. 0009029

SECTION 523 - DYNAMIC PILE TESTING

523.1 General Description

The work consists of performing dynamic pile testing using the Pile Driving Analyzer (PDA) to monitor the driving of piles with accelerometer and strain gauges attached to the piles. Piles to be dynamically tested will be identified in the Special Provision or on the Plans. Prior to pile driving, the Engineer will determine production or test piles to be dynamically tested. Perform the dynamic pile testing in accordance with ASTM D4945-12.

Take dynamic measurements during driving of any required piles. Drive the pile as shown in the Special Provisions or on the Plans.

523.2 Materials

Furnish measuring instruments for dynamic pile testing. Attach instruments near the top of the piles with bolts placed in drilled holes. Furnish materials, labor and equipment necessary for installation of the instruments.

523.3 Construction Requirements

Measure wave speed prior to driving piles. Wave speed measurements will not be required for Steel H piles or metal shell piles. When wave speed measurements are performed, place the piles in a horizontal position not in contact with other piles.

Perform dynamic pile testing during driving. Modify the driving to reduce the stress and/or eliminate the damage, should the recommended stress level be exceeded or if damage occurs (determined visually or as indicated by the instrumentation).

Do not exceed the following maximum driving stresses, as determined by the dynamic pile testing:

1. For Steel piles:

   0.9 Fy, where Fy = Yield strength of steel

2. For Prestressed Concrete Piles:

   Compression:

   $$\sigma_{dr} = (0.85f'_c - f_{pe})$$

   Tension in Normal Environments:

   $$\sigma_{dr} = (0.095\sqrt{f'_c} + f_{pe})$$

   Tension in Severe Corrosive Environments:

   $$\sigma_{dr} = \varphi_{da} f_{pe}$$

   where;
   σ_{dr} = maximum allowed driving stress, ksi
   f 'c= specified minimum 28-day compressive strength of concrete, ksi
   f pe= effective prestress in concrete, ksi, (after all losses) at the time of driving taken as 0.78 times the initial prestress force

Re-drive friction piles that do not obtain bearing after a freeze period of a minimum of 24 hours or for a period designated on the Plans, whichever is longer. Reset the gauges if required. Re-strike the pile with a warm hammer until a maximum penetration of 3 inches (76 mm) or 40 blows is reached, whichever occurs first. The Engineer may modify the Pile Driving Objective based on the results of the PDA work.

Provide two weeks' notice prior to the driving of designated piles and cooperate with the Engineer in connection with the performance of Dynamic Pile Testing.

Provide a complete report consisting of but not limited to PDA field monitoring data, results of CAPWAP computer analyses, and recommendations such as pile lengths, hammer fuel setting, and valid driving criteria. Valid driving criteria is defined as having the required hammer having a hammer set greater than 3 blows per inch and less than 10 blows per inch at the driving resistance for that pile. Submit the report electronically in PDF format and the electronic data files of the PDA analysis and CAPWAP to the Geotechnical Bureau and allow seven (7) calendar days for review and approval before proceeding with driving production piles.

523.4 Measurement

The Dynamic Pile Tests performed in accordance with these Specifications will be counted separately for payment. (Refer to plans summary sheet for the required amount of PDA testing.)

523.5 Payment

The Dynamic Pile Test completed and accepted will be paid for at the Contract unit Price. This payment will be full compensation for all costs of complying with this specification, including incidentals, additional work, and any delays incurred in conjunction therewith.

Payment will be made under:

Item No. 523. Dynamic Pile Test_____ . . . . . Per Each

Office of Materials and Testing

SITE LOCATION DIAGRAM		Figure No.: 1
BRIDGE FOUNDATION INVESTIGATION REPORT	Project No.: 10:9672	
South River Trail Phase 5 - Bridge 1 DeKalb County, Georgia	Not To Scale	
Reference: Google Earth	Date: 6/2018	

SOIL CLASSIFICATION LEGEND

- FILL - FILL (POSS/PROB) OF ALL TYPES
- GW - WELL GRADED GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GC - CLAYEY GRAVEL
- SW - WELL GRADED SAND
- SM - SILTY SAND
- SP - POORLY GRADED SAND
- SC - CLAYEY SAND
- ML - LOW PLASTICITY SILT
- CL - LOW PLASTICITY CLAY
- MH - HIGH PLASTICITY SILT
- CH - HIGH PLASTICITY CLAY
- OH - HIGH PLASTICITY ORGANIC SILTS AND CLAYS
- OL - LOW PLASTICITY ORGANIC SILTS AND CLAY
- PT - PEAT
- PWR - PARTIALLY WEATHERED ROCK
- SP-SM - SAND WITH SILT

SURFACE MATERIALS

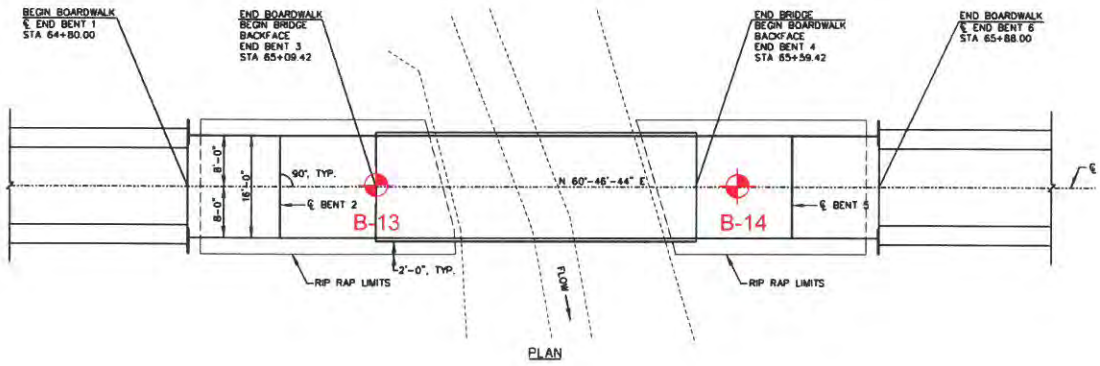
- TOPSOIL
- ASPHALT
- GRAVEL
- CONCRETE
- NR - NO RECOVERY

ROCK TYPES

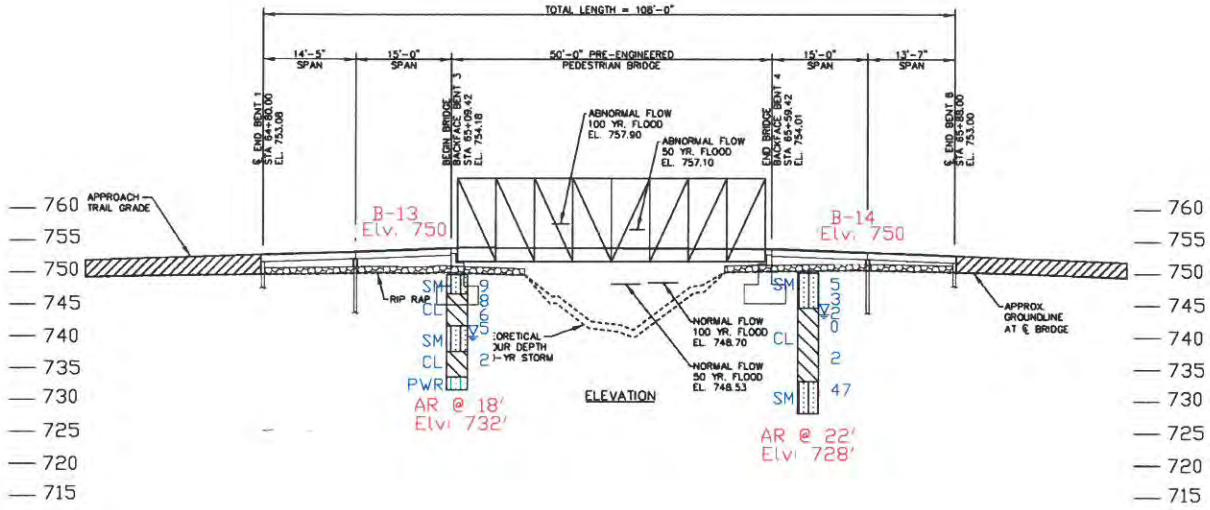
- IGNEOUS
- METAMORPHIC
- SEDIMENTARY

SYMBOL LEGEND

- WATER LEVEL
- WL BEFORE CASING REMOVAL
- WL AFTER CASING REMOVAL
- WL AFTER 24 HOURS
- APPROXIMATE BORING LOCATION
- B-X BORING DESIGNATION



PLAN



LEGEND

- Approximate Boring Location
- B-# Boring Designation

Note: N-values have been corrected with 94% ER.

NORTH

Graphic Scale 1"=30'

30 20 10 0 10 20 30

ECS	JOB NO.	10:9672	REVISIONS	FIGURE NAME: BORING LOCATION & PROFILE PLAN - Bridge No.: 1	PROJECT: South River Trail Phase 5	FIGURE NO.: 2
	SCALE	As Shown				
	DRAWN	CLJ				
	APPR. BY	RHB		REFERENCE: Preliminary Layout Bridge 1 Drawing No. 35-01 Heath & Lineback Engineers	PREPARED FOR: Path Foundation	
	DATE	5/21/2018				

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]	
	ASPHALT
	CONCRETE
	GRAVEL
	TOPSOIL
	VOID
	BRICK
	AGGREGATE BASE COURSE
	FILL[3] MAN-PLACED SOILS
GW	**WELL-GRADED GRAVEL** gravel-sand mixtures, little or no fines
GP	**POORLY-GRADED GRAVEL** gravel-sand mixtures, little or no fines
GM	**SILTY GRAVEL** gravel-sand-silt mixtures
GC	**CLAYEY GRAVEL** gravel-sand-clay mixtures
SW	**WELL-GRADED SAND** gravelly sand, little or no fines
SP	**POORLY-GRADED SAND** gravelly sand, little or no fines
SM	**SILTY SAND** sand-silt mixtures
SC	**CLAYEY SAND** sand-clay mixtures
ML	**SILT** non-plastic to medium plasticity
MH	**ELASTIC SILT** high plasticity
CL	**LEAN CLAY** low to medium plasticity
CH	**FAT CLAY** high plasticity
OL	**ORGANIC SILT or CLAY** non-plastic to low plasticity
OH	**ORGANIC SILT or CLAY** high plasticity
PT	**PEAT** highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS			
SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION		
DESIGNATION		**PARTICLE SIZES**
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS		
UNCONFINED COMPRESSIVE STRENGTH, Q_P[4]	**SPT[5] (BPF)**	**CONSISTENCY[7] (COHESIVE)**
<0.25	<3	Very Soft
0.25 - <0.50	3 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

GRAVELS, SANDS & NON-COHESIVE SILTS	
SPT[5]	**DENSITY**
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
Dual Symbol *(ex: SW-SM)*	10	10
With	15 - 20	15 - 25
Adjective *(ex: "Silty")*	≥25	≥30

WATER LEVELS[6]		
	WL	Water Level (WS)(WD)
		(WS) While Sampling
		(WD) While Drilling
	SHW	Seasonal High WT
	ACR	After Casing Removal
	SWT	Stabilized Water Table
	DCI	Dry Cave-In
	WCI	Wet Cave-In

[1] *Classifications and symbols per ASTM D 2488-09 (Visual-Manual Procedure) unless noted otherwise.*

[2] *To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.*

[3] *Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-**FILL**)].*

[4] *Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).*

[5] *Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf).*

[6] *The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.*

[7] *Minor deviation from ASTM D 2488-09 Note 16.*

[8] *Percentages are estimated to the nearest 5% per ASTM D 2488-09.*

CLIENT	JOB #	BORING #	SHEET
Path Foundation	10:9672	B-13	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
South River Trail Phase 5 Bridge 1	

SITE LOCATION: DeKalb County, GA

GDOT PROJ. #: CSTEE-0009-00(029)

STATION: 65+10, CL

P.I. #: 0009029

CALIBRATED PENETROMETER TONS/FT^2 (1 2 3 4 5+)

ROCK QUALITY DESIGNATION & RECOVERY
RQD% (20% 40% 60% 80% 100%) REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %

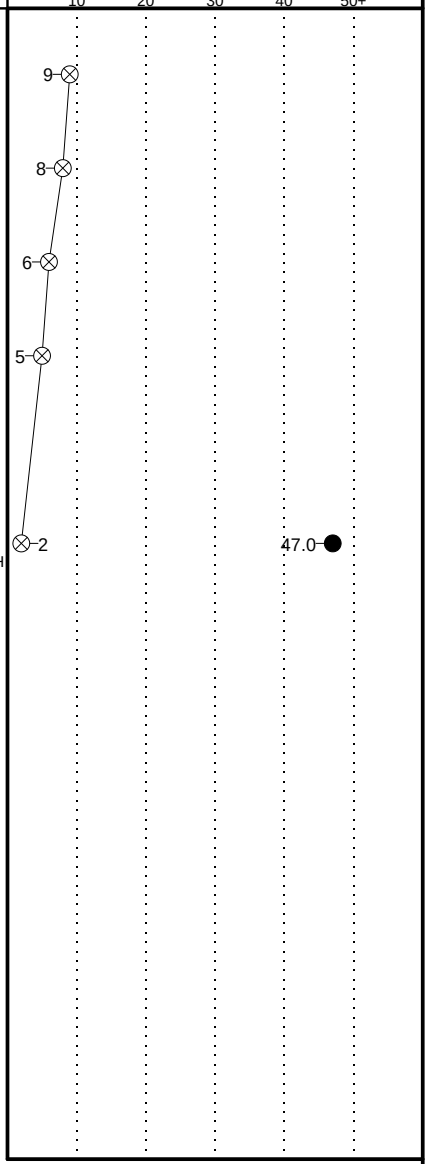
STANDARD PENETRATION BLOWS/FT (10 20 30 40 50+)

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 750

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [1"]		750	
	S-1	SS	18	18	(SM) SILTY SAND, contains mica and contains slight roots, brown, moist, loose			4 3 3
	S-2	SS	18	18	(CL) SANDY LEAN CLAY, contains mica, brown, moist, firm			3 2 3
5							745	
	S-3	SS	18	18				3 2 2
	S-4	SS	18	18	(SP-SM) SAND WITH SILT, contains mica, brown, wet, loose	▽		4 2 1
10							740	
	S-5	SS	18	18	(CL) SANDY LEAN CLAY, contains mica, brown, moist, very soft			1 1 WOH
15							735	
					(POSSIBLE PWR) POSSIBLE PARTIALLY WEATHERED ROCK - Hard drilling starting at 16'			
					AUGER REFUSAL @ 18'			
					*Note: Blows/6" are uncorrected field measurements. N-values shown have been corrected with 94% ER.			
20							730	
25							725	
30							720	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

▽ WL 9 WS ☐ WD ☒	BORING STARTED 05/11/18	
▽ WL(BCR) ▼ WL(ACR)	BORING COMPLETED 05/11/18	CAVE IN DEPTH
▽ WL	RIG Dietrich D-50 FOREMAN JD	DRILLING METHOD 2-1/4" Hollow Stem Auger

CLIENT	Job #:	BORING #	SHEET
Path Foundation	10:9672	B-14	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
South River Trail Phase 5 Bridge 1	

SITE LOCATION
DeKalb County, GA

GDOT PROj.#	STATION
CSTEE-0009-00(029)	65+65, CL

P.I. #
0009029

—○— CALIBRATED PENETROMETER TONS/FT^2

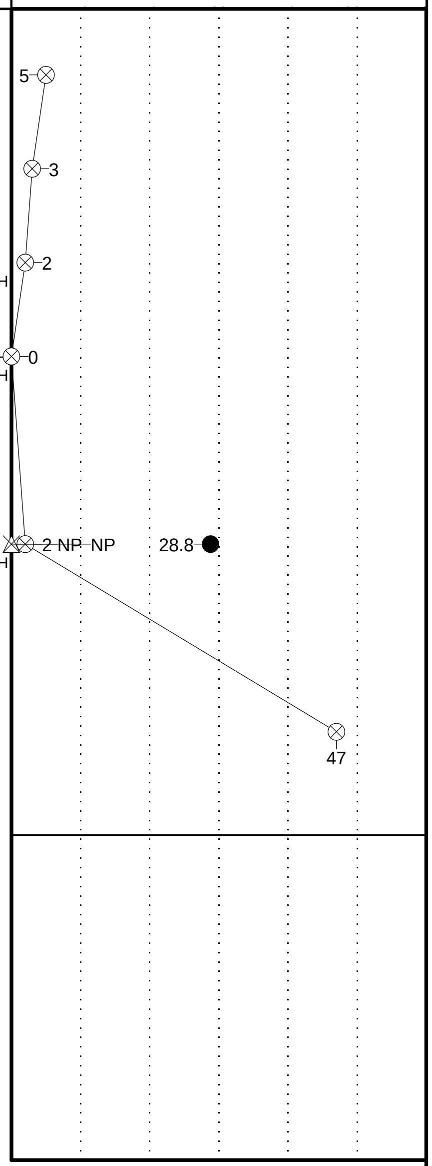
ROCK QUALITY DESIGNATION & RECOVERY
RQD% — — — REC% ———

PLASTIC LIMIT% ✕ — WATER CONTENT% ● — LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION
SURFACE ELEVATION 750

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [8"]		750	
	S-1	SS	18	18	(SM) SILTY SAND, contains mica and contains slight roots, brown, moist, very loose			2 2 1
	S-2	SS	18	18				1 1 1
5					(CL) SANDY LEAN CLAY, contains mica, brown to grayish brown, saturated, very soft	▽	745	
	S-3	SS	18	18				1 1 WOH
10	S-4	SS	18	18			740	1 WOH WOH
					(SM) SILTY SAND, grayish brown, saturated, very loose			
15	S-5	SS	18	18			735	2 1 WOH
					(SP-SM) SAND WITH SILT, contains mica, gray, moist, dense			
20	S-6	SS	18	18			730	5 11 19
					AUGER REFUSAL @ 22'			
					*Note: Blows/6" are uncorrected field measurements. N-values shown have been corrected with 94% ER.			
25							725	
30							720	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 6 WS ☐ WD ☒	BORING STARTED 05/11/18	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 05/11/18	HAMMER TYPE Auto
WL	RIG Dietrich D -50 FOREMAN JD	DRILLING METHOD 2-1/4" Hollow Stem Auger

Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-13												
	S-5	13.5 - 15.0	47.0	CL				86.7				
B-14												
	S-5	13.5 - 15.0	28.8	SM	NP	NP	NP	19.3				

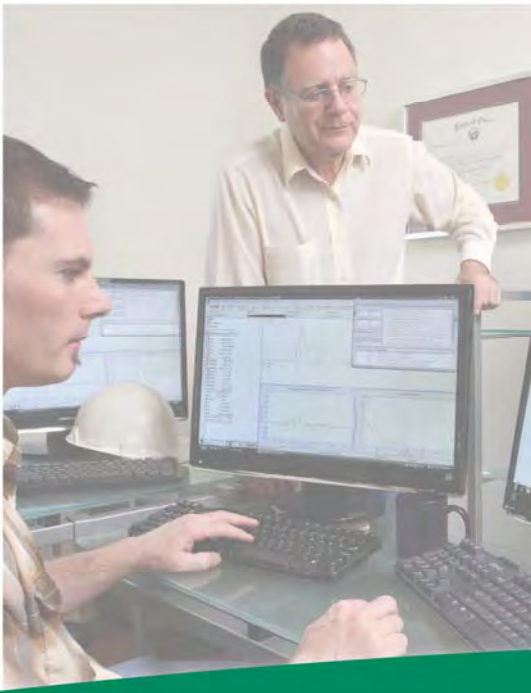
Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 10:9672

Project Name: South River Trail Phase 5 Bridge 1

ECS SOUTHEAST, LLP
1281 Kennestone Circle, NE, Suite 200
Marietta, GA 30066
Phone: (770) 590-1971
Fax: (770) 590-1975



GRL engineers, inc.

Dynamic Measurements and Analyses

Job No. 179031-1

Report on: Standard Penetration Test Energy Measurements
Jonesboro, GA

Prepared for Big Dog Geotech

By Thomas G. Hyatt, P.E. and Joel S. Webster, E.I.

June 20, 2017

www.GRLengineers.com info@GRLengineers.com

June 20, 2017

John Dodd
Big Dog Geotech
P.O. Box 928
Cumming, GA 30028

Re: Standard Penetration Test Energy Measurements
Jonesboro, GA GRL Job No. 179031-1

Dear Mr. Dodd,

This report presents results of energy measurements obtained on June 8, 2017 during Standard Penetration Tests (SPT) sampling. Two automatic hammers mounted on two separate Diedrich D-50 dill rigs that were tested generally following ASTM D4633-10 standards. All dynamic tests were performed on AWJ drill rods. GRL Engineers, Inc. obtained the dynamic measurements with an instrumented AW subsection that had AWJ adapters and a Model 8G Pile Driving Analyzer®. This report describes the testing procedures and summarizes the test results. Appendix A describes our measurement and analysis methods, Appendix B contains calibration information for the gages and equipment used, and Appendix C is a summary of the field data.

PURPOSE AND SCOPE OF WORK

At the request of Big Dog Geotech, GRL conducted SPT energy measurements in Jonesboro, GA according to ASTM D4633-10. Specifically, we recorded SPT energy measurements at five-foot sample intervals between 18.5 and 43.5 feet below the existing ground surface. SPT samples were taken every five feet from the ground surface until a boring depth of about 43.5 feet was reached. All SPT samples were driven for a total of 3 six-inch increments, or 1.5 feet.

EQUIPMENT

Drilling and SPT Hammer Equipment

Diedrich D-50 (Serial # 380)

SPT energy measurements were made on an automatic hammer mounted on a Diedrich D-50 drill rig. The drilling method used to advance the boring was hollow stem auger. Energy measurements for this drill rig were collected at a borehole located in Jonesboro, GA. SPT energy measurements were performed at 5-foot sampling intervals between 18.5 and 40.0 feet. A total of five energy measurement events were performed for this drill rig.

Diedrich D-50 (Serial # 404)

SPT energy measurements were made on an automatic hammer mounted on a Diedrich D-50 drill rig. The drilling method used to advance the boring was hollow stem auger. Energy measurements for this drill rig were collected at a borehole located in Jonesboro, GA. SPT energy measurements were performed at 5-foot sampling intervals between 18.5 and 43.5 feet. A total of six energy measurement events were performed for this drill rig. The SPT energy measurements performed from 33.5 to 40 feet did not meet the ASTM D4633-10 specifications for blow counts and were not considered in the calibration of this drill rig.

Instrumentation

A Model 8G Pile Driving Analyzer (PDA) data acquisition system (SN# 4613LE) was used to collect and process the dynamic measurements of force and velocity. The data was collected using a two foot long section of AW rod subsection (SN# 246AW) with a cross sectional area of 1.21 square inches and instrumented with two full bridge foil resistance strain gages and two piezoresistive accelerometers mounted in the midpoint location of the instrumented rod. Couplings were used to convert the threads from the AW rod subsection to the AWJ rod string.

Analog signals from the strain gages and accelerometers were conditioned, digitized, stored and processed with the PDA. The sampling frequency used during the SPT testing was 50 kHz. Selected output from the PDA for each recorded impact included the energy transfer ratio (ETR), maximum rod top velocity (VMX), maximum energy transfer (EFV), maximum rod top force (FMX), and the hammer operating rate (BPM).

MEASUREMENTS AND CALCULATIONS

FV Method (EFV)

Energy transfer to the PDA gage location, EFV, was computed by the PDA using force, F(t), and velocity, v(t), records as follows:

$$EFV = \int_a^b F(t) \cdot v(t) dt$$

The time "a" corresponds to the start of the record when the energy transfer begins, and "b" is the time at which energy transferred to the rod reaches a maximum value. The FV Method is currently recognized in ASTM D4633-10, and is the theoretically correct result; therefore, no other energy calculation methods are reported.

Corrected SPT number (N_{60})

While the primary purpose of SPT energy testing is to calculate the maximum transferred energy (ETR) of each hammer blow, the overall average EFV value can be used to calculate the corrected SPT number (N_{60}). To adjust the SPT N-values for hammer performance, the following correction as suggested by Seed for N-value adjustment to 60% transfer efficiency (e.g. 210 ft-pounds) was used:

Where:

N_{60} = Corrected N-value
E_m = overall average measured energy transfer (EFV)
N_m =number of blows for last 12 inches of sampler penetration

A general introduction to dynamic SPT testing methods is included in this report as Appendix A. References for more detailed descriptions of our testing and analysis methods are available upon request.

Any cross-sectional area difference between the GRL rod subsection and the drill rods, any loose connections or changes in area at section joints, or any cross-sectional area differences between the individual drill rod sections will result in stress wave reflections that can potentially influence the energy transfer. The EFV transferred energy calculation method, utilizing both force and velocity records, is theoretically correct and gives energy transfer results that are not adversely affected by cross-sectional area changes or loose connectors. The EFV results are included in Appendix C for all records collected and accepted after checking them for consistency.

RESULTS

Upon return to the office, the records collected by the PDA were checked for consistency and accuracy. For example, records from very weak startup or final impacts were not included in average results. Appendix C contains a representative plot of force and normalized velocity versus time, as well as tables of PDA results for all hammer blows at each dynamically monitored sampling depth. The results include the EFV (transferred energy by the FV method, as recommended by ASTM D4633-10), ETR (energy transfer efficiency for the EFV method), BPM (hammer operating rate), FMX (maximum rod top force) and VMX (maximum rod top velocity). The tables show statistical summaries for the final two 6 inch increments over which the SPT N value is calculated. At the end of each table is a statistical evaluation of these results which include the average and standard deviation.

$$N_{60} = \left(\frac{E_m}{210}\right) N_m$$

The table below and the summary tables in Appendix C summarize the average transferred energy values calculated by the EFV method. The records consist of averaged hammer blows from the last 12 inches (i.e. N value) at each dynamically monitored sampling depth. The "energy transfer ratio" (ETR) is defined as the ratio of maximum transferred energy EFV divided by the theoretical hammer potential energy of 350 ft-lbs (i.e., computed per the 140 lb SPT hammer and the standard 30 inch drop as specified by ASTM D1586-08). The average hammer operating rate is reported in blows per minute (BPM). A summary of the dynamic measurements of the energy transfer to the drill rods using the EFV equation is provided in the table below.

Drill Rig	Avg. EFV (ft-lbs)	Avg ETR (%)	Range of EFV (ft-lbs)	Range of ETR (%)
Diedrich D-50 SN 380	330	94	309 – 367	88 – 105
Diedrich D-50 SN 404	325	93	302 – 343	86 – 98

CONCLUSIONS

Based upon the dynamic test data obtained, the following conclusions are presented:

1. Loose connections in the drill string were sometimes observed in the force and velocity records. However, energy transfer values calculated using the EFV equation are not adversely affected by the connectors and therefore are considered a better indication of transferred energy.

2. Dynamic measurements of the transferred energy to the drill rods using the EFV equation ranged from 309 to 367 ft-lbs for the Diedrich D-50, SN 380 drill rig. This corresponds to a transfer efficiency ranging from 88 to 105% of the SPT hammer energy of 350 ft-lbs.

3. Dynamic measurements of the transferred energy to the drill rods using the EFV equation ranged from 302 to 343 ft-lbs for the Diedrich D-50, SN 404 drill rig. This corresponds to a transfer efficiency ranging from 86 to 98% of the SPT hammer energy of 350 ft-lbs.

4. The average transferred energy (EFV) and energy transfer ratio (ETR) for the Diedrich D-50 drill rigs tested was as follows:

   Diedrich D-50, SN 380: Average EFV = 330 ft-lbs; Average ETR = 94%

   Diedrich D-50, SN 404: Average EFV = 325 ft-lbs; Average ETR = 93%

Please review both ASTM D4633-10 and ASTM D1586-08 prior to applying these test results. The energy calibrations reported herein are valid for the same hammer/drill rig, with the same drill operator, same anvil dimensions, and same drilling methods.

We appreciate the opportunity to be of assistance to you on this project. Please contact our office should you have any questions regarding this submittal, require additional information, or if we may be of further service.

Sincerely,

GRL Engineers, Inc.

Thomas G. Hyatt, P.E.

Joel S. Webster, E.I.

TGH:JSW:dms

Appendix A

An Introduction into SPT Dynamic Pile Testing

APPENDIX A
AN INTRODUCTION INTO SPT DYNAMIC PILE TESTING

1. BACKGROUND

The Standard Penetration Test is frequently conducted as an in-situ assessment of soil strength. This test requires that a 140 lb weight is dropped 30 inches onto a drive rod at whose bottom a sampler is usually installed. The sampler is driven for 18 inches; the number of blows required for the last 12 inches of driving is the so-called N-value. The N-value may be used as a strength indicator for foundation design or as a means of assessing the liquefaction potential of soils.

Obviously, the SPT hammer efficiency is an important consideration when using the N-values for design purposes. Measurements have indicated that the energy in the drive rod is sometimes only 30% and and may reach 90% of the potential or rated energy of the SPT hammer (E-rated = 0.35 kip-ft or 0.475 kJ). The type of hammer used to drive the rod is the main reason for these variations. On the average, the energy in the drive rod is 60% of the standard rated energy.

Because of the variability of energy, methods based on N-values are considered unreliable. However, measurements during SPT testing using the Case Method can be done on a routine basis and these measurements yield the transferred energy values. With measured energy, EMX, known, an adjustment of the measured N-value, N_m, can be made as follows.

$$N_{60} = N_m [E_m / (0.6E_r)] \quad (1)$$

Thus, if the measured energy value is equal to the normally expected transferred energy of 60% of E-rated then the adjusted and measured N-values are identical. On the other hand, if the measured energy is only 30% then the adjusted blow count will be reduced by 50%.

2. DYNAMIC TESTING AND ANALYSIS METHODS APPLIED TO SPT

The Case Method of dynamic pile testing, named after the Case Institute of Technology where it was developed between 1964 and 1975, requires that a substantial ram mass (e.g. a pile driving hammer) impacts the pile top such that the pile undergoes at least a small permanent set. Thus, the method is also referred to as a “High Strain Method”. The Case Method requires dynamic measurements on the pile or shaft under the ram impact and then a calculation of various quantities. Conveniently, for SPT applications, the measurements and analyses are done by a single piece of equipment: the SPT Analyzer. The Pile Driving Analyzer® (PDA) is also suitable to perform these measurements and data processing.

A related analysis method is the “Wave Equation Analysis” which calculates a relationship between bearing capacity, pile stresses, transferred energy and field blow count. The GRLWEAP™ program performs this analysis and provides a complete set of helpful information and input data. This program can be used very effectively to simulate the SPT driving process.

3. MEASUREMENTS

GRL uses equipment manufactured by Pile Dynamics, Inc. The system includes either an SPT-Analyzer™ (SPTA) or a Pile Driving Analyzer® (PDA), an instrumented rod section and two accelerometers. SPT energy testing is very closely related to and borrows procedures from dynamic pile testing. Those interested in the basis of the SPT energy testing method may obtain extensive literature on dynamic pile testing from GRL Engineers, Inc.

3.1 SPT Analyzer or Pile Driving Analyzer

The basis for the results calculated by the SPTA or PDA are strain and acceleration measured in an instrumented rod section. These signals are converted to rod top force, F(t), and rod top velocity, v(t). The SPTA or PDA conditions, calibrates and displays these signals and immediately computes average pile force and velocity thereby eliminating bending effects. The product of these two

measurements is then integrated over time which yields the energy transferred to the instrumented section as a function of time (see Section 4.1).

For convenience and accuracy, strain measurements are usually taken on an instrumented section of SPT drive rod. Ideally, the section properties of the instrumented rod and those of the drive rod are the same, however, using subs, other sections can also be utilized.

For the instrumented section, PDI provides a force calibration in such a way that the output of the instrumented rod is directly calculated without the need for an accurate elastic modulus or cross sectional area of the rod section.

The acceleration measurements are often demanding in the SPT environment, because of high frequency and high acceleration motion components. An experienced measurement engineer, therefore, has to evaluate the quality of this data before final conclusions are drawn from the numerical results calculated by SPTA or PDA.

SPTA or PDA records are taken while the standard N-value is acquired in the conventional manner. This then allows a direct correlation between N-value and average transferred energy.

3.2 HPA

The SPT hammer's ram velocity may be directly obtained using radar technology in the Hammer Performance Analyzer™. The impact velocity results can be automatically processed with a PC or recorded on a strip chart. HPA measurements yield a hammer kinetic energy, but not the energy transferred to the drive rod.

4 RECORD EVALUATION BY SPTA OR PDA

4.1 HAMMER PERFORMANCE

The PDA calculates the energy transferred to the pile top from:

$$E(t) = {}_0\int^t F(\tau)v(\tau)\, d\tau \qquad (2)$$

The maximum of the E(t) curve is often called **ENTHRU or EMX;** it is the most important quantity for an overall evaluation of the performance of a hammer and driving system. **EMX** allows for a classification of the hammer's performance when presented as, e_T, the rated transfer efficiency, also called energy transfer ratio (**ETR**) or global efficiency.

$$e_T = EMX/E_R \qquad (3)$$

where E_R is the hammer manufacturer's rated energy value or 0.35 kip-ft (0.475 kJ) in the case of the SPT hammer.

Often in the SPT literature one finds also reference to the EF2 energy. This evaluation is based on assumed proportionality between force and velocity (see also Section 5):

$$v(t) = F(t) / Z \qquad (4)$$

where Z = EA/c is the pile impedance, E is the elastic modulus, A is the cross sectional area and c is the speed of the stress wave in the pile material..

Combining equations 2 and 4 leads to

$$EF(t) = {}_0\int^t F(\tau)^2 / Z\, d\tau \qquad (5)$$

The EF2 transferred energy value is the EF-value at the time t = 2L/c, where L is the drive rod length and c is the stress wave speed in steel (16,800 ft/s or 5,124 m/s). Since the force is easier to measure than both force and velocity, Equation 5 is preferred by some test engineers. However, the EF method is fraught with errors and certain correction factors have to be applied to make it approximately correct. Among the error sources are the following:

- Proportionality is often violated prior to time 2L/c. The proportionality between force and velocity in a downward traveling wave only holds if the wave does not encounter a disturbance prior to reflecting off the pile toe. Such disturbances include a change in cross sectional area, an open or loose splice or joint, or resistance along the shaft.

- Using only one force measurement precludes a data quality check based on the proportionality between force and velocity. Thus, a force measurement that is for some reason in error may not be detectable, which will lead to errors in the EF2 value. Data quality checks will be discussed further in Section 5.

The use if EF2 is therefore not recommended but it is often included in result presentations for the sake of completeness.

4.2 STRESSES

During SPT monitoring, it is also of interest to monitor compressive stresses at both the top of the drive rod and at its bottom.

At the pile top (location of sensors) the maximum compression stress averaged over the rod's cross section, **CSX**, is directly obtained from the measurements. Note that this stress value refers to the instrumented section. If the rod has a different cross sectional area then the stress in the rod will be different from CSX.

The SPTA or PDA can also calculate, in an approximate manner, the force at the rod bottom, **CFB**. To obtain the corresponding stress, this force value should be divided by the appropriate cross sectional area, e.g. by the rod area just above the sampler or by the sampler area itself. Of course, non-uniform stress components as they might occur at the sampler tip due to a sloping rock are not considered in this calculation.

5. DATA QUALITY CHECKS

Quality data is the first and foremost requirement for accurate dynamic testing results. It is therefore important that the measurement engineer performing SPTA or PDA tests has the experience necessary to recognize measurement problems and take appropriate corrective action should problems develop. Fortunately, dynamic pile testing allows for certain data quality checks because two independent measurements are taken that have to conform to the so-called proportionality relationship.

As long as there is only a wave traveling in one direction, as is the case during impact when only a downward traveling wave exists in the rod, force and velocity measured at its top are proportional

$$F = v\,Z \qquad (5)$$

where Z is again the pile impedance, Z = EA/c. This relationship can also be expressed in terms of stress

$$\sigma = F/A = v\,(E/c) \qquad (6)$$

or strain

$$\epsilon = \sigma/E = v / c \qquad (7)$$

This means that the early portion of strain times wave speed must be equal to the velocity unless the proportionality is affected by high friction near the pile top or by a pile cross sectional change not far below the sensors. Checking the proportionality is an excellent means of assuring meaningful measurements but is only truly meaningful for perfectly uniform rods. Open or loose splices, for example, will lead to a non-proportionality. For SPT rods it is fortunate that usually no soil resistance acts along the shaft and for that reason, proportionality can exist until the stress wave returns from sampler top or rod bottom unless connectors are not sufficiently tightened or have a significant mass.

Velocity data quality can also be checked by looking at the final displacement, DFN, which is calculated from the acceleration by double integration. If the calculated final displacement is much higher or lower than indicated by the N-value, the accelerometer attachment may be loose or the sensor may be faulty. If major drift in the velocity is observed, the EMX value may be in error, even though proportionality from impact to time 2L/c exists. In this case, it may be useful to evaluate the energy transferred to the drill rod at time 2L/c, which is calculated by the PDA or SPTA as the E2E quantity.

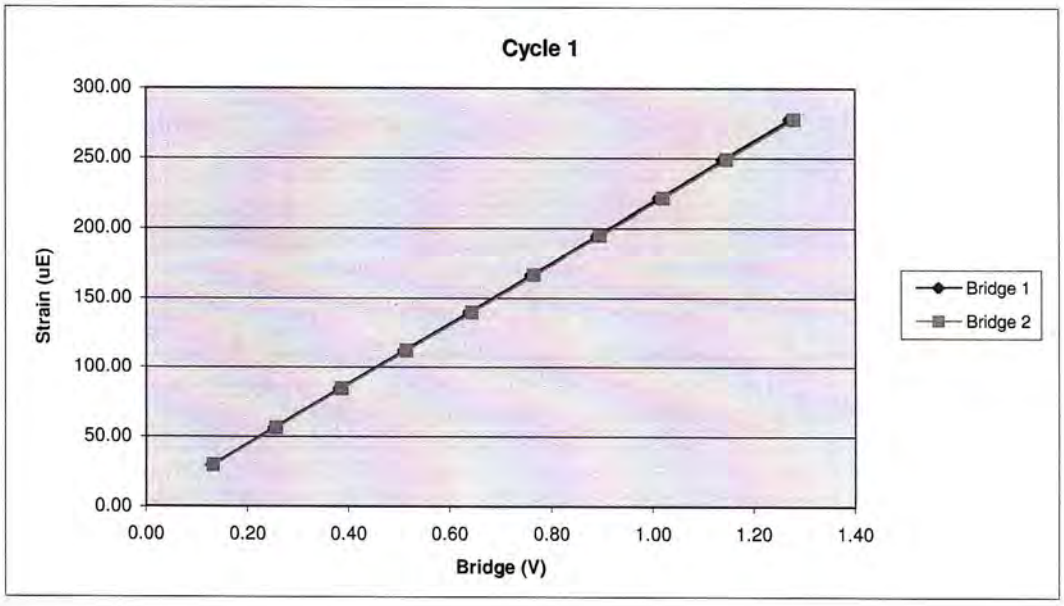
APPENDIX B

Instrumentation Calibration Information

246AW		Cycle 1		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	1020.02	29.76	0.13	0.13
3	1977.93	56.14	0.25	0.26
4	2989.67	84.55	0.38	0.39
5	3988.00	111.89	0.51	0.51
6	4987.71	139.46	0.64	0.64
7	5947.40	166.51	0.76	0.77
8	6957.75	194.61	0.89	0.90
9	7933.02	221.39	1.01	1.02
10	8932.33	249.03	1.14	1.15
11	9958.85	277.60	1.27	1.28

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7842.88**	**Force Calibration (lb/V)**	**7796.38**
Offset	-7.41	Offset	-16.71
Correlation	0.999996	Correlation	0.999997
Strain Calibration (µE/V)	**217.50**	**Strain Calibration (µE/V)**	**216.21**
Offset	1.21	Offset	0.95
Correlation	0.999996	Correlation	0.999996

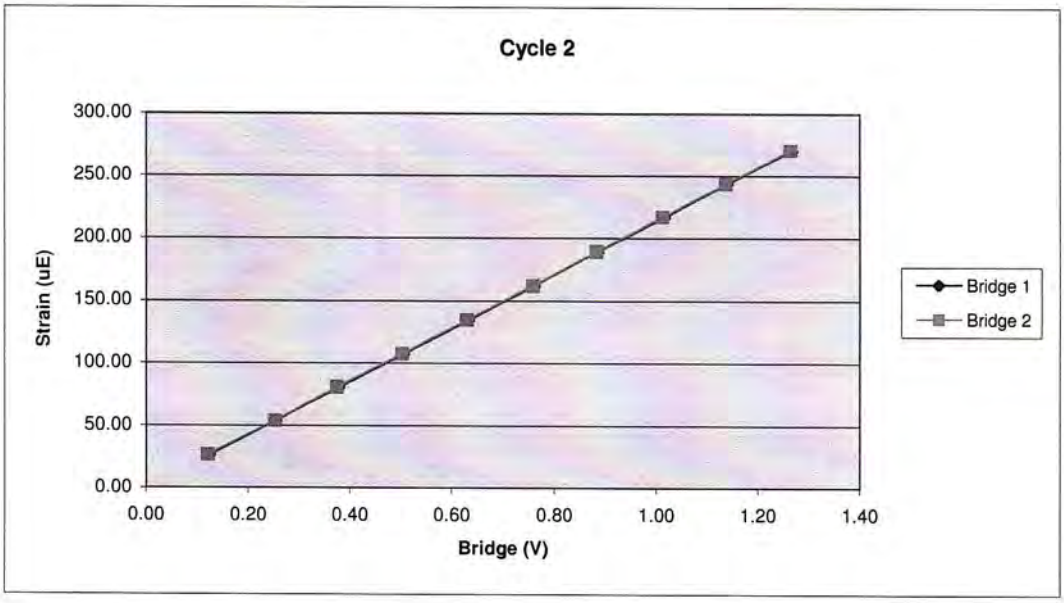
Force Strain Calibration	
EA (Kips)	**36058.95**
Offset	-51.11
Correlation	0.999998



246AW		Cycle 2		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	961.27	26.70	0.12	0.12
3	1979.31	53.83	0.25	0.25
4	2941.96	80.57	0.38	0.37
5	3940.88	107.53	0.50	0.50
6	4929.94	134.63	0.63	0.63
7	5938.33	162.08	0.76	0.76
8	6918.13	188.92	0.88	0.88
9	7937.16	216.87	1.02	1.01
10	8901.18	243.54	1.14	1.14
11	9907.20	270.51	1.27	1.26

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7830.35**	**Force Calibration (lb/V)**	**7828.10**
Offset	**-11.13**	Offset	**6.08**
Correlation	**0.999999**	Correlation	**0.999999**
Strain Calibration (µE/V)	**213.83**	**Strain Calibration (µE/V)**	**213.77**
Offset	**-0.22**	Offset	**0.25**
Correlation	**0.999995**	Correlation	**0.999995**

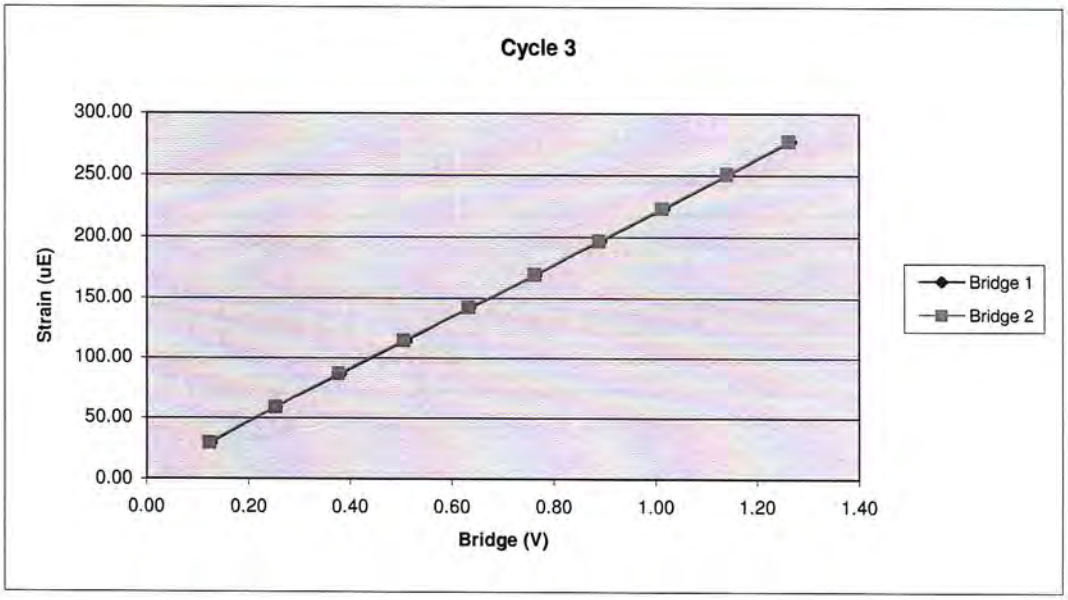
Force Strain Calibration	
EA (Kips)	**36618.79**
Offset	**-2.97**
Correlation	**0.999996**



246AW		Cycle 3		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	963.44	29.44	0.13	0.12
3	1974.38	59.00	0.25	0.25
4	2948.07	86.73	0.38	0.38
5	3962.57	114.52	0.51	0.50
6	4953.80	141.89	0.63	0.63
7	5954.69	169.40	0.76	0.76
8	6961.30	197.12	0.89	0.89
9	7923.95	223.39	1.02	1.01
10	8918.14	250.73	1.14	1.14
11	9891.83	277.64	1.27	1.26

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7827.06**	**Force Calibration (lb/V)**	**7833.29**
Offset	**-18.39**	Offset	**-0.33**
Correlation	**0.999998**	Correlation	**0.999997**
Strain Calibration (µE/V)	**216.63**	**Strain Calibration (µE/V)**	**216.81**
Offset	**3.77**	Offset	**4.27**
Correlation	**0.999969**	Correlation	**0.999967**

Force Strain Calibration	
EA (Kips)	**36128.27**
Offset	**-154.15**
Correlation	**0.999967**



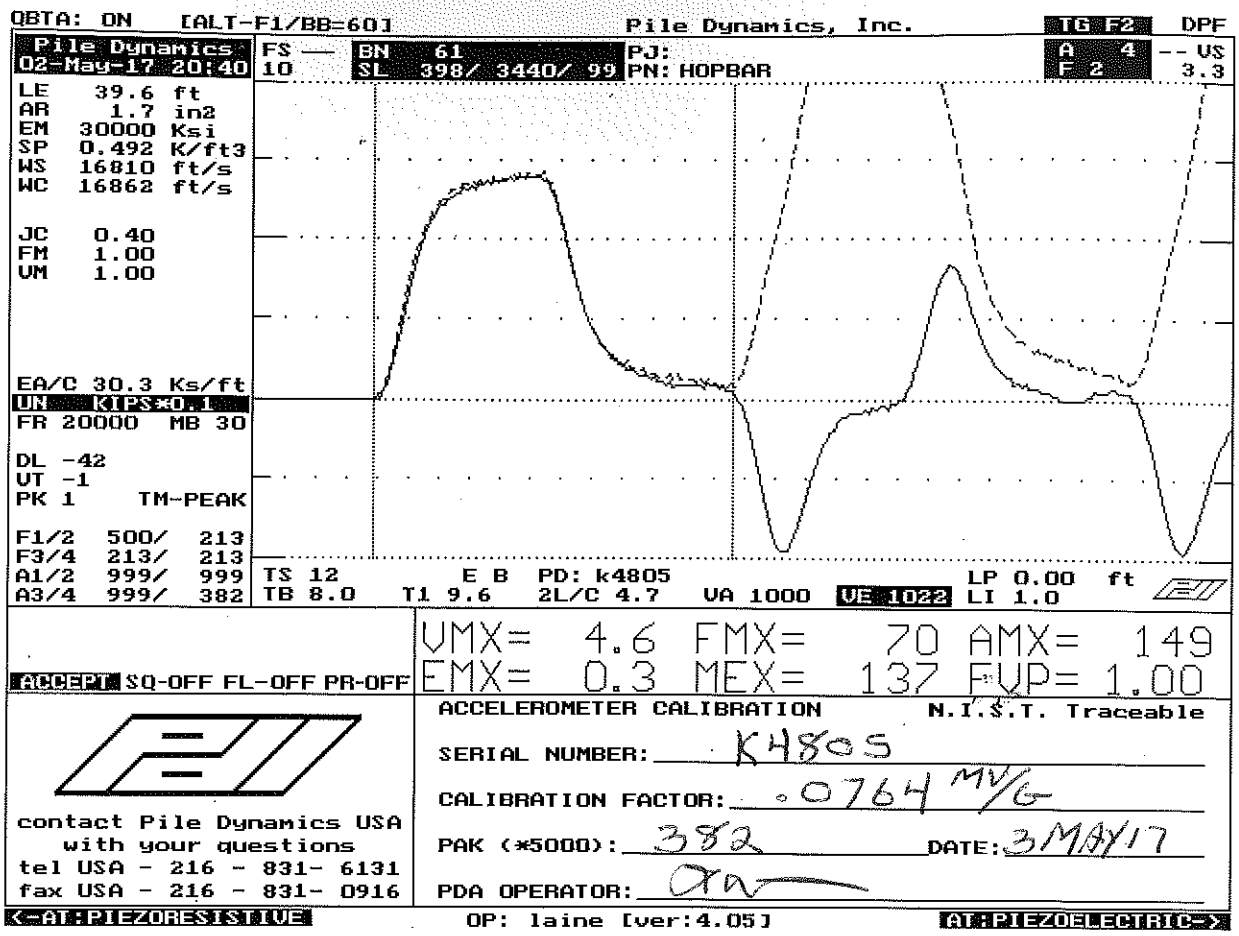
Bridge Excitation (V) 5
Shunt Resitor (ohm) 60.4k

Calibration Factors	246AW		
Bridge 1 (µE/V)	215.99	Bridge 2 (µE/V)	215.60
EA Factor (Kips)	36268.67	Area (in^2)	1.21

Calibrated by: David Bu
Calibrated Date: 9/22/2015

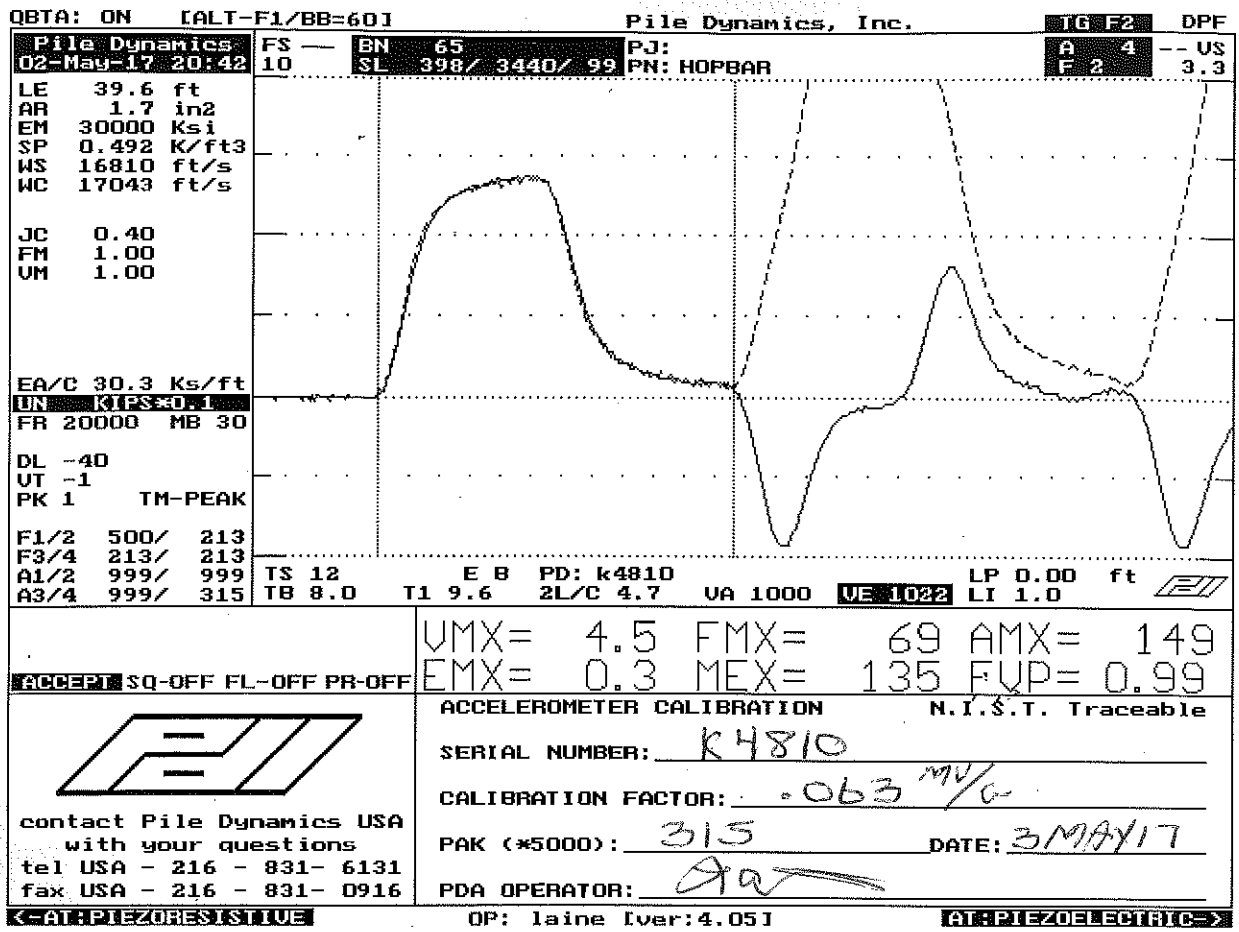
Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.



Smart Sensor

Smart Chip Programmed By A.M.W **on** 3MAY17 **CRC Value** BC78



Smart Sensor

Smart Chip Programmed By J.M.W. **on** 3MAY17 **CRC Value** 9E7A

Certificate of Calibration

Pile Dynamics, Inc. certifies that the

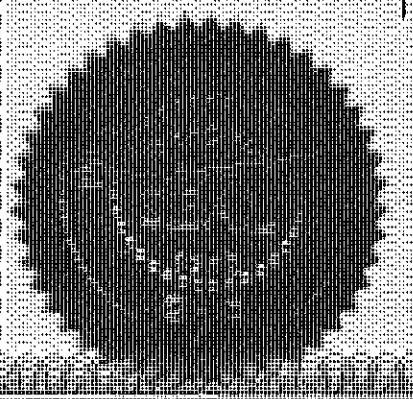
Pile Driving Analyzer®, Model 8G

Serial Number: 4613 LE

was calibrated on 4/14/2017

using a PDA Calibration Box whose output was calibrated with test equipment traceable to NIST.

This certificate is valid for 2 years from above date.



Tested by: [signature]

Pile Dynamics, Inc.
30725 Aurora Road
Cleveland, Ohio 44139 USA

PDCA
PILE DRIVING CONTRACTORS ASSOCIATION

Pile Dynamics, Inc.

This documents that

Thomas Hyatt
GRL Engineers, Inc.

has on January 26, 2017 achieved the rank of

MASTER

on the **Dynamic Measurement and Analysis Proficiency Test.**

The individual identified on this document demonstrated to the degree granted above an understanding of theory, data quality evaluation, interpretation and signal matching for high strain dynamic testing of deep foundations. ***It is recommended*** **that individuals at the Master level seek to attain Expert level through additional study within eight years of the date of this document**

The ability of the individual named to provide appropriate knowledge and advice on a specific project is not implied or warranted by the Pile Driving Contractors Association or Pile Dynamics, Inc. The Pile Driving Contractors Association or Pile Dynamics, Inc. assumes no liability for foundation testing and analysis work performed by the bearer of this certificate. This certificate can be verified at www.PDAproficiencytest.com.

Steven A. Hall, Executive Director
Pile Driving Contractors Association

Garland Likins, Senior Partner
Pile Dynamics, Inc.

No. 2182

Appendix C

SPT Calibration Results

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

Summary of SPT Test Results

Project: Diedrich D-50 Serial # 380, Test Date: 6/8/2017

FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated
DFN: Final Displacement
FVP: Force/Velocity Proportionality

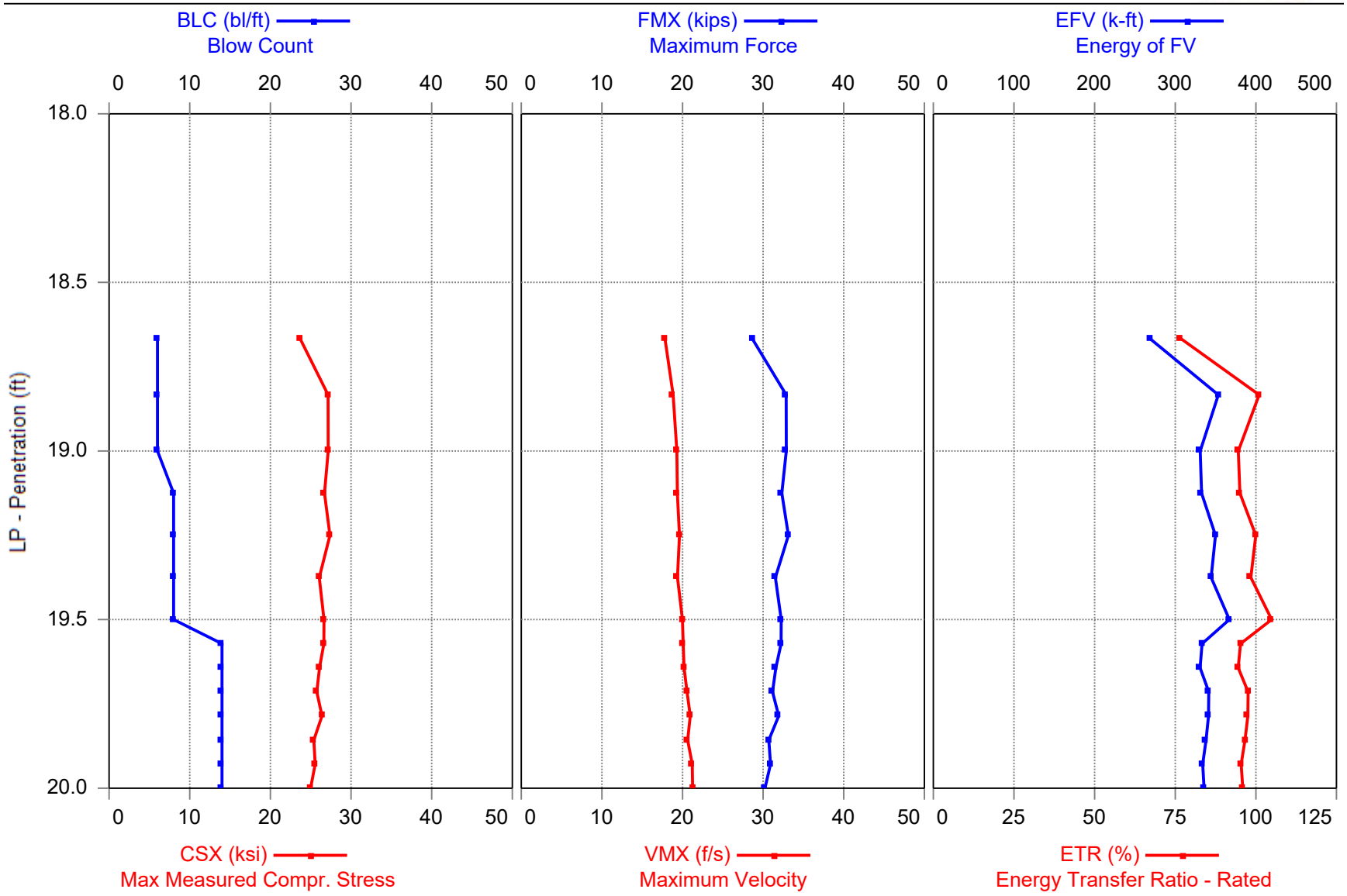
Instr. Length ft	Blows Applied /6"	Start Depth ft	Final Depth ft	**N Value**	**N60 Value**	Average FMX kips	Average VMX ft/s	Average BPM bpm	Average EFV ft-lb	Average ETR (%)	Average DFN in	Average FVP []
24.00	**3-4-7**	18.50	20.00	**11**	**17**	32	20.3	53.7	341	97.4	1.09	0.7
29.00	**5-6-14**	23.50	25.00	**20**	**31**	31	20.4	52.6	332	95.0	0.60	0.7
34.00	**6-8-12**	28.50	30.00	**20**	**31**	32	21.5	51.5	320	91.5	0.60	0.7
37.00	**2-5-10**	33.50	35.00	**15**	**23**	34	22.7	53.7	339	96.8	0.80	0.7
42.00	**5-3-6**	38.50	40.00	**9**	**14**	32	21.2	53.8	323	92.2	1.33	0.7
				Overall Average Values:		32	21.2	52.8	330	94.4	0.80	0.7
				Standard Deviation:		1	1.0	1.0	11	3.2	0.38	0.0
				Overall Maximum Value:		36	23.7	54.3	367	104.9	2.00	0.8
				Overall Minimum Value:		30	19.4	50.4	309	88.3	0.43	0.6

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-18.5-20



Diedrich D-50 SN380 - SS-18.5-20 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 24.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
3	19.0	6	AV3	26.0	31	18.7	318	91	36	2.93	2.00	0.74
			MAX	27.2	33	19.3	353	101	54	3.28	2.00	0.77
			MIN	23.7	29	17.8	268	77	2	2.56	2.00	0.70
7	19.5	8	AV4	26.7	32	19.6	349	100	54	1.91	1.50	0.76
			MAX	27.4	33	20.0	367	105	54	1.96	1.50	0.78
			MIN	26.1	32	19.4	333	95	53	1.83	1.50	0.74
14	20.0	14	AV7	25.8	31	20.7	336	96	54	1.31	0.86	0.68
			MAX	26.6	32	21.2	342	98	54	1.50	0.86	0.72
			MIN	25.0	30	20.1	331	95	54	1.22	0.86	0.64
			Average	26.1	32	19.9	336	96	50	1.83	1.29	0.71
			Maximum	27.4	33	21.2	367	105	54	3.28	2.00	0.78
			Minimum	23.7	29	17.8	268	77	2	1.22	0.86	0.64

Total number of blows analyzed: 14

Sensors

Blows: 1-14

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 14 seconds 10:07 AM - 10:07 AM BN 1 - 14

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

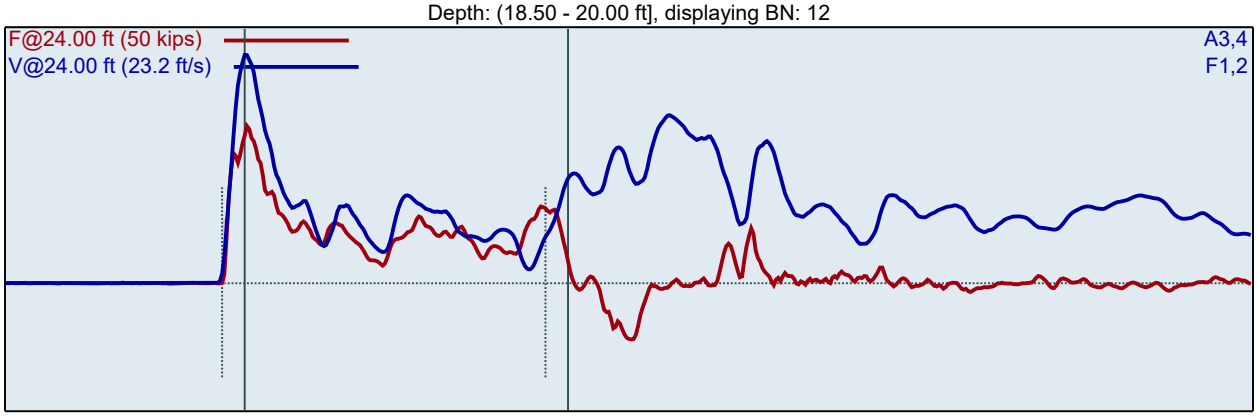
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 24.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (18.50 - 20.00 ft], displaying BN: 12



FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
1	3	18.67	29	17.8	1.9	268	76.7	2.00	0.7
2	3	18.83	33	18.8	53.7	353	101.0	2.00	0.7
3	3	19.00	33	19.3	53.2	331	94.6	2.00	0.8
4	4	19.13	32	19.4	54.1	333	95.0	1.50	0.8
5	4	19.25	33	19.6	53.2	350	100.0	1.50	0.8
6	4	19.38	32	19.4	53.6	345	98.4	1.50	0.8
7	4	19.50	32	20.0	53.6	367	104.9	1.50	0.7
8	7	19.57	32	20.1	53.5	333	95.2	0.86	0.7
9	7	19.64	32	20.2	53.8	331	94.5	0.86	0.7
10	7	19.71	31	20.6	53.7	342	97.6	0.86	0.7
11	7	19.79	32	21.0	54.0	341	97.5	0.86	0.7
12	7	19.86	31	20.6	53.7	338	96.6	0.86	0.6
13	7	19.93	31	21.2	53.5	334	95.4	0.86	0.7
14	7	20.00	30	21.2	53.7	336	95.9	0.86	0.6
		Average	32	20.3	53.7	341	97.4	1.09	0.7
		Std Dev	1	0.7	0.2	10	2.8	0.31	0.0
		Maximum	33	21.2	54.1	367	104.9	1.50	0.8
		Minimum	30	19.4	53.2	331	94.5	0.86	0.6
				N-value: 11					

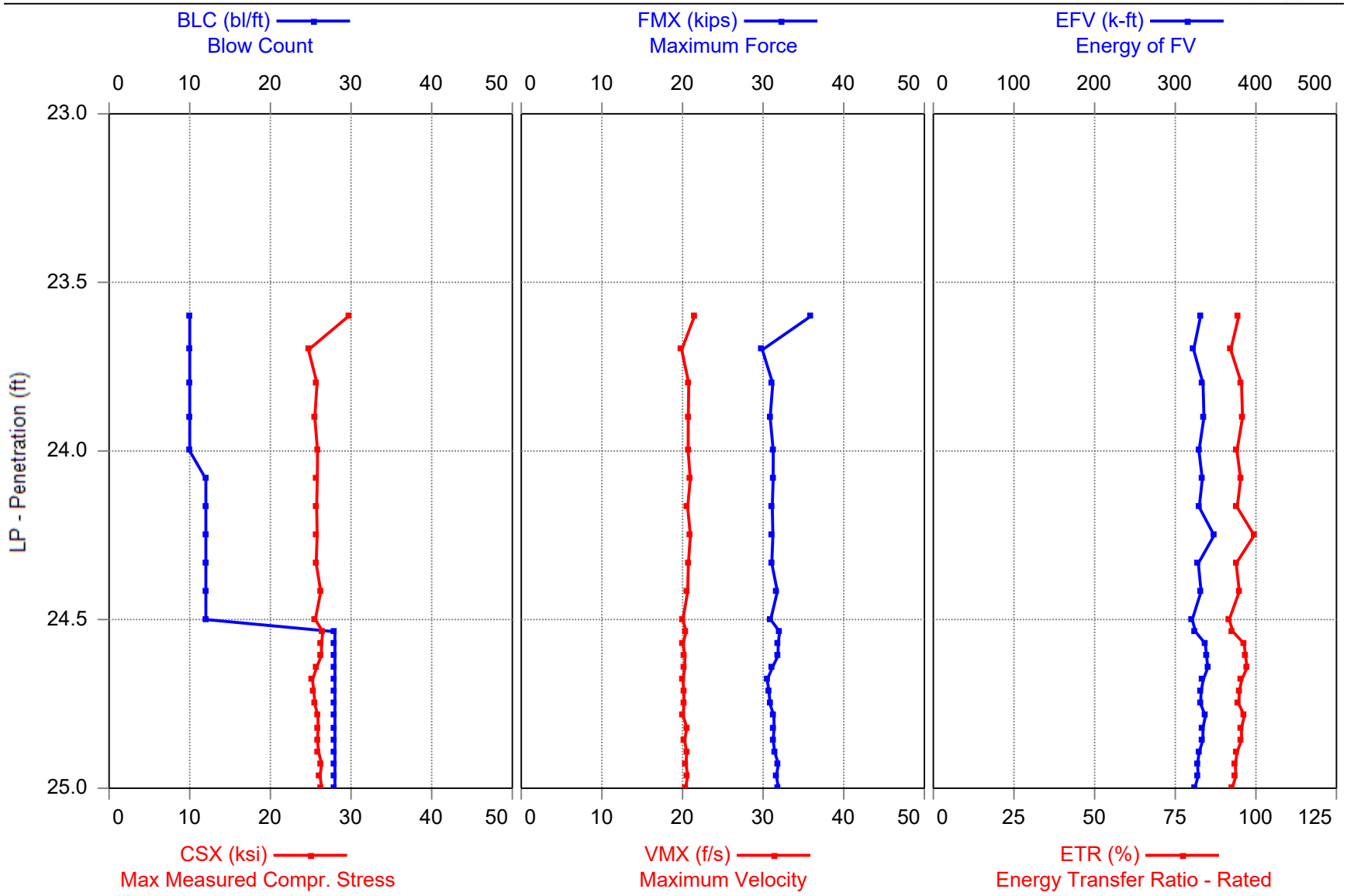
Sample Interval Time: 14.57 seconds.

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-23.5-25



Diedrich D-50 SN380 - SS-23.5-25 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 29.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
5	24.0	10	AV5	26.3	32	20.7	331	95	43	1.67	1.20	0.70
			MAX	29.7	36	21.5	336	96	55	2.28	1.20	0.75
			MIN	24.7	30	19.9	323	92	2	1.21	1.20	0.68
11	24.5	12	AV6	25.8	31	20.7	332	95	53	1.13	1.00	0.70
			MAX	26.2	32	21.0	348	99	53	1.40	1.00	0.70
			MIN	25.6	31	20.0	321	92	52	1.00	1.00	0.69
25	25.0	28	AV14	26.0	31	20.3	333	95	53	0.59	0.43	0.71
			MAX	26.5	32	20.6	340	97	53	0.76	0.43	0.72
			MIN	25.2	31	20.1	324	93	52	0.50	0.43	0.69
			Average	26.0	31	20.5	332	95	51	0.93	0.72	0.70
			Maximum	29.7	36	21.5	348	99	55	2.28	1.20	0.75
			Minimum	24.7	30	19.9	321	92	2	0.50	0.43	0.68

Total number of blows analyzed: 25

Sensors

Blows: 1-25

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 27 seconds 10:13 AM - 10:14 AM BN 1 - 25

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

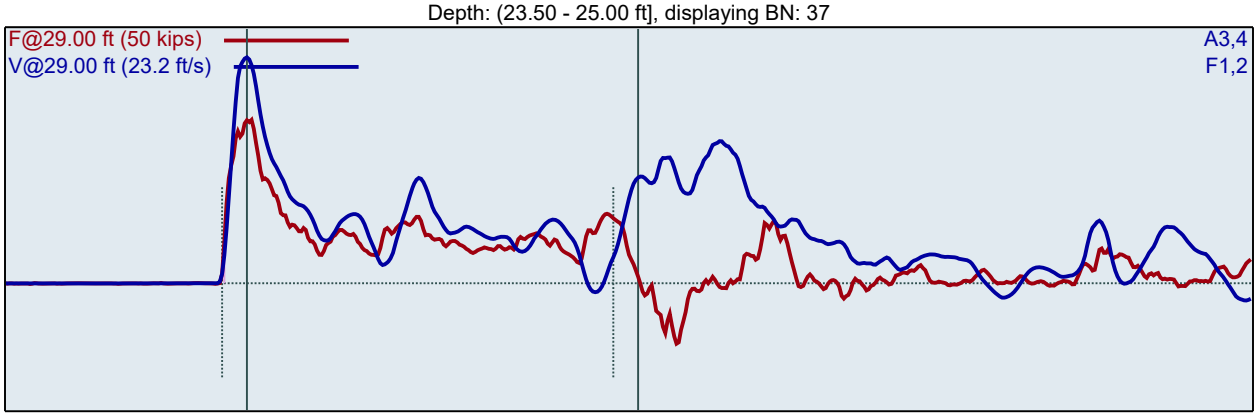
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 29.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (23.50 - 25.00 ft], displaying BN: 37



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
15	5	23.60	36	21.5	1.9	332	94.7	1.20	0.8
16	5	23.70	30	19.9	54.7	323	92.2	1.20	0.7
17	5	23.80	31	20.8	51.6	334	95.6	1.20	0.7
18	5	23.90	31	20.7	52.6	336	95.9	1.20	0.7
19	5	24.00	31	20.7	52.3	329	94.1	1.20	0.7
20	6	24.08	31	21.0	52.8	334	95.3	1.00	0.7
21	6	24.17	31	20.6	52.8	330	94.2	1.00	0.7
22	6	24.25	31	21.0	52.1	348	99.5	1.00	0.7
23	6	24.33	31	20.7	53.3	329	93.9	1.00	0.7
24	6	24.42	32	20.6	52.3	332	94.9	1.00	0.7
25	6	24.50	31	20.0	53.0	321	91.7	1.00	0.7
26	14	24.54	32	20.4	52.6	325	92.9	0.43	0.7
27	14	24.57	32	20.1	52.3	337	96.4	0.43	0.7
28	14	24.61	32	20.3	52.3	339	96.8	0.43	0.7
29	14	24.64	31	20.3	52.4	340	97.2	0.43	0.7
30	14	24.68	31	20.1	53.0	335	95.6	0.43	0.7
31	14	24.71	31	20.2	52.8	332	94.9	0.43	0.7
32	14	24.75	31	20.2	52.5	331	94.7	0.43	0.7
33	14	24.79	31	20.1	52.3	337	96.4	0.43	0.7
34	14	24.82	31	20.5	52.8	334	95.5	0.43	0.7
35	14	24.86	31	20.2	52.6	334	95.5	0.43	0.7
36	14	24.89	31	20.5	52.8	330	94.2	0.43	0.7
37	14	24.93	32	20.4	52.9	328	93.6	0.43	0.7
38	14	24.96	32	20.6	52.8	328	93.8	0.43	0.7
39	14	25.00	32	20.4	52.5	324	92.6	0.43	0.7
		Average	31	20.4	52.6	332	95.0	0.60	0.7
		Std Dev	0	0.3	0.3	6	1.7	0.26	0.0
		Maximum	32	21.0	53.3	348	99.5	1.00	0.7
		Minimum	31	20.0	52.1	321	91.7	0.43	0.7
				N-value: 20					

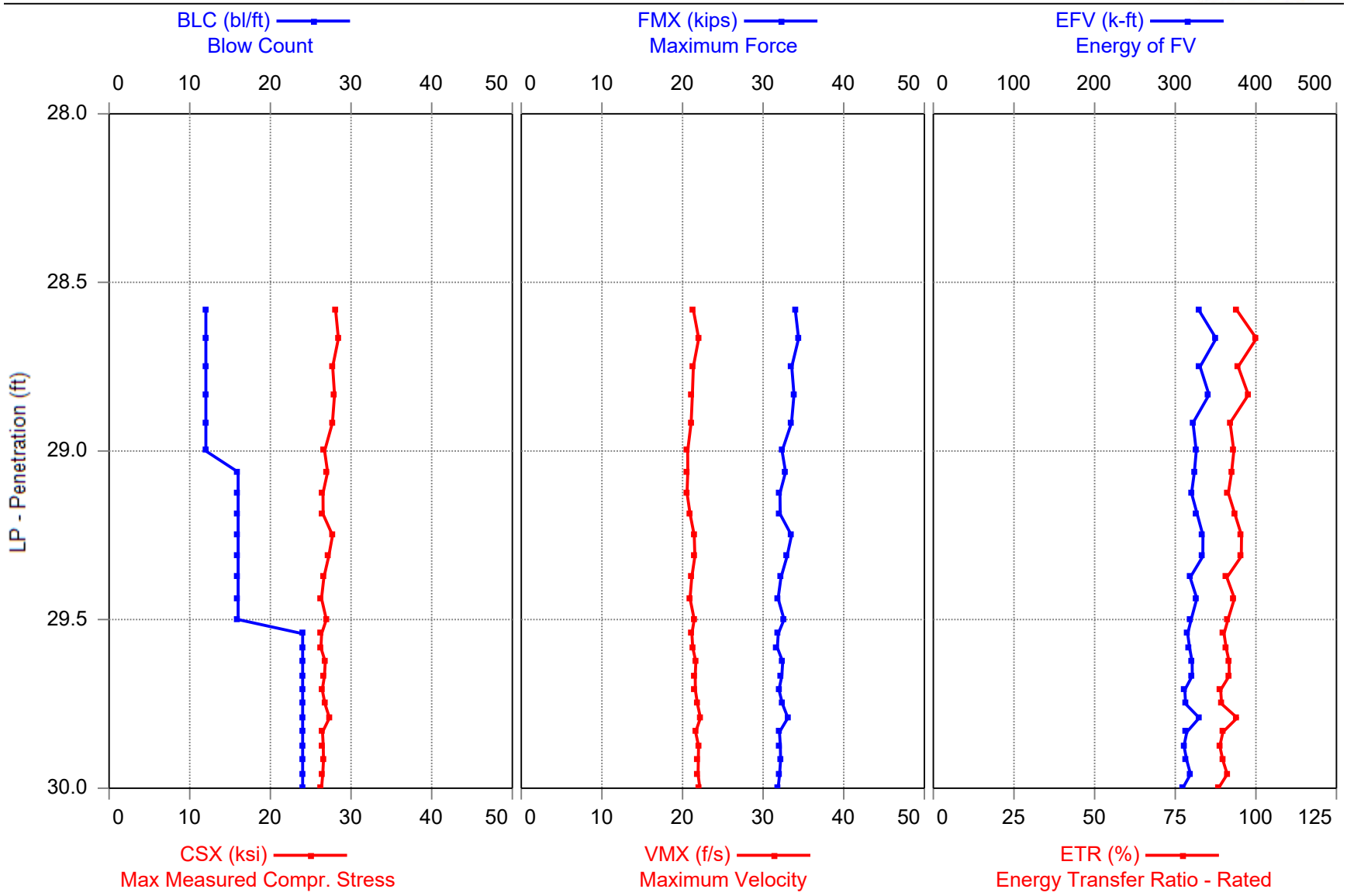
Sample Interval Time: 27.36 seconds.

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-28.5-30



Diedrich D-50 SN380 - SS-28.5-30 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 34.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
6	29.0	12	AV6	27.8	34	21.3	333	95	44	1.82	1.00	0.73
			MAX	28.4	34	22.0	351	100	54	2.15	1.00	0.74
			MIN	26.7	32	20.6	322	92	2	1.59	1.00	0.71
14	29.5	16	AV8	26.9	33	21.1	326	93	52	0.87	0.75	0.71
			MAX	27.7	34	21.5	334	96	52	1.31	0.75	0.73
			MIN	26.3	32	20.6	319	91	51	0.75	0.75	0.70
26	30.0	24	AV12	26.6	32	21.7	316	90	51	0.65	0.50	0.68
			MAX	27.3	33	22.2	330	94	53	0.71	0.50	0.70
			MIN	26.3	32	21.2	309	88	50	0.56	0.50	0.67
			Average	26.9	33	21.4	323	92	50	0.98	0.69	0.70
			Maximum	28.4	34	22.2	351	100	54	2.15	1.00	0.74
			Minimum	26.3	32	20.6	309	88	2	0.56	0.50	0.67

Total number of blows analyzed: 26

Sensors

Blows: 1-26

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 29 seconds 10:47 AM - 10:47 AM BN 1 - 26

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

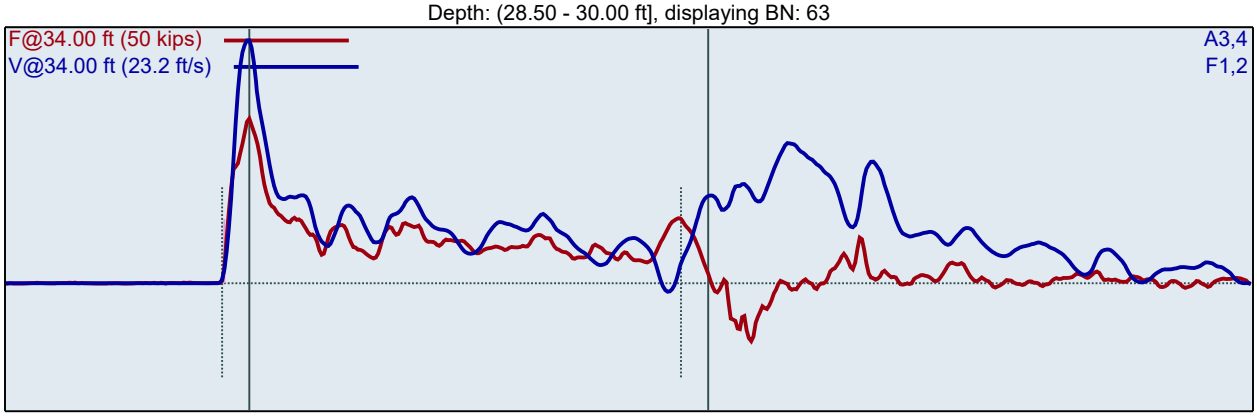
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 34.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (28.50 - 30.00 ft], displaying BN: 63



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
40	6	28.58	34	21.4	1.9	330	94.2	1.00	0.7
41	6	28.67	34	22.0	51.1	351	100.2	1.00	0.7
42	6	28.75	34	21.4	54.1	331	94.5	1.00	0.7
43	6	28.83	34	21.2	51.7	342	97.7	1.00	0.7
44	6	28.92	34	21.1	52.4	322	92.0	1.00	0.7
45	6	29.00	32	20.6	51.7	326	93.1	1.00	0.7
46	8	29.06	33	20.7	51.0	324	92.5	0.75	0.7
47	8	29.13	32	20.6	52.1	320	91.5	0.75	0.7
48	8	29.19	32	20.9	51.5	327	93.5	0.75	0.7
49	8	29.25	34	21.5	51.1	334	95.5	0.75	0.7
50	8	29.31	33	21.5	51.4	334	95.5	0.75	0.7
51	8	29.38	32	21.2	52.1	319	91.0	0.75	0.7
52	8	29.44	32	20.9	51.9	327	93.4	0.75	0.7
53	8	29.50	33	21.5	51.5	320	91.3	0.75	0.7
54	12	29.54	32	21.2	51.6	315	90.1	0.50	0.7
55	12	29.58	32	21.3	51.1	318	90.8	0.50	0.7
56	12	29.63	32	21.6	51.3	321	91.7	0.50	0.7
57	12	29.67	32	21.6	51.8	321	91.8	0.50	0.7
58	12	29.71	32	21.6	51.4	312	89.1	0.50	0.7
59	12	29.75	32	21.9	51.2	313	89.4	0.50	0.7
60	12	29.79	33	22.2	50.4	330	94.2	0.50	0.7
61	12	29.83	32	21.6	52.7	314	89.8	0.50	0.7
62	12	29.88	32	22.0	51.6	311	88.8	0.50	0.7
63	12	29.92	32	22.0	51.8	314	89.8	0.50	0.7
64	12	29.96	32	21.9	51.2	319	91.1	0.50	0.7
65	12	30.00	32	22.1	51.5	309	88.4	0.50	0.7
		Average	32	21.5	51.5	320	91.5	0.60	0.7
		Std Dev	0	0.5	0.5	7	2.0	0.12	0.0
		Maximum	34	22.2	52.7	334	95.5	0.75	0.7
		Minimum	32	20.6	50.4	309	88.4	0.50	0.7

N-value: 20

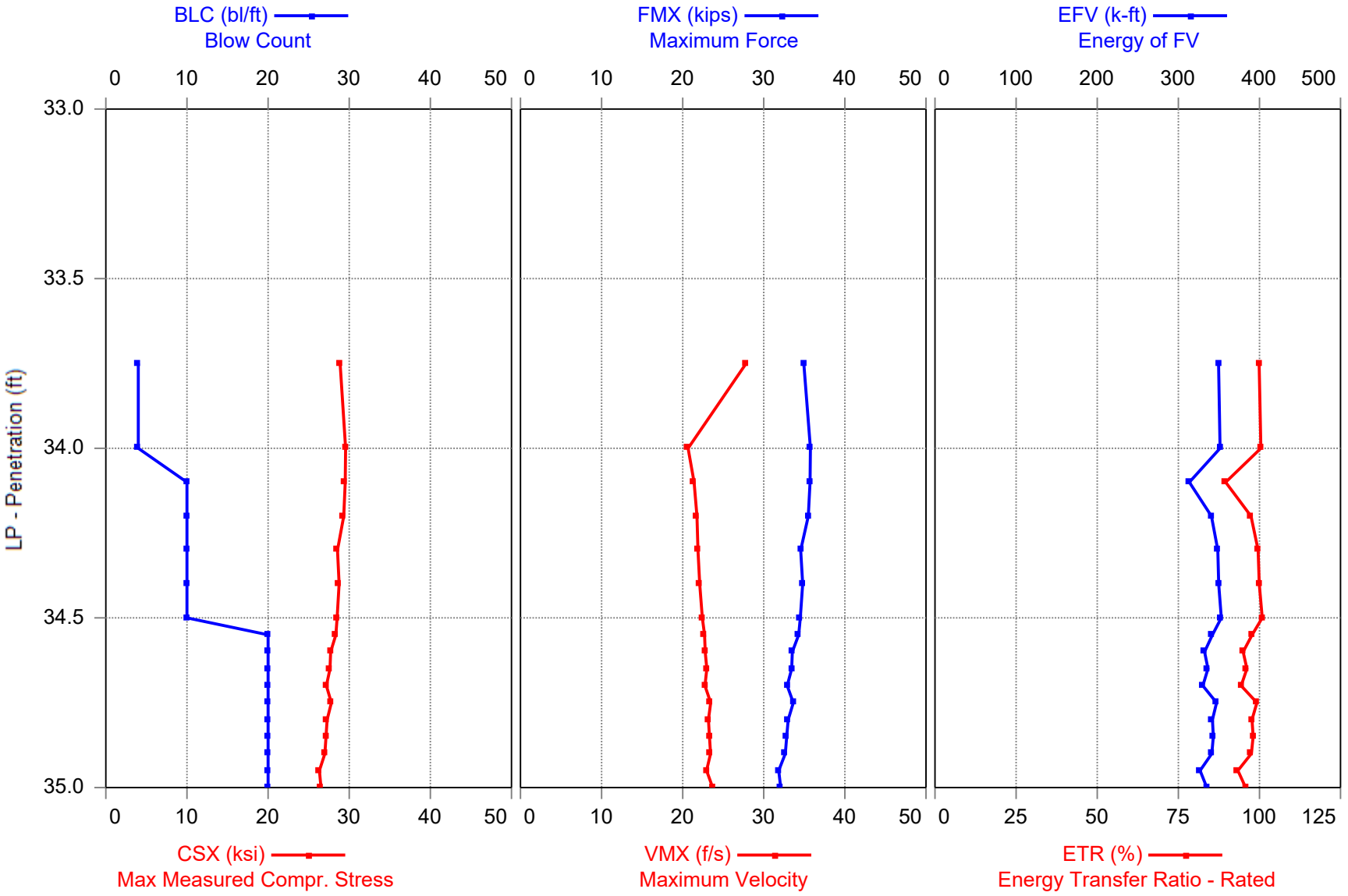
Sample Interval Time: 29.05 seconds.

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-33.5-35



Diedrich D-50 SN380 - SS-33.5-35 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 37.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
2	34.0	4	AV2	29.2	35	24.2	351	100	28	3.28	3.00	0.77
			MAX	29.5	36	27.8	352	100	54	3.56	3.00	0.80
			MIN	28.9	35	20.7	350	100	2	2.99	2.99	0.73
7	34.5	10	AV5	28.9	35	21.9	341	97	54	1.31	1.19	0.70
			MAX	29.5	36	22.4	353	101	54	1.57	1.20	0.71
			MIN	28.5	34	21.4	314	90	53	1.20	1.18	0.68
17	35.0	20	AV10	27.3	33	23.1	338	96	54	0.70	0.60	0.64
			MAX	28.4	34	23.7	347	99	54	0.87	0.60	0.69
			MIN	26.3	32	22.7	327	93	53	0.60	0.59	0.60
			Average	28.0	34	22.9	340	97	51	1.18	1.06	0.67
			Maximum	29.5	36	27.8	353	101	54	3.56	3.00	0.80
			Minimum	26.3	32	20.7	314	90	2	0.60	0.59	0.60

Total number of blows analyzed: 17

Sensors

Blows: 1-17

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 17 seconds 10:55 AM - 10:55 AM BN 1 - 17

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

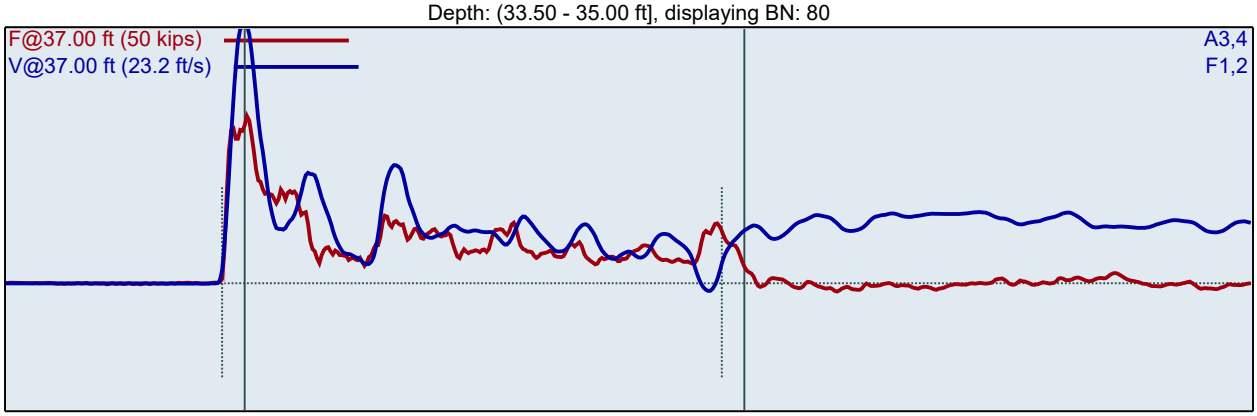
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 37.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (33.50 - 35.00 ft], displaying BN: 80



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
66	2	33.75	35	27.8	1.9	350	99.9	3.00	0.7
67	2	34.00	36	20.7	54.4	352	100.4	2.99	0.8
68	5	34.10	36	21.4	53.6	314	89.6	1.18	0.7
69	5	34.20	35	21.8	53.5	341	97.4	1.19	0.7
70	5	34.30	35	21.9	53.3	349	99.6	1.20	0.7
71	5	34.40	35	22.1	54.2	350	99.9	1.20	0.7
72	5	34.50	34	22.4	53.3	353	100.8	1.20	0.7
73	10	34.55	34	22.7	53.6	342	97.7	0.59	0.7
74	10	34.60	34	22.8	53.7	332	95.0	0.59	0.7
75	10	34.65	33	23.0	53.3	337	96.1	0.59	0.7
76	10	34.70	33	22.7	54.3	330	94.4	0.60	0.7
77	10	34.75	34	23.5	52.7	347	99.2	0.60	0.6
78	10	34.80	33	23.2	54.2	342	97.7	0.60	0.6
79	10	34.85	33	23.3	53.9	343	98.0	0.60	0.6
80	10	34.90	33	23.4	53.6	341	97.5	0.60	0.6
81	10	34.95	32	22.9	54.3	327	93.4	0.60	0.6
82	10	35.00	32	23.7	53.6	335	95.7	0.60	0.6
		Average	34	22.7	53.7	339	96.8	0.80	0.7
		Std Dev	1	0.7	0.4	10	2.8	0.28	0.0
		Maximum	36	23.7	54.3	353	100.8	1.20	0.7
		Minimum	32	21.4	52.7	314	89.6	0.59	0.6
				N-value: 15					

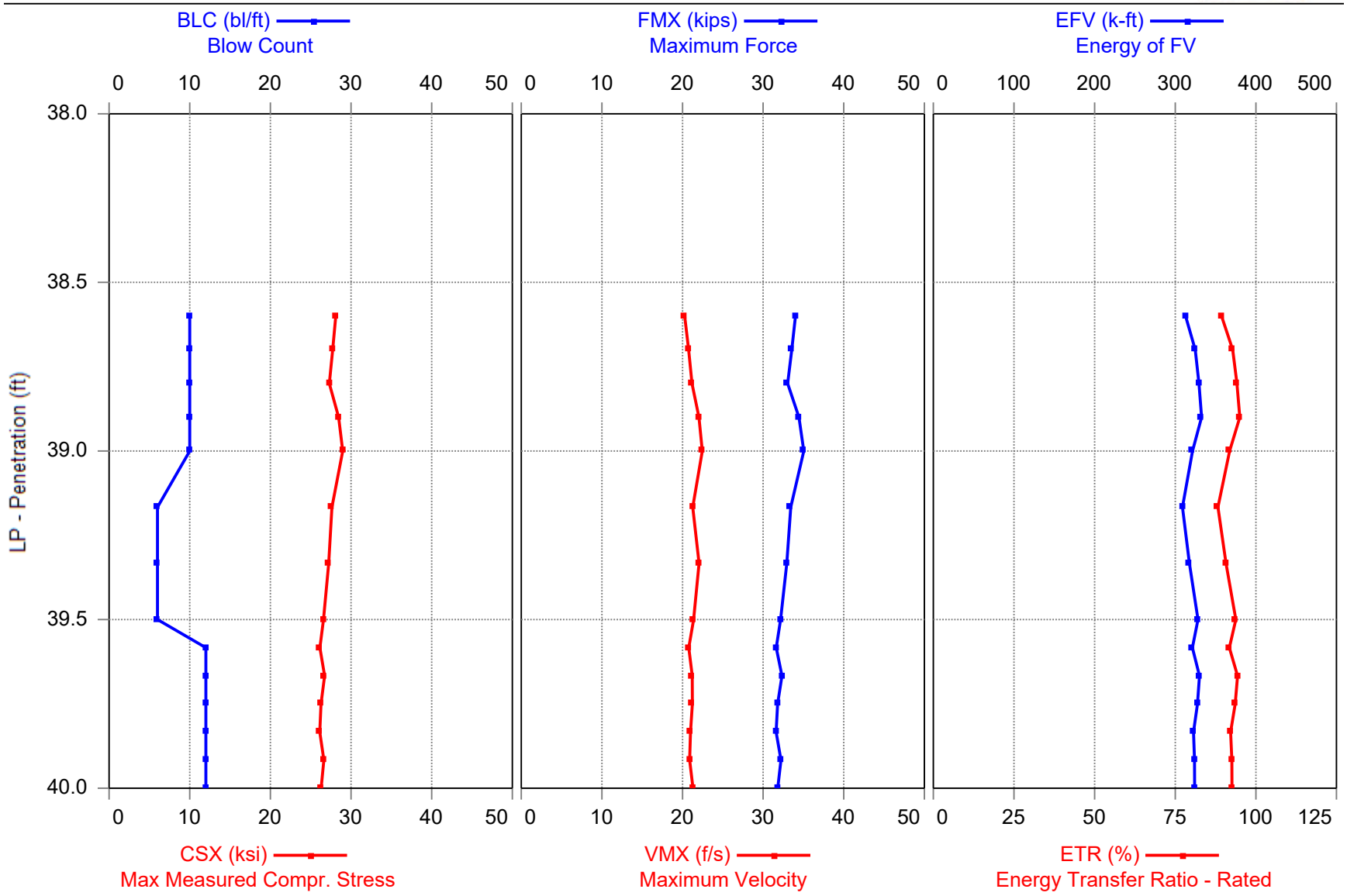
Sample Interval Time: 17.91 seconds.

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-38.5-40



Diedrich D-50 SN380 - SS-38.5-40 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 42.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
5	39.0	10	AV5	28.1	34	21.3	324	93	44	1.32	1.20	0.72
			MAX	29.0	35	22.5	333	95	55	1.62	1.20	0.75
			MIN	27.3	33	20.3	313	89	2	1.20	1.19	0.69
8	39.5	6	AV3	27.1	33	21.6	318	91	54	2.06	1.99	0.68
			MAX	27.6	33	22.1	328	94	54	2.09	2.00	0.70
			MIN	26.6	32	21.3	309	88	53	2.02	1.99	0.67
14	40.0	12	AV6	26.4	32	21.1	325	93	54	1.06	1.00	0.69
			MAX	26.7	32	21.3	330	94	54	1.28	1.00	0.71
			MIN	26.1	32	20.8	321	92	54	1.00	1.00	0.67
			Average	27.2	33	21.3	323	92	50	1.36	1.28	0.70
			Maximum	29.0	35	22.5	333	95	55	2.09	2.00	0.75
			Minimum	26.1	32	20.3	309	88	2	1.00	1.00	0.67

Total number of blows analyzed: 14

Sensors

Blows: 1-14

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 14 seconds 11:02 AM - 11:03 AM BN 1 - 14

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

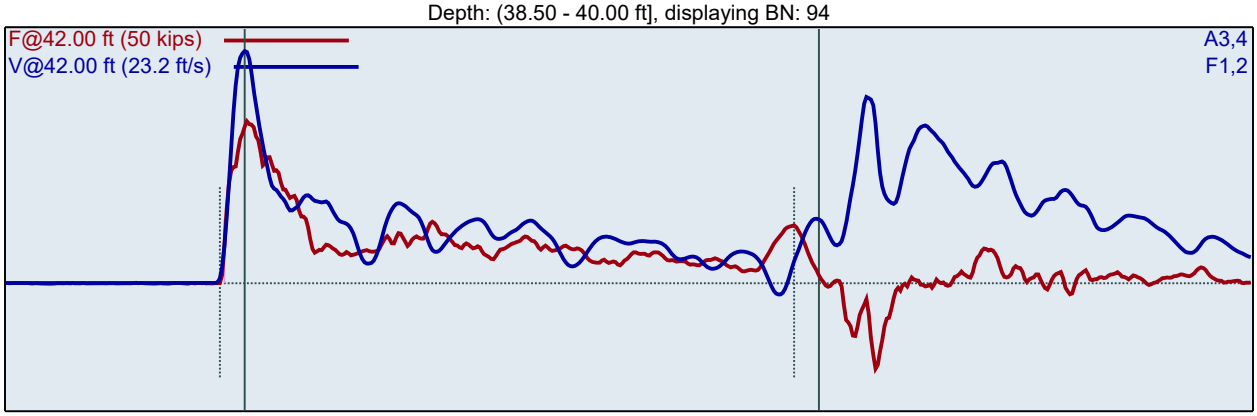
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 42.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (38.50 - 40.00 ft], displaying BN: 94



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
83	5	38.60	34	20.3	1.9	313	89.4	1.19	0.7
84	5	38.70	34	20.8	55.0	325	92.8	1.20	0.7
85	5	38.80	33	21.2	54.0	329	94.1	1.20	0.7
86	5	38.90	34	22.0	53.4	333	95.0	1.20	0.7
87	5	39.00	35	22.5	54.2	321	91.8	1.20	0.7
88	3	39.17	33	21.3	53.5	309	88.3	1.99	0.7
89	3	39.33	33	22.1	53.8	318	90.8	1.99	0.7
90	3	39.50	32	21.4	54.2	328	93.8	2.00	0.7
91	6	39.58	32	20.8	54.1	321	91.8	1.00	0.7
92	6	39.67	32	21.2	53.6	330	94.3	1.00	0.7
93	6	39.75	32	21.2	53.6	328	93.6	1.00	0.7
94	6	39.83	32	21.0	54.2	323	92.2	1.00	0.7
95	6	39.92	32	20.9	53.7	324	92.5	1.00	0.7
96	6	40.00	32	21.3	53.9	324	92.6	1.00	0.7
		Average	32	21.2	53.8	323	92.2	1.33	0.7
		Std Dev	1	0.3	0.2	6	1.7	0.47	0.0
		Maximum	33	22.1	54.2	330	94.3	2.00	0.7
		Minimum	32	20.8	53.5	309	88.3	1.00	0.7
				N-value: 9					

Sample Interval Time: 14.43 seconds.

PROJECT NAME: South River Trail Phase 5 - Bridge 1

PROJECT NO.: 10:9672

N bar = **21**

Layer Top	Layer Top Elevation	Layer Bottom	N-values at Borings										N_{AVG}	D_i	D_i / N_{AV}
			B-13												
0		2.5	9										9.00	2.5	0.28
2.5		5	8										8.00	2.5	0.31
5		7.5	6										6.00	2.5	0.42
7.5		10	5										5.00	2.5	0.50
10		15	2										2.00	5	2.50
15		20	100										100.00	5	0.05
20		25	100										100.00	5	0.05
25		30	100										100.00	5	0.05
30		35	100										100.00	5	0.05
35		40	100										100.00	5	0.05
40		45	100										100.00	5	0.05
45		50	100										100.00	5	0.05
50		55	100										100.00	5	0.05
55		60	100										100.00	5	0.05
60		65	100										100.00	5	0.05
65		70	100										100.00	5	0.05
70		75	100										100.00	5	0.05
75		80	100										100.00	5	0.05
80		85	100										100.00	5	0.05
85		90	100										100.00	5	0.05
90		95	100										100.00	5	0.05
95		100	100										100.00	5	0.05
													78.64	**100**	**4.86**

N bar = **21**

SITE CLASS	SOIL PROFILE NAME	AVERAGE PROPERTIES IN TOP 100 ft, AS PER SECTION 1615.1.5		
		Soil shear wave velocity, Vs-bar, (ft/s)	Standard Penetration Resistance, N-bar	Soil Undrained Shear Strength, Su-bar , (psf)
A	Hard Rock	Vs-bar > 5,000	Not Applicable	Not Applicable
B	Rock	2,500 < Vs-bar ≤ 5,000	Not Applicable	Not Applicable
C	Very Dense Soil and Soft Rock	1,200 < Vs-bar ≤ 2,500	N-bar > 50	Su-bar ≥ 2000
D	Stiff Soil Profile	600 ≤ Vs-bar ≤ 1,200	15 ≤ N-bar ≤ 50	1,000 ≤ Su-bar ≤ 2000
E	Soft Soil Profile	Vs-bar < 600	N-bar < 15	Su-bar < 1,000
E	–	Any profile with more than 10 feet of soil having the following characteristics: 1. Plaxticity Index , PI > 20; 2. Moisture content , w ≥ 40%, and 3. Undrained shear strength, Su-bar < 500 psf		
F	–	Any profile containing soils having one or more of the following characteristics: 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and/or highly organic clays (H > 10 ft or peat and/or highly organic caly where H = thickness of soil) 3. Very high plasticity clays (H> 25 ft with plasticity index PI > 75) 4. Very thick soft/medium stiff clays (H > 120 ft)		

PROJECT NAME: South River Trail Phase 5 - Bridge 1

PROJECT NO.: 10:9672

N bar = **12**

Layer Top	Layer Top Elevation	Layer Bottom	N-values at Borings										N_{AVG}	D_i	D_i / N_{AV}
			B-14												
0		2.5	5										5.00	2.5	0.50
2.5		5	3										3.00	2.5	0.83
5		7.5	2										2.00	2.5	1.25
7.5		10	1										1.00	2.5	2.50
10		15	2										2.00	5	2.50
15		20	47										47.00	5	0.11
20		25	100										100.00	5	0.05
25		30	100										100.00	5	0.05
30		35	100										100.00	5	0.05
35		40	100										100.00	5	0.05
40		45	100										100.00	5	0.05
45		50	100										100.00	5	0.05
50		55	100										100.00	5	0.05
55		60	100										100.00	5	0.05
60		65	100										100.00	5	0.05
65		70	100										100.00	5	0.05
70		75	100										100.00	5	0.05
75		80	100										100.00	5	0.05
80		85	100										100.00	5	0.05
85		90	100										100.00	5	0.05
90		95	100										100.00	5	0.05
95		100	100										100.00	5	0.05
													75.45	**100**	**8.49**

N bar = **12**

SITE CLASS	SOIL PROFILE NAME	AVERAGE PROPERTIES IN TOP 100 ft, AS PER SECTION 1615.1.5		
		Soil shear wave velocity, Vs-bar, (ft/s)	Standard Penetration Resistance, N-bar	Soil Undrained Shear Strength, Su-bar , (psf)
A	Hard Rock	Vs-bar > 5,000	Not Applicable	Not Applicable
B	Rock	2,500 < Vs-bar ≤ 5,000	Not Applicable	Not Applicable
C	Very Dense Soil and Soft Rock	1,200 < Vs-bar ≤ 2,500	N-bar > 50	Su-bar ≥ 2000
D	Stiff Soil Profile	600 ≤ Vs-bar ≤ 1,200	15 ≤ N-bar ≤ 50	1,000 ≤ Su-bar ≤ 2000
E	Soft Soil Profile	Vs-bar < 600	N-bar < 15	Su-bar < 1,000
E	–	Any profile with more than 10 feet of soil having the following characteristics: 1. Plaxticity Index , PI > 20; 2. Moisture content , w ≥ 40%, and 3. Undrained shear strength, Su-bar < 500 psf		
F	–	Any profile containing soils having one or more of the following characteristics: 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and/or highly organic clays (H > 10 ft or peat and/or highly organic caly where H = thickness of soil) 3. Very high plasticity clays (H> 25 ft with plasticity index PI > 75) 4. Very thick soft/medium stiff clays (H > 120 ft)		

Nominal Pile Driving Resistance - C10.7.3.7

Project Name:	South River Trail Phase 5 - Bridge 1
Project Number:	10:9672
Project Location:	DeKalb County
Boring Number:	B-13
Bent (EB/IB):	EB Bent 3
Pile Type:	H-Pile 10X42

Factored Load:

Nominal Pile Driving Resistance	Rndr		
Resistance Factor (10.5.5.2.3.1)	phi(dyn)	0.65	PDA
Load factor for downdrag (1.05, 3.4.1-2)	yp		
Downdrag load per pile (10.7.3.7)	DD		
Side resistance for the down drag zone (10.7.3.7)	Rsdd		
Side resistance for the scour zone (10.7.3.6)	Rsscour		

Rndr = (Factored Load/phi(dyn))+((yp*DD)/phi(dyn))+Rsdd+Rsscour

Rndr (Service Limit State)	106	Rndr(Strength Limit State)	153
phi(dyn)	0.65	phi(dyn)	0.65
yp	0.75	yp	0.75
DD	0	DD	0
Rsdd	0	Rsdd	0
Rsscour	0	Rsscour	0
Factored Load	68.96	Factored Load	99.6

Nominal Pile Driving Resistance - C10.7.3.7

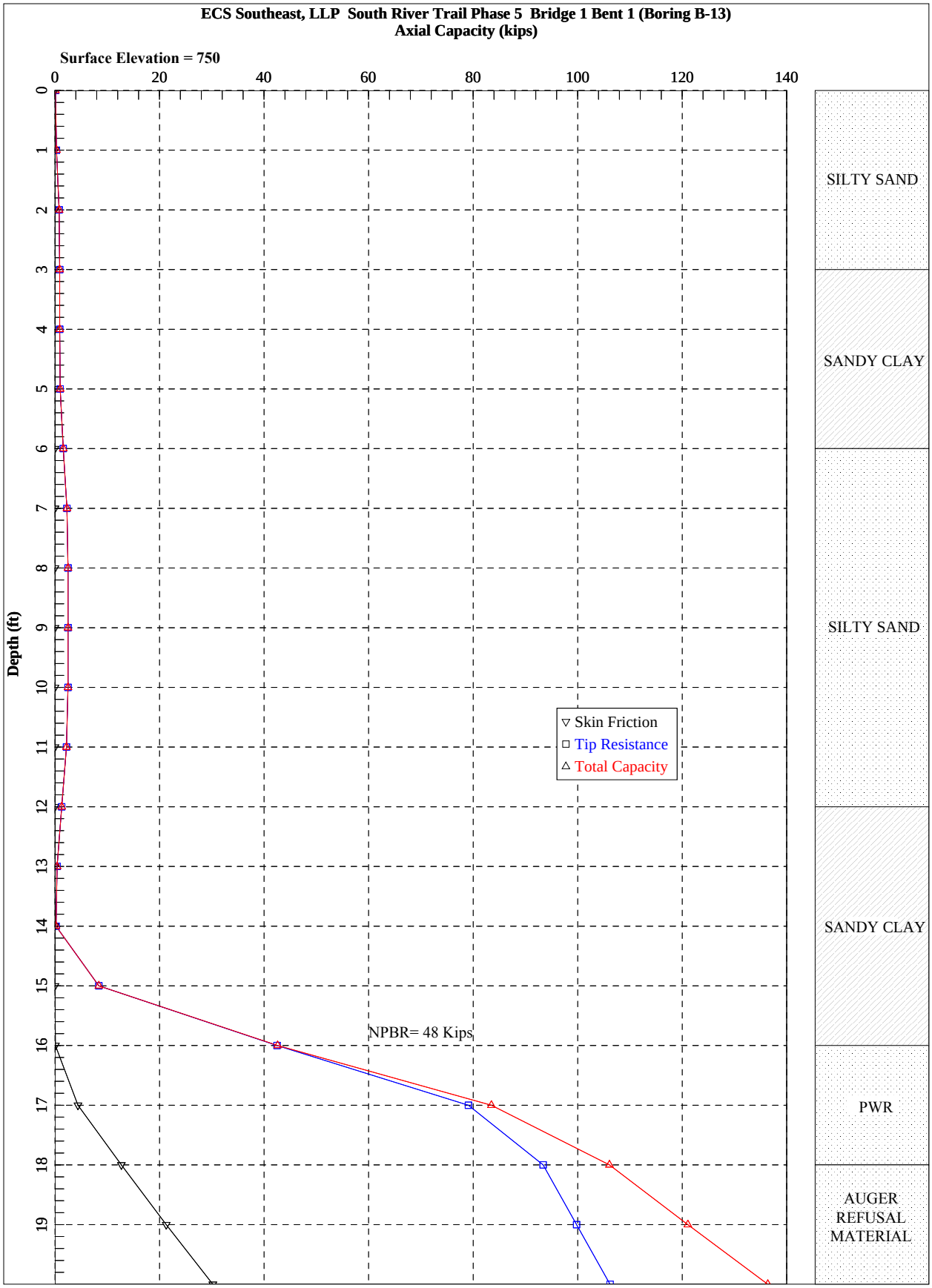
Project Name: South River Trail Phase 5 - Bridge 1
Project Number: 10:9672
Project Location: DeKalb County
Boring Number: B-14
Bent (EB/IB): EB Bent 4
Pile Type: H-Pile 10X42

Factored Load:

Nominal Pile Driving Resistance	Rndr		
Resistance Factor (10.5.5.2.3.1)	phi(dyn)	0.65	PDA
Load factor for downdrag (1.05, 3.4.1-2)	yp		
Downdrag load per pile (10.7.3.7)	DD		
Side resistance for the down drag zone (10.7.3.7)	Rsdd		
Side resistance for the scour zone (10.7.3.6)	Rsscour		

Rndr = (Factored Load/phi(dyn))+((yp*DD)/phi(dyn))+Rsdd+Rsscour

Rndr (Service Limit State)	106	Rndr(Strength Limit State)	153
phi(dyn)	0.65	phi(dyn)	0.65
yp	0.75	yp	0.75
DD	0	DD	0
Rsdd	0	Rsdd	0
Rsscour	0	Rsscour	0
Factored Load	68.96	Factored Load	99.6


ECS Southeast, LLP South River Trail Phase 5 Bridge 1 Bent 1 (Boring B-13)
Axial Capacity (kips)
Surface Elevation = 750
0
20
40
60
80
100
120
140
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
Skin Friction
Tip Resistance
Total Capacity
NPBR= 48 Kips
SILTY SAND
SANDY CLAY
SILTY SAND
SANDY CLAY
PWR
AUGER
REFUSAL
MATERIAL

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\
Name of input data file : 9672, Boring B-13_ Bridge 1 Bent 1.ap7d
Name of output file : 9672, Boring B-13_ Bridge 1 Bent 1.ap7o
Name of plot output file : 9672, Boring B-13_ Bridge 1 Bent 1.ap7p

Time and Date of Analysis

Date: June 14, 2018 Time: 10:55:31

1

* INPUT INFORMATION *

South River Trail - Phase 5 - Bridge 1 (Bent 1)

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
10.00	9.00
20.00	8.00
25.00	7.50

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 10.00 IN.
- TOTAL PILE LENGTH, TL = 20.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 16.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	30.00	0.00
3.00	SAND	0.00	130.00	30.00	0.00
3.00	CLAY	0.00	120.00	0.00	0.00
6.00	CLAY	0.00	120.00	0.00	0.00
6.00	SAND	0.00	115.00	30.00	0.00
12.00	SAND	0.00	115.00	30.00	0.00
12.00	CLAY	0.00	100.00	0.00	0.00
16.00	CLAY	0.00	100.00	0.00	0.00
16.00	SAND	0.00	140.00	43.00	0.00
18.00	SAND	0.00	140.00	43.00	0.00
18.00	SAND	0.00	145.00	43.00	0.00
50.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.50	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.50	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00

0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
3.00	1.000	1.000
3.00	1.000	1.000
6.00	1.000	1.000
6.00	1.000	1.000
12.00	1.000	1.000
12.00	1.000	1.000
16.00	1.000	1.000
16.00	1.000	1.000
18.00	1.000	1.000
18.00	1.000	1.000
50.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.1	0.1
1.00	0.0	0.3	0.3
2.00	0.0	0.8	0.8
3.00	0.0	0.9	0.9
4.00	0.0	0.9	0.9
5.00	0.0	1.0	1.0
6.00	0.0	1.6	1.6
7.00	0.0	2.3	2.3
8.00	0.0	2.5	2.5
9.00	0.0	2.5	2.5
10.00	0.0	2.5	2.5
11.00	0.0	2.2	2.2
12.00	0.0	1.3	1.3
13.00	0.0	0.4	0.4
14.00	0.0	0.2	0.2
15.00	0.0	8.4	8.4
16.00	0.1	42.5	42.6
17.00	4.4	79.1	83.5
18.00	12.7	93.4	106.1

19.00	21.3	99.8	121.1
20.00	30.2	106.2	136.4

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.1525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.2958E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.3000E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00

```
                                0.0000E+00      0.2000E+01
 5          10      0.4525E+01
                                0.0000E+00      0.0000E+00
                                0.0000E+00      0.1600E-01
                                0.0000E+00      0.3100E-01
                                0.0000E+00      0.5700E-01
                                0.0000E+00      0.8000E-01
                                0.0000E+00      0.1000E+00
                                0.0000E+00      0.2000E+00
                                0.0000E+00      0.3000E+00
                                0.0000E+00      0.5000E+00
                                0.0000E+00      0.2000E+01
 6          10      0.5958E+01
                                0.0000E+00      0.0000E+00
                                0.0000E+00      0.1600E-01
                                0.0000E+00      0.3100E-01
                                0.0000E+00      0.5700E-01
                                0.0000E+00      0.8000E-01
                                0.0000E+00      0.1000E+00
                                0.0000E+00      0.2000E+00
                                0.0000E+00      0.3000E+00
                                0.0000E+00      0.5000E+00
                                0.0000E+00      0.2000E+01
 7          10      0.6000E+01
                                0.0000E+00      0.0000E+00
                                0.0000E+00      0.1000E-01
                                0.0000E+00      0.2000E-01
                                0.0000E+00      0.4000E-01
                                0.0000E+00      0.6000E-01
                                0.0000E+00      0.8000E-01
                                0.0000E+00      0.9000E-01
                                0.0000E+00      0.1000E+00
                                0.0000E+00      0.5000E+00
                                0.0000E+00      0.2000E+01
 8          10      0.9025E+01
                                0.0000E+00      0.0000E+00
                                0.0000E+00      0.1000E-01
                                0.0000E+00      0.2000E-01
                                0.0000E+00      0.4000E-01
                                0.0000E+00      0.6000E-01
                                0.0000E+00      0.8000E-01
                                0.0000E+00      0.9000E-01
                                0.0000E+00      0.1000E+00
                                0.0000E+00      0.5000E+00
                                0.0000E+00      0.2000E+01
 9          10      0.1196E+02
                                0.0000E+00      0.0000E+00
                                0.0000E+00      0.1000E-01
                                0.0000E+00      0.2000E-01
                                0.0000E+00      0.4000E-01
                                0.0000E+00      0.6000E-01
                                0.0000E+00      0.8000E-01
                                0.0000E+00      0.9000E-01
                                0.0000E+00      0.1000E+00
                                0.0000E+00      0.5000E+00
                                0.0000E+00      0.2000E+01
10          10      0.1200E+02
                                0.0000E+00      0.0000E+00
                                0.0000E+00      0.1600E-01
                                0.0000E+00      0.3100E-01
                                0.0000E+00      0.5700E-01
                                0.0000E+00      0.8000E-01
                                0.0000E+00      0.1000E+00
```

			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
11	10	0.1403E+02		
			0.0000E+00	0.0000E+00
			0.8658E-01	0.1600E-01
			0.1443E+00	0.3100E-01
			0.2165E+00	0.5700E-01
			0.2597E+00	0.8000E-01
			0.2886E+00	0.1000E+00
			0.2597E+00	0.2000E+00
			0.2597E+00	0.3000E+00
			0.2597E+00	0.5000E+00
			0.2597E+00	0.2000E+01
12	10	0.1596E+02		
			0.0000E+00	0.0000E+00
			0.3394E+01	0.1600E-01
			0.5657E+01	0.3100E-01
			0.8486E+01	0.5700E-01
			0.1018E+02	0.8000E-01
			0.1131E+02	0.1000E+00
			0.1018E+02	0.2000E+00
			0.1018E+02	0.3000E+00
			0.1018E+02	0.5000E+00
			0.1018E+02	0.2000E+01
13	10	0.1600E+02		
			0.0000E+00	0.0000E+00
			0.1671E+01	0.1000E-01
			0.3343E+01	0.2000E-01
			0.6685E+01	0.4000E-01
			0.1003E+02	0.6000E-01
			0.1337E+02	0.8000E-01
			0.1504E+02	0.9000E-01
			0.1671E+02	0.1000E+00
			0.1671E+02	0.5000E+00
			0.1671E+02	0.2000E+01
14	10	0.1703E+02		
			0.0000E+00	0.0000E+00
			0.2249E+01	0.1000E-01
			0.4498E+01	0.2000E-01
			0.8996E+01	0.4000E-01
			0.1349E+02	0.6000E-01
			0.1799E+02	0.8000E-01
			0.2024E+02	0.9000E-01
			0.2249E+02	0.1000E+00
			0.2249E+02	0.5000E+00
			0.2249E+02	0.2000E+01
15	10	0.1796E+02		
			0.0000E+00	0.0000E+00
			0.2249E+01	0.1000E-01
			0.4498E+01	0.2000E-01
			0.8996E+01	0.4000E-01
			0.1349E+02	0.6000E-01
			0.1799E+02	0.8000E-01
			0.2024E+02	0.9000E-01
			0.2249E+02	0.1000E+00
			0.2249E+02	0.5000E+00
			0.2249E+02	0.2000E+01
16	10	0.1800E+02		
			0.0000E+00	0.0000E+00
			0.2320E+01	0.1000E-01
			0.4641E+01	0.2000E-01

			0.9281E+01	0.4000E-01
			0.1392E+02	0.6000E-01
			0.1856E+02	0.8000E-01
			0.2088E+02	0.9000E-01
			0.2320E+02	0.1000E+00
			0.2320E+02	0.5000E+00
			0.2320E+02	0.2000E+01
17	10	0.3403E+02		
			0.0000E+00	0.0000E+00
			0.2354E+01	0.1000E-01
			0.4708E+01	0.2000E-01
			0.9416E+01	0.4000E-01
			0.1412E+02	0.6000E-01
			0.1883E+02	0.8000E-01
			0.2119E+02	0.9000E-01
			0.2354E+02	0.1000E+00
			0.2354E+02	0.5000E+00
			0.2354E+02	0.2000E+01
18	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.2354E+01	0.1000E-01
			0.4708E+01	0.2000E-01
			0.9416E+01	0.4000E-01
			0.1412E+02	0.6000E-01
			0.1883E+02	0.8000E-01
			0.2119E+02	0.9000E-01
			0.2354E+02	0.1000E+00
			0.2354E+02	0.5000E+00
			0.2354E+02	0.2000E+01

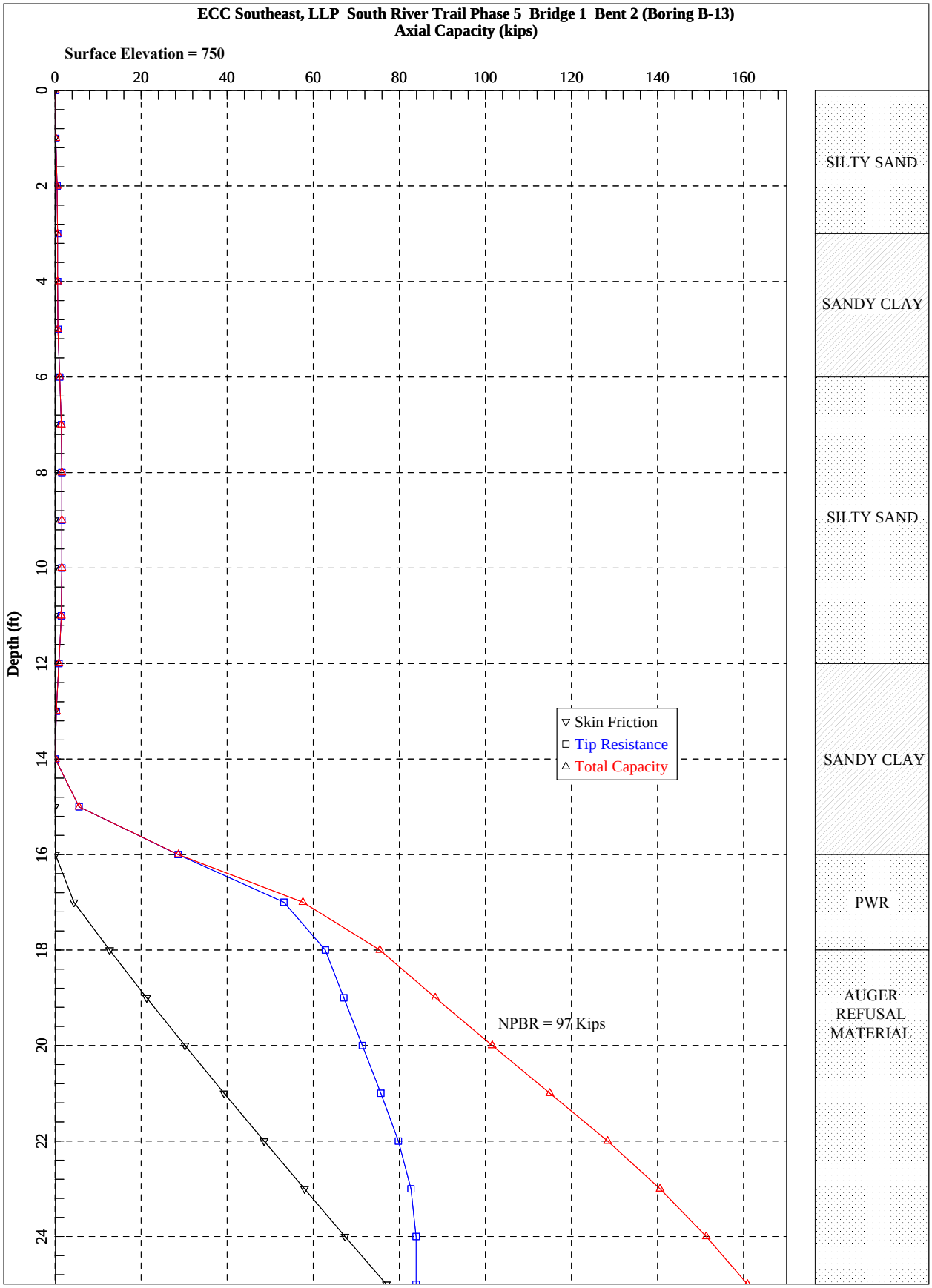
TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.6637E+01	0.5000E-02
0.1327E+02	0.1000E-01
0.2655E+02	0.2000E-01
0.5310E+02	0.1300E+00
0.7965E+02	0.4200E+00
0.9558E+02	0.7300E+00
0.1062E+03	0.1000E+01
0.1062E+03	0.1500E+01
0.1062E+03	0.2000E+01

LOAD VERSUS SETTLEMENT CURVE

****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.3216E+00	0.5189E-02	0.1327E+00	0.1000E-03
0.3566E+01	0.5724E-01	0.1327E+01	0.1000E-02
0.1646E+02	0.2681E+00	0.6637E+01	0.5000E-02
0.3083E+02	0.5086E+00	0.1327E+02	0.1000E-01
0.6789E+02	0.1183E+01	0.3379E+02	0.5000E-01
0.8274E+02	0.1497E+01	0.4586E+02	0.1000E+00
0.1206E+03	0.2573E+01	0.8376E+02	0.5000E+00
0.1431E+03	0.3474E+01	0.1062E+03	0.1000E+01

0.1431E+03 0.4474E+01 0.1062E+03 0.2000E+01


ECC Southeast, LLP South River Trail Phase 5 Bridge 1 Bent 2 (Boring B-13)
Axial Capacity (kips)
Surface Elevation = 750
0
20
40
60
80
100
120
140
160
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
Skin Friction
Tip Resistance
Total Capacity
NPBR = 97 Kips
SILTY SAND
SANDY CLAY
SILTY SAND
SANDY CLAY
PWR
AUGER
REFUSAL
MATERIAL

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Bridge 1\
Name of input data file : 9672, Boring B-13_ Bridge 1 Bent 2.ap7d
Name of output file : 9672, Boring B-13_ Bridge 1 Bent 2.ap7o
Name of plot output file : 9672, Boring B-13_ Bridge 1 Bent 2.ap7p

---

Time and Date of Analysis

Date: June 15, 2018 Time: 11:01:40

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 1 (Bent 2)

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
10.00	9.00
20.00	8.00
30.00	7.00

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 10.00 IN.
- TOTAL PILE LENGTH, TL = 25.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 16.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	30.00	0.00
3.00	SAND	0.00	130.00	30.00	0.00
3.00	CLAY	0.00	120.00	0.00	0.00
6.00	CLAY	0.00	120.00	0.00	0.00
6.00	SAND	0.00	115.00	30.00	0.00
12.00	SAND	0.00	115.00	30.00	0.00
12.00	CLAY	0.00	100.00	0.00	0.00
16.00	CLAY	0.00	100.00	0.00	0.00
16.00	SAND	0.00	140.00	43.00	0.00
18.00	SAND	0.00	140.00	43.00	0.00
18.00	SAND	0.00	145.00	43.00	0.00
50.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.50	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.50	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00

0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
3.00	1.000	1.000
3.00	1.000	1.000
6.00	1.000	1.000
6.00	1.000	1.000
12.00	1.000	1.000
12.00	1.000	1.000
16.00	1.000	1.000
16.00	1.000	1.000
18.00	1.000	1.000
18.00	1.000	1.000
50.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.1	0.1
1.00	0.0	0.2	0.2
2.00	0.0	0.5	0.5
3.00	0.0	0.6	0.6
4.00	0.0	0.6	0.6
5.00	0.0	0.7	0.7
6.00	0.0	1.1	1.1
7.00	0.0	1.5	1.5
8.00	0.0	1.6	1.6
9.00	0.0	1.6	1.6
10.00	0.0	1.6	1.6
11.00	0.0	1.5	1.5
12.00	0.0	0.9	0.9
13.00	0.0	0.3	0.3
14.00	0.0	0.1	0.1
15.00	0.0	5.6	5.6
16.00	0.1	28.6	28.7
17.00	4.4	53.2	57.6
18.00	12.7	62.8	75.5

19.00	21.3	67.1	88.4
20.00	30.2	71.4	101.6
21.00	39.3	75.7	115.0
22.00	48.6	79.8	128.4
23.00	58.0	82.7	140.6
24.00	67.4	83.9	151.3
25.00	77.0	83.9	160.9

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.1525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.2958E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.3000E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01

			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
5	10	0.4525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
6	10	0.5958E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
7	10	0.6000E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
8	10	0.9025E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
9	10	0.1196E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
10	10	0.1200E+02		
			0.0000E+00	0.0000E+00

			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
11	10	0.1403E+02		
			0.0000E+00	0.0000E+00
			0.8658E-01	0.1600E-01
			0.1443E+00	0.3100E-01
			0.2165E+00	0.5700E-01
			0.2597E+00	0.8000E-01
			0.2886E+00	0.1000E+00
			0.2597E+00	0.2000E+00
			0.2597E+00	0.3000E+00
			0.2597E+00	0.5000E+00
			0.2597E+00	0.2000E+01
12	10	0.1596E+02		
			0.0000E+00	0.0000E+00
			0.3394E+01	0.1600E-01
			0.5657E+01	0.3100E-01
			0.8486E+01	0.5700E-01
			0.1018E+02	0.8000E-01
			0.1131E+02	0.1000E+00
			0.1018E+02	0.2000E+00
			0.1018E+02	0.3000E+00
			0.1018E+02	0.5000E+00
			0.1018E+02	0.2000E+01
13	10	0.1600E+02		
			0.0000E+00	0.0000E+00
			0.1671E+01	0.1000E-01
			0.3343E+01	0.2000E-01
			0.6685E+01	0.4000E-01
			0.1003E+02	0.6000E-01
			0.1337E+02	0.8000E-01
			0.1504E+02	0.9000E-01
			0.1671E+02	0.1000E+00
			0.1671E+02	0.5000E+00
			0.1671E+02	0.2000E+01
14	10	0.1703E+02		
			0.0000E+00	0.0000E+00
			0.2249E+01	0.1000E-01
			0.4498E+01	0.2000E-01
			0.8996E+01	0.4000E-01
			0.1349E+02	0.6000E-01
			0.1799E+02	0.8000E-01
			0.2024E+02	0.9000E-01
			0.2249E+02	0.1000E+00
			0.2249E+02	0.5000E+00
			0.2249E+02	0.2000E+01
15	10	0.1796E+02		
			0.0000E+00	0.0000E+00
			0.2249E+01	0.1000E-01
			0.4498E+01	0.2000E-01
			0.8996E+01	0.4000E-01
			0.1349E+02	0.6000E-01
			0.1799E+02	0.8000E-01
			0.2024E+02	0.9000E-01
			0.2249E+02	0.1000E+00
			0.2249E+02	0.5000E+00

			0.2249E+02	0.2000E+01
16	10	0.1800E+02		
			0.0000E+00	0.0000E+00
			0.2320E+01	0.1000E-01
			0.4641E+01	0.2000E-01
			0.9281E+01	0.4000E-01
			0.1392E+02	0.6000E-01
			0.1856E+02	0.8000E-01
			0.2088E+02	0.9000E-01
			0.2320E+02	0.1000E+00
			0.2320E+02	0.5000E+00
			0.2320E+02	0.2000E+01
17	10	0.3403E+02		
			0.0000E+00	0.0000E+00
			0.2532E+01	0.1000E-01
			0.5065E+01	0.2000E-01
			0.1013E+02	0.4000E-01
			0.1519E+02	0.6000E-01
			0.2026E+02	0.8000E-01
			0.2279E+02	0.9000E-01
			0.2532E+02	0.1000E+00
			0.2532E+02	0.5000E+00
			0.2532E+02	0.2000E+01
18	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.2532E+01	0.1000E-01
			0.5065E+01	0.2000E-01
			0.1013E+02	0.4000E-01
			0.1519E+02	0.6000E-01
			0.2026E+02	0.8000E-01
			0.2279E+02	0.9000E-01
			0.2532E+02	0.1000E+00
			0.2532E+02	0.5000E+00
			0.2532E+02	0.2000E+01

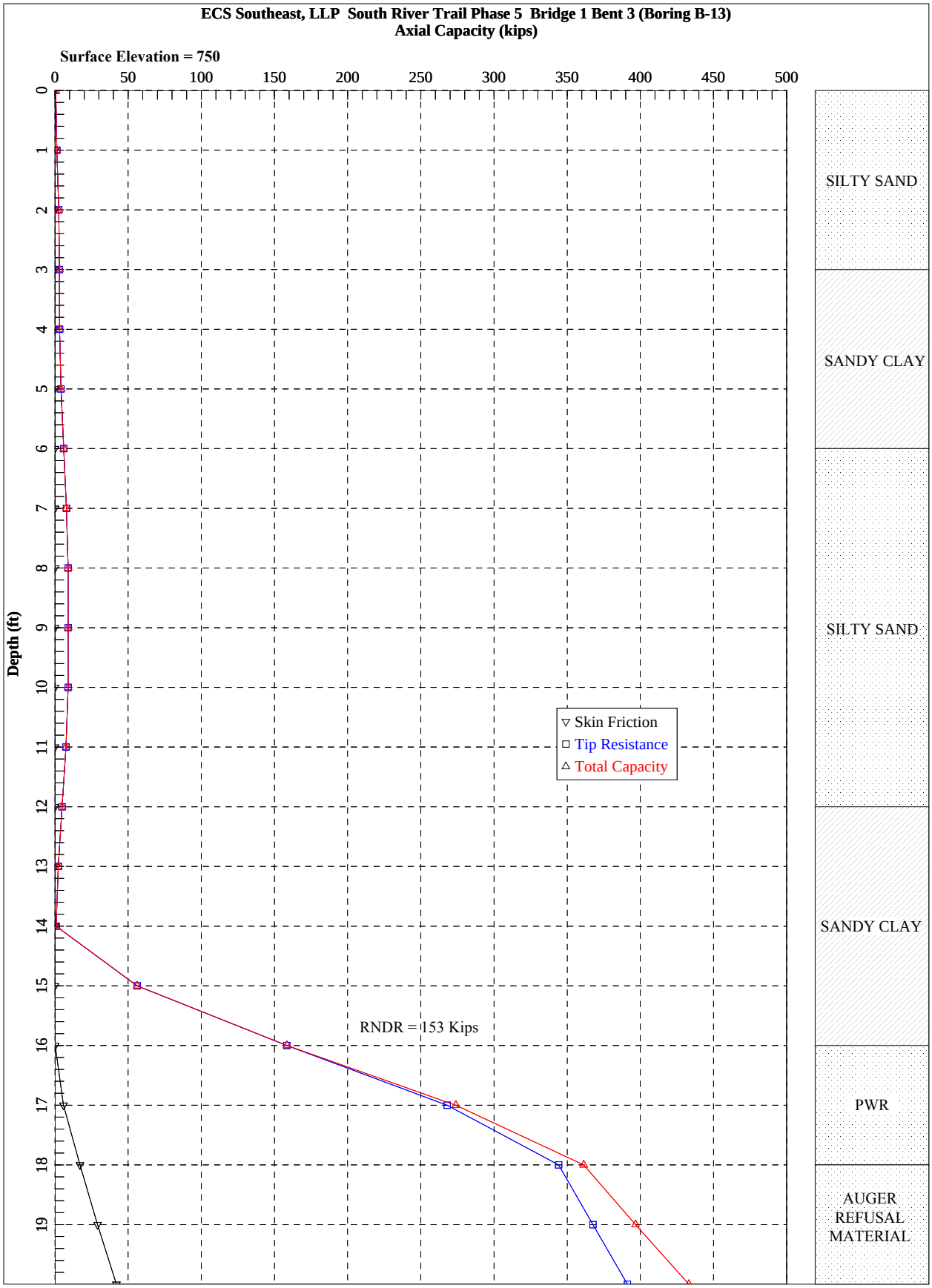
TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.5244E+01	0.5000E-02
0.1049E+02	0.1000E-01
0.2098E+02	0.2000E-01
0.4195E+02	0.1300E+00
0.6293E+02	0.4200E+00
0.7552E+02	0.7300E+00
0.8391E+02	0.1000E+01
0.8391E+02	0.1500E+01
0.8391E+02	0.2000E+01

LOAD VERSUS SETTLEMENT CURVE

****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1192E+01	0.1942E-01	0.1049E+00	0.1000E-03
0.1227E+02	0.2025E+00	0.1049E+01	0.1000E-02
0.4741E+02	0.8223E+00	0.5244E+01	0.5000E-02

0.6824E+02	0.1242E+01	0.1049E+02	0.1000E-01
0.1047E+03	0.2079E+01	0.2670E+02	0.5000E-01
0.1176E+03	0.2423E+01	0.3623E+02	0.1000E+00
0.1476E+03	0.3512E+01	0.6618E+02	0.5000E+00
0.1653E+03	0.4420E+01	0.8391E+02	0.1000E+01
0.1653E+03	0.5420E+01	0.8391E+02	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 1 Bent 3 (Boring B-13)
Axial Capacity (kips)
Surface Elevation = 750
0
50
100
150
200
250
300
350
400
450
500
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
Skin Friction
Tip Resistance
Total Capacity
RNDR = 153 Kips
SILTY SAND
SANDY CLAY
SILTY SAND
SANDY CLAY
PWR
AUGER
REFUSAL
MATERIAL

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\
Name of input data file : 9672, Boring B-13_ Bridge 1 Bent 3.ap7d
Name of output file : 9672, Boring B-13_ Bridge 1 Bent 3.ap7o
Name of plot output file : 9672, Boring B-13_ Bridge 1 Bent 3.ap7p

Time and Date of Analysis

Date: June 14, 2018 Time: 11:32:15

1

* INPUT INFORMATION *

South River Trail - Phase 5 - Bridge 1 (Bent 3)

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

H-Pile/Steel Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 12.40 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 20.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 16.00 FT.
- PERIMETER OF PILE = 39.55 IN.
- TIP AREA OF PILE = 97.73 IN2
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	30.00	0.00
3.00	SAND	0.00	130.00	30.00	0.00
3.00	CLAY	0.00	120.00	0.00	0.00
6.00	CLAY	0.00	120.00	0.00	0.00
6.00	SAND	0.00	115.00	30.00	0.00
12.00	SAND	0.00	115.00	30.00	0.00
12.00	CLAY	0.00	100.00	0.00	0.00
16.00	CLAY	0.00	100.00	0.00	0.00
16.00	SAND	0.00	140.00	43.00	0.00
18.00	SAND	0.00	140.00	43.00	0.00
18.00	SAND	0.00	145.00	43.00	0.00
50.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.50	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.50	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
  WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
  PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
3.00	1.000	1.000
3.00	1.000	1.000
6.00	1.000	1.000
6.00	1.000	1.000
12.00	1.000	1.000
12.00	1.000	1.000
16.00	1.000	1.000
16.00	1.000	1.000
18.00	1.000	1.000
18.00	1.000	1.000
50.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.6	0.6
1.00	0.0	1.3	1.3
2.00	0.0	2.6	2.6
3.00	0.0	3.1	3.1
4.00	0.0	3.2	3.2
5.00	0.0	4.1	4.1
6.00	0.0	6.0	6.0
7.00	0.0	7.9	7.9
8.00	0.0	9.0	9.0
9.00	0.0	9.0	9.0
10.00	0.0	9.0	9.0
11.00	0.0	7.5	7.5
12.00	0.0	4.9	4.9
13.00	0.0	2.3	2.3
14.00	0.0	0.8	0.8
15.00	0.0	56.2	56.2
16.00	0.2	158.4	158.6
17.00	5.8	268.0	273.9
18.00	17.1	344.2	361.3
19.00	29.1	367.6	396.7
20.00	42.0	391.2	433.2

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.1525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.2958E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.3000E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01
			0.0000E+00	0.3903E-01
			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01
5	10	0.4525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01

			0.0000E+00	0.3903E-01
			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01
6	10	0.5958E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01
			0.0000E+00	0.3903E-01
			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01
7	10	0.6000E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
8	10	0.9025E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
9	10	0.1196E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
10	10	0.1200E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01
			0.0000E+00	0.3903E-01
			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01

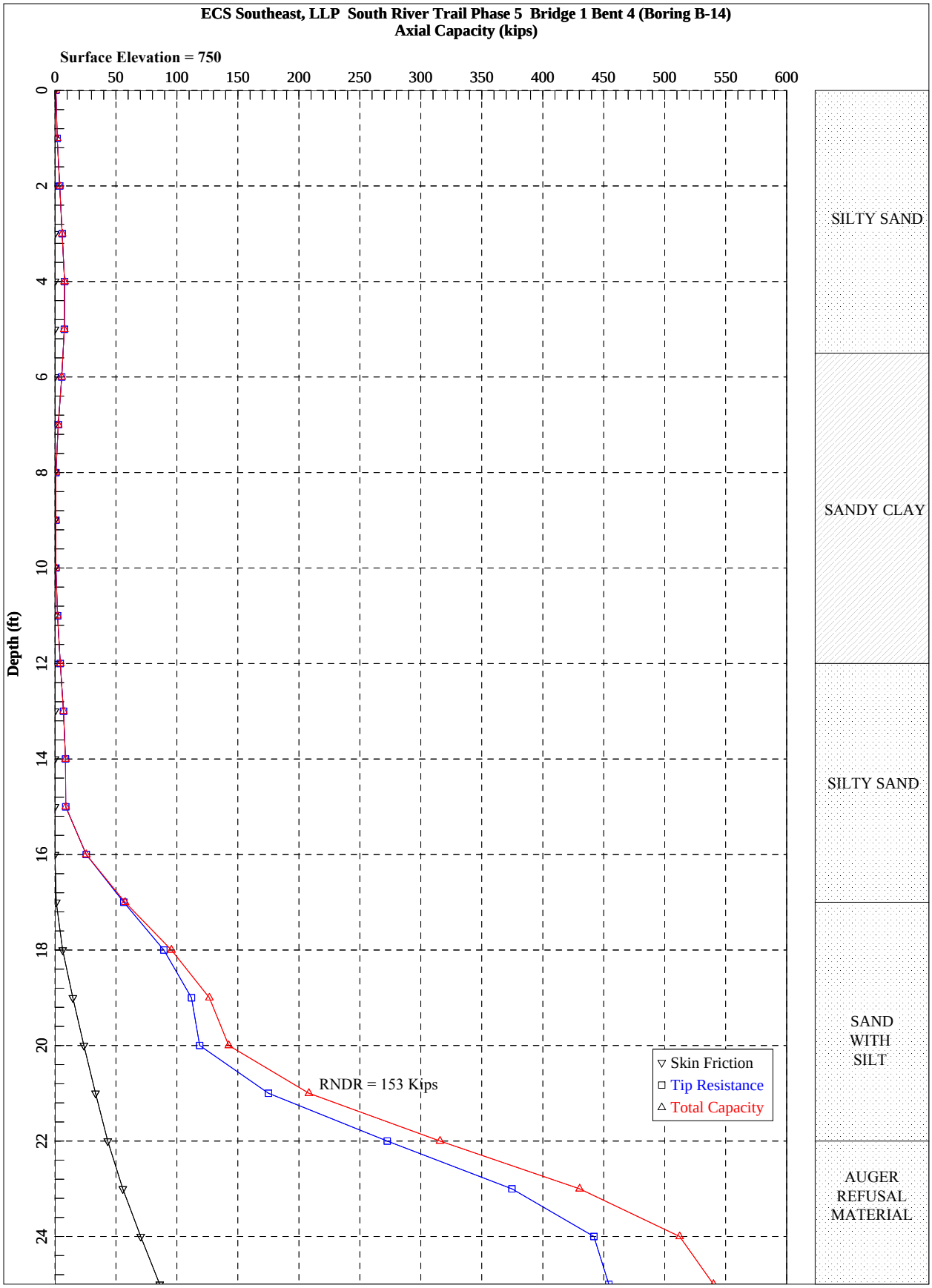
```
11          10      0.1403E+02
                                  0.0000E+00      0.0000E+00
                                  0.1302E+00      0.2014E-01
                                  0.2170E+00      0.3903E-01
                                  0.3255E+00      0.7176E-01
                                  0.3906E+00      0.1007E+00
                                  0.4340E+00      0.1259E+00
                                  0.3906E+00      0.2518E+00
                                  0.3906E+00      0.3777E+00
                                  0.3906E+00      0.6295E+00
                                  0.3906E+00      0.2518E+01
12          10      0.1596E+02
                                  0.0000E+00      0.0000E+00
                                  0.3564E+01      0.2014E-01
                                  0.5940E+01      0.3903E-01
                                  0.8910E+01      0.7176E-01
                                  0.1069E+02      0.1007E+00
                                  0.1188E+02      0.1259E+00
                                  0.1069E+02      0.2518E+00
                                  0.1069E+02      0.3777E+00
                                  0.1069E+02      0.6295E+00
                                  0.1069E+02      0.2518E+01
13          10      0.1600E+02
                                  0.0000E+00      0.0000E+00
                                  0.1779E+01      0.1000E-01
                                  0.3559E+01      0.2000E-01
                                  0.7118E+01      0.4000E-01
                                  0.1068E+02      0.6000E-01
                                  0.1424E+02      0.8000E-01
                                  0.1601E+02      0.9000E-01
                                  0.1779E+02      0.1000E+00
                                  0.1779E+02      0.5000E+00
                                  0.1779E+02      0.2000E+01
14          10      0.1703E+02
                                  0.0000E+00      0.0000E+00
                                  0.2454E+01      0.1000E-01
                                  0.4908E+01      0.2000E-01
                                  0.9815E+01      0.4000E-01
                                  0.1472E+02      0.6000E-01
                                  0.1963E+02      0.8000E-01
                                  0.2208E+02      0.9000E-01
                                  0.2454E+02      0.1000E+00
                                  0.2454E+02      0.5000E+00
                                  0.2454E+02      0.2000E+01
15          10      0.1796E+02
                                  0.0000E+00      0.0000E+00
                                  0.2454E+01      0.1000E-01
                                  0.4908E+01      0.2000E-01
                                  0.9815E+01      0.4000E-01
                                  0.1472E+02      0.6000E-01
                                  0.1963E+02      0.8000E-01
                                  0.2208E+02      0.9000E-01
                                  0.2454E+02      0.1000E+00
                                  0.2454E+02      0.5000E+00
                                  0.2454E+02      0.2000E+01
16          10      0.1800E+02
                                  0.0000E+00      0.0000E+00
                                  0.2621E+01      0.1000E-01
                                  0.5243E+01      0.2000E-01
                                  0.1049E+02      0.4000E-01
                                  0.1573E+02      0.6000E-01
                                  0.2097E+02      0.8000E-01
                                  0.2359E+02      0.9000E-01
```

			0.2621E+02	0.1000E+00
			0.2621E+02	0.5000E+00
			0.2621E+02	0.2000E+01
17	10	0.3403E+02		
			0.0000E+00	0.0000E+00
			0.2706E+01	0.1000E-01
			0.5411E+01	0.2000E-01
			0.1082E+02	0.4000E-01
			0.1623E+02	0.6000E-01
			0.2165E+02	0.8000E-01
			0.2435E+02	0.9000E-01
			0.2706E+02	0.1000E+00
			0.2706E+02	0.5000E+00
			0.2706E+02	0.2000E+01
18	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.2706E+01	0.1000E-01
			0.5411E+01	0.2000E-01
			0.1082E+02	0.4000E-01
			0.1623E+02	0.6000E-01
			0.2165E+02	0.8000E-01
			0.2435E+02	0.9000E-01
			0.2706E+02	0.1000E+00
			0.2706E+02	0.5000E+00
			0.2706E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2445E+02	0.6295E-02
0.4890E+02	0.1259E-01
0.9781E+02	0.2518E-01
0.1956E+03	0.1637E+00
0.2934E+03	0.5287E+00
0.3521E+03	0.9190E+00
0.3912E+03	0.1259E+01
0.3912E+03	0.1888E+01
0.3912E+03	0.2518E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.4583E+00	0.3998E-03	0.3885E+00	0.1000E-03
0.4583E+01	0.3998E-02	0.3885E+01	0.1000E-02
0.2310E+02	0.2010E-01	0.1942E+02	0.5000E-02
0.4621E+02	0.4020E-01	0.3885E+02	0.1000E-01
0.1464E+03	0.1453E+00	0.1153E+03	0.5000E-01
0.2026E+03	0.2314E+00	0.1507E+03	0.1000E+00
0.3370E+03	0.7212E+00	0.2857E+03	0.5000E+00
0.4127E+03	0.1272E+01	0.3614E+03	0.1000E+01
0.4425E+03	0.2292E+01	0.3912E+03	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 1 Bent 4 (Boring B-14)
Axial Capacity (kips)
Surface Elevation = 750
0
50
100
150
200
250
300
350
400
450
500
550
600
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
SILTY SAND
SANDY CLAY
SILTY SAND
SAND WITH SILT
AUGER REFUSAL MATERIAL
RNDR = 153 Kips
Skin Friction
Tip Resistance
Total Capacity

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\
Name of input data file : 9672, Boring B-14_ Bridge 1 Bent 4.ap7d
Name of output file : 9672, Boring B-14_ Bridge 1 Bent 4.ap7o
Name of plot output file : 9672, Boring B-14_ Bridge 1 Bent 4.ap7p

Time and Date of Analysis

Date: June 14, 2018 Time: 12:32:33

1

* INPUT INFORMATION *

South River Trail - Phase 5 - Bridge 1 (Bent 4)

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

H-Pile/Steel Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 12.40 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 25.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 17.00 FT.
- PERIMETER OF PILE = 39.55 IN.
- TIP AREA OF PILE = 97.73 IN2
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	115.00	32.00	0.00
5.50	SAND	0.00	115.00	32.00	0.00
5.50	CLAY	0.00	105.00	0.00	0.00
12.00	CLAY	0.00	105.00	0.00	0.00
12.00	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	125.00	38.00	0.00
22.00	SAND	0.00	125.00	38.00	0.00
22.00	SAND	0.00	145.00	43.00	0.00
50.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
5.50	1.000	1.000
5.50	1.000	1.000
12.00	1.000	1.000
12.00	1.000	1.000
17.00	1.000	1.000
17.00	1.000	1.000
22.00	1.000	1.000
22.00	1.000	1.000
50.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.8	0.8
1.00	0.0	1.8	1.8
2.00	0.0	3.9	3.9
3.00	0.0	5.9	5.9
4.00	0.0	7.9	7.9
5.00	0.0	7.7	7.7
6.00	0.0	5.5	5.5
7.00	0.0	2.7	2.7
8.00	0.0	0.8	0.8
9.00	0.0	0.8	0.8
10.00	0.0	0.8	0.8
11.00	0.0	2.1	2.1
12.00	0.0	4.4	4.4
13.00	0.0	7.0	7.0
14.00	0.0	8.7	8.7
15.00	0.0	8.9	8.9
16.00	0.0	25.7	25.7
17.00	1.1	56.4	57.5
18.00	6.3	89.3	95.5
19.00	14.7	112.0	126.7
20.00	23.7	118.7	142.5
21.00	33.3	175.1	208.3
22.00	43.3	272.5	315.8
23.00	55.6	374.7	430.3
24.00	70.3	441.9	512.3
25.00	85.9	454.2	540.0

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

```
**********************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
**********************************************
```

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.2775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.5458E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.5500E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01
			0.0000E+00	0.3903E-01
			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01
5	10	0.8775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01
			0.0000E+00	0.3903E-01

			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01
6	10	0.1196E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01
			0.0000E+00	0.3903E-01
			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01
7	10	0.1200E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
8	10	0.1453E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
9	10	0.1696E+02		
			0.0000E+00	0.0000E+00
			0.1093E+01	0.1000E-01
			0.2186E+01	0.2000E-01
			0.4372E+01	0.4000E-01
			0.6558E+01	0.6000E-01
			0.8743E+01	0.8000E-01
			0.9836E+01	0.9000E-01
			0.1093E+02	0.1000E+00
			0.1093E+02	0.5000E+00
			0.1093E+02	0.2000E+01
10	10	0.1700E+02		
			0.0000E+00	0.0000E+00
			0.1438E+01	0.1000E-01
			0.2877E+01	0.2000E-01
			0.5754E+01	0.4000E-01
			0.8630E+01	0.6000E-01
			0.1151E+02	0.8000E-01
			0.1295E+02	0.9000E-01
			0.1438E+02	0.1000E+00
			0.1438E+02	0.5000E+00
			0.1438E+02	0.2000E+01
11	10	0.1953E+02		

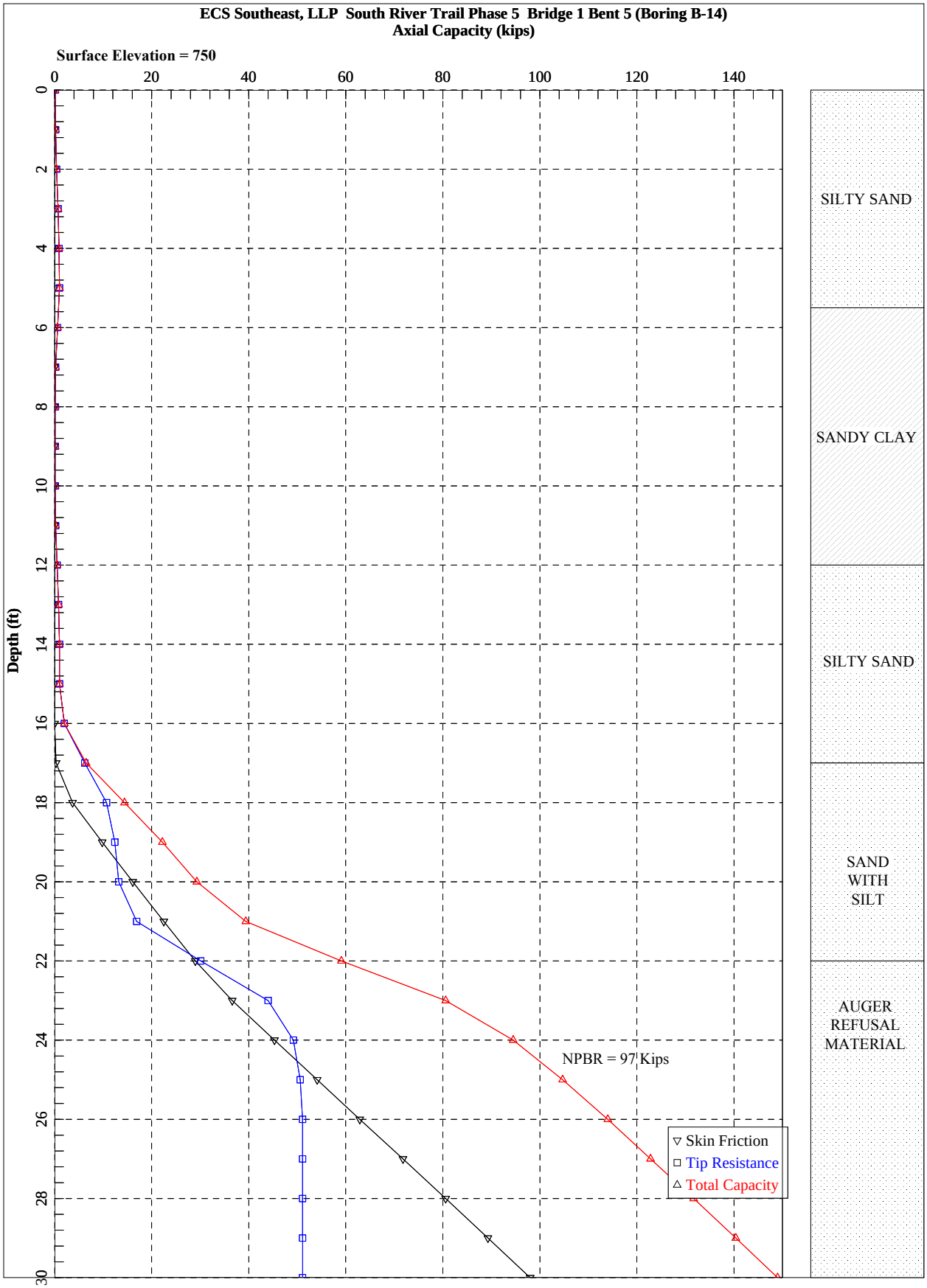
			0.0000E+00	0.0000E+00
			0.1950E+01	0.1000E-01
			0.3901E+01	0.2000E-01
			0.7802E+01	0.4000E-01
			0.1170E+02	0.6000E-01
			0.1560E+02	0.8000E-01
			0.1755E+02	0.9000E-01
			0.1950E+02	0.1000E+00
			0.1950E+02	0.5000E+00
			0.1950E+02	0.2000E+01
12	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.2356E+01	0.1000E-01
			0.4712E+01	0.2000E-01
			0.9424E+01	0.4000E-01
			0.1414E+02	0.6000E-01
			0.1885E+02	0.8000E-01
			0.2120E+02	0.9000E-01
			0.2356E+02	0.1000E+00
			0.2356E+02	0.5000E+00
			0.2356E+02	0.2000E+01
13	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.2848E+01	0.1000E-01
			0.5697E+01	0.2000E-01
			0.1139E+02	0.4000E-01
			0.1709E+02	0.6000E-01
			0.2279E+02	0.8000E-01
			0.2564E+02	0.9000E-01
			0.2848E+02	0.1000E+00
			0.2848E+02	0.5000E+00
			0.2848E+02	0.2000E+01
14	10	0.3603E+02		
			0.0000E+00	0.0000E+00
			0.3271E+01	0.1000E-01
			0.6541E+01	0.2000E-01
			0.1308E+02	0.4000E-01
			0.1962E+02	0.6000E-01
			0.2617E+02	0.8000E-01
			0.2944E+02	0.9000E-01
			0.3271E+02	0.1000E+00
			0.3271E+02	0.5000E+00
			0.3271E+02	0.2000E+01
15	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.3271E+01	0.1000E-01
			0.6541E+01	0.2000E-01
			0.1308E+02	0.4000E-01
			0.1962E+02	0.6000E-01
			0.2617E+02	0.8000E-01
			0.2944E+02	0.9000E-01
			0.3271E+02	0.1000E+00
			0.3271E+02	0.5000E+00
			0.3271E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2839E+02	0.6295E-02
0.5677E+02	0.1259E-01

0.1135E+03	0.2518E-01
0.2271E+03	0.1637E+00
0.3406E+03	0.5287E+00
0.4087E+03	0.9190E+00
0.4542E+03	0.1259E+01
0.4542E+03	0.1888E+01
0.4542E+03	0.2518E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.5951E+00	0.5744E-03	0.4509E+00	0.1000E-03
0.5951E+01	0.5744E-02	0.4509E+01	0.1000E-02
0.3015E+02	0.2900E-01	0.2255E+02	0.5000E-02
0.6029E+02	0.5799E-01	0.4509E+02	0.1000E-01
0.1986E+03	0.2063E+00	0.1339E+03	0.5000E-01
0.2676E+03	0.3113E+00	0.1749E+03	0.1000E+00
0.4244E+03	0.8421E+00	0.3317E+03	0.5000E+00
0.5122E+03	0.1415E+01	0.4196E+03	0.1000E+01
0.5468E+03	0.2444E+01	0.4542E+03	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 1 Bent 5 (Boring B-14)
Axial Capacity (kips)
Surface Elevation = 750
Depth (ft)
0
20
40
60
80
100
120
140
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
SILTY SAND
SANDY CLAY
SILTY SAND
SAND WITH SILT
AUGER REFUSAL MATERIAL
NPBR = 97 Kips
Skin Friction
Tip Resistance
Total Capacity

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Bridge 1\
Name of input data file : 9672, Boring B-14_ Bridge 1 Bent 5.ap7d
Name of output file : 9672, Boring B-14_ Bridge 1 Bent 5.ap7o
Name of plot output file : 9672, Boring B-14_ Bridge 1 Bent 5.ap7p

---

Time and Date of Analysis

Date: June 15, 2018 Time: 09:17:22

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 1 (Bent 5)

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
25.00	7.50

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 10.00 IN.
- TOTAL PILE LENGTH, TL = 30.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 17.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	115.00	32.00	0.00
5.50	SAND	0.00	115.00	32.00	0.00
5.50	CLAY	0.00	105.00	0.00	0.00
12.00	CLAY	0.00	105.00	0.00	0.00
12.00	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	125.00	38.00	0.00
22.00	SAND	0.00	125.00	38.00	0.00
22.00	SAND	0.00	145.00	43.00	0.00
50.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING

WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
5.50	1.000	1.000
5.50	1.000	1.000
12.00	1.000	1.000
12.00	1.000	1.000
17.00	1.000	1.000
17.00	1.000	1.000
22.00	1.000	1.000
22.00	1.000	1.000
50.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.1	0.1
1.00	0.0	0.2	0.2
2.00	0.0	0.4	0.4
3.00	0.0	0.7	0.7
4.00	0.0	0.9	0.9
5.00	0.0	1.0	1.0
6.00	0.0	0.6	0.6
7.00	0.0	0.2	0.2
8.00	0.0	0.1	0.1
9.00	0.0	0.1	0.1
10.00	0.0	0.1	0.1
11.00	0.0	0.2	0.2
12.00	0.0	0.5	0.5
13.00	0.0	0.8	0.8
14.00	0.0	1.0	1.0
15.00	0.0	1.0	1.0
16.00	0.0	2.0	2.0
17.00	0.3	6.2	6.5
18.00	3.7	10.7	14.4
19.00	9.8	12.4	22.2
20.00	16.1	13.2	29.3
21.00	22.5	16.9	39.4
22.00	29.0	30.1	59.1
23.00	36.6	44.0	80.6
24.00	45.3	49.2	94.5
25.00	54.1	50.6	104.7
26.00	62.9	51.1	114.0

27.00	71.8	51.1	122.8
28.00	80.6	51.1	131.7
29.00	89.3	51.1	140.4
30.00	98.0	51.1	149.0

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.2775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.5458E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.5500E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00

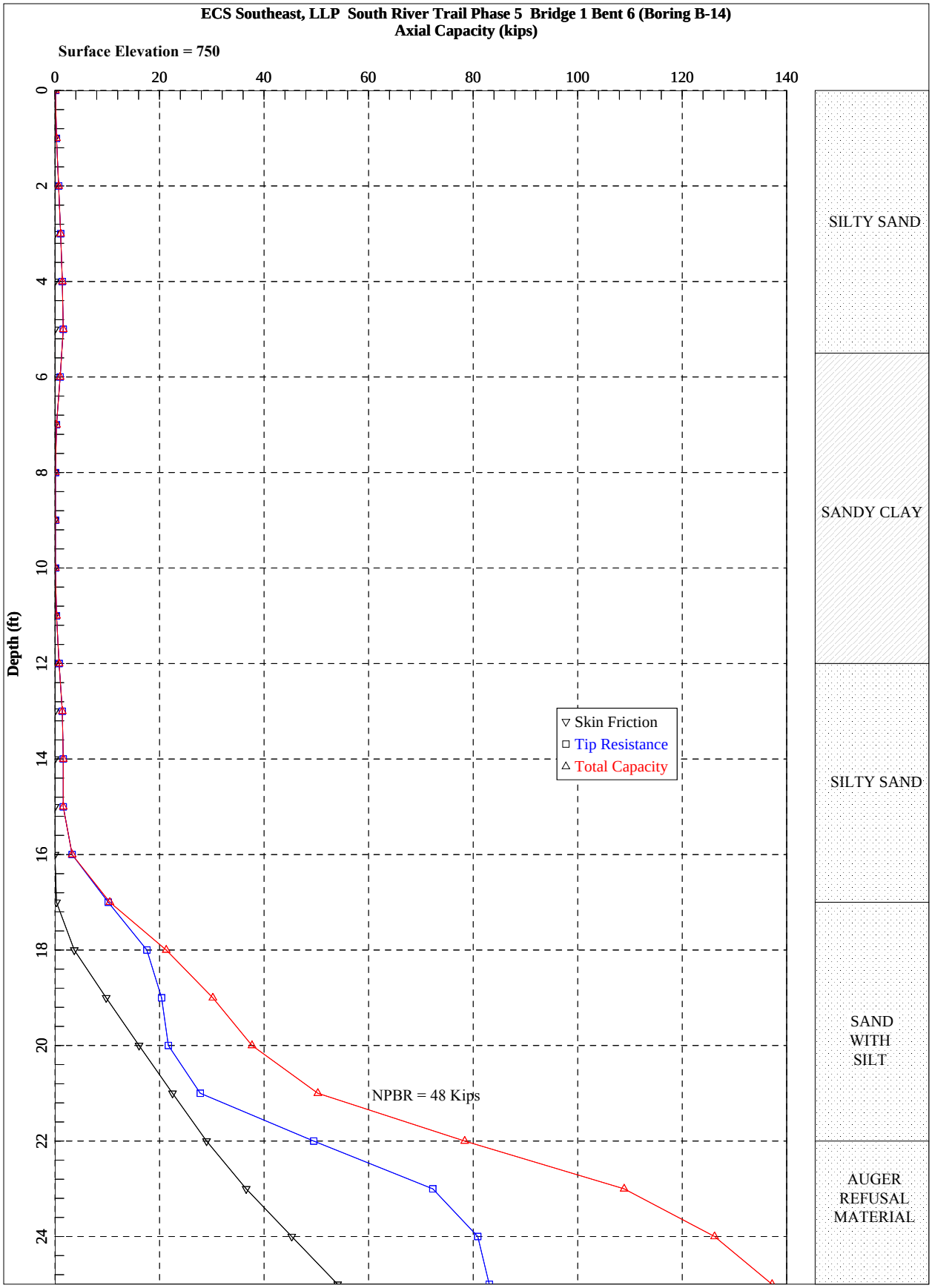
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
5	10	0.8775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
6	10	0.1196E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
7	10	0.1200E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
8	10	0.1453E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
9	10	0.1696E+02		
			0.0000E+00	0.0000E+00
			0.8957E+00	0.1000E-01
			0.1791E+01	0.2000E-01
			0.3583E+01	0.4000E-01
			0.5374E+01	0.6000E-01
			0.7166E+01	0.8000E-01
			0.8061E+01	0.9000E-01
			0.8957E+01	0.1000E+00
			0.8957E+01	0.5000E+00
			0.8957E+01	0.2000E+01
10	10	0.1700E+02		
			0.0000E+00	0.0000E+00
			0.1258E+01	0.1000E-01
			0.2516E+01	0.2000E-01
			0.5032E+01	0.4000E-01

			0.7548E+01	0.6000E-01
			0.1006E+02	0.8000E-01
			0.1132E+02	0.9000E-01
			0.1258E+02	0.1000E+00
			0.1258E+02	0.5000E+00
			0.1258E+02	0.2000E+01
11	10	0.1953E+02		
			0.0000E+00	0.0000E+00
			0.1678E+01	0.1000E-01
			0.3356E+01	0.2000E-01
			0.6712E+01	0.4000E-01
			0.1007E+02	0.6000E-01
			0.1342E+02	0.8000E-01
			0.1510E+02	0.9000E-01
			0.1678E+02	0.1000E+00
			0.1678E+02	0.5000E+00
			0.1678E+02	0.2000E+01
12	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.1871E+01	0.1000E-01
			0.3742E+01	0.2000E-01
			0.7483E+01	0.4000E-01
			0.1122E+02	0.6000E-01
			0.1497E+02	0.8000E-01
			0.1684E+02	0.9000E-01
			0.1871E+02	0.1000E+00
			0.1871E+02	0.5000E+00
			0.1871E+02	0.2000E+01
13	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.2165E+01	0.1000E-01
			0.4329E+01	0.2000E-01
			0.8659E+01	0.4000E-01
			0.1299E+02	0.6000E-01
			0.1732E+02	0.8000E-01
			0.1948E+02	0.9000E-01
			0.2165E+02	0.1000E+00
			0.2165E+02	0.5000E+00
			0.2165E+02	0.2000E+01
14	10	0.3603E+02		
			0.0000E+00	0.0000E+00
			0.2290E+01	0.1000E-01
			0.4581E+01	0.2000E-01
			0.9161E+01	0.4000E-01
			0.1374E+02	0.6000E-01
			0.1832E+02	0.8000E-01
			0.2061E+02	0.9000E-01
			0.2290E+02	0.1000E+00
			0.2290E+02	0.5000E+00
			0.2290E+02	0.2000E+01
15	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.2290E+01	0.1000E-01
			0.4581E+01	0.2000E-01
			0.9161E+01	0.4000E-01
			0.1374E+02	0.6000E-01
			0.1832E+02	0.8000E-01
			0.2061E+02	0.9000E-01
			0.2290E+02	0.1000E+00
			0.2290E+02	0.5000E+00
			0.2290E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3193E+01	0.5000E-02
0.6385E+01	0.1000E-01
0.1277E+02	0.2000E-01
0.2554E+02	0.1300E+00
0.3831E+02	0.4200E+00
0.4598E+02	0.7300E+00
0.5108E+02	0.1000E+01
0.5108E+02	0.1500E+01
0.5108E+02	0.2000E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1535E+01	0.2792E-01	0.6385E-01	0.1000E-03
0.1732E+02	0.3151E+00	0.6385E+00	0.1000E-02
0.5647E+02	0.1109E+01	0.3193E+01	0.5000E-02
0.7627E+02	0.1582E+01	0.6385E+01	0.1000E-01
0.1113E+03	0.2533E+01	0.1625E+02	0.5000E-01
0.1225E+03	0.2890E+01	0.2206E+02	0.1000E+00
0.1407E+03	0.3799E+01	0.4029E+02	0.5000E+00
0.1515E+03	0.4600E+01	0.5108E+02	0.1000E+01
0.1515E+03	0.5600E+01	0.5108E+02	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 1 Bent 6 (Boring B-14)
Axial Capacity (kips)
Surface Elevation = 750
0
20
40
60
80
100
120
140
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
Skin Friction
Tip Resistance
Total Capacity
NPBR = 48 Kips
SILTY SAND
SANDY CLAY
SILTY SAND
SAND WITH SILT
AUGER REFUSAL MATERIAL

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\
Name of input data file : 9672, Boring B-14_ Bridge 1 Bent 6.ap7d
Name of output file : 9672, Boring B-14_ Bridge 1 Bent 6.ap7o
Name of plot output file : 9672, Boring B-14_ Bridge 1 Bent 6.ap7p

---

Time and Date of Analysis

Date: June 14, 2018 Time: 13:06:40

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 1 (Bent 6)

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
25.00	7.50

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 10.00 IN.
- TOTAL PILE LENGTH, TL = 25.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 17.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	115.00	32.00	0.00
5.50	SAND	0.00	115.00	32.00	0.00
5.50	CLAY	0.00	105.00	0.00	0.00
12.00	CLAY	0.00	105.00	0.00	0.00
12.00	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	125.00	38.00	0.00
22.00	SAND	0.00	125.00	38.00	0.00
22.00	SAND	0.00	145.00	43.00	0.00
50.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.12	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING

WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
5.50	1.000	1.000
5.50	1.000	1.000
12.00	1.000	1.000
12.00	1.000	1.000
17.00	1.000	1.000
17.00	1.000	1.000
22.00	1.000	1.000
22.00	1.000	1.000
50.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.1	0.1
1.00	0.0	0.3	0.3
2.00	0.0	0.7	0.7
3.00	0.0	1.1	1.1
4.00	0.0	1.4	1.4
5.00	0.0	1.6	1.6
6.00	0.0	1.0	1.0
7.00	0.0	0.3	0.3
8.00	0.0	0.1	0.1
9.00	0.0	0.1	0.1
10.00	0.0	0.1	0.1
11.00	0.0	0.3	0.3
12.00	0.0	0.8	0.8
13.00	0.0	1.4	1.4
14.00	0.0	1.6	1.6
15.00	0.0	1.6	1.6
16.00	0.0	3.3	3.3
17.00	0.3	10.2	10.5
18.00	3.7	17.6	21.3
19.00	9.8	20.4	30.2
20.00	16.1	21.7	37.7
21.00	22.5	27.8	50.3
22.00	29.0	49.5	78.4
23.00	36.6	72.3	108.9
24.00	45.3	80.9	126.2
25.00	54.1	83.1	137.2

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.2775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.5458E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.5500E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
5	10	0.8775E+01		
			0.0000E+00	0.0000E+00

			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
6	10	0.1196E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1600E-01
			0.0000E+00	0.3100E-01
			0.0000E+00	0.5700E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.2000E+00
			0.0000E+00	0.3000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
7	10	0.1200E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
8	10	0.1453E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
9	10	0.1696E+02		
			0.0000E+00	0.0000E+00
			0.8957E+00	0.1000E-01
			0.1791E+01	0.2000E-01
			0.3583E+01	0.4000E-01
			0.5374E+01	0.6000E-01
			0.7166E+01	0.8000E-01
			0.8061E+01	0.9000E-01
			0.8957E+01	0.1000E+00
			0.8957E+01	0.5000E+00
			0.8957E+01	0.2000E+01
10	10	0.1700E+02		
			0.0000E+00	0.0000E+00
			0.1258E+01	0.1000E-01
			0.2516E+01	0.2000E-01
			0.5032E+01	0.4000E-01
			0.7548E+01	0.6000E-01
			0.1006E+02	0.8000E-01
			0.1132E+02	0.9000E-01
			0.1258E+02	0.1000E+00
			0.1258E+02	0.5000E+00

			0.1258E+02	0.2000E+01
11	10	0.1953E+02		
			0.0000E+00	0.0000E+00
			0.1678E+01	0.1000E-01
			0.3356E+01	0.2000E-01
			0.6712E+01	0.4000E-01
			0.1007E+02	0.6000E-01
			0.1342E+02	0.8000E-01
			0.1510E+02	0.9000E-01
			0.1678E+02	0.1000E+00
			0.1678E+02	0.5000E+00
			0.1678E+02	0.2000E+01
12	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.1871E+01	0.1000E-01
			0.3742E+01	0.2000E-01
			0.7483E+01	0.4000E-01
			0.1122E+02	0.6000E-01
			0.1497E+02	0.8000E-01
			0.1684E+02	0.9000E-01
			0.1871E+02	0.1000E+00
			0.1871E+02	0.5000E+00
			0.1871E+02	0.2000E+01
13	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.2165E+01	0.1000E-01
			0.4329E+01	0.2000E-01
			0.8659E+01	0.4000E-01
			0.1299E+02	0.6000E-01
			0.1732E+02	0.8000E-01
			0.1948E+02	0.9000E-01
			0.2165E+02	0.1000E+00
			0.2165E+02	0.5000E+00
			0.2165E+02	0.2000E+01
14	10	0.3603E+02		
			0.0000E+00	0.0000E+00
			0.2333E+01	0.1000E-01
			0.4666E+01	0.2000E-01
			0.9332E+01	0.4000E-01
			0.1400E+02	0.6000E-01
			0.1866E+02	0.8000E-01
			0.2100E+02	0.9000E-01
			0.2333E+02	0.1000E+00
			0.2333E+02	0.5000E+00
			0.2333E+02	0.2000E+01
15	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.2333E+01	0.1000E-01
			0.4666E+01	0.2000E-01
			0.9332E+01	0.4000E-01
			0.1400E+02	0.6000E-01
			0.1866E+02	0.8000E-01
			0.2100E+02	0.9000E-01
			0.2333E+02	0.1000E+00
			0.2333E+02	0.5000E+00
			0.2333E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00

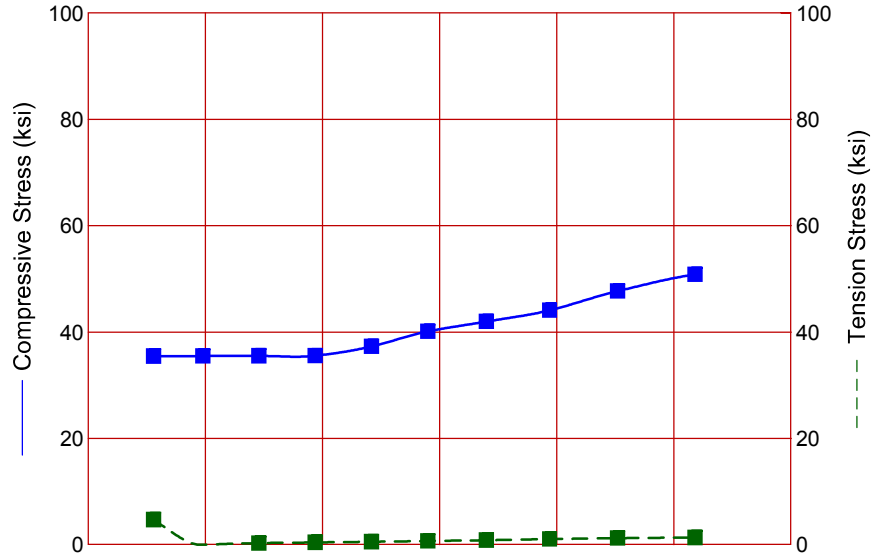
0.5196E+01	0.5000E-02
0.1039E+02	0.1000E-01
0.2078E+02	0.2000E-01
0.4157E+02	0.1300E+00
0.6235E+02	0.4200E+00
0.7482E+02	0.7300E+00
0.8314E+02	0.1000E+01
0.8314E+02	0.1500E+01
0.8314E+02	0.2000E+01

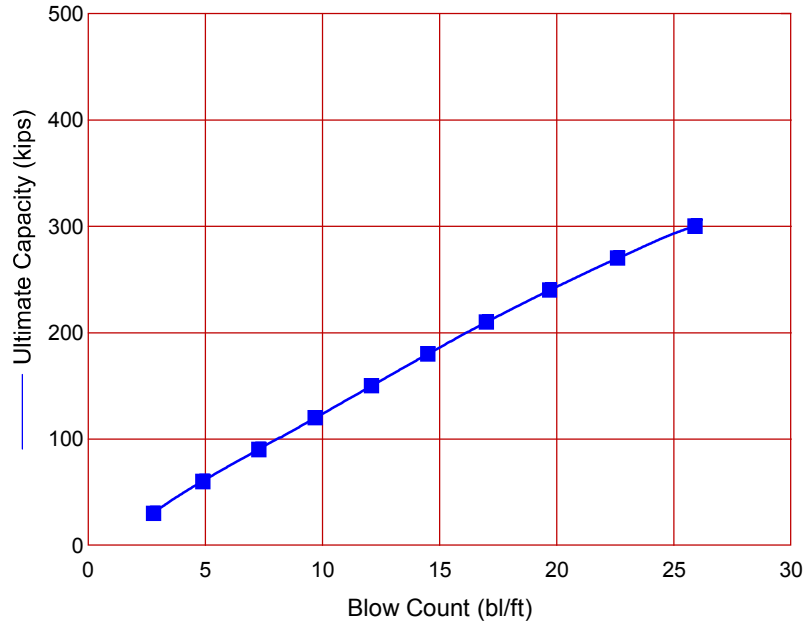
LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.5512E+00	0.1002E-01	0.1039E+00	0.1000E-03
0.6161E+01	0.1117E+00	0.1039E+01	0.1000E-02
0.2963E+02	0.5424E+00	0.5196E+01	0.5000E-02
0.4809E+02	0.9151E+00	0.1039E+02	0.1000E-01
0.8231E+02	0.1705E+01	0.2645E+02	0.5000E-01
0.9490E+02	0.2042E+01	0.3590E+02	0.1000E+00
0.1246E+03	0.3125E+01	0.6557E+02	0.5000E+00
0.1421E+03	0.4030E+01	0.8314E+02	0.1000E+01
0.1421E+03	0.5030E+01	0.8314E+02	0.2000E+01

ECS Southeast LLP
South River Trail- Phase 5 Bent 3

12-Jul-2018
GRLWEAP Version 2010

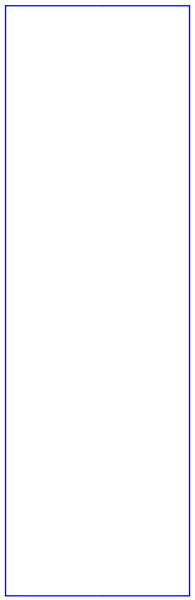




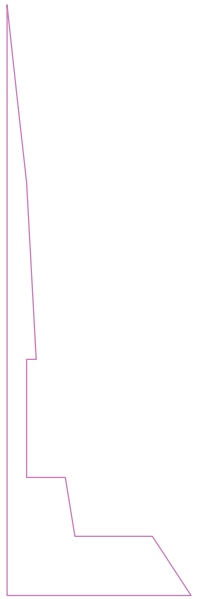
JUNTTAN HHK 4A

Stroke	3.94	ft
Ram Weight	8.82	kips
Efficiency	0.950	
Helmet Weight	1.01	kips
Hammer Cushion	11354	kips/in
COR of H.C.	0.900	
Skin Quake	0.100	in
Toe Quake	0.167	in
Skin Damping	0.200	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	20.00	ft
Pile Penetration	20.00	ft
Pile Top Area	12.40	in2

Pile Model



Skin Friction Distribution



Res. Shaft = 10 %
(Proportional)

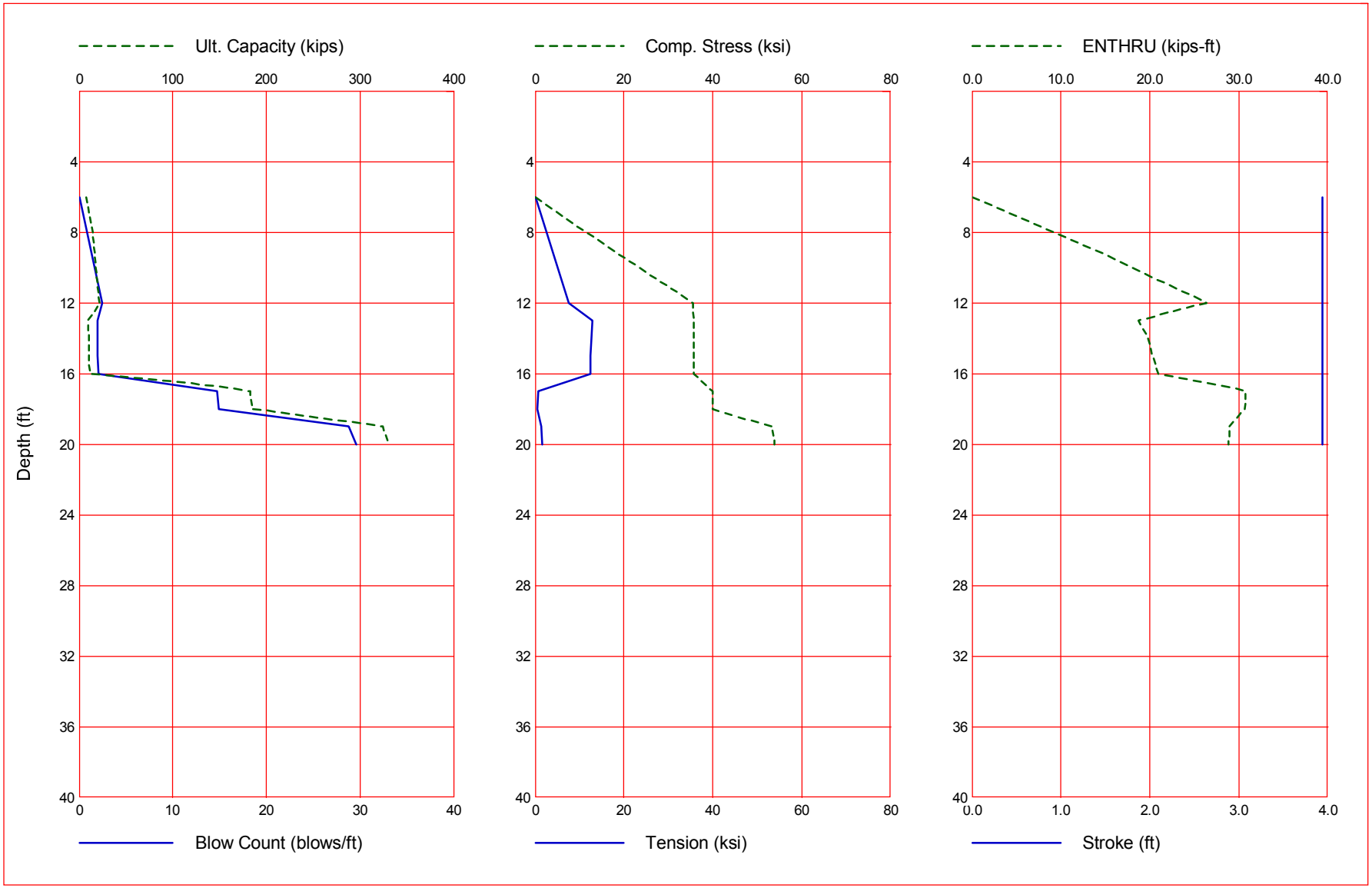
ECS Carolinas LLP 12-Jul-2018
South River Trail - Phase 5 Bent 3 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
30.0	35.48	4.71	2.8	3.94	28.63
60.0	35.50	0.00	4.9	3.94	30.70
90.0	35.53	0.32	7.3	3.94	31.04
120.0	35.55	0.45	9.7	3.94	31.06
150.0	37.31	0.58	12.1	3.94	30.93
180.0	40.13	0.72	14.5	3.94	30.71
210.0	41.98	0.86	17.0	3.94	30.39
240.0	44.10	1.07	19.7	3.94	29.94
270.0	47.71	1.25	22.6	3.94	29.57
300.0	50.83	1.36	25.9	3.94	29.26

ECS Southeast LLP
South River Trail- Phase 5 Bent 3

Jun 21 2018
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000



Gain/Loss 1 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	7.9	2.5	5.4	0.0	0.000	0.000	3.94	0.0
12.0	21.7	7.6	14.2	2.5	35.614	-7.600	3.94	26.4
13.0	9.7	8.2	1.5	2.0	35.710	-12.986	3.94	18.7
14.0	10.4	8.9	1.5	2.0	35.781	-12.729	3.94	19.8
15.0	11.1	9.6	1.5	2.0	35.818	-12.546	3.94	20.3
16.0	11.8	10.2	1.5	2.1	35.816	-12.418	3.94	21.0
17.0	182.3	12.2	170.1	14.7	40.074	-0.667	3.94	30.8
18.0	184.4	14.3	170.1	14.9	40.017	-0.616	3.94	30.7
19.0	325.0	19.6	305.4	28.8	53.497	-1.322	3.94	29.0
20.0	330.8	25.5	305.4	29.6	53.838	-1.536	3.94	28.9

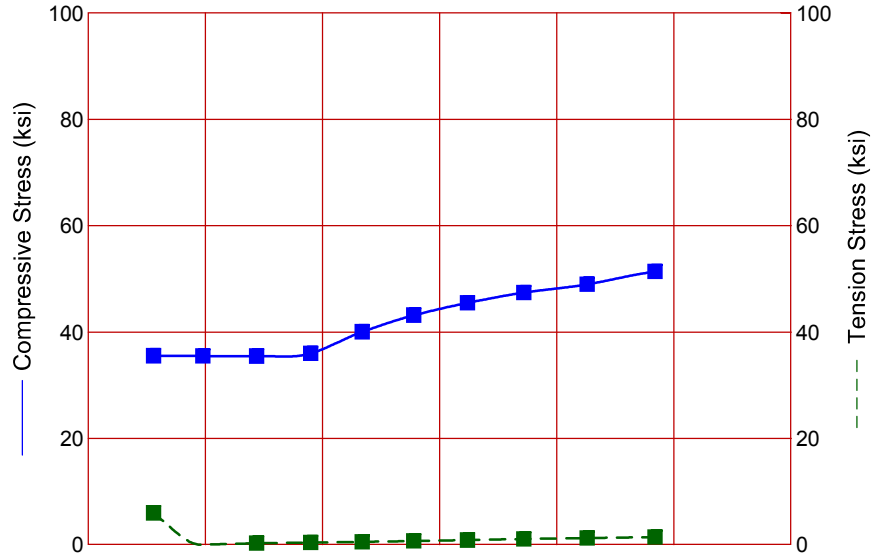
Total Number of Blows: 89

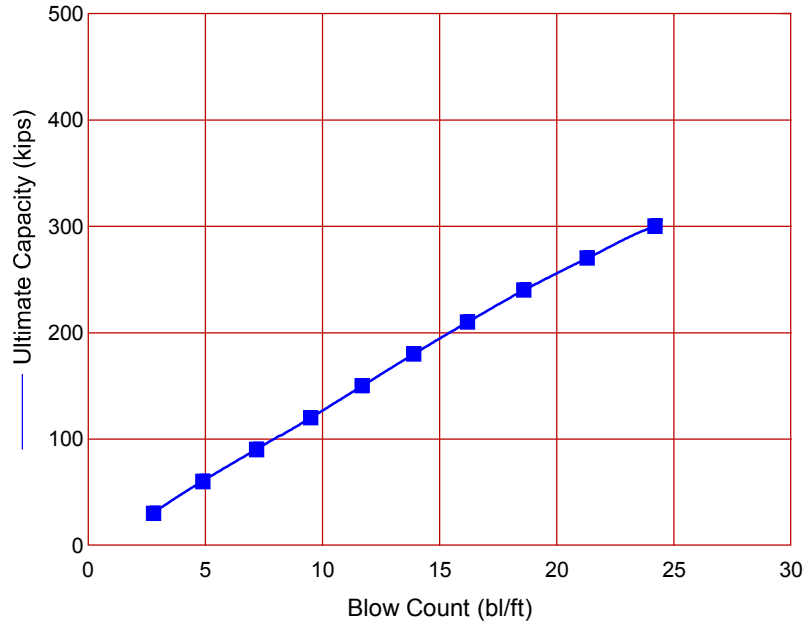
Driving lime (min):	2	2	1	1	1	1	0	0	0	0
@Blow Rate (b/min):	30	40	50	60	70	80	90	100	110	120

Driving lime for continuously running hammer; any wait times not included

ECS Southeast LLP
South River Trail- Phase 5 Bent4

12-Jul-2018
GRLWEAP Version 2010

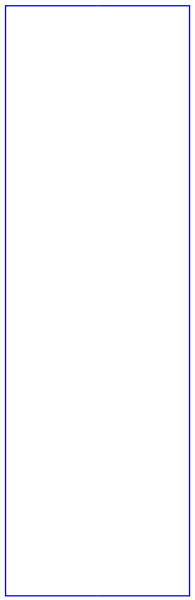




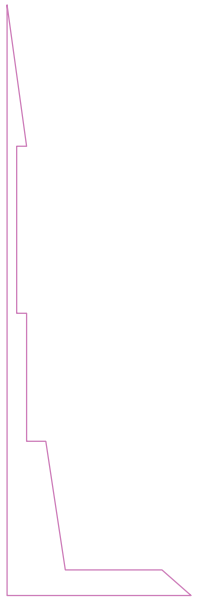
JUNTTAN HHK 4A

Stroke	3.94	ft
Ram Weight	8.82	kips
Efficiency	0.950	
Helmet Weight	1.01	kips
Hammer Cushion	11354	kips/in
COR of H.C.	0.900	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.200	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	23.00	ft
Pile Penetration	23.00	ft
Pile Top Area	12.40	in2

Pile Model



Skin Friction Distribution



Res. Shaft = 10 %
(Proportional)

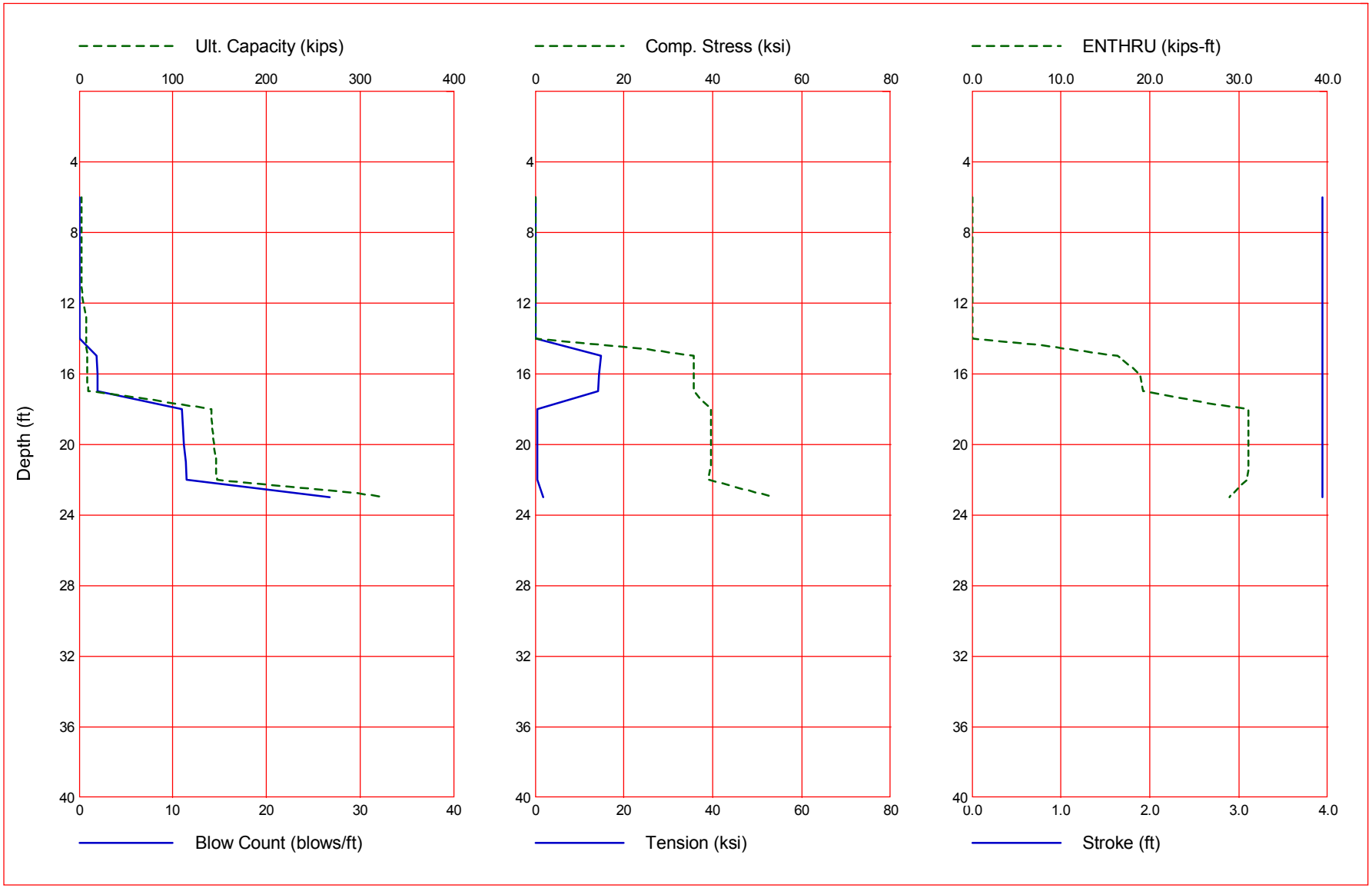
ECS Carolinas LLP 12-Jul-2018
South River Trail - Phase 5 Bent 4 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
30.0	35.53	5.97	2.8	3.94	28.72
60.0	35.51	0.00	4.9	3.94	30.71
90.0	35.48	0.28	7.2	3.94	31.06
120.0	35.99	0.41	9.5	3.94	31.11
150.0	40.04	0.56	11.7	3.94	30.99
180.0	43.16	0.72	13.9	3.94	30.75
210.0	45.49	0.89	16.2	3.94	30.41
240.0	47.43	1.10	18.6	3.94	29.95
270.0	48.98	1.26	21.3	3.94	29.64
300.0	51.37	1.45	24.2	3.94	29.30

ECS Southeast LLP
South River Trail- Phase 5 Bent 4

Jun 21 2018
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000



ECS Southeast LLP
South River Trail - Phase 5 Bent 4

Jun 21 2018
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	2.4	1.6	0.8	0.0	0.000	0.000	3.94	0.0
12.0	4.5	3.7	0.8	0.0	0.000	0.000	3.94	0.0
13.0	7.1	4.3	2.8	0.0	0.000	0.000	3.94	0.0
14.0	7.7	4.9	2.8	0.0	0.000	0.000	3.94	0.0
15.0	8.4	5.5	2.8	1.9	35.678	-14.771	3.94	16.4
16.0	9.0	6.2	2.8	2.0	35.693	-14.463	3.94	18.8
17.0	9.7	6.8	2.8	2.0	35.736	-14.169	3.94	19.2
18.0	141.3	8.1	133.2	11.0	39.600	-0.527	3.94	31.1
19.0	142.7	9.5	133.2	11.1	39.621	-0.516	3.94	31.1
20.0	144.2	11.0	133.2	11.2	39.635	-0.520	3.94	31.1
21.0	145.9	12.6	133.2	11.4	39.494	-0.522	3.94	31.1
22.0	147.6	14.4	133.2	11.5	39.150	-0.525	3.94	31.0
23.0	325.0	19.6	305.4	26.8	53.595	-1.728	3.94	29.0

Total Number of Blows: 74

Driving lime (min):	2	1	1	1	1	0	0	0	0	0
@Blow Rate (b/min):	30	40	50	60	70	80	90	100	110	120

Driving lime for continuously running hammer; any wait times not included

DEPARTMENT OF TRANSPORTATION

STATE OF GEORGIA

INTERDEPARTMENTAL CORRESPONDENCE

FILE	CSTEE-0009-00(029), DeKalb County PI No. 0009029 South River Trial Phase 5 – Bridge No. 2	**OFFICE** **DATE**	Materials and Testing Forest Park, Georgia August 8, 2018

FROM Monica L. Flournoy A.A.A
Monica L. Flournoy, P.E., State Materials Engineer

TO Kimberly Nesbitt, State Program Delivery Administrator
Attn: Mark Lawing, Project Manager

SUBJECT **Acceptance of Consultant's Bridge Foundation Investigation Report**

As requested, we have reviewed the Bridge Foundation Investigation Report that was written on June 22, 2018, and revised on July 26, 2018, by ECS Southeast, LLP of Marietta, Georgia. This Report is acceptable for use. Copies of this Report should be forwarded to the appropriate Offices by the Project Manager.

The consultant should provide a PDF of the accepted Report to this Office.

If additional information is needed, please contact Nicolas Sotolongo of the Geotechnical Bureau at 404-608-4729 (Direct) or 404-608-4720 (Main).

MLF: GEF: NLS

cc: Bill DuVall, P.E., State Bridge and Structural Engineer
Attn: Lyn Clements, P.E., Assistant State Bridge and Structural Engineer
Clayton Bennett, P.E., State Bridge Maintenance Engineer
Kathy Zahul, District Engineer, Chamblee
Christopher Raymond, Area Engineer, Chamblee
Robert Barnes, P.E., (RBarnes@ecslimited.com)
Jay Hornsby, P.G., (Jhornsby@ecslimited.com)

ECS Southeast, LLP

Report of Bridge Foundation Investigation

South River Trail Phase 5 – Bridge No. 2 over Cobbs Creek

DeKalb County, Georgia

CSTEE-0009-00(029)

P.I. No.: 0009029

ECS Project Number 10:9672

July 26, 2018
Revision No. 2

July 26, 2018
Revision No. 2

Mr. Jonathan McCaig
Path Foundation
1601 W. Peachtree Street
Atlanta, GA 30309

Reference: BFI Report – Bridge No. 2 over Cobbs Creek
South River Trail Phase 5
DeKalb County, Georgia
P.I. No.: 0009029

ECS Project No. 10:9672

Dear Mr. McCaig:

ECS Southeast, LLP (ECS) is pleased to submit this revised Bridge Foundation Investigation (BFI) Report for the site referenced above. The attached report has been revised to incorporate the comments we received back from the Georgia Department of Transportation Office of Materials and Testing (OMAT) in their review correspondence dated July 10, 2018 as well as a follow up phone conversation with Mr. Nicolas Sotolongo of the OMAT Geotechnical & Environmental Bureau on July 26, 2018.

Thank you for the opportunity to provide geotechnical engineering services on this project. Should you have questions regarding our findings or need additional consultation, please do not hesitate to contact our office.

Sincerely,

ECS SOUTHEAST, LLP represented by:

Jay Hornsby, P.G.
Geotechnical Department Manager

Robert H. Barnes, P.E., P.G.
Principal Engineer
GA Registration No. 29715

Enclosure: BFI Data Form

Bridge Foundation Investigation (LRFD), Br. 2
CSTEE-0009-00(029), DeKalb County
PI No. 0009029
July 26, 2018
Revision No. 2

LOCATION (See Map) South River Trail, Phase 5 over Cobbs Creek, Bridge No. 2. Bridge No. 2 consists of a 100-feet long pre-engineered pedestrian bridge over Cobbs Creek. The bridge will be supported by two end bents (Bents 5 and 6). The approach to the bridge on both sides is boardwalk supported by Bents 1, 2, 3, 4, 7, 8, 9 and 10.

GENERAL INFORMATION

GEOLOGIC FORMATION Mica Schist/ Gneiss/ Amphibolite (pms3a) Formation of the Georgia Piedmont Region.

SUBSURFACE FEATURES The subsurface is comprised of various layers of: silty sand, sandy lean clay, sandy silt, and sand with silt overlaying partially weathered rock and bedrock (auger refusal material).

Partially weathered rock (PWR) was noted at:

Bent	Boring	Elevation
Bent 5	B-9A	726
Bent 5 (offset)	B-9	725
Bent 6	B-10A	735*
Bent 6 (offset)	B-10	725

*Note: Possible boulder or obstruction.

Refusal is a designation applied to any material which cannot be further penetrated by the power auger and is normally indicative of very hard or very dense material such as boulders, rock lenses, or the upper surface of bedrock.

Auger refusal was encountered at:

Bent	Boring	Elevation
Bent 5	B-9A	721
Bent 5 (offset)	B-9	717
Bent 6	B-10A	733*
Bent 6 (offset)	B-10	717

*Note: Possible boulder or obstruction.

Groundwater was noted in the borings at:

Bent	Boring	Elevation
Bent 5	B-9A	736
Bent 5 (offset)	B-9	732
Bent 6 (offset)	B-10	727

For additional information see the boring layout and boring logs.

SITE CLASSIFICATION We recommend a site class of D per AASHTO LRFD 3.10.3.1.

1.0 -- FOUNDATION RECOMMENDATIONS

Bents	Pile Footing (Type)
5 & 6 (Bridge)	H-Pile
1 - 4 and 7 - 10 (Boardwalk)	Timber

1.1 -- Pile Properties

Bents	Pile Type	Pile Size (in)	Nominal Compression Stress (ksi)	Nominal Tension Stress (ksi)	Maximum Factored Structural Resistance (kips)
5 & 6 (Bridge)	HP (50 ksi)	10 x 42	45.0	45.0	310

1.2 -- DESIGN LOADS

Bents	Maximum Factored Strength Limit State Load (kips)	Maximum Factored Service Limit State Load (kips)	Factored Extreme Event I Limit State Load (kips)
5 (Bridge)	176.2	116.3	99.2
6 (Bridge)	177.3	117.0	99.7

Bents	Maximum Factored Strength Limit State Load (kips)	Maximum Factored Service Limit State Load (kips)	Factored Extreme Event I Limit State Load (kips)
1 (Boardwalk)	16.7	10.3	7.2
2, 3 & 4 (Boardwalk)	32.8	20.2	13.9
7 & 8 (Boardwalk)	40.6	24.9	17.0
9 (Boardwalk)	35.0	21.5	14.7
10 (Boardwalk)	17.8	11.0	7.7

2.0 -- FOUNDATION LOADS

2.1 – PILE FOUNDATION LOADS

Bents	Pile Type	Size (in)	Driving Resistance (kips)*
5	H-Pile (50 ksi)	10 x 42	271
6	H-Pile (50 ksi)	10 x 42	273
1	Timber	10	48[A]
2, 3 & 4	Timber	10	94[A]
7 & 8	Timber	10	116[A]
9	Timber	10	100[A]
10	Timber	10	51[A]

[A] Timber piles installed by vibration methods; unfactored Nominal Pile Bearing Resistance (NPBR) required.

3.0 -- FOUNDATION ELEVATIONS - PILES

Bents	Minimum Tip	Estimated Tip
Bridge		
5	725	723
6	724	721
Boardwalk		
1	727	724
2, 3 & 4	723	721
7 & 8	723	720
9	736	733
10	735	725

4.0 -- GENERAL NOTES

Elevations All elevations are based on plans prepared by Heath & Lineback Engineers.

Waiting Period None required.

Theoretical Scour Appears feasible for the material encountered.

As Built Foundation Information The as built foundation information should be forwarded to the Geotechnical Engineering Bureau and DeKalb County upon completion of the foundation system.

Special Problems

A. The construction of temporary access roads/ working pads may be required to get the construction equipment and materials into the site.

B. Sanitary sewer manholes and pipes are present in and near the planned bridge area. This should be considered when driving piles near the sanitary sewer. Pre-augering below the manhole bottom or pipe invert should be considered to reduce vibration related disturbance to sanitary sewer. See Figure 3 for invert information.

4.1 -- PILE FOUNDATION NOTES

PDO **Bents 5 & 6** - Driving resistance after minimum tip elevations are achieved in conjunction with Special Provision 520 Piling for LRFD and Special Provision 523 Dynamic Pile Testing.

Perform one PDA test at the following locations:

Bent	Location
5	Left
6	Right

*** Nominal Bearing Resistance of Single Pile**

Driving resistance for Bents 5 and 6 is based on the following field verification method and resistance factor φ_{dyn} AASHTO LRFD 2014 (10.5.5.2.3-1):

Resistance Determination Method	Resistance Factor
Driving criteria established by dynamic testing of at least two piles per site condition, but no less than 2% of the production piles.	0.65

Nominal bearing resistance for the timber piles at Bents 1 - 4 and 7 - 10 is based on a side resistance and end bearing factor, φ_{stat}):

Resistance Determination Method	Resistance Factor
Side Resistance and End Bearing: Clay and Mixed Soils (α method)	0.35

Drivability

A drivability analysis for Bents 5 & 6 has been completed on the above mentioned piles to their respective estimated tips with a Junttan HHK 4A hammer system.

Pilot Holes

Boulders or layers of very dense PWR or rock layers may be encountered above minimum tip elevation at Bent 6 requiring Pilot Holes. Pilot Holes may also be required to advance the piles below the adjacent sanitary sewer manholes and pipes.

Drill Pilot Holes only when the minimum tip elevation specified in the Plans cannot be attained by normal pile driving. Refer to Special Provision Section 520 Modified – Piling.

Pre-drilling

Pre-drilling may be required to achieve the Minimum Tip Elevations for the timber piles at Bents 2, 3, 4, 7, 8 and 9. If pre-drilling is used, it should be to the following elevation, and may be adjusted by the Engineer during construction:

Bents	Elevation
2, 3, & 4	723
7 & 8	723
9	736

No separate payment will be made if the Contractor chooses to use pre-drilling. The maximum diameter of the pre-drilled hole should be determined from the following table:

Pile Size	Maximum Pre-Drill Hole Size
10“	8“

Points Pile points are recommended for each pile to be driven at Bent 5 to insure adequate penetration into very dense weathered rock.

Special Problems

A. Erratic pile lengths can be expected.

B. Sanitary sewer manholes and pipes are present in and near the planned bridge area. This should be considered when driving piles near the sanitary sewer. Pre-augering or pilot holes will likely be required for piles at Bent 6 to advance the pile below the adjacent sanitary sewer manholes and pipes invert elevations.

5.0 – QA / QC

This Report of Bridge Foundation Investigation has been prepared in accordance with generally accepted geotechnical engineering practice and GDOT requirements for Bridge Foundation Investigations. No warranty is expressed or implied. Furthermore, ECS assumes no liability for any third party’s usage of this report and its attachments without express written consent.

The evaluations presented in this report are based on the available project information, as well as on the results of the exploration. Should a change in the project criteria be made such as the location of the new construction, ECS should be notified to evaluate the changes and make new recommendations if warranted.

ECS SOUTHEAST, LLP represented by:

Prepared By: _____ **Reviewed By:** _____

Robert H. Barnes, P.E., P.G.
GA PE Registration No. 29715

Jay Hornsby, P.G.

Attachments:

Special Provision 520 Modified - Piling (Pilot Holes)
Special Provision 520 Piling (Option to Pre Drill)
Special Provision 520 Piling for LRFD
Special Provision 523 Dynamic Pile Testing
Figure 1 – Site Vicinity Map
Figure 2 – Boring Location Plan and Profile Section
Figure 3 – Utility Plan
Reference Notes for Borings
Boring Logs (B-9, B-9A, B-10, B-10A)
Lab Summary Sheet
Driller’s Hammer Energy Rating Report (Diedrich D-50 ATV Rig SN 380)

Attachments (Continued):

Seismic Site Class Calculations (B-9A, B-10A)
Nominal Pile Driving Resistance Calculation Sheets (Bents 5 and 6)
APile analysis (Bents 1 through 10)
GRLWEAP analysis (Bearing Chart and Data Sheets, Drive Chart and Data Sheets)

Attachments

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

PROJECT NO. CSTEE-0009-00(29), DeKalb County
P.I. NO. 0009029

SECTION 520 MODIFIED—PILING

Delete Sub-Section 520.3.05.B and substitute the following:

520.3.05.B. Drill Pilot Holes

Drill Pilot Holes only when the minimum tip elevation specified in the Plans cannot be attained by normal pile driving. Remove the driven piles that did not reach minimum tip elevations prior to drilling pilot holes and cut off any damaged sections as directed by the Engineer prior to reuse. Include the cost of pile removal and cut off in the bid price for pilot holes.

When pilot holes are required, drill them to the diameter and approximate depth specified on the Plans.

Backfill voids and holes with Class A or better concrete. Furnishing and placing backfill concrete is an incidental part of the work.

The following are not considered pilot holes:

- Holes created by spudding (punching)
- Holes dug to drive piling that is too long to fit leads
- Holes dug to replace a template (if permitted)

Where pilot holes are required in granular material and the material cannot be sealed off using "mudding" drilling methods, drill the pilot hole as follows:

1. Place a casing pipe with a large enough diameter around the boring device.
2. Hold the casing in position until the pilot hole is completed and the pile driving progresses deep enough into the hard material to keep loose material out of the pilot hole.

The use of casing is incidental to the work.

Office of Materials and Testing

Revised: November 15, 2003

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

PROJECT NO. CSTEE-0009-00(29), DeKalb County
P.I. NO. 0009029

SECTION 520—PILING

Add the following to Subsection 520.3.05.G:

At the Contractor's option, predrilling may be used to loosen dense soil layers to assist in the installation of piling. To predrill, drill an auger into the ground to the required elevation at the pile location. It is not necessary to remove all material or to provide casing. Use one of the following maximum auger diameters corresponding to the pile size:

Timber Pile Size	**Maximum Pre-drill Auger Size**
10" (254 mm)	8" (203 mm)

There will not be any separate payment made for predrilling.

Office of Materials and Testing

DEPARTMENT OF TRANSPORTATION STATE OF GEORGIA

SPECIAL PROVISION

PROJECT NO. CSTEE-0009-00(29), DeKalb County

P.I. NO. 0009029

SECTION 520—PILING

Delete Sub-Section 520.3.05.D.1 and substitute the following:

520.3.05.D.1. Determine Driving Resistance
Drive piles in one continuous operation. Determine the driving resistance of the piling based on the method specified in the plans, which will be one of the following methods (a – c):

a. Upon completion of the dynamic pile testing in accordance with Special Provision Section 523. The pile bearing will be determined by computing the penetration per blow with less than ¼-inch (6-mm) rebound averaged through 12 inches (305 mm) each of penetration. When it is considered necessary by the Engineer, the average penetration per blow may be determined by averaging the penetration per blow through the last 10 to 20 blows of the hammer. In soft material the driving resistance may be determined, at the Engineer's discretion, after delaying driving operations and performing pile re-strikes.

b. Upon completion of the loading test in accordance with Sub-Section 520.3.05.D.2.

c. Shall not be used when driving pile to hard rock. Using FHWA-modified Gates Formula as provided below:

$R_{ndr} = 1.75 (E_d)^{0.5} \log_{10} (10N_b) - 100$ (kips) U.S units

$R_{ndr} = 7 (E_d)^{0.5} \log_{10} (10N_b) - 550$ (kN) S.I. units

Where:

R_{ndr} = nominal pile driving resistance measured during pile driving

E_d = developed hammer energy. This is the kinetic energy in the ram at impact for a given blow. If ram velocity is not measured, it may be assumed equal to the potential energy of the ram at the height of the

stroke, taken as the ram weight times the actual stroke (ft-lb for U.S units, kN-m for S.I. units)

N_b = Number of hammer blows for 1.0 inch of pile permanent set (blows/in)

These resistance formulas apply only when:

- The hammer has a free fall.
- The head of the pile is not broomed, crushed, spalled, or excessively crimped.
- The penetration rate is reasonably uniform.

Determining driving resistance by formula is not a Pay Item. Provide the facilities for determining driving resistance by formula as an incidental part of the work.

Once the driving resistance has been determined by one of the methods noted above, do not continue to drive piles if the Engineer determines that the piles have reached practical refusal. Practical refusal is defined as 20 blows per inch with the hammer operating at the highest setting or setting determined by the Engineer and less than ¼-inch (6-mm) rebound per blow. The Engineer will generally make this determination within 2 inches (51 mm) of driving. However, the Engineer will not approve the continuation of driving at practical refusal for more than 12 inches (305 mm). When the required pile penetration cannot be achieved by driving without exceeding practical refusal, use other penetration aids such as jetting, spudding, predrilling or other methods approved by the Engineer.

d. **Wave Equation:** Use the Wave Equation Analysis for Piles (WEAP) program to evaluate the suitability of the proposed driving system chosen from the methods noted above (including the hammer, follower, capblock and pile cushions) as well as to estimate the driving resistance to achieve the pile bearing requirements and to evaluate pile driving stresses. Use the WEAP program to show that the hammer is capable of driving to a driving resistance equal 130% (1.3 times) the driving resistance shown in the Plans without overstressing the piling in compression or tension and without reaching practical refusal.

   Perform the WEAP analysis with personnel who are experienced in this type work, and have performed this analysis on a minimum of 15 projects. Provide a list of the qualifications and experience of the personnel to perform the WEAP analysis for this Project.

   The Engineer may modify the scour resistance shown in the plans if the dynamic pile test is used to determine the actual soil resistance through the scour zone. Also, the Engineer may make modifications in scour resistance when the Contractor proposes drilling and/or jetting to reduce the soil resistance in the scour zone.

A minimum of two weeks prior to beginning any pile driving operations, submit to the Engineer for evaluation and approval the following information on all of the proposed pile driving system(s) to be used on the Project including but not limited to:

i. Items on Pile Driving Equipment Data Sheet
ii. Other information on the driving system required by the Engineer
iii. A WEAP program output indicating the approximate depth or elevation where the pile will achieve the bearing required
iv. Valid Driving Criteria.

Valid driving criteria is defined as having the required hammer having a hammer set greater than 3 blows per inch and less than 10 blows per inch at the driving resistance for that pile.

If WEAP analyses show that the hammer(s) will overstress the pile, modify the driving system or method of operation as required to prevent overstressing the pile. Resubmit the modified pile driving system information and WEAP program output to the Engineer for re-evaluation. Do not begin pile driving operations until the Engineer has approved the qualifications of the personnel, the WEAP program output, and the pile driving system(s).

Approval of the pile driving system(s) is also based on satisfactory field trials with dynamic pile testing. Obtain approval from the Engineer for the pile driving system(s) based on satisfactory field performance.

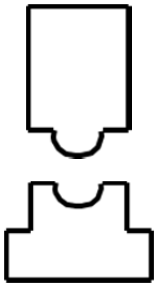
If piles require different hammer sizes, the Contractor may elect to drive with more than one size hammer or with a variable energy hammer, provided that the hammer is properly sized and cushioned, will not damage the pile, and will develop the required resistance.

For penetration of weak soils by concrete piles, use thick cushions and/or reduced stroke to control tension stresses during driving.

Pile Driving Data Form

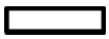
Contract ID:
PI Number:
County

Structure Name:
Structure No.:
Pile Driving Contractor:



Hammer

Manufacturer: _____ Model No. _____
Hammer Type: _____ Serial No. _____
Manufacturers Maximum Rated Energy: _____(ft-k)
Stroke at Maximum Rated Energy: _____(ft)
Range in Operating Energy: _____ to _____(ft-k)
Range in Operating Stroke: _____ to _____(ft)
Ram Weight: _____ (kips)
Modifications: _____



Striker Plate

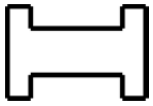
Weight: _____(kips) Diameter: _____(in)
Thickness: _____(in)

Hammer Cushion

Material 1
Name: _____
Area: _____(in^2)
Thickness/Plate: _____(in)
No. of Plates: _____

Material 2
Name: _____
Area: (in^2)
Thickness/Plate:_____(in)
No. of Plates: _____

Total Thickness of Hammer Cushion: _____(in)

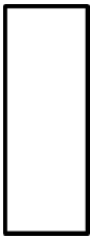


Helmet

Weight including inserts: _____(kips)

Pile Cushion

Material: _____
Area: _____(in^2) Thickness/Sheet: _____(in)
No. of Sheets: _____
Total Thickness of Pile Cushion: _____(in)



Pile

Pile Type: _____
Wall Thickness: _____(in) Taper: _____
Cross Sectional Area: ___(in^2) Weight/Meter: _____
Ordered Length: _____(ft)
Driving Resistance: _____(kips)
Description of Splice: _____
Driving Shoe/Closure Plate Description: _____

Submitted By: _____ Date: _____

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

PROJECT NO. CSTEE-0009-00(29), DeKalb County

P.I. NO. 0009029

SECTION 523 - DYNAMIC PILE TESTING

523.1 General Description

The work consists of performing dynamic pile testing using the Pile Driving Analyzer (PDA) to monitor the driving of piles with accelerometer and strain gauges attached to the piles. Piles to be dynamically tested will be identified in the Special Provision or on the Plans. Prior to pile driving, the Engineer will determine production or test piles to be dynamically tested. Perform the dynamic pile testing in accordance with ASTM D4945-12.

Take dynamic measurements during driving of any required piles. Drive the pile as shown in the Special Provisions or on the Plans.

523.2 Materials

Furnish measuring instruments for dynamic pile testing. Attach instruments near the top of the piles with bolts placed in drilled holes. Furnish materials, labor and equipment necessary for installation of the instruments.

523.3 Construction Requirements

Measure wave speed prior to driving piles. Wave speed measurements will not be required for Steel H piles or metal shell piles. When wave speed measurements are performed, place the piles in a horizontal position not in contact with other piles.

Perform dynamic pile testing during driving. Modify the driving to reduce the stress and/or eliminate the damage, should the recommended stress level be exceeded or if damage occurs (determined visually or as indicated by the instrumentation).

Do not exceed the following maximum driving stresses, as determined by the dynamic pile testing:

1. For Steel piles:

   0.9 Fy, where Fy = Yield strength of steel

2. For Prestressed Concrete Piles:

   Compression:

   $$\sigma_{dr} = (0.85f'_c - f_{pe})$$

   Tension in Normal Environments:

   $$\sigma_{dr} = (0.095\sqrt{f'_c} + f_{pe})$$

   Tension in Severe Corrosive Environments:

   $$\sigma_{dr} = \varphi_{da} f_{pe}$$

   where;
   σ_{dr} = maximum allowed driving stress, ksi
   f 'c= specified minimum 28-day compressive strength of concrete, ksi
   f pe= effective prestress in concrete, ksi, (after all losses) at the time of driving taken as 0.78 times the initial prestress force

Re-drive friction piles that do not obtain bearing after a freeze period of a minimum of 24 hours or for a period designated on the Plans, whichever is longer. Reset the gauges if required. Re-strike the pile with a warm hammer until a maximum penetration of 3 inches (76 mm) or 40 blows is reached, whichever occurs first. The Engineer may modify the Pile Driving Objective based on the results of the PDA work.

Provide two weeks' notice prior to the driving of designated piles and cooperate with the Engineer in connection with the performance of Dynamic Pile Testing.

Provide a complete report consisting of but not limited to PDA field monitoring data, results of CAPWAP computer analyses, and recommendations such as pile lengths, hammer fuel setting, and valid driving criteria. Valid driving criteria is defined as having the required hammer having a hammer set greater than 3 blows per inch and less than 10 blows per inch at the driving resistance for that pile. Submit the report electronically in PDF format and the electronic data files of the PDA analysis and CAPWAP to the Geotechnical Bureau and allow seven (7) calendar days for review and approval before proceeding with driving production piles.

523.4 Measurement

The Dynamic Pile Tests performed in accordance with these Specifications will be counted separately for payment. (Refer to plans summary sheet for the required amount of PDA testing.)

523.5 Payment

The Dynamic Pile Test completed and accepted will be paid for at the Contract unit Price. This payment will be full compensation for all costs of complying with this specification, including incidentals, additional work, and any delays incurred in conjunction therewith.

Payment will be made under:

Item No. 523. Dynamic Pile Test_____ . . . . . Per Each

Office of Materials and Testing

SITE LOCATION DIAGRAM		**Figure No.:** 1
BRIDGE FOUNDATION INVESTIGATION REPORT	**Project No.: 10:9672**	
South River Trail Phase 5 - Bridge 2 DeKalb County, Georgia	**Not To Scale**	
Reference: Google Earth	**Date: 6/2018**	

SOIL CLASSIFICATION LEGEND

- FILL - FILL (POSS/PROB) OF ALL TYPES.
- GW - WELL GRADED GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GC - CLAYEY GRAVEL
- SW - WELL GRADED SAND
- SM - SILTY SAND
- SP - POORLY GRADED SAND
- SC - CLAYEY SAND
- ML - LOW PLASTICITY SILT
- CL - LOW PLASTICITY CLAY
- MH - HIGH PLASTICITY SILT
- CH - HIGH PLASTICITY CLAY
- OH - HIGH PLASTICITY ORGANIC SILTS AND CLAYS
- OL - LOW PLASTICITY ORGANIC SILTS AND CLAY
- PT - PEAT
- PWR - PARTIALLY WEATHERED ROCK
- SP-SM - SAND WITH SILT

SURFACE MATERIALS

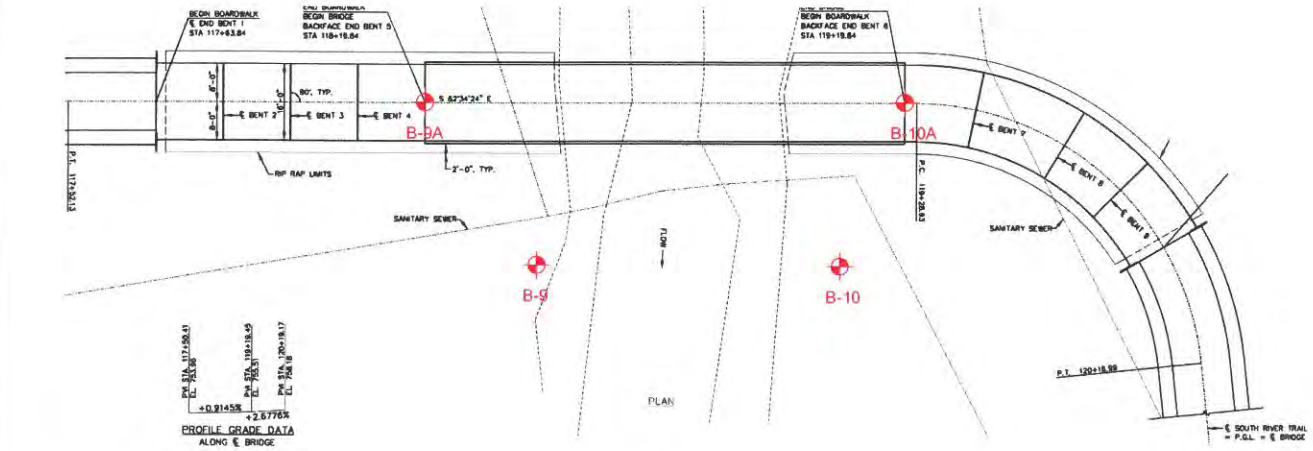
- TOPSOIL
- ASPHALT
- GRAVEL
- CONCRETE
- NR - NO RECOVERY

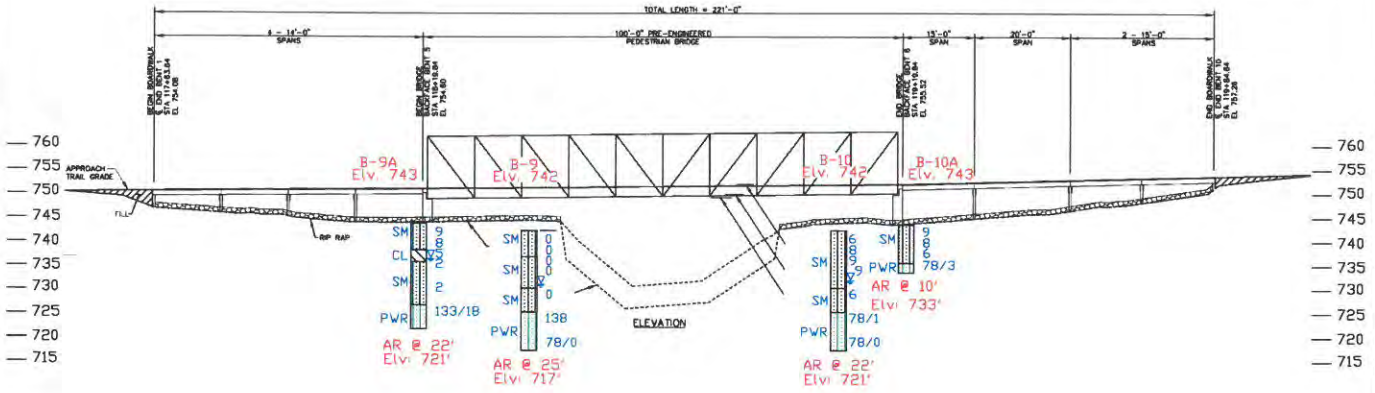
ROCK TYPES

- IGNEOUS
- METAMORPHIC
- SEDIMENTARY

SYMBOL LEGEND

- WATER LEVEL
- WL BEFORE CASING REMOVAL
- WL AFTER CASING REMOVAL
- WL AFTER 24 HOURS
- APPROXIMATE BORING LOCATION
- B-X BORING DESIGNATION





LEGEND

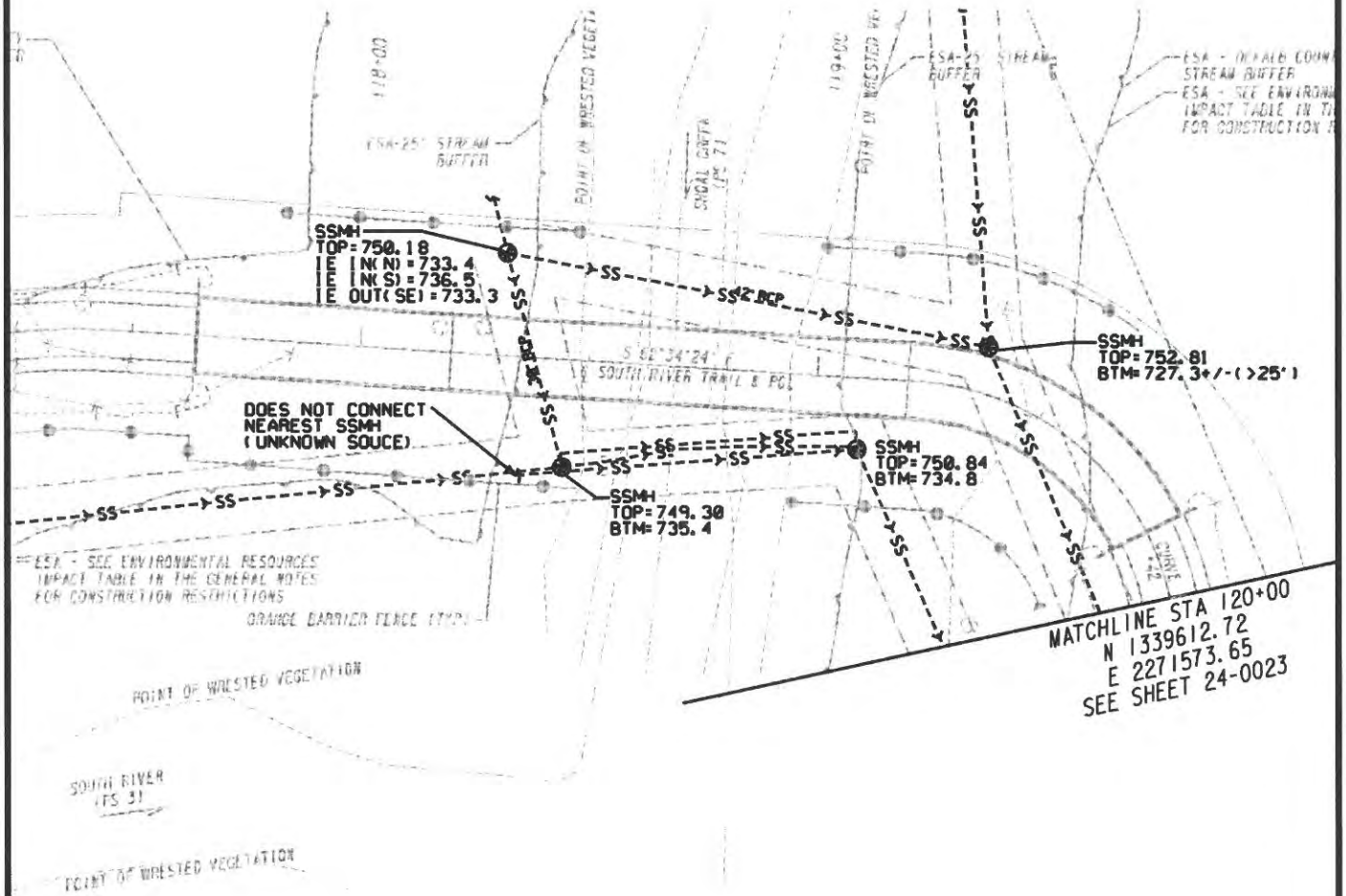
- Approximate Boring Location
- B-# Boring Designation

Note: N-values have been corrected with 94% ER.

Graphic Scale 1"=40'

40 20 0 10 20 30 40

ECS	JOB NO.	10:9672	REVISIONS	FIGURE NAME: BORING LOCATION & PROFILE PLAN - Bridge No.: 2	PROJECT: South River Trail Phase 5	FIGURE NO.: 2
	SCALE	1:40				
	DRAWN	CLJ				
	APPR. BY	RHB		REFERENCE: Preliminary Layout Bridge 2 Drawing No. 35 - 02 Heath & Lineback Engineers	PREPARED FOR: Path Foundation	
	DATE	5/21/2018				



Graphic Scale 1"=40'

40 20 0 10 20 30 40

ECS	JOB NO.	10:9672	REVISIONS	FIGURE NAME: UTILITY PLAN - Bridge No.: 2	PROJECT: South River Trail Phase 5	FIGURE NO.: 3
	SCALE	1:40				
	DRAWN	CLJ		REFERENCE: Utility Plans Drawing No. 24 - 0022 Heath & Lineback Engineers	PREPARED FOR: Path Foundation	
	APPR. BY	RHB				
	DATE	5/31/2018				

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]	
	ASPHALT
	CONCRETE
	GRAVEL
	TOPSOIL
	VOID
	BRICK
	AGGREGATE BASE COURSE
	FILL[3] MAN-PLACED SOILS
GW	**WELL-GRADED GRAVEL** gravel-sand mixtures, little or no fines
GP	**POORLY-GRADED GRAVEL** gravel-sand mixtures, little or no fines
GM	**SILTY GRAVEL** gravel-sand-silt mixtures
GC	**CLAYEY GRAVEL** gravel-sand-clay mixtures
SW	**WELL-GRADED SAND** gravelly sand, little or no fines
SP	**POORLY-GRADED SAND** gravelly sand, little or no fines
SM	**SILTY SAND** sand-silt mixtures
SC	**CLAYEY SAND** sand-clay mixtures
ML	**SILT** non-plastic to medium plasticity
MH	**ELASTIC SILT** high plasticity
CL	**LEAN CLAY** low to medium plasticity
CH	**FAT CLAY** high plasticity
OL	**ORGANIC SILT or CLAY** non-plastic to low plasticity
OH	**ORGANIC SILT or CLAY** high plasticity
PT	**PEAT** highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS			
SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION		
DESIGNATION		**PARTICLE SIZES**
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS		
UNCONFINED COMPRESSIVE STRENGTH, Q_P[4]	**SPT[5] (BPF)**	**CONSISTENCY[7] (COHESIVE)**
<0.25	<3	Very Soft
0.25 - <0.50	3 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

GRAVELS, SANDS & NON-COHESIVE SILTS	
SPT[5]	**DENSITY**
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
Dual Symbol *(ex: SW-SM)*	10	10
With	15 - 20	15 - 25
Adjective *(ex: "Silty")*	≥25	≥30

WATER LEVELS[6]		
	WL	Water Level (WS)(WD)
		(WS) While Sampling
		(WD) While Drilling
	SHW	Seasonal High WT
	ACR	After Casing Removal
	SWT	Stabilized Water Table
	DCI	Dry Cave-In
	WCI	Wet Cave-In

[1] *Classifications and symbols per ASTM D 2488-09 (Visual-Manual Procedure) unless noted otherwise.*

[2] *To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.*

[3] *Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-**FILL**)].*

[4] *Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).*

[5] *Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf).*

[6] *The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.*

[7] *Minor deviation from ASTM D 2488-09 Note 16.*

[8] *Percentages are estimated to the nearest 5% per ASTM D 2488-09.*

CLIENT	JOB #	BORING #	SHEET
Path Foundation	10:9672	B-9	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
South River Trail Phase 5 Bridge 2	

SITE LOCATION: DeKalb County, GA

GDOT PROJ. #: CSTEE-0009-00(029)

STATION: 118+43,36'R

P.I. #: 0009029

CALIBRATED PENETROMETER TONS/FT^2 (1 2 3 4 5+)

ROCK QUALITY DESIGNATION & RECOVERY — RQD% (20% 40% 60% 80% 100%) REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %

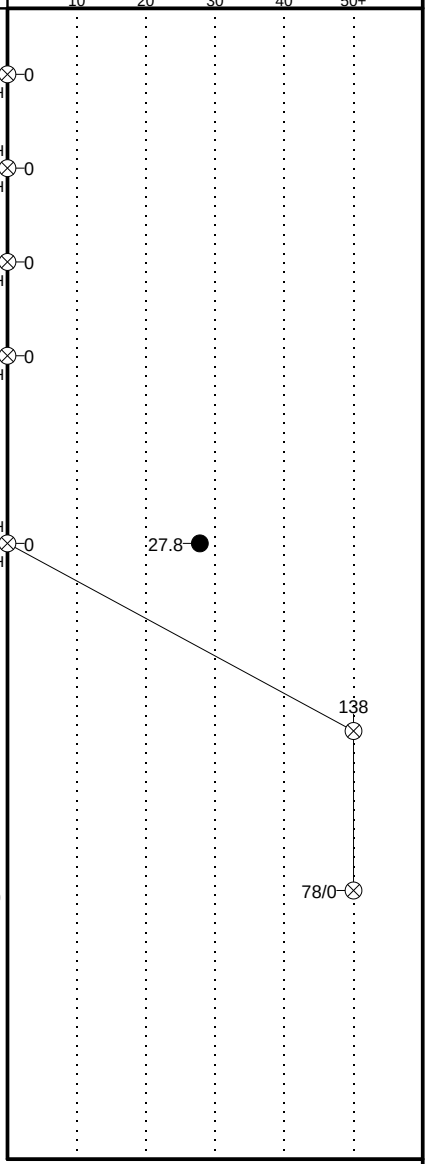
STANDARD PENETRATION BLOWS/FT (10 20 30 40 50+)

ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 742

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	18	18	(SM) SILTY SAND, contains mica and contains slight rock fragments, brown, moist, very loose * Wood fragments encountered @ 1'		740	1 WOH WOH
	S-2	SS	18	18				WOH WOH WOH
5	S-3	SS	18	18	(ML/SM) SANDY SILT, brown to grayish brown, wet to saturated, very soft		735	1 WOH WOH
	S-4	SS	18	18				1 WOH WOH
10							730	
	S-5	SS	18	18	(SM) SILTY SAND, grayish brown, wet, very loose			WOH WOH WOH
15							725	
	S-6	SS	18	18	(PWR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, contains mica and contains slight rock fragments, grayish brown, moist			5 38 50
20							720	
	S-7	SS	0	0				50/0
25					AUGER REFUSAL @ 25' *Note: Blows/6" are uncorrected field measurements. N-values shown have been corrected with 94% ER.		715	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 11 WS ☐ WD ☒	BORING STARTED 03/09/18	
WL(BCR) WL(ACR)	BORING COMPLETED 03/09/18	CAVE IN DEPTH
WL 10.2 @ 24 Hrs	RIG Dietrich D-50 FOREMAN RH	DRILLING METHOD 2-1/4" Hollow Stem Auger

CLIENT	JOB #	BORING #	SHEET
Path Foundation	10:9672	B-9A	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
South River Trail Phase 5 Bridge 2	

SITE LOCATION: DeKalb County, GA

GDOT PROJ. #: CSTEE-0009-00(029)

STATION: 118+20, CL

P.I. #: 0009029

CALIBRATED PENETROMETER TONS/FT^2 (1 2 3 4 5+)

ROCK QUALITY DESIGNATION & RECOVERY: RQD% (20% 40% 60% 80% 100%) REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %

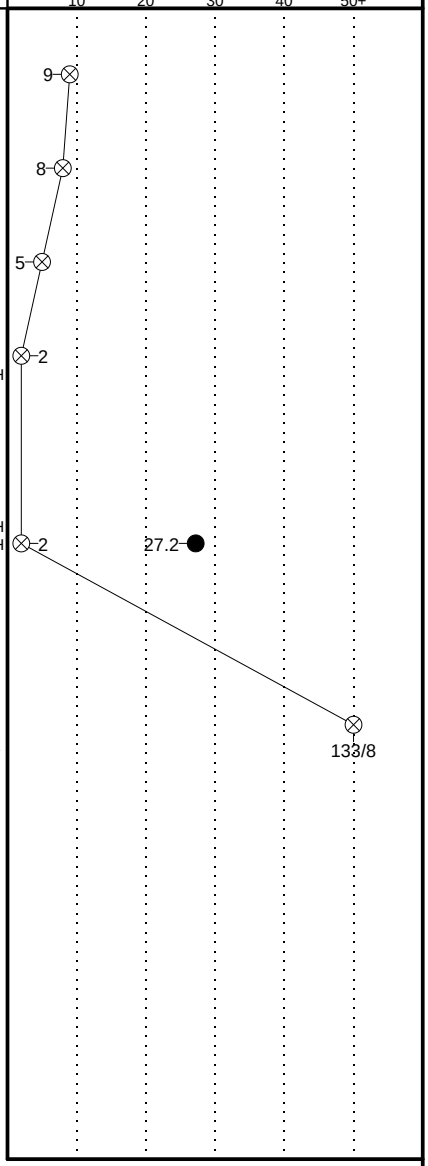
STANDARD PENETRATION BLOWS/FT (10 20 30 40 50+)

ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 743

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [10"]			
	S-1	SS	18	18	(SM) SILTY SAND, contains mica, brown, moist, loose		740	2 3 3
	S-2	SS	18	18				2 2 3
5					(CL) SANDY LEAN CLAY, contains mica, brown, moist, firm			2 2 1
	S-3	SS	18	18			735	
	S-4	SS	18	18	(SM) SILTY SAND, contains mica, brown, saturated, very loose			2 1 WOH
10							730	
	S-5	SS	18	18				WOH WOH 1
15					(PWR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, contains mica and contains slight rock fragments, gray, moist. Grinding @ 20' to 22'		725	
20	S-6	SS	14	14				17 35 50/2
					AUGER REFUSAL @ 22'		720	
25					* Note: Blows/6' are uncorrected field measurements. N-values shown have been corrected with 94% ER.			
							715	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 7 WS ☐ WD ☒	BORING STARTED 05/11/18	
WL(BCR) WL(ACR)	BORING COMPLETED 05/11/18	CAVE IN DEPTH
WL	RIG Dietrich D-50 FOREMAN JD	DRILLING METHOD 2-1/4" Hollow Stem Auger

CLIENT	JOB #	BORING #	SHEET
Path Foundation	10:9672	B-10	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
South River Trail Phase 5 Bridge 2	

SITE LOCATION: DeKalb County, GA

GDOT PROJ. #: CSTEE-0009-00(029)

P.I. #: 0009029

STATION: 119+05,36'R

CALIBRATED PENETROMETER TONS/FT^2 (1 2 3 4 5+)

ROCK QUALITY DESIGNATION & RECOVERY: RQD% 20% 40% 60% 80% 100% — REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %

STANDARD PENETRATION BLOWS/FT (10 20 30 40 50+)

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 742

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0							
	S-1	SS	18	18		740	1 2 2
	S-2	SS	18	18			2 2 3
5							
	S-3	SS	18	18		735	2 3 3
	S-4	SS	18	18			3 3 3
10						730	
	S-5	SS	18	18	▽		WOH 2 2
15					▽	725	
	S-6	SS	7	7			26 50/1
20						720	
	S-7	SS	0	0			50/0
25						715	
30							

(SM) SILTY SAND, contains slight rock fragments and roots, brown, moist, loose

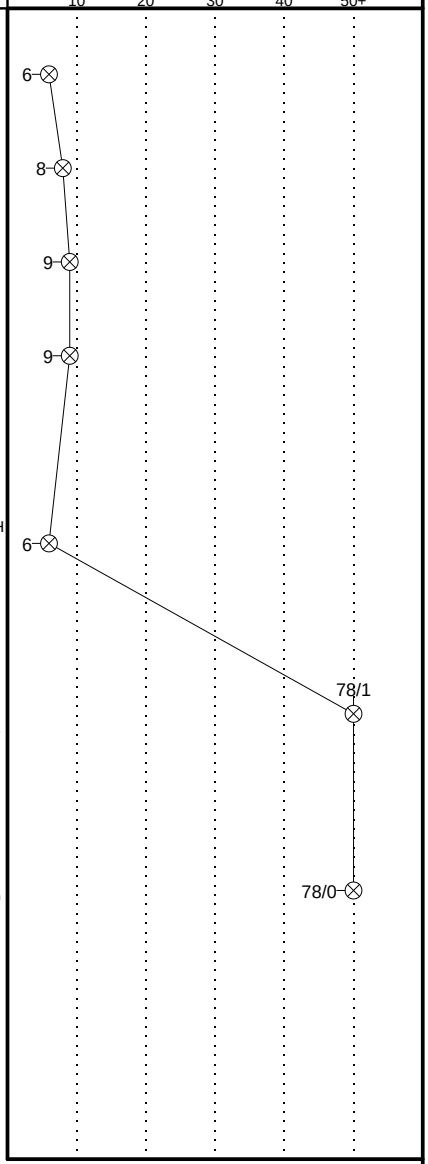
* Trace roots encountered @ 5.5'

(SP-SM) SAND WITH SILT, contains mica, gray, moist wet, loose

(PWR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, contains mica, grayish brown, moist

AUGER REFUSAL @ 25'

*Note: Blows/6" are uncorrected field measurements. N-values shown have been corrected with 94% ER.



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 16 WS ☐ WD ☒	BORING STARTED 03/09/18	
WL(BCR) WL(ACR)	BORING COMPLETED 03/09/18	CAVE IN DEPTH
WL 14.8 @ 24 Hrs	RIG Dietrich D-50 FOREMAN RH	DRILLING METHOD 2-1/4" Hollow Stem Auger

CLIENT	JOB #	BORING #	SHEET
Path Foundation	10:9672	B-10A	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
South River Trail Phase 5 Bridge 2	

SITE LOCATION: DeKalb County, GA

GDOT PROJ. #: CSTEE-0009-00(029)

STATION: 119+20, CL

P.I. #: 0009029

CALIBRATED PENETROMETER TONS/FT^2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% 20% 40% 60% 80% 100% — REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %

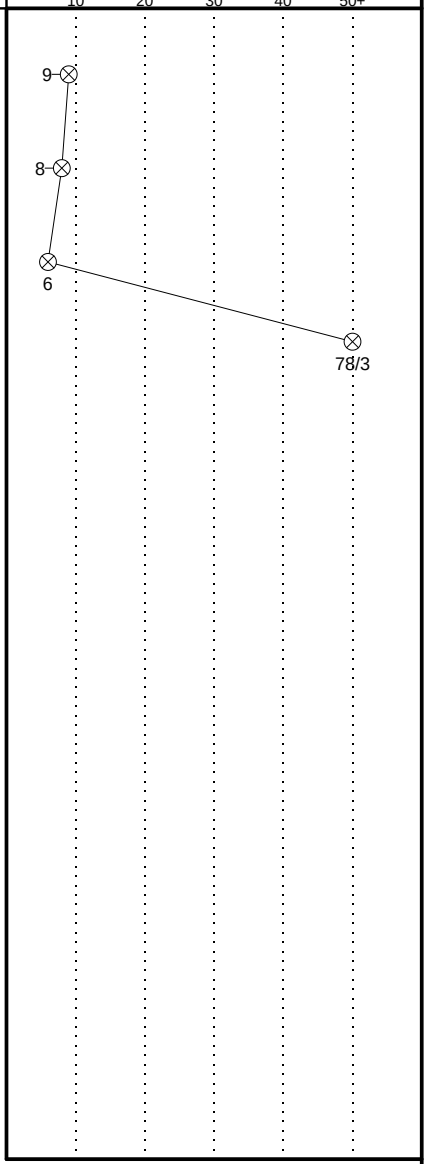
STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 743

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [10"]			
	S-1	SS	18	18	(SM) SILTY SAND, contains mica and contains slight roots, brown, moist, loose		740	3 3 3
	S-2	SS	18	18				2 2 3
5	S-3	SS	18	18				2 2 2
	S-4	SS	9	9	(PWR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, contains mica, grayish brown, moist, very dense		735	18 50/3
10					AUGER REFUSAL @ 10' Possible obstruction or boulder.		730	
15							725	
20							720	
25							715	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL Dry WS ☐ WD ☒	BORING STARTED 05/11/18	
WL(BCR) WL(ACR)	BORING COMPLETED 05/11/18	CAVE IN DEPTH
WL	RIG D-50 ATV FOREMAN John	DRILLING METHOD 2-1/4" Hollow Stem Auger

Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-9												
	S-5	13.5 - 15.0	27.8	SM	NP	NP	NP	40.7				
B-9A												
	S-5	13.5 - 15.0	27.2	SM				27.9				

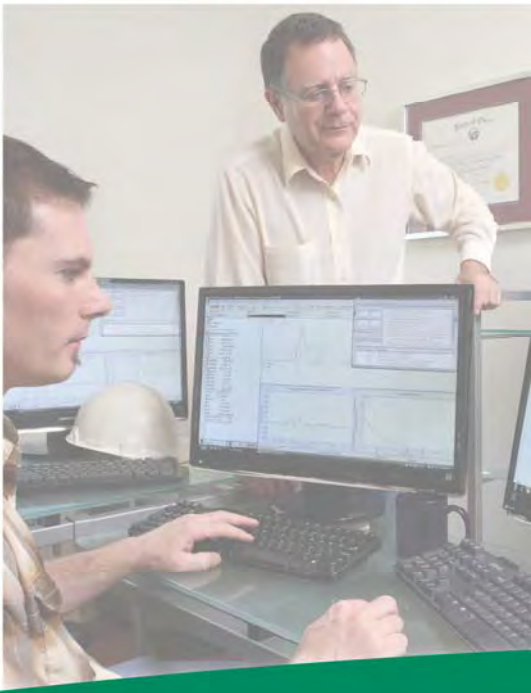
Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 10:9672

Project Name: South River Trail Phase 5 Bridge 2

ECS SOUTHEAST, LLP
1281 Kennestone Circle, NE, Suite 200
Marietta, GA 30066
Phone: (770) 590-1971
Fax: (770) 590-1975



GRL engineers, inc.

Dynamic Measurements and Analyses

Job No. 179031-1

Report on: Standard Penetration Test Energy Measurements
Jonesboro, GA

Prepared for Big Dog Geotech

By Thomas G. Hyatt, P.E. and Joel S. Webster, E.I.

June 20, 2017

www.GRLengineers.com info@GRLengineers.com

June 20, 2017

John Dodd
Big Dog Geotech
P.O. Box 928
Cumming, GA 30028

Re: Standard Penetration Test Energy Measurements
Jonesboro, GA GRL Job No. 179031-1

Dear Mr. Dodd,

This report presents results of energy measurements obtained on June 8, 2017 during Standard Penetration Tests (SPT) sampling. Two automatic hammers mounted on two separate Diedrich D-50 dill rigs that were tested generally following ASTM D4633-10 standards. All dynamic tests were performed on AWJ drill rods. GRL Engineers, Inc. obtained the dynamic measurements with an instrumented AW subsection that had AWJ adapters and a Model 8G Pile Driving Analyzer®. This report describes the testing procedures and summarizes the test results. Appendix A describes our measurement and analysis methods, Appendix B contains calibration information for the gages and equipment used, and Appendix C is a summary of the field data.

PURPOSE AND SCOPE OF WORK

At the request of Big Dog Geotech, GRL conducted SPT energy measurements in Jonesboro, GA according to ASTM D4633-10. Specifically, we recorded SPT energy measurements at five-foot sample intervals between 18.5 and 43.5 feet below the existing ground surface. SPT samples were taken every five feet from the ground surface until a boring depth of about 43.5 feet was reached. All SPT samples were driven for a total of 3 six-inch increments, or 1.5 feet.

EQUIPMENT

Drilling and SPT Hammer Equipment

Diedrich D-50 (Serial # 380)

SPT energy measurements were made on an automatic hammer mounted on a Diedrich D-50 drill rig. The drilling method used to advance the boring was hollow stem auger. Energy measurements for this drill rig were collected at a borehole located in Jonesboro, GA. SPT energy measurements were performed at 5-foot sampling intervals between 18.5 and 40.0 feet. A total of five energy measurement events were performed for this drill rig.

Diedrich D-50 (Serial # 404)

SPT energy measurements were made on an automatic hammer mounted on a Diedrich D-50 drill rig. The drilling method used to advance the boring was hollow stem auger. Energy measurements for this drill rig were collected at a borehole located in Jonesboro, GA. SPT energy measurements were performed at 5-foot sampling intervals between 18.5 and 43.5 feet. A total of six energy measurement events were performed for this drill rig. The SPT energy measurements performed from 33.5 to 40 feet did not meet the ASTM D4633-10 specifications for blow counts and were not considered in the calibration of this drill rig.

Instrumentation

A Model 8G Pile Driving Analyzer (PDA) data acquisition system (SN# 4613LE) was used to collect and process the dynamic measurements of force and velocity. The data was collected using a two foot long section of AW rod subsection (SN# 246AW) with a cross sectional area of 1.21 square inches and instrumented with two full bridge foil resistance strain gages and two piezoresistive accelerometers mounted in the midpoint location of the instrumented rod. Couplings were used to convert the threads from the AW rod subsection to the AWJ rod string.

Analog signals from the strain gages and accelerometers were conditioned, digitized, stored and processed with the PDA. The sampling frequency used during the SPT testing was 50 kHz. Selected output from the PDA for each recorded impact included the energy transfer ratio (ETR), maximum rod top velocity (VMX), maximum energy transfer (EFV), maximum rod top force (FMX), and the hammer operating rate (BPM).

MEASUREMENTS AND CALCULATIONS

FV Method (EFV)

Energy transfer to the PDA gage location, EFV, was computed by the PDA using force, F(t), and velocity, v(t), records as follows:

$$EFV = \int_a^b F(t) \cdot v(t) dt$$

The time "a" corresponds to the start of the record when the energy transfer begins, and "b" is the time at which energy transferred to the rod reaches a maximum value. The FV Method is currently recognized in ASTM D4633-10, and is the theoretically correct result; therefore, no other energy calculation methods are reported.

Corrected SPT number (N_{60})

While the primary purpose of SPT energy testing is to calculate the maximum transferred energy (ETR) of each hammer blow, the overall average EFV value can be used to calculate the corrected SPT number (N_{60}). To adjust the SPT N-values for hammer performance, the following correction as suggested by Seed for N-value adjustment to 60% transfer efficiency (e.g. 210 ft-pounds) was used:

Where:

N_{60} = Corrected N-value
E_m = overall average measured energy transfer (EFV)
N_m =number of blows for last 12 inches of sampler penetration

A general introduction to dynamic SPT testing methods is included in this report as Appendix A. References for more detailed descriptions of our testing and analysis methods are available upon request.

Any cross-sectional area difference between the GRL rod subsection and the drill rods, any loose connections or changes in area at section joints, or any cross-sectional area differences between the individual drill rod sections will result in stress wave reflections that can potentially influence the energy transfer. The EFV transferred energy calculation method, utilizing both force and velocity records, is theoretically correct and gives energy transfer results that are not adversely affected by cross-sectional area changes or loose connectors. The EFV results are included in Appendix C for all records collected and accepted after checking them for consistency.

RESULTS

Upon return to the office, the records collected by the PDA were checked for consistency and accuracy. For example, records from very weak startup or final impacts were not included in average results. Appendix C contains a representative plot of force and normalized velocity versus time, as well as tables of PDA results for all hammer blows at each dynamically monitored sampling depth. The results include the EFV (transferred energy by the FV method, as recommended by ASTM D4633-10), ETR (energy transfer efficiency for the EFV method), BPM (hammer operating rate), FMX (maximum rod top force) and VMX (maximum rod top velocity). The tables show statistical summaries for the final two 6 inch increments over which the SPT N value is calculated. At the end of each table is a statistical evaluation of these results which include the average and standard deviation.

$$N_{60} = \left(\frac{E_m}{210}\right) N_m$$

The table below and the summary tables in Appendix C summarize the average transferred energy values calculated by the EFV method. The records consist of averaged hammer blows from the last 12 inches (i.e. N value) at each dynamically monitored sampling depth. The "energy transfer ratio" (ETR) is defined as the ratio of maximum transferred energy EFV divided by the theoretical hammer potential energy of 350 ft-lbs (i.e., computed per the 140 lb SPT hammer and the standard 30 inch drop as specified by ASTM D1586-08). The average hammer operating rate is reported in blows per minute (BPM). A summary of the dynamic measurements of the energy transfer to the drill rods using the EFV equation is provided in the table below.

Drill Rig	Avg. EFV (ft-lbs)	Avg ETR (%)	Range of EFV (ft-lbs)	Range of ETR (%)
Diedrich D-50 SN 380	330	94	309 – 367	88 – 105
Diedrich D-50 SN 404	325	93	302 – 343	86 – 98

CONCLUSIONS

Based upon the dynamic test data obtained, the following conclusions are presented:

1. Loose connections in the drill string were sometimes observed in the force and velocity records. However, energy transfer values calculated using the EFV equation are not adversely affected by the connectors and therefore are considered a better indication of transferred energy.

2. Dynamic measurements of the transferred energy to the drill rods using the EFV equation ranged from 309 to 367 ft-lbs for the Diedrich D-50, SN 380 drill rig. This corresponds to a transfer efficiency ranging from 88 to 105% of the SPT hammer energy of 350 ft-lbs.

3. Dynamic measurements of the transferred energy to the drill rods using the EFV equation ranged from 302 to 343 ft-lbs for the Diedrich D-50, SN 404 drill rig. This corresponds to a transfer efficiency ranging from 86 to 98% of the SPT hammer energy of 350 ft-lbs.

4. The average transferred energy (EFV) and energy transfer ratio (ETR) for the Diedrich D-50 drill rigs tested was as follows:

   Diedrich D-50, SN 380: Average EFV = 330 ft-lbs; Average ETR = 94%

   Diedrich D-50, SN 404: Average EFV = 325 ft-lbs; Average ETR = 93%

Please review both ASTM D4633-10 and ASTM D1586-08 prior to applying these test results. The energy calibrations reported herein are valid for the same hammer/drill rig, with the same drill operator, same anvil dimensions, and same drilling methods.

We appreciate the opportunity to be of assistance to you on this project. Please contact our office should you have any questions regarding this submittal, require additional information, or if we may be of further service.

Sincerely,

GRL Engineers, Inc.

Thomas G. Hyatt, P.E.

Joel S. Webster, E.I.

TGH:JSW:dms

Appendix A

An Introduction into SPT Dynamic Pile Testing

APPENDIX A
AN INTRODUCTION INTO SPT DYNAMIC PILE TESTING

1. BACKGROUND

The Standard Penetration Test is frequently conducted as an in-situ assessment of soil strength. This test requires that a 140 lb weight is dropped 30 inches onto a drive rod at whose bottom a sampler is usually installed. The sampler is driven for 18 inches; the number of blows required for the last 12 inches of driving is the so-called N-value. The N-value may be used as a strength indicator for foundation design or as a means of assessing the liquefaction potential of soils.

Obviously, the SPT hammer efficiency is an important consideration when using the N-values for design purposes. Measurements have indicated that the energy in the drive rod is sometimes only 30% and and may reach 90% of the potential or rated energy of the SPT hammer (E-rated = 0.35 kip-ft or 0.475 kJ). The type of hammer used to drive the rod is the main reason for these variations. On the average, the energy in the drive rod is 60% of the standard rated energy.

Because of the variability of energy, methods based on N-values are considered unreliable. However, measurements during SPT testing using the Case Method can be done on a routine basis and these measurements yield the transferred energy values. With measured energy, EMX, known, an adjustment of the measured N-value, N_m, can be made as follows.

$$N_{60} = N_m [E_m / (0.6E_r)] \quad (1)$$

Thus, if the measured energy value is equal to the normally expected transferred energy of 60% of E-rated then the adjusted and measured N-values are identical. On the other hand, if the measured energy is only 30% then the adjusted blow count will be reduced by 50%.

2. DYNAMIC TESTING AND ANALYSIS METHODS APPLIED TO SPT

The Case Method of dynamic pile testing, named after the Case Institute of Technology where it was developed between 1964 and 1975, requires that a substantial ram mass (e.g. a pile driving hammer) impacts the pile top such that the pile undergoes at least a small permanent set. Thus, the method is also referred to as a “High Strain Method”. The Case Method requires dynamic measurements on the pile or shaft under the ram impact and then a calculation of various quantities. Conveniently, for SPT applications, the measurements and analyses are done by a single piece of equipment: the SPT Analyzer. The Pile Driving Analyzer® (PDA) is also suitable to perform these measurements and data processing.

A related analysis method is the “Wave Equation Analysis” which calculates a relationship between bearing capacity, pile stresses, transferred energy and field blow count. The GRLWEAP™ program performs this analysis and provides a complete set of helpful information and input data. This program can be used very effectively to simulate the SPT driving process.

3. MEASUREMENTS

GRL uses equipment manufactured by Pile Dynamics, Inc. The system includes either an SPT-Analyzer™ (SPTA) or a Pile Driving Analyzer® (PDA), an instrumented rod section and two accelerometers. SPT energy testing is very closely related to and borrows procedures from dynamic pile testing. Those interested in the basis of the SPT energy testing method may obtain extensive literature on dynamic pile testing from GRL Engineers, Inc.

3.1 SPT Analyzer or Pile Driving Analyzer

The basis for the results calculated by the SPTA or PDA are strain and acceleration measured in an instrumented rod section. These signals are converted to rod top force, F(t), and rod top velocity, v(t). The SPTA or PDA conditions, calibrates and displays these signals and immediately computes average pile force and velocity thereby eliminating bending effects. The product of these two

measurements is then integrated over time which yields the energy transferred to the instrumented section as a function of time (see Section 4.1).

For convenience and accuracy, strain measurements are usually taken on an instrumented section of SPT drive rod. Ideally, the section properties of the instrumented rod and those of the drive rod are the same, however, using subs, other sections can also be utilized.

For the instrumented section, PDI provides a force calibration in such a way that the output of the instrumented rod is directly calculated without the need for an accurate elastic modulus or cross sectional area of the rod section.

The acceleration measurements are often demanding in the SPT environment, because of high frequency and high acceleration motion components. An experienced measurement engineer, therefore, has to evaluate the quality of this data before final conclusions are drawn from the numerical results calculated by SPTA or PDA.

SPTA or PDA records are taken while the standard N-value is acquired in the conventional manner. This then allows a direct correlation between N-value and average transferred energy.

3.2 HPA

The SPT hammer's ram velocity may be directly obtained using radar technology in the Hammer Performance Analyzer™. The impact velocity results can be automatically processed with a PC or recorded on a strip chart. HPA measurements yield a hammer kinetic energy, but not the energy transferred to the drive rod.

4 RECORD EVALUATION BY SPTA OR PDA

4.1 HAMMER PERFORMANCE

The PDA calculates the energy transferred to the pile top from:

$$E(t) = {}_0\int^t F(\tau)v(\tau)\, d\tau \qquad (2)$$

The maximum of the E(t) curve is often called **ENTHRU or EMX;** it is the most important quantity for an overall evaluation of the performance of a hammer and driving system. **EMX** allows for a classification of the hammer's performance when presented as, e_T, the rated transfer efficiency, also called energy transfer ratio (**ETR**) or global efficiency.

$$e_T = EMX/E_R \qquad (3)$$

where E_R is the hammer manufacturer's rated energy value or 0.35 kip-ft (0.475 kJ) in the case of the SPT hammer.

Often in the SPT literature one finds also reference to the EF2 energy. This evaluation is based on assumed proportionality between force and velocity (see also Section 5):

$$v(t) = F(t) / Z \qquad (4)$$

where Z = EA/c is the pile impedance, E is the elastic modulus, A is the cross sectional area and c is the speed of the stress wave in the pile material..

Combining equations 2 and 4 leads to

$$EF(t) = {}_0\int^t F(\tau)^2 / Z\, d\tau \qquad (5)$$

The EF2 transferred energy value is the EF-value at the time t = 2L/c, where L is the drive rod length and c is the stress wave speed in steel (16,800 ft/s or 5,124 m/s). Since the force is easier to measure than both force and velocity, Equation 5 is preferred by some test engineers. However, the EF method is fraught with errors and certain correction factors have to be applied to make it approximately correct. Among the error sources are the following:

- Proportionality is often violated prior to time 2L/c. The proportionality between force and velocity in a downward traveling wave only holds if the wave does not encounter a disturbance prior to reflecting off the pile toe. Such disturbances include a change in cross sectional area, an open or loose splice or joint, or resistance along the shaft.

- Using only one force measurement precludes a data quality check based on the proportionality between force and velocity. Thus, a force measurement that is for some reason in error may not be detectable, which will lead to errors in the EF2 value. Data quality checks will be discussed further in Section 5.

The use if EF2 is therefore not recommended but it is often included in result presentations for the sake of completeness.

4.2 STRESSES

During SPT monitoring, it is also of interest to monitor compressive stresses at both the top of the drive rod and at its bottom.

At the pile top (location of sensors) the maximum compression stress averaged over the rod's cross section, **CSX**, is directly obtained from the measurements. Note that this stress value refers to the instrumented section. If the rod has a different cross sectional area then the stress in the rod will be different from CSX.

The SPTA or PDA can also calculate, in an approximate manner, the force at the rod bottom, **CFB**. To obtain the corresponding stress, this force value should be divided by the appropriate cross sectional area, e.g. by the rod area just above the sampler or by the sampler area itself. Of course, non-uniform stress components as they might occur at the sampler tip due to a sloping rock are not considered in this calculation.

5. DATA QUALITY CHECKS

Quality data is the first and foremost requirement for accurate dynamic testing results. It is therefore important that the measurement engineer performing SPTA or PDA tests has the experience necessary to recognize measurement problems and take appropriate corrective action should problems develop. Fortunately, dynamic pile testing allows for certain data quality checks because two independent measurements are taken that have to conform to the so-called proportionality relationship.

As long as there is only a wave traveling in one direction, as is the case during impact when only a downward traveling wave exists in the rod, force and velocity measured at its top are proportional

$$F = v\,Z \qquad (5)$$

where Z is again the pile impedance, Z = EA/c. This relationship can also be expressed in terms of stress

$$\sigma = F/A = v\,(E/c) \qquad (6)$$

or strain

$$\epsilon = \sigma/E = v / c \qquad (7)$$

This means that the early portion of strain times wave speed must be equal to the velocity unless the proportionality is affected by high friction near the pile top or by a pile cross sectional change not far below the sensors. Checking the proportionality is an excellent means of assuring meaningful measurements but is only truly meaningful for perfectly uniform rods. Open or loose splices, for example, will lead to a non-proportionality. For SPT rods it is fortunate that usually no soil resistance acts along the shaft and for that reason, proportionality can exist until the stress wave returns from sampler top or rod bottom unless connectors are not sufficiently tightened or have a significant mass.

Velocity data quality can also be checked by looking at the final displacement, DFN, which is calculated from the acceleration by double integration. If the calculated final displacement is much higher or lower than indicated by the N-value, the accelerometer attachment may be loose or the sensor may be faulty. If major drift in the velocity is observed, the EMX value may be in error, even though proportionality from impact to time 2L/c exists. In this case, it may be useful to evaluate the energy transferred to the drill rod at time 2L/c, which is calculated by the PDA or SPTA as the E2E quantity.

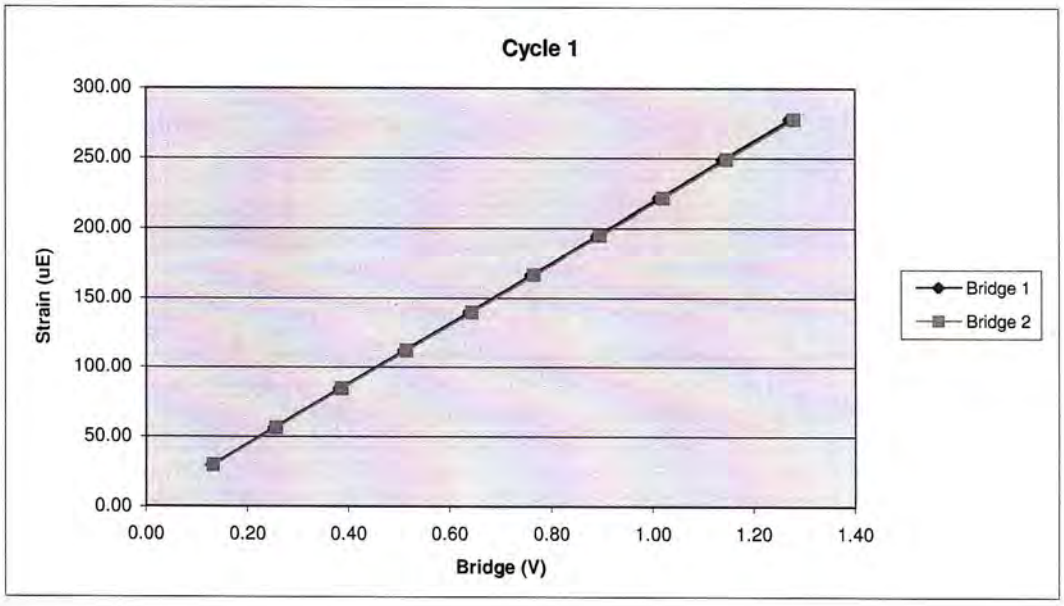
APPENDIX B

Instrumentation Calibration Information

246AW		Cycle 1		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	1020.02	29.76	0.13	0.13
3	1977.93	56.14	0.25	0.26
4	2989.67	84.55	0.38	0.39
5	3988.00	111.89	0.51	0.51
6	4987.71	139.46	0.64	0.64
7	5947.40	166.51	0.76	0.77
8	6957.75	194.61	0.89	0.90
9	7933.02	221.39	1.01	1.02
10	8932.33	249.03	1.14	1.15
11	9958.85	277.60	1.27	1.28

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7842.88**	**Force Calibration (lb/V)**	**7796.38**
Offset	-7.41	Offset	-16.71
Correlation	0.999996	Correlation	0.999997
Strain Calibration (µE/V)	**217.50**	**Strain Calibration (µE/V)**	**216.21**
Offset	1.21	Offset	0.95
Correlation	0.999996	Correlation	0.999996

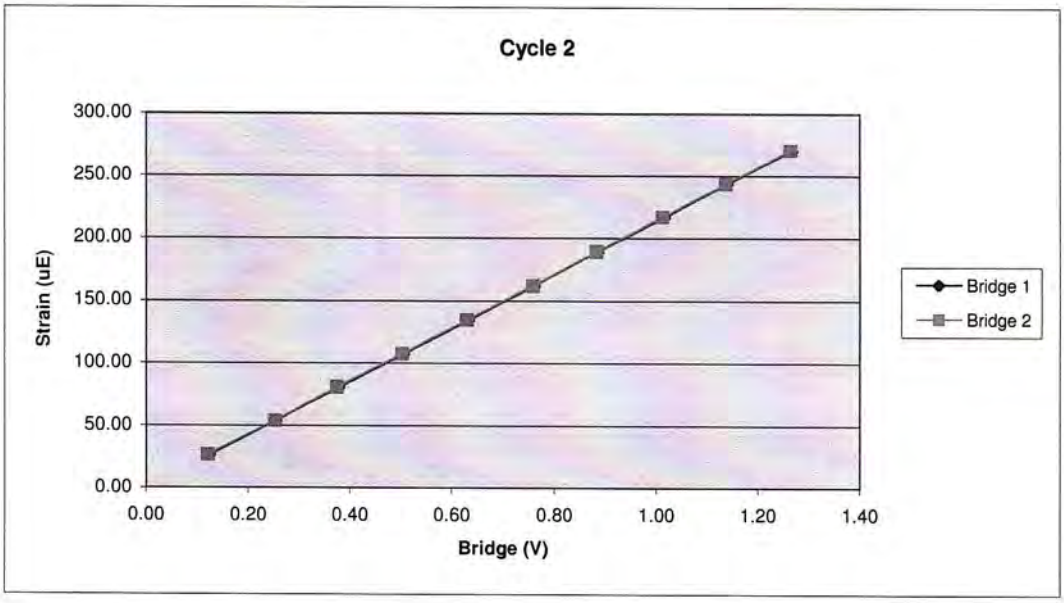
Force Strain Calibration	
EA (Kips)	**36058.95**
Offset	-51.11
Correlation	0.999998



246AW		Cycle 2		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	961.27	26.70	0.12	0.12
3	1979.31	53.83	0.25	0.25
4	2941.96	80.57	0.38	0.37
5	3940.88	107.53	0.50	0.50
6	4929.94	134.63	0.63	0.63
7	5938.33	162.08	0.76	0.76
8	6918.13	188.92	0.88	0.88
9	7937.16	216.87	1.02	1.01
10	8901.18	243.54	1.14	1.14
11	9907.20	270.51	1.27	1.26

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7830.35**	**Force Calibration (lb/V)**	**7828.10**
Offset	**-11.13**	Offset	**6.08**
Correlation	**0.999999**	Correlation	**0.999999**
Strain Calibration (µE/V)	**213.83**	**Strain Calibration (µE/V)**	**213.77**
Offset	**-0.22**	Offset	**0.25**
Correlation	**0.999995**	Correlation	**0.999995**

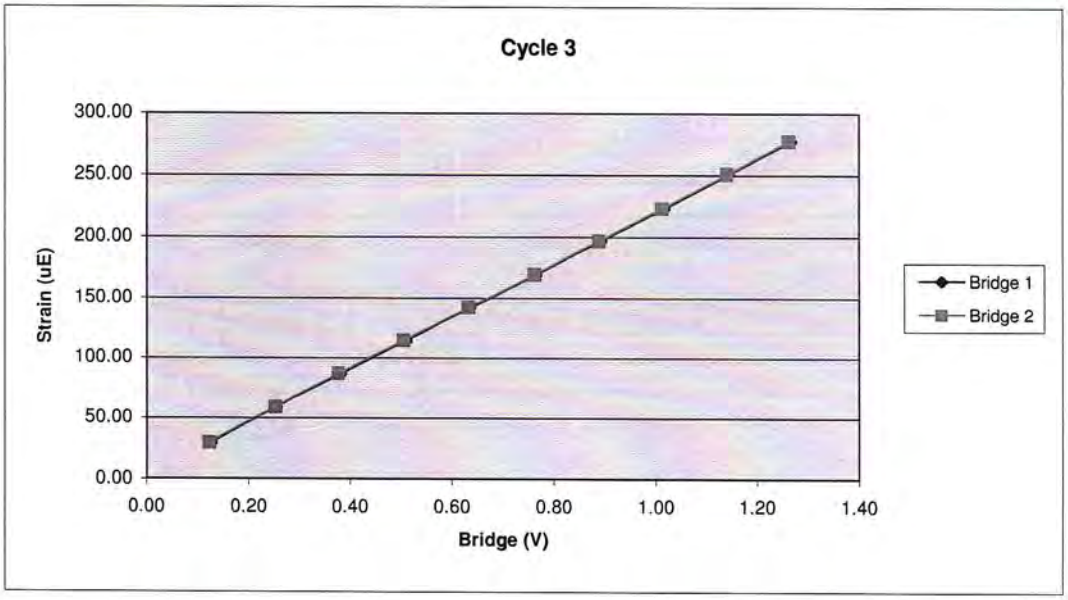
Force Strain Calibration	
EA (Kips)	**36618.79**
Offset	**-2.97**
Correlation	**0.999996**



246AW		Cycle 3		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	963.44	29.44	0.13	0.12
3	1974.38	59.00	0.25	0.25
4	2948.07	86.73	0.38	0.38
5	3962.57	114.52	0.51	0.50
6	4953.80	141.89	0.63	0.63
7	5954.69	169.40	0.76	0.76
8	6961.30	197.12	0.89	0.89
9	7923.95	223.39	1.02	1.01
10	8918.14	250.73	1.14	1.14
11	9891.83	277.64	1.27	1.26

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7827.06**	**Force Calibration (lb/V)**	**7833.29**
Offset	**-18.39**	Offset	**-0.33**
Correlation	**0.999998**	Correlation	**0.999997**
Strain Calibration (µE/V)	**216.63**	**Strain Calibration (µE/V)**	**216.81**
Offset	**3.77**	Offset	**4.27**
Correlation	**0.999969**	Correlation	**0.999967**

Force Strain Calibration	
EA (Kips)	**36128.27**
Offset	**-154.15**
Correlation	**0.999967**



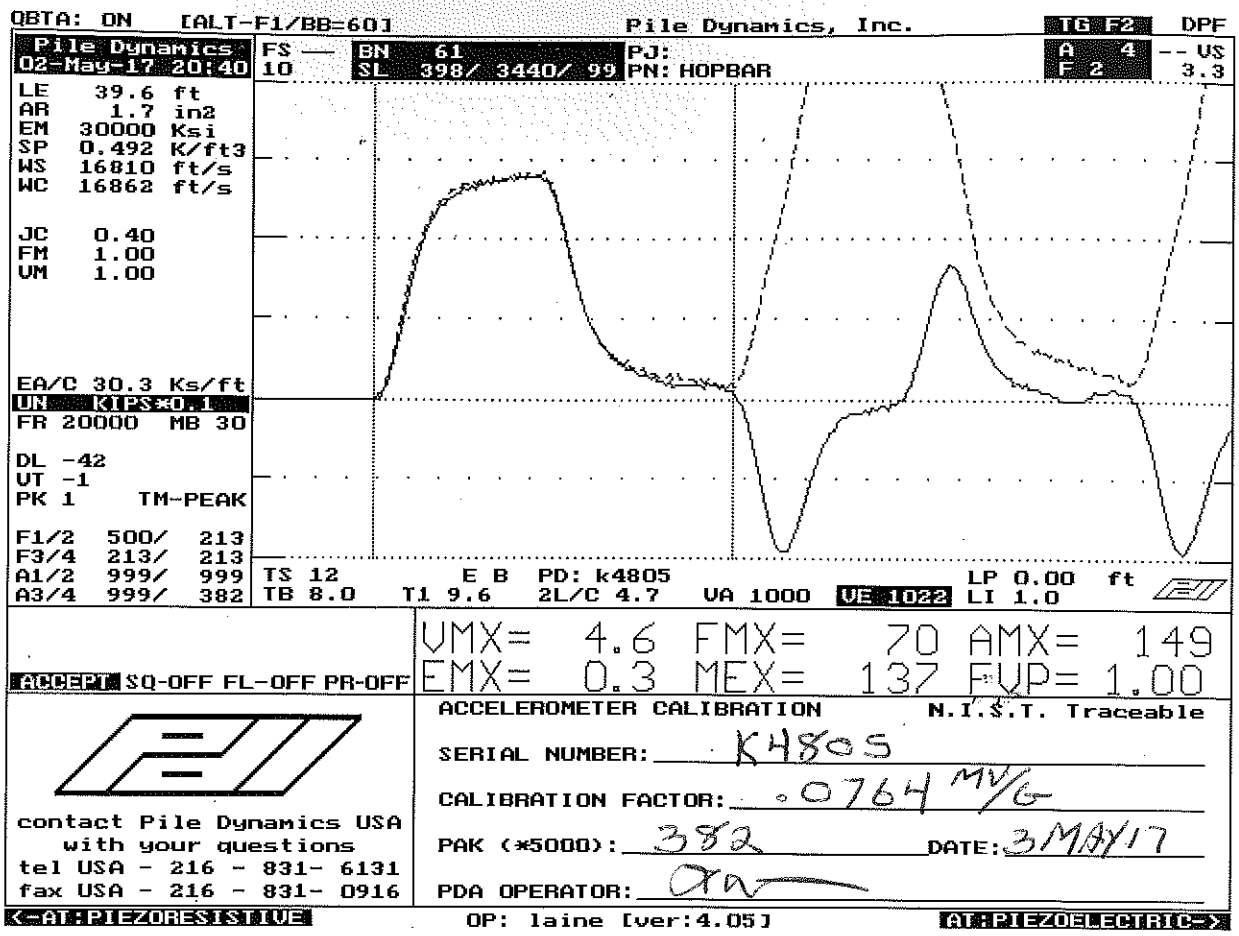
Bridge Excitation (V) 5
Shunt Resitor (ohm) 60.4k

Calibration Factors	246AW		
Bridge 1 (µE/V)	215.99	Bridge 2 (µE/V)	215.60
EA Factor (Kips)	36268.67	Area (in^2)	1.21

Calibrated by: David Bu
Calibrated Date: 9/22/2015

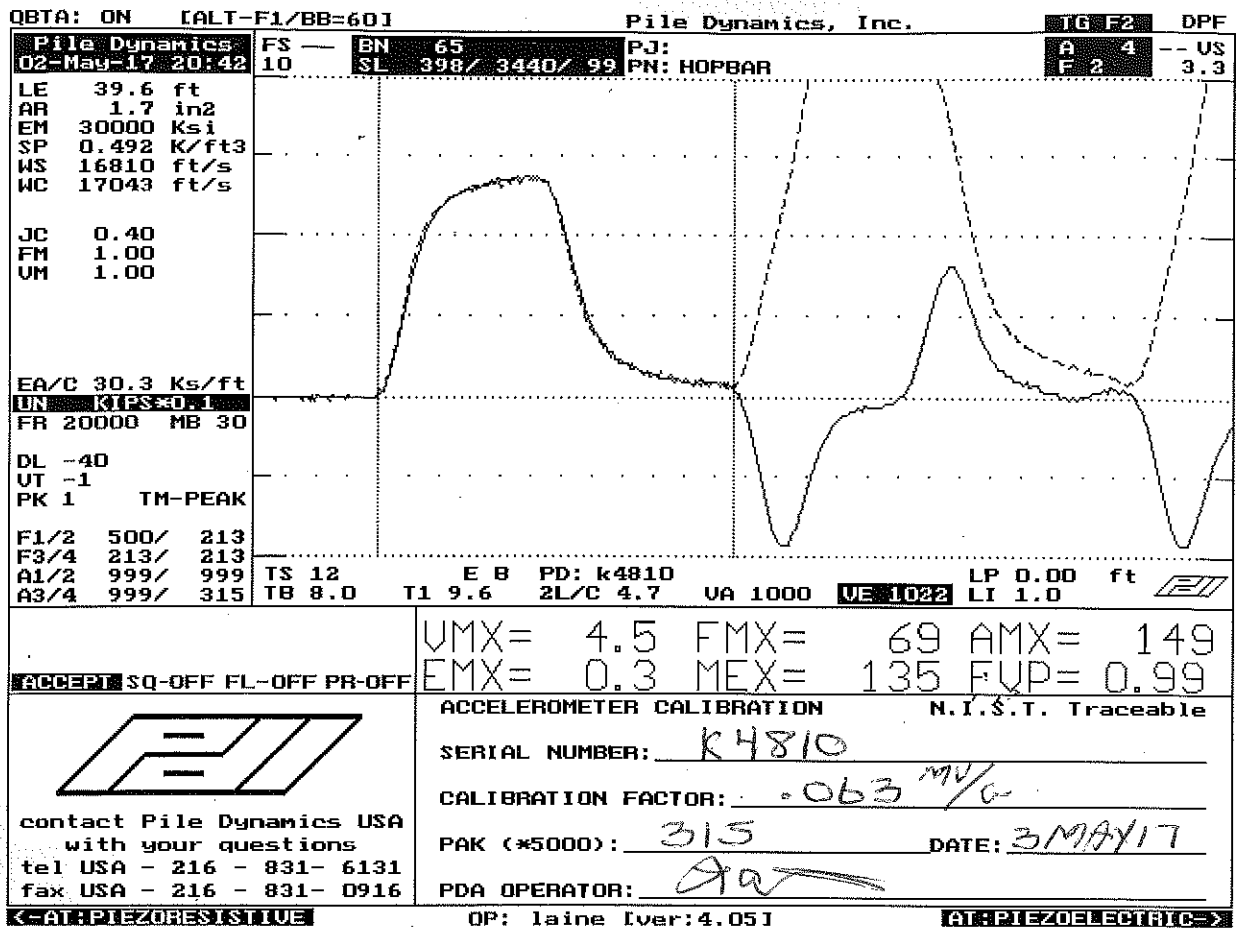
Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.



Smart Sensor

Smart Chip Programmed By A.M.W **on** 3MAY17 **CRC Value** BC78



Smart Sensor

Smart Chip Programmed By J.M.W. **on** 3MAY17 **CRC Value** 9E7A

Certificate of Calibration

Pile Dynamics, Inc. certifies that the

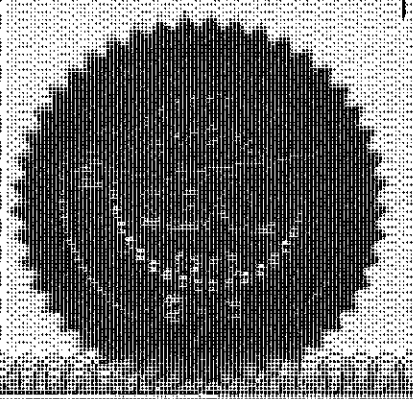
Pile Driving Analyzer®, Model 8G

Serial Number: 4613 LE

was calibrated on 4/14/2017

using a PDA Calibration Box whose output was calibrated with test equipment traceable to NIST.

This certificate is valid for 2 years from above date.



Tested by: [signature]

Pile Dynamics, Inc.
30725 Aurora Road
Cleveland, Ohio 44139 USA

PDCA
PILE DRIVING CONTRACTORS ASSOCIATION

Pile Dynamics, Inc.

This documents that

Thomas Hyatt
GRL Engineers, Inc.

has on January 26, 2017 achieved the rank of

MASTER

on the **Dynamic Measurement and Analysis Proficiency Test.**

The individual identified on this document demonstrated to the degree granted above an understanding of theory, data quality evaluation, interpretation and signal matching for high strain dynamic testing of deep foundations. ***It is recommended*** **that individuals at the Master level seek to attain Expert level through additional study within eight years of the date of this document**

The ability of the individual named to provide appropriate knowledge and advice on a specific project is not implied or warranted by the Pile Driving Contractors Association or Pile Dynamics, Inc. The Pile Driving Contractors Association or Pile Dynamics, Inc. assumes no liability for foundation testing and analysis work performed by the bearer of this certificate. This certificate can be verified at www.PDAproficiencytest.com.

Steven A. Hall, Executive Director
Pile Driving Contractors Association

Garland Likins, Senior Partner
Pile Dynamics, Inc.

No. 2182

Appendix C

SPT Calibration Results

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

Summary of SPT Test Results

Project: Diedrich D-50 Serial # 380, Test Date: 6/8/2017

FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated
DFN: Final Displacement
FVP: Force/Velocity Proportionality

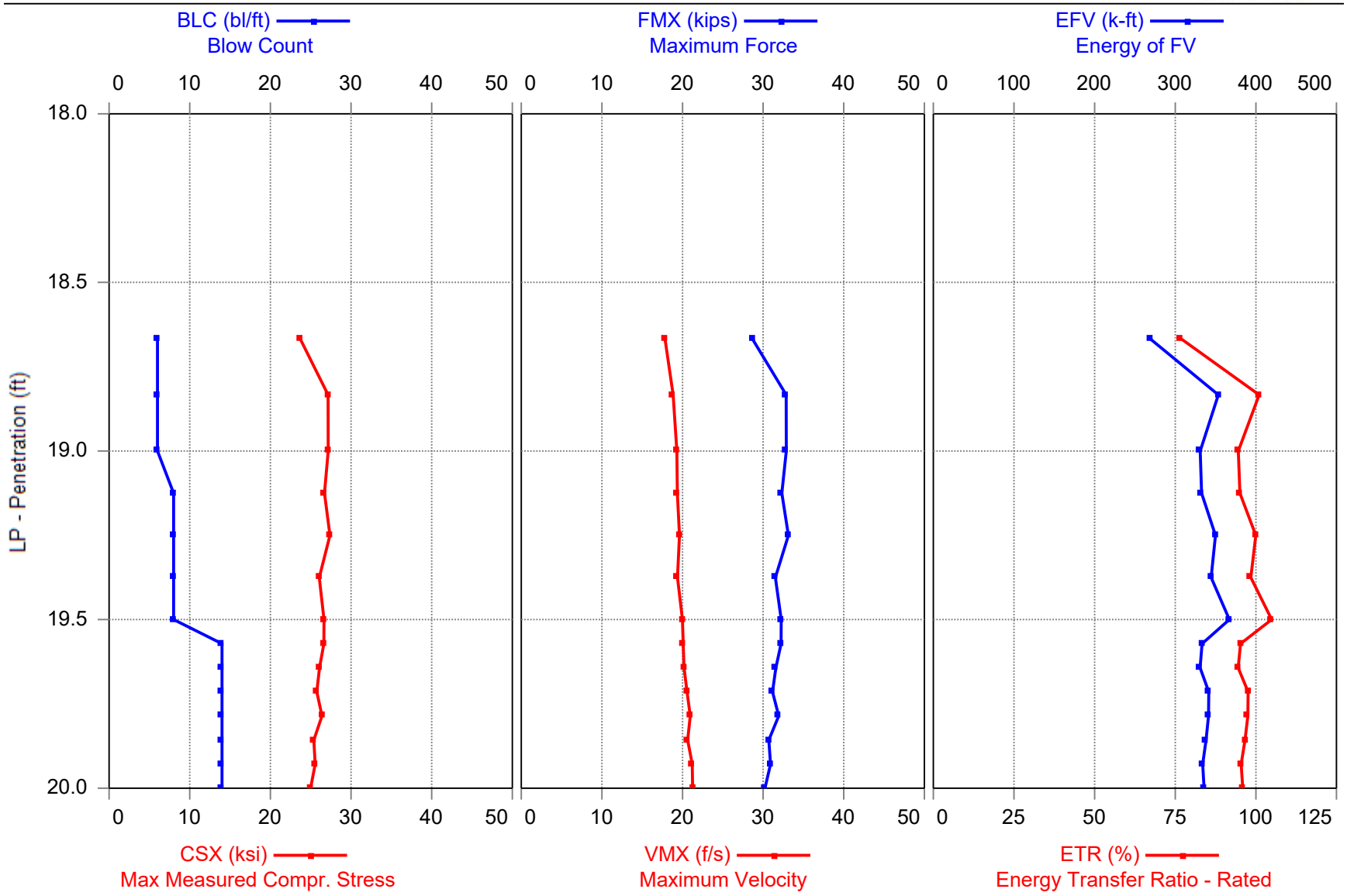
Instr. Length ft	Blows Applied /6"	Start Depth ft	Final Depth ft	**N Value**	**N60 Value**	Average FMX kips	Average VMX ft/s	Average BPM bpm	Average EFV ft-lb	Average ETR (%)	Average DFN in	Average FVP []
24.00	**3-4-7**	18.50	20.00	**11**	**17**	32	20.3	53.7	341	97.4	1.09	0.7
29.00	**5-6-14**	23.50	25.00	**20**	**31**	31	20.4	52.6	332	95.0	0.60	0.7
34.00	**6-8-12**	28.50	30.00	**20**	**31**	32	21.5	51.5	320	91.5	0.60	0.7
37.00	**2-5-10**	33.50	35.00	**15**	**23**	34	22.7	53.7	339	96.8	0.80	0.7
42.00	**5-3-6**	38.50	40.00	**9**	**14**	32	21.2	53.8	323	92.2	1.33	0.7
				Overall Average Values:		32	21.2	52.8	330	94.4	0.80	0.7
				Standard Deviation:		1	1.0	1.0	11	3.2	0.38	0.0
				Overall Maximum Value:		36	23.7	54.3	367	104.9	2.00	0.8
				Overall Minimum Value:		30	19.4	50.4	309	88.3	0.43	0.6

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-18.5-20



Diedrich D-50 SN380 - SS-18.5-20 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 24.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
3	19.0	6	AV3	26.0	31	18.7	318	91	36	2.93	2.00	0.74
			MAX	27.2	33	19.3	353	101	54	3.28	2.00	0.77
			MIN	23.7	29	17.8	268	77	2	2.56	2.00	0.70
7	19.5	8	AV4	26.7	32	19.6	349	100	54	1.91	1.50	0.76
			MAX	27.4	33	20.0	367	105	54	1.96	1.50	0.78
			MIN	26.1	32	19.4	333	95	53	1.83	1.50	0.74
14	20.0	14	AV7	25.8	31	20.7	336	96	54	1.31	0.86	0.68
			MAX	26.6	32	21.2	342	98	54	1.50	0.86	0.72
			MIN	25.0	30	20.1	331	95	54	1.22	0.86	0.64
			Average	26.1	32	19.9	336	96	50	1.83	1.29	0.71
			Maximum	27.4	33	21.2	367	105	54	3.28	2.00	0.78
			Minimum	23.7	29	17.8	268	77	2	1.22	0.86	0.64

Total number of blows analyzed: 14

Sensors

Blows: 1-14

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 14 seconds 10:07 AM - 10:07 AM BN 1 - 14

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

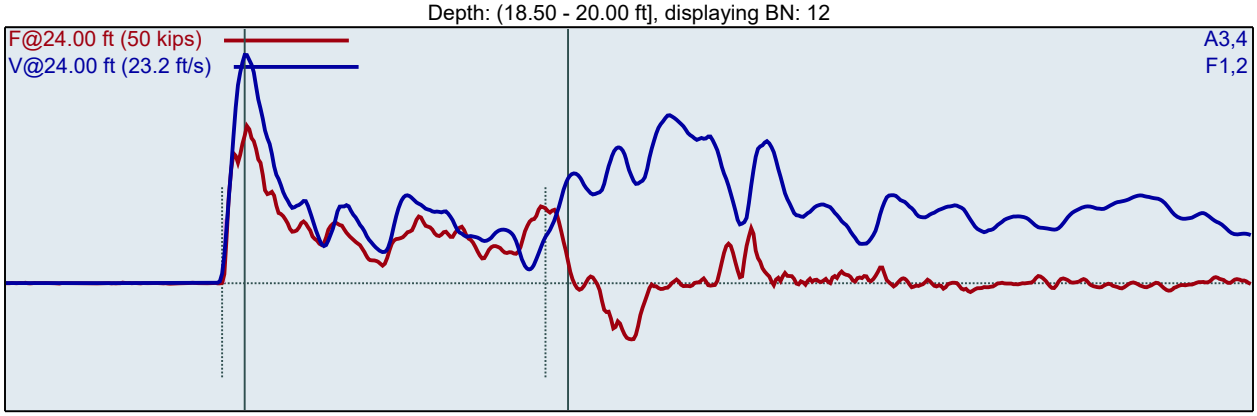
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 24.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (18.50 - 20.00 ft], displaying BN: 12



FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
1	3	18.67	29	17.8	1.9	268	76.7	2.00	0.7
2	3	18.83	33	18.8	53.7	353	101.0	2.00	0.7
3	3	19.00	33	19.3	53.2	331	94.6	2.00	0.8
4	4	19.13	32	19.4	54.1	333	95.0	1.50	0.8
5	4	19.25	33	19.6	53.2	350	100.0	1.50	0.8
6	4	19.38	32	19.4	53.6	345	98.4	1.50	0.8
7	4	19.50	32	20.0	53.6	367	104.9	1.50	0.7
8	7	19.57	32	20.1	53.5	333	95.2	0.86	0.7
9	7	19.64	32	20.2	53.8	331	94.5	0.86	0.7
10	7	19.71	31	20.6	53.7	342	97.6	0.86	0.7
11	7	19.79	32	21.0	54.0	341	97.5	0.86	0.7
12	7	19.86	31	20.6	53.7	338	96.6	0.86	0.6
13	7	19.93	31	21.2	53.5	334	95.4	0.86	0.7
14	7	20.00	30	21.2	53.7	336	95.9	0.86	0.6
		Average	32	20.3	53.7	341	97.4	1.09	0.7
		Std Dev	1	0.7	0.2	10	2.8	0.31	0.0
		Maximum	33	21.2	54.1	367	104.9	1.50	0.8
		Minimum	30	19.4	53.2	331	94.5	0.86	0.6
				N-value: 11					

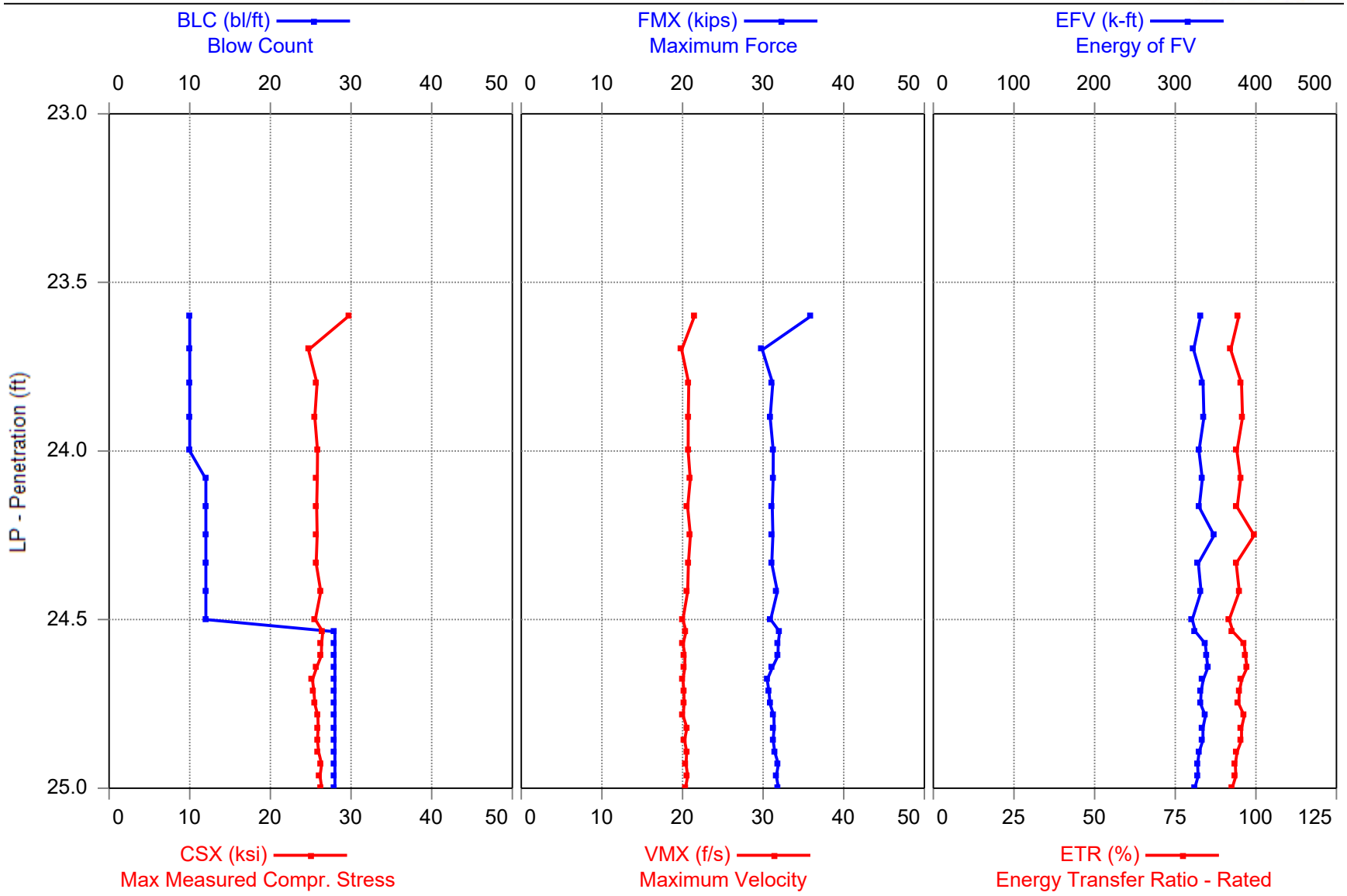
Sample Interval Time: 14.57 seconds.

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-23.5-25



Diedrich D-50 SN380 - SS-23.5-25 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 29.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
5	24.0	10	AV5	26.3	32	20.7	331	95	43	1.67	1.20	0.70
			MAX	29.7	36	21.5	336	96	55	2.28	1.20	0.75
			MIN	24.7	30	19.9	323	92	2	1.21	1.20	0.68
11	24.5	12	AV6	25.8	31	20.7	332	95	53	1.13	1.00	0.70
			MAX	26.2	32	21.0	348	99	53	1.40	1.00	0.70
			MIN	25.6	31	20.0	321	92	52	1.00	1.00	0.69
25	25.0	28	AV14	26.0	31	20.3	333	95	53	0.59	0.43	0.71
			MAX	26.5	32	20.6	340	97	53	0.76	0.43	0.72
			MIN	25.2	31	20.1	324	93	52	0.50	0.43	0.69
			Average	26.0	31	20.5	332	95	51	0.93	0.72	0.70
			Maximum	29.7	36	21.5	348	99	55	2.28	1.20	0.75
			Minimum	24.7	30	19.9	321	92	2	0.50	0.43	0.68

Total number of blows analyzed: 25

Sensors

Blows: 1-25

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 27 seconds 10:13 AM - 10:14 AM BN 1 - 25

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

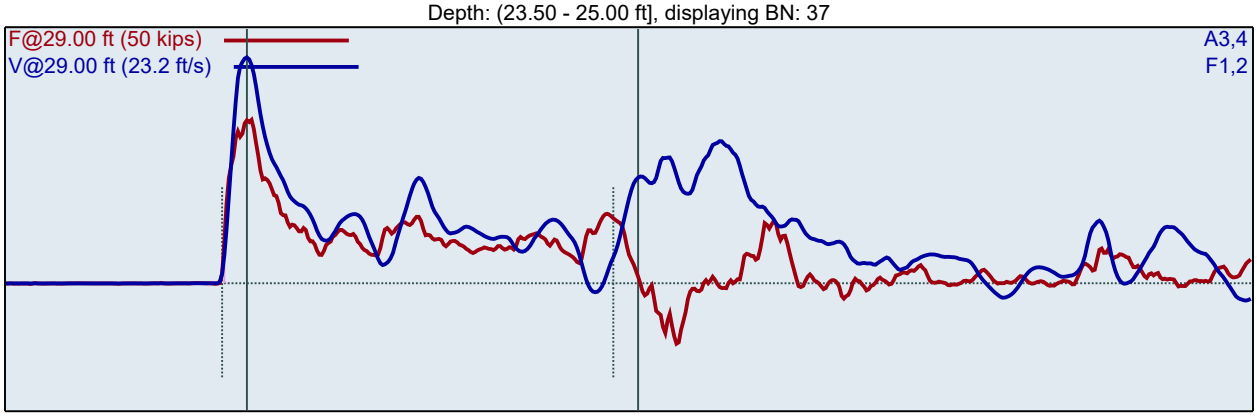
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 29.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (23.50 - 25.00 ft], displaying BN: 37



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
15	5	23.60	36	21.5	1.9	332	94.7	1.20	0.8
16	5	23.70	30	19.9	54.7	323	92.2	1.20	0.7
17	5	23.80	31	20.8	51.6	334	95.6	1.20	0.7
18	5	23.90	31	20.7	52.6	336	95.9	1.20	0.7
19	5	24.00	31	20.7	52.3	329	94.1	1.20	0.7
20	6	24.08	31	21.0	52.8	334	95.3	1.00	0.7
21	6	24.17	31	20.6	52.8	330	94.2	1.00	0.7
22	6	24.25	31	21.0	52.1	348	99.5	1.00	0.7
23	6	24.33	31	20.7	53.3	329	93.9	1.00	0.7
24	6	24.42	32	20.6	52.3	332	94.9	1.00	0.7
25	6	24.50	31	20.0	53.0	321	91.7	1.00	0.7
26	14	24.54	32	20.4	52.6	325	92.9	0.43	0.7
27	14	24.57	32	20.1	52.3	337	96.4	0.43	0.7
28	14	24.61	32	20.3	52.3	339	96.8	0.43	0.7
29	14	24.64	31	20.3	52.4	340	97.2	0.43	0.7
30	14	24.68	31	20.1	53.0	335	95.6	0.43	0.7
31	14	24.71	31	20.2	52.8	332	94.9	0.43	0.7
32	14	24.75	31	20.2	52.5	331	94.7	0.43	0.7
33	14	24.79	31	20.1	52.3	337	96.4	0.43	0.7
34	14	24.82	31	20.5	52.8	334	95.5	0.43	0.7
35	14	24.86	31	20.2	52.6	334	95.5	0.43	0.7
36	14	24.89	31	20.5	52.8	330	94.2	0.43	0.7
37	14	24.93	32	20.4	52.9	328	93.6	0.43	0.7
38	14	24.96	32	20.6	52.8	328	93.8	0.43	0.7
39	14	25.00	32	20.4	52.5	324	92.6	0.43	0.7
		Average	31	20.4	52.6	332	95.0	0.60	0.7
		Std Dev	0	0.3	0.3	6	1.7	0.26	0.0
		Maximum	32	21.0	53.3	348	99.5	1.00	0.7
		Minimum	31	20.0	52.1	321	91.7	0.43	0.7
				N-value: 20					

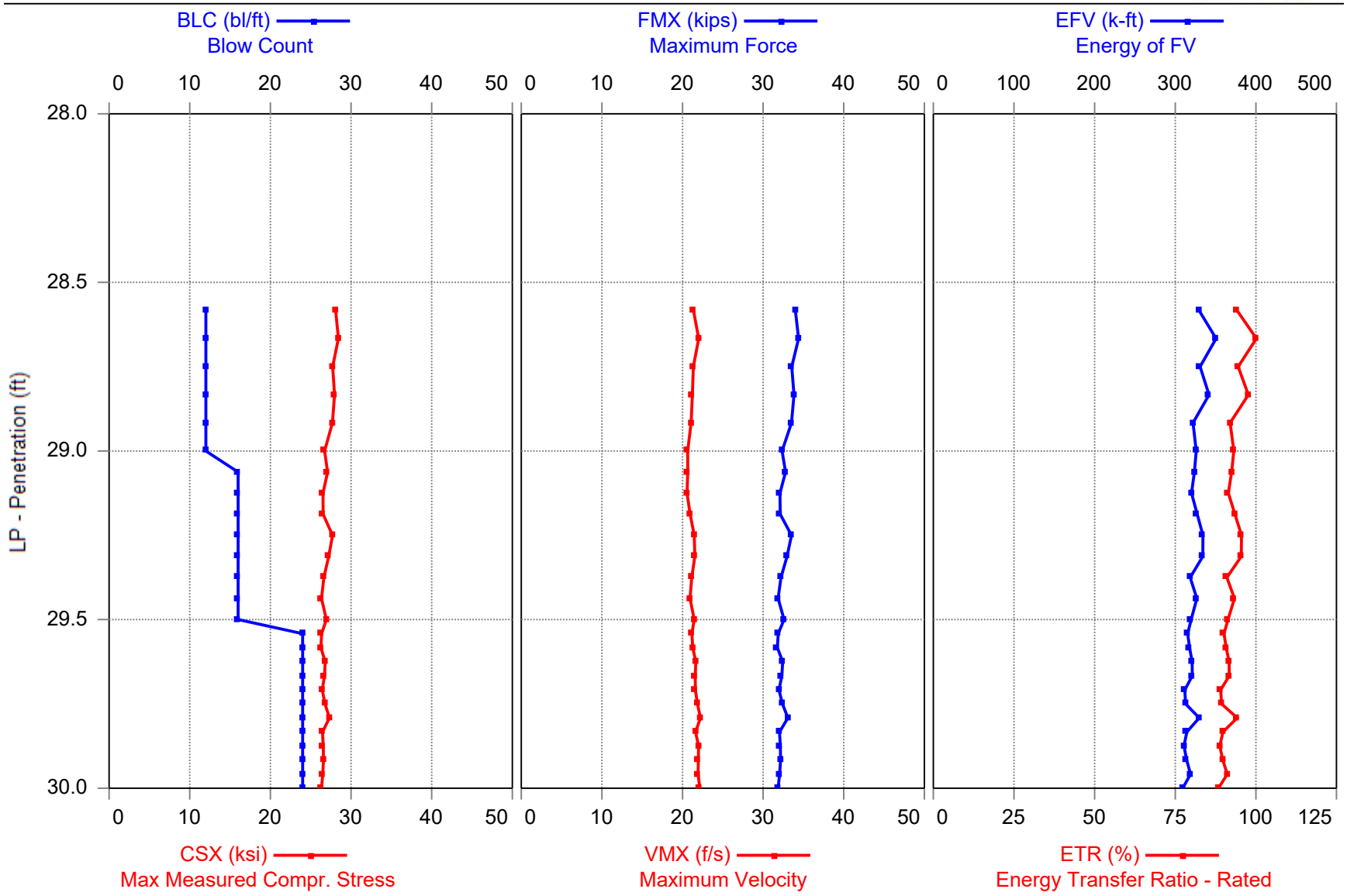
Sample Interval Time: 27.36 seconds.

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-28.5-30



Diedrich D-50 SN380 - SS-28.5-30 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 34.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
6	29.0	12	AV6	27.8	34	21.3	333	95	44	1.82	1.00	0.73
			MAX	28.4	34	22.0	351	100	54	2.15	1.00	0.74
			MIN	26.7	32	20.6	322	92	2	1.59	1.00	0.71
14	29.5	16	AV8	26.9	33	21.1	326	93	52	0.87	0.75	0.71
			MAX	27.7	34	21.5	334	96	52	1.31	0.75	0.73
			MIN	26.3	32	20.6	319	91	51	0.75	0.75	0.70
26	30.0	24	AV12	26.6	32	21.7	316	90	51	0.65	0.50	0.68
			MAX	27.3	33	22.2	330	94	53	0.71	0.50	0.70
			MIN	26.3	32	21.2	309	88	50	0.56	0.50	0.67
			Average	26.9	33	21.4	323	92	50	0.98	0.69	0.70
			Maximum	28.4	34	22.2	351	100	54	2.15	1.00	0.74
			Minimum	26.3	32	20.6	309	88	2	0.56	0.50	0.67

Total number of blows analyzed: 26

Sensors

Blows: 1-26

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 29 seconds 10:47 AM - 10:47 AM BN 1 - 26

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

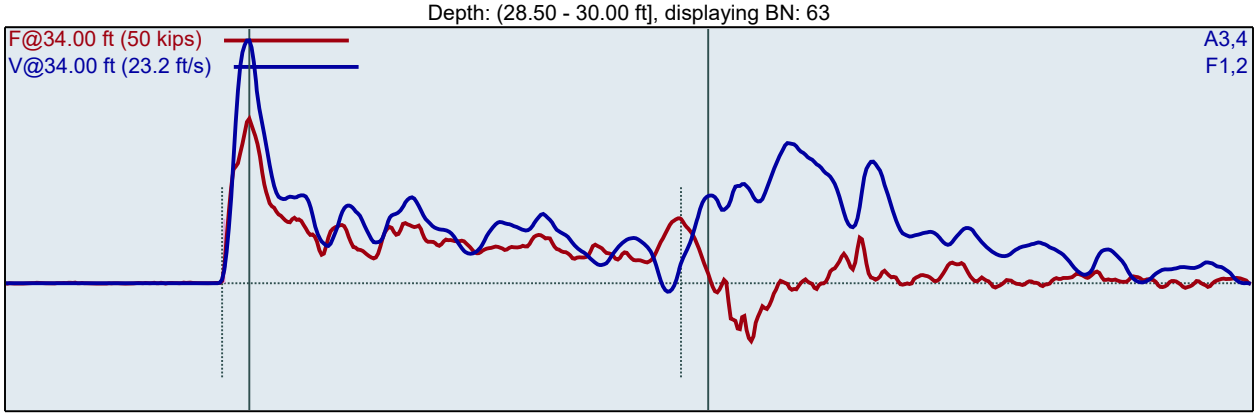
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 34.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (28.50 - 30.00 ft], displaying BN: 63



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
40	6	28.58	34	21.4	1.9	330	94.2	1.00	0.7
41	6	28.67	34	22.0	51.1	351	100.2	1.00	0.7
42	6	28.75	34	21.4	54.1	331	94.5	1.00	0.7
43	6	28.83	34	21.2	51.7	342	97.7	1.00	0.7
44	6	28.92	34	21.1	52.4	322	92.0	1.00	0.7
45	6	29.00	32	20.6	51.7	326	93.1	1.00	0.7
46	8	29.06	33	20.7	51.0	324	92.5	0.75	0.7
47	8	29.13	32	20.6	52.1	320	91.5	0.75	0.7
48	8	29.19	32	20.9	51.5	327	93.5	0.75	0.7
49	8	29.25	34	21.5	51.1	334	95.5	0.75	0.7
50	8	29.31	33	21.5	51.4	334	95.5	0.75	0.7
51	8	29.38	32	21.2	52.1	319	91.0	0.75	0.7
52	8	29.44	32	20.9	51.9	327	93.4	0.75	0.7
53	8	29.50	33	21.5	51.5	320	91.3	0.75	0.7
54	12	29.54	32	21.2	51.6	315	90.1	0.50	0.7
55	12	29.58	32	21.3	51.1	318	90.8	0.50	0.7
56	12	29.63	32	21.6	51.3	321	91.7	0.50	0.7
57	12	29.67	32	21.6	51.8	321	91.8	0.50	0.7
58	12	29.71	32	21.6	51.4	312	89.1	0.50	0.7
59	12	29.75	32	21.9	51.2	313	89.4	0.50	0.7
60	12	29.79	33	22.2	50.4	330	94.2	0.50	0.7
61	12	29.83	32	21.6	52.7	314	89.8	0.50	0.7
62	12	29.88	32	22.0	51.6	311	88.8	0.50	0.7
63	12	29.92	32	22.0	51.8	314	89.8	0.50	0.7
64	12	29.96	32	21.9	51.2	319	91.1	0.50	0.7
65	12	30.00	32	22.1	51.5	309	88.4	0.50	0.7
		Average	32	21.5	51.5	320	91.5	0.60	0.7
		Std Dev	0	0.5	0.5	7	2.0	0.12	0.0
		Maximum	34	22.2	52.7	334	95.5	0.75	0.7
		Minimum	32	20.6	50.4	309	88.4	0.50	0.7

N-value: 20

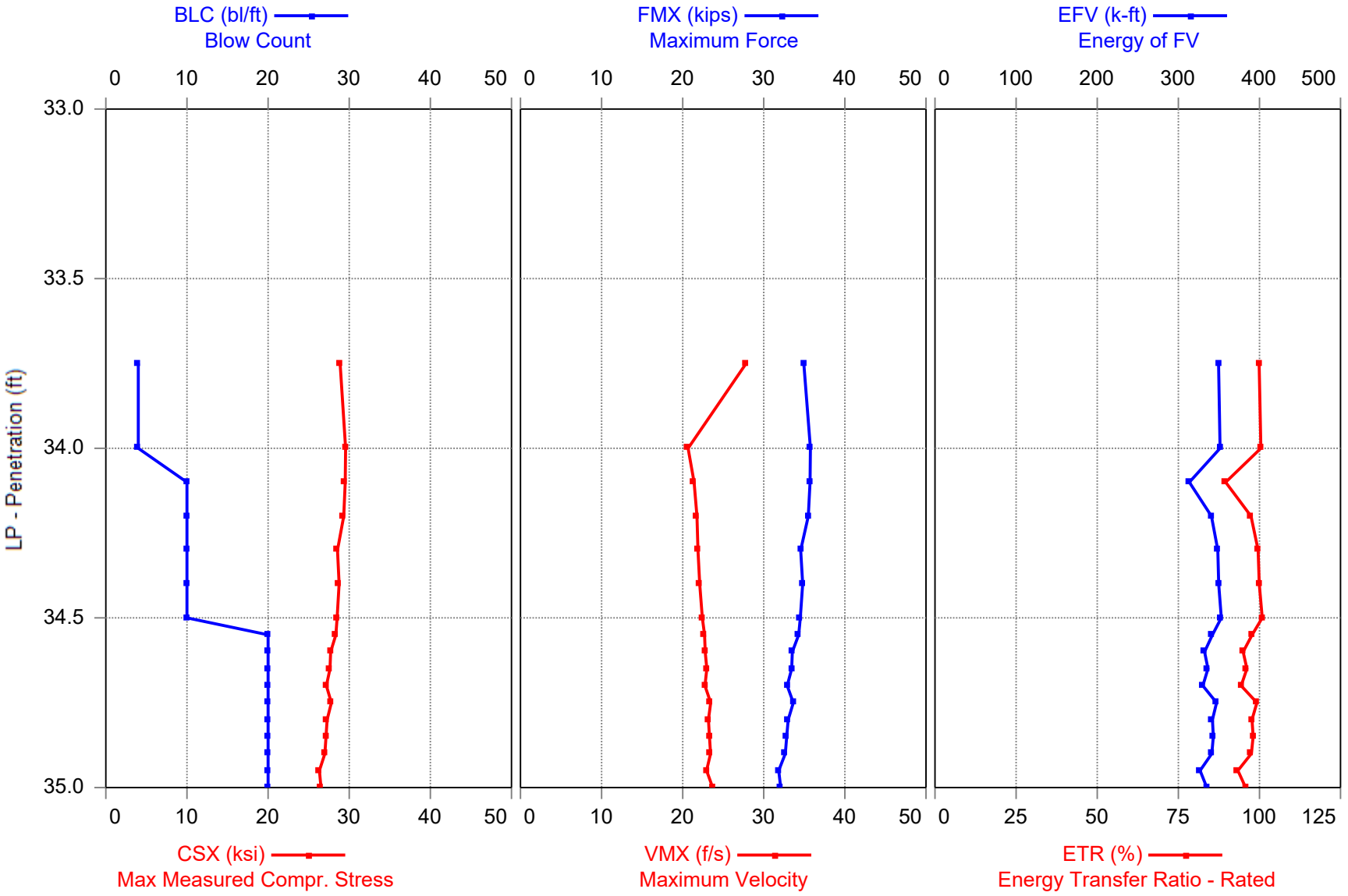
Sample Interval Time: 29.05 seconds.

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-33.5-35



Diedrich D-50 SN380 - SS-33.5-35 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 37.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
2	34.0	4	AV2	29.2	35	24.2	351	100	28	3.28	3.00	0.77
			MAX	29.5	36	27.8	352	100	54	3.56	3.00	0.80
			MIN	28.9	35	20.7	350	100	2	2.99	2.99	0.73
7	34.5	10	AV5	28.9	35	21.9	341	97	54	1.31	1.19	0.70
			MAX	29.5	36	22.4	353	101	54	1.57	1.20	0.71
			MIN	28.5	34	21.4	314	90	53	1.20	1.18	0.68
17	35.0	20	AV10	27.3	33	23.1	338	96	54	0.70	0.60	0.64
			MAX	28.4	34	23.7	347	99	54	0.87	0.60	0.69
			MIN	26.3	32	22.7	327	93	53	0.60	0.59	0.60
			Average	28.0	34	22.9	340	97	51	1.18	1.06	0.67
			Maximum	29.5	36	27.8	353	101	54	3.56	3.00	0.80
			Minimum	26.3	32	20.7	314	90	2	0.60	0.59	0.60

Total number of blows analyzed: 17

Sensors

Blows: 1-17

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 17 seconds 10:55 AM - 10:55 AM BN 1 - 17

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

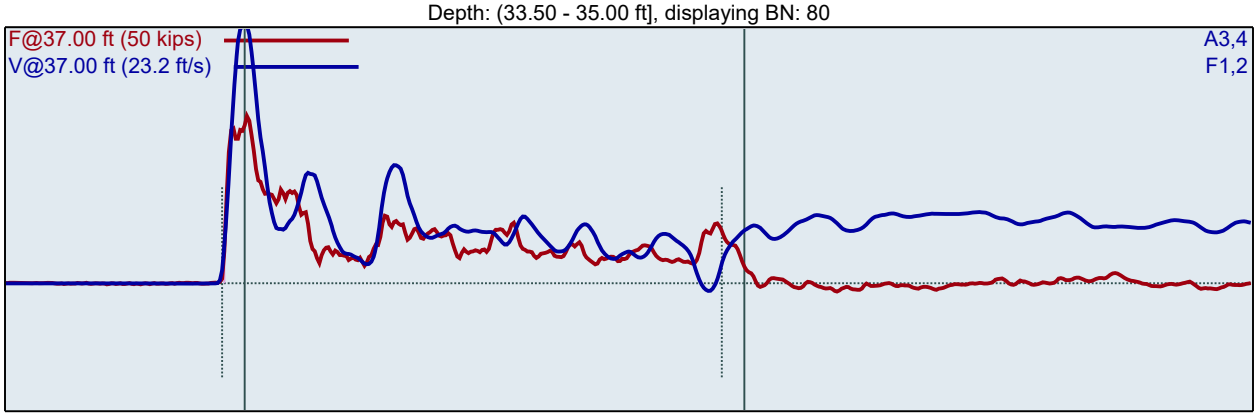
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 37.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (33.50 - 35.00 ft], displaying BN: 80



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
66	2	33.75	35	27.8	1.9	350	99.9	3.00	0.7
67	2	34.00	36	20.7	54.4	352	100.4	2.99	0.8
68	5	34.10	36	21.4	53.6	314	89.6	1.18	0.7
69	5	34.20	35	21.8	53.5	341	97.4	1.19	0.7
70	5	34.30	35	21.9	53.3	349	99.6	1.20	0.7
71	5	34.40	35	22.1	54.2	350	99.9	1.20	0.7
72	5	34.50	34	22.4	53.3	353	100.8	1.20	0.7
73	10	34.55	34	22.7	53.6	342	97.7	0.59	0.7
74	10	34.60	34	22.8	53.7	332	95.0	0.59	0.7
75	10	34.65	33	23.0	53.3	337	96.1	0.59	0.7
76	10	34.70	33	22.7	54.3	330	94.4	0.60	0.7
77	10	34.75	34	23.5	52.7	347	99.2	0.60	0.6
78	10	34.80	33	23.2	54.2	342	97.7	0.60	0.6
79	10	34.85	33	23.3	53.9	343	98.0	0.60	0.6
80	10	34.90	33	23.4	53.6	341	97.5	0.60	0.6
81	10	34.95	32	22.9	54.3	327	93.4	0.60	0.6
82	10	35.00	32	23.7	53.6	335	95.7	0.60	0.6
		Average	34	22.7	53.7	339	96.8	0.80	0.7
		Std Dev	1	0.7	0.4	10	2.8	0.28	0.0
		Maximum	36	23.7	54.3	353	100.8	1.20	0.7
		Minimum	32	21.4	52.7	314	89.6	0.59	0.6
				N-value: 15					

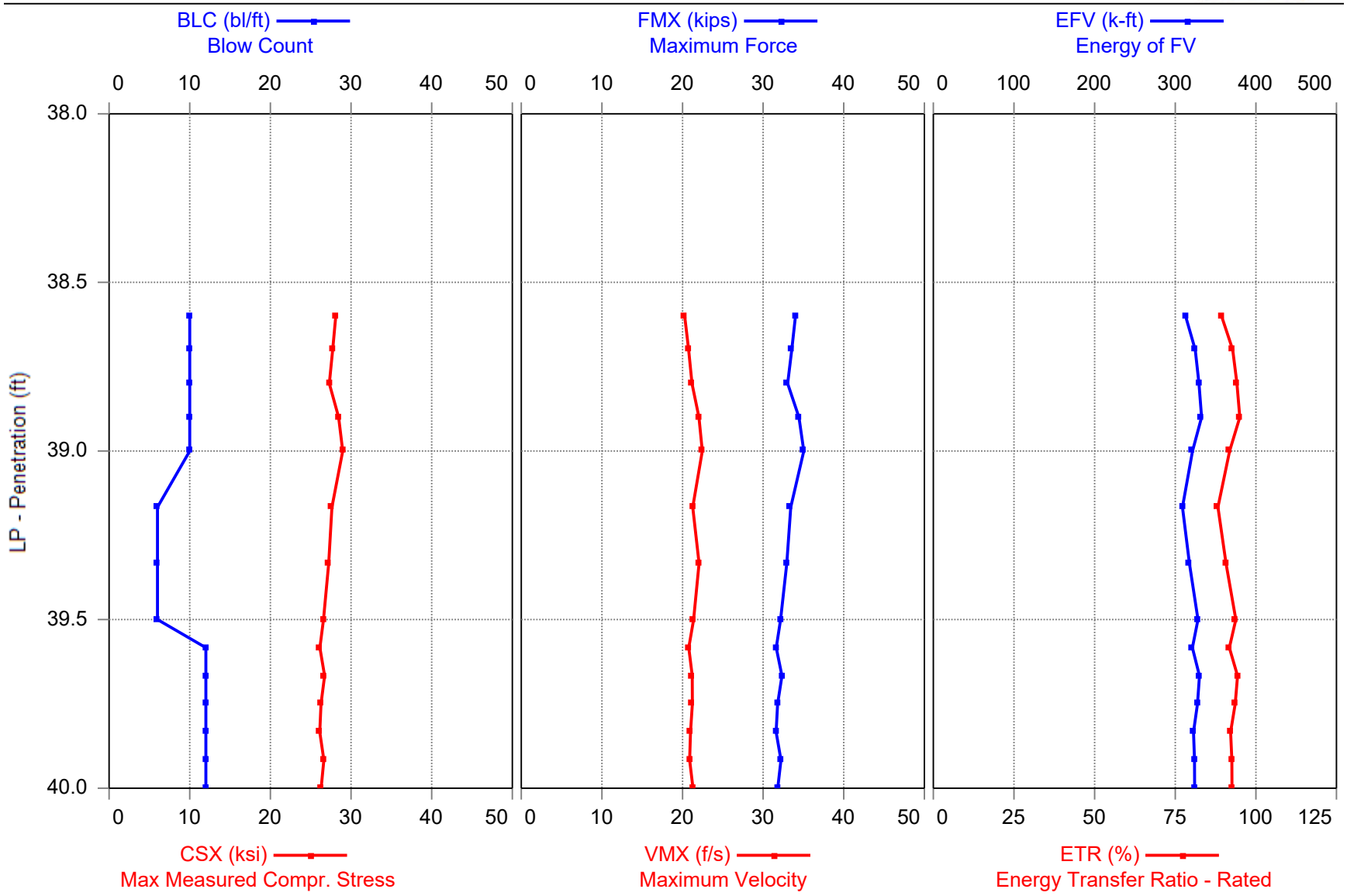
Sample Interval Time: 17.91 seconds.

GRL Engineers, Inc. - PDIPLOT2 Ver 2016.2.57.6 - Case Method & iCAP® Results

Printed: 12-June-2017

Test started: 08-June-2017

Diedrich D-50 SN380 - SS-38.5-40



Diedrich D-50 SN380 - SS-38.5-40 B-2
OP: TH/JW Date: 08-June-2017

AR: 1.21 in² SP: 0.492 k/ft³
LE: 42.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.90 []

CSX: Max Measured Compr. Stress
FMX: Maximum Force
VMX: Maximum Velocity
EFV: Energy of FV
ETR: Energy Transfer Ratio - Rated
BPM: Blows per Minute
DMX: Maximum Displacement
DFN: Final Displacement
FVP: Force/Velocity proportionality

BL#	Depth ft	BLC bl/ft	TYPE	CSX ksi	FMX kips	VMX f/s	EFV k-ft	ETR (%)	BPM bpm	DMX in	DFN in	FVP []
5	39.0	10	AV5	28.1	34	21.3	324	93	44	1.32	1.20	0.72
			MAX	29.0	35	22.5	333	95	55	1.62	1.20	0.75
			MIN	27.3	33	20.3	313	89	2	1.20	1.19	0.69
8	39.5	6	AV3	27.1	33	21.6	318	91	54	2.06	1.99	0.68
			MAX	27.6	33	22.1	328	94	54	2.09	2.00	0.70
			MIN	26.6	32	21.3	309	88	53	2.02	1.99	0.67
14	40.0	12	AV6	26.4	32	21.1	325	93	54	1.06	1.00	0.69
			MAX	26.7	32	21.3	330	94	54	1.28	1.00	0.71
			MIN	26.1	32	20.8	321	92	54	1.00	1.00	0.67
			Average	27.2	33	21.3	323	92	50	1.36	1.28	0.70
			Maximum	29.0	35	22.5	333	95	55	2.09	2.00	0.75
			Minimum	26.1	32	20.3	309	88	2	1.00	1.00	0.67

Total number of blows analyzed: 14

Sensors

Blows: 1-14

Sensor	Type	Serial Nr.	Calibration	Replay Factor
F1	Strain	246 AW-2	215.6	1.00
F2	Strain	246 AW-1	216.0	1.00
A3	PR Accel	K4805	382.0	1.00
A4	PR Accel	K4810	315.0	1.00

Time Summary

Drive 14 seconds 11:02 AM - 11:03 AM BN 1 - 14

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 6/12/2017

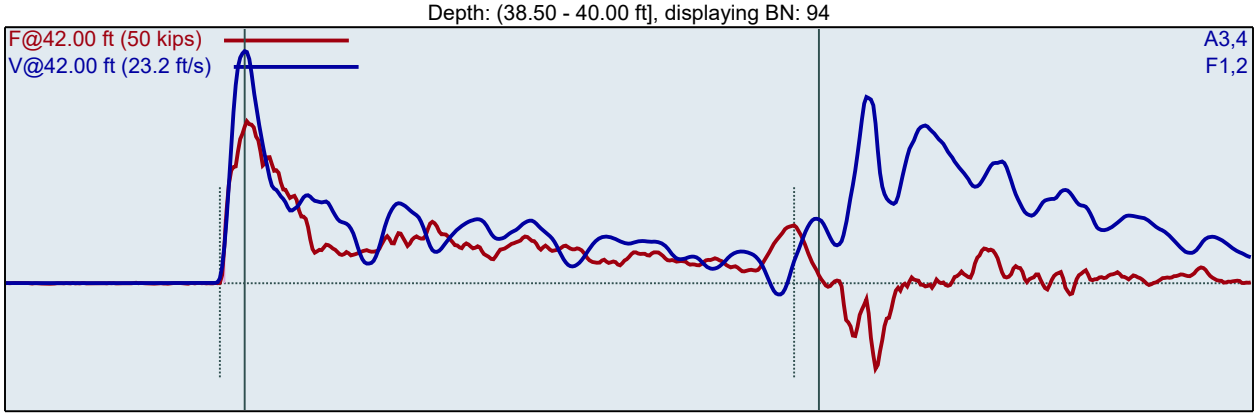
Diedrich D-50 Serial # 380
TH/JW

Test date: 6/8/2017

AR: 1.21 in^2
LE: 42.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (38.50 - 40.00 ft], displaying BN: 94



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
83	5	38.60	34	20.3	1.9	313	89.4	1.19	0.7
84	5	38.70	34	20.8	55.0	325	92.8	1.20	0.7
85	5	38.80	33	21.2	54.0	329	94.1	1.20	0.7
86	5	38.90	34	22.0	53.4	333	95.0	1.20	0.7
87	5	39.00	35	22.5	54.2	321	91.8	1.20	0.7
88	3	39.17	33	21.3	53.5	309	88.3	1.99	0.7
89	3	39.33	33	22.1	53.8	318	90.8	1.99	0.7
90	3	39.50	32	21.4	54.2	328	93.8	2.00	0.7
91	6	39.58	32	20.8	54.1	321	91.8	1.00	0.7
92	6	39.67	32	21.2	53.6	330	94.3	1.00	0.7
93	6	39.75	32	21.2	53.6	328	93.6	1.00	0.7
94	6	39.83	32	21.0	54.2	323	92.2	1.00	0.7
95	6	39.92	32	20.9	53.7	324	92.5	1.00	0.7
96	6	40.00	32	21.3	53.9	324	92.6	1.00	0.7
		Average	32	21.2	53.8	323	92.2	1.33	0.7
		Std Dev	1	0.3	0.2	6	1.7	0.47	0.0
		Maximum	33	22.1	54.2	330	94.3	2.00	0.7
		Minimum	32	20.8	53.5	309	88.3	1.00	0.7
				N-value: 9					

Sample Interval Time: 14.43 seconds.

PROJECT NAME: South River Trail Phase 5 - Bridge 2

PROJECT NO.: 10:9672

N bar = **18**

Layer Top	Layer Top Elevation	Layer Bottom	N-values at Borings										N_{AVG}	D_i	D_i / N_{AV}
			B-9A												
0		2.5	9										9.00	2.5	0.28
2.5		5	8										8.00	2.5	0.31
5		7.5	5										5.00	2.5	0.50
7.5		10	2										2.00	2.5	1.25
10		15	2										2.00	5	2.50
15		20	100										100.00	5	0.05
20		25	100										100.00	5	0.05
25		30	100										100.00	5	0.05
30		35	100										100.00	5	0.05
35		40	100										100.00	5	0.05
40		45	100										100.00	5	0.05
45		50	100										100.00	5	0.05
50		55	100										100.00	5	0.05
55		60	100										100.00	5	0.05
60		65	100										100.00	5	0.05
65		70	100										100.00	5	0.05
70		75	100										100.00	5	0.05
75		80	100										100.00	5	0.05
80		85	100										100.00	5	0.05
85		90	100										100.00	5	0.05
90		95	100										100.00	5	0.05
95		100	100										100.00	5	0.05
													78.45	**100**	**5.69**

N bar = **18**

SITE CLASS	SOIL PROFILE NAME	AVERAGE PROPERTIES IN TOP 100 ft, AS PER SECTION 1615.1.5		
		Soil shear wave velocity, Vs-bar, (ft/s)	Standard Penetration Resistance, N-bar	Soil Undrained Shear Strength, Su-bar , (psf)
A	Hard Rock	Vs-bar > 5,000	Not Applicable	Not Applicable
B	Rock	2,500 < Vs-bar ≤ 5,000	Not Applicable	Not Applicable
C	Very Dense Soil and Soft Rock	1,200 < Vs-bar ≤ 2,500	N-bar > 50	Su-bar ≥ 2000
D	Stiff Soil Profile	600 ≤ Vs-bar ≤ 1,200	15 ≤ N-bar ≤ 50	1,000 ≤ Su-bar ≤ 2000
E	Soft Soil Profile	Vs-bar < 600	N-bar < 15	Su-bar < 1,000
E	–	Any profile with more than 10 feet of soil having the following characteristics: 1. Plaxticity Index , PI > 20; 2. Moisture content , w ≥ 40%, and 3. Undrained shear strength, Su-bar < 500 psf		
F	–	Any profile containing soils having one or more of the following characteristics: 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and/or highly organic clays (H > 10 ft or peat and/or highly organic caly where H = thickness of soil) 3. Very high plasticity clays (H> 25 ft with plasticity index PI > 75) 4. Very thick soft/medium stiff clays (H > 120 ft)		

PROJECT NAME: South River Trail Phase 5 - Bridge 2

PROJECT NO.: 10:9672

N bar = **52**

Layer Top	Layer Top Elevation	Layer Bottom	N-values at Borings										N_{AVG}	D_i	D_i / N_{AV}
			B-10A												
0		2.5	9										9.00	2.5	0.28
2.5		5	8										8.00	2.5	0.31
5		7.5	6										6.00	2.5	0.42
7.5		10	100										100.00	2.5	0.03
10		15	100										100.00	5	0.05
15		20	100										100.00	5	0.05
20		25	100										100.00	5	0.05
25		30	100										100.00	5	0.05
30		35	100										100.00	5	0.05
35		40	100										100.00	5	0.05
40		45	100										100.00	5	0.05
45		50	100										100.00	5	0.05
50		55	100										100.00	5	0.05
55		60	100										100.00	5	0.05
60		65	100										100.00	5	0.05
65		70	100										100.00	5	0.05
70		75	100										100.00	5	0.05
75		80	100										100.00	5	0.05
80		85	100										100.00	5	0.05
85		90	100										100.00	5	0.05
90		95	100										100.00	5	0.05
95		100	100										100.00	5	0.05
													87.41	**100**	**1.93**

N bar = **52**

SITE CLASS	SOIL PROFILE NAME	AVERAGE PROPERTIES IN TOP 100 ft, AS PER SECTION 1615.1.5		
		Soil shear wave velocity, Vs-bar, (ft/s)	Standard Penetration Resistance, N-bar	Soil Undrained Shear Strength, Su-bar , (psf)
A	Hard Rock	Vs-bar > 5,000	Not Applicable	Not Applicable
B	Rock	2,500 < Vs-bar ≤ 5,000	Not Applicable	Not Applicable
C	Very Dense Soil and Soft Rock	1,200 < Vs-bar ≤ 2,500	N-bar > 50	Su-bar ≥ 2000
D	Stiff Soil Profile	600 ≤ Vs-bar ≤ 1,200	15 ≤ N-bar ≤ 50	1,000 ≤ Su-bar ≤ 2000
E	Soft Soil Profile	Vs-bar < 600	N-bar < 15	Su-bar < 1,000
E	–	Any profile with more than 10 feet of soil having the following characteristics: 1. Plaxticity Index , PI > 20; 2. Moisture content , w ≥ 40%, and 3. Undrained shear strength, Su-bar < 500 psf		
F	–	Any profile containing soils having one or more of the following characteristics: 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and/or highly organic clays (H > 10 ft or peat and/or highly organic caly where H = thickness of soil) 3. Very high plasticity clays (H> 25 ft with plasticity index PI > 75) 4. Very thick soft/medium stiff clays (H > 120 ft)		

Nominal Pile Driving Resistance - C10.7.3.7

Project Name:	South River Trail Phase 5 - Bridge 2
Project Number:	10:9672
Project Location:	DeKalb County
Boring Number:	B-9/ B-9A
Bent (EB/IB):	EB Bent 5
Pile Type:	H-Pile 12X53

Factored Load:

Nominal Pile Driving Resistance	Rndr		
Resistance Factor (10.5.5.2.3.1)	phi(dyn)	0.65	PDA
Load factor for downdrag (1.05, 3.4.1-2)	yp		
Downdrag load per pile (10.7.3.7)	DD		
Side resistance for the down drag zone (10.7.3.7)	Rsdd		
Side resistance for the scour zone (10.7.3.6)	Rsscour		

Rndr = (Factored Load/phi(dyn))+((yp*DD)/phi(dyn))+Rsdd+Rsscour

Rndr (Service Limit State)	179	Rndr(Strength Limit State)	271
phi(dyn)	0.65	phi(dyn)	0.65
yp	0.75	yp	0.75
DD	0	DD	0
Rsdd	0	Rsdd	0
Rsscour	0	Rsscour	0
Factored Load	116.3	Factored Load	176.2

Nominal Pile Driving Resistance - C10.7.3.7

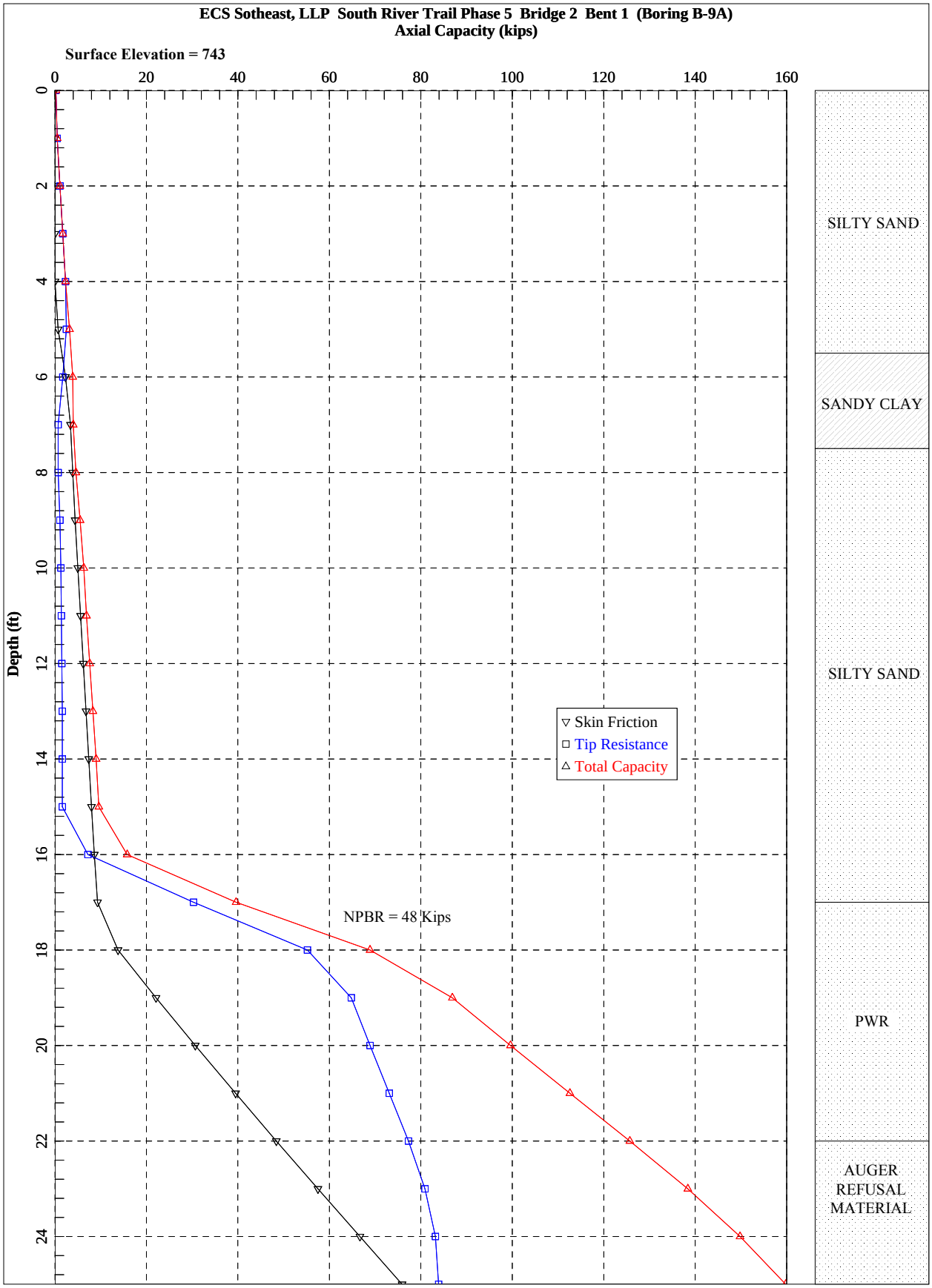
Project Name:	South River Trail Phase 5 - Bridge 2
Project Number:	10:9672
Project Location:	DeKalb County
Boring Number:	B-10/ B-10A
Bent (EB/IB):	EB Bent 6
Pile Type:	H-Pile 12X53

Factored Load:

Nominal Pile Driving Resistance	Rndr		
Resistance Factor (10.5.5.2.3.1)	phi(dyn)	0.65	PDA
Load factor for downdrag (1.05, 3.4.1-2)	yp		
Downdrag load per pile (10.7.3.7)	DD		
Side resistance for the down drag zone (10.7.3.7)	Rsdd		
Side resistance for the scour zone (10.7.3.6)	Rsscour		

Rndr = (Factored Load/phi(dyn))+((yp*DD)/phi(dyn))+Rsdd+Rsscour

Rndr (Service Limit State)	180	Rndr(Strength Limit State)	273
phi(dyn)	0.65	phi(dyn)	0.65
yp	0.75	yp	0.75
DD	0	DD	0
Rsdd	0	Rsdd	0
Rsscour	0	Rsscour	0
Factored Load	117	Factored Load	177.3


ECS Sotheast, LLP South River Trail Phase 5 Bridge 2 Bent 1 (Boring B-9A)
Axial Capacity (kips)
Surface Elevation = 743
0
20
40
60
80
100
120
140
160
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
Skin Friction
Tip Resistance
Total Capacity
NPBR = 48 Kips
SILTY SAND
SANDY CLAY
SILTY SAND
PWR
AUGER
REFUSAL
MATERIAL

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Apile Bridge 2\
Name of input data file : 9672, Boring B-9A_ Bridge 2 Bent 1.ap7d
Name of output file : 9672, Boring B-9A_ Bridge 2 Bent 1.ap7o
Name of plot output file : 9672, Boring B-9A_ Bridge 2 Bent 1.ap7p

---

Time and Date of Analysis

Date: June 18, 2018 Time: 10:14:19

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 2 (Bent 1)

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
10.00	9.00
20.00	8.00
25.00	7.50

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 10.00 IN.
- TOTAL PILE LENGTH, TL = 25.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	34.00	0.00
5.50	SAND	0.00	130.00	34.00	0.00
5.50	CLAY	0.00	120.00	0.00	0.00
7.50	CLAY	0.00	120.00	0.00	0.00
7.50	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	140.00	43.00	0.00
22.00	SAND	0.00	140.00	43.00	0.00
22.00	SAND	0.00	145.00	43.00	0.00
50.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.25	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.25	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
  WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
  PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
5.50	1.000	1.000
5.50	1.000	1.000
7.50	1.000	1.000
7.50	1.000	1.000
17.00	1.000	1.000
17.00	1.000	1.000
22.00	1.000	1.000
22.00	1.000	1.000
50.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.2	0.2
1.00	0.0	0.5	0.5
2.00	0.0	1.1	1.1
3.00	0.0	1.7	1.7
4.00	0.0	2.3	2.3
5.00	0.7	2.5	3.2
6.00	2.3	1.7	3.9
7.00	3.4	0.7	4.0
8.00	3.9	0.7	4.6
9.00	4.4	1.1	5.5
10.00	5.0	1.3	6.3
11.00	5.6	1.4	6.9
12.00	6.2	1.5	7.6
13.00	6.8	1.6	8.3
14.00	7.4	1.6	9.0
15.00	8.0	1.6	9.6
16.00	8.6	7.2	15.8
17.00	9.3	30.3	39.6
18.00	13.8	55.2	68.9
19.00	22.1	64.8	86.9
20.00	30.7	68.9	99.6
21.00	39.5	73.1	112.6
22.00	48.4	77.3	125.7
23.00	57.5	80.9	138.4
24.00	66.7	83.2	149.8

25.00 75.9 83.9 159.8

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.2775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.5458E+01		
			0.0000E+00	0.0000E+00
			0.3490E+00	0.1000E-01
			0.6980E+00	0.2000E-01
			0.1396E+01	0.4000E-01
			0.2094E+01	0.6000E-01
			0.2792E+01	0.8000E-01
			0.3141E+01	0.9000E-01
			0.3490E+01	0.1000E+00
			0.3490E+01	0.5000E+00
			0.3490E+01	0.2000E+01
4	10	0.5500E+01		
			0.0000E+00	0.0000E+00
			0.1047E+01	0.1600E-01
			0.1745E+01	0.3100E-01
			0.2618E+01	0.5700E-01
			0.3141E+01	0.8000E-01
			0.3490E+01	0.1000E+00
			0.3141E+01	0.2000E+00
			0.3141E+01	0.3000E+00
			0.3141E+01	0.5000E+00
			0.3141E+01	0.2000E+01

5	10	0.6525E+01		
			0.0000E+00	0.0000E+00
			0.6507E+00	0.1600E-01
			0.1084E+01	0.3100E-01
			0.1627E+01	0.5700E-01
			0.1952E+01	0.8000E-01
			0.2169E+01	0.1000E+00
			0.1952E+01	0.2000E+00
			0.1952E+01	0.3000E+00
			0.1952E+01	0.5000E+00
			0.1952E+01	0.2000E+01
6	10	0.7458E+01		
			0.0000E+00	0.0000E+00
			0.4337E+00	0.1600E-01
			0.7229E+00	0.3100E-01
			0.1084E+01	0.5700E-01
			0.1301E+01	0.8000E-01
			0.1446E+01	0.1000E+00
			0.1301E+01	0.2000E+00
			0.1301E+01	0.3000E+00
			0.1301E+01	0.5000E+00
			0.1301E+01	0.2000E+01
7	10	0.7500E+01		
			0.0000E+00	0.0000E+00
			0.1446E+00	0.1000E-01
			0.2892E+00	0.2000E-01
			0.5783E+00	0.4000E-01
			0.8675E+00	0.6000E-01
			0.1157E+01	0.8000E-01
			0.1301E+01	0.9000E-01
			0.1446E+01	0.1000E+00
			0.1446E+01	0.5000E+00
			0.1446E+01	0.2000E+01
8	10	0.1228E+02		
			0.0000E+00	0.0000E+00
			0.1593E+00	0.1000E-01
			0.3187E+00	0.2000E-01
			0.6373E+00	0.4000E-01
			0.9560E+00	0.6000E-01
			0.1275E+01	0.8000E-01
			0.1434E+01	0.9000E-01
			0.1593E+01	0.1000E+00
			0.1593E+01	0.5000E+00
			0.1593E+01	0.2000E+01
9	10	0.1696E+02		
			0.0000E+00	0.0000E+00
			0.6830E+00	0.1000E-01
			0.1366E+01	0.2000E-01
			0.2732E+01	0.4000E-01
			0.4098E+01	0.6000E-01
			0.5464E+01	0.8000E-01
			0.6147E+01	0.9000E-01
			0.6830E+01	0.1000E+00
			0.6830E+01	0.5000E+00
			0.6830E+01	0.2000E+01
10	10	0.1700E+02		
			0.0000E+00	0.0000E+00
			0.1700E+01	0.1000E-01
			0.3399E+01	0.2000E-01
			0.6798E+01	0.4000E-01
			0.1020E+02	0.6000E-01
			0.1360E+02	0.8000E-01
			0.1530E+02	0.9000E-01

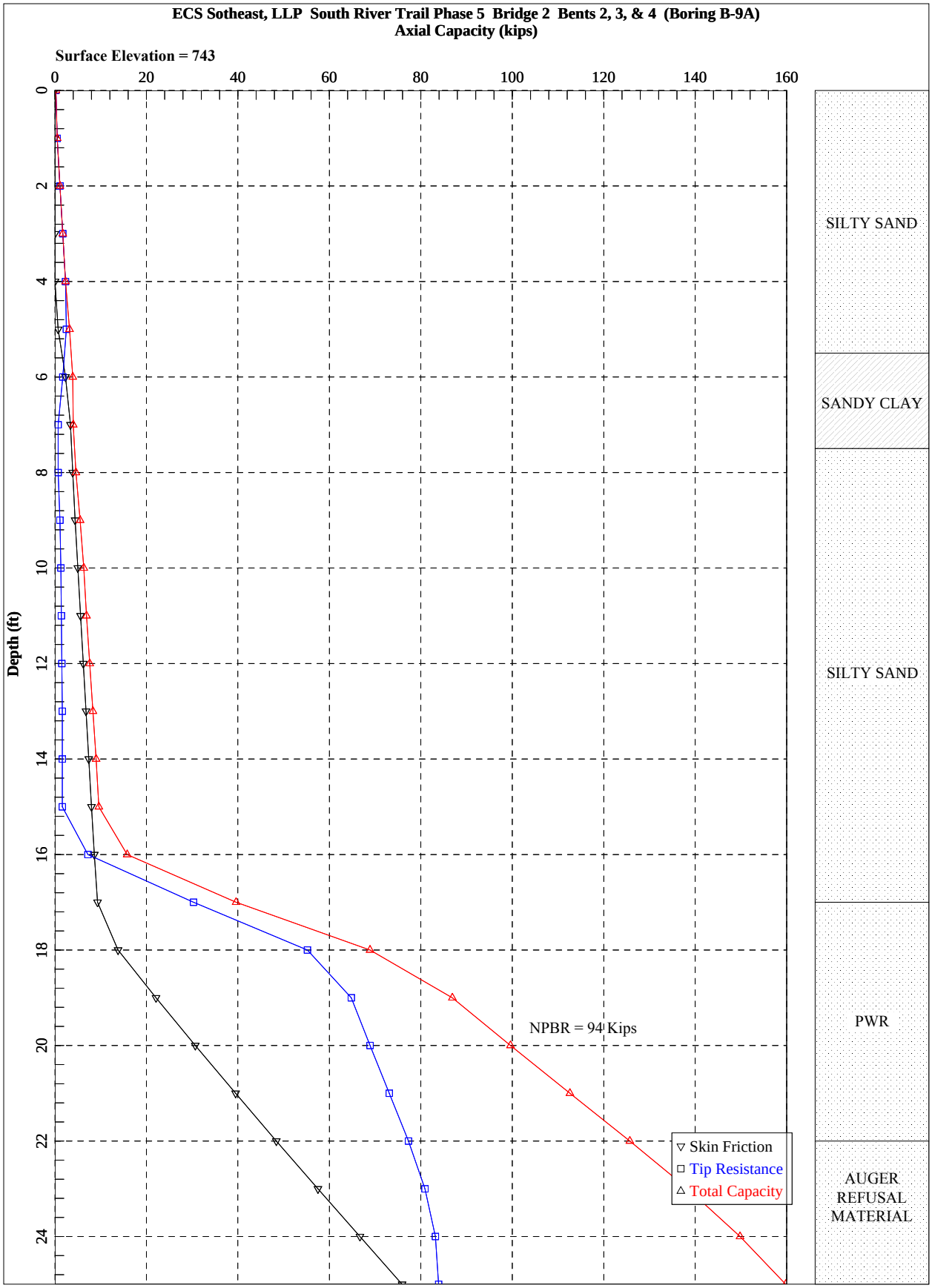
			0.1700E+02	0.1000E+00
			0.1700E+02	0.5000E+00
			0.1700E+02	0.2000E+01
11	10	0.1953E+02		
			0.0000E+00	0.0000E+00
			0.2301E+01	0.1000E-01
			0.4601E+01	0.2000E-01
			0.9202E+01	0.4000E-01
			0.1380E+02	0.6000E-01
			0.1840E+02	0.8000E-01
			0.2071E+02	0.9000E-01
			0.2301E+02	0.1000E+00
			0.2301E+02	0.5000E+00
			0.2301E+02	0.2000E+01
12	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.2391E+01	0.1000E-01
			0.4782E+01	0.2000E-01
			0.9564E+01	0.4000E-01
			0.1435E+02	0.6000E-01
			0.1913E+02	0.8000E-01
			0.2152E+02	0.9000E-01
			0.2391E+02	0.1000E+00
			0.2391E+02	0.5000E+00
			0.2391E+02	0.2000E+01
13	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.2424E+01	0.1000E-01
			0.4847E+01	0.2000E-01
			0.9694E+01	0.4000E-01
			0.1454E+02	0.6000E-01
			0.1939E+02	0.8000E-01
			0.2181E+02	0.9000E-01
			0.2424E+02	0.1000E+00
			0.2424E+02	0.5000E+00
			0.2424E+02	0.2000E+01
14	10	0.3603E+02		
			0.0000E+00	0.0000E+00
			0.2456E+01	0.1000E-01
			0.4911E+01	0.2000E-01
			0.9823E+01	0.4000E-01
			0.1473E+02	0.6000E-01
			0.1965E+02	0.8000E-01
			0.2210E+02	0.9000E-01
			0.2456E+02	0.1000E+00
			0.2456E+02	0.5000E+00
			0.2456E+02	0.2000E+01
15	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.2456E+01	0.1000E-01
			0.4911E+01	0.2000E-01
			0.9823E+01	0.4000E-01
			0.1473E+02	0.6000E-01
			0.1965E+02	0.8000E-01
			0.2210E+02	0.9000E-01
			0.2456E+02	0.1000E+00
			0.2456E+02	0.5000E+00
			0.2456E+02	0.2000E+01

TIP	LOAD	TIP MOVEMENT
	KIP	IN.

0.0000E+00	0.0000E+00
0.5242E+01	0.5000E-02
0.1048E+02	0.1000E-01
0.2097E+02	0.2000E-01
0.4194E+02	0.1300E+00
0.6291E+02	0.4200E+00
0.7549E+02	0.7300E+00
0.8388E+02	0.1000E+01
0.8388E+02	0.1500E+01
0.8388E+02	0.2000E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1623E+01	0.1877E-01	0.1048E+00	0.1000E-03
0.1534E+02	0.1949E+00	0.1048E+01	0.1000E-02
0.4681E+02	0.7535E+00	0.5242E+01	0.5000E-02
0.6757E+02	0.1172E+01	0.1048E+02	0.1000E-01
0.1042E+03	0.2013E+01	0.2669E+02	0.5000E-01
0.1171E+03	0.2357E+01	0.3622E+02	0.1000E+00
0.1471E+03	0.3446E+01	0.6616E+02	0.5000E+00
0.1648E+03	0.4354E+01	0.8388E+02	0.1000E+01
0.1648E+03	0.5354E+01	0.8388E+02	0.2000E+01


ECS Sotheast, LLP South River Trail Phase 5 Bridge 2 Bents 2, 3, & 4 (Boring B-9A)
Axial Capacity (kips)
Surface Elevation = 743
Depth (ft)
0
20
40
60
80
100
120
140
160
2
4
6
8
10
12
14
16
18
20
22
24
SILTY SAND
SANDY CLAY
SILTY SAND
PWR
AUGER REFUSAL MATERIAL
NPBR = 94 Kips
Skin Friction
Tip Resistance
Total Capacity

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations   : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Apile Bridge 2\
Name of input data file   : 9672, Boring B-9A_ Bridge 2 Bents 2-4.ap7d
Name of output file   : 9672, Boring B-9A_ Bridge 2 Bents 2-4.ap7o
Name of plot output file   : 9672, Boring B-9A_ Bridge 2 Bents 2-4.ap7p

---

Time and Date of Analysis

Date: June 18, 2018   Time: 10:01:44

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 2 (Bents 2, 3, & 4)

DESIGNER   : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
10.00	9.00
20.00	8.00
25.00	7.50

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 10.00 IN.
- TOTAL PILE LENGTH, TL = 25.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	34.00	0.00
5.50	SAND	0.00	130.00	34.00	0.00
5.50	CLAY	0.00	120.00	0.00	0.00
7.50	CLAY	0.00	120.00	0.00	0.00
7.50	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	140.00	43.00	0.00
22.00	SAND	0.00	140.00	43.00	0.00
22.00	SAND	0.00	145.00	43.00	0.00
50.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.25	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.25	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
  WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
  PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
5.50	1.000	1.000
5.50	1.000	1.000
7.50	1.000	1.000
7.50	1.000	1.000
17.00	1.000	1.000
17.00	1.000	1.000
22.00	1.000	1.000
22.00	1.000	1.000
50.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.2	0.2
1.00	0.0	0.5	0.5
2.00	0.0	1.1	1.1
3.00	0.0	1.7	1.7
4.00	0.0	2.3	2.3
5.00	0.7	2.5	3.2
6.00	2.3	1.7	3.9
7.00	3.4	0.7	4.0
8.00	3.9	0.7	4.6
9.00	4.4	1.1	5.5
10.00	5.0	1.3	6.3
11.00	5.6	1.4	6.9
12.00	6.2	1.5	7.6
13.00	6.8	1.6	8.3
14.00	7.4	1.6	9.0
15.00	8.0	1.6	9.6
16.00	8.6	7.2	15.8
17.00	9.3	30.3	39.6
18.00	13.8	55.2	68.9
19.00	22.1	64.8	86.9
20.00	30.7	68.9	99.6
21.00	39.5	73.1	112.6
22.00	48.4	77.3	125.7
23.00	57.5	80.9	138.4
24.00	66.7	83.2	149.8

25.00 75.9 83.9 159.8

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.2775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.5458E+01		
			0.0000E+00	0.0000E+00
			0.3490E+00	0.1000E-01
			0.6980E+00	0.2000E-01
			0.1396E+01	0.4000E-01
			0.2094E+01	0.6000E-01
			0.2792E+01	0.8000E-01
			0.3141E+01	0.9000E-01
			0.3490E+01	0.1000E+00
			0.3490E+01	0.5000E+00
			0.3490E+01	0.2000E+01
4	10	0.5500E+01		
			0.0000E+00	0.0000E+00
			0.1047E+01	0.1600E-01
			0.1745E+01	0.3100E-01
			0.2618E+01	0.5700E-01
			0.3141E+01	0.8000E-01
			0.3490E+01	0.1000E+00
			0.3141E+01	0.2000E+00
			0.3141E+01	0.3000E+00
			0.3141E+01	0.5000E+00
			0.3141E+01	0.2000E+01

5	10	0.6525E+01		
			0.0000E+00	0.0000E+00
			0.6507E+00	0.1600E-01
			0.1084E+01	0.3100E-01
			0.1627E+01	0.5700E-01
			0.1952E+01	0.8000E-01
			0.2169E+01	0.1000E+00
			0.1952E+01	0.2000E+00
			0.1952E+01	0.3000E+00
			0.1952E+01	0.5000E+00
			0.1952E+01	0.2000E+01
6	10	0.7458E+01		
			0.0000E+00	0.0000E+00
			0.4337E+00	0.1600E-01
			0.7229E+00	0.3100E-01
			0.1084E+01	0.5700E-01
			0.1301E+01	0.8000E-01
			0.1446E+01	0.1000E+00
			0.1301E+01	0.2000E+00
			0.1301E+01	0.3000E+00
			0.1301E+01	0.5000E+00
			0.1301E+01	0.2000E+01
7	10	0.7500E+01		
			0.0000E+00	0.0000E+00
			0.1446E+00	0.1000E-01
			0.2892E+00	0.2000E-01
			0.5783E+00	0.4000E-01
			0.8675E+00	0.6000E-01
			0.1157E+01	0.8000E-01
			0.1301E+01	0.9000E-01
			0.1446E+01	0.1000E+00
			0.1446E+01	0.5000E+00
			0.1446E+01	0.2000E+01
8	10	0.1228E+02		
			0.0000E+00	0.0000E+00
			0.1593E+00	0.1000E-01
			0.3187E+00	0.2000E-01
			0.6373E+00	0.4000E-01
			0.9560E+00	0.6000E-01
			0.1275E+01	0.8000E-01
			0.1434E+01	0.9000E-01
			0.1593E+01	0.1000E+00
			0.1593E+01	0.5000E+00
			0.1593E+01	0.2000E+01
9	10	0.1696E+02		
			0.0000E+00	0.0000E+00
			0.6830E+00	0.1000E-01
			0.1366E+01	0.2000E-01
			0.2732E+01	0.4000E-01
			0.4098E+01	0.6000E-01
			0.5464E+01	0.8000E-01
			0.6147E+01	0.9000E-01
			0.6830E+01	0.1000E+00
			0.6830E+01	0.5000E+00
			0.6830E+01	0.2000E+01
10	10	0.1700E+02		
			0.0000E+00	0.0000E+00
			0.1700E+01	0.1000E-01
			0.3399E+01	0.2000E-01
			0.6798E+01	0.4000E-01
			0.1020E+02	0.6000E-01
			0.1360E+02	0.8000E-01
			0.1530E+02	0.9000E-01

			0.1700E+02	0.1000E+00
			0.1700E+02	0.5000E+00
			0.1700E+02	0.2000E+01
11	10	0.1953E+02		
			0.0000E+00	0.0000E+00
			0.2301E+01	0.1000E-01
			0.4601E+01	0.2000E-01
			0.9202E+01	0.4000E-01
			0.1380E+02	0.6000E-01
			0.1840E+02	0.8000E-01
			0.2071E+02	0.9000E-01
			0.2301E+02	0.1000E+00
			0.2301E+02	0.5000E+00
			0.2301E+02	0.2000E+01
12	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.2391E+01	0.1000E-01
			0.4782E+01	0.2000E-01
			0.9564E+01	0.4000E-01
			0.1435E+02	0.6000E-01
			0.1913E+02	0.8000E-01
			0.2152E+02	0.9000E-01
			0.2391E+02	0.1000E+00
			0.2391E+02	0.5000E+00
			0.2391E+02	0.2000E+01
13	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.2424E+01	0.1000E-01
			0.4847E+01	0.2000E-01
			0.9694E+01	0.4000E-01
			0.1454E+02	0.6000E-01
			0.1939E+02	0.8000E-01
			0.2181E+02	0.9000E-01
			0.2424E+02	0.1000E+00
			0.2424E+02	0.5000E+00
			0.2424E+02	0.2000E+01
14	10	0.3603E+02		
			0.0000E+00	0.0000E+00
			0.2456E+01	0.1000E-01
			0.4911E+01	0.2000E-01
			0.9823E+01	0.4000E-01
			0.1473E+02	0.6000E-01
			0.1965E+02	0.8000E-01
			0.2210E+02	0.9000E-01
			0.2456E+02	0.1000E+00
			0.2456E+02	0.5000E+00
			0.2456E+02	0.2000E+01
15	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.2456E+01	0.1000E-01
			0.4911E+01	0.2000E-01
			0.9823E+01	0.4000E-01
			0.1473E+02	0.6000E-01
			0.1965E+02	0.8000E-01
			0.2210E+02	0.9000E-01
			0.2456E+02	0.1000E+00
			0.2456E+02	0.5000E+00
			0.2456E+02	0.2000E+01

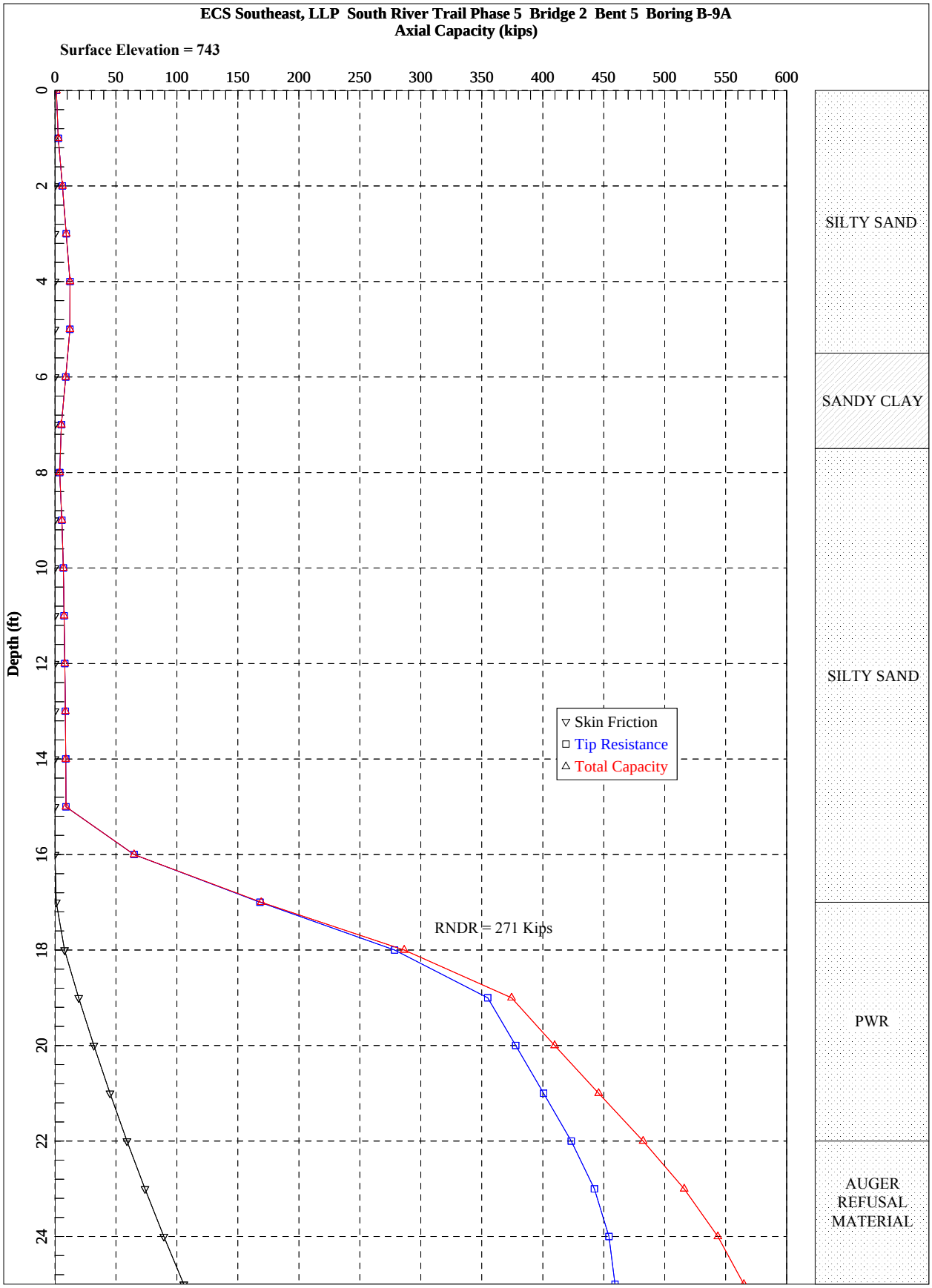
TIP	LOAD	TIP MOVEMENT
	KIP	IN.

0.0000E+00	0.0000E+00
0.5242E+01	0.5000E-02
0.1048E+02	0.1000E-01
0.2097E+02	0.2000E-01
0.4194E+02	0.1300E+00
0.6291E+02	0.4200E+00
0.7549E+02	0.7300E+00
0.8388E+02	0.1000E+01
0.8388E+02	0.1500E+01
0.8388E+02	0.2000E+01

LOAD VERSUS SETTLEMENT CURVE

****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1623E+01	0.1877E-01	0.1048E+00	0.1000E-03
0.1534E+02	0.1949E+00	0.1048E+01	0.1000E-02
0.4681E+02	0.7535E+00	0.5242E+01	0.5000E-02
0.6757E+02	0.1172E+01	0.1048E+02	0.1000E-01
0.1042E+03	0.2013E+01	0.2669E+02	0.5000E-01
0.1171E+03	0.2357E+01	0.3622E+02	0.1000E+00
0.1471E+03	0.3446E+01	0.6616E+02	0.5000E+00
0.1648E+03	0.4354E+01	0.8388E+02	0.1000E+01
0.1648E+03	0.5354E+01	0.8388E+02	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 2 Bent 5 Boring B-9A
Axial Capacity (kips)
Surface Elevation = 743
0
50
100
150
200
250
300
350
400
450
500
550
600
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
Skin Friction
Tip Resistance
Total Capacity
RNDR = 271 Kips
SILTY SAND
SANDY CLAY
SILTY SAND
PWR
AUGER
REFUSAL
MATERIAL

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Apile Bridge 2\
Name of input data file : 9672, Boring B-9A_ Bridge 2 Bent 5.ap7d
Name of output file : 9672, Boring B-9A_ Bridge 2 Bent 5.ap7o
Name of plot output file : 9672, Boring B-9A_ Bridge 2 Bent 5.ap7p

---

Time and Date of Analysis

Date: June 15, 2018 Time: 15:27:26

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 2 (Bent 5)

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

H-Pile/Steel Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 12.40 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 25.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 17.00 FT.
- PERIMETER OF PILE = 39.55 IN.
- TIP AREA OF PILE = 97.73 IN2
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	34.00	0.00
5.50	SAND	0.00	130.00	34.00	0.00
5.50	CLAY	0.00	120.00	0.00	0.00
7.50	CLAY	0.00	120.00	0.00	0.00
7.50	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	100.00	26.00	0.00
17.00	SAND	0.00	140.00	43.00	0.00
22.00	SAND	0.00	140.00	43.00	0.00
22.00	SAND	0.00	145.00	43.00	0.00
50.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.25	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.25	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
5.50	1.000	1.000
5.50	1.000	1.000
7.50	1.000	1.000
7.50	1.000	1.000
17.00	1.000	1.000
17.00	1.000	1.000
22.00	1.000	1.000
22.00	1.000	1.000
50.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.2	1.2
1.00	0.0	2.7	2.7
2.00	0.0	6.1	6.1
3.00	0.0	9.2	9.2
4.00	0.0	12.4	12.4
5.00	0.0	12.3	12.3
6.00	0.0	8.9	8.9
7.00	0.0	5.3	5.3
8.00	0.0	3.9	3.9
9.00	0.0	5.6	5.6
10.00	0.0	6.9	6.9
11.00	0.0	7.5	7.5
12.00	0.0	8.1	8.1
13.00	0.0	8.6	8.6
14.00	0.0	8.9	8.9
15.00	0.0	9.0	9.0
16.00	0.0	64.9	64.9
17.00	1.1	168.1	169.2
18.00	7.9	278.5	286.4
19.00	19.5	354.9	374.4
20.00	31.9	377.8	409.7
21.00	45.1	400.7	445.8
22.00	59.0	423.3	482.3
23.00	73.8	442.3	516.0
24.00	89.3	454.3	543.6
25.00	105.6	459.2	564.9

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.2775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.5458E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.5500E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01
			0.0000E+00	0.3903E-01
			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01
5	10	0.6525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01
			0.0000E+00	0.3903E-01

			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01
6	10	0.7458E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2014E-01
			0.0000E+00	0.3903E-01
			0.0000E+00	0.7176E-01
			0.0000E+00	0.1007E+00
			0.0000E+00	0.1259E+00
			0.0000E+00	0.2518E+00
			0.0000E+00	0.3777E+00
			0.0000E+00	0.6295E+00
			0.0000E+00	0.2518E+01
7	10	0.7500E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
8	10	0.1228E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
9	10	0.1696E+02		
			0.0000E+00	0.0000E+00
			0.1422E+01	0.1000E-01
			0.2844E+01	0.2000E-01
			0.5688E+01	0.4000E-01
			0.8532E+01	0.6000E-01
			0.1138E+02	0.8000E-01
			0.1280E+02	0.9000E-01
			0.1422E+02	0.1000E+00
			0.1422E+02	0.5000E+00
			0.1422E+02	0.2000E+01
10	10	0.1700E+02		
			0.0000E+00	0.0000E+00
			0.1936E+01	0.1000E-01
			0.3872E+01	0.2000E-01
			0.7743E+01	0.4000E-01
			0.1161E+02	0.6000E-01
			0.1549E+02	0.8000E-01
			0.1742E+02	0.9000E-01
			0.1936E+02	0.1000E+00
			0.1936E+02	0.5000E+00
			0.1936E+02	0.2000E+01
11	10	0.1953E+02		

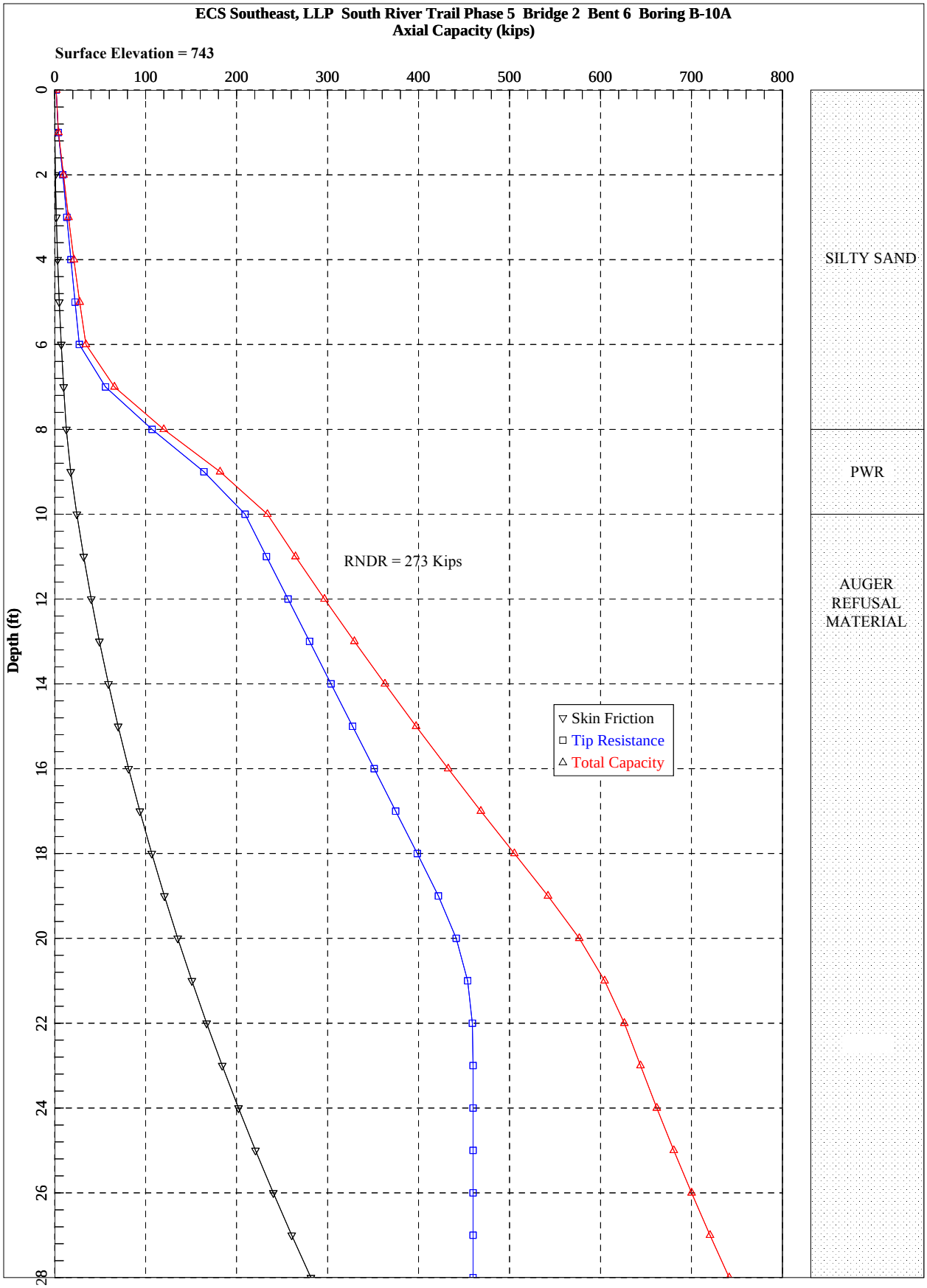
			0.0000E+00	0.0000E+00
			0.2694E+01	0.1000E-01
			0.5389E+01	0.2000E-01
			0.1078E+02	0.4000E-01
			0.1617E+02	0.6000E-01
			0.2155E+02	0.8000E-01
			0.2425E+02	0.9000E-01
			0.2694E+02	0.1000E+00
			0.2694E+02	0.5000E+00
			0.2694E+02	0.2000E+01
12	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.3022E+01	0.1000E-01
			0.6044E+01	0.2000E-01
			0.1209E+02	0.4000E-01
			0.1813E+02	0.6000E-01
			0.2418E+02	0.8000E-01
			0.2720E+02	0.9000E-01
			0.3022E+02	0.1000E+00
			0.3022E+02	0.5000E+00
			0.3022E+02	0.2000E+01
13	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.3189E+01	0.1000E-01
			0.6379E+01	0.2000E-01
			0.1276E+02	0.4000E-01
			0.1914E+02	0.6000E-01
			0.2552E+02	0.8000E-01
			0.2871E+02	0.9000E-01
			0.3189E+02	0.1000E+00
			0.3189E+02	0.5000E+00
			0.3189E+02	0.2000E+01
14	10	0.3603E+02		
			0.0000E+00	0.0000E+00
			0.3443E+01	0.1000E-01
			0.6886E+01	0.2000E-01
			0.1377E+02	0.4000E-01
			0.2066E+02	0.6000E-01
			0.2754E+02	0.8000E-01
			0.3099E+02	0.9000E-01
			0.3443E+02	0.1000E+00
			0.3443E+02	0.5000E+00
			0.3443E+02	0.2000E+01
15	10	0.4996E+02		
			0.0000E+00	0.0000E+00
			0.3443E+01	0.1000E-01
			0.6886E+01	0.2000E-01
			0.1377E+02	0.4000E-01
			0.2066E+02	0.6000E-01
			0.2754E+02	0.8000E-01
			0.3099E+02	0.9000E-01
			0.3443E+02	0.1000E+00
			0.3443E+02	0.5000E+00
			0.3443E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2870E+02	0.6295E-02
0.5740E+02	0.1259E-01

0.1148E+03	0.2518E-01
0.2296E+03	0.1637E+00
0.3444E+03	0.5287E+00
0.4133E+03	0.9190E+00
0.4592E+03	0.1259E+01
0.4592E+03	0.1888E+01
0.4592E+03	0.2518E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.6613E+00	0.6150E-03	0.4560E+00	0.1000E-03
0.6626E+01	0.6156E-02	0.4560E+01	0.1000E-02
0.3363E+02	0.3113E-01	0.2280E+02	0.5000E-02
0.6725E+02	0.6225E-01	0.4560E+02	0.1000E-01
0.2250E+03	0.2226E+00	0.1354E+03	0.5000E-01
0.2992E+03	0.3315E+00	0.1768E+03	0.1000E+00
0.4578E+03	0.8638E+00	0.3354E+03	0.5000E+00
0.5466E+03	0.1438E+01	0.4242E+03	0.1000E+01
0.5816E+03	0.2467E+01	0.4592E+03	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 2 Bent 6 Boring B-10A
Axial Capacity (kips)
Surface Elevation = 743
0
100
200
300
400
500
600
700
800
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
SILTY SAND
PWR
AUGER
REFUSAL
MATERIAL
RNDR = 273 Kips
Skin Friction
Tip Resistance
Total Capacity

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations   : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Apile Bridge 2\
Name of input data file   : 9672, Boring B-10A_ Bridge 2 Bent 6.ap7d
Name of output file   : 9672, Boring B-10A_ Bridge 2 Bent 6.ap7o
Name of plot output file   : 9672, Boring B-10A_ Bridge 2 Bent 6.ap7p

---

Time and Date of Analysis

Date: June 15, 2018   Time: 17:24:36

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 2 (Bent 6) Boring B-10A

DESIGNER   : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

H-Pile/Steel Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY   = 0.290E+08 PSI
- CROSS SECTION AREA   =   12.40 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL   =   28.00 FT.
- PILE STICKUP LENGTH, PSL =   0.00 FT.
- ZERO FRICTION LENGTH, ZFL =   0.00 FT.
- PERIMETER OF PILE   =   39.55 IN.
- TIP AREA OF PILE   =   97.73 IN2
- INCREMENT OF PILE LENGTH
  USED IN COMPUTATION   =   1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	36.00	0.00
8.00	SAND	0.00	130.00	36.00	0.00
8.00	SAND	0.00	140.00	43.00	0.00
10.00	SAND	0.00	140.00	43.00	0.00
10.00	SAND	0.00	145.00	43.00	0.00
35.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000

8.00	1.000	1.000
8.00	1.000	1.000
10.00	1.000	1.000
10.00	1.000	1.000
35.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.7	1.7
1.00	0.2	4.0	4.2
2.00	0.8	8.9	9.7
3.00	1.8	13.4	15.2
4.00	3.2	17.9	21.1
5.00	5.0	22.5	27.5
6.00	7.2	27.1	34.4
7.00	9.9	55.9	65.7
8.00	12.9	107.1	120.0
9.00	17.7	164.1	181.8
10.00	24.4	209.4	233.8
11.00	31.9	232.8	264.7
12.00	40.2	256.5	296.6
13.00	49.2	280.1	329.4
14.00	59.1	303.8	363.0
15.00	69.8	327.5	397.3
16.00	81.3	351.2	432.5
17.00	93.6	374.9	468.5
18.00	106.7	398.6	505.3
19.00	120.6	421.8	542.3
20.00	135.3	441.4	576.6
21.00	150.8	453.9	604.6
22.00	167.1	459.1	626.2
23.00	184.2	459.9	644.0
24.00	202.1	459.9	661.9
25.00	220.8	459.9	680.6
26.00	240.3	459.9	700.1
27.00	260.6	459.9	720.4
28.00	281.7	459.9	741.5

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING   *

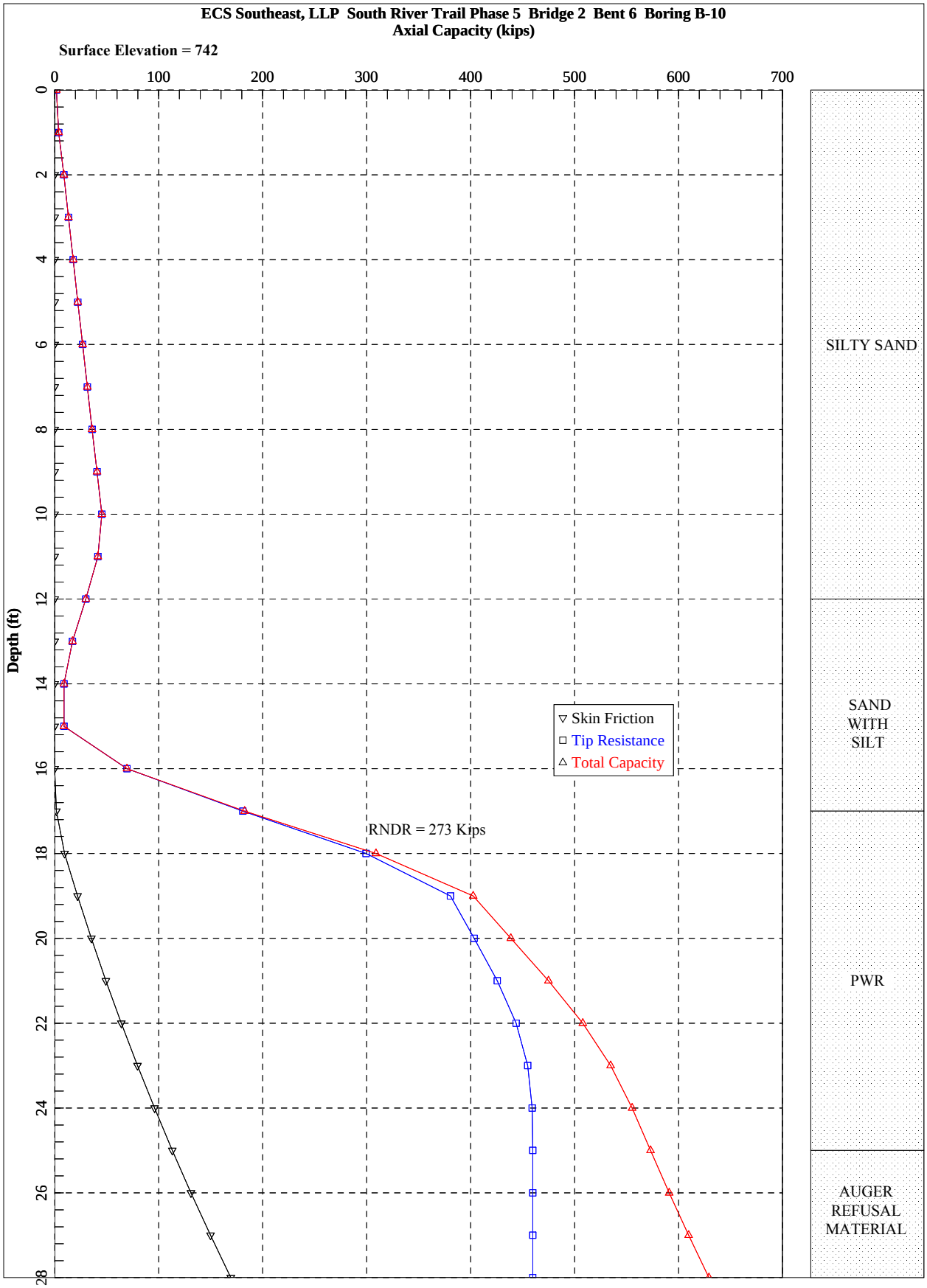
T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.1253E+00	0.1000E-01
			0.2505E+00	0.2000E-01
			0.5011E+00	0.4000E-01
			0.7516E+00	0.6000E-01
			0.1002E+01	0.8000E-01
			0.1127E+01	0.9000E-01
			0.1253E+01	0.1000E+00
			0.1253E+01	0.5000E+00
			0.1253E+01	0.2000E+01
2	10	0.4025E+01		
			0.0000E+00	0.0000E+00
			0.4250E+00	0.1000E-01
			0.8499E+00	0.2000E-01
			0.1700E+01	0.4000E-01
			0.2550E+01	0.6000E-01
			0.3400E+01	0.8000E-01
			0.3825E+01	0.9000E-01
			0.4250E+01	0.1000E+00
			0.4250E+01	0.5000E+00
			0.4250E+01	0.2000E+01
3	10	0.7958E+01		
			0.0000E+00	0.0000E+00
			0.8272E+00	0.1000E-01
			0.1654E+01	0.2000E-01
			0.3309E+01	0.4000E-01
			0.4963E+01	0.6000E-01
			0.6617E+01	0.8000E-01
			0.7445E+01	0.9000E-01
			0.8272E+01	0.1000E+00
			0.8272E+01	0.5000E+00
			0.8272E+01	0.2000E+01
4	10	0.8000E+01		
			0.0000E+00	0.0000E+00
			0.1209E+01	0.1000E-01
			0.2419E+01	0.2000E-01
			0.4837E+01	0.4000E-01
			0.7256E+01	0.6000E-01
			0.9675E+01	0.8000E-01
			0.1088E+02	0.9000E-01
			0.1209E+02	0.1000E+00
			0.1209E+02	0.5000E+00
			0.1209E+02	0.2000E+01
5	10	0.9025E+01		
			0.0000E+00	0.0000E+00
			0.1493E+01	0.1000E-01
			0.2985E+01	0.2000E-01
			0.5971E+01	0.4000E-01
			0.8956E+01	0.6000E-01
			0.1194E+02	0.8000E-01
			0.1343E+02	0.9000E-01
			0.1493E+02	0.1000E+00
			0.1493E+02	0.5000E+00
			0.1493E+02	0.2000E+01
6	10	0.9958E+01		
			0.0000E+00	0.0000E+00

			0.1493E+01	0.1000E-01
			0.2985E+01	0.2000E-01
			0.5971E+01	0.4000E-01
			0.8956E+01	0.6000E-01
			0.1194E+02	0.8000E-01
			0.1343E+02	0.9000E-01
			0.1493E+02	0.1000E+00
			0.1493E+02	0.5000E+00
			0.1493E+02	0.2000E+01
7	10	0.1000E+02		
			0.0000E+00	0.0000E+00
			0.1660E+01	0.1000E-01
			0.3320E+01	0.2000E-01
			0.6641E+01	0.4000E-01
			0.9961E+01	0.6000E-01
			0.1328E+02	0.8000E-01
			0.1494E+02	0.9000E-01
			0.1660E+02	0.1000E+00
			0.1660E+02	0.5000E+00
			0.1660E+02	0.2000E+01
8	10	0.2253E+02		
			0.0000E+00	0.0000E+00
			0.3687E+01	0.1000E-01
			0.7374E+01	0.2000E-01
			0.1475E+02	0.4000E-01
			0.2212E+02	0.6000E-01
			0.2950E+02	0.8000E-01
			0.3319E+02	0.9000E-01
			0.3687E+02	0.1000E+00
			0.3687E+02	0.5000E+00
			0.3687E+02	0.2000E+01
9	10	0.3496E+02		
			0.0000E+00	0.0000E+00
			0.4447E+01	0.1000E-01
			0.8895E+01	0.2000E-01
			0.1779E+02	0.4000E-01
			0.2668E+02	0.6000E-01
			0.3558E+02	0.8000E-01
			0.4003E+02	0.9000E-01
			0.4447E+02	0.1000E+00
			0.4447E+02	0.5000E+00
			0.4447E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2874E+02	0.6295E-02
0.5748E+02	0.1259E-01
0.1150E+03	0.2518E-01
0.2299E+03	0.1637E+00
0.3449E+03	0.5287E+00
0.4139E+03	0.9190E+00
0.4599E+03	0.1259E+01
0.4599E+03	0.1888E+01
0.4599E+03	0.2518E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1300E+01	0.9531E-03	0.4566E+00	0.1000E-03
0.1327E+02	0.9650E-02	0.4566E+01	0.1000E-02
0.6724E+02	0.4882E-01	0.2283E+02	0.5000E-02
0.1345E+03	0.9765E-01	0.4566E+02	0.1000E-01
0.3854E+03	0.3246E+00	0.1356E+03	0.5000E-01
0.4676E+03	0.4476E+00	0.1771E+03	0.1000E+00
0.6263E+03	0.9960E+00	0.3359E+03	0.5000E+00
0.7153E+03	0.1579E+01	0.4248E+03	0.1000E+01
0.7503E+03	0.2612E+01	0.4599E+03	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 2 Bent 6 Boring B-10
Axial Capacity (kips)
Surface Elevation = 742
0
100
200
300
400
500
600
700
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Skin Friction
Tip Resistance
Total Capacity
RNDR = 273 Kips
SILTY SAND
SAND WITH SILT
PWR
AUGER REFUSAL MATERIAL

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Apile Bridge 2\
Name of input data file : 9672, Boring B-10_ Bridge 2 Bent 6.ap7d
Name of output file : 9672, Boring B-10_ Bridge 2 Bent 6.ap7o
Name of plot output file : 9672, Boring B-10_ Bridge 2 Bent 6.ap7p

---

Time and Date of Analysis

Date: June 15, 2018 Time: 16:18:22

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 2 (Bent 6) Boring B-10

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

H-Pile/Steel Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 12.40 IN2

NONCIRCULAR PILE PROPERTIES :

- TOTAL PILE LENGTH, TL = 28.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 17.00 FT.
- PERIMETER OF PILE = 39.55 IN.
- TIP AREA OF PILE = 97.73 IN2
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	36.00	0.00
12.00	SAND	0.00	130.00	36.00	0.00
12.00	SAND	0.00	110.00	30.00	0.00
17.00	SAND	0.00	110.00	30.00	0.00
17.00	SAND	0.00	140.00	43.00	0.00
25.00	SAND	0.00	140.00	43.00	0.00
25.00	SAND	0.00	145.00	43.00	0.00
35.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

LRFD FACTOR LRFD FACTOR

DEPTH FT.	ON UNIT FRICTION	ON UNIT BEARING
0.00	1.000	1.000
12.00	1.000	1.000
12.00	1.000	1.000
17.00	1.000	1.000
17.00	1.000	1.000
25.00	1.000	1.000
25.00	1.000	1.000
35.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.7	1.7
1.00	0.0	3.9	3.9
2.00	0.0	8.8	8.8
3.00	0.0	13.3	13.3
4.00	0.0	17.8	17.8
5.00	0.0	22.3	22.3
6.00	0.0	26.9	26.9
7.00	0.0	31.4	31.4
8.00	0.0	36.0	36.0
9.00	0.0	40.7	40.7
10.00	0.0	45.4	45.4
11.00	0.0	41.5	41.5
12.00	0.0	30.0	30.0
13.00	0.0	17.1	17.1
14.00	0.0	9.0	9.0
15.00	0.0	9.0	9.0
16.00	0.0	69.6	69.6
17.00	1.7	181.0	182.7
18.00	9.5	299.5	309.0
19.00	22.0	380.6	402.6
20.00	35.3	403.5	438.7
21.00	49.3	425.7	475.0
22.00	64.1	443.9	508.0
23.00	79.7	455.0	534.8
24.00	96.1	459.3	555.4
25.00	113.2	459.9	573.1
26.00	131.1	459.9	591.0
27.00	149.9	459.9	609.8
28.00	169.4	459.9	629.3

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

```
**********************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
**********************************************
```

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.6025E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
3	10	0.1196E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
4	10	0.1200E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
5	10	0.1453E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01

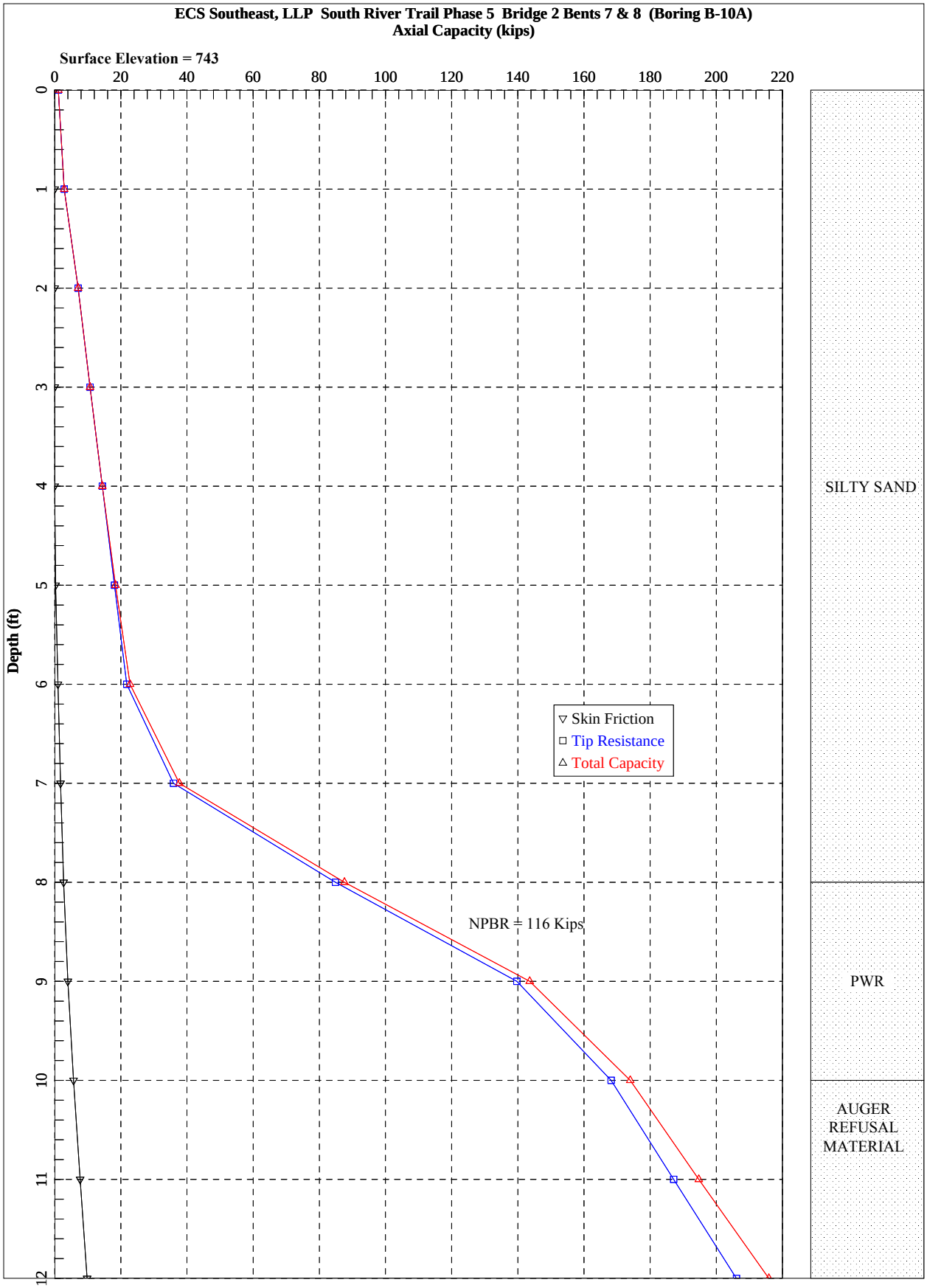
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
6	10	0.1696E+02		
			0.0000E+00	0.0000E+00
			0.1638E+01	0.1000E-01
			0.3276E+01	0.2000E-01
			0.6552E+01	0.4000E-01
			0.9827E+01	0.6000E-01
			0.1310E+02	0.8000E-01
			0.1474E+02	0.9000E-01
			0.1638E+02	0.1000E+00
			0.1638E+02	0.5000E+00
			0.1638E+02	0.2000E+01
7	10	0.1700E+02		
			0.0000E+00	0.0000E+00
			0.2135E+01	0.1000E-01
			0.4271E+01	0.2000E-01
			0.8542E+01	0.4000E-01
			0.1281E+02	0.6000E-01
			0.1708E+02	0.8000E-01
			0.1922E+02	0.9000E-01
			0.2135E+02	0.1000E+00
			0.2135E+02	0.5000E+00
			0.2135E+02	0.2000E+01
8	10	0.2103E+02		
			0.0000E+00	0.0000E+00
			0.3204E+01	0.1000E-01
			0.6408E+01	0.2000E-01
			0.1282E+02	0.4000E-01
			0.1922E+02	0.6000E-01
			0.2563E+02	0.8000E-01
			0.2883E+02	0.9000E-01
			0.3204E+02	0.1000E+00
			0.3204E+02	0.5000E+00
			0.3204E+02	0.2000E+01
9	10	0.2496E+02		
			0.0000E+00	0.0000E+00
			0.3695E+01	0.1000E-01
			0.7389E+01	0.2000E-01
			0.1478E+02	0.4000E-01
			0.2217E+02	0.6000E-01
			0.2956E+02	0.8000E-01
			0.3325E+02	0.9000E-01
			0.3695E+02	0.1000E+00
			0.3695E+02	0.5000E+00
			0.3695E+02	0.2000E+01
10	10	0.2500E+02		
			0.0000E+00	0.0000E+00
			0.3862E+01	0.1000E-01
			0.7724E+01	0.2000E-01
			0.1545E+02	0.4000E-01
			0.2317E+02	0.6000E-01
			0.3090E+02	0.8000E-01
			0.3476E+02	0.9000E-01
			0.3862E+02	0.1000E+00
			0.3862E+02	0.5000E+00
			0.3862E+02	0.2000E+01
11	10	0.3003E+02		
			0.0000E+00	0.0000E+00
			0.4115E+01	0.1000E-01
			0.8231E+01	0.2000E-01

			0.1646E+02	0.4000E-01
			0.2469E+02	0.6000E-01
			0.3292E+02	0.8000E-01
			0.3704E+02	0.9000E-01
			0.4115E+02	0.1000E+00
			0.4115E+02	0.5000E+00
			0.4115E+02	0.2000E+01
12	10	0.3496E+02		
			0.0000E+00	0.0000E+00
			0.4115E+01	0.1000E-01
			0.8231E+01	0.2000E-01
			0.1646E+02	0.4000E-01
			0.2469E+02	0.6000E-01
			0.3292E+02	0.8000E-01
			0.3704E+02	0.9000E-01
			0.4115E+02	0.1000E+00
			0.4115E+02	0.5000E+00
			0.4115E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2874E+02	0.6295E-02
0.5748E+02	0.1259E-01
0.1150E+03	0.2518E-01
0.2299E+03	0.1637E+00
0.3449E+03	0.5287E+00
0.4139E+03	0.9190E+00
0.4599E+03	0.1259E+01
0.4599E+03	0.1888E+01
0.4599E+03	0.2518E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.7970E+00	0.7706E-03	0.4566E+00	0.1000E-03
0.8043E+01	0.7752E-02	0.4566E+01	0.1000E-02
0.4080E+02	0.3922E-01	0.2283E+02	0.5000E-02
0.8159E+02	0.7844E-01	0.4566E+02	0.1000E-01
0.2771E+03	0.2803E+00	0.1356E+03	0.5000E-01
0.3583E+03	0.4025E+00	0.1771E+03	0.1000E+00
0.5170E+03	0.9509E+00	0.3359E+03	0.5000E+00
0.6060E+03	0.1534E+01	0.4248E+03	0.1000E+01
0.6411E+03	0.2567E+01	0.4599E+03	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 2 Bents 7 & 8 (Boring B-10A)
Axial Capacity (kips)
Surface Elevation = 743
0
20
40
60
80
100
120
140
160
180
200
220
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
Skin Friction
Tip Resistance
Total Capacity
NPBR = 116 Kips
SILTY SAND
PWR
AUGER
REFUSAL
MATERIAL

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations   : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Apile Bridge 2\
Name of input data file   : 9672, Boring B-10A_ Bridge 2 Bents 7-8.ap7d
Name of output file   : 9672, Boring B-10A_ Bridge 2 Bents 7-8.ap7o
Name of plot output file   : 9672, Boring B-10A_ Bridge 2 Bents 7-8.ap7p

---

Time and Date of Analysis

Date: June 18, 2018   Time: 14:03:18

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 2 (Bents 7 & 8) Boring B-10A

DESIGNER   : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY   = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
10.00	9.00
20.00	8.00
25.00	7.50

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD   =   10.00 IN.
- TOTAL PILE LENGTH, TL   =   12.00 FT.
- PILE STICKUP LENGTH, PSL =   0.00 FT.
- ZERO FRICTION LENGTH, ZFL =   5.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION   =   1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	36.00	0.00
8.00	SAND	0.00	130.00	36.00	0.00
8.00	SAND	0.00	140.00	43.00	0.00
10.00	SAND	0.00	140.00	43.00	0.00
10.00	SAND	0.00	145.00	43.00	0.00
35.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

LRFD FACTOR LRFD FACTOR

DEPTH FT.	ON UNIT FRICTION	ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
10.00	1.000	1.000
10.00	1.000	1.000
35.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.1	1.1
1.00	0.0	2.9	2.9
2.00	0.0	7.1	7.1
3.00	0.0	10.7	10.7
4.00	0.0	14.4	14.4
5.00	0.3	18.1	18.4
6.00	1.0	21.8	22.8
7.00	1.8	35.9	37.7
8.00	2.7	84.9	87.6
9.00	4.0	139.7	143.6
10.00	5.7	168.2	174.0
11.00	7.7	187.1	194.7
12.00	9.8	206.1	215.9

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING   *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01

```
                                0.0000E+00      0.8000E-01
                                0.0000E+00      0.9000E-01
                                0.0000E+00      0.1000E+00
                                0.0000E+00      0.5000E+00
                                0.0000E+00      0.2000E+01
2         10      0.4025E+01
                                0.0000E+00      0.0000E+00
                                0.1777E+00      0.1000E-01
                                0.3554E+00      0.2000E-01
                                0.7108E+00      0.4000E-01
                                0.1066E+01      0.6000E-01
                                0.1422E+01      0.8000E-01
                                0.1599E+01      0.9000E-01
                                0.1777E+01      0.1000E+00
                                0.1777E+01      0.5000E+00
                                0.1777E+01      0.2000E+01
3         10      0.7958E+01
                                0.0000E+00      0.0000E+00
                                0.2957E+00      0.1000E-01
                                0.5914E+00      0.2000E-01
                                0.1183E+01      0.4000E-01
                                0.1774E+01      0.6000E-01
                                0.2366E+01      0.8000E-01
                                0.2661E+01      0.9000E-01
                                0.2957E+01      0.1000E+00
                                0.2957E+01      0.5000E+00
                                0.2957E+01      0.2000E+01
4         10      0.8000E+01
                                0.0000E+00      0.0000E+00
                                0.4024E+00      0.1000E-01
                                0.8047E+00      0.2000E-01
                                0.1609E+01      0.4000E-01
                                0.2414E+01      0.6000E-01
                                0.3219E+01      0.8000E-01
                                0.3621E+01      0.9000E-01
                                0.4024E+01      0.1000E+00
                                0.4024E+01      0.5000E+00
                                0.4024E+01      0.2000E+01
5         10      0.9025E+01
                                0.0000E+00      0.0000E+00
                                0.4851E+00      0.1000E-01
                                0.9701E+00      0.2000E-01
                                0.1940E+01      0.4000E-01
                                0.2910E+01      0.6000E-01
                                0.3880E+01      0.8000E-01
                                0.4366E+01      0.9000E-01
                                0.4851E+01      0.1000E+00
                                0.4851E+01      0.5000E+00
                                0.4851E+01      0.2000E+01
6         10      0.9958E+01
                                0.0000E+00      0.0000E+00
                                0.4851E+00      0.1000E-01
                                0.9701E+00      0.2000E-01
                                0.1940E+01      0.4000E-01
                                0.2910E+01      0.6000E-01
                                0.3880E+01      0.8000E-01
                                0.4366E+01      0.9000E-01
                                0.4851E+01      0.1000E+00
                                0.4851E+01      0.5000E+00
                                0.4851E+01      0.2000E+01
7         10      0.1000E+02
                                0.0000E+00      0.0000E+00
                                0.5395E+00      0.1000E-01
```

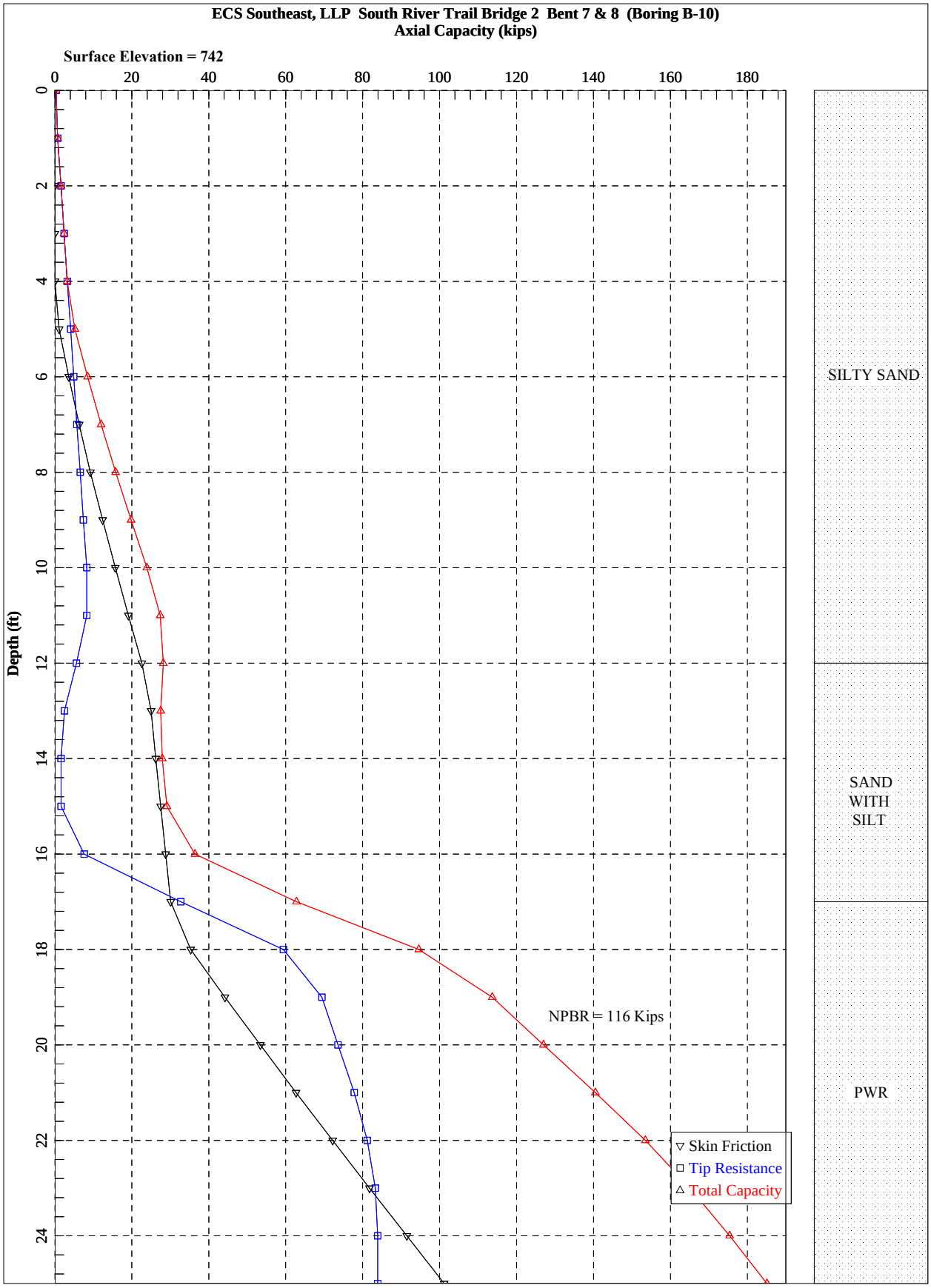
			0.1079E+01	0.2000E-01
			0.2158E+01	0.4000E-01
			0.3237E+01	0.6000E-01
			0.4316E+01	0.8000E-01
			0.4855E+01	0.9000E-01
			0.5395E+01	0.1000E+00
			0.5395E+01	0.5000E+00
			0.5395E+01	0.2000E+01
8	10	0.2253E+02		
			0.0000E+00	0.0000E+00
			0.5669E+00	0.1000E-01
			0.1134E+01	0.2000E-01
			0.2268E+01	0.4000E-01
			0.3402E+01	0.6000E-01
			0.4535E+01	0.8000E-01
			0.5102E+01	0.9000E-01
			0.5669E+01	0.1000E+00
			0.5669E+01	0.5000E+00
			0.5669E+01	0.2000E+01
9	10	0.3496E+02		
			0.0000E+00	0.0000E+00
			0.5669E+00	0.1000E-01
			0.1134E+01	0.2000E-01
			0.2268E+01	0.4000E-01
			0.3402E+01	0.6000E-01
			0.4535E+01	0.8000E-01
			0.5102E+01	0.9000E-01
			0.5669E+01	0.1000E+00
			0.5669E+01	0.5000E+00
			0.5669E+01	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1288E+02	0.5000E-02
0.2576E+02	0.1000E-01
0.5153E+02	0.2000E-01
0.1031E+03	0.1300E+00
0.1546E+03	0.4200E+00
0.1855E+03	0.7300E+00
0.2061E+03	0.1000E+01
0.2061E+03	0.1500E+01
0.2061E+03	0.2000E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.3890E+00	0.3409E-02	0.2576E+00	0.1000E-03
0.3890E+01	0.3409E-01	0.2576E+01	0.1000E-02
0.1903E+02	0.1697E+00	0.1288E+02	0.5000E-02
0.3472E+02	0.3272E+00	0.2576E+02	0.1000E-01
0.7748E+02	0.8010E+00	0.6558E+02	0.5000E-01
0.1013E+03	0.1095E+01	0.8900E+02	0.1000E+00
0.1749E+03	0.2247E+01	0.1626E+03	0.5000E+00

0.2184E+03	0.3192E+01	0.2061E+03	0.1000E+01
0.2184E+03	0.4192E+01	0.2061E+03	0.2000E+01


ECS Southeast, LLP South River Trail Bridge 2 Bent 7 & 8 (Boring B-10)
Axial Capacity (kips)
Surface Elevation = 742
0
20
40
60
80
100
120
140
160
180
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
SILTY SAND
SAND WITH SILT
PWR
NPBR = 116 Kips
Skin Friction
Tip Resistance
Total Capacity

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations   : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Apile Bridge 2\
Name of input data file   : 9672, Boring B-10_ Bridge 2 Bents 7 - 8.ap7d
Name of output file   : 9672, Boring B-10_ Bridge 2 Bents 7 - 8.ap7o
Name of plot output file   : 9672, Boring B-10_ Bridge 2 Bents 7 - 8.ap7p

---

Time and Date of Analysis

Date: June 18, 2018   Time: 15:34:40

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 2 (Bents 7-8) Boring B-10

DESIGNER   : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
10.00	9.00
20.00	8.00
25.00	7.50

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 10.00 IN.
- TOTAL PILE LENGTH, TL = 25.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	36.00	0.00
12.00	SAND	0.00	130.00	36.00	0.00
12.00	SAND	0.00	110.00	30.00	0.00
17.00	SAND	0.00	110.00	30.00	0.00
17.00	SAND	0.00	140.00	43.00	0.00
25.00	SAND	0.00	140.00	43.00	0.00
25.00	SAND	0.00	145.00	43.00	0.00
35.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
12.00	1.000	1.000
12.00	1.000	1.000
17.00	1.000	1.000
17.00	1.000	1.000
25.00	1.000	1.000
25.00	1.000	1.000
35.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.3	0.3
1.00	0.0	0.7	0.7
2.00	0.0	1.6	1.6
3.00	0.0	2.4	2.4
4.00	0.0	3.2	3.2
5.00	1.1	4.1	5.2
6.00	3.6	4.9	8.5
7.00	6.3	5.7	12.0
8.00	9.2	6.6	15.8
9.00	12.4	7.4	19.8
10.00	15.7	8.3	23.9
11.00	19.1	8.3	27.4
12.00	22.6	5.6	28.2
13.00	25.0	2.5	27.5
14.00	26.2	1.6	27.9
15.00	27.5	1.6	29.1
16.00	28.8	7.6	36.4
17.00	30.1	32.7	62.8
18.00	35.3	59.4	94.6
19.00	44.2	69.4	113.7
20.00	53.4	73.6	127.0
21.00	62.7	77.8	140.5
22.00	72.2	81.2	153.5
23.00	81.8	83.3	165.1
24.00	91.5	83.9	175.4
25.00	101.2	83.9	185.1

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION

OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

```
**********************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
**********************************************
```

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.6025E+01		
			0.0000E+00	0.0000E+00
			0.7498E+00	0.1000E-01
			0.1500E+01	0.2000E-01
			0.2999E+01	0.4000E-01
			0.4499E+01	0.6000E-01
			0.5998E+01	0.8000E-01
			0.6748E+01	0.9000E-01
			0.7498E+01	0.1000E+00
			0.7498E+01	0.5000E+00
			0.7498E+01	0.2000E+01
3	10	0.1196E+02		
			0.0000E+00	0.0000E+00
			0.7827E+00	0.1000E-01
			0.1565E+01	0.2000E-01
			0.3131E+01	0.4000E-01
			0.4696E+01	0.6000E-01
			0.6262E+01	0.8000E-01
			0.7044E+01	0.9000E-01
			0.7827E+01	0.1000E+00
			0.7827E+01	0.5000E+00
			0.7827E+01	0.2000E+01
4	10	0.1200E+02		
			0.0000E+00	0.0000E+00
			0.4775E+00	0.1000E-01
			0.9549E+00	0.2000E-01
			0.1910E+01	0.4000E-01
			0.2865E+01	0.6000E-01
			0.3820E+01	0.8000E-01
			0.4297E+01	0.9000E-01
			0.4775E+01	0.1000E+00
			0.4775E+01	0.5000E+00
			0.4775E+01	0.2000E+01
5	10	0.1453E+02		
			0.0000E+00	0.0000E+00
			0.3407E+00	0.1000E-01
			0.6813E+00	0.2000E-01
			0.1363E+01	0.4000E-01
			0.2044E+01	0.6000E-01

			0.2725E+01	0.8000E-01
			0.3066E+01	0.9000E-01
			0.3407E+01	0.1000E+00
			0.3407E+01	0.5000E+00
			0.3407E+01	0.2000E+01
6	10	0.1696E+02		
			0.0000E+00	0.0000E+00
			0.8591E+00	0.1000E-01
			0.1718E+01	0.2000E-01
			0.3436E+01	0.4000E-01
			0.5154E+01	0.6000E-01
			0.6872E+01	0.8000E-01
			0.7732E+01	0.9000E-01
			0.8591E+01	0.1000E+00
			0.8591E+01	0.5000E+00
			0.8591E+01	0.2000E+01
7	10	0.1700E+02		
			0.0000E+00	0.0000E+00
			0.1869E+01	0.1000E-01
			0.3738E+01	0.2000E-01
			0.7477E+01	0.4000E-01
			0.1121E+02	0.6000E-01
			0.1495E+02	0.8000E-01
			0.1682E+02	0.9000E-01
			0.1869E+02	0.1000E+00
			0.1869E+02	0.5000E+00
			0.1869E+02	0.2000E+01
8	10	0.2103E+02		
			0.0000E+00	0.0000E+00
			0.2535E+01	0.1000E-01
			0.5070E+01	0.2000E-01
			0.1014E+02	0.4000E-01
			0.1521E+02	0.6000E-01
			0.2028E+02	0.8000E-01
			0.2281E+02	0.9000E-01
			0.2535E+02	0.1000E+00
			0.2535E+02	0.5000E+00
			0.2535E+02	0.2000E+01
9	10	0.2496E+02		
			0.0000E+00	0.0000E+00
			0.2576E+01	0.1000E-01
			0.5152E+01	0.2000E-01
			0.1030E+02	0.4000E-01
			0.1546E+02	0.6000E-01
			0.2061E+02	0.8000E-01
			0.2318E+02	0.9000E-01
			0.2576E+02	0.1000E+00
			0.2576E+02	0.5000E+00
			0.2576E+02	0.2000E+01
10	10	0.2500E+02		
			0.0000E+00	0.0000E+00
			0.2576E+01	0.1000E-01
			0.5152E+01	0.2000E-01
			0.1030E+02	0.4000E-01
			0.1546E+02	0.6000E-01
			0.2061E+02	0.8000E-01
			0.2318E+02	0.9000E-01
			0.2576E+02	0.1000E+00
			0.2576E+02	0.5000E+00
			0.2576E+02	0.2000E+01
11	10	0.3003E+02		
			0.0000E+00	0.0000E+00
			0.2576E+01	0.1000E-01

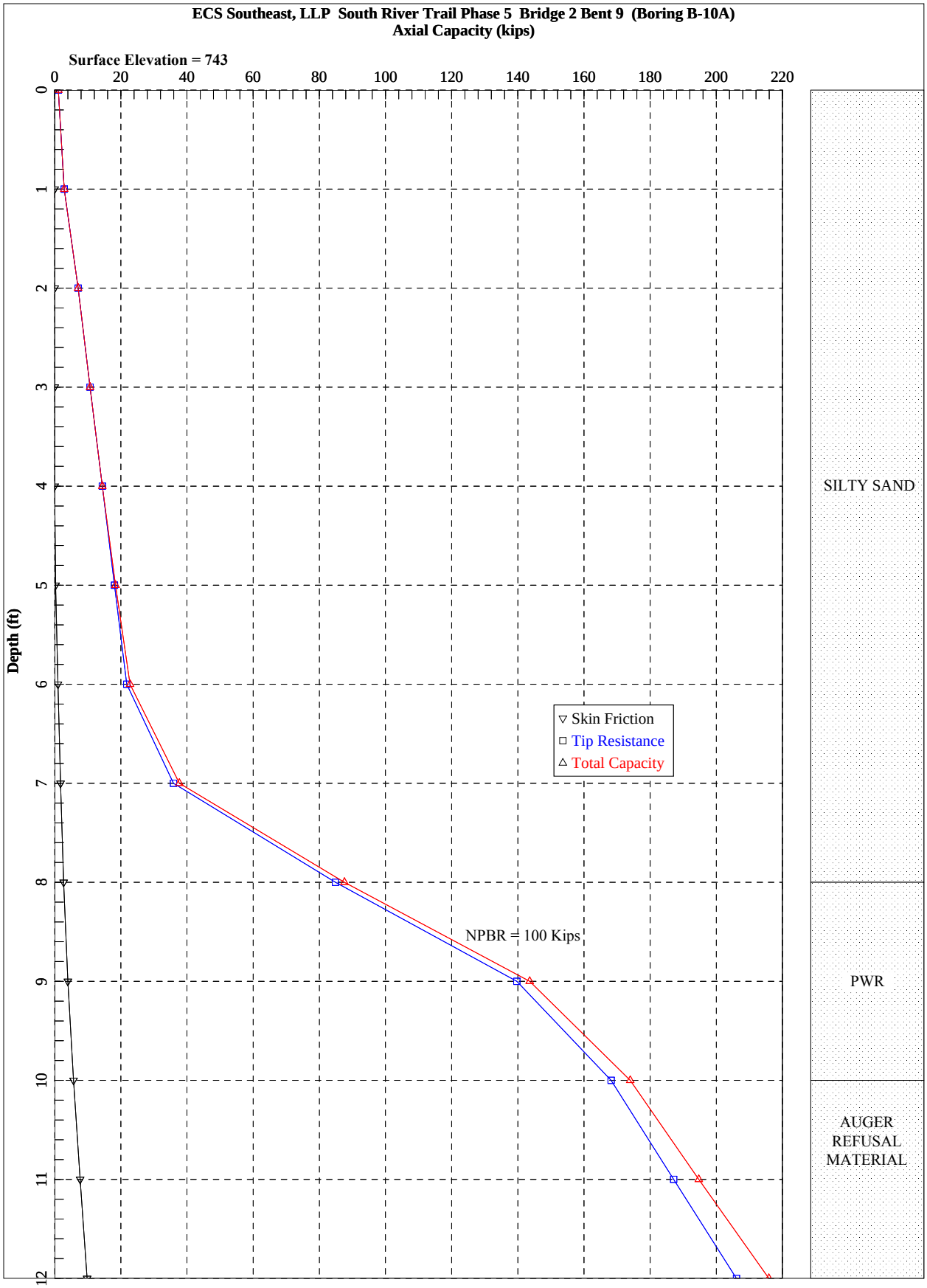
			0.5152E+01	0.2000E-01
			0.1030E+02	0.4000E-01
			0.1546E+02	0.6000E-01
			0.2061E+02	0.8000E-01
			0.2318E+02	0.9000E-01
			0.2576E+02	0.1000E+00
			0.2576E+02	0.5000E+00
			0.2576E+02	0.2000E+01
12	10	0.3496E+02		
			0.0000E+00	0.0000E+00
			0.2576E+01	0.1000E-01
			0.5152E+01	0.2000E-01
			0.1030E+02	0.4000E-01
			0.1546E+02	0.6000E-01
			0.2061E+02	0.8000E-01
			0.2318E+02	0.9000E-01
			0.2576E+02	0.1000E+00
			0.2576E+02	0.5000E+00
			0.2576E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.5244E+01	0.5000E-02
0.1049E+02	0.1000E-01
0.2098E+02	0.2000E-01
0.4195E+02	0.1300E+00
0.6293E+02	0.4200E+00
0.7552E+02	0.7300E+00
0.8391E+02	0.1000E+01
0.8391E+02	0.1500E+01
0.8391E+02	0.2000E+01

LOAD VERSUS SETTLEMENT CURVE

****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.4415E+01	0.3354E-01	0.1049E+00	0.1000E-03
0.3527E+02	0.3247E+00	0.1049E+01	0.1000E-02
0.6976E+02	0.9249E+00	0.5244E+01	0.5000E-02
0.9093E+02	0.1352E+01	0.1049E+02	0.1000E-01
0.1286E+03	0.2213E+01	0.2670E+02	0.5000E-01
0.1416E+03	0.2562E+01	0.3623E+02	0.1000E+00
0.1716E+03	0.3651E+01	0.6618E+02	0.5000E+00
0.1893E+03	0.4559E+01	0.8391E+02	0.1000E+01
0.1893E+03	0.5559E+01	0.8391E+02	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 2 Bent 9 (Boring B-10A)
Axial Capacity (kips)
Surface Elevation = 743
0
20
40
60
80
100
120
140
160
180
200
220
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
Skin Friction
Tip Resistance
Total Capacity
NPBR = 100 Kips
SILTY SAND
PWR
AUGER
REFUSAL
MATERIAL

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations   : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Apile Bridge 2\
Name of input data file   : 9672, Boring B-10A_ Bridge 2 Bent 9.ap7d
Name of output file   : 9672, Boring B-10A_ Bridge 2 Bent 9.ap7o
Name of plot output file   : 9672, Boring B-10A_ Bridge 2 Bent 9.ap7p

---

Time and Date of Analysis

Date: June 18, 2018   Time: 14:28:56

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 2 (Bent 9) Boring B-10A

DESIGNER   : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
10.00	9.00
20.00	8.00
25.00	7.50

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 10.00 IN.
- TOTAL PILE LENGTH, TL = 12.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	36.00	0.00
8.00	SAND	0.00	130.00	36.00	0.00
8.00	SAND	0.00	140.00	43.00	0.00
10.00	SAND	0.00	140.00	43.00	0.00
10.00	SAND	0.00	145.00	43.00	0.00
35.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

LRFD FACTOR LRFD FACTOR

DEPTH FT.	ON UNIT FRICTION	ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
10.00	1.000	1.000
10.00	1.000	1.000
35.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.1	1.1
1.00	0.0	2.9	2.9
2.00	0.0	7.1	7.1
3.00	0.0	10.7	10.7
4.00	0.0	14.4	14.4
5.00	0.3	18.1	18.4
6.00	1.0	21.8	22.8
7.00	1.8	35.9	37.7
8.00	2.7	84.9	87.6
9.00	4.0	139.7	143.6
10.00	5.7	168.2	174.0
11.00	7.7	187.1	194.7
12.00	9.8	206.1	215.9

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING   *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01

			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.4025E+01		
			0.0000E+00	0.0000E+00
			0.1777E+00	0.1000E-01
			0.3554E+00	0.2000E-01
			0.7108E+00	0.4000E-01
			0.1066E+01	0.6000E-01
			0.1422E+01	0.8000E-01
			0.1599E+01	0.9000E-01
			0.1777E+01	0.1000E+00
			0.1777E+01	0.5000E+00
			0.1777E+01	0.2000E+01
3	10	0.7958E+01		
			0.0000E+00	0.0000E+00
			0.2957E+00	0.1000E-01
			0.5914E+00	0.2000E-01
			0.1183E+01	0.4000E-01
			0.1774E+01	0.6000E-01
			0.2366E+01	0.8000E-01
			0.2661E+01	0.9000E-01
			0.2957E+01	0.1000E+00
			0.2957E+01	0.5000E+00
			0.2957E+01	0.2000E+01
4	10	0.8000E+01		
			0.0000E+00	0.0000E+00
			0.4024E+00	0.1000E-01
			0.8047E+00	0.2000E-01
			0.1609E+01	0.4000E-01
			0.2414E+01	0.6000E-01
			0.3219E+01	0.8000E-01
			0.3621E+01	0.9000E-01
			0.4024E+01	0.1000E+00
			0.4024E+01	0.5000E+00
			0.4024E+01	0.2000E+01
5	10	0.9025E+01		
			0.0000E+00	0.0000E+00
			0.4851E+00	0.1000E-01
			0.9701E+00	0.2000E-01
			0.1940E+01	0.4000E-01
			0.2910E+01	0.6000E-01
			0.3880E+01	0.8000E-01
			0.4366E+01	0.9000E-01
			0.4851E+01	0.1000E+00
			0.4851E+01	0.5000E+00
			0.4851E+01	0.2000E+01
6	10	0.9958E+01		
			0.0000E+00	0.0000E+00
			0.4851E+00	0.1000E-01
			0.9701E+00	0.2000E-01
			0.1940E+01	0.4000E-01
			0.2910E+01	0.6000E-01
			0.3880E+01	0.8000E-01
			0.4366E+01	0.9000E-01
			0.4851E+01	0.1000E+00
			0.4851E+01	0.5000E+00
			0.4851E+01	0.2000E+01
7	10	0.1000E+02		
			0.0000E+00	0.0000E+00
			0.5395E+00	0.1000E-01

			0.1079E+01	0.2000E-01
			0.2158E+01	0.4000E-01
			0.3237E+01	0.6000E-01
			0.4316E+01	0.8000E-01
			0.4855E+01	0.9000E-01
			0.5395E+01	0.1000E+00
			0.5395E+01	0.5000E+00
			0.5395E+01	0.2000E+01
8	10	0.2253E+02		
			0.0000E+00	0.0000E+00
			0.5669E+00	0.1000E-01
			0.1134E+01	0.2000E-01
			0.2268E+01	0.4000E-01
			0.3402E+01	0.6000E-01
			0.4535E+01	0.8000E-01
			0.5102E+01	0.9000E-01
			0.5669E+01	0.1000E+00
			0.5669E+01	0.5000E+00
			0.5669E+01	0.2000E+01
9	10	0.3496E+02		
			0.0000E+00	0.0000E+00
			0.5669E+00	0.1000E-01
			0.1134E+01	0.2000E-01
			0.2268E+01	0.4000E-01
			0.3402E+01	0.6000E-01
			0.4535E+01	0.8000E-01
			0.5102E+01	0.9000E-01
			0.5669E+01	0.1000E+00
			0.5669E+01	0.5000E+00
			0.5669E+01	0.2000E+01

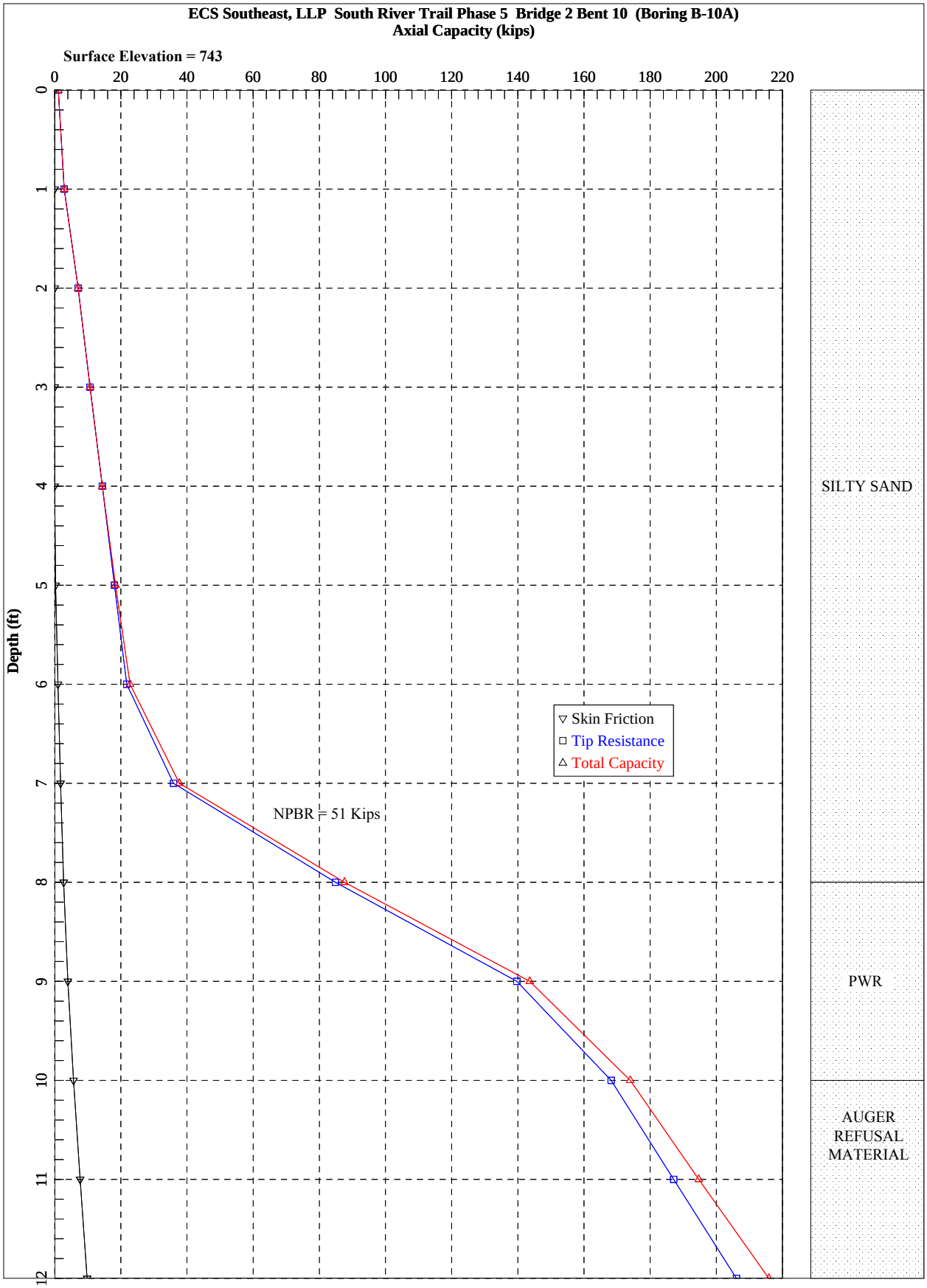
TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1288E+02	0.5000E-02
0.2576E+02	0.1000E-01
0.5153E+02	0.2000E-01
0.1031E+03	0.1300E+00
0.1546E+03	0.4200E+00
0.1855E+03	0.7300E+00
0.2061E+03	0.1000E+01
0.2061E+03	0.1500E+01
0.2061E+03	0.2000E+01

LOAD VERSUS SETTLEMENT CURVE

****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.3890E+00	0.3409E-02	0.2576E+00	0.1000E-03
0.3890E+01	0.3409E-01	0.2576E+01	0.1000E-02
0.1903E+02	0.1697E+00	0.1288E+02	0.5000E-02
0.3472E+02	0.3272E+00	0.2576E+02	0.1000E-01
0.7748E+02	0.8010E+00	0.6558E+02	0.5000E-01
0.1013E+03	0.1095E+01	0.8900E+02	0.1000E+00
0.1749E+03	0.2247E+01	0.1626E+03	0.5000E+00

0.2184E+03	0.3192E+01	0.2061E+03	0.1000E+01
0.2184E+03	0.4192E+01	0.2061E+03	0.2000E+01


ECS Southeast, LLP South River Trail Phase 5 Bridge 2 Bent 10 (Boring B-10A)
Axial Capacity (kips)
Surface Elevation = 743
0
20
40
60
80
100
120
140
160
180
200
220
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
Skin Friction
Tip Resistance
Total Capacity
NPBR = 51 Kips
SILTY SAND
PWR
AUGER
REFUSAL
MATERIAL

==========

APILE for Windows, Version 2015.7.4

Serial Number : 166870365

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.

==========

This program is licensed to :

ECS Southeast, LLC.
Marietta, GA

Path to file locations : I:\GEOTECH\REPORTS\9501-9750\9672 South River Trail - Phase V\calcs\Apile\Apile Bridge 2\
Name of input data file : 9672, Boring B-10A_ Bridge 2 Bent 10.ap7d
Name of output file : 9672, Boring B-10A_ Bridge 2 Bent 10.ap7o
Name of plot output file : 9672, Boring B-10A_ Bridge 2 Bent 10.ap7p

---

Time and Date of Analysis

Date: June 18, 2018 Time: 14:37:13

1

****
* INPUT INFORMATION *
****

South River Trail - Phase 5 - Bridge 2 (Bent 10) Boring B-10A

DESIGNER : Robert Barnes

JOB NUMBER : GDOT P.I. # 0009029

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
  Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)

TYPE OF LOADING :
- COMPRESSION

PILE TYPE :

Timber pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.150E+07 PSI
- CROSS SECTION AREA ALONG DEPTH

DEPTH,FT.	AREA,IN2
0.00	10.00
10.00	9.00
20.00	8.00
25.00	7.50

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 10.00 IN.
- TOTAL PILE LENGTH, TL = 12.00 FT.
- PILE STICKUP LENGTH, PSL = 0.00 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	0.00	120.00	36.00	0.00
8.00	SAND	0.00	130.00	36.00	0.00
8.00	SAND	0.00	140.00	43.00	0.00
10.00	SAND	0.00	140.00	43.00	0.00
10.00	SAND	0.00	145.00	43.00	0.00
35.00	SAND	0.00	145.00	43.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00
0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

LRFD FACTOR LRFD FACTOR

DEPTH FT.	ON UNIT FRICTION	ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
10.00	1.000	1.000
10.00	1.000	1.000
35.00	1.000	1.000

1

****
* COMPUTATION RESULT *
****

****
* FED. HWY. METHOD *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.1	1.1
1.00	0.0	2.9	2.9
2.00	0.0	7.1	7.1
3.00	0.0	10.7	10.7
4.00	0.0	14.4	14.4
5.00	0.3	18.1	18.4
6.00	1.0	21.8	22.8
7.00	1.8	35.9	37.7
8.00	2.7	84.9	87.6
9.00	4.0	139.7	143.6
10.00	5.7	168.2	174.0
11.00	7.7	187.1	194.7
12.00	9.8	206.1	215.9

NOTES:
- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
  IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
  OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING   *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01

			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.4025E+01		
			0.0000E+00	0.0000E+00
			0.1777E+00	0.1000E-01
			0.3554E+00	0.2000E-01
			0.7108E+00	0.4000E-01
			0.1066E+01	0.6000E-01
			0.1422E+01	0.8000E-01
			0.1599E+01	0.9000E-01
			0.1777E+01	0.1000E+00
			0.1777E+01	0.5000E+00
			0.1777E+01	0.2000E+01
3	10	0.7958E+01		
			0.0000E+00	0.0000E+00
			0.2957E+00	0.1000E-01
			0.5914E+00	0.2000E-01
			0.1183E+01	0.4000E-01
			0.1774E+01	0.6000E-01
			0.2366E+01	0.8000E-01
			0.2661E+01	0.9000E-01
			0.2957E+01	0.1000E+00
			0.2957E+01	0.5000E+00
			0.2957E+01	0.2000E+01
4	10	0.8000E+01		
			0.0000E+00	0.0000E+00
			0.4024E+00	0.1000E-01
			0.8047E+00	0.2000E-01
			0.1609E+01	0.4000E-01
			0.2414E+01	0.6000E-01
			0.3219E+01	0.8000E-01
			0.3621E+01	0.9000E-01
			0.4024E+01	0.1000E+00
			0.4024E+01	0.5000E+00
			0.4024E+01	0.2000E+01
5	10	0.9025E+01		
			0.0000E+00	0.0000E+00
			0.4851E+00	0.1000E-01
			0.9701E+00	0.2000E-01
			0.1940E+01	0.4000E-01
			0.2910E+01	0.6000E-01
			0.3880E+01	0.8000E-01
			0.4366E+01	0.9000E-01
			0.4851E+01	0.1000E+00
			0.4851E+01	0.5000E+00
			0.4851E+01	0.2000E+01
6	10	0.9958E+01		
			0.0000E+00	0.0000E+00
			0.4851E+00	0.1000E-01
			0.9701E+00	0.2000E-01
			0.1940E+01	0.4000E-01
			0.2910E+01	0.6000E-01
			0.3880E+01	0.8000E-01
			0.4366E+01	0.9000E-01
			0.4851E+01	0.1000E+00
			0.4851E+01	0.5000E+00
			0.4851E+01	0.2000E+01
7	10	0.1000E+02		
			0.0000E+00	0.0000E+00
			0.5395E+00	0.1000E-01

			0.1079E+01	0.2000E-01
			0.2158E+01	0.4000E-01
			0.3237E+01	0.6000E-01
			0.4316E+01	0.8000E-01
			0.4855E+01	0.9000E-01
			0.5395E+01	0.1000E+00
			0.5395E+01	0.5000E+00
			0.5395E+01	0.2000E+01
8	10	0.2253E+02		
			0.0000E+00	0.0000E+00
			0.5669E+00	0.1000E-01
			0.1134E+01	0.2000E-01
			0.2268E+01	0.4000E-01
			0.3402E+01	0.6000E-01
			0.4535E+01	0.8000E-01
			0.5102E+01	0.9000E-01
			0.5669E+01	0.1000E+00
			0.5669E+01	0.5000E+00
			0.5669E+01	0.2000E+01
9	10	0.3496E+02		
			0.0000E+00	0.0000E+00
			0.5669E+00	0.1000E-01
			0.1134E+01	0.2000E-01
			0.2268E+01	0.4000E-01
			0.3402E+01	0.6000E-01
			0.4535E+01	0.8000E-01
			0.5102E+01	0.9000E-01
			0.5669E+01	0.1000E+00
			0.5669E+01	0.5000E+00
			0.5669E+01	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1288E+02	0.5000E-02
0.2576E+02	0.1000E-01
0.5153E+02	0.2000E-01
0.1031E+03	0.1300E+00
0.1546E+03	0.4200E+00
0.1855E+03	0.7300E+00
0.2061E+03	0.1000E+01
0.2061E+03	0.1500E+01
0.2061E+03	0.2000E+01

LOAD VERSUS SETTLEMENT CURVE

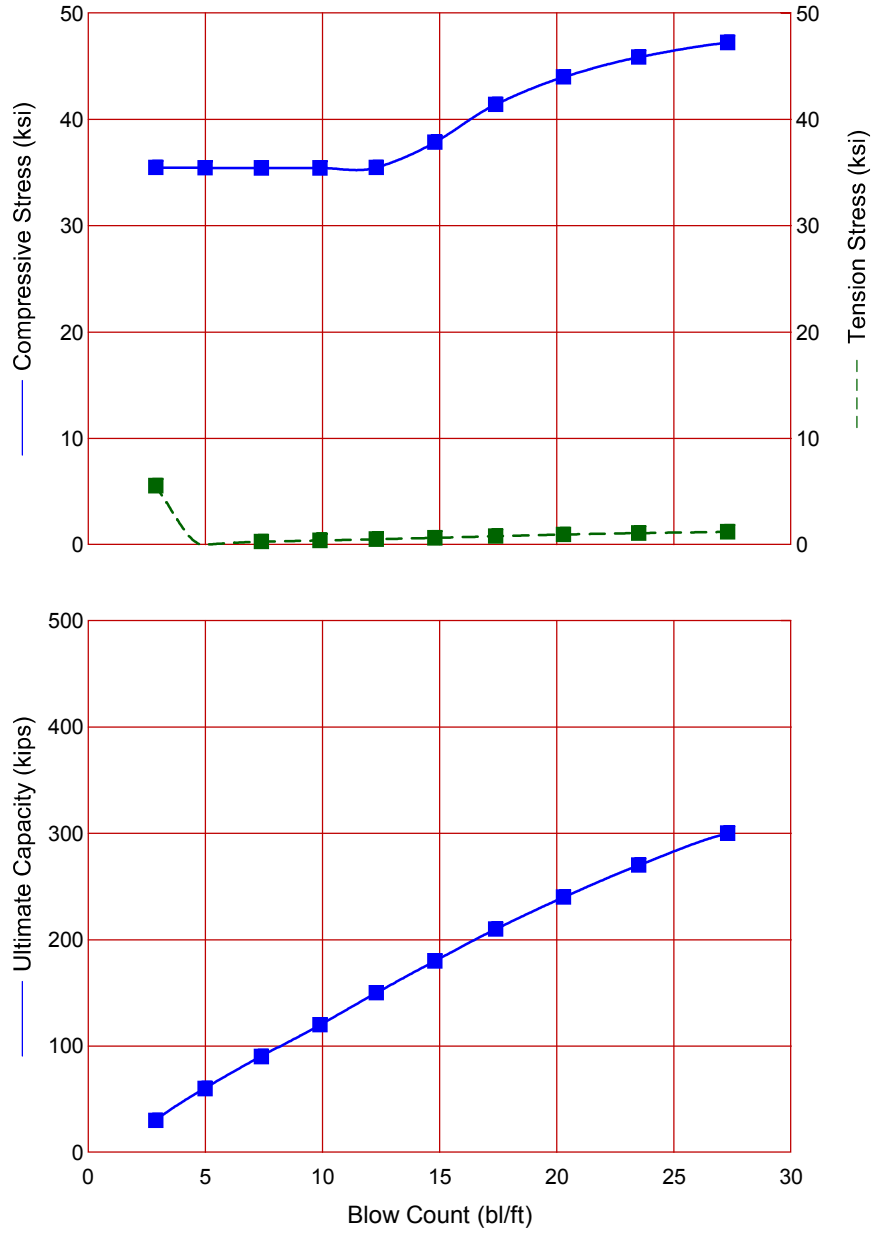
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.3890E+00	0.3409E-02	0.2576E+00	0.1000E-03
0.3890E+01	0.3409E-01	0.2576E+01	0.1000E-02
0.1903E+02	0.1697E+00	0.1288E+02	0.5000E-02
0.3472E+02	0.3272E+00	0.2576E+02	0.1000E-01
0.7748E+02	0.8010E+00	0.6558E+02	0.5000E-01
0.1013E+03	0.1095E+01	0.8900E+02	0.1000E+00
0.1749E+03	0.2247E+01	0.1626E+03	0.5000E+00

0.2184E+03	0.3192E+01	0.2061E+03	0.1000E+01
0.2184E+03	0.4192E+01	0.2061E+03	0.2000E+01

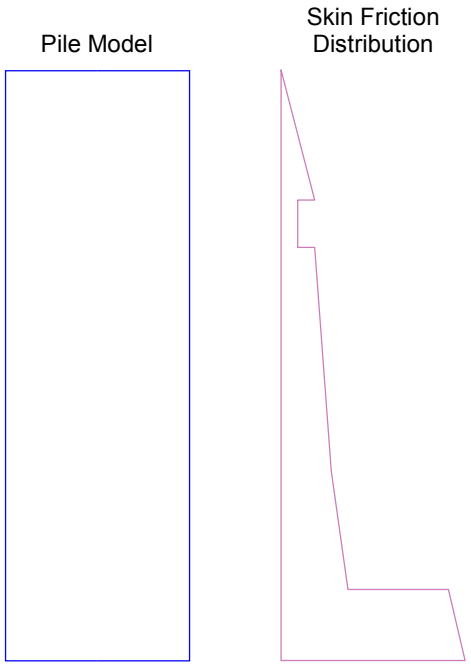
ECS Southeast LLP
South River Trail- Phase 5 Bent 5

12-Jul-2018
GRLWEAP Version 2010



JUNTTAN HHK 4A

Stroke	3.94	ft
Ram Weight	8.82	kips
Efficiency	0.950	
Helmet Weight	1.01	kips
Hammer Cushion	11354	kips/in
COR of H.C.	0.900	
Skin Quake	0.100	in
Toe Quake	0.200	in
Skin Damping	0.200	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	25.00	ft
Pile Penetration	25.00	ft
Pile Top Area	12.40	in2



Res. Shaft = 10 %
(Proportional)

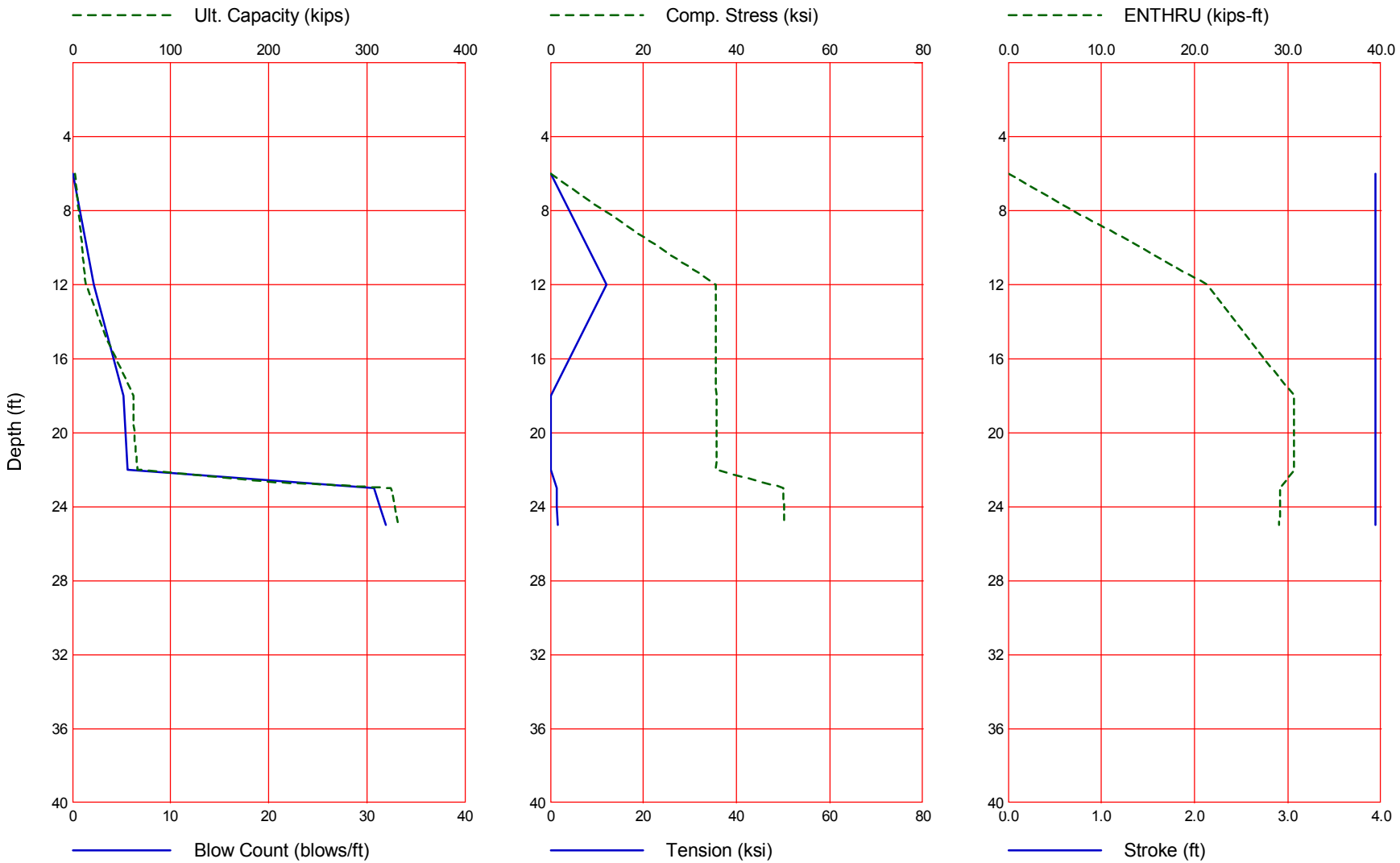
ECS Carolinas LLP 12-Jul-2018
South River Trail - Phase 5 Bent 5 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
30.0	35.47	5.55	2.9	3.94	28.64
60.0	35.44	0.00	5.0	3.94	30.68
90.0	35.42	0.29	7.4	3.94	30.93
120.0	35.43	0.40	9.9	3.94	31.01
150.0	35.47	0.52	12.3	3.94	30.94
180.0	37.84	0.66	14.8	3.94	30.77
210.0	41.41	0.81	17.4	3.94	30.47
240.0	43.98	0.97	20.3	3.94	30.15
270.0	45.84	1.10	23.5	3.94	29.85
300.0	47.21	1.21	27.3	3.94	29.51

ECS Southeast LLP
South River Trail- Phase 5 Bent 5

Jun 21 2018
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000



ECS Southeast LLP
South River Trail - Phase 5 Bent 5

Jun 21 2018
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	2.4	1.6	0.8	0.0	0.000	0.000	3.94	0.0
12.0	13.5	5.9	7.6	2.2	35.516	-11.977	3.94	21.4
18.0	61.9	12.0	49.9	5.2	35.693	0.000	3.94	30.7
22.0	66.1	16.2	49.9	5.6	35.585	0.000	3.94	30.7
23.0	324.9	19.5	305.4	30.7	50.057	-1.417	3.94	29.2
24.0	328.3	22.9	305.4	31.3	50.150	-1.429	3.94	29.2
25.0	331.7	26.4	305.4	31.9	50.226	-1.525	3.94	29.1

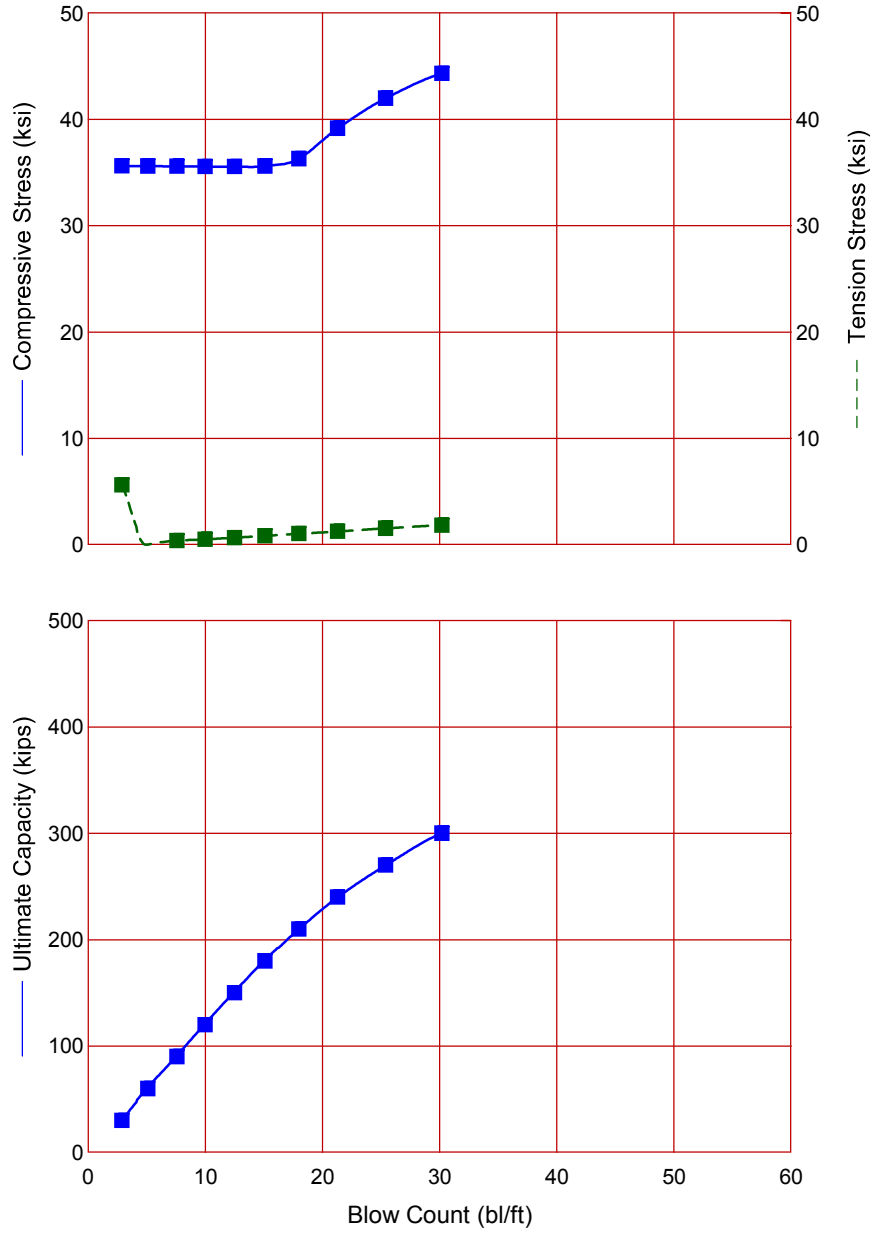
Total Number of Blows: 131

Driving lime (min):	4	3	2	2	1	1	1	1	1	1
@Blow Rate (b/min):	30	40	50	60	70	80	90	100	110	120

Driving lime for continuously running hammer; any wait times not included

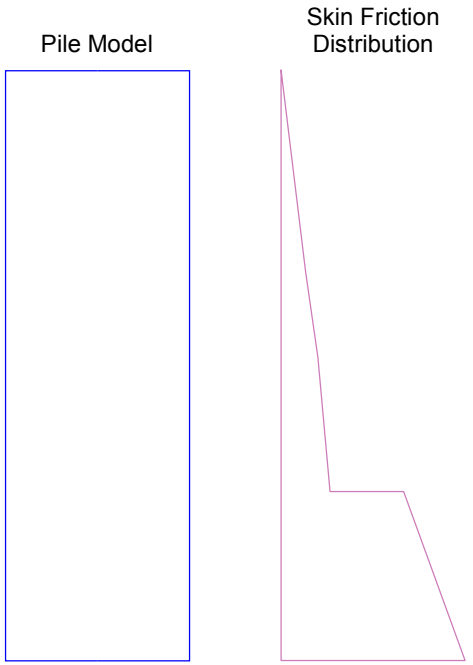
ECS Southeast LLP
South River Trail- Phase 5 Bent 6 B-10

12-Jul-2018
GRLWEAP Version 2010



JUNTTAN HHK 4A

Stroke	3.94	ft
Ram Weight	8.82	kips
Efficiency	0.950	
Helmet Weight	1.01	kips
Hammer Cushion	11354	kips/in
COR of H.C.	0.900	
Skin Quake	0.100	in
Toe Quake	0.243	in
Skin Damping	0.200	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	35.00	ft
Pile Penetration	35.00	ft
Pile Top Area	12.40	in2



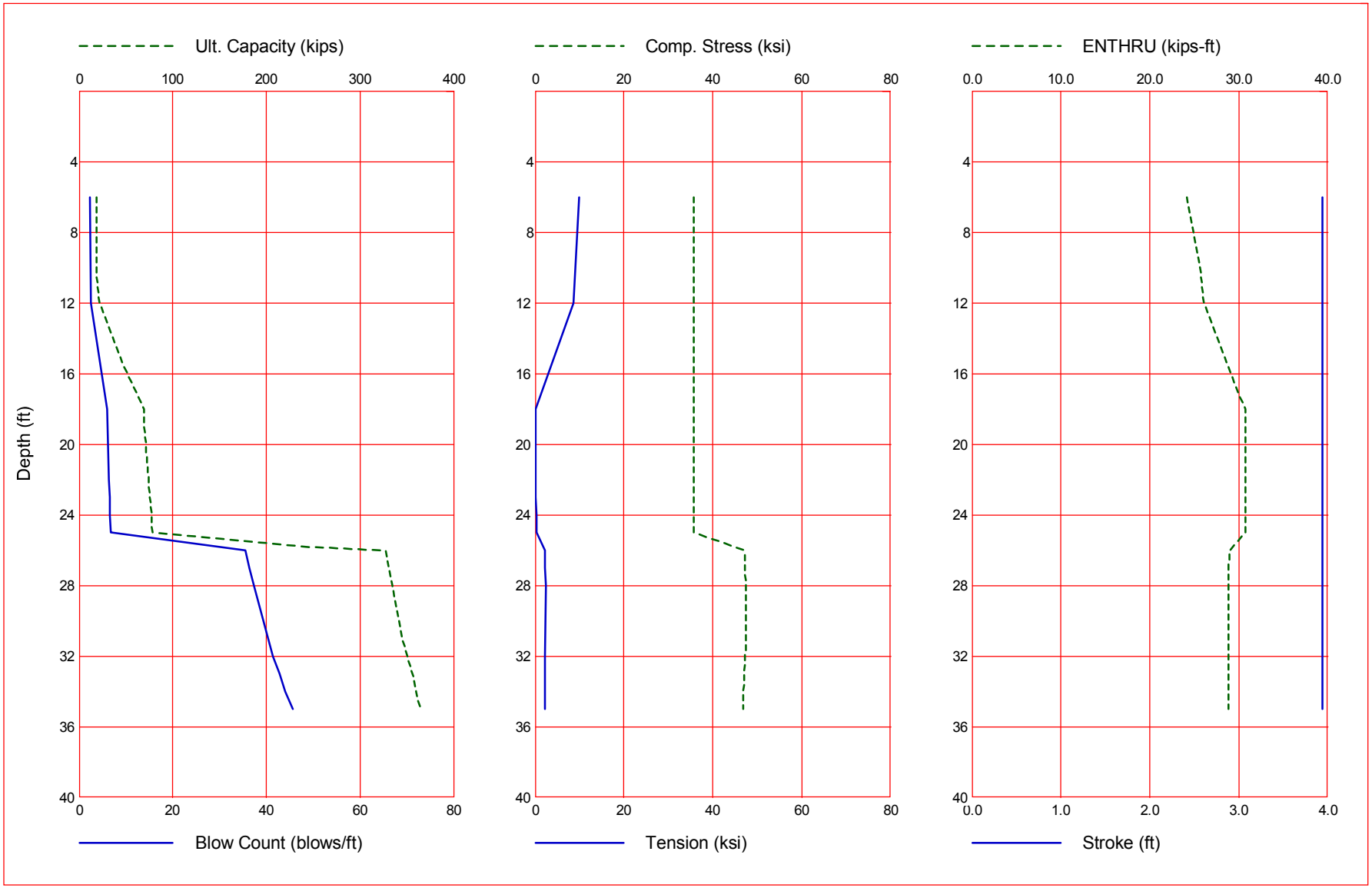
ECS Carolinas LLP 12-Jul-2018
South River Trail - Phase 5 Bent 6 B-10 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
30.0	35.62	5.62	2.9	3.94	28.48
60.0	35.60	0.00	5.1	3.94	30.74
90.0	35.58	0.39	7.6	3.94	30.85
120.0	35.56	0.51	10.0	3.94	30.87
150.0	35.55	0.66	12.5	3.94	30.77
180.0	35.60	0.84	15.1	3.94	30.56
210.0	36.30	1.04	18.0	3.94	30.27
240.0	39.15	1.25	21.3	3.94	29.91
270.0	41.98	1.55	25.4	3.94	29.59
300.0	44.32	1.84	30.2	3.94	29.29

ECS Southeast LLP
South River Trail- Phase 5 Bent 6 B-10

Jun 21 2018
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000



ECS Southeast LLP
South River Trail - Phase 5 Bent 6 B-10

Jun 21 2018
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	18.6	1.0	17.6	2.4	35.661	-10.006	3.94	24.2
12.0	21.6	4.1	17.6	2.6	35.679	-8.550	3.94	26.1
18.0	69.8	9.8	60.0	5.9	35.824	0.000	3.94	30.8
22.0	74.6	14.5	60.0	6.4	35.796	0.000	3.94	30.8
23.0	75.9	15.8	60.0	6.5	35.786	-0.050	3.94	30.8
24.0	77.3	17.2	60.0	6.6	35.766	-0.294	3.94	30.8
25.0	78.7	18.6	60.0	6.8	35.773	-0.391	3.94	30.8
26.0	327.4	22.0	305.4	35.6	47.295	-2.215	3.94	29.0
27.0	330.9	25.6	305.4	36.4	47.347	-2.297	3.94	28.9
28.0	334.7	29.3	305.4	37.3	47.398	-2.366	3.94	28.9
32.0	351.1	45.7	305.4	41.5	47.182	-2.302	3.94	28.9
33.0	355.7	50.3	305.4	42.8	47.039	-2.236	3.94	28.9
34.0	360.4	55.0	305.4	44.1	46.913	-2.201	3.94	28.8
35.0	365.2	59.8	305.4	45.6	46.798	-2.142	3.94	28.8

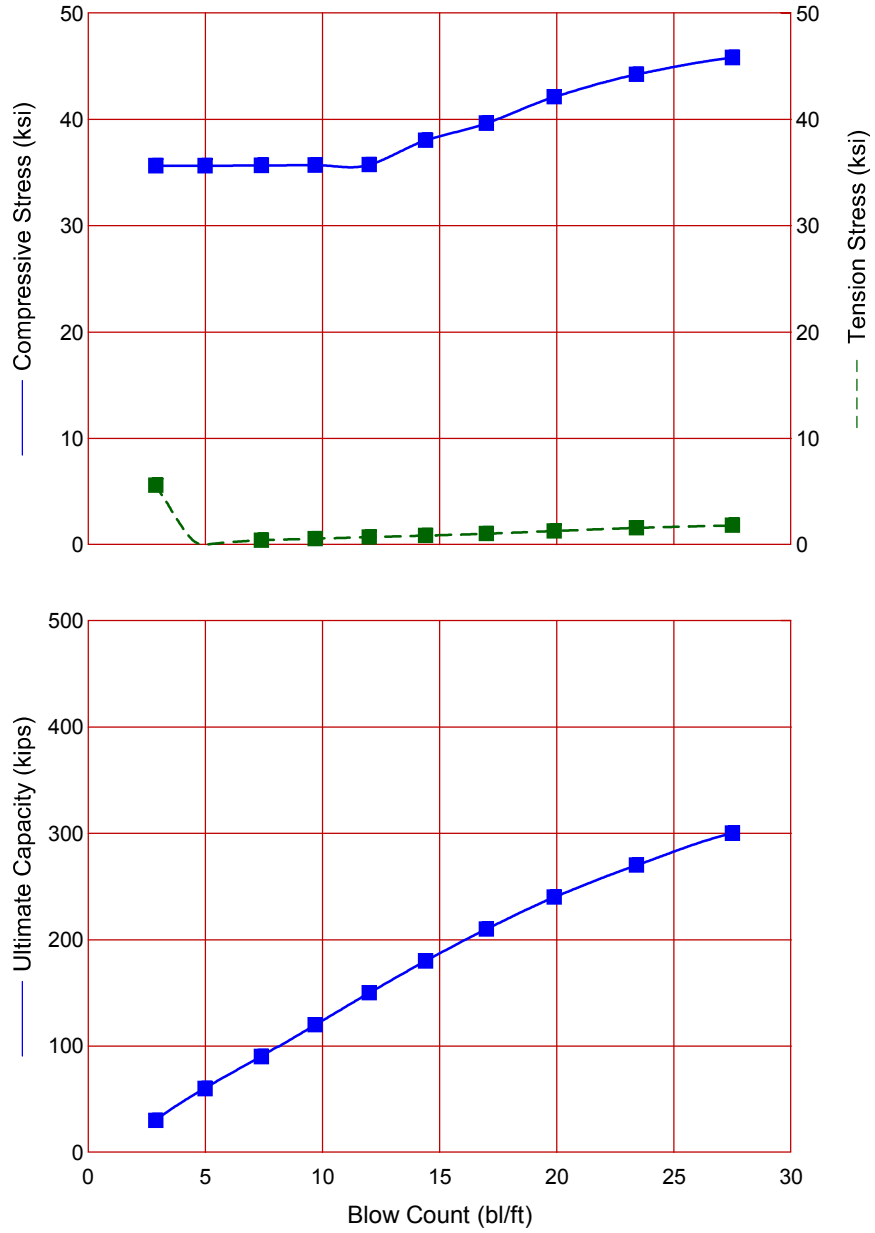
Total Number of Blows: 474

Driving lime (min):	15	11	9	7	6	5	5	4	4	3
@Blow Rate (b/min):	30	40	50	60	70	80	90	100	110	120

Driving lime for continuously running hammer; any wait times not included

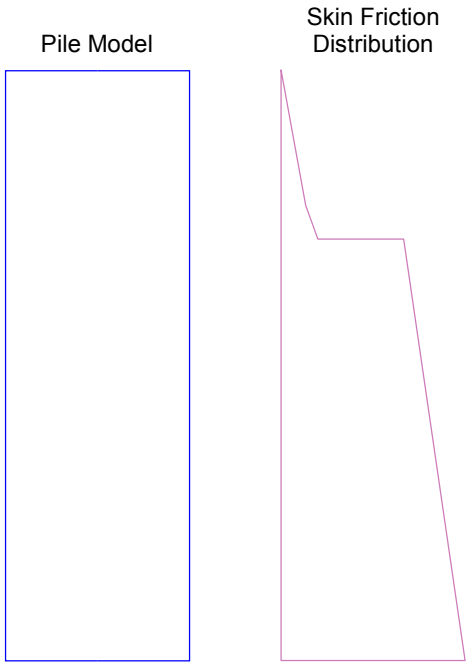
ECS Southeast LLP
South River Trail- Phase 5 Bent 6 B-10A

12-Jul-2018
GRLWEAP Version 2010



JUNTTAN HHK 4A

Stroke	3.94	ft
Ram Weight	8.82	kips
Efficiency	0.950	
Helmet Weight	1.01	kips
Hammer Cushion	11354	kips/in
COR of H.C.	0.900	
Skin Quake	0.100	in
Toe Quake	0.167	in
Skin Damping	0.200	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	35.00	ft
Pile Penetration	35.00	ft
Pile Top Area	12.40	in2



Res. Shaft = 10 %
(Proportional)

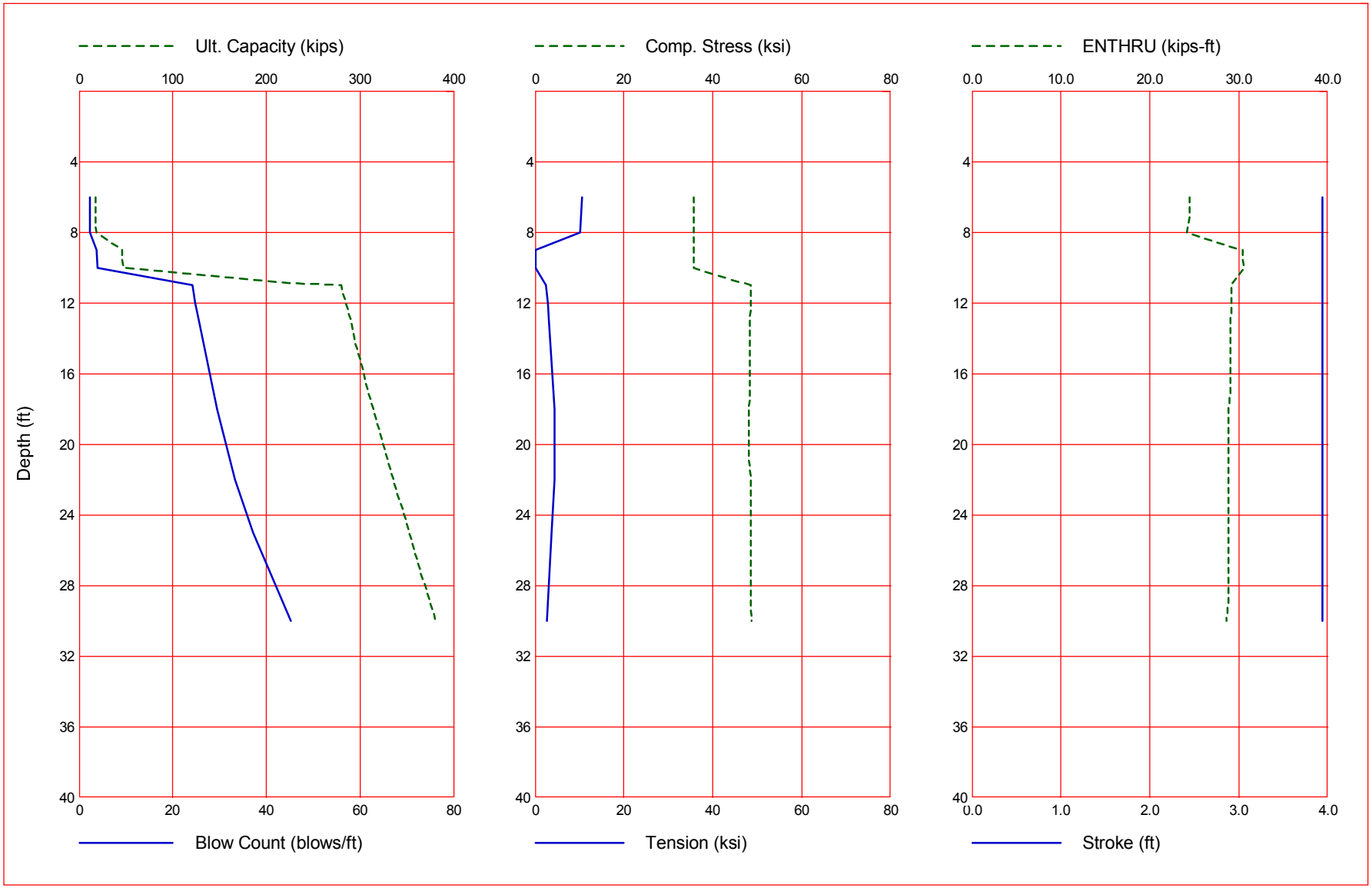
ECS Carolinas LLP 12-Jul-2018
South River Trail - Phase 5 Bent 6 B-10A GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
30.0	35.63	5.60	2.9	3.94	28.51
60.0	35.64	0.00	5.0	3.94	30.79
90.0	35.67	0.43	7.4	3.94	30.95
120.0	35.69	0.57	9.7	3.94	30.98
150.0	35.73	0.72	12.0	3.94	30.87
180.0	38.02	0.87	14.4	3.94	30.63
210.0	39.63	1.04	17.0	3.94	30.30
240.0	42.11	1.30	19.9	3.94	29.96
270.0	44.22	1.59	23.4	3.94	29.62
300.0	45.80	1.82	27.5	3.94	29.28

ECS Southeast LLP
South River Trail- Phase 5 Bent 6 B-10A

Jun 21 2018
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000



Gain/Loss 1 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	17.5	1.3	16.3	2.3	35.661	-10.571	3.94	24.5
7.0	18.0	1.7	16.3	2.3	35.661	-10.320	3.94	24.5
8.0	18.5	2.2	16.3	2.4	35.661	-10.043	3.94	24.2
9.0	45.8	3.1	42.7	3.8	35.662	0.000	3.94	30.5
10.0	46.7	4.0	42.7	3.9	35.662	0.000	3.94	30.6
11.0	280.1	7.3	272.8	24.2	48.471	-2.499	3.94	29.2
12.0	284.9	10.7	274.2	24.9	48.436	-2.782	3.94	29.2
13.0	289.7	14.2	275.5	25.6	48.370	-3.063	3.94	29.1
18.0	314.8	32.5	282.3	29.5	48.132	-4.324	3.94	28.9
22.0	336.0	48.3	287.7	33.4	48.490	-4.407	3.94	28.9
25.0	352.7	60.9	291.8	37.1	48.515	-3.779	3.94	28.8
30.0	381.7	83.1	298.6	45.2	48.831	-2.672	3.94	28.6

Total Number of Blows: 658

Driving lime (min):	21	16	13	10	9	8	7	6	5	5
@Blow Rate (b/min):	30	40	50	60	70	80	90	100	110	120

Driving lime for continuously running hammer; any wait times not included

4/12/2019

SPECIAL PROVISION

PROJECT NUMBER: 0009029

COUNTY: DEKALB

P.I. No.: 0009029

SECTION 502 – Timber Structures

Delete Sub-Section 502.4.B. Lumber and Timber as written and substitute the following:

B: Lumber and Timber

Lumber and timber for boardwalks completed and accepted as specified in the plans, based on the plan width specified, will be measured for payment on a linear foot basis measured along the centerline.

Delete Sub-Section 502.5.B. Lumber and Timber as written and substitute the following:

B: Lumber and Timber

Payment for boardwalks will be made at the linear foot price bid completed and accepted. The payment will be full compensation for all work specified in this Section and for furnishing and installing materials and for labor, equipment, and incidentals necessary to complete the Item.

Payment will be made under:

Item No. 502	Boardwalk (Bridge timber, treated)	Per linear foot
Item No. 502	Boardwalk (Bridge timber, glued laminated treated)	Per linear foot

Dekalb County

ITEM NO.	DESCRIPTION	APPROX QTY	UNITS	UNIT PRICE	AMOUNT
	ROADWAY ITEMS				
150-1000	TRAFFIC CONTROL	LS	LS		
154-1000	CONSTRUCTION VIBRATION MONITORING	LS	LS		
163-0232	TEMPORARY GRASSING	4.64	AC		
163-0240	MULCH	144	TN		
163-0300	CONSTRUCTION EXIT	5	EA		
165-0030	MAINT OF TEMP SILT FENCE, TP C	16322	LF		
165-0101	MAINT OF CONST EXIT	5	EA		
167-1000	WATER QUALITY MONITORING AND SAMPLING	3	EA		
167-1500	WATER QUALITY INSPECTIONS	18	MO		
171-0030	TEMPORARY SILT FENCE, TYPE C	32643	LF		
210-0100	GRADING COMPLETE	LS	LS		
441-0105	CONC SIDEWALK, 5 IN	13065	SY		
500-3002	CL AA CONCRETE BR 2	43	CY		
500-3101	CLASS A CONCRETE BR 1	8	CY		
500-3104	CL A CONC, SIGNS	1.3	CY		
500-3201	CL B CONC, RET WALL	50	CY		
502-1200	BOARDWALK (BRIDGE TIMBER, TREATED)	1096	LF		
502-1500	BOARDWALK (BRIDGE TIMBER, GLUED LAMINATED TREATED)	711	LF		
511-1000	BAR REINF STEEL	6196	LB		
515-1000	FERROUS METAL HDRAIL, SPCL DESIGN	160	LF		
520-1104	PIL-IN-PL, STEEL H, HP 10 X 42	255	LF		
520-0242	H-PILE POINTS, HP 10 X 42	12	EA		
520-4104	LOAD TEST, STEEL H, HP 10 X 42 (IF REQD)	2	EA		
520-5000	PILOT HOLES	69	LF		
523-1100	DYNAMIC PILE TEST	4	EA		
534-1000	PEDESTRIAN OVERPASS BRIDGE, STA 65+09.42 BR 1	LS	LS		
534-1000	PEDESTRIAN OVERPASS BRIDGE, STA 118+19.84 BR 2	LS	LS		
550-1150	STM DR PIPE 15, H 1-10	116.2	LF		
550-4215	FLARED END SECT 15 IN, ST DR	8	EA		

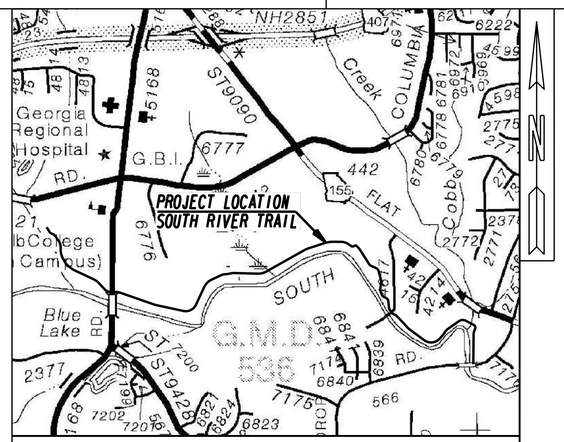
603-2012	STN DUMPED RIP RAP, TP 1, 12	481	SY		
603-2181	STN DUMPED RIP RAP, TP 3, 18	42	SY		
603-7000	PLASTIC FILTER FABRIC	42	SY		
603-7000	PLASTIC FILTER FABRIC BR 1	481	SY		
610-1055	REM GUARDRAIL	36	LF		
636-1033	HWY SIGNS, TP 1 MAT, REFL SH TP 9	45.2	SF		
636-1041	HWY SIGNS, TP 2 MAT, REFL SH TP 9	20	SF		
636-1045	HWY SGN, TP 2, REFL SH TP 11	9	SF		
636-2070	GALV STEEL POSTS, TP 7	165.5	LF		
641-1200	GUARDRAIL, TP W	25	LF		
641-5001	GUARDRAIL ANCHORAGE, TP 1	2	EA		
643-8200	BARRIER FENCE (ORANGE), 4 FT	8579	LF		
652-5402	SOLID TRAF STRIPE, 4 IN, YELLOW SOLID	1207	LF		
652-6402	SKIP TRAF STRIPE, 4 IN, YELLOW SKIP	11704	GLF		
700-6910	PERMANENT GRASSING	9.27	AC		
700-7000	AGRICULTURAL LIME	28	TN		
700-8000	FERTILIZER MIXED GRADE	9.27	TN		
700-8100	FERTILIZER NITROGEN CONTENT	464	LB		
716-2000	EROSION CONTROL MATS, SLOPES	390	SY		
754-4000	WASTE RECEPTACLE UNIT	5	EA		
754-5000	BENCH	5	EA		
900-0526	BOLLARDS	6	EA		
999-9000	WORK ALLOWANCE	LS	LS	$200,000.00	$200,000.00
			CONSTRUCTION TOTAL		

DATE$$$ $USER$ | PRF | DGN GAWCOV | Project No. 0009029

DEKALB COUNTY & PATH FOUNDATION

CONSTRUCTION PLANS OF PROPOSED SOUTH RIVER TRAIL, PHASE 5 CSTEE-009-00(029)

FEDERAL AID PROJECT



LOCATION SKETCH

FEDERAL ROUTE(S): N/A
STATE ROUTE(S): N/A
P.I.NO.: 0009029

BEGIN PROJECT
BEGIN CONSTRUCTION
SOUTH RIVER TRAIL, PHASE 5
STA 10+11.00
N = 1341591.5549
E = 2263154.0625

PROJECT MIDPOINT
STA 68+63.00
N = 1340959.0359
E = 2267880.7361

END BOARDWALK
STA 65+88.00

END BRIDGE
BEGIN BOARDWALK
STA 65+59.42

END BOARDWALK
BEGIN BRIDGE
STA 65+09.42

BEGIN BOARDWALK
STA 64+80.00

BEGIN BOARDWALK
STA 79+71.00

BEGIN SPECIAL DESIGN BOARDWALK
STA 82+59.00

END SPECIAL DESIGN BOARDWALK
STA 82+89.00

END BOARDWALK
STA 83+73.00

BEGIN BOARDWALK
STA 98+05.00

END BOARDWALK
STA 99+70.00

BEGIN BOARDWALK
STA 117+63.84

END BOARDWALK
BEGIN BRIDGE
STA 118+19.84

END BRIDGE
BEGIN BOARDWALK
STA 119+19.84

END BOARDWALK
STA 119+84.84

END PROJECT
STA 127+14.50
END CONSTRUCTION
SOUTH RIVER TRAIL
N = 1338903.5297
E = 2271534.8634

BEGIN BOARDWALK
STA 30+85.00

END BOARDWALK
STA 41+45.00

ESA - WETLAND 2
ESA - WETLAND 4
ESA - 75' STREAM BUFFER
ESA - 25' STREAM BUFFER
ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN THE GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS

SOUTH RIVER
PANTERSVILLE RD
WARRIORS PATH
WALDROP RD

DESIGN DATA:
SPEED DESIGN: 20 MPH

LOCATION & DESIGN
APPROVAL DATE: 11/24/2009

FUNCTIONAL CLASS: SHARED USE PATH

THIS PROJECT IS 100% IN DEKALB COUNTY AND IS 100% IN CONG. DIST. NO. 5.

LAND LOTS: 59,70,71,72,73
TH LAND DISTRICT
GMD: 536

PROJECT DESIGNATION:
DESIGNED IN ENGLISH UNITS.

THIS PROJECT HAS BEEN PREPARED USING THE HORIZONTAL GEORGIA COORDINATE SYSTEM OF 1984 (NAD 1983)/94 WEST ZONE, AND THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

THIS PROJECT HAS BEEN DESIGNED TO COMPLY WITH TITLE II PROVISIONS OF THE AMERICANS WITH DISABILITIES ACT (ADA).

PROJECT TO BE CONSTRUCTED AS PER GEORGIA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS, 2013 EDITION, AND GDOT SUPPLEMENTAL SPECIFICATIONS BOOK, 2016 EDITION, AS APPROVED BY THE FEDERAL HIGHWAY ADMINISTRATION AND AS MODIFIED BY CONTRACT DOCUMENTS.

NOTE :
ALL REFERENCES IN THIS DOCUMENT, WHICH INCLUDES ALL PAPERS, WRITINGS, DOCUMENTS, DRAWINGS, OR PHOTOGRAPHS USED, OR TO BE USED IN CONNECTION WITH THIS DOCUMENT, TO "STATE HIGHWAY DEPARTMENT OF GEORGIA", "STATE HIGHWAY DEPARTMENT", GEORGIA STATE HIGHWAY DEPARTMENT", "HIGHWAY DEPARTMENT", OR "DEPARTMENT" WHEN THE CONTEXT THEREOF MEANS THE STATE HIGHWAY DEPARTMENT OF GEORGIA, AND SHALL BE DEEMED TO MEAN THE DEPARTMENT OF TRANSPORTATION.

THE DATA, TOGETHER WITH ALL OTHER INFORMATION SHOWN ON THESE PLANS OR IN ANYWAY INDICATED THEREBY, WHETHER BY DRAWINGS OR NOTES, OR IN ANY OTHER MANNER, ARE BASED UPON FIELD INVESTIGATIONS AND ARE BELIEVED TO BE INDICATIVE OF ACTUAL CONDITIONS. HOWEVER, THE SAME ARE SHOWN AS INFORMATION ONLY, ARE NOT GUARANTEED, AND DO NOT BIND THE DEPARTMENT OF TRANSPORTATION IN ANY WAY. THE ATTENTION OF BIDDER IS SPECIFICALLY DIRECTED TO SUBSECTIONS 102.04, 102.05, AND 104.03 OF THE SPECIFICATIONS.

DEKALB COUNTY

NOI REQUIRED

DISTURBED AREA: 10.45 ACRES

LENGTH OF PROJECT	COUNTY No. 089 Project No. CSTEE-009-00(029)
	MILES
NET LENGTH OF TRAIL	2.217
NET LENGTH OF BRIDGES	0.371
NET LENGTH OF PROJECT	2.217
NET LENGTH OF EXCEPTIONS	0.000
GROSS LENGTH OF PROJECT	2.217

SCALE IN FEET
0 500 1000 2000

GEORGIA REGISTERED No. 16762 PROFESSIONAL ENGINEER MARK WILLIAM HOLMES
04/16/2019

PREPARED BY:
Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

DATE | CHIEF ENGINEER

PLANS COMPLETED 02-11/2019	
REVISIONS	
03/14/19 50-0001, 51-0002, 51-0003,	
051-0004, 54-0001 - 54-0072, 55-0001	
04/16/19 03-0001, 06-0001, 22-0001, 26-0025	
38-0002, 38-0003, 38-0004 54-0022, 54-0046	

DRAWING No. 01-0001

DATE	DRAWING NO.	REVISION
03/14/19	50-0001, 51-0002	ADDRESS GA EPD COMMENTS - OUTFALL ID TABLE REVISION
03/14/19	51-0003, 51-0004	REV SAMPLING INFORMATION TABLE 51-0003, REV CHECKLIST NOTE 30 51-0004
03/14/19	54-0001 - 54-0072	BLOCK REVISION - ADD ORANGE BARRIER FENCE TO LEGEND
03/14/19	55-0001	SAMPLING LOCATION REVISION
04/16/19	03-0001	ADD REVISION SUMMARIES
04/16/19	06-0001	REV SIGN POST TYPE, ADD CONST EXIT AND MAINTENANCE OF CONST EXIT
04/16/19	22-0001	CHANGE PIPE TYPE TO HDPE
04/16/19	26-0025	ADD TRAIL REGULATORY SIGN
04/16/19	38-0002, 38-0003	REVISE DECK AND RAIL FASTENER SIZES AND MATERIAL TO STAINLESS STEEL
04/16/19	38-0004	REVISE BOARDWALK PAY ITEM UNITS TO LF AND QUANTITIES, ADD NOTE
04/16/19	54-0022, 54-0046	ADD CONSTRUCTION EXIT

DATE	DRAWING NO.	REVISION

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

REVISION DATES		
04/16/19		

DEKALB COUNTY & PATH FOUNDATION

REVISION SUMMARY

SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:		03-0001
CORRECTED:	AE & PAL	DATE:		
VERIFIED:	MWH	DATE:		

7/31/2015 GPLN

SUMMARY OF QUANTITIES

TRAFFIC CONTROL	
TOTAL	1 LS

WASTE RECEPTACLE UNIT	
TOTAL	5 EA

GRADING COMPLETE	
TOTAL	1 LS

BENCH	
TOTAL	5 EA

CONCRETE SIDEWALK, 5IN	
TOTAL	13065 SY

HANDRAIL	
TOTAL	160 LF

DRAINAGE

STRUCTURE*	STATION	OFFSET	PIPES	PIPE LENGTH (LF) H= 1-10	DITCH DROP INLET	F.E.S. 15"	F.E.S. 30"	MANHOLE STD 1011A
A1-A2	12+16.00		15"	28.60		2		
B1-B2	12+85.90		15"	28.00		2		
C1-C2	13+98.00		15"	31.00		2		
D1-D2	78+00.00		15"	28.60		2		
TOTALS:				116.20		8		

GRASSING			AGRICULTURAL LIME	FERTILIZER MIXED GRADE	FERTILIZER NITROGEN CONTENT	MULCH
	UNIT	QUANTITY	TN	TN	LB	TN
PERMANENT GRASSING	AC	9.27	28	8.34	464	28
TEMPORARY GRASSING	AC	4.64	-	0.93	-	14
DISTURBED AREAS	AC	10.26	-	-	-	103
TOTAL			28	9.27	464	144

WATER QUALITY MONITORING AND SAMPLING	
TOTAL	3 EA

TEMPORARY SILT FENCE, TYPE C	
TOTAL	32643 LF

WATER QUALITY INSPECTIONS	
TOTAL	18 MO

MAINTENANCE OF SILT FENCE, TYPE C	
TOTAL	16322 LF

CONSTRUCTION EXIT	
TOTAL	5 EA

BARRIER FENCE (ORANGE), 4FT	
TOTAL	8579 LF

MAINTENANCE OF CONSTRUCTION EXIT	
TOTAL	5 EA

EROSION CONTROL MATS, SLOPES	
TOTAL	390 SY

STRUCTURES
DESCRIPTION
⊙ CONSTRUCTION OF BRIDGES COMPLETE
⊙⊙ CONSTRUCTION OF BOARDWALKS

⊙SEE BRIDGE PLANS FOR QUANTITIES
⊙⊙SEE DWG NO. 38-0004 FOR QUANTITIES

CLASS B CONCRETE, RETAINING WALL	
TOTAL	50 CY

GUARDRAIL		
DESCRIPTION	UNIT	QUANTITY
REMOVE GUARDRAIL	LF	36
GUARDRAIL, TP W	LF	25
GUARDRAIL ANCHORAGE, TP 1	EA	2

BOLLARDS		
DESCRIPTION	UNIT	QUANTITY
FIXED BOLLARDS	EA	4
REMOVABLE BOLLARDS	EA	2

STN DUMPED RIP RAP, TP 3, 18IN	
TOTAL	42 SY

PLASTIC FILTER FABRIC	
TOTAL	42 SY

PAVEMENT MARKING		
DESCRIPTION	UNIT	QUANTITY
⊙ SOLID TRAFFIC STRIPE, 4 IN, YELLOW	LF	1207
SKIP TRAFFIC STRIPE, 4 IN, YELLOW	GLF	11704

⊙ SHALL BE PAID FOR AS 5 INCH SOLID TRAFFIC STRIPE.

CLASS A CONCRETE, SIGNS	
TOTAL	1.3 CY

SIGNS

STATION	DESCRIPTION	TP 1 MAT'L REFL SHEETING TP 9 SIZE (IN)		TP 1 MAT'L REFL SHEETING TP 9 AREA (SQ FT)	TP 2 MAL'T REFL SHEETING TP 9 SIZE (IN)		TP 2 MAL'T REFL SHEETING TP 9 AREA (SQ FT)	TP 2 MAL'T REFL SHEETING TP 11 SIZE (IN)		TP 2 MAL'T REFL SHEETING TP 11 AREA (SQ FT)	SQUARE ALUMINUM POST, 4"X4" LENGTH (FT)
10+11 RT	INFO SIGN				48.00	30.00	10.00				10.00
	MILE MARKER	8.00	22.00	1.22							4.50
28+00 RT	SP. DESIGN 1	12.00	18.00	1.50							10.00
42+00 RT	SP. DESIGN 2	18.00	18.00	2.25							30.00
44+00 LT				2.25							
68+00 RT				2.25							
69+90 LT	MILE MARKER	8.00	22.00	1.22							4.50
70+00 LT	SP. DESIGN 2	18.00	18.00	2.25							10.00
79+50 LT	W1-3L	36.00	36.00	9.00							14.00
	R2-1	30.00	24.00	5.00							
95+00 RT	SP. DESIGN 2	18.00	18.00	2.25							20.00
96+50 LT				2.25							
115+70 LT	MILE MARKER	8.00	22.00	1.22							4.50
125+00 RT	SP. DESIGN 2	18.00	18.00	2.25							20.00
126+00 LT				2.25							
126+50 LT	INFO SIGN				48.00	30.00	10.00				10.00
127+06 RT	R1-1							36.00	36.00	9.00	7.00
127+14 RT/LT	R5-3	24.00	24.00	8.00							21.00 (TP 7)
TOTALS				45.20			20.00			9.00	144.5 21.00 (TP 7)

NOTE: PAY ITEM 636-2070 GALV STEEL POSTS, TP 7 INCLUDES BOTH SQUARE ALUMINUM POST, 4"X 4"AND TP 7 QUANTITIES.

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

REVISION DATES		
04/16/19		

DEKALB COUNTY & PATH FOUNDATION
SUMMARY QUANTITIES
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	
CORRECTED:	AE & PAL	DATE:	
VERIFIED:	MWH	DATE:	

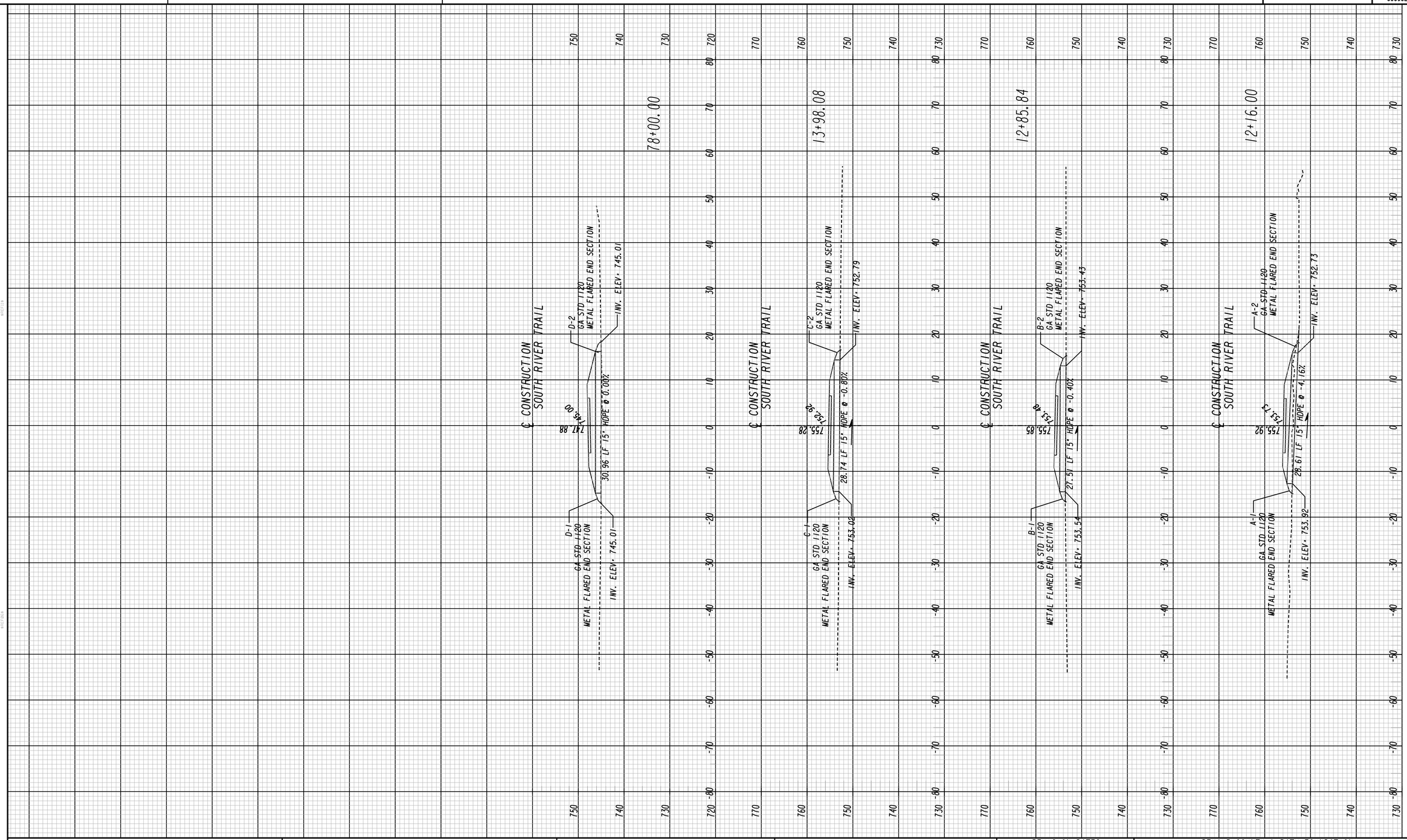
DRAWING No. 06-0001

7/31/2015 GPLN

DATE$$ TIME$$ $PRF8$ DGN

$USER$

P. I. No. 0009029



Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 10 20 40

REVISION DATES
04/16/19

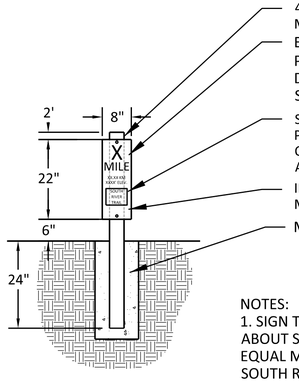
DEKALB COUNTY & PATH FOUNDATION

DRAINAGE PROFILES

SOUTH RIVER TRAIL, PHASE 5

CHECKED:		DATE:	DRAWING No.
BACKCHECKED:		DATE:	22-0001
CORRECTED:		DATE:	
VERIFIED:		DATE:	

7/31/2015 GPLN



4"X4" ALUMINUM POST WITH SANDED FINISH CLEAR-COATED TO MATCH SIGN PANELS.

EACH DISTANCE MARKER TO CONTAIN TWO SIGN PANELS; EACH SIGN PANEL SHALL BE ATTACHED TO SIGNPOST USING (2) 1" LONG, 1/4 DIAMETER, STAINLESS STEEL #14A BUTTON HD TORX SECURITY METAL SCREW.

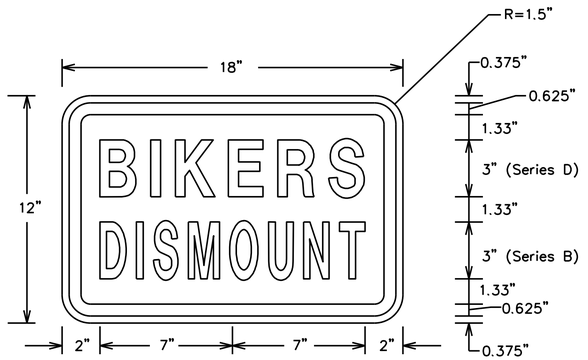
SIGN PANELS TO BE 1/4" BRUSHED ALUMINUM WITH ALL INFORMATION DIRECT PRINTED TO THE BRUSHED ALUMINUM PANEL. ENTIRE SIGN PANEL TO BE OVER-COATED WITH AUTOCOAT BT LV650 ANTI-GRAFFITI CLEAR-COAT. BOTTOM ANGLE OF SIGN PANEL TO MATCH SOUTH RIVER LOGO SHAPE.

INFORMATION SHOWN FOR EXAMPLE PURPOSES ONLY. REFER TO SIGN MATRIX FOR EACH INDIVIDUAL SIGN PANEL LAYOUT.

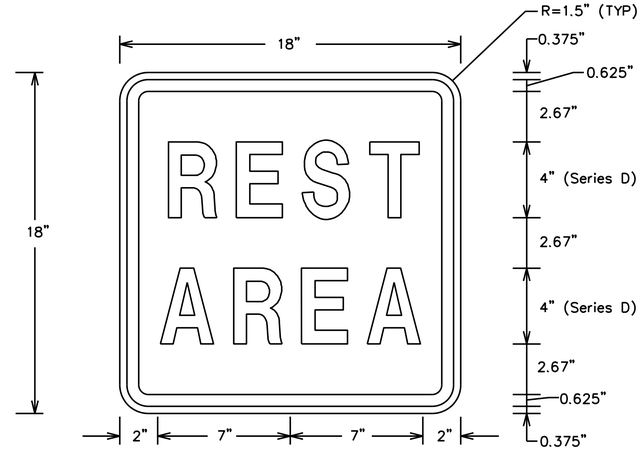
MIN. 12"X12" CONCRETE FOOTER

NOTES:
1. SIGN TO BE MANUFACTURED BY CAPITAL SIGNS 770-564-8582, ABOUT SIGNS 404-285-9331, HENRY GRAPHICS, INC. 770-932-3222 OR APPROVED EQUAL MANUFACTURER. CONTRACTOR TO PROVIDE SHOP DRAWINGS OF SIGNS TO SOUTH RIVER TO OBTAIN FINAL APPROVAL PRIOR TO FABRICATION.
1. SOUTH RIVER TO DETERMINE IN FIELD THE APPROPRIATE SIGN TO BE UTILIZED BASED ON FIELD CONDITIONS AND AVAILABLE SPACE FOR SIGNAGE.
2. ALL SIGNS SHALL BE LOCATED WITH 2'-0" CLEAR AREA FROM EDGE OF TRAILWAY TO OUTSIDE EDGE OF SIGN.

DISTANCE MARKER
Scale: N.T.S.



Special Design Sign #1
Scale: N.T.S.



Special Design Sign #2
Scale: N.T.S.

COLORS: LEGEND – WHITE
BACKGROUND – BLUE (RETROFLECTIVE)

SIGN TO BE FRAMED OUT OF 1" ALUMINUM TUBE AND CONSTRUCTED TO ALLOW BOTH PANELS TO BE REMOVABLE FOR REPLACEMENT. FAUX 2" WIDE SIGN FRAME TO BE PERMANENTLY ATTACHED TO OPPOSITE SIDE OF POST.

SIGN PANEL TO BE 1/8" BRUSHED ALUMINUM WITH LOGO AND COMMUNITY TEXT ROUTED-OUT. LOGO COLOR AND "PATH" TEXT TO BE DIRECT PRINTED TO 1/8" BRUSHED ALUMINUM PANEL AND ATTACHED TO BACK OF SIGN PANEL USING 3M VHV DOUBLE-SIDED TAPE.

CUSTOM SIGN TEXT TO BE PROVIDED BY THE PATH FOUNDATION. TEXT FONT TO BE "INTERSTATE" AND DIRECT PRINTED TO BRUSHED ALUMINUM PANEL. ENTIRE SIGN PANEL TO BE OVER-COATED WITH AUTOCOAT BT LV650 ANTI-GRAFFITI CLEAR-COAT.

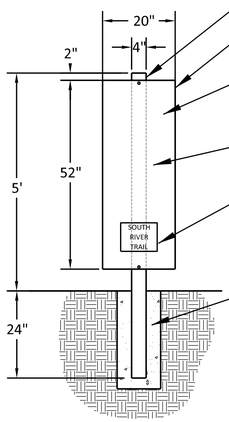
(3) 1.25" DIA. 5/8" THICK ALUMINUM WITH ANODIZED FINISH CAPS TO BE EPOXIED PERMANENTLY TO POST 5 1/2 " FROM TOP OF POST AND 25" O.C.

4"X4" ALUMINUM POST WITH SANDED FINISH CLEAR-COATED TO MATCH SIGN PANELS.

MIN. 12"X12" CONCRETE FOOTER

NOTES:
1. SIGN TO BE MANUFACTURED BY CAPITAL SIGNS 770-564-8582, ABOUT SIGNS 404-285-9331, HENRY GRAPHICS, INC. 770-932-3222 OR APPROVED EQUAL MANUFACTURER. CONTRACTOR TO PROVIDE SHOP DRAWINGS OF SIGNS TO SOUTH RIVER TO OBTAIN FINAL APPROVAL PRIOR TO FABRICATION.
1. SOUTH RIVER TO DETERMINE IN FIELD THE APPROPRIATE SIGN TO BE UTILIZED BASED ON FIELD CONDITIONS AND AVAILABLE SPACE FOR SIGNAGE.
2. ALL SIGNS SHALL BE LOCATED WITH 2'-0" CLEAR AREA FROM EDGE OF TRAILWAY TO OUTSIDE EDGE OF SIGN.

SOUTH RIVER TRAIL INFORMATION SIGN
Scale: N.T.S.



4"X4" ALUMINUM POST WITH SANDED FINISH CLEAR-COATED TO MATCH SIGN PANELS.

EACH REGULATORY SIGN TO CONTAIN TWO SIGN PANELS; EACH SIGN PANEL TO BE ATTACHED TO SIGNPOST USING (3) 1" LONG, 1/4 DIAMETER, STAINLESS STEEL #14A BUTTON HD TORX SECURITY METAL SCREW.

SIGN PANELS TO BE 1/4" BRUSHED ALUMINUM WITH ALL MUTCD REGULATORY SIGNAGE TO BE DIRECT PRINTED TO THE BRUSHED ALUMINUM PANEL. ENTIRE SIGN PANEL TO BE OVER-COATED WITH AUTOCOAT BT LV650 ANTI-GRAFFITI CLEAR-COAT.

MUTCD SIGNAGE SHOWN FOR EXAMPLE PURPOSES ONLY. REFER TO SIGN MATRIX FOR EACH SIGN PANEL'S LAYOUT.

LOGO SIGN PANELS TO BE ATTACHED 1" BELOW REGULATORY SIGN PANEL ON EACH SIDE OF POST (6" ABOVE FINISHED GRADE). LOGO AND TEXT TO BE DIRECT PRINTED TO THE 1/4" BRUSHED ALUMINUM PANEL AND OVER-COATED WITH AUTOCOAT BT LV650 ANTI-GRAFFITI CLEAR-COAT. DISTANCE AND COMMUNITY INFORMATION TO BE INCORPORATED BELOW LOGO; LAYOUT TO BE APPROVED BY PATH FOUNDATION PRIOR TO FABRICATION OF SIGN PANELS.

MIN. 12"X12" CONCRETE FOOTER

NOTES:
1. SIGN TO BE MANUFACTURED BY CAPITAL SIGNS 770-564-8582 OR APPROVED EQUAL MANUFACTURER. CONTRACTOR TO PROVIDE SHOP DRAWINGS OF SIGNS TO PATH FOUNDATION TO OBTAIN FINAL APPROVAL PRIOR TO FABRICATION.
2. PATH FOUNDATION TO DETERMINE IN FIELD THE APPROPRIATE SIGN TO BE UTILIZED BASED ON FIELD CONDITIONS AND AVAILABLE SPACE FOR SIGNAGE.
3. ALL SIGNS SHALL BE LOCATED WITH 2'-0" CLEAR AREA FROM EDGE OF TRAILWAY TO OUTSIDE EDGE OF SIGN.

TRAIL REGULATORY SIGN
Scale: N.T.S.

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

REVISION DATES
04/16/19

DEKALB COUNTY & PATH FOUNDATION

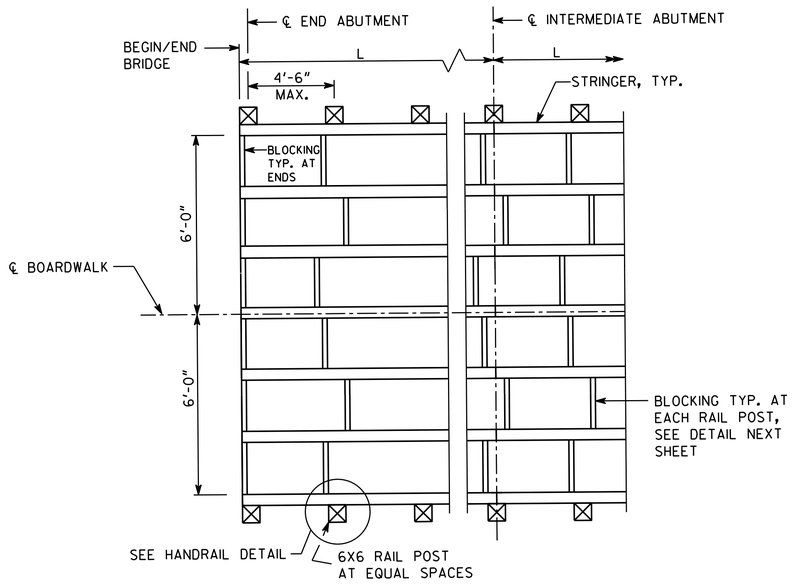
SIGNING AND MARKING PLANS

SOUTH RIVER TRAIL, PHASE 5

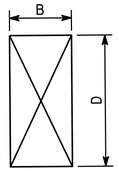
CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 26-0025

7/31/2015 GPLN



PLAN



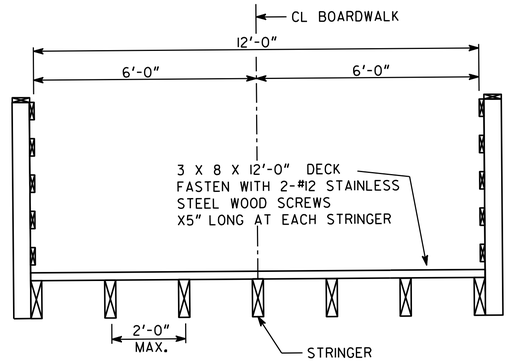
B= NOMINAL STRINGER WIDTH
D= NOMINAL STRINGER DEPTH

STRINGER

STRINGER SELECTION TABLE

NOMINAL STRINGER SIZE (IN) (B X D)	DENSE NO. 1 SOUTHERN PINE				
	MAXIMUM SPAN, L*	MINIMUM BEARING LENGTH (IN)	BLOCKING SIZE (IN)	MINIMUM INTERMEDIATE BENT CAP SIZE (IN)	F_b (NORMAL DURATION) (PSI)
4 X 14	10'-0"	3"	2 X 10	12 X 14	1150
4 X 16	12'-0"	4"	2 X 12	12 X 14	1150
** 5 X 15 1/8	18'-0"	3"	2 X 12	12 X 14	1030 CAP
** 5 X 16 1/2	20'-0"	3"	2 X 12	12 X 16	1030 CAP
** 5 X 17 7/8	24'-0"	3"	2 X 12	12 X 16	1030 CAP
** 5 X 19 1/4	26'-0"	3"	2 X 12	12 X 16	1030 CAP
** 5 X 20 5/8	30'-0"	3"	2 X 12	12 X 16	1030 CAP

* SIMPLE SPAN WITH "L" MEASURED CENTER-TO-CENTER OF BEARINGS. CRUVED SPAN LENGTH MEASURED AT ℄ BOARDWALK.
** ACTUAL FINISHED GLULAM DIMENSIONS, SEE GENERAL NOTE 16



TYPICAL SECTION

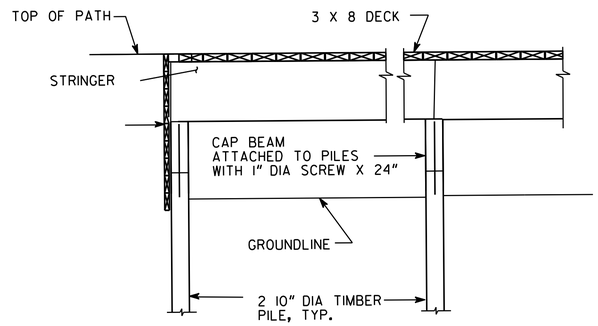
MINIMUM AND ESTIMATED TIMBER PILE TIP ELEVATIONS

BRIDGE 1	MINIMUM TIP EL	ESTIMATED TIP EL	DRIVING RESISTANCE (KIPS)
BENT 1	733	731	5
BENT 2	730	728	14
BENT 5	729	725	14
BENT 6	731	725	5
BRIDGE 2			
BENT 1	727	724	5
BENTS 2, 3, & 4	723	721	14
BENTS 7 & 8	723	720	16 *
BENT 9	736	733	14
BENT 10	735	725	5

* PRE-DRILL PILES FOR BENTS 7 & 8 SPANNING SEWER LINE.

MINIMUM TIMBER PILE EMBEDMENT LENGTH

BOARDWALK 1	MINIMUM EMBEDMENT EMBEDMENT (FT)	DRIVING RESISTANCE (KIPS)
10' SPANS	24'	9
BOARDWALK 2		
12' AND 14' SPANS SOUTH	26'	14
30' SPAN	27'	16
14' SPANS NORTH	27'	14
BOARDWALK 3		
12' AND 14' SPANS	29'	14



ELEVATION

NOTE: HANDRAIL NOT SHOWN FOR CLARITY

GENERAL NOTES

1. THESE DRAWINGS ARE FOR LONGITUDINAL STRINGER/TRANSVERSE DECK TIMBER BRIDGES CONSTRUCTED OF SOUTHERN PINE. THE DESIGNS ARE APPLICABLE FOR 12'-0" WIDE BOARDWALKS WITH CENTER-TO-CENTER SPANS ACCORDING TO STRINGER SELECTION TABLE AND AS NOTED ON PLANS.
2. DESIGNS COMPLY WITH THE AMERICAN WOOD COUNCIL, NATIONAL DESIGN SPECIFICATIONS, (2009 EDITION), AND THE STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES (17TH EDITION, 2002), PUBLISHED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO).
3. BOARDWALKS ARE DESIGNED FOR THE FOLLOWING LOADS:
   VEHICLE: H5 TRUCK PEDESTRIAN: 90 PSF (NO REDUCTION)
   TOP DOWN CONSTRUCTION LOAD: 6600 LB MAXIMUM RUBBER TIRE OR CRAWLER MOUNTED PILE DRIVING CRANE, 14,000 LB MAXIMUM HAMMER AND LEAD WEIGHT AND 50 PSF MAXIMUM CONSTRUCTION LOAD. PROVIDE CRANE MATS TO SPREAD CRANE LOADS TO ALL STRINGERS AND TO PROTECT THE 3X8 TIMBER DECK.
4. IF TOP DOWN CONSTRUCTION LOADS EXCEED THOSE NOTED ABOVE IN NOTE 3, THE CONTRACTOR SHALL REDESIGN TOP DOWN CONSTRUCTED SPANS AT NO COST.
5. ALL LUMBER SHALL BE VISUALLY GRADED NO. 1 DENSE OR BETTER SOUTHERN PINE DIMENSION LUMBER OR TIMBERS AS SPECIFIED.
6. SAWN LUMBER STRINGERS SHALL HAVE THE FOLLOWING PROPERTIES:
   F_b = SEE STRINGER SELECTION TABLE
   Fv = 264 PSI
   E = 1,200,000 PSI
7. THE MAXIMUM THICKNESS OF DECK SHALL BE NO GREATER THAN 1/4 IN. LARGER THAN ITS NOMINAL THICKNESS.
8. VARIATION IN DEPTH BETWEEN STRINGERS SHALL NOT EXCEED 1/4 IN. SO AS TO PROVIDE A FLAT SURFACE ACROSS THE WIDTH OF THE BRIDGE TO ENSURE THE DECK HAS FIRM CONTACT WITH ALL STRINGERS.
9. ALL SOUTHERN PINE SAWN LUMBER, TIMBERS, PILES, AND GLUED LAMINATED BEAMS SHALL BE TREATED IN ACCORDANCE WITH THE REQUIREMENTS OF AWPA STANDARD U1-18 AND THE FOLLOWING USE CATEGORIES AND COMODITY SPECIFICATIONS:
   SAWN LUMBER AND TIMBERS - END BENTS: UC4C
   TIMBERS - INTERMEDIATE BENTS: UC4B

   SAWN LUMBER - STRINGERS: UC4B
   SAWN LUMBER - DECK: UC4B
   ROUND PILES: UC4C
   GLUED LAMINATED BEAMS: UC4B
10. TREATED WOOD SHALL BE INSPECTED AND CERTIFIED IN ACCORDANCE WITH AWPA STANDARD U1-18 - T1(A).
11. STEEL PLATES AND SHAPES SHALL COMPLY WITH THE REQUIREMENTS OF ASTM A36 OR MANUFACTURER'S REQUIREMENTS.
12. BOLTS AND LAG SCREWS SHALL COMPLY WITH THE REQUIREMENTS OF ANSI/ASME STANDARD B18.2.1-1981, GRADE 2.
13. WASHERS SHALL BE PROVIDED UNDER BOLT AND LAG SCREW HEADS AND NUTS THAT ARE IN CONTACT WITH WOOD.
14. ALL STEEL CONNECTIONS AND FASTENERS SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M111, AASHTO M232 OR ASTM A709 GRADE 36.
15. THE COST OF ALL CONNECTIONS FOR TIMBER AND GLUED LAMINATED ITEMS SHALL BE INCLUDED IN PRICE BID FOR EACH BOARDWALK. SEE 38-0004 FOR BOARDWALK QUANTITIES.
16. PILES SHALL BE INSTALLED IN ACCORDANCE WITH SECTION 520 OF GDOT STANDARD SPECIFICATIONS AND DRIVEN TO THE NOTED DRIVING RESISTANCE ON THIS DRAWING. DRIVING RESISTANCE SHALL BE VERIFIED BY A REGISTERED GEOTECHNICAL ENGINEER.
17. GLULAM STRINGERS SHALL HAVE THE FOLLOWING MINIMUM PROPERTIES:
   STRESS CLASS: 16F-V3 D/F HORIZONTAL LAMINATIONS
   ALLOWABLE BENDING STRESS = 1600PSI
   ALLOWABLE SHEAR STRESS 265 PSI
   E = 1,500,000 PSI
18. PRE-DRILLING OF TIMBER PILES MAY BE REQUIRED TO ACHIEVE MINIMUM TIP ELEVATIONS. USE 8" MAXIMUM DIAMETER PRE-DRILL HOLES. NO SEPARATE PAYMENT WILL BE MADE IF CONTRACTOR CHOOSES TO USE PRE-DRILLING.
19. MINIMUM TIMBER PILE PROPERTIES:
   SOUTHERN PINE
   F_v = 2400 PSI
   F_c = 110 PSI
   F = 1200 PSI PARALLEL WITH GRAIN
   E = 1,500,000 PSI
20. ALL DECK AND HANDRAIL FASTENERS SHALL BE STAINLESS STEEL.

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 2 4 8

SCALE: 1/2" = 1'-0"

REVISION DATES		
04/16/19		

DEKALB COUNTY & PATH FOUNDATION

OFFICE:

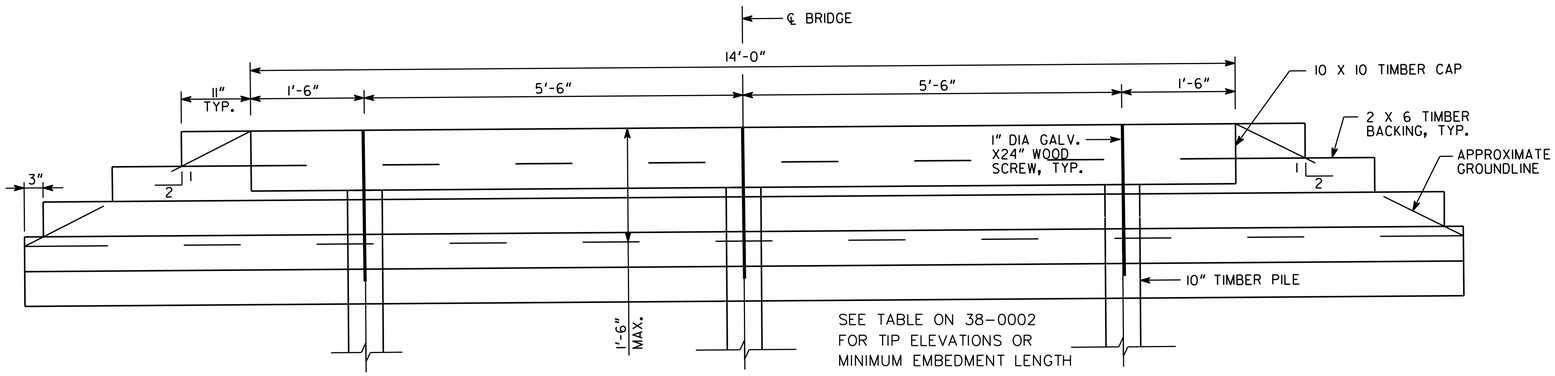
BOARDWALK DETAILS 1

South River Trail, Phase 5

DRAWING No. 38-0002

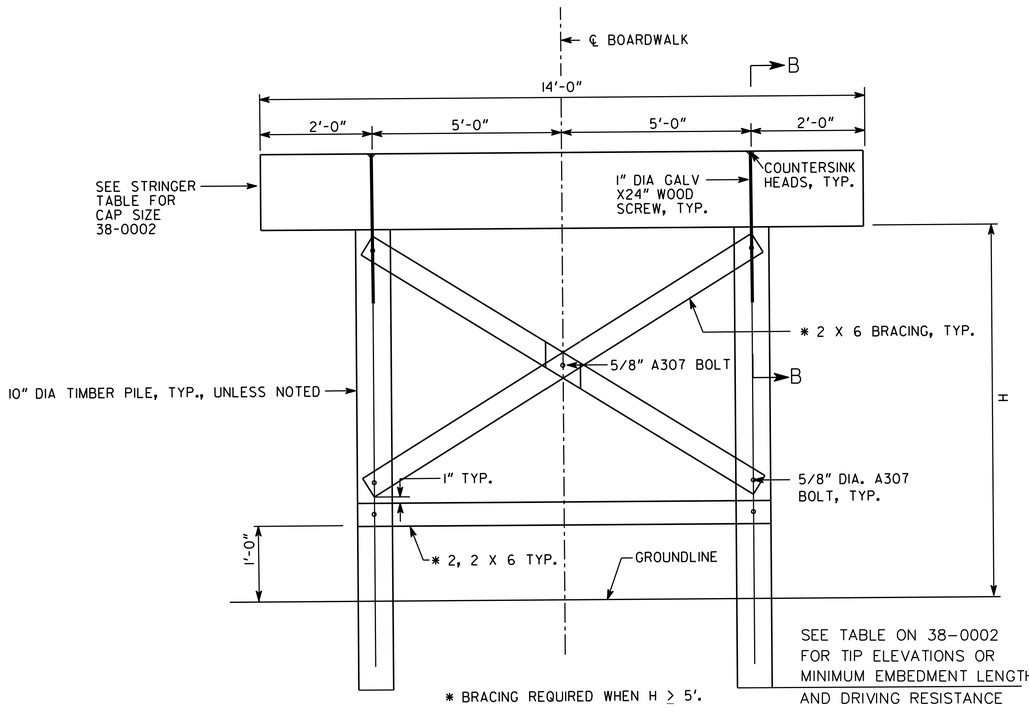
11/30/2011 GR320E

DATE$$$	TIME$$$	$PRFB$	DGN	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
$USER$		$$PENTABLE$$		GA	----------	-----	----



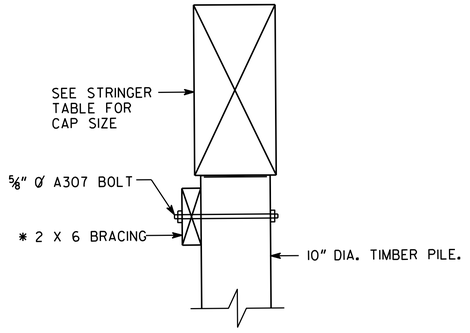
END BENT ELEVATION

NOT TO SCALE



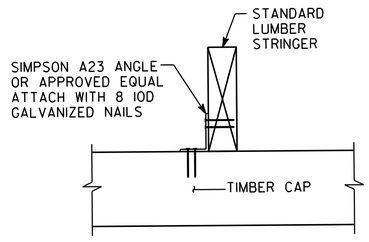
TIMBER INTERMEDIATE BENT ELEVATION

SCALE: 1" = 1'-0"



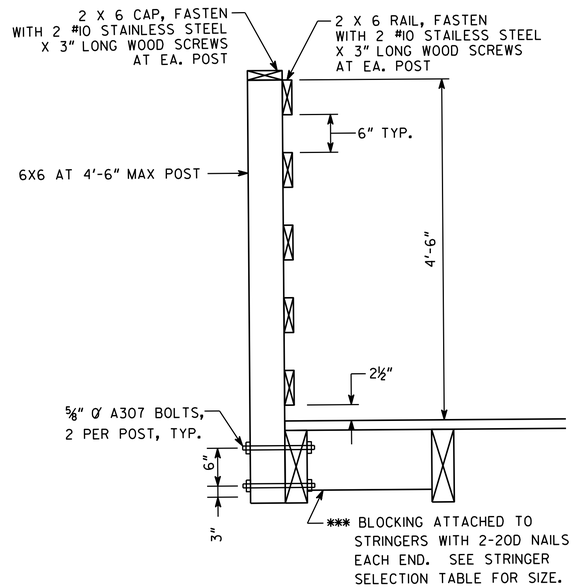
SECTION B-B

SCALE: 1" = 1'-0"



TYPICAL BEARING DETAIL

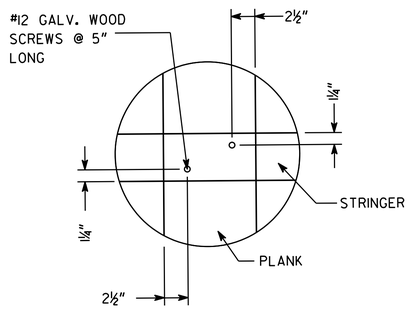
NO SCALE



HANDRAIL DETAIL

NO SCALE

*** ADD ADDITIONAL BLOCKING IN EXTERIOR BAYS WITHIN 6" OF HANDRAIL POST LOCATIONS. LOCATION OF BLOCKING AT 1/3 POINTS MAY BE ADJUSTED TO AVOID POST CONNECTIONS.



PLANK ATTACHMENT DETAIL

NO SCALE

		Heath & Lineback Engineers INCORPORATED 2390 CANTON ROAD, BUILDING 200 MARIETTA, GEORGIA 30066-5393 (770)424-1668

SCALE IN FEET: 0 2 4 8

SCALE: ½" = 1'-0"

REVISION DATES
04/16/19

DEKALB COUNTY & PATH FOUNDATION

OFFICE:

BOARDWALK DETAILS 3

South River Trail, Phase 5

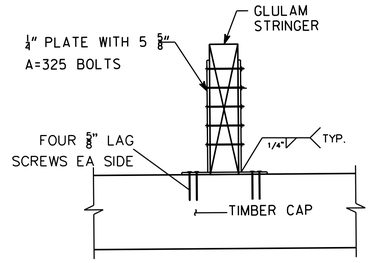
DRAWING No. 38-0003

11/30/2011 GR320E

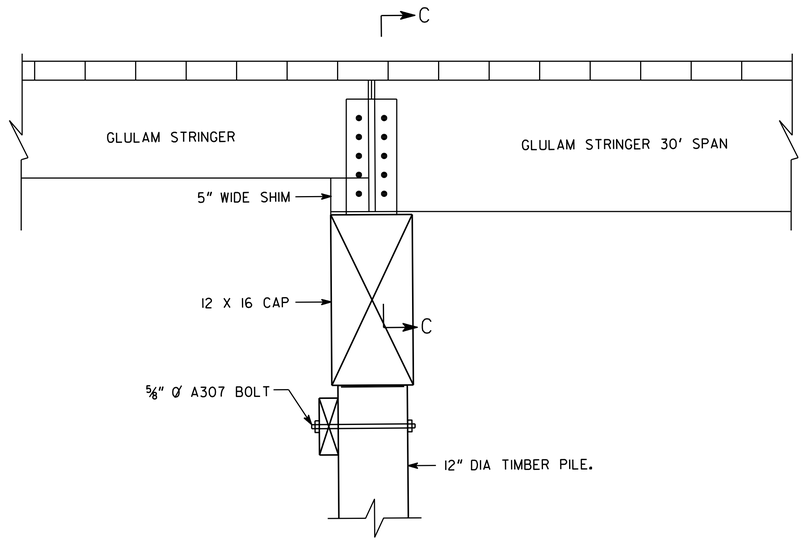
ITEM NO.	DESCRIPTION	APPROX QTY	UNITS
502-1200	BOARDWALK (BRIDGE TIMBER, TREATED)	1096	LF
502-1500	BOARDWALK (BRIDGE TIMBER, GLUED LAMINATED TREATED)	711	LF

NOTE:
502-1200 BOARDWALK (BRIDGE TIMBER, TREATED) LF, REFERS TO 4X14 AND 4X16 STRINGER SPANS NOTED IN THE STRINGER SELECTION TABLE ON 38-0002. PRICE BID PER LF SHALL INCLUDE ALL ITEMS NECESSSARY TO CONSTRUCT BOARDWALK COMPLETE IN ACCORDANCE WITH THE DETAILS AND NOTES ON 38-0002, 38-0003, AND38-0004.

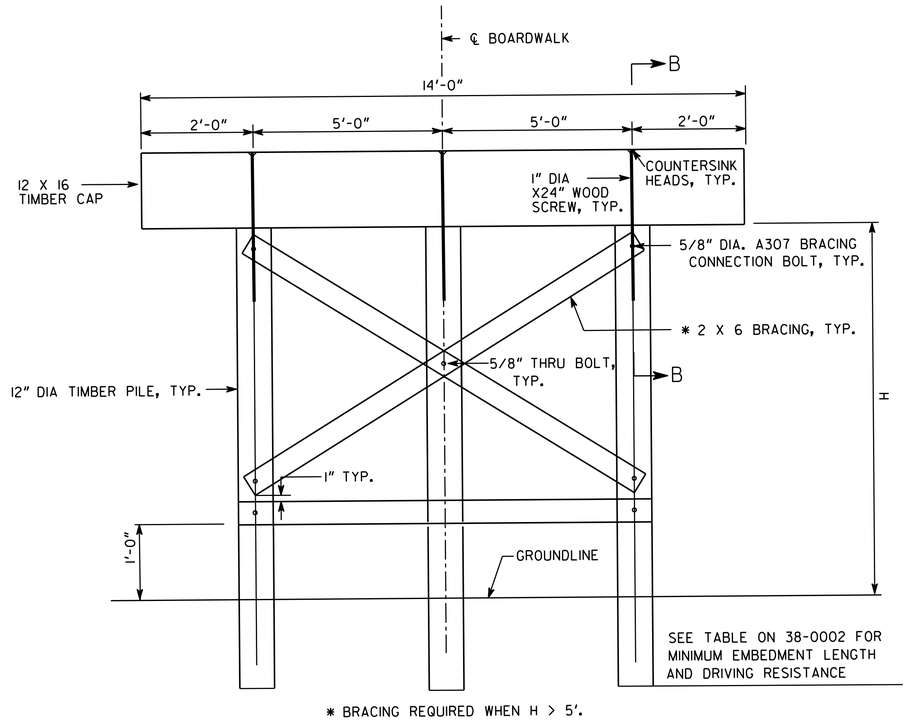
502-1500 BOARDWALK (BRIDGE TIMBER GLUED LAMINATED TREATED) LF, REFERS TO GLUED LAMINATED SPANS NOTED IN THE STRINGER SELECTION TABLE ON 38-0002. PRICE BID PER LF SHALL INCLUDE ALL ITEMS NECESSSARY TO CONSTRUCT BOARDWALK COMPLETE IN ACCORDANCE WITH THE DETAILS AND NOTES ON 38-0002, 38-0003, AND38-0004.



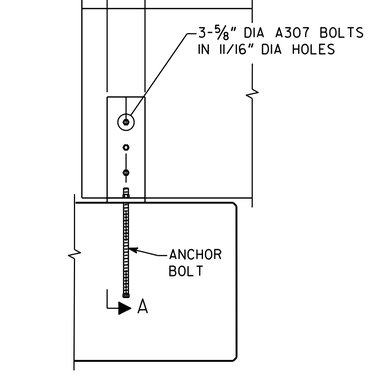
SECTION C-C
SCALE 1 1/2" = 1'-0"



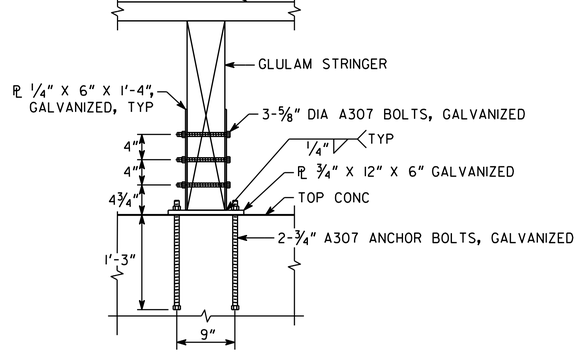
SECTION B-B
SCALE: 1 1/2" = 1'-0"



BOARDWALK 2 30' TIMBER SPAN (INTERMEDIATE BENTS 21 AND 22)
SCALE: 1" = 1'-0"



TYPICAL GLULAM BEAM BEARING AT CONCRETE BENT
2" = 1'-0"



SECTION A-A
2" = 1'-0"

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 2 4 8

SCALE: ½" = 1'-0"

REVISION DATES
04/16/19

DEKALB COUNTY & PATH FOUNDATION

OFFICE:

BOARDWALK DETAILS 3

South River Trail, Phase 5

DRAWING No. 38-0004

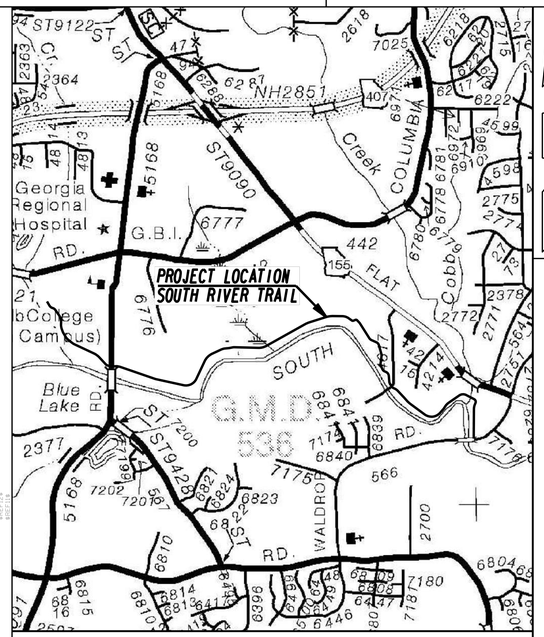
DATE$$$ | $PRF8$ | DGN | Project No.
$USER$ | | GRWCOV | 0009029

DEKALB COUNTY & PATH FOUNDATION

EROSION, SEDIMENT, & POLLUTION CONTROL PLAN

SOUTH RIVER TRAIL, PHASE 5

FEDERAL AID PROJECT



LOCATION SKETCH

"I certify that this Erosion, Sedimentation and Pollution Control Plan has been prepared in accordance with Part IV, of the General NPDES Permit No. GARI00002."

"I certify that the permittee's Erosion, Sedimentation and Pollution Control Plan provides for an appropriate and comprehensive system of best management practices required by the Georgia Water Quality Control Act and the document "Manual for Erosion and Sediment Control in Georgia" (Manual) published by the State Soil and Water Conservation Commission as of January 1 of the year in which the land disturbing activity was permitted, provides for sampling of the receiving water(s) or the sampling of the storm water outfalls and that the designed system of best management practices and sampling methods is expected to meet the requirements contained in the General NPDES Permit No. GARI00002."

"I certify that the permittee's Erosion, Sedimentation and Pollution Control Plan provides for the monitoring of: (a) all perennial and intermittent streams and other water bodies shown on the USGS topographic map and all other field verified perennial and intermittent streams and other water bodies, or (b) where any such specific identified perennial or intermittent stream and other water body is not proposed to be sampled, I have determined in my professional judgment, utilizing the factors required in the General NPDES Permit No. GARI00002, that the increase in the turbidity of each specific identified sampled receiving water will be representative of the increase in the turbidity of a specific identified un-sampled receiving water."

"I certify under penalty of law that this plan was prepared after a site visit to the location described herein by myself or my authorized agent, under my direct supervision."

MARK W. HOLMBERG, PE

BEGIN PROJECT
BEGIN CONSTRUCTION
SOUTH RIVER TRAIL
STA 10+11.00
N = 1341591.5549
E = 2263154.0625
LAT 33.68806°
LONG 84.27657°

FEDERAL ROUTE # N/A
STATE ROUTE # N/A
P.I. NO. 0009029

PROJECT MIDPOINT
STA 68+63.00
N = 1340959.0359
E = 2267880.7361
LAT 33.68639°
LONG 84.26103°

END PROJECT
STA 127+14.50
END CONSTRUCTION
SOUTH RIVER TRAIL
N = 1338903.5297
E = 2271534.8634
LAT 33.68074°
LONG 84.24901°

BEGIN BOARDWALK STA 30+85.00
END BOARDWALK STA 41+45.00
END BOARDWALK STA 65+88.00
END BRIDGE BEGIN BOARDWALK STA 65+59.42
BEGIN BOARDWALK STA 64+80.00
BEGIN BOARDWALK STA 79+71.00
BEGIN SPECIAL DESIGN BOARDWALK STA 82+59.00
END SPECIAL DESIGN BOARDWALK STA 82+89.00
END BOARDWALK STA 83+73.00
BEGIN BOARDWALK STA 98+05.00
END BOARDWALK STA 99+70.00
BEGIN BOARDWALK STA 117+63.84
END BOARDWALK BEGIN BRIDGE STA 118+19.84
END BRIDGE BEGIN BOARDWALK STA 118+19.85
END BOARDWALK STA 119+84.84

ESA - WETLAND 2
ESA - WETLAND 4
ESA - 75' STREAM BUFFER
ESA - 25' STREAM BUFFER
ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLR IN THE GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS

DOUTTIE CREEK (PS 1)
SOUTH RIVER (PS 3)
PANTERSVILLE RD
SOUTH RIVER
WARRIORS PATH
SHOAL CREEK (PS 7)
WALDROP RD

01 02 03 04 05 06 06A 07 07A 07B 08 09 10 11 12 13 14 15 16 17

SCALE IN FEET
0 500 1000 2000

GSWCC GEORGIA SOIL AND WATER CONSERVATION COMMISSION
Mark W. Holmberg
Level II Certified Design Professional
CERTIFICATION NUMBER 0000037396
ISSUED 02/22/2019 EXPIRES 02/22/2022

PRIMARY PERMITTEE

PRIMARY PERMITEE:
PATH FOUNDATION
PO BOX 14327
ATLANTA, GA 30324
PHONE: (404) 875-7284

NOI REQUIRED

DISTURBED AREA: 10.45 ACRES

GEORGIA REGISTERED No. 15762 PROFESSIONAL ENGINEER MARK WILLIAM HOLMBERG
03/14/2019

PLANS PREPARED BY:

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

24 HOUR CONTACT:

JONATHAN McCAIG
Name

1601 WEST PEACHTREE
Street Address

ATLANTA, GA 30324
City, State Zip

404-433-1900
Phone Number

JONATHAN@PATHFOUNDATION.ORG
Email Address

Contractor shall complete the information in this box.

LENGTH OF PROJECT	COUNTY No. 089
	MILES
NET LENGTH OF ROADWAY	2.217
NET LENGTH OF BRIDGES	0.028
NET LENGTH OF PROJECT	2.217
NET LENGTH OF EXCEPTIONS	0.000
GROSS LENGTH OF PROJECT	2.217

PLANS COMPLETED 01/30/2019

REVISIONS

DATE	ENTITY REQUESTING REVISION(S)	DRAWING NUMBER(S)	SIGNATURE	GSWCC LEVEL II CERT.#
03-14-2019	GA EDP	50-0001, 51-0002-51-0004, 54-0001-54-0072, 55-0001	MARK W HOLMBERG, PE	0000037396
- -				
- -				
- -				
- -				
- -				
- -				
- -				
- -				

DRAWING No. 50-0001

PETROLEUM STORAGE, SPILLS, AND LEAKS

These plans expressly delegate the responsibility of proper on-site hazardous material management to the Contractor. The Contractor shall at a minimum provide an action plan and keep the necessary materials on site for the capture, clean up, and disposal of any petroleum product, or other hazardous material, leaks or spills associated with the servicing, refueling or operation of any equipment utilized at the site. A copy of the action plan shall be submitted to the Project Engineer and maintained on the project site. All personnel operating or servicing equipment shall be familiar with the action plan. The Contractor shall not park, refuel, or maintain equipment within stream buffers.

If the Contractor elects to store petroleum products on site, the Contractor shall prepare an ESPCP addendum that addresses the additional BMPs needed for onsite storage and spill prevention for petroleum products. This plan shall be prepared by a Certified Design Professional as required by GAR100002 for inclusion with these plans. The Contractor's attention is specifically directed to Standard Specification 107-Legal Regulations and Responsibility to the public for additional requirements.

POSTCONSTRUCTION BMP'S FOR STORMWATER MANAGEMENT

All permanent postconstruction BMP's are shown in the construction plans and in the ESPCP plan. The postconstruction BMP's for this project consist of vegetation, permanent slope drains and/or flumes, riprap at pipe outlets for velocity dissipation and outlet stabilization, vegetated swales/ditches where practical, and riprap where necessary. The postconstruction BMP's will provide permanent stabilization of the site and prevent abnormal transportation of sediment and pollutants into receiving waters.

SILT FENCE INSTALLATIONS WITH J HOOKS AND SPURS

Silt fence should never be run continuously. The silt fence should turn back into the fill or slope to create small pockets that trap silt and force stormwater to flow through the silt fence. This technique is called using J hooks (or spurs). The J hooks shall be utilized on all silt fences that are located around the perimeter of the project and along the toe of embankments or slopes. The J hooks shall be spaced in accordance with GDOT Construction Detail D-24C. The maximum J hook spacing is reached when the top of the J hook is at the same elevation as the bottom of the immediately upgradient J hook. J Hooks shall be paid for as silt fence items per linear foot. All costs and other incidental items are included in cost of installing and maintaining silt fence.

SITE STABILIZATION AND BMP MAINTENANCE MEASURES

See the Department's Standard Specifications (or Special Provisions) 161, 163, 165, 700, 711, and other contract documents for stabilization and maintenance measures.

WASTE DISPOSAL

Where attainable, locate waste collection areas, dumpsters, trash cans and portable toilets at least 50 feet away from streets, gutters, watercourses and storm drains. Secondary containment shall be provided around liquid waste collection areas to minimize the likelihood of contaminated discharges. The Contractor shall comply with applicable state and local waste storage and disposal regulations and obtain all necessary permits. **Waste materials shall not be discharged to waters of the State, except as authorized by a section 404 permit.**

NONSTORMWATER DISCHARGES

Nonstormwater discharges defined in Part III.A.2 of the NPDES Permit will be identified after construction has commenced. These discharges shall be subject to the same requirements as storm water discharges required by the Georgia Erosion and Sedimentation Control Act, the NPDES Permit, the Clean Water Act, the Manual for Erosion and Sediment Control in Georgia, Department Standards, and other contract documents. The NPDES does not authorize the discharge of soaps or solvents used in vehicle and equipment washing or the discharge of wastewater containing stucco, paint, oils, curing compounds, and other construction materials.

INSPECTIONS AND REPORTING

As the primary permittee, the Department must retain the design professional who prepared the ESPCP, or an alternative design professional approved by EPD in writing, to inspect the installation of the initial sediment storage requirements and perimeter control BMPs within 7 days of installation over the entire infrastructure project. Alternatively, for linear infrastructure projects, the permittee must retain either of these personnel to inspect the initial sediment storage requirements and perimeter control BMPs for the initial segment, as defined by Part IV.A.5. of the current GAR100002 Permit, within 7 days of installation and all sediment basins within the entire linear infrastructure project within 7 days of installation. The inspecting design professional shall report the results to the primary permittee within 7 days, and the permittee must correct all deficiencies within 2 business days of receipt of the inspection report, unless on-site weather conditions are such that more time is required. Additionally, the Department's Construction Project Engineer will be responsible for all subsequent 7 day inspections for all new BMP installations.

All other inspections shall be documented on the appropriate Department inspection forms. See Standard Specification (or Special Provision) 167 and other contract documents for inspection and reporting requirements. These inspections shall continue until the Notice of Termination (NOT) is submitted.

Whenever the Department finds that a BMP has failed or is deficient beyond routine maintenance and has resulted in sediment deposition into waters of the State, the Contractor shall take reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events. When the repair does not require a new or replacement BMP or significant repair, the BMP failure or deficiency must be corrected by the close of the next business day from the time of discovery. A repair requiring a new or replacement BMP or significant repair must be operational by no later than 7 days from the time of discovery. If the repair time within 7 days is infeasible, the Contractor and the Department shall schedule the BMP repair to be operational as soon as practical after the 7 day time frame.

Failure to perform inspections as required by the contract documents and the NPDES permit shall result in the cessation of all construction activities with the exception of Traffic Control and Erosion Control. Continued failure to perform inspections shall result in non-refundable deductions as specified in the contract documents.

DEWATERING AND PUMPING ACTIVITIES

Any pumped discharge from an excavation or disturbed area shall be routed through an appropriately sized sediment basin, silt filter bag, or shall be treated equivalently with suitable BMP's. The contractor shall ensure the post BMP treated discharge is sheet flowing. Failure to create sheet flow will obligate the contractor to perform water quality sampling of pumped discharges. The contractor shall prepare sampling plans in accordance with the current GAR100002 NPDES permit by utilizing a Certified Design Professional. No separate payment will be made for water quality sampling of pump discharges.

OTHER CONTROLS

The Contractor shall follow this ESPCP and ensure and demonstrate compliance with all applicable State and/or local regulations for waste disposal, sanitary sewer and septic system, and petroleum storage.

The Contractor shall control dust from the site in accordance with Section 161 of the current edition of the Department's Standard Specifications.

RETENTION OF RECORDS

The Department will retain all records related to the implementation of this ESPCP in accordance with Part IV.F of the General Permit GAR100002.

SEDIMENT STORAGE

The site has a total disturbed area of 10.45 acres.

The following table summarizes the required and available sediment storage for every outfall on this project. The Contractor shall provide and maintain the storage volumes for the BMP's specified in this table.

Location Number	Total Drainage Area (acres)	Disturbed Area (Acres)	Required Sediment Storage Volume (CY)	Total Storage Volume Provided (CY)	Diversion	Silt Fence	
					No. of Acres Diverted	Linear Feet	Total Volume (CY)
1	23.54	0.07	10.0	34.7	23.39	207	34.7
2	1.53	0.20	14.1	100.2	1.32	598	100.2
3	0.43	0.08	4.7	28.6	0.36	171	28.6
4	0.75	0.15	10.1	60.8	0.60	363	60.8
5	34.52	1.62	274.7	500.8	30.42	2990	500.8
6	0.69	0.37	46.2	166.7	0.00	995	166.7
SF1	0.20	0.20	13.4	151.8	0.00	906	151.8
SF2	0.84	0.45	56.3	203.5	0.00	1215	203.5
SF3	0.42	0.42	28.1	229.3	0.00	1369	229.3
SF4	0.54	0.34	36.2	187.1	0.00	1117	187.1
SF5	1.72	0.83	115.2	439.2	0.00	2622	439.2
SF6	3.03	1.60	203.0	733.3	0.00	4378	733.3
SF7	11.04	1.49	93.8	611.4	9.64	3650	611.4
SF8	3.16	1.56	211.7	759.4	0.00	4534	759.4
SF9	1.04	0.29	69.7	104.5	0.00	624	104.5
SF10	2.04	0.78	136.7	362.1	0.00	2162	362.1
TOTAL DISTURBED AREA (AC) =		10.45					

TEMPORARY SEDIMENT BASINS:

Outfalls 1-6:
Sediment basins are not used at this location.
The disturbance activities consist of clearing & grubbing and general roadway construction. Land disturbance activities associated with constructing and removing sediment basins at this outfall location would cause additional adverse impacts. BMP's as shown in the erosion control plans are adequate to control sediment runoff from the disturbed areas of the project.

SF1-SF10:
Sediment basins are not used at this location.
The disturbance activities consist of clearing & grubbing and general roadway construction. Land disturbance activities associated with constructing and removing sediment basins at this outfall location would cause additional adverse impacts. BMP's as shown in the erosion control plans are adequate to control sediment runoff from the disturbed areas of the project.

USE OF ALTERNATIVE AND/OR ADDITIONAL BMPS

No alternative or additional BMP's will be used on this project.

DISCHARGES INTO OR WITHIN ONE LINEAR MILE UPSTREAM OF AND WITHIN THE SAME WATERSHED AS ANY PORTION OF A BIOTA IMPAIRED STREAM SEGMENT

The following is a summary of project outfalls within 1 mile and within the watershed of an identified impaired stream segment that has been listed for criteria violated, "Bio F" (impaired fish community) and/or "Bio M" (impaired macro invertebrate community), within Category 4a, 4b or 5, and the potential cause is either "NP" (nonpoint source) or "UR" (urban runoff).

Outfall ID # and Location	Reach Name	Location of the Impaired Stream Segment as Indicated in the 305b/303d List	Criterie Violated (Bio F or Bio M)	Potential Cause (NP or UR)	Cateogry (4a, 4b, or 5)	Numeric waste load allocation (WLA) for sediment
OUTFALL 1, STA 10+56, 51.24' RT	DOOLITTLE CREEK	Headw aters to South River	Bio F	N/A	4a	N/A
OUTFALL 2, STA 12+16, 19.72' RT	SOUTH RIVER	Atlanta to Flakes Mill Road	Bio M, Bio F	N/A	4a, 5	N/A
OUTFALL 3, STA 12+86, 18.96' RT	SOUTH RIVER	Atlanta to Flakes Mill Road	Bio M, Bio F	N/A	4a, 5	N/A
OUTFALL 4, STA 13+98, 19.76' RT	SOUTH RIVER	Atlanta to Flakes Mill Road	Bio M, Bio F	N/A	4a, 5	N/A
OUTFALL 5, STA 24+33, 13.56' RT	SOUTH RIVER	Atlanta to Flakes Mill Road	Bio M, Bio F	N/A	4a, 5	N/A
OUTFALL 6, STA 51+31, 18.97' RT	SOUTH RIVER	Atlanta to Flakes Mill Road	Bio M, Bio F	N/A	4a, 5	N/A

The TMDL for Ocmulgee River Basin w as completed in January 2007 w ithout a sediment WLA for future construction projects. Future construction projects are required to follow the General Storm Water Permit.

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION
GENERAL NOTES
ESPCP GENERAL NOTES
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 51-0002

READY MIX CHUTE WASH DOWN

The washing of ready-mix concrete drums and dump truck bodies used in the delivery of Portland cement concrete is prohibited on this site.

In accordance with Standard Specification 107: Legal Regulations and Responsibility to the Public, only the discharge chute utilized in the delivery of Portland cement concrete may be rinsed free of fresh concrete remains. The Contractor shall excavate a pit outside of State water buffers, at least 25 feet from any storm drain and outside of the travelled way, including shoulders, for a wash-down pit. The pit shall be large enough to store all wash-down water without overtopping. Immediately after the wash-down operations are completed and after the wash-down water has soaked into the ground, the pit shall be filled in, and the ground above it shall be graded to match the elevation of the surrounding areas. Alternate wash-down plans must be approved by the Project Engineer.

Wash-down plans describe procedures that prevent wash-down water from entering streams and rivers. Never dispose of wash-down water down a storm drain. Establish a wash-down pit that includes the following: (1) a location away from any storm drain, stream, or river, (2) access to the vehicle being used for wash down, (3) sufficient volume for wash-down water, and (4) permission to use the area for wash down.

On sites where permission or access to excavate a wash-down pit is unavailable, the Contractor may have to wash-down into a sealable 55-gallon drum or other suitable container and then transport the container to a proper disposal site. For additional information, refer to the Georgia Small Business Environmental Assistance Program's "A Guide for Ready Mix Chute/Hopper Wash-down".

STATE-WATER BUFFER IMPACTS

State-water buffers, as defined by O.C.G.A. 12-7-1, are impacted by this project.

Non-exempt activities shall not be conducted within the 25 or 50-foot undisturbed stream buffers as measured from the point of wrested vegetation or within 25-feet of the coastal marshland buffer as measured from the Jurisdictional Determination Line without first acquiring the necessary variances and permits.

The Contractor is not authorized to enter state-water buffers, except as described in the table below:

Name or Number of Stream or other State Water Type	Location of Stream or other State Water*			State Water Type (Warm/Cold Water)**	Buffer Variance Required? (Yes/No)
	Alignment	Begin Station and Offset	End Station and Offset		
SOUTH RIVER	SOUTH RIVER TRAIL	27+54.21.42' RT	30+37.24.06' RT	Warm	Y
SOUTH RIVER	SOUTH RIVER TRAIL	35+81.25.05' RT	40+25.29.13' RT	Warm	Y
SOUTH RIVER	SOUTH RIVER TRAIL	94+67.22.00' RT	95+39.22.00' RT	Warm	Y
SOUTH RIVER	SOUTH RIVER TRAIL	97+78.22.00' RT	99+36.22.00' RT	Warm	Y
Description of Impacts: Impacts associated with proposed trail construction and placement of rip rap and drainage structures.					

Unless noted otherwise, utility companies will be submitting the required permits/variances in conjunction with the impacts caused by their activities. If utility impacts are covered by the Department's state-water buffer variance, this shall be noted in the buffer-variance-required column.

* Warm water streams have a 25-foot minimum buffer as measured from the wrested vegetation. Cold Water streams have a 50-foot buffer as measured from the wrested vegetation.
**Locations are approximate, a detailed location of stream buffers and authorized work areas are shown on the individual BMP sheets

SAMPLING GENERAL NOTES

Representative sampling may be utilized on this project as explained here. The individual outfall drainage basins along the project corridor have been carefully evaluated and compared on the basis of four characteristics: the type of construction activity, the disturbed acreage, the average slope about the outfall, and the soil erosion index 0-10, 10 being the most erodible soil. The construction activity types are new road on fill, new road in cut, road widening, and maintenance/safety. The disturbed area classes are less than or equal to 1 acre, greater than 1 acre to less than 2 acres, and equal to or greater than 2 acres. The average outfall slope is mild if it is equal to or less than 0.03, and steep if it is greater than 0.03. The soil erosion index is low if it is less than or equal to 5 and high if it is greater than 5. After evaluation of these characteristics as presented in the project's drainage area map, hydrology and hydraulic studies, construction plans, geotechnical soil survey, and erosion sedimentation and pollution control plans, the Department has determined that the representative sampling scheme shown below is valid for the duration of the project. The table shows the groups of similar outfall drainage basins.

The increase in turbidity at the specified locations in the table below will be representative of the alternate outfall drainage basins when similar outfall drainage basins exist. Approved primary and alternate representative sampled features are identified in the table below.

Note: The Total site area is 12.48 acres.											Representative Sampling Scheme				
SAMPLING INFORMATION											OUTFALL CHARACTERISTICS				
Primary Sampled Feature	Location (Station and Offset)	Name of Receiving Water	Applicable Construction Stage for Sampling	Sampling Type (Outfall or Receiving water)	Drainage Area for Receiving Water (mi^2)	Upstream Disturbed Area (acres)	Warm or Cold Water Stream	Appendix B NTU Value (Outfall Sampling only)	Allowable NTU Increase (Receiving water sampling only)	Location Description	Construction Activity	Disturbed Area (acres)	Average Outfall Slope (Rise/Run)	Soil Erosion Index	Represented Outfall Drainage Basins
1	STA 10+56.03, 51.24' RT	Doolittle Creek	All	Outfall	7.0	0.07	Warm	100	N/A	Existing 42" CMP	Trail Construction	0.07	0.009	7	3,4,6
2	STA 12+16.00, 19.72' RT	South River	All	Outfall	82.3	0.20	Warm	300	N/A	Proposed 15" Pipe	Trail Construction	0.20	0.042	7	N/A
5	STA 24+25.68, 13.42' RT	South River	All	Outfall	82.3	1.62	Warm	300	N/A	Existing Ditch	Trail Construction	1.62	0.001	7	N/A

The primary sampled features specified should be used as the initial sampling locations. An alternate sampled feature may be used if additional sampling is required or to replace a primary sampled feature that is no longer located within the active phase of construction.

WATER QUALITY INSPECTING AND SAMPLING PROCEDURES

See Special Provision 167 and other contract documents for the inspecting and sampling procedures.

RIPRAP OUTLET PROTECTION

Location	Pipe Diameter Do (ft)	Q_{25} (ft^3/s)	V_{25} (ft/s)	Tailwater Condition (TW<0.5 Do TW>0.5 Do)	Width at Drainage Structure W1=3Do (ft)	Apron Length La (ft)	Downstream Width W2=Do+La (ft)	Average Stone Diameter d_{50} (ft)	Minimum Apron Thickness D (ft)	Riprap Type (Type 3 or Type 1)	Quantity (yd^2)
STA 12+16.00, 19.72' RT	1.25	4.70	8.53	TW<0.5 Do	3.75	8	9.25	0.30	0.50	Type 3	6
STA 12+85.84, 18.96' RT	1.25	2.06	3.32	TW<0.5 Do	3.75	8	9.25	0.30	0.50	Type 3	6
STA 13+98.08, 19.76' RT	1.25	3.36	4.25	TW<0.5 Do	3.75	8	9.25	0.30	0.50	Type 3	6

CHANNEL PROTECTION

All channels may be stabilized exclusively with permanent grassing.

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

GENERAL NOTES
ESPCP GENERAL NOTES

SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 51-0003

7/31/2015 GPLN

EROSION, SEDIMENTATION & POLLUTION CONTROL PLAN CHECKLIST
INFRASTRUCTURE CONSTRUCTION PROJECTS

SWCD : REGION 2

Project Name: SOUTH RIVER TRAIL, PHASE 5 Address: SOUTH RIVER TRAIL, PHASE 5

City/County: DEKALB COUNTY Date on Plans: 05-07-2018

Name&email of person filling out checklist: Mark Holmberg mholmberg@heath-lineback.com

TO BE SHOWN ON ES&PC PLAN

Plan Page #	Included Y/N		
51-0004	Y	1.	The applicable Erosion, Sedimentation and Pollution Control Plan Checklist established by the Commission as of January 1 of the year in which the land-disturbing activity was permitted. (The completed Checklist must be submitted with the ES&PC Plan or the Plan will not be reviewed)
50-0001	Y	2.	Level II certification number issued by the Commission, signature and seal of the certified design professional. (Signature, seal and Level II number must be on each sheet pertaining to ES&PC plan or the Plan will not be reviewed)
50-0001	Y	3.	The name and phone number of the 24-hour local contact responsible for erosion, sedimentation and pollution controls.
50-0001	Y	4.	Provide the name, address, email address, and phone number of primary permittee.
53-0001	Y	5.	Note total and disturbed acreage of the project or phase under construction.
50-0001	Y	6.	Provide the GPS locations of the Beginning and End of the Infrastructure project. Give the Latitude and Longitude in decimal degrees.
50-0001	Y	7.	Initial date of the Plan and the dates of any revisions made to the Plan including the entity who requested the revisions.
51-0001	Y	8.	Description of the nature of construction activity.
50-0001	Y	9.	Provide vicinity map showing site's relation to surrounding areas. Include designation of specific phase, if necessary.
55-0001	Y	10.	Identify the project receiving waters and describe all sensitive adjacent areas including streams, lakes, residential areas, wetlands, etc. which may be affected.
50-0001	Y	11.	Design professional's certification statement and signature that the site was visited prior to development of the ES&PC Plan as stated on Part IV page 21 of the permit.
50-0001	Y	12.	Design professional's certification statement and signature that the permittee's ES&PC Plan provides for an appropriate and comprehensive system of BMPs and sampling to meet permit requirements as stated on Part IV page 20 of the permit.*
50-0001	Y	13.	Design professional certification statement and signature that the permittee's ES&PC plan provides for representative sampling as stated on Part IV.D.6.c.(3) page 37 of permit as applicable.*
51-0002	Y	14.	Clearly note the statement that "The design professional who prepared the ES&PC Plan is to inspect the installation of the initial sediment storage requirements, perimeter control BMPs and sediment basins in accordance with part IV.A.5. within 7 days after installation." in accordance with Part IV.A.5. page 26 of the permit.*
51-0003	Y	15.	Clearly note the statement that "Non-exempt activities shall not be conducted within the 25 or 50-foot undisturbed stream buffers as measured from the point of wrested vegetation or within 25-feet of the coastal marshland buffer as measured from the Jurisdictional Determination Line without first acquiring the necessary variances and permits."
51-0003	Y	16.	Provide a description of any buffer encroachments and indicate whether a buffer variance is required.
51-0001	Y	17.	Clearly note the statement that "Amendments/revisions to the ES&PC Plan which have a significant effect on BMPs with a hydraulic component must be certified by the design professional."*
51-0002	Y	18.	Clearly note the statement that "Waste materials shall not be discharged to waters of the State, except as authorized by a section 404 permit."*
51-0001	Y	19.	Clearly note statement that "The escape of sediment from the site shall be prevented by the installation of erosion and sediment control measures and practices prior to land disturbing activities."
51-0001	Y	20.	Clearly note statement that "Erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source."
51-0001	Y	21.	Clearly note the statement "Any disturbed area left exposed for a period greater than 14 days shall be stabilized with mulch or temporary seeding."
51-0002	Y	22.	Any construction activity which discharges storm water into an Impaired Stream Segment, or within 1 linear mile upstream of and within the same watershed as, any portion of an Biota Impaired Stream Segment must comply with Part III. C. of the Permit. Include the completed Appendix 1 listing all the BMPs that will be used for those areas of the site which discharge to the Impaired Stream Segment.*
51-0002	Y	23.	If a TMDL Implementation Plan for sediment has been finalized for the Impaired Stream Segment (identified in item 22 above) at least six months prior to submittal of NOI, the ES&PC Plan must address any site-specific conditions or requirements included in the TMDL Implementation Plan.*
51-0003	Y	24.	BMPs for concrete washdown of tools, concrete mixer chutes, hoppers and the rear of the vehicles. Washout of the drum at the construction site is prohibited.*
51-0002	Y	25.	Provide BMPs for the remediation of all petroleum spills and leaks.
51-0002	Y	26.	Description of the measures that will be installed during the construction process to control pollutants in storm water that will occur after construction operations have been completed.*
51-ALL	Y	27.	Description of practices to provide cover for buiding materials and building products ons site.*
51-ALL	Y	28.	Description of the practices that will be used to reduce the pollutants in storm water discharges.*
51-0001	Y	29.	Description and chart or timeline of the intended sequence of major activities which disturb soils for the major portions of the site (i.e., initial perimeter and sediment storage BMPs, clearing and grubbing activities, excavation activities, utility activities, temporary and final stabilization).
51-0002	Y	30.	Provide complete requirements of Inspections and record keeping by the primary permittee.*
51-0003	Y	31.	Provide complete requirements of sampling frequency and reporting of sampling results.*
51-0002	Y	32.	Provide complete details for retention of records as per Part IV.F. of the permit.*
51-0003	Y	33.	Description of analytical methods to be used to collect and analyze the samples from each location.*
51-0003	Y	34.	Appendix B rationale for NTU values at all outfall sampling points where applicable.*
55-0001;51-0003	Y	35.	Delineate all sampling locations, perennial and intermittent streams and other water bodies into which storm water is discharged also provide a summary chart of the justification and analysis for the representative sampling as applicable.*
51-0001;54-ALL	Y	36.	A description of appropriate controls and measures that will be implemented at the construction site including; (1) initial sediment storage requirements and perimeter control BMPs, (2) intermediate grading and drainage BMPs, and (3) final BMPs. For construction sites where there will be no mass grading and the initial perimeter control BMPs, intermediate grading and drainage BMPs, and final BMPs are the same, the plan may combine all of the BMPs into a single phase.*
50-0001;53-0001 54-ALL;55-0001	Y	37.	Graphic scale and North arrow.
53-0001;55-0001	Y	38.	Existing and proposed contour lines with contour lines drawn at an interval in accordance with the following: Existing Contours — USGS 1": 2000' Topographical Sheets; Proposed Contours — 1" : 400' Centerline Profile
51-0002	N/A	39.	Use of alternative BMPs whose performance has been documented to be equivalent to or superior to conventional BMPs as certified by a Design Professional (unless disapproved by EPD or the Georgia Soil and Water Conservation Commission). Please refer to the Alternative BMP Guidance Document found at www.gaswcc.org.
51-0002	N/A	40.	Use of alternative BMP for application to the Equivalent BMP List. Please refer to Appendix A-2 of the Manual for Erosion & Sediment Control in Georgia 2016 Edition.*
53-0001; 54-ALL	Y	41.	Delineation of the applicable 25-foot or 50-foot undisturbed buffers adjacent to state waters and any additional buffers required by the Local Issuing Authority. Clearly note and delineate all areas of impact.
55-0001	Y	42.	Delineation of on-site wetlands and all State waters located on and within 200 feet of the project site.
53-0001	Y	43.	Delineation and acreage of contributing drainage basins on the project site.
53-0001	Y	44.	Delineate on-site drainage and off-site watersheds using USGS 1' :2000' topographical sheets.
53-0001	Y	45.	An estimate of the runoff coefficient or peak discharge flow of the site prior to and after construction activities are completed.
53-0001; 54-ALL	Y	46.	Storm-drain pipe and weir velocities with appropriate outlet protection to accommodate discharges without erosion. Identify/Delineate all storm water discharge points.
51-0001	Y	47.	Soil series for the project site and their delineation.
54-ALL	Y	48.	The limits of disturbance for each phase of construction.
51-0002	Y	49.	Provide a minimum of 67 cubic yards of sediment storage per acre drained using a temporary sediment basin, retrofitted detention pond, and/or excavated inlet sediment traps for each common drainage location. Sediment storage volume must be in place prior to and during all land disturbance activities until final stabilization of the site has been achieved. A written justfication explaining the decision to use equivalent controls when a sediment basin is not attainable must be included in the plan for each common drainage location in which a sediment basin is not provided. A written justification as to why 67 cubic yards of storage is not attainable must also be given. Worksheets from the Manual must be included for structural BMPs and all calculations used by the design professional to obtain the required sediment storage when using equivalent controls. When discharging from sediment basins and impoundments, permittees are required to utilize outlet structures that withdraw water from the surface, unless infeasible. If outlet structures that withdraw water from the surface are not feasable, a written justification explaining this decision must be included in the plan.
54-ALL	Y	50.	Location of Best Management Practices that are consistent with and no less stringent than the Manual for Erosion and Sediment Control in Georgia. Use uniform coding symbols from the Manual, Chapter 6, with legend.
52-ALL; 56-ALL	Y	51.	Provide detailed drawings for all structural practices. Specifications must, at a minimum, meet the guidelines set forth in the Manual for Erosion and Sediment Control in Georgia.
51-0001	Y	52.	Provide vegetative plan, noting all temporary and permanent vegetative practices. Include species, planting dates and seeding, fertilizer, lime and mulching rates. Vegetative plan shall be site specific for appropriate time of year that seeding will take place and for the appropriate geographic region of Georgia.

Effective January 1, 2019

*If using this checklist for a project that is less than 1 acre and not part of a common development but within 200 ft of a perennial stream the * checklist items would be N/A.

GSWCC

APPENDIX 1

THE ES&PC PLAN MUST INCLUDE AT LEAST FOUR (4) OF THE FOLLOWING BMPS FOR THOSE AREAS OF THE SITE WHICH DISCHARGE TO A IMPAIRED STREAM SEGMENT AND FOR SITES WHICH EPD HAS APPROVED IN WRITING A REQUEST TO DISTURB 50 ACRES OR MORE AT ANY ONE TIME.

Plan Page #	Included Y/N		
N/A	N	a.	During construction activities, double the width of the 25 foot undisturbed vegetated buffer along all State waters requiring a buffer and the 50 foot undisturbed vegetated buffer along all State waters classified as "trout streams" requiring a buffer. During construction activities, EPD will not grant variances to any suchbuffers that are increased in width.
N/A	N	b.	Increase all temporary sediment basins and retrofitted storm water management basins to provide sediment storage of at least 3600 cubic feet (134 cubic yards) per acre drained.
N/A	N	c.	Use baffles in all temporary sediment basins and retrofitted storm water management basins to at least double the conventional flow path length to the outlet structure.
N/A	Y	d.	A large sign (minimum 4 feet x 8 feet) must be on the site on the actual start date of construction visible from a public roadway identifying the construction site, the permittee(s), and the contact person(s) and telephone number(s) until a NOT has been submitted.
54-ALL	Y	e.	Use anionic polyacrylamide (PAM) and/or mulch to stabilize areas left disturbed for more than seven (7) calendar days in accordance with Part III. D.1. of the NPDES Permit.
N/A	N	f.	Conduct turbidity sampling after every rain event of 0.5 inch or greater within any 24 hour period, recognizing the exceptions specified in Part IV.D.6.d. of the NPDES Permits.
N/A	N	g.	Comply with the applicable end-of-pipe turbidity effluent limit, without the "BMP defense" as provided for in O.C.G.A. 12-7-6 (a)(1).
N/A	N	h.	Reduce the total planned site disturbance to less than 50% impervious surfaces (excluding any State-mandated buffer areas from such calculations). All calculations must be included on the plan.
N/A	N	i.	Limit the amount of disturbed area at any one time to no greater than 25 acres or 50% of the total planned site, whichever is less. All calculations must be included on the plan.
N/A	N	j.	Use "Dirt II" techniques available on the EPD website, www.gaepd.org (e.g., seep berms, sand filters, anionic PAM) to model and manage construction storm water runoff (including sheet flow). All calculations must be included on the Plan.
N/A	N	k.	Add appropriate organic soil amendments (e.g., compost) and conduct pre- and post-construction soil sampling to a depth of six (6) inches to document improved levels of soil carbon after final stabilization of the construction site.
N/A	N	l.	Use mulch filter berms, in addition to a silt fence, on the site perimeter wherever construction storm water (including sheet flow) may be discharged. Mulch filter berms cannot be placed in waterways or areas of concentrated flow.
54-ALL	Y	m.	Apply the appropriate Georgia Department of Transportation approved erosion control matting or blankets or bonded fiber matrix to all slopes steeper than 3:1. All graphical illustrations must be included on the Plan.
N/A	N	n.	Use appropriate erosion control matting or blankets instead of concrete in all construction storm water ditches and storm drainages designed for a 25 year, 24 hour rainfall event.
N/A	N	o.	Use anionic PAM under a passive dosing method (e.g., flocculant blocks) within construction storm water ditches and storm drainages that feed into temporary sediment basins and retrofitted management basins.
N/A	N	p.	Install sod for a minimum 20 foot width (in lieu of seeding) after final grade has been achieved, along the site perimeter wherever storm water (including sheet flow) may be discharged.
N/A	N	q.	Conduct soil tests to identify and to implement site-specific fertilizer needs.
51-0002	Y	r.	Certified personnel for primary permittees shall conduct inspections at least twice every seven (7) calendar days and within 24 hours of the end of the storm that is 0.5 inches rainfall or greater in accordance with Part IV.D.4.a.(3).(a) - (c); secondary permittees, Part IV.D.4.b.(3).(a) - (c); and tertiary permittees Part IV.D.4.c.(3).(a) - (c). *
N/A	N	s.	Apply the appropriate compost blankets (minimum depth 1.5 inches) to protect soil surfaces until vegetation is established during the final stabilization phase of the construction activity.
N/A	N	t.	Use alternative BMPs whose performance has been documented to be superior to conventional BMPs as certified by aDesign Professional (unless disapproved by EPD or the State Soil and Water Conservation Commission). (If using this item please refer to the Alternative BMP guidance document found at www.gaswcc.georgia.gov)
N/A	N	u.	Limit the total planned site disturbance to less than 15% impervious surfaces (excluding any state mandated buffer areas from such calculations). All calculations must be included in the plan.

Effective January 1, 2019

*This requirement is different for infrastructure projects.
Certified personnel for primary permittees shall conduct inspections at least once every seven (7) calendar days and within 24 hours of the end of the storm that is 0.5 inches rainfall or greater in accordance with Part IV.D.4.a.(3).(a) ◇ (c) of this permit.

GSWCC

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

REVISION DATES
03/14/19

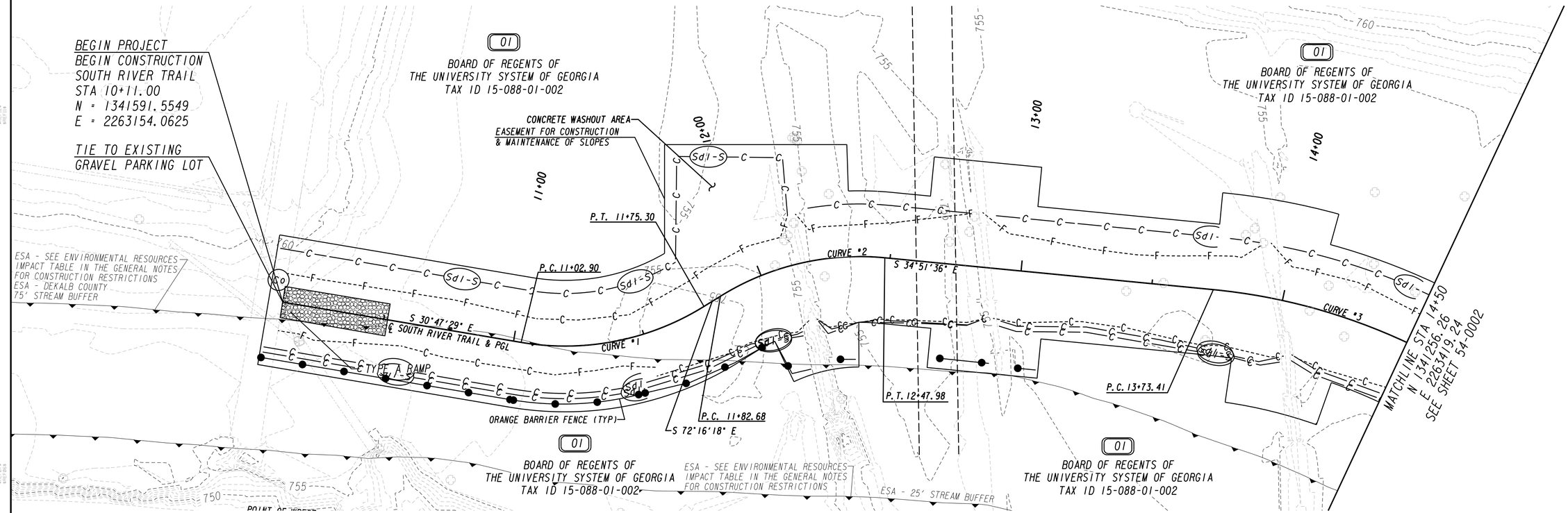
DEKALB COUNTY & PATH FOUNDATION

GENERAL NOTES
ESPCP GENERAL NOTES

SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 51-0004



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0001

MATCHLINE STA 14+50
N 1341256.26
E 2263419.24
SEE SHEET 54-0001

01
BOARD OF REGENTS OF
THE UNIVERSITY SYSTEM OF GEORGIA
TAX ID 15-088-01-002

02
DEKALB COUNTY BOE
TAX ID 15-074-01-004

03
DEKALB COUNTY BOE
TAX ID 15-073-01-004

MATCHLINE STA 20+00
N 1340783.46
E 2263643.54
SEE SHEET 54-0003

04
DEKALB COUNTY BOE
TAX ID 15-073-01-005

01
BOARD OF REGENTS OF
THE UNIVERSITY SYSTEM OF GEORGIA
TAX ID 15-088-01-002

15+00
16+00
17+00
18+00
19+00

CURVE #3
S 1°10'10" W
P.C. 15+66.10
P.T. 15+14.90
CURVE #4
P.T. 16+46.16
P.C. 17+00.79
S 19°13'02" E
℄ SOUTH RIVER TRAIL & PGL
CURVE #5
P.T. 17+45.54
S 30°36'46" E
CURVE #6
S 51°29'33" E
P.C. 18+20.36
P.T. 19+02.36

EASEMENT FOR CONSTRUCTION
& MAINTENANCE OF SLOPES

ESA - SEE ENVIRONMENTAL RESOURCES
IMPACT TABLE IN THE GENERAL NOTES
FOR CONSTRUCTION RESTRICTIONS

ESA - 25' STREAM BUFFER

ESA - SEE ENVIRONMENTAL RESOURCES
IMPACT TABLE IN THE GENERAL NOTES
FOR CONSTRUCTION RESTRICTIONS

ESA - DEKALB COUNTY
75' STREAM BUFFER

EASEMENT FOR CONSTRUCTION
& MAINTENANCE OF SLOPES

ESA - DEKALB COUNTY
75' STREAM BUFFER

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

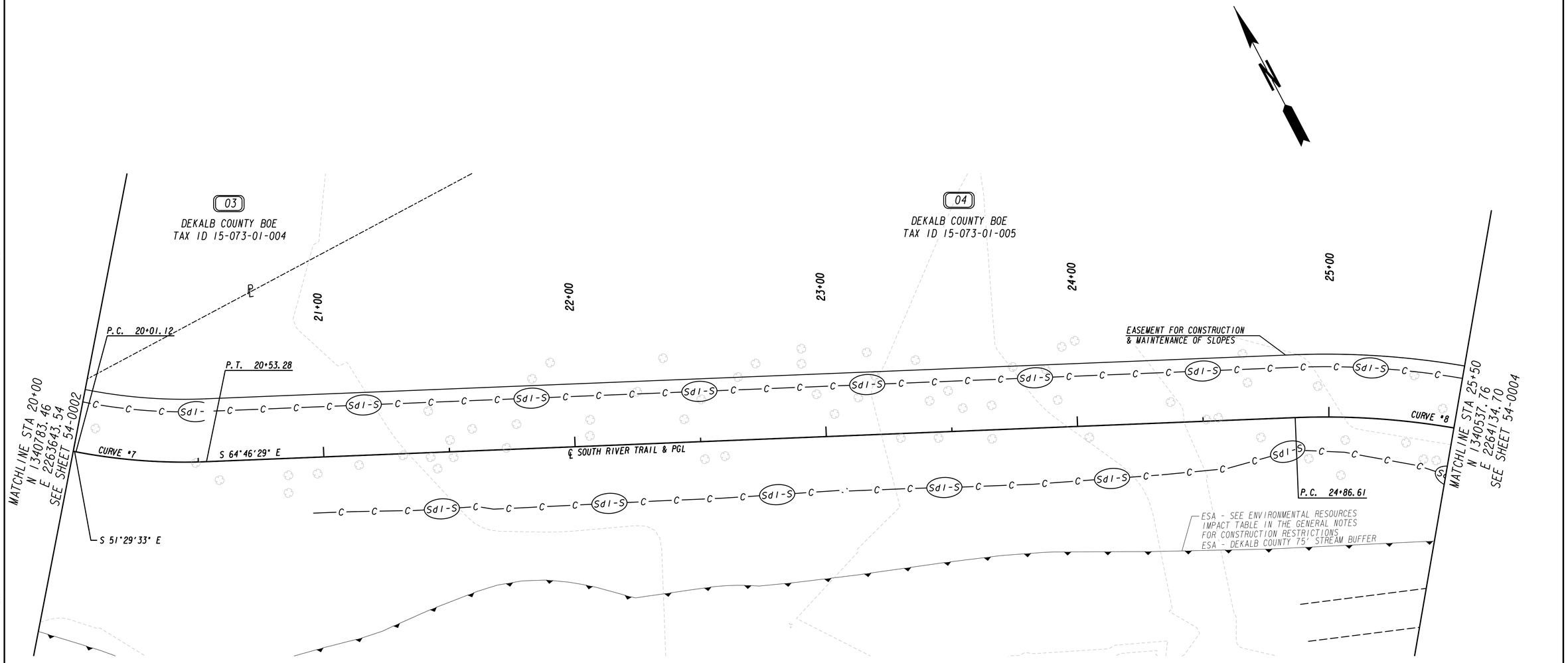
REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0002
VERIFIED:	MWH	DATE:	05-07-2018	



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

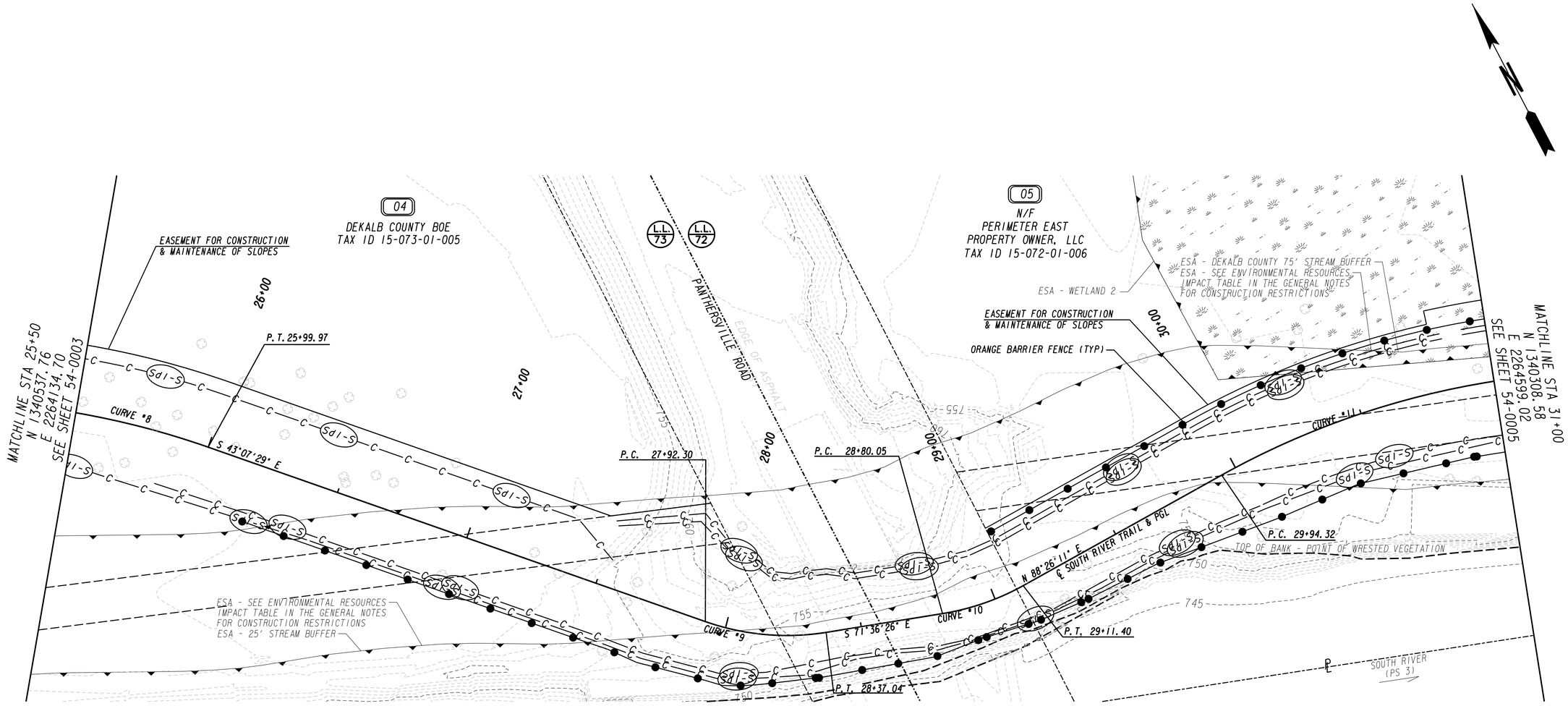
BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0003

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

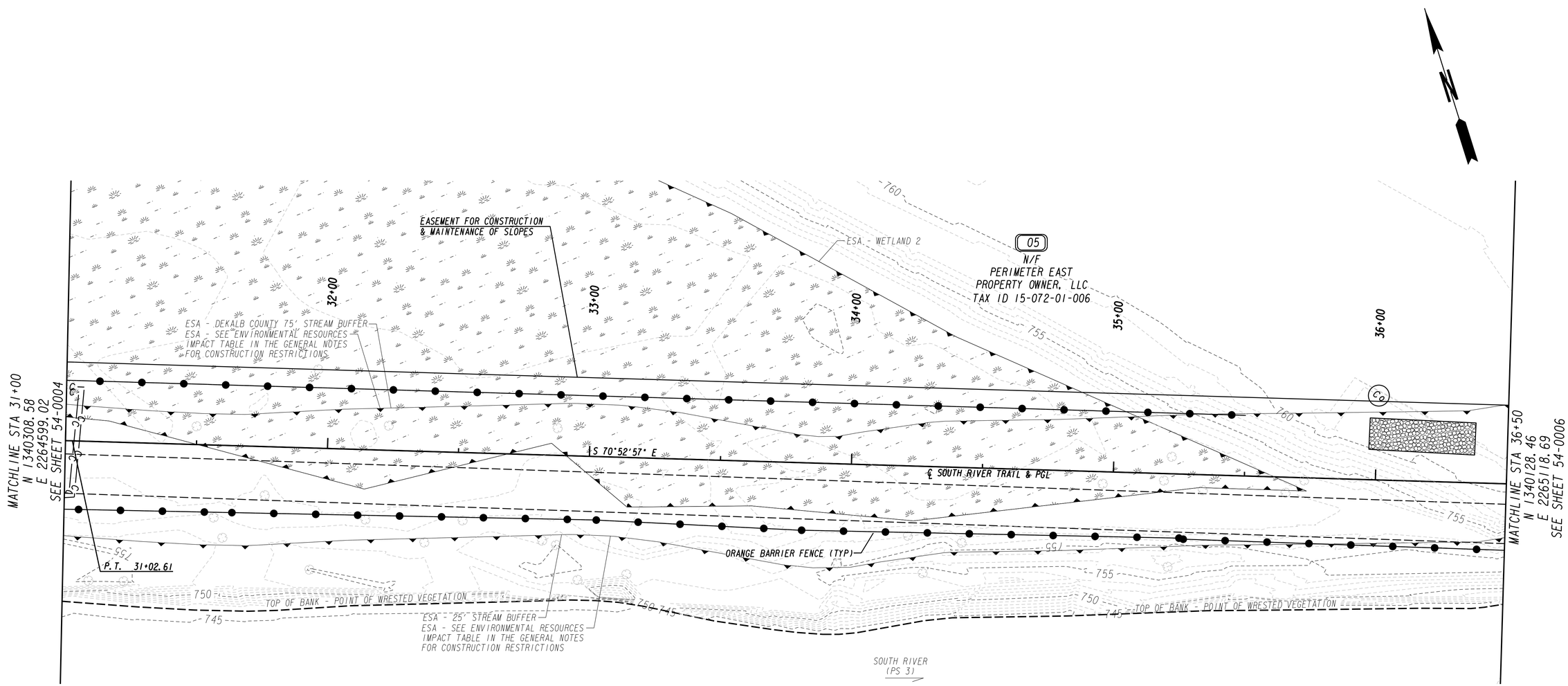
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0004



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

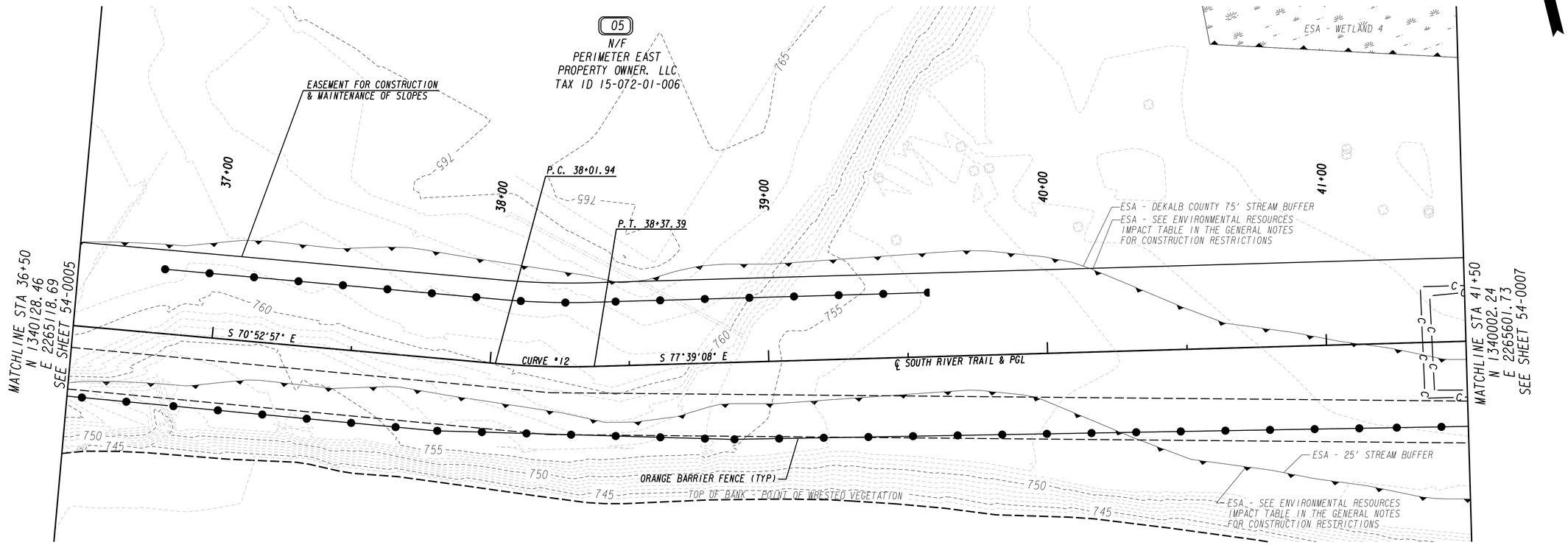
BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0005

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

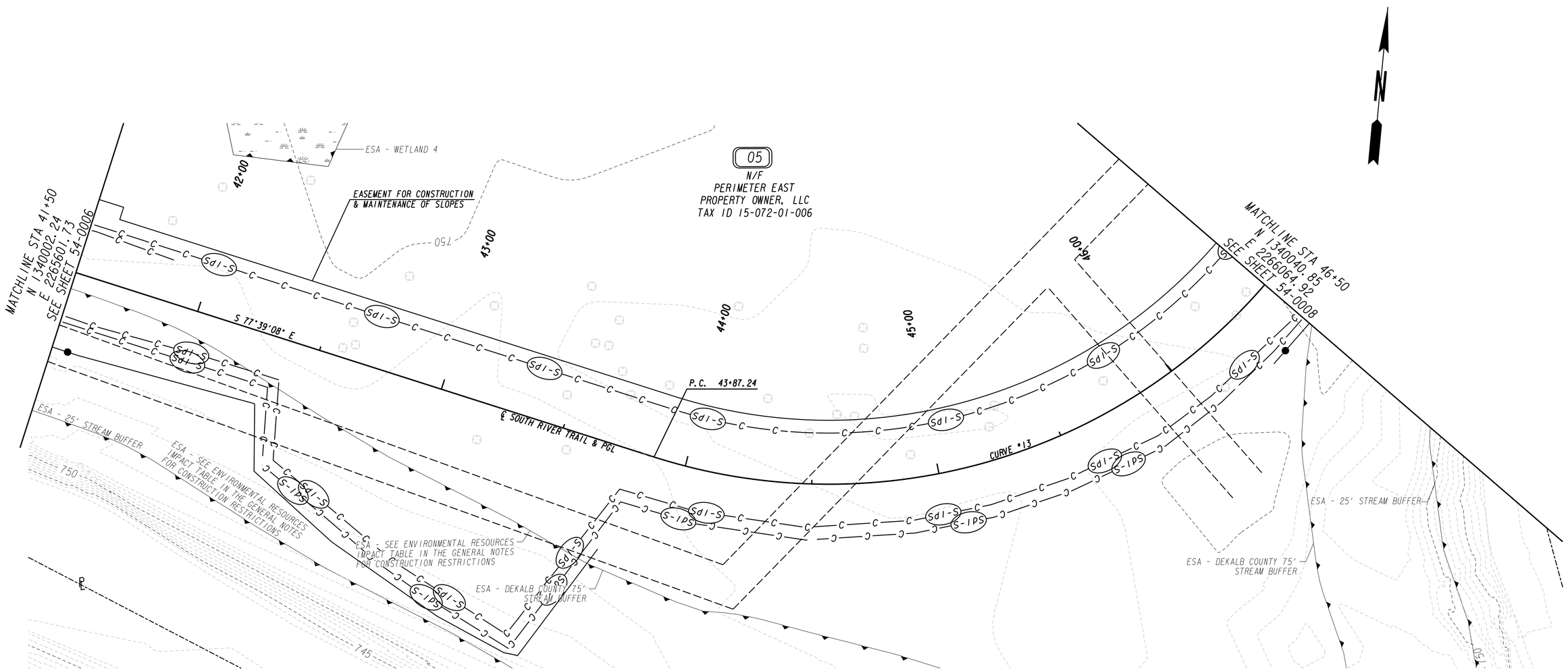
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS
STAGE I - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0006

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

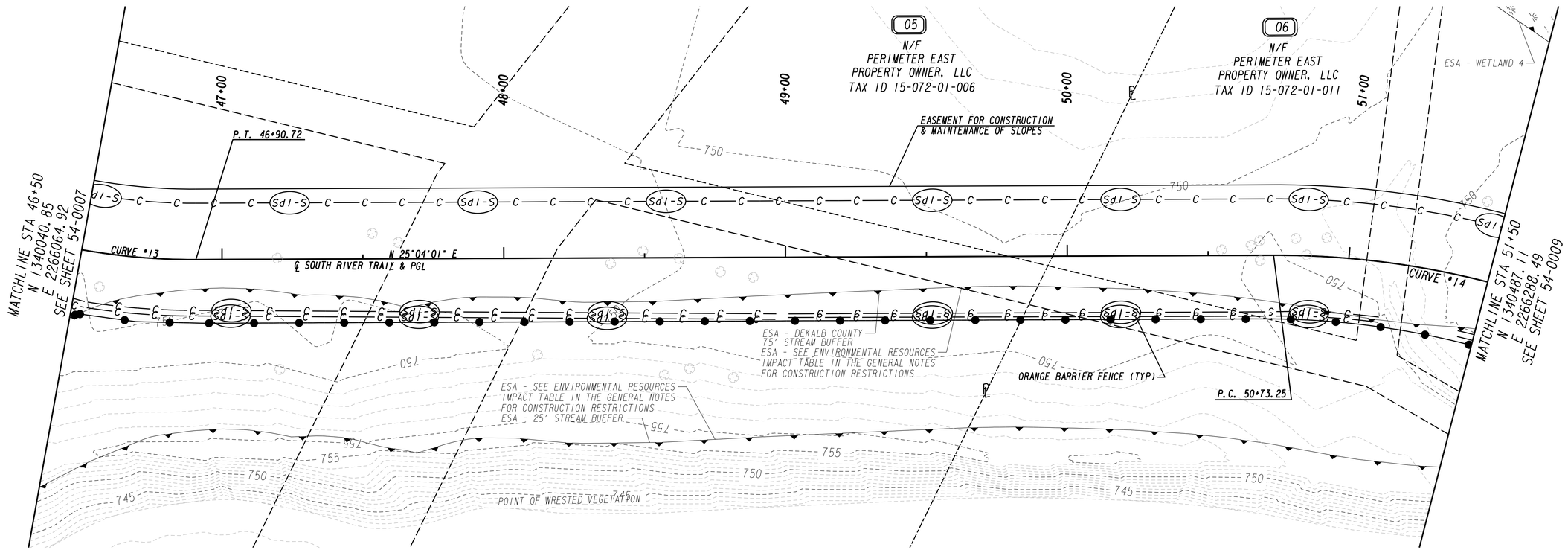
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0007
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

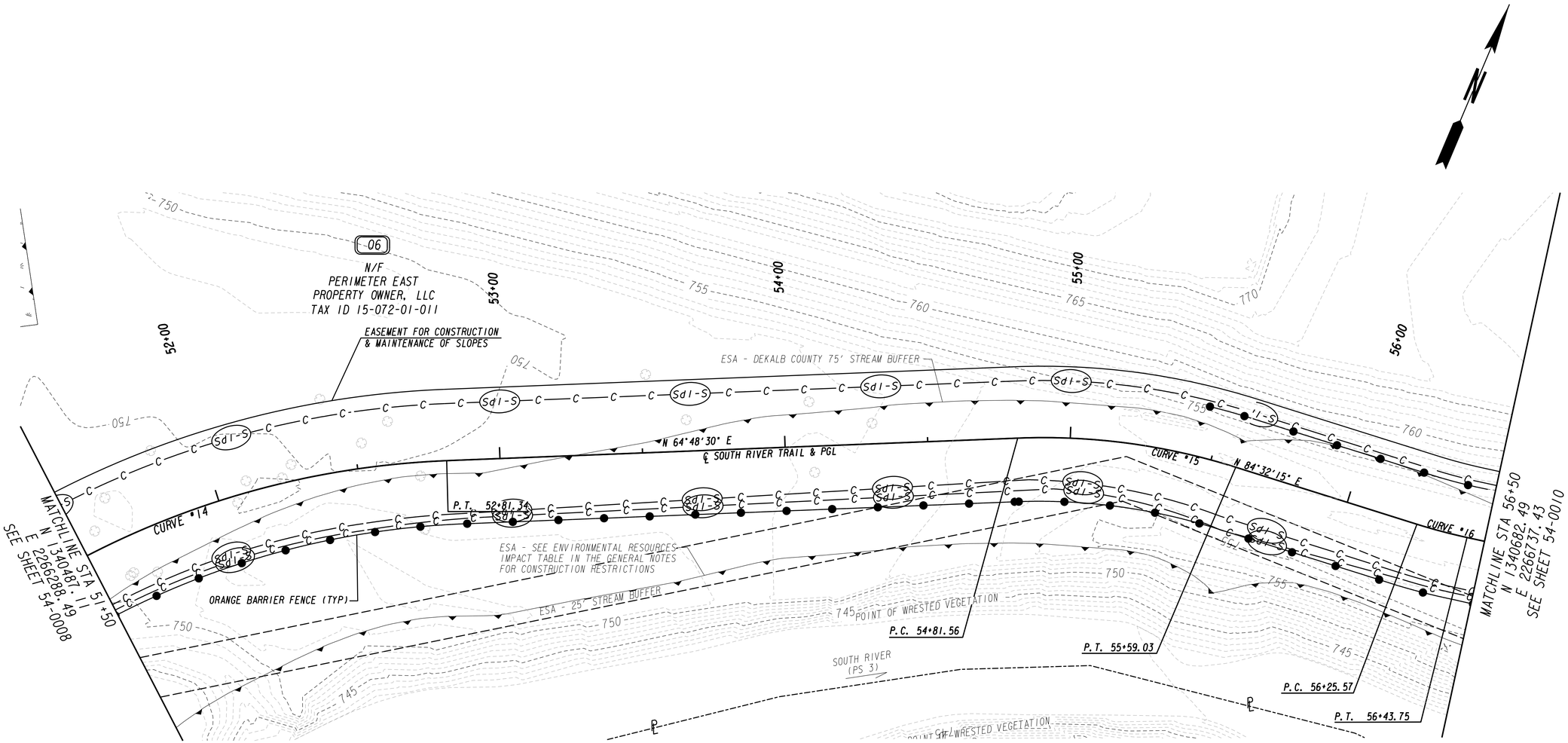
BMP LOCATION DETAILS

STAGE I - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0008

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

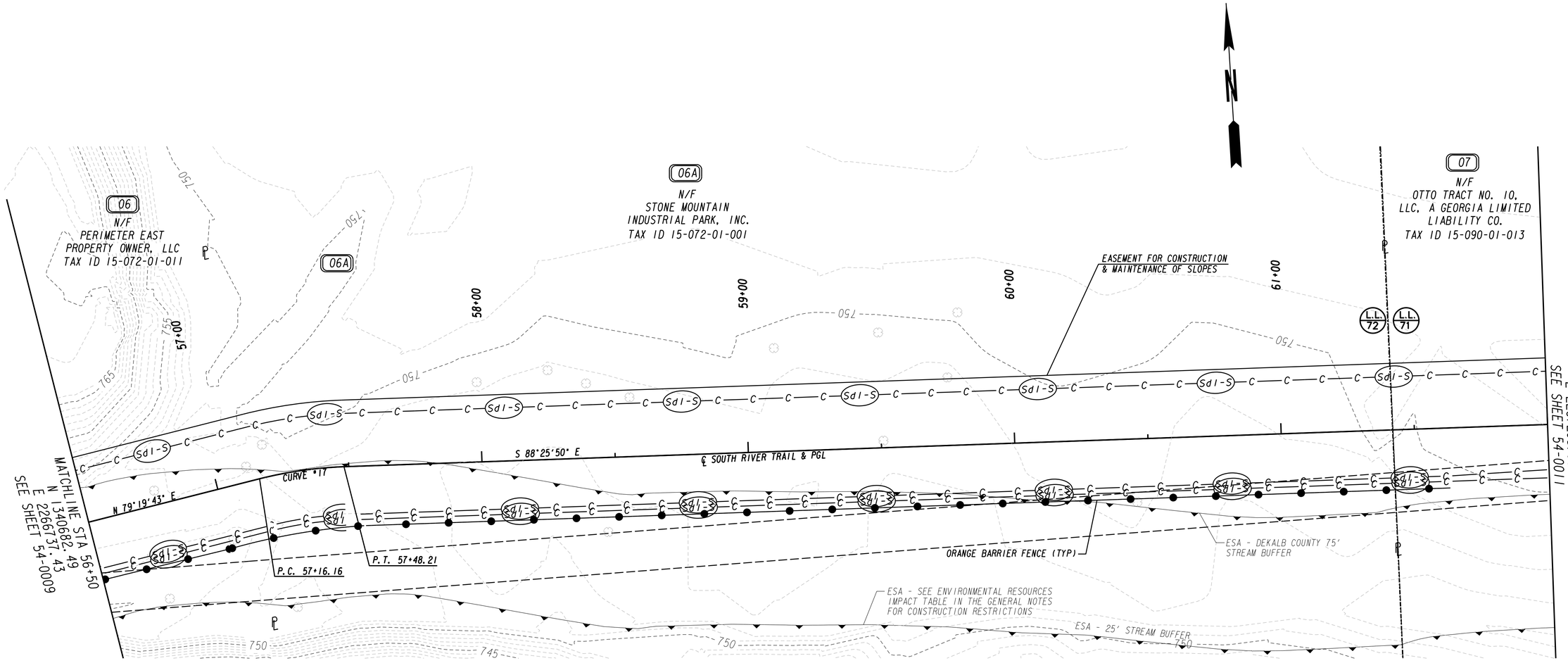
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0009



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

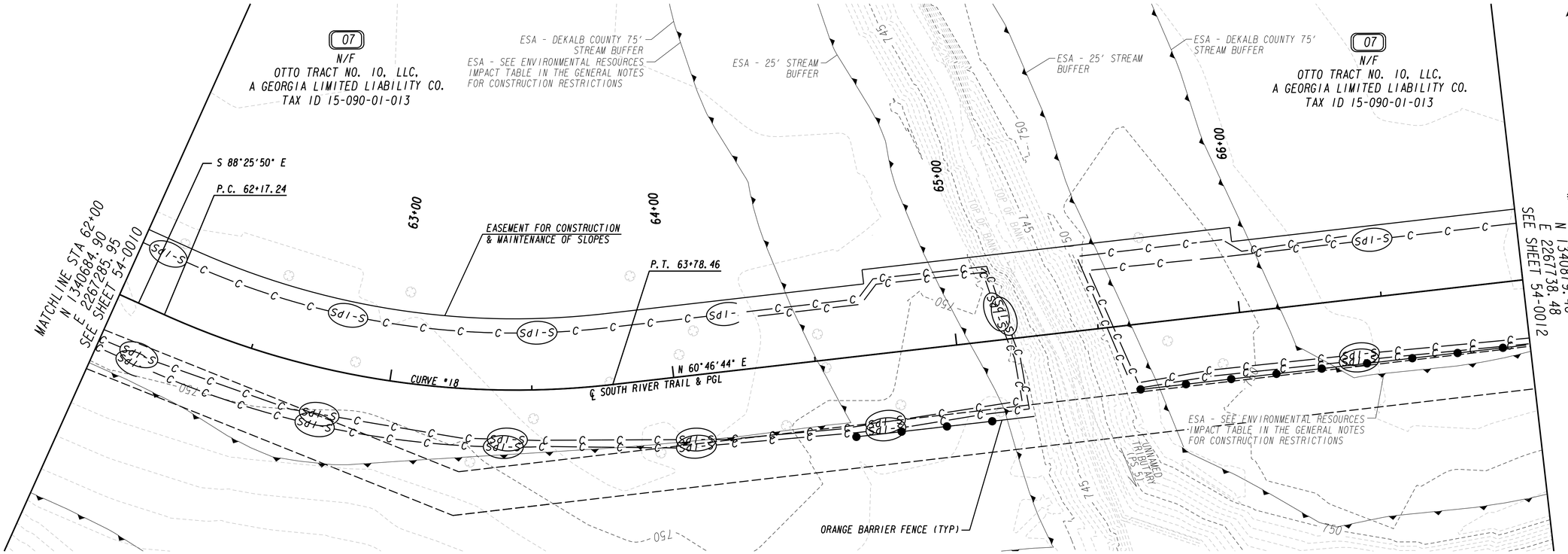
BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	WMH	DATE:	05-07-2018

DRAWING No.
54-0010

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

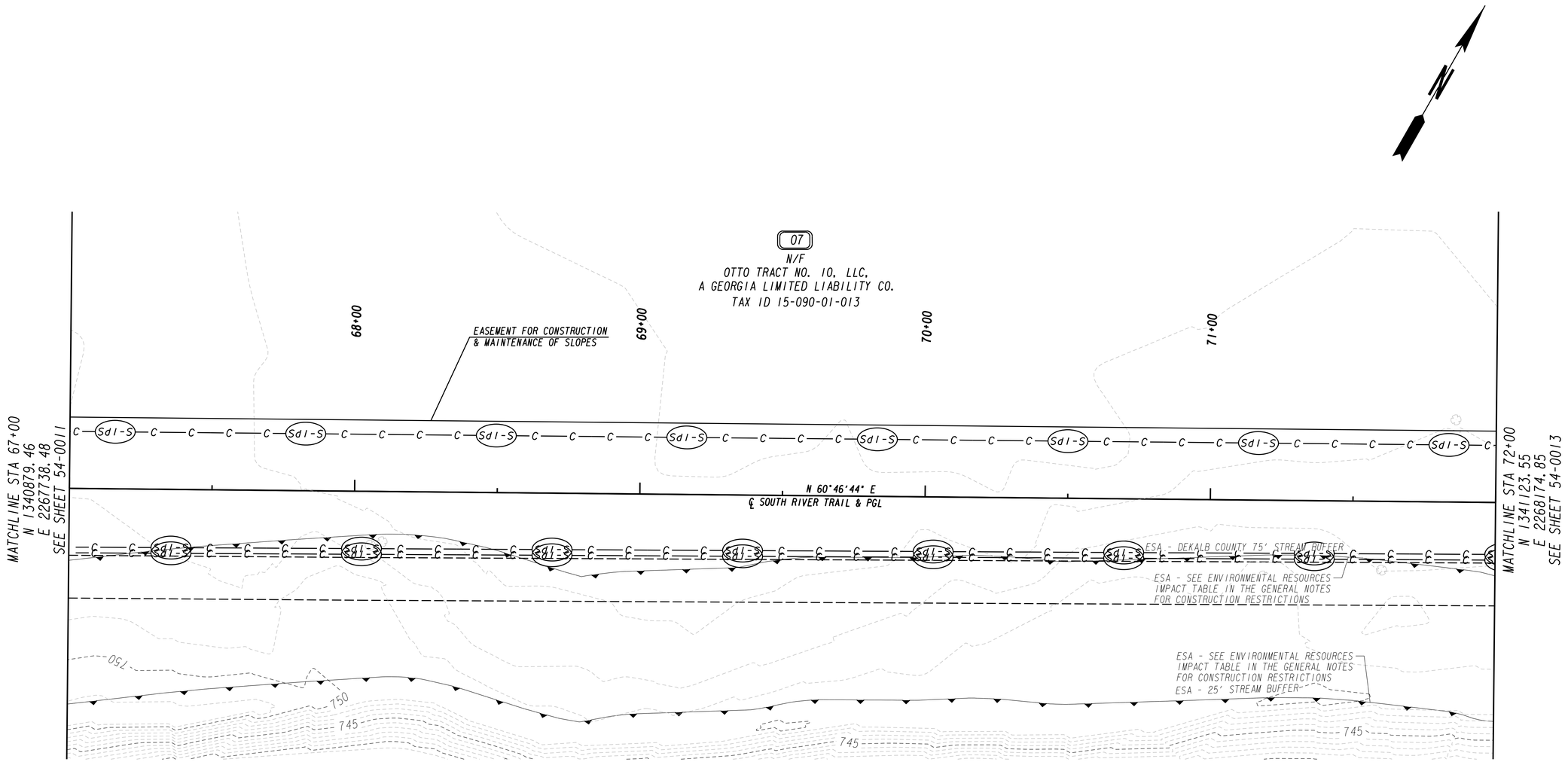
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0011
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

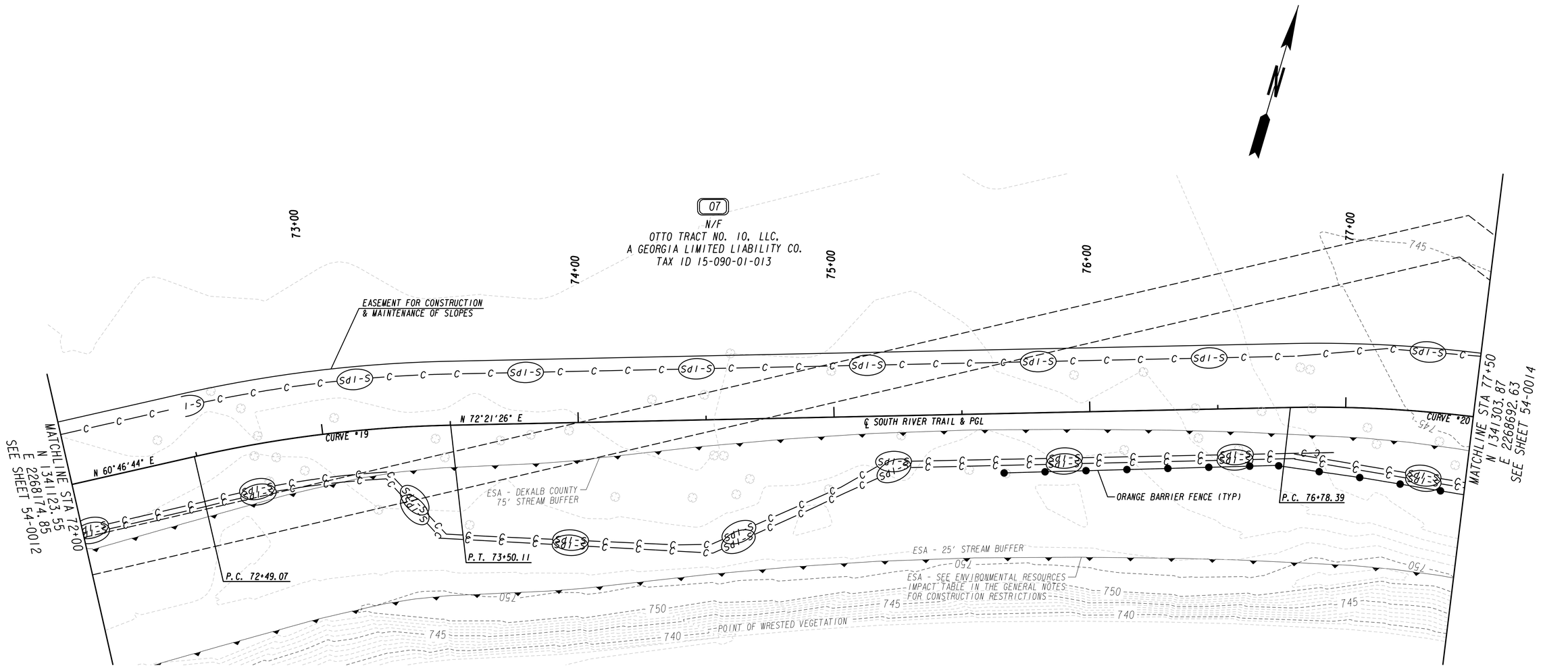
BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0012

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

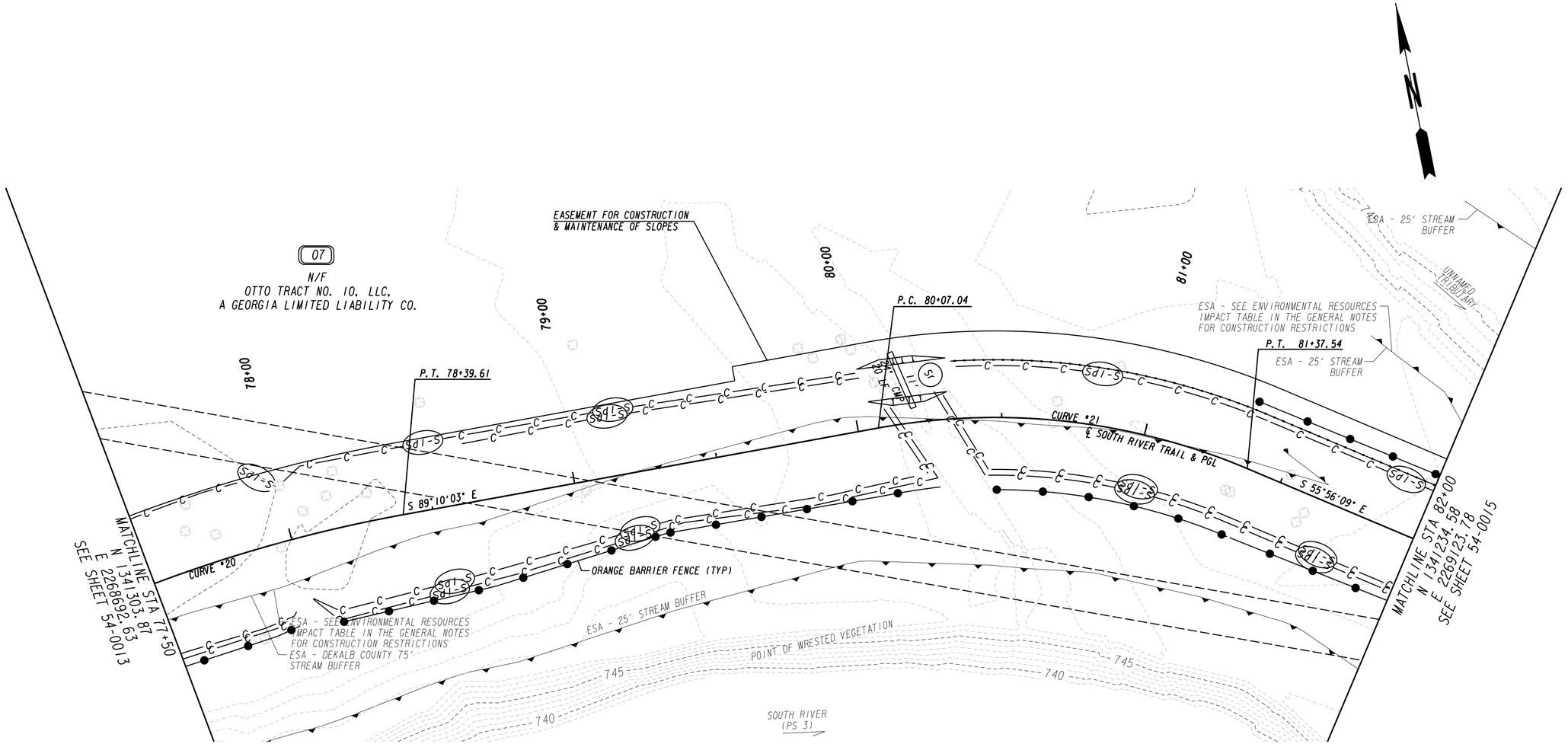
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0013
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

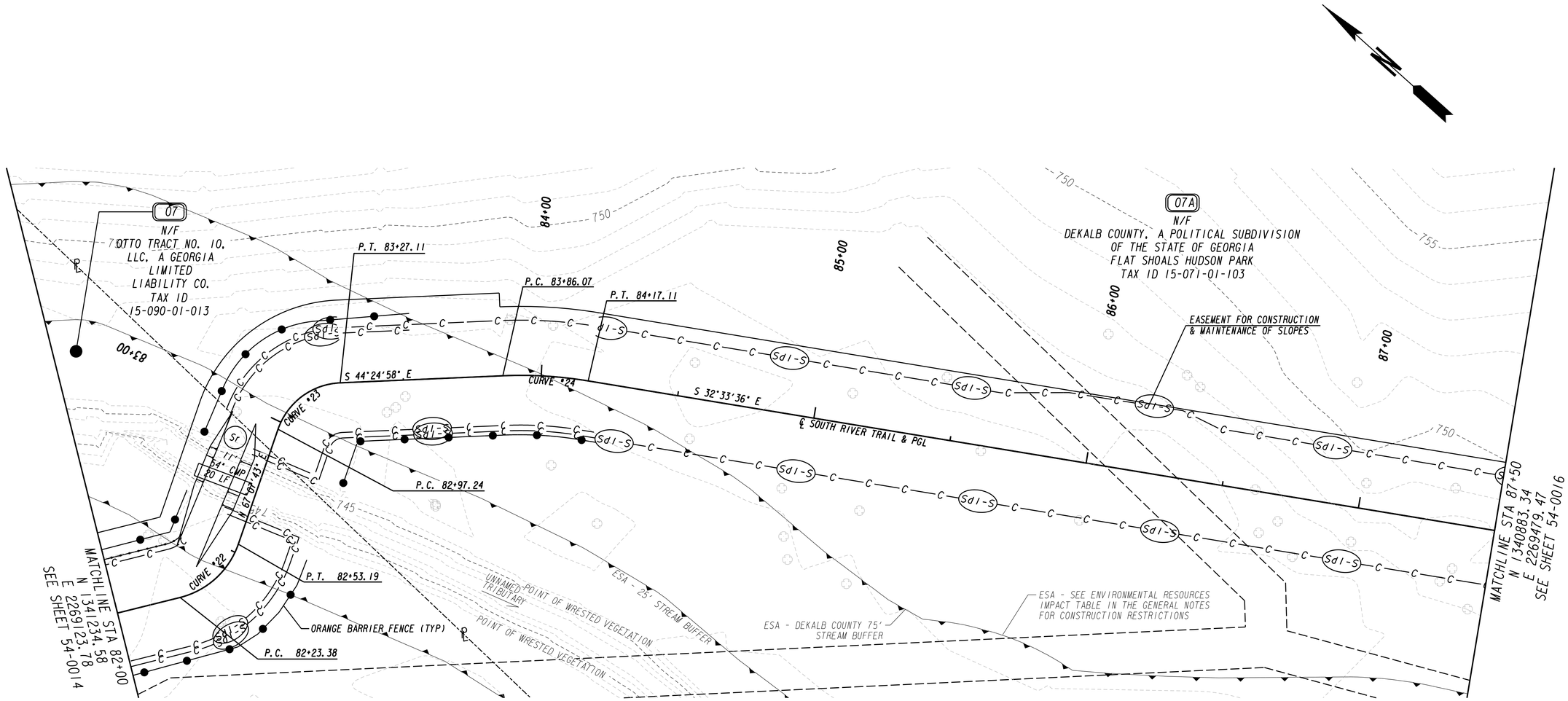
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE I - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	54-0014
CORRECTED:	AE & PAL	DATE:	05-07-2018	
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE	---℄---
REQUIRED R/W LINE	———
CONSTRUCTION LIMITS	—C— —F—
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	▨
EASEMENT FOR CONSTR OF SLOPES	▨
EASEMENT FOR CONSTR OF DRIVES	▨

BEGIN LIMIT OF ACCESS............BLA	
END LIMIT OF ACCESS.............ELA	
LIMIT OF ACCESS	—∘∘∘—
REQ'D R/W & LIMIT OF ACCESS	—⫲—
ORANGE BARRIER FENCE	—●—

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES		
03/14/19		

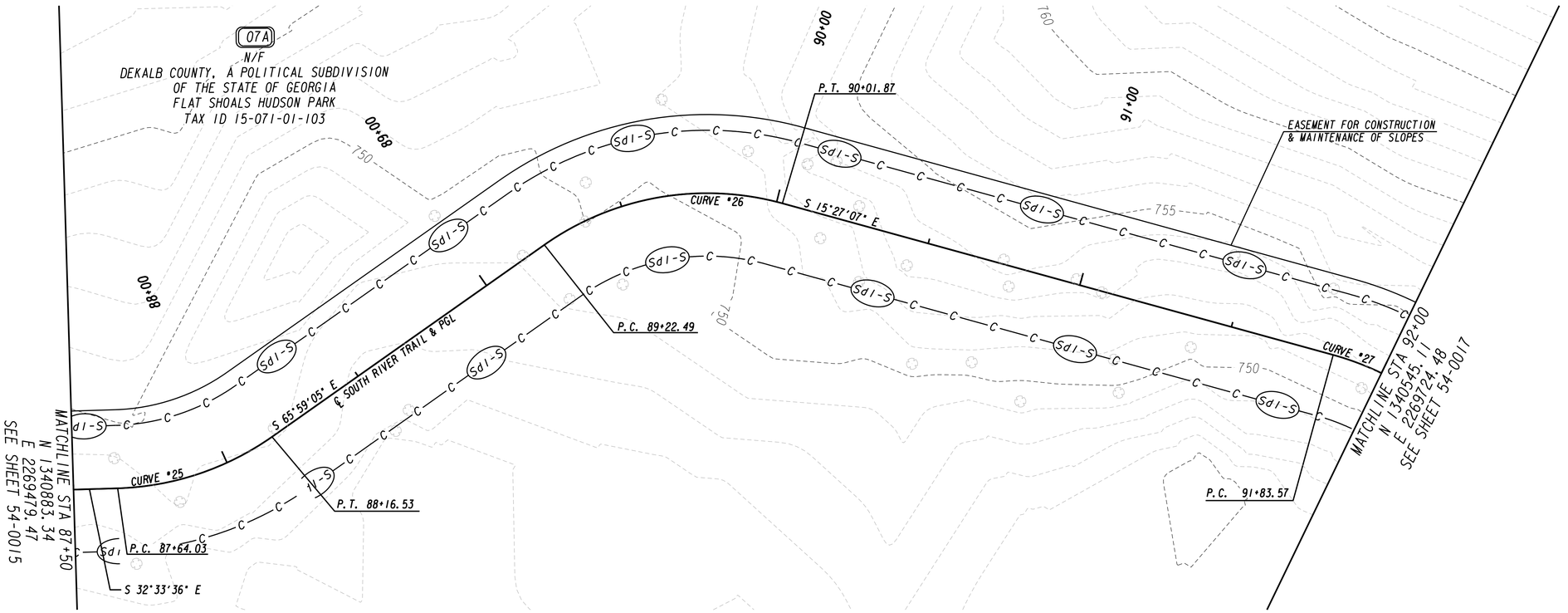
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE I - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0015



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

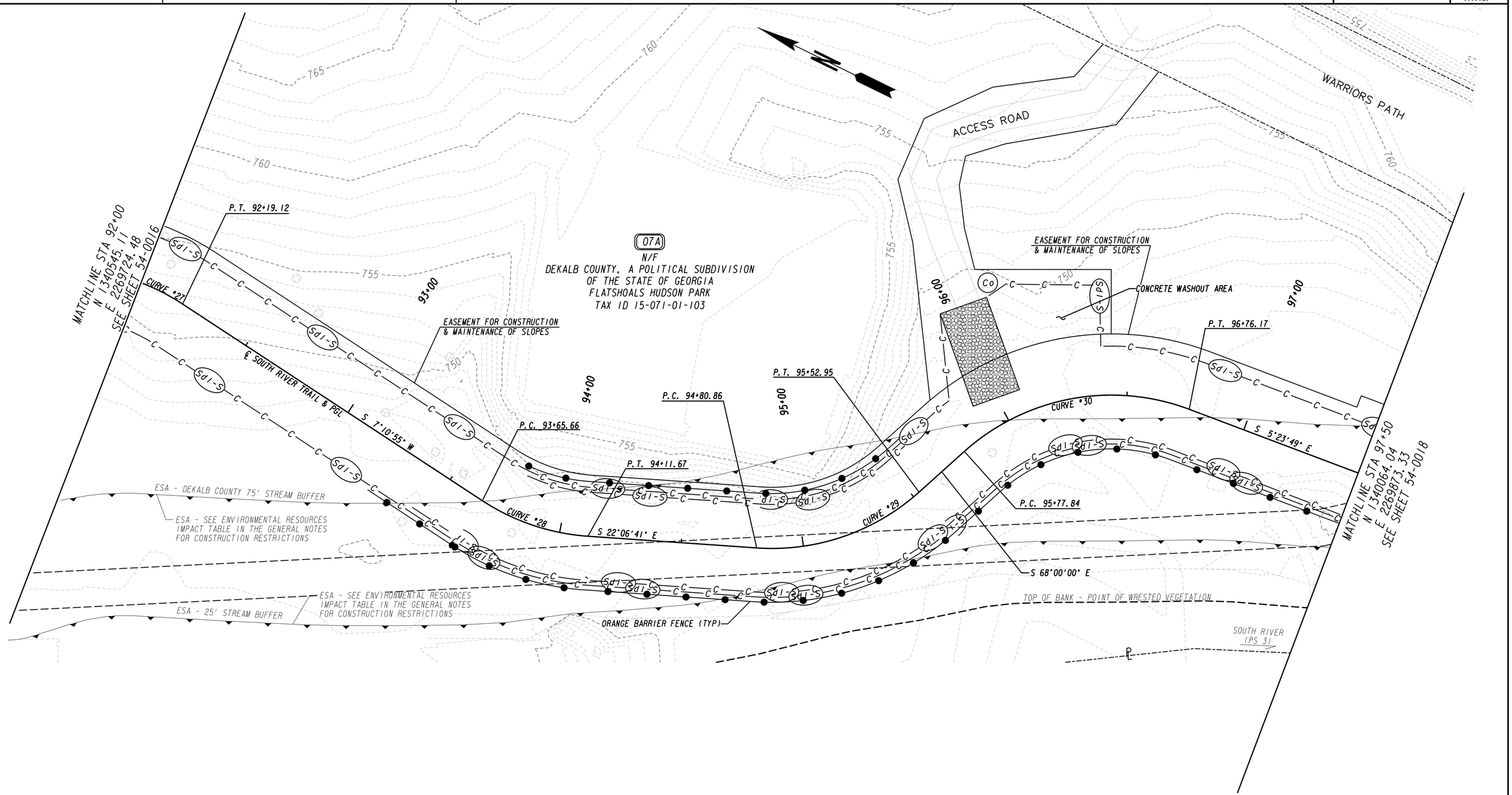
BMP LOCATION DETAILS

STAGE I - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0016

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

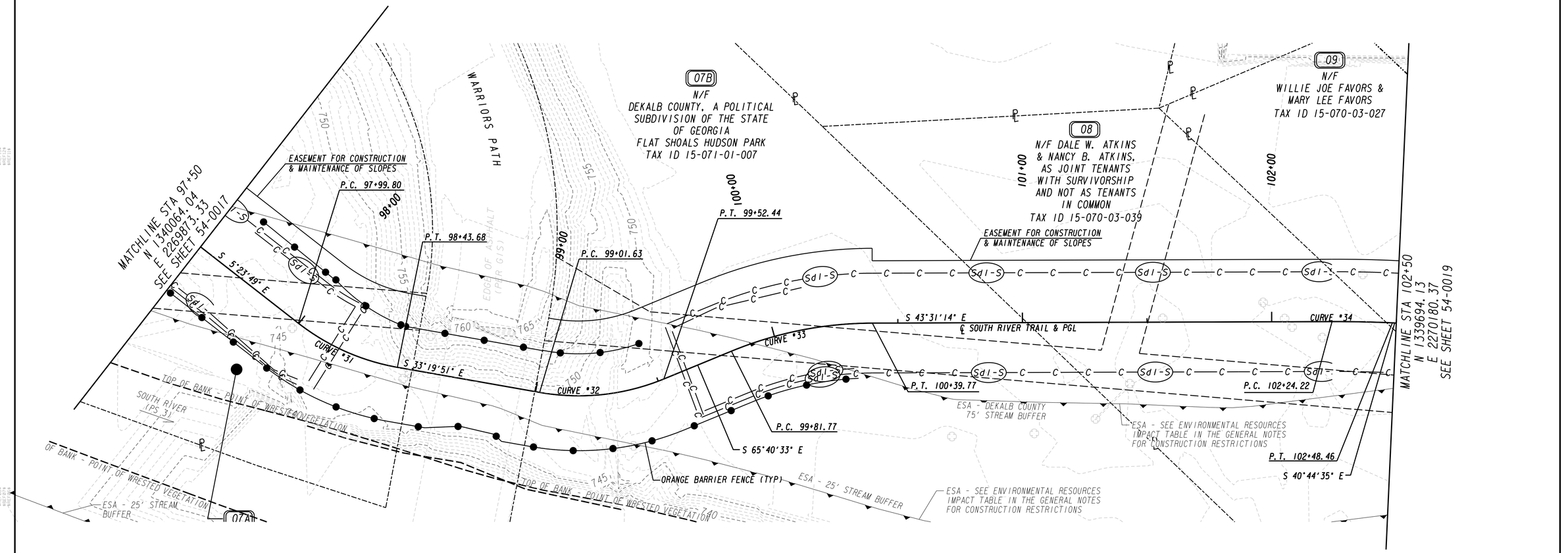
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE I - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0017
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

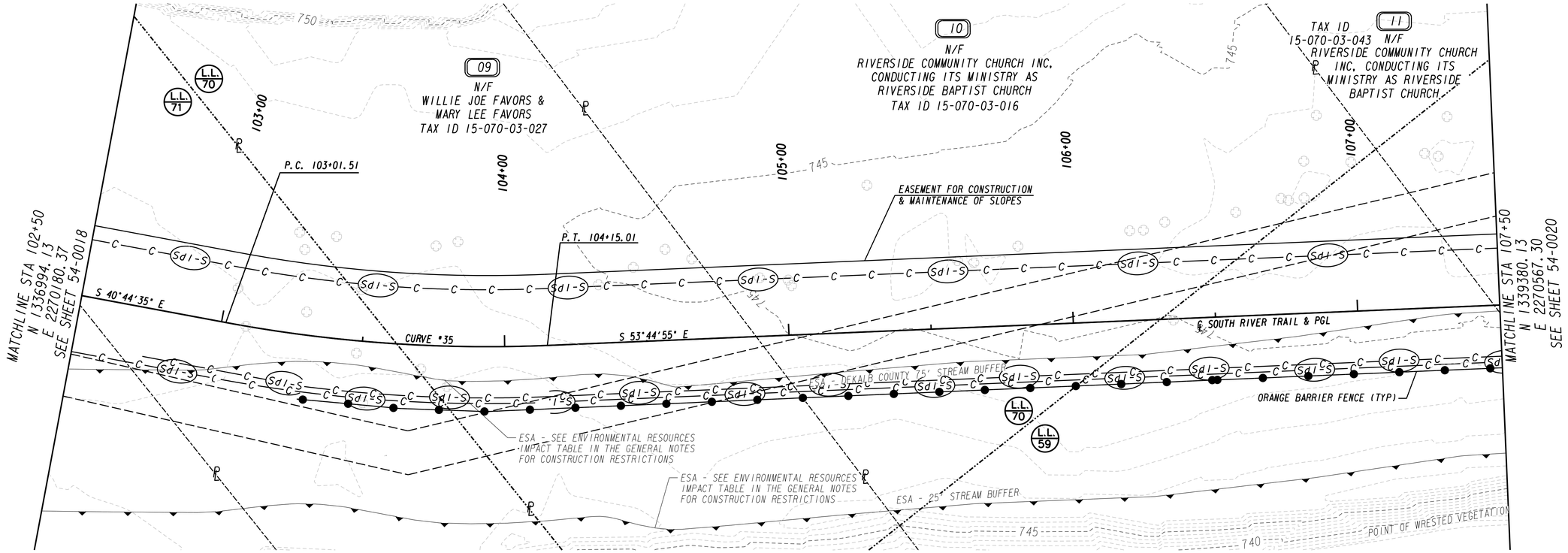
BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	WMH	DATE:	05-07-2018

DRAWING No. 54-0018

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

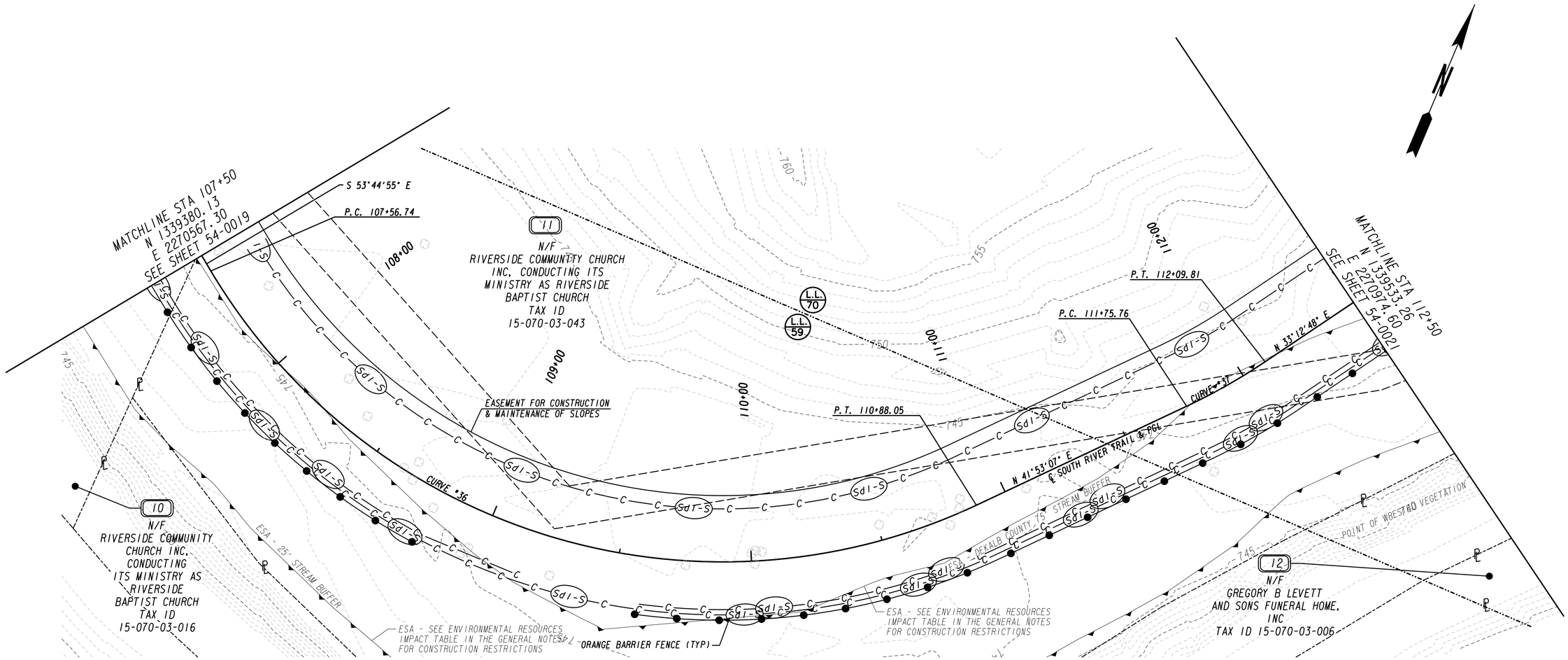
BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0019

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

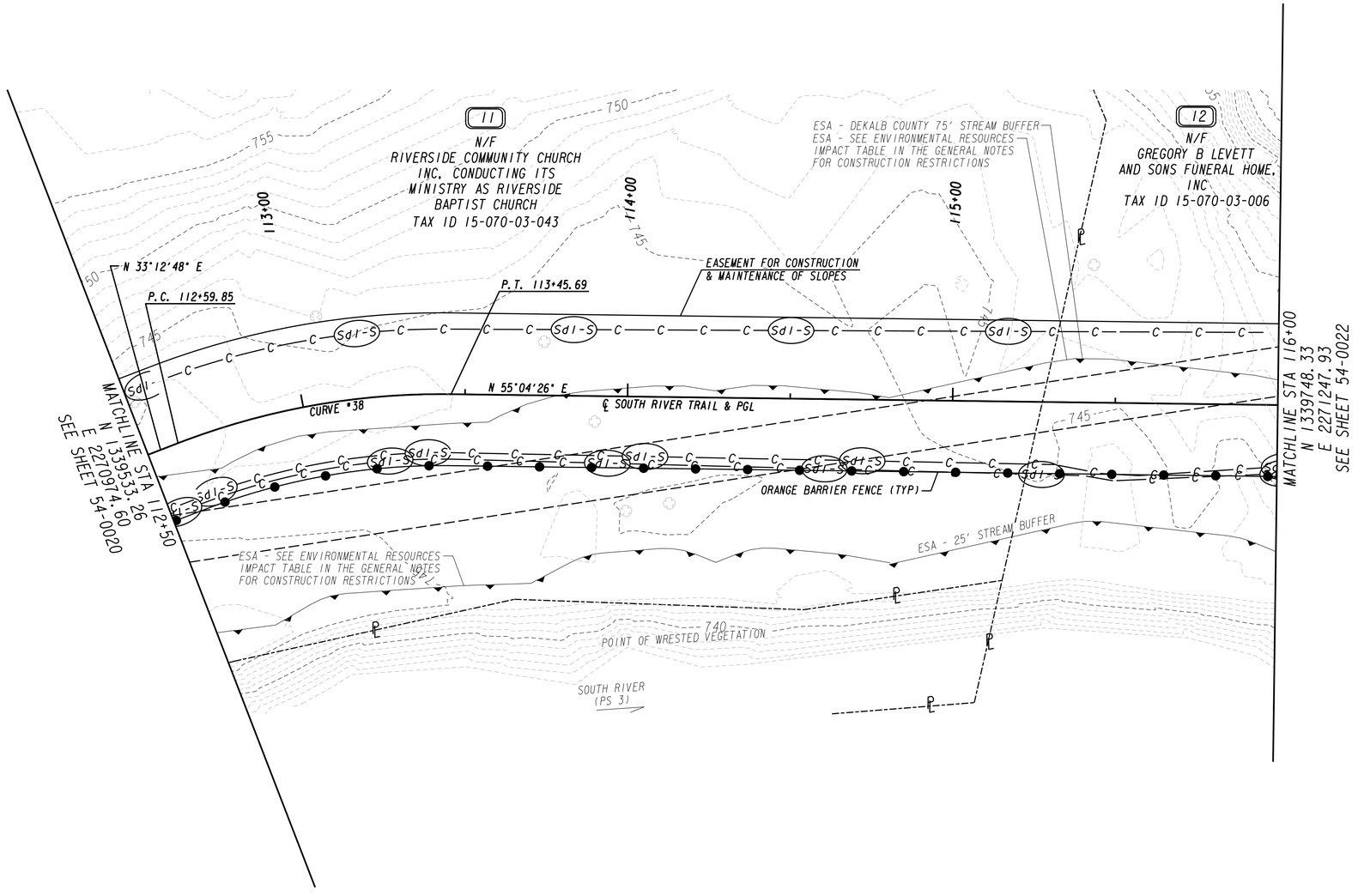
BMP LOCATION DETAILS

STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0020

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

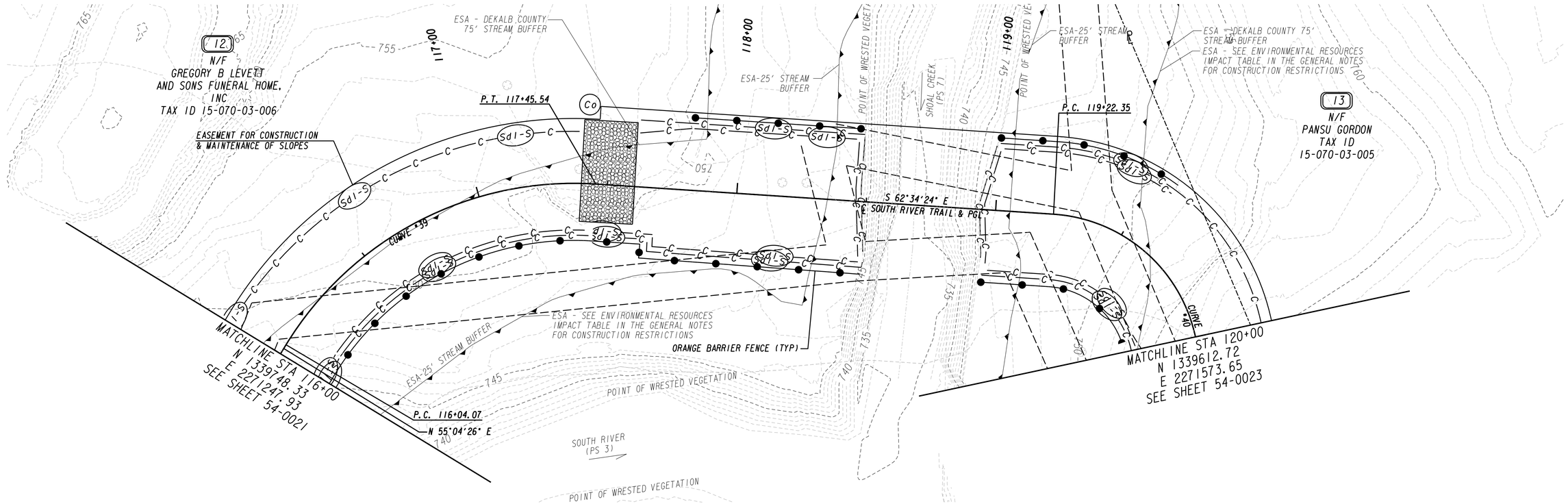
STAGE 1 - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0021

DATE$$$ TIME$$$ $PRF8$ DGN P. I. No. 0009029

$USER$



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19
04/16/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

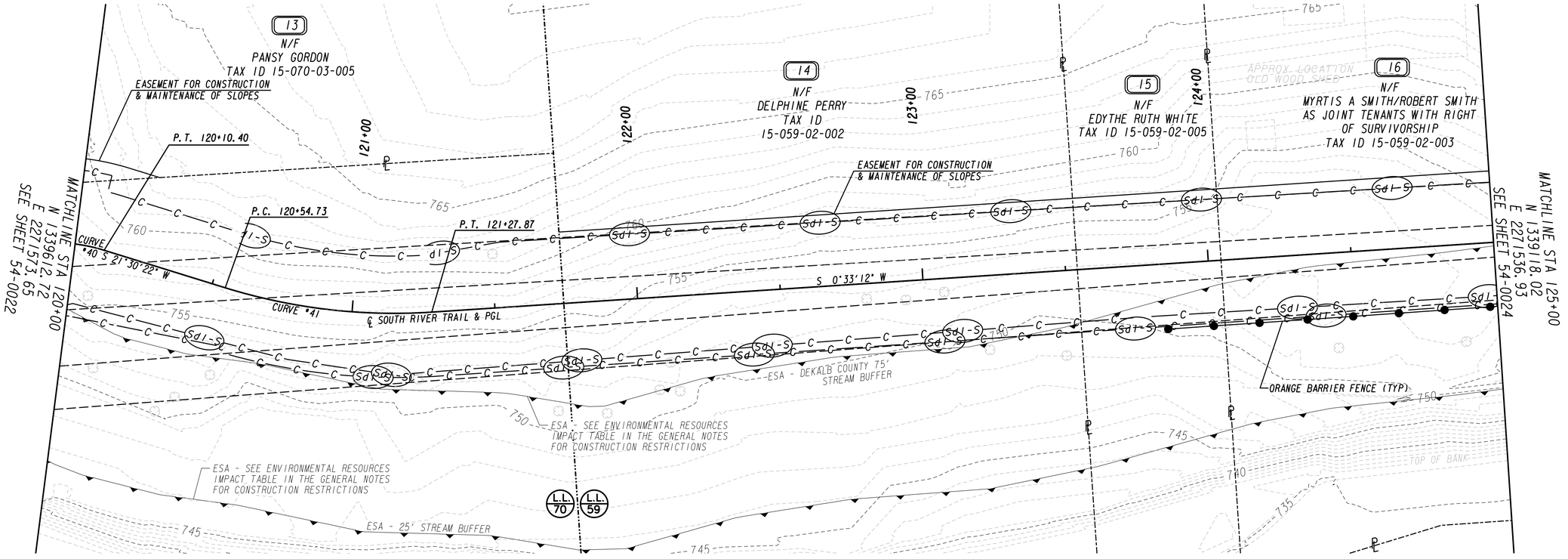
STAGE 1 - INITIAL PHASE

SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0022

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

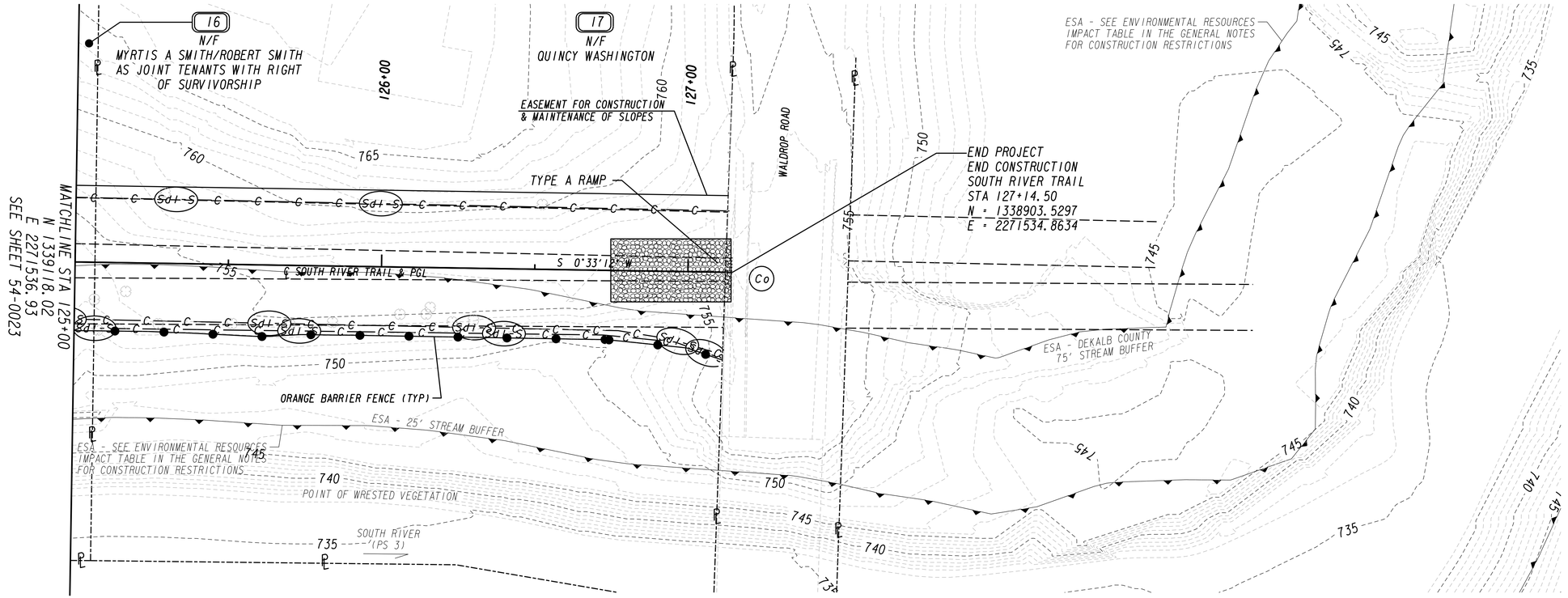
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE I - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0023
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



N

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

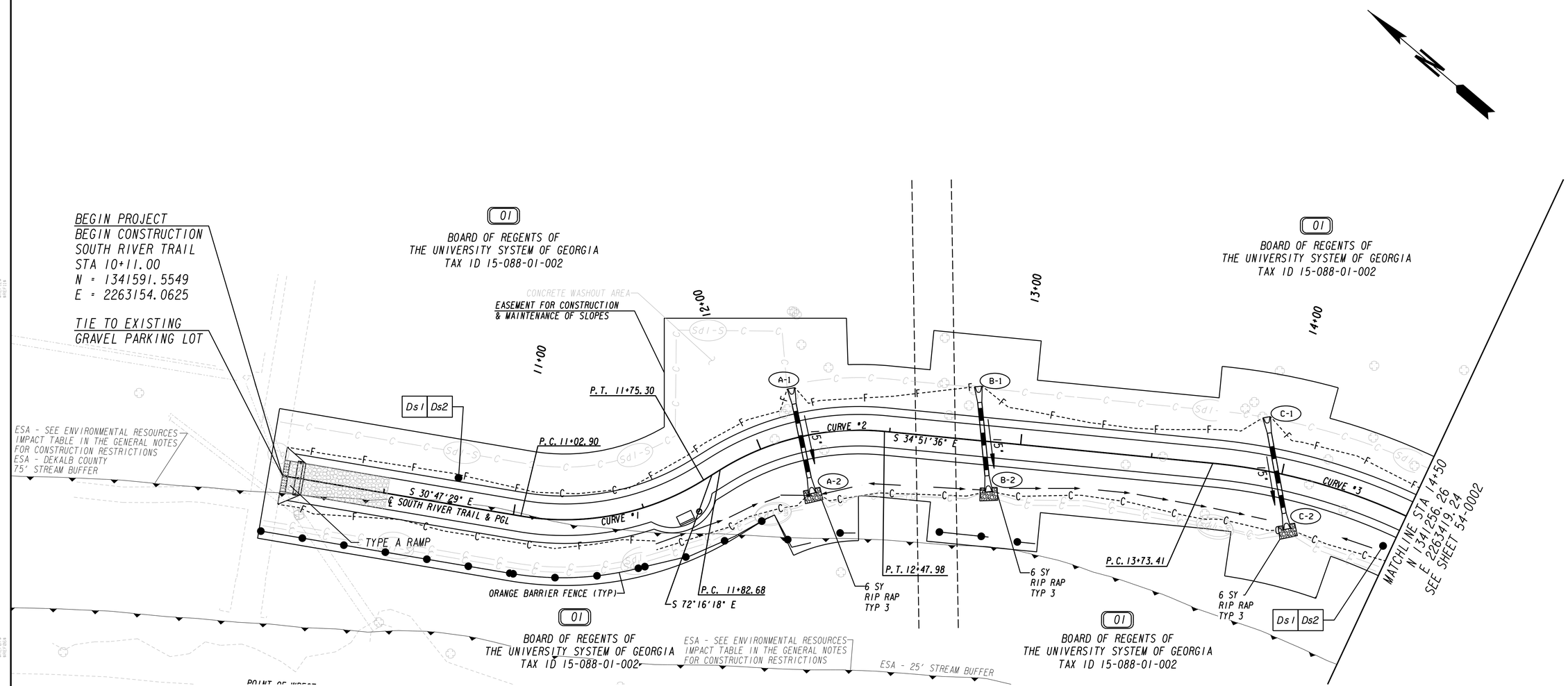
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE I - INITIAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0024
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

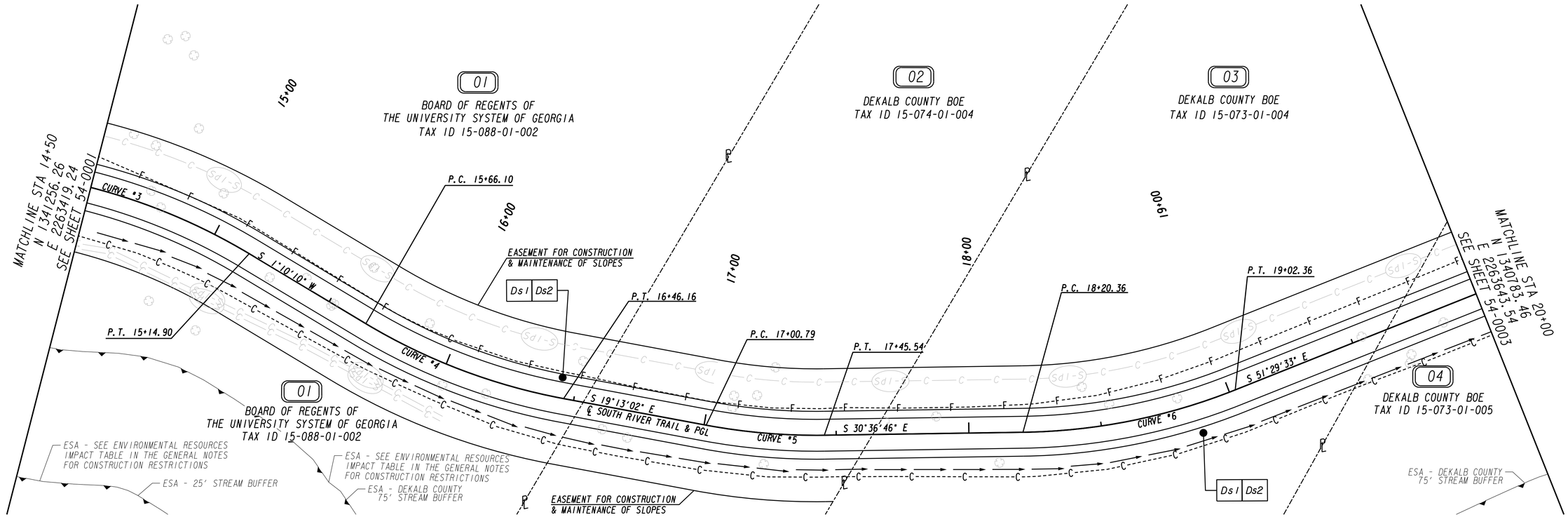
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0025

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

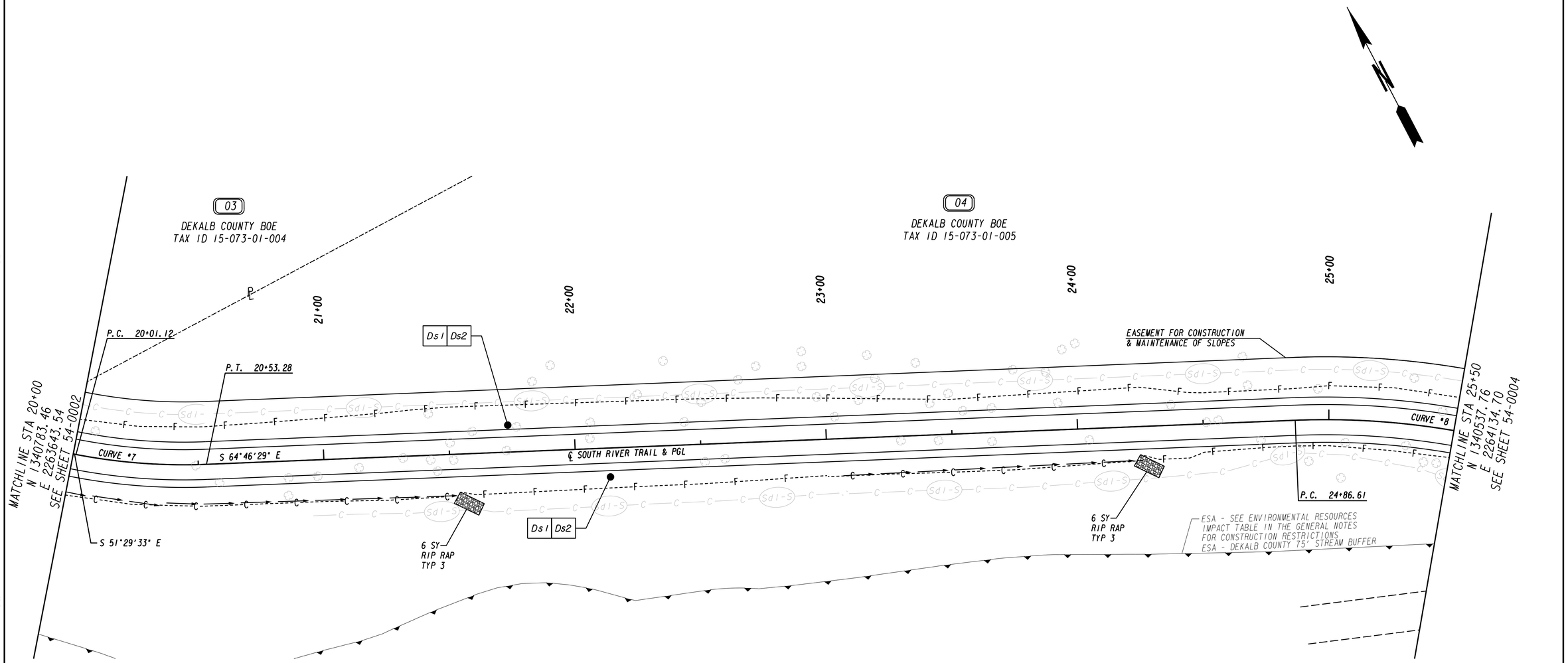
REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0026
VERIFIED:	MWH	DATE:	05-07-2018	



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

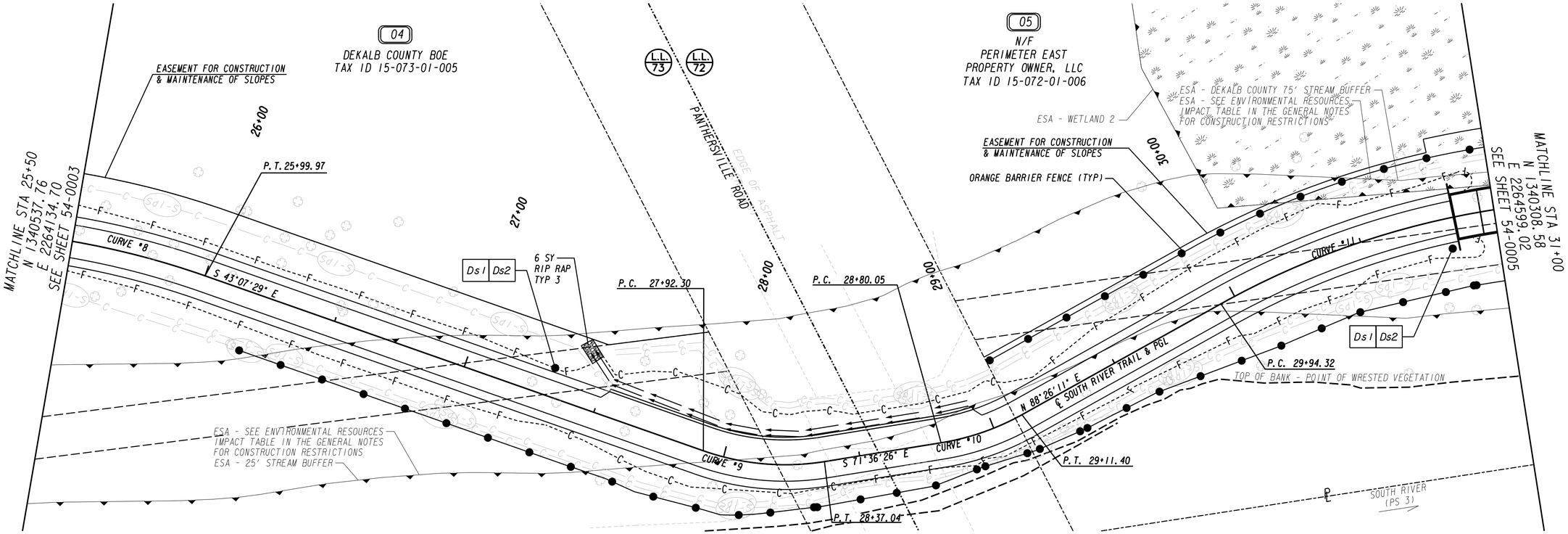
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0027

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

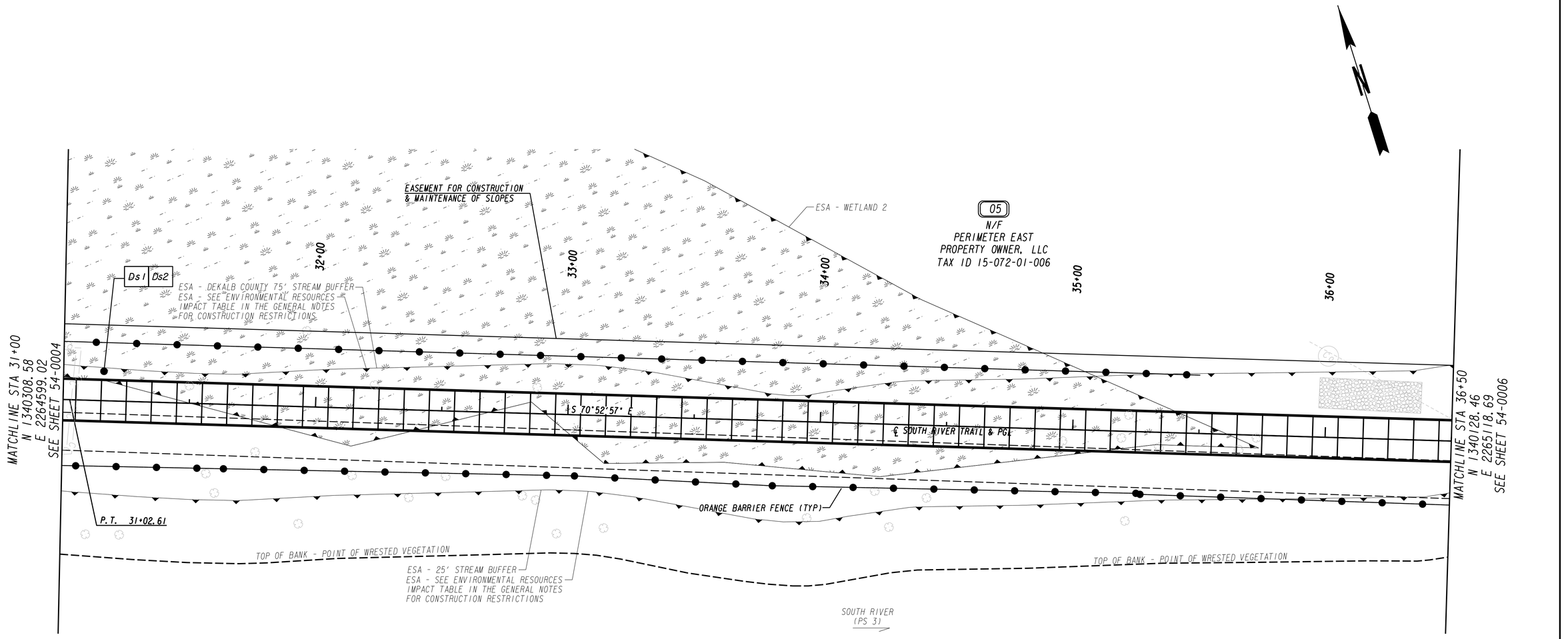
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0028



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

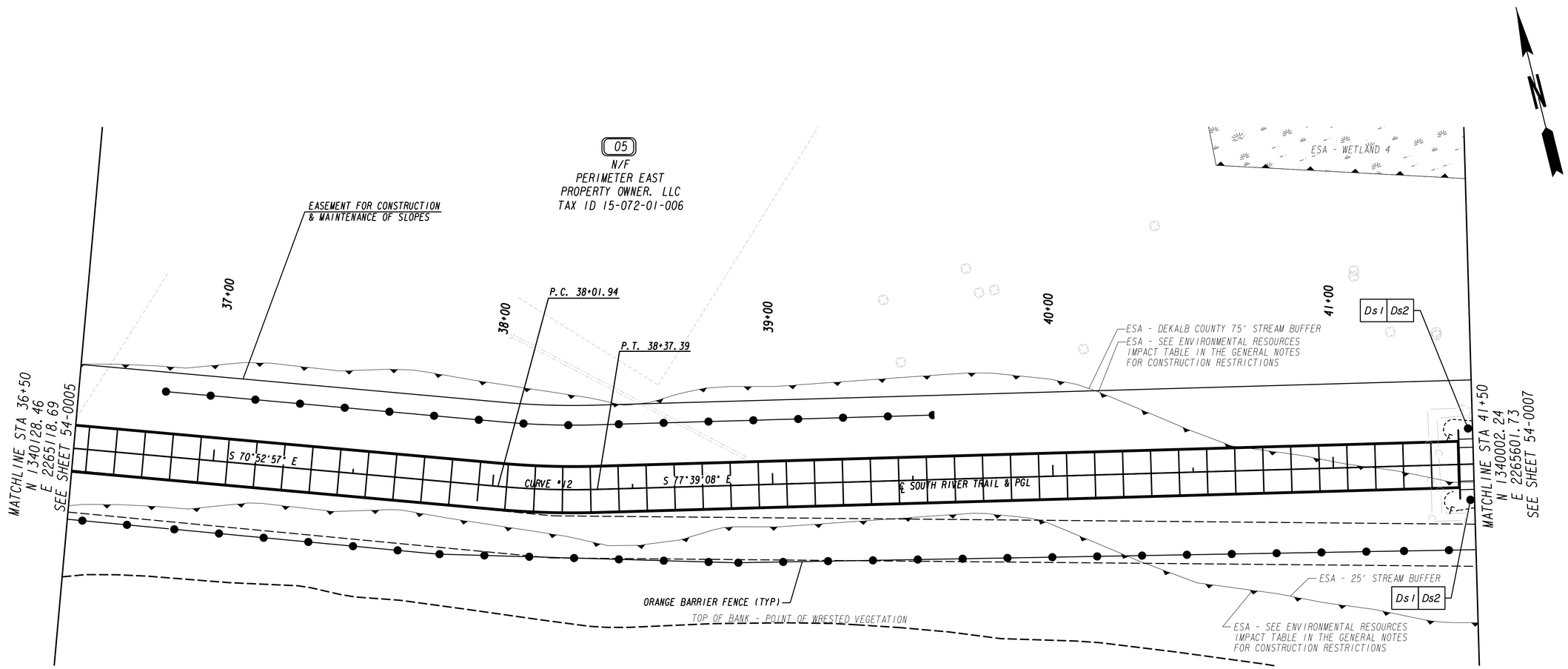
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0029

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

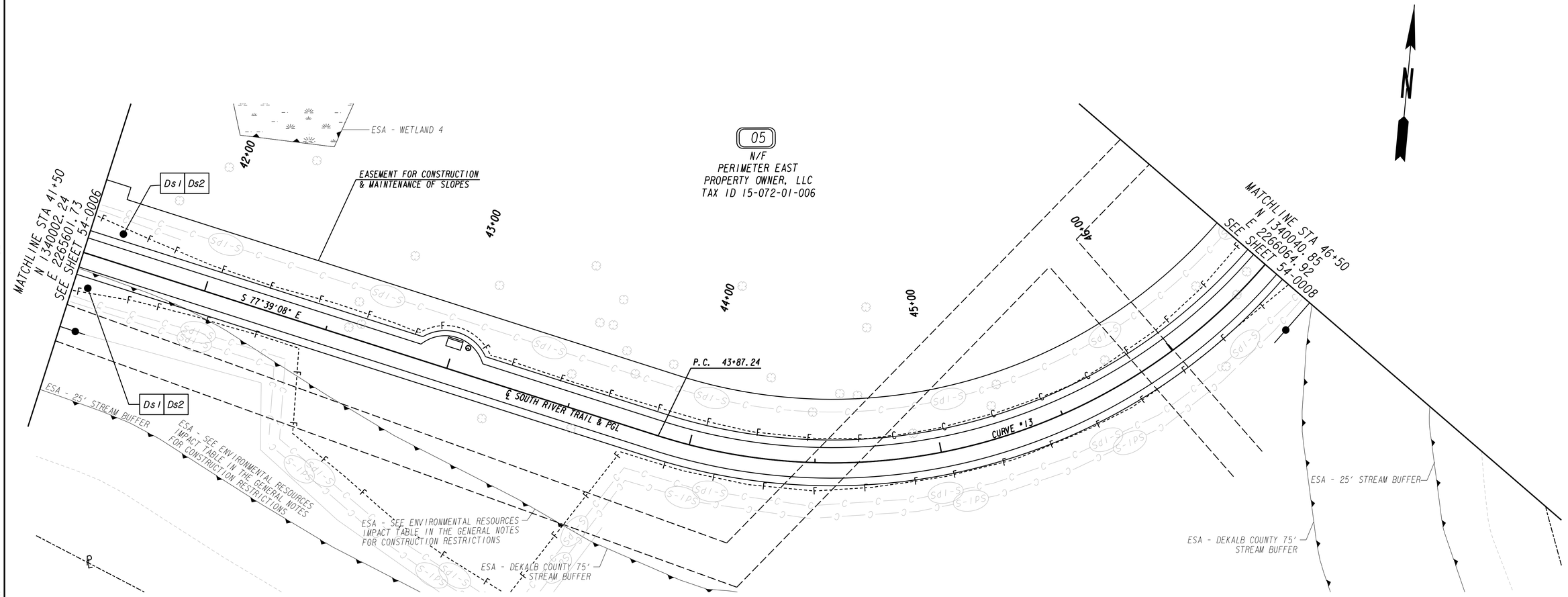
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0030

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

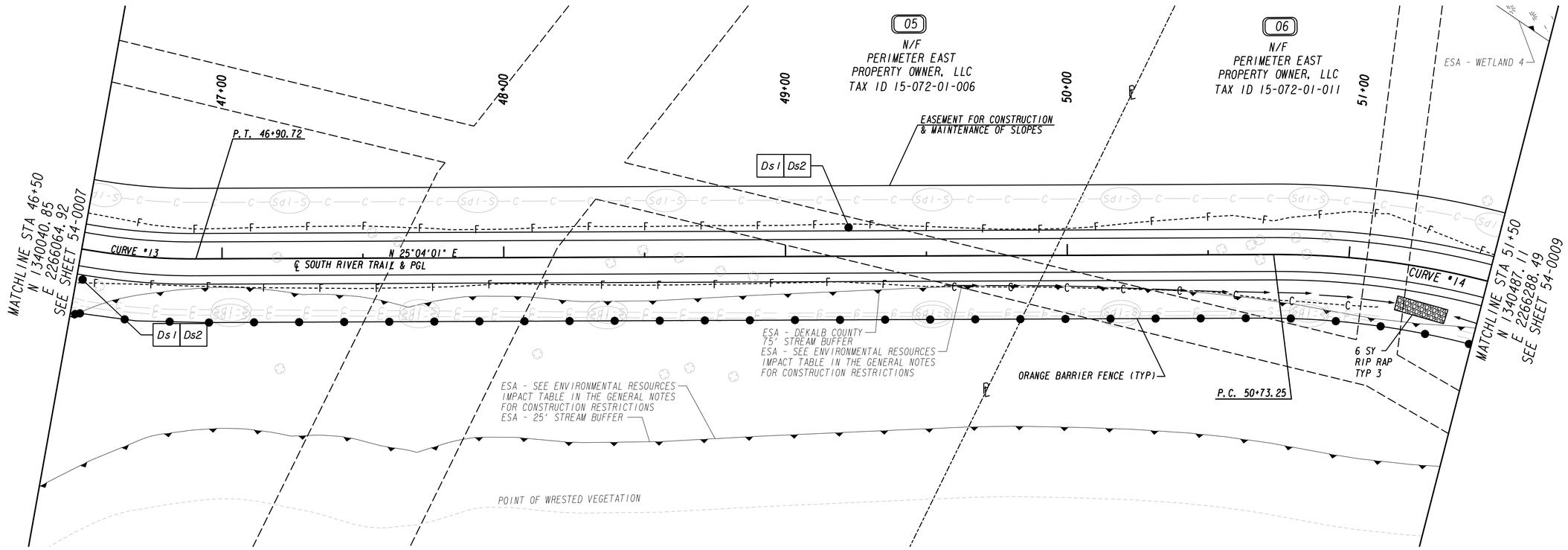
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0031

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

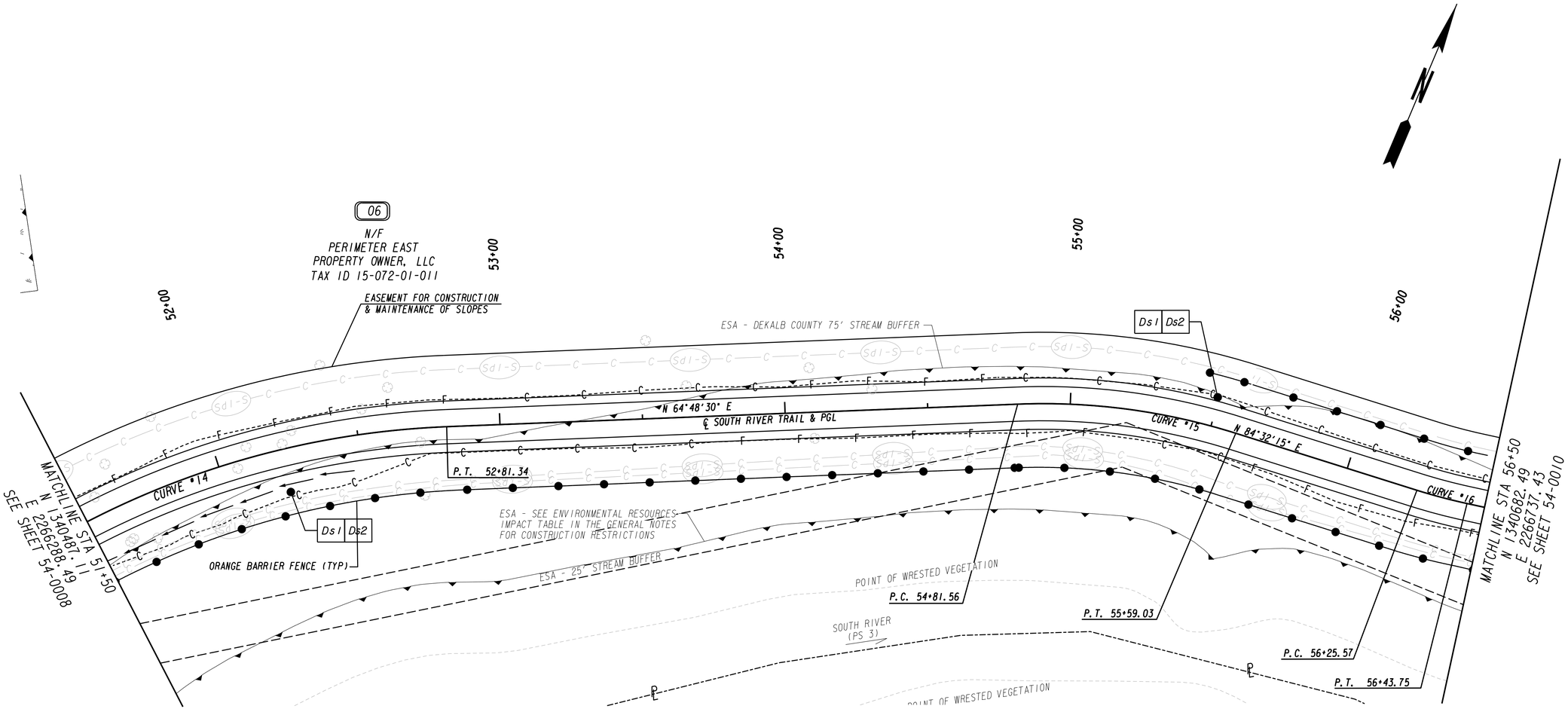
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0032

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

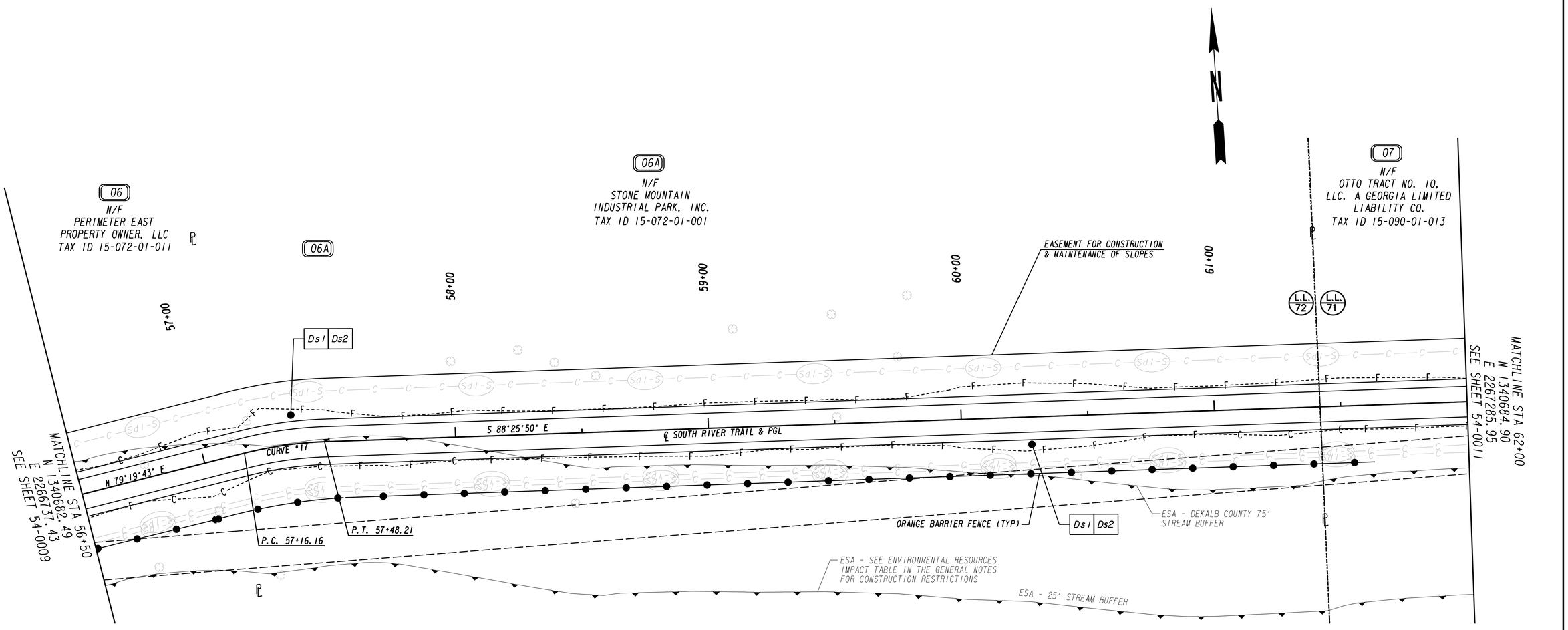
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0033

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

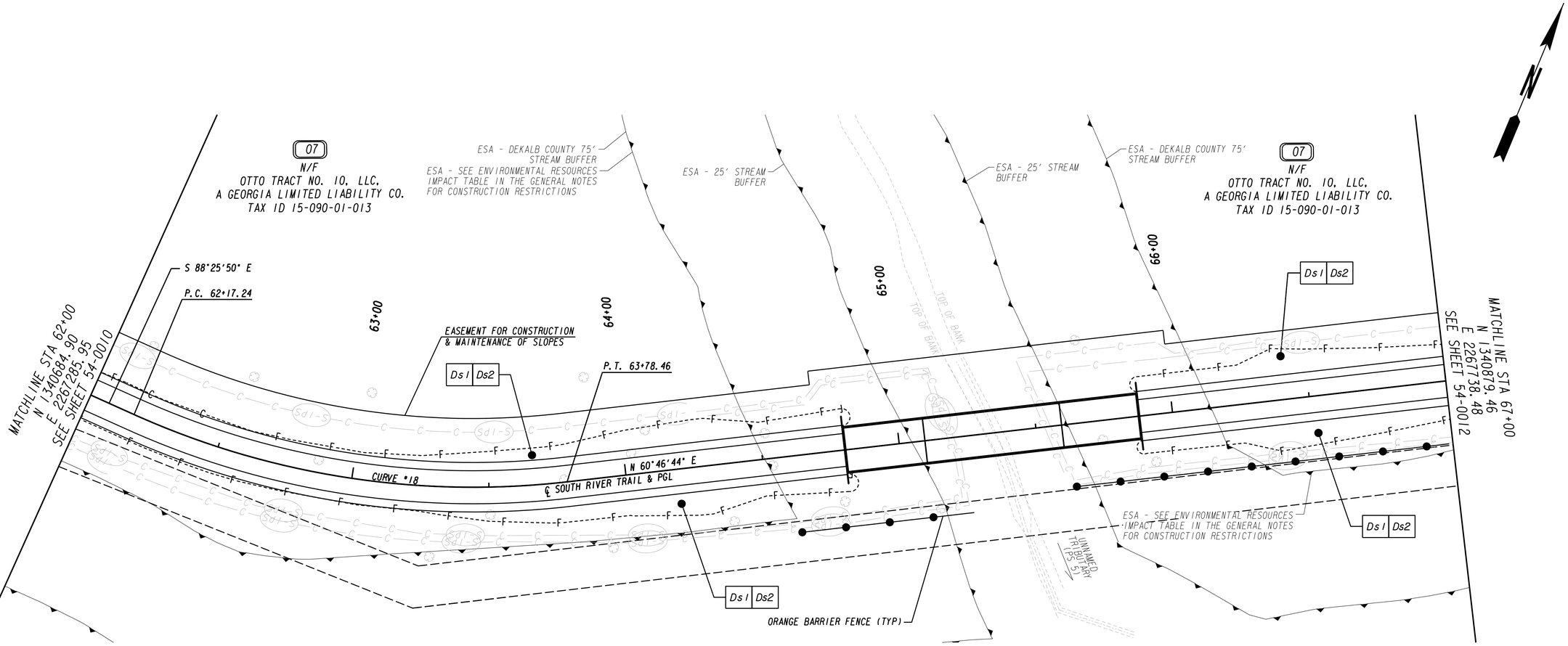
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	WMH	DATE:	05-07-2018

DRAWING No. 54-0034

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0035
VERIFIED:	MWH	DATE:	05-07-2018	

07
N/F
OTTO TRACT NO. 10, LLC.
A GEORGIA LIMITED LIABILITY CO.
TAX ID 15-090-01-013

68+00 69+00 70+00 71+00

EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES

MATCHLINE STA 67+00
N 1340879.46
E 2267738.48
SEE SHEET 54-0011

MATCHLINE STA 72+00
N 1341123.55
E 2268174.85
SEE SHEET 54-0013

Ds1 | Ds2

N 60°46'44" E
℄ SOUTH RIVER TRAIL & PGL

ESA - DEKALB COUNTY 75' STREAM BUFFER

ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN THE GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS

ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN THE GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS
ESA - 25' STREAM BUFFER

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

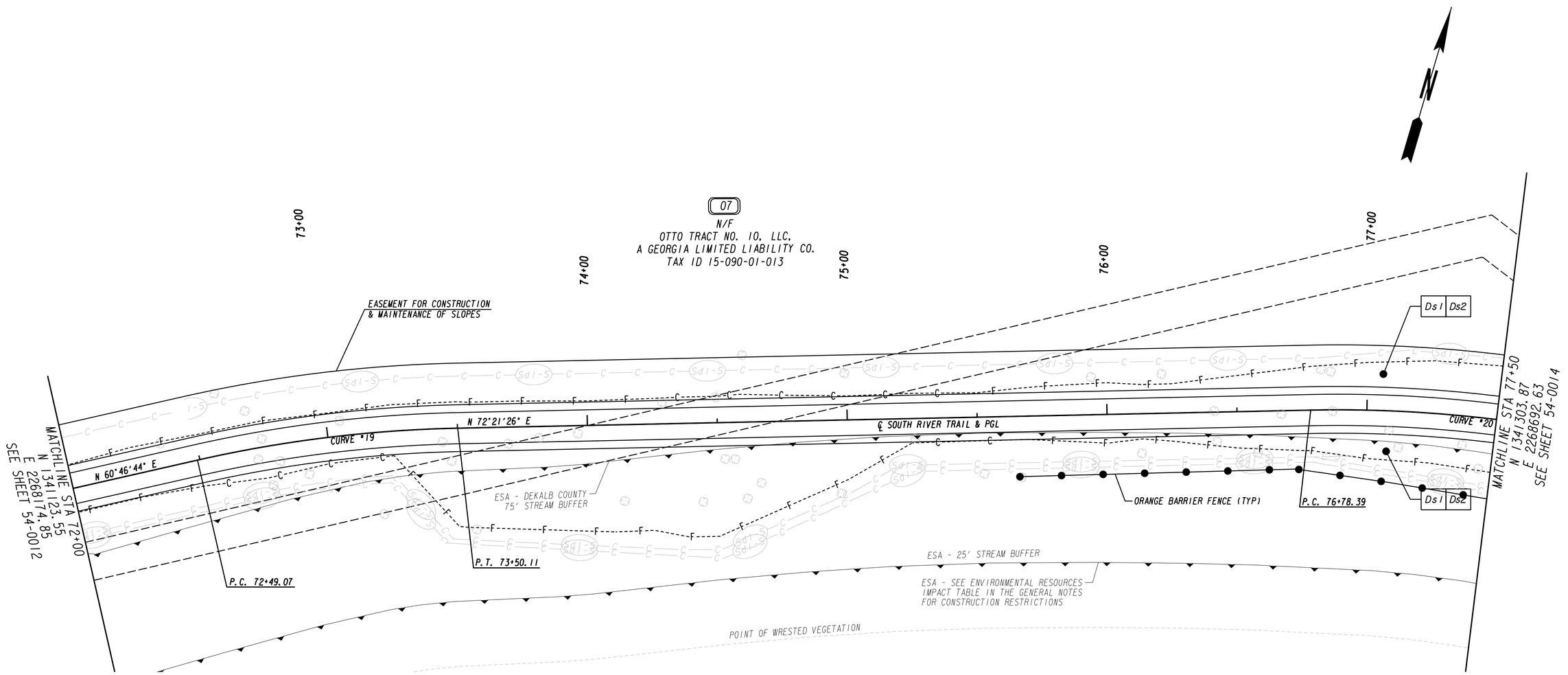
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0036

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

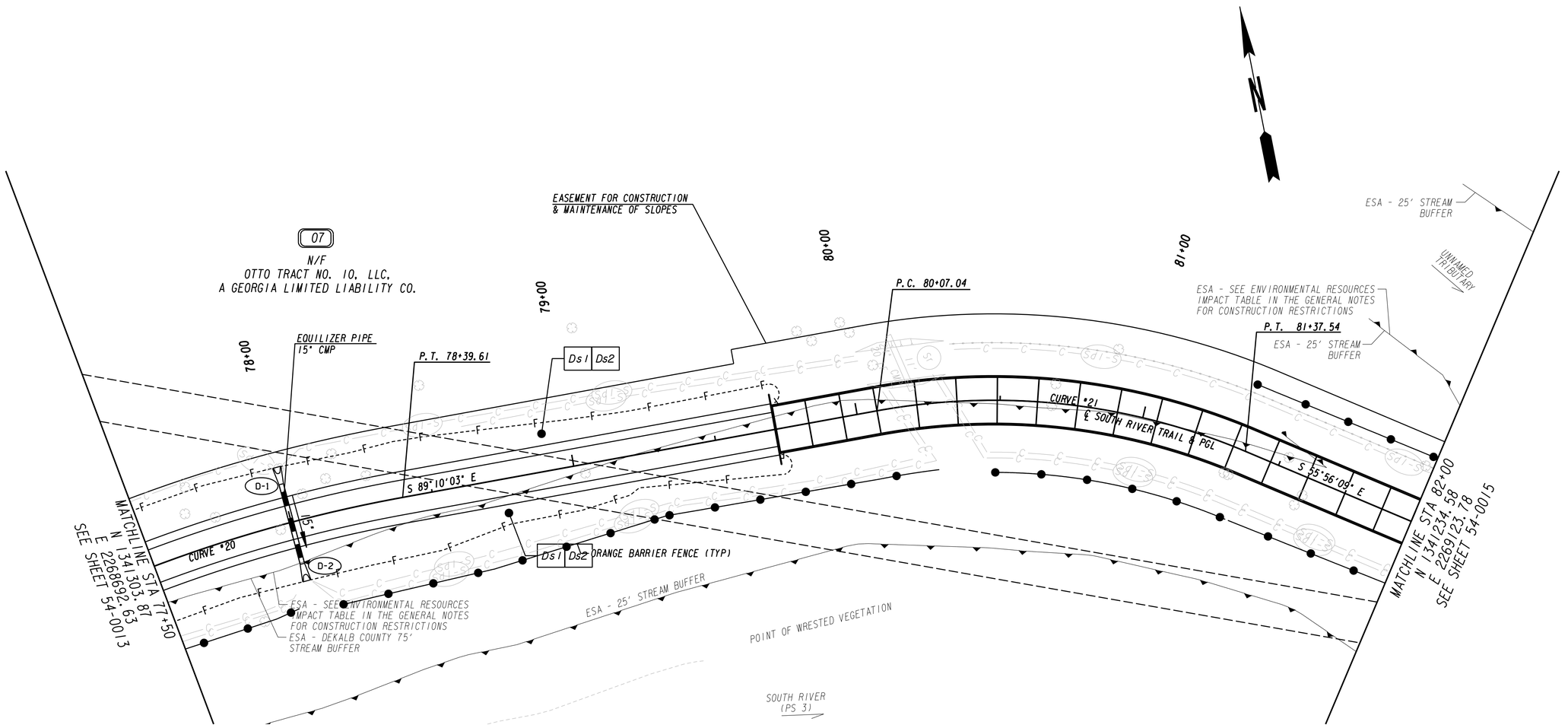
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0037

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

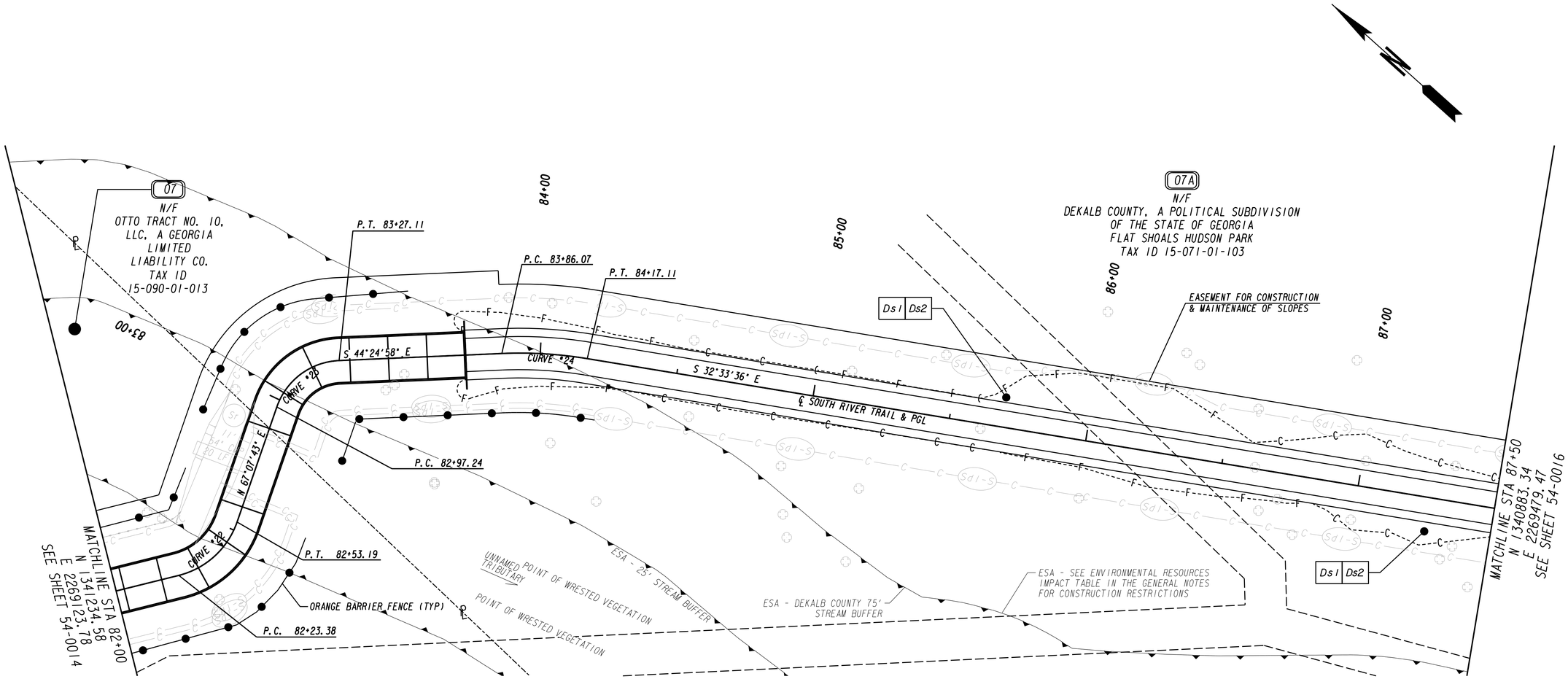
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0038

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

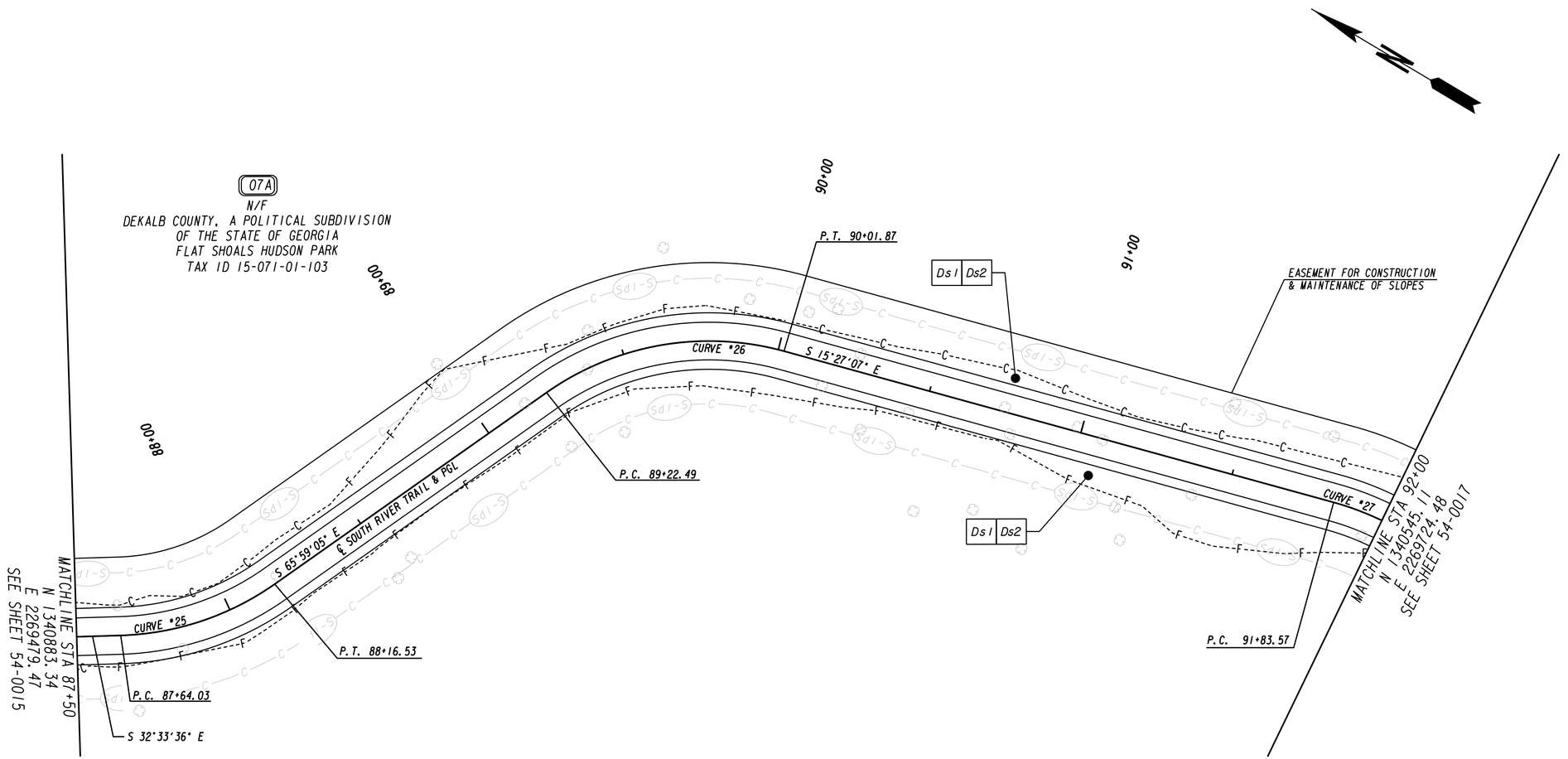
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0039

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

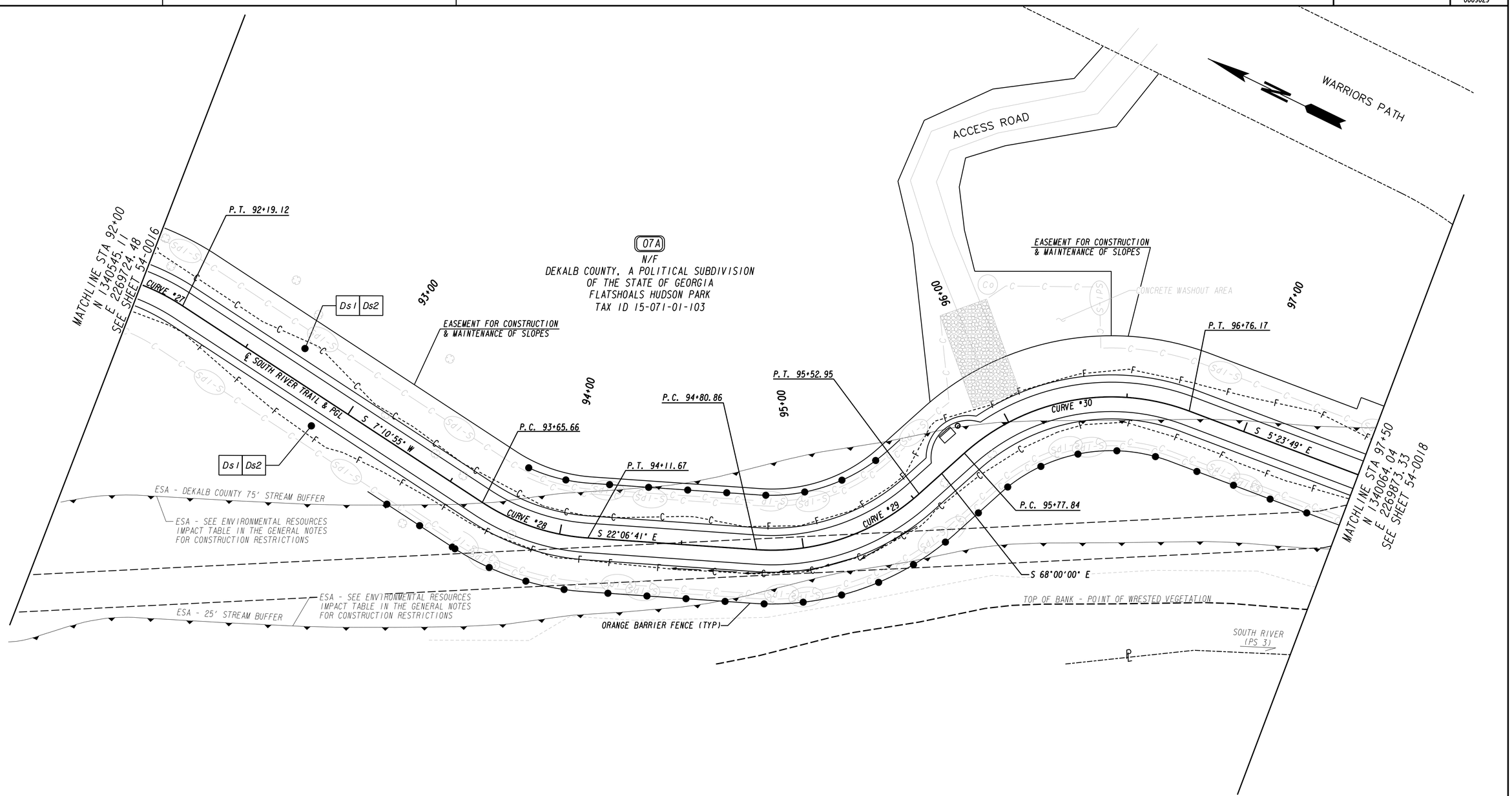
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0040



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

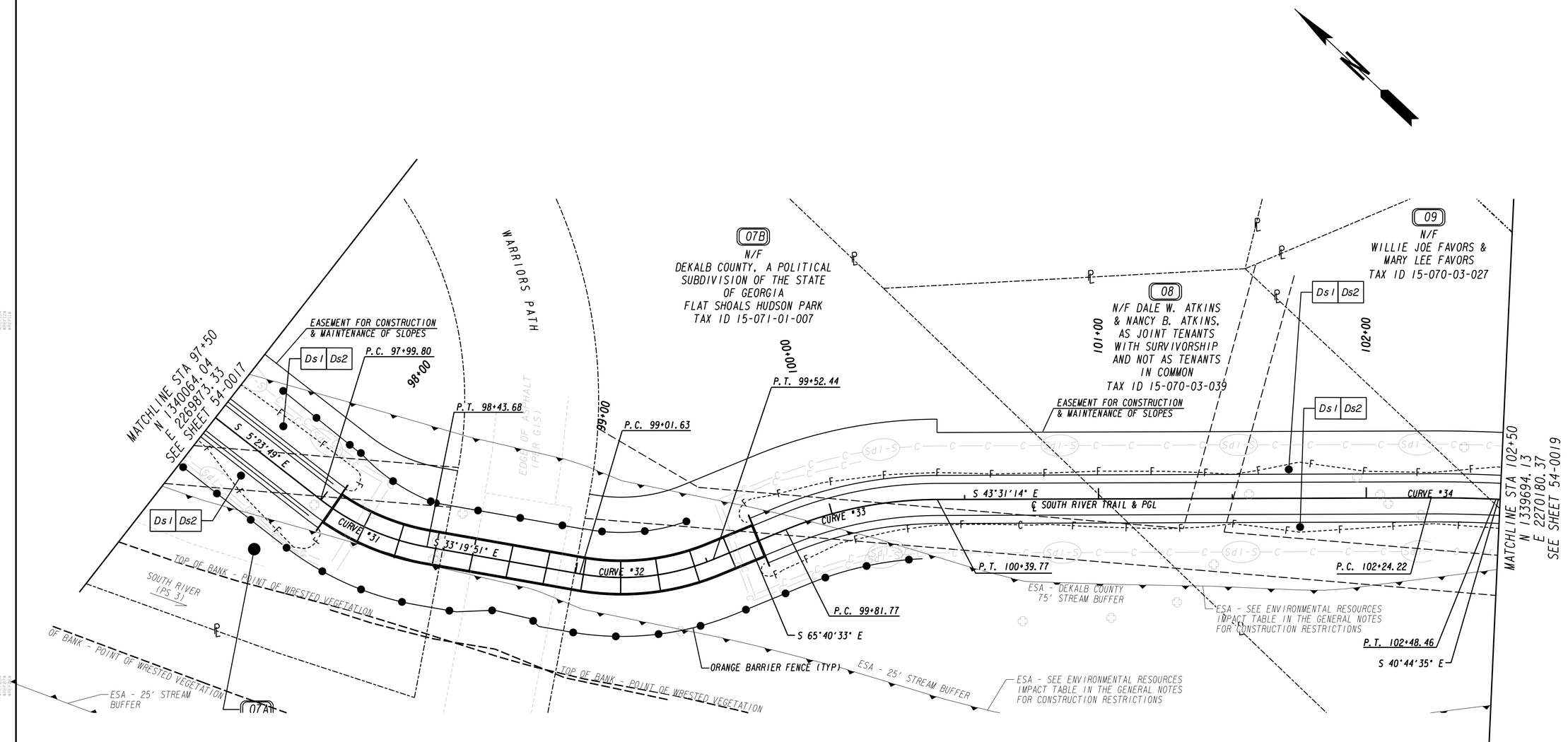
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0041
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

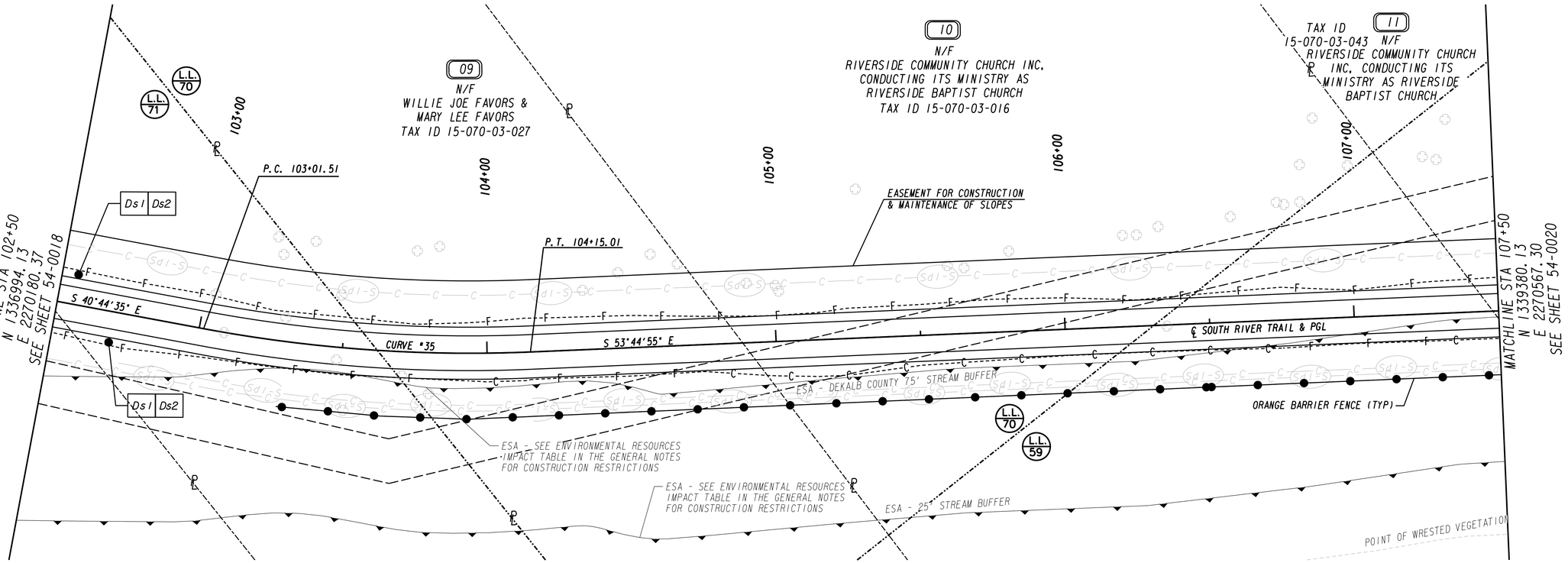
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MHH	DATE:	05-07-2018

DRAWING No. 54-0042

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

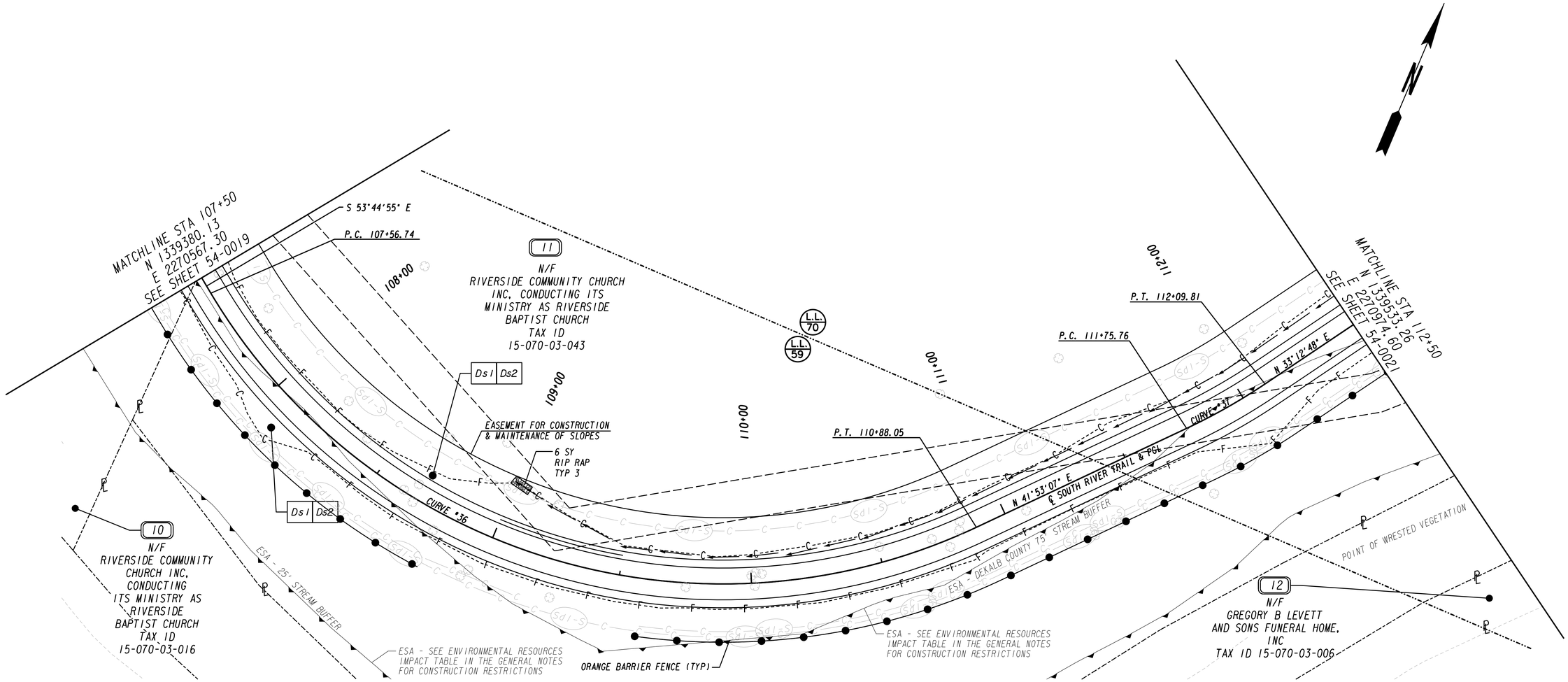
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0043

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

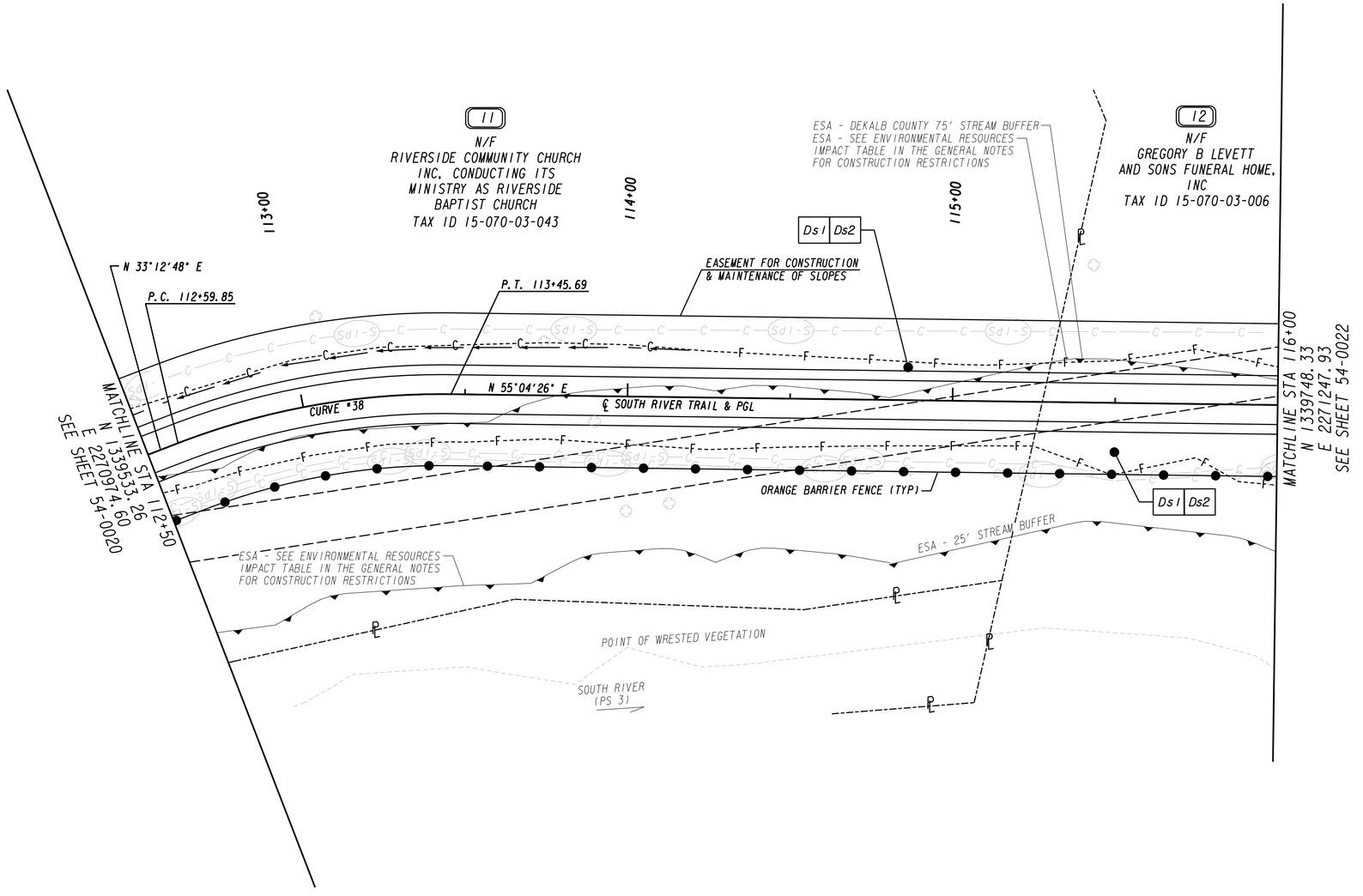
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No.
54-0044



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES		
03/14/19		

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

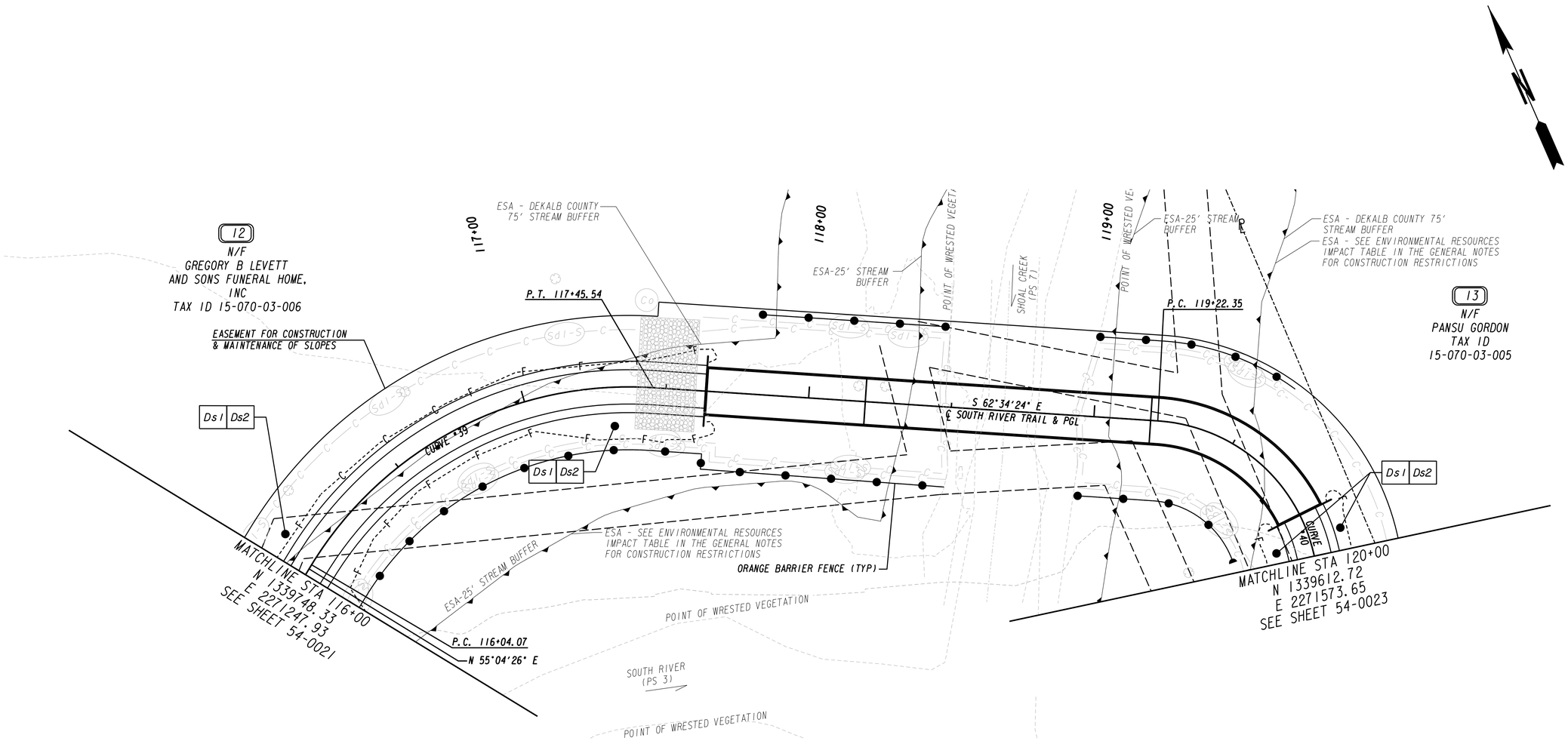
STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0045
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN

DATE$$ TIME$$ $PRFB$ DGN P. I. No. 0009029

$USER$



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19
04/16/19

DEKALB COUNTY & PATH FOUNDATION

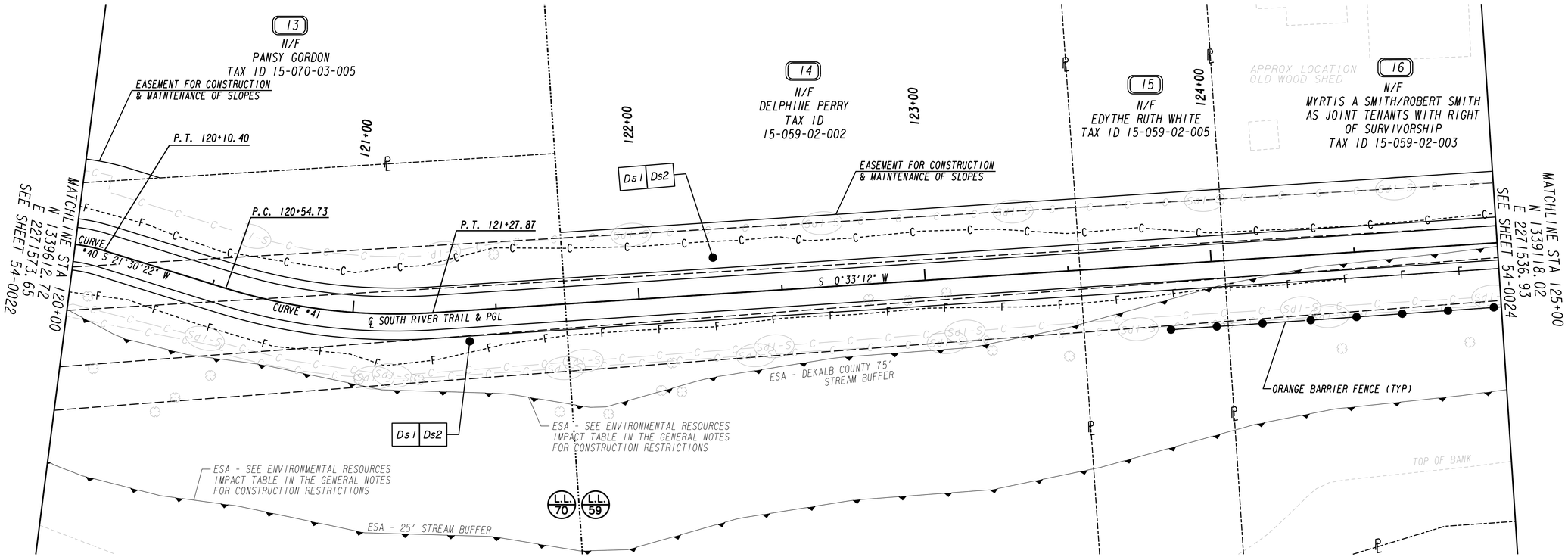
BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0046

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

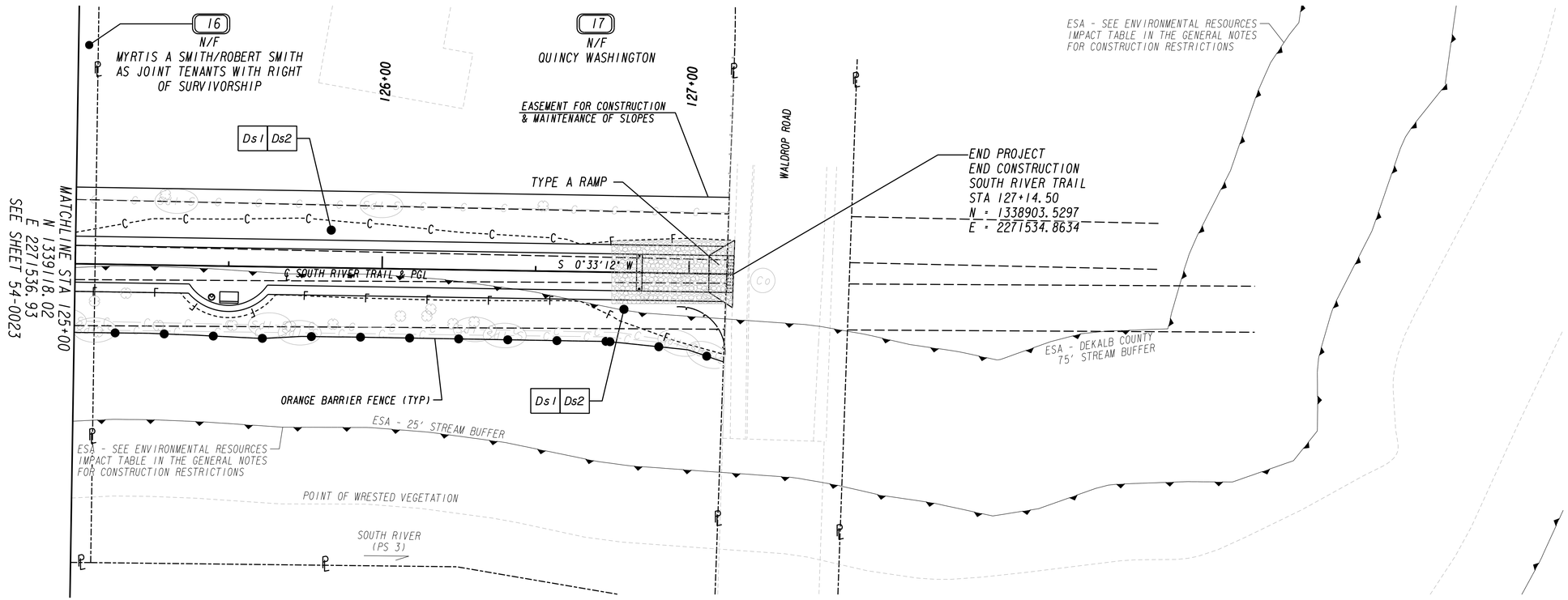
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	54-0047
CORRECTED:	AE & PAL	DATE:	05-07-2018	
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 2 - INTERMEDIATE PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	WMH	DATE:	05-07-2018

DRAWING No. 54-0048

BEGIN PROJECT
BEGIN CONSTRUCTION
SOUTH RIVER TRAIL
STA 10+11.00
N = 1341591.5549
E = 2263154.0625

TIE TO EXISTING
GRAVEL PARKING LOT

ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN THE GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS
ESA - DEKALB COUNTY
75' STREAM BUFFER

01
BOARD OF REGENTS OF
THE UNIVERSITY SYSTEM OF GEORGIA
TAX ID 15-088-01-002

EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES

11+00
12+00
13+00
14+00

Ds1 | Ds3

P.T. 11+75.30
P.C. 11+02.90
S 30°47'29" E
℄ SOUTH RIVER TRAIL & PGL
CURVE #1
TYPE A RAMP
P.C. 11+82.68
S 72°16'18" E
CURVE #2
S 34°51'36" E
P.T. 12+47.98
P.C. 13+73.41
CURVE #3
6 SY RIP RAP TYP 3
A-1
A-2
B-1
B-2
C-1
C-2
MATCHLINE STA 14+50
N 1341256.26
E 2263419.24
SEE SHEET 54-0002

ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN THE GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS
ESA - 25' STREAM BUFFER

POINT OF WORK

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

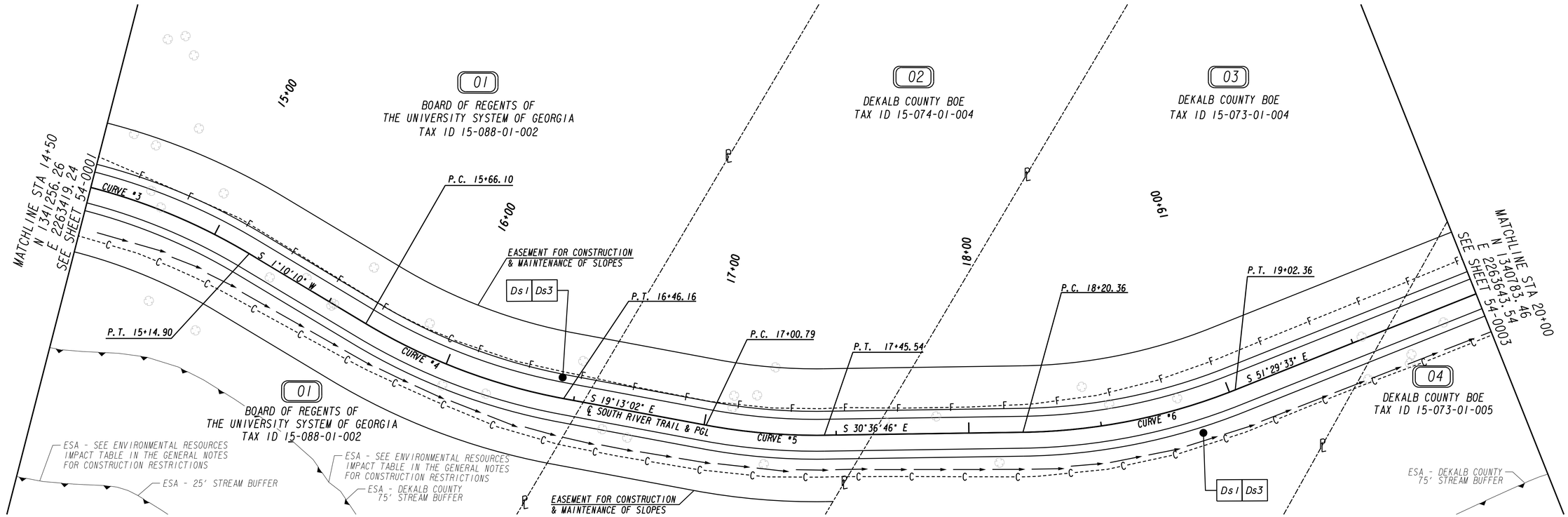
BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0049

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

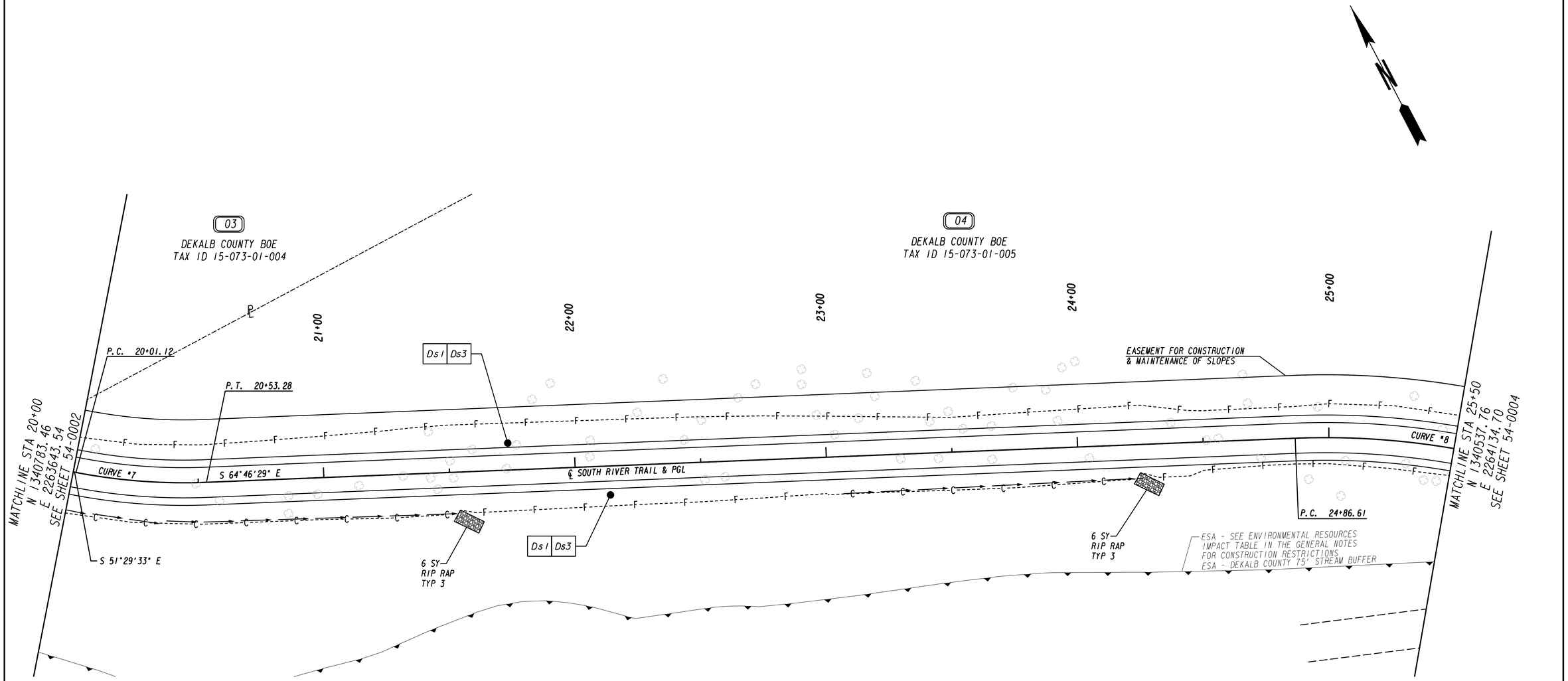
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0050
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

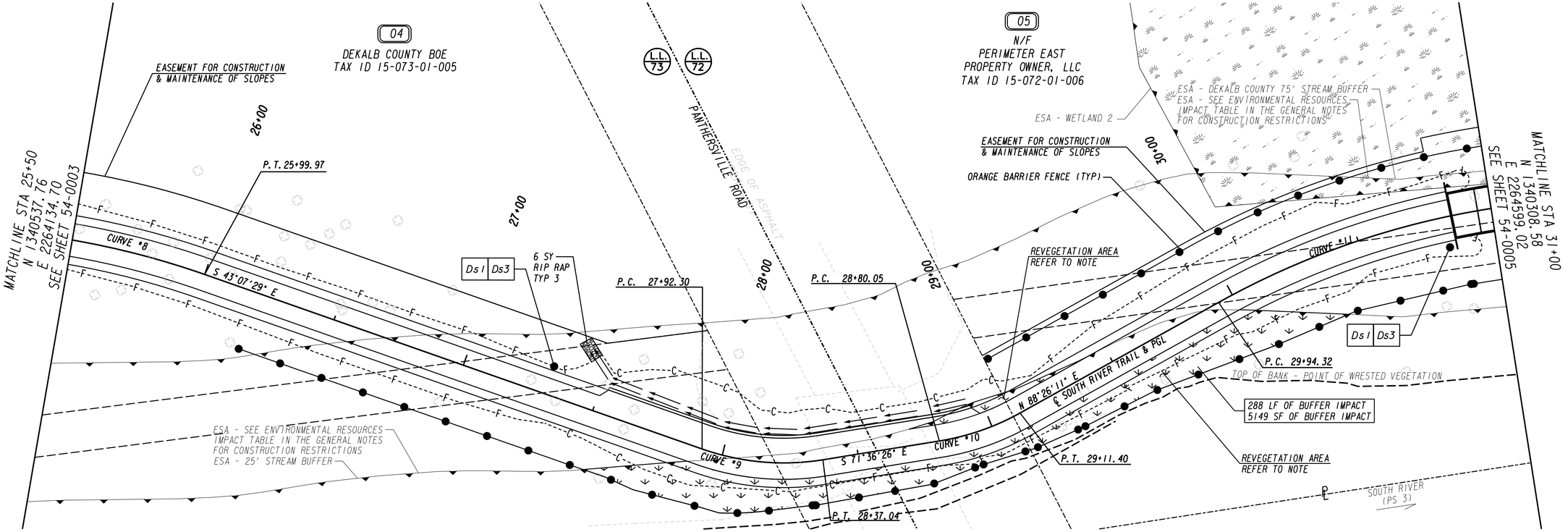
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0051



NOTE: REVEGETATION AREAS REQUIRE RIPARIAN SEED MIX PER GDOT STANDARD SPECIFICATIONS SECTION 700.

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE
REVEGETATION AREA

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

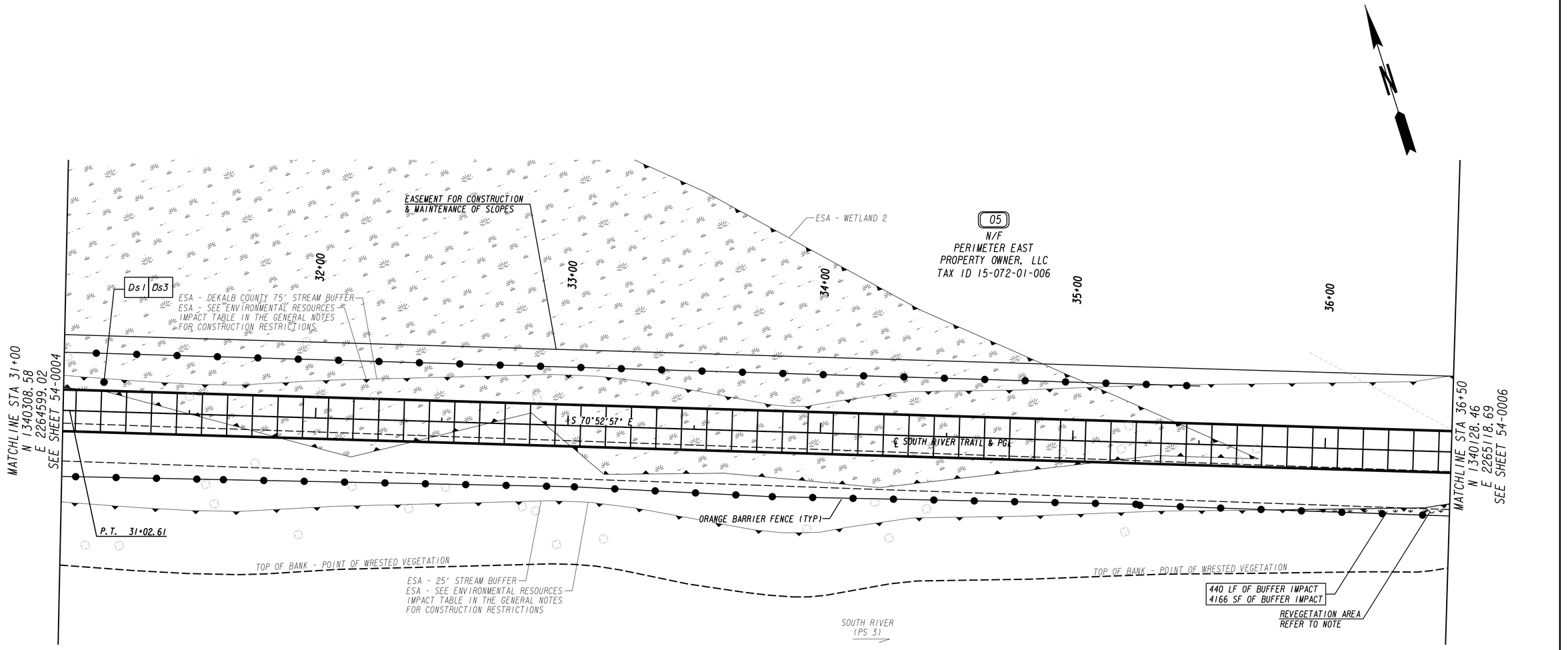
REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS
STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0052



NOTE: REVEGETATION AREAS REQUIRE RIPARIAN SEED MIX PER GDOT STANDARD SPECIFICATIONS SECTION 700.

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE
REVEGETATION AREA

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

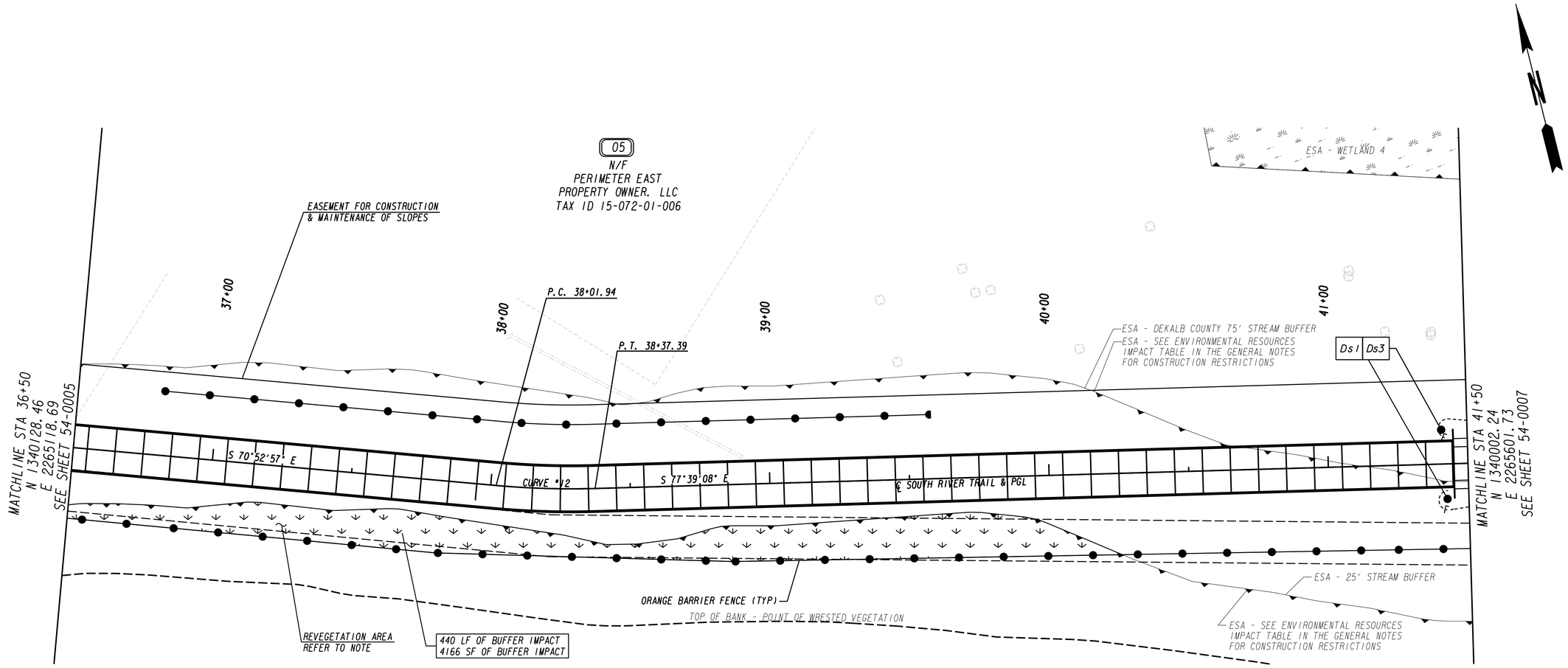
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0053
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



NOTE: REVEGETATION AREAS REQUIRE RIPARIAN SEED MIX PER GDOT STANDARD SPECIFICATIONS SECTION 700.

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE
REVEGETATION AREA

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

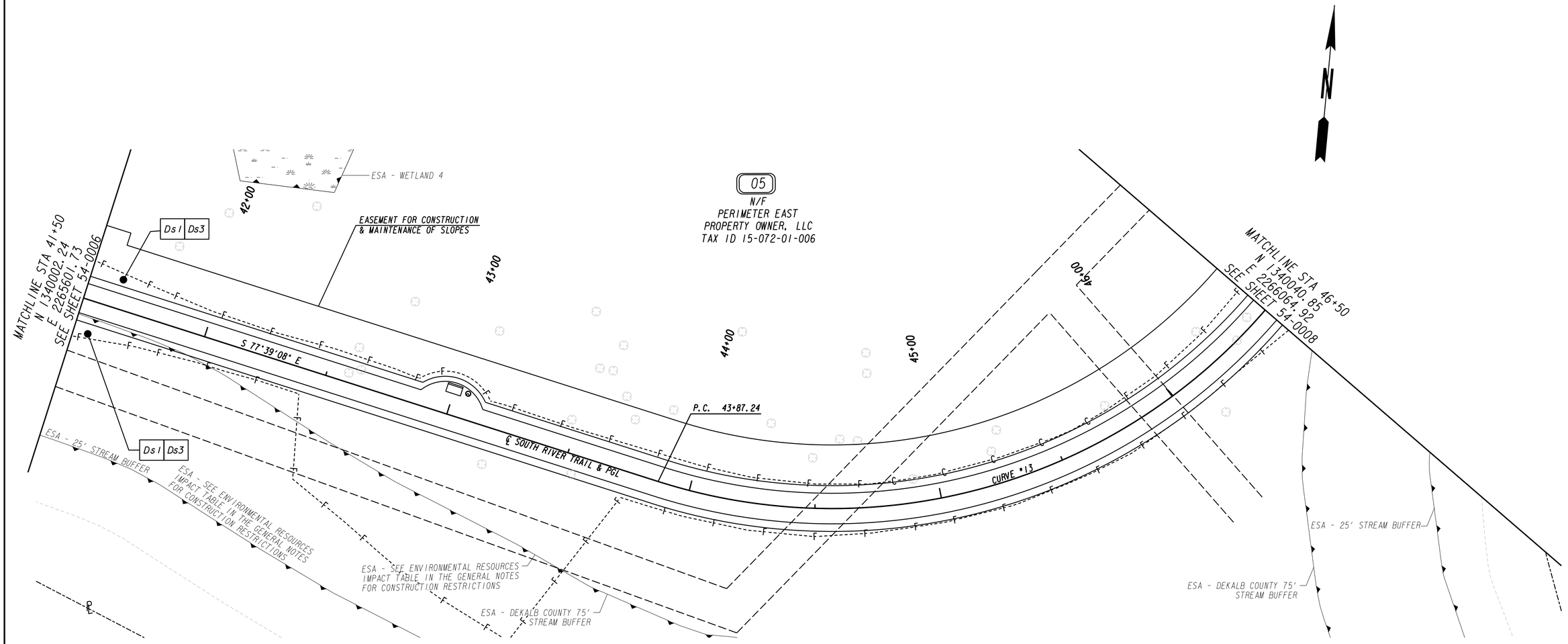
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	54-0054
CORRECTED:	AE & PAL	DATE:	05-07-2018	
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

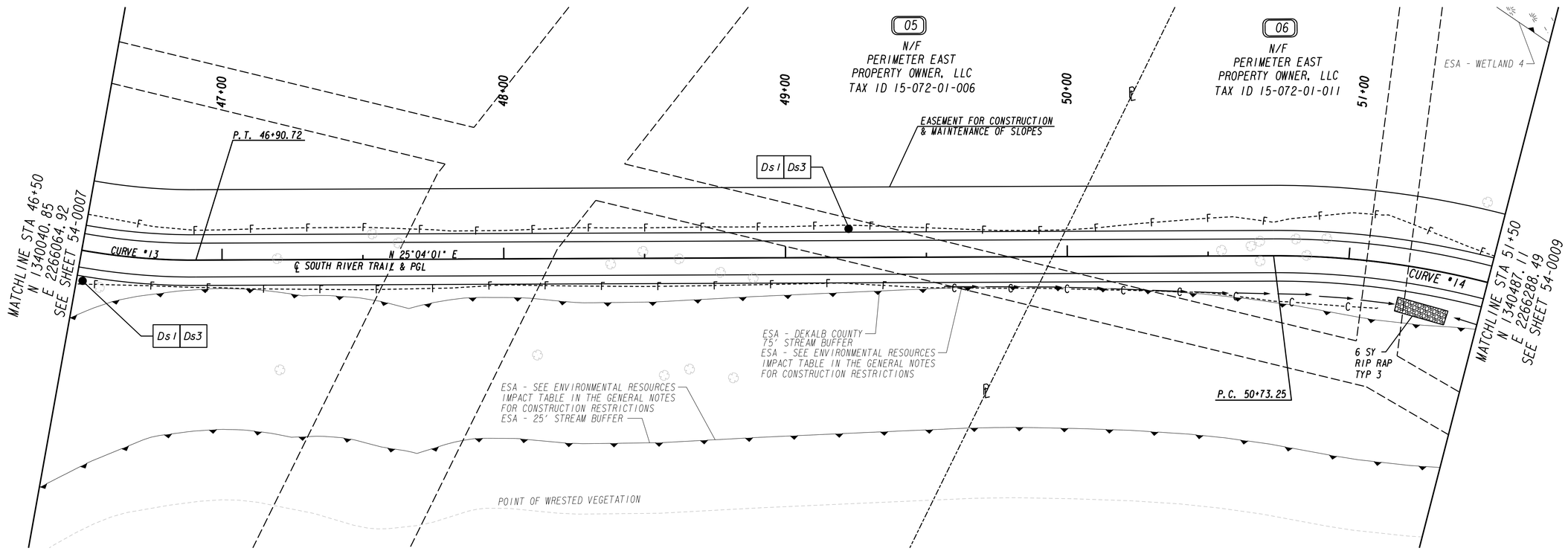
STAGE 3 - FINAL PHASE

SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0055

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

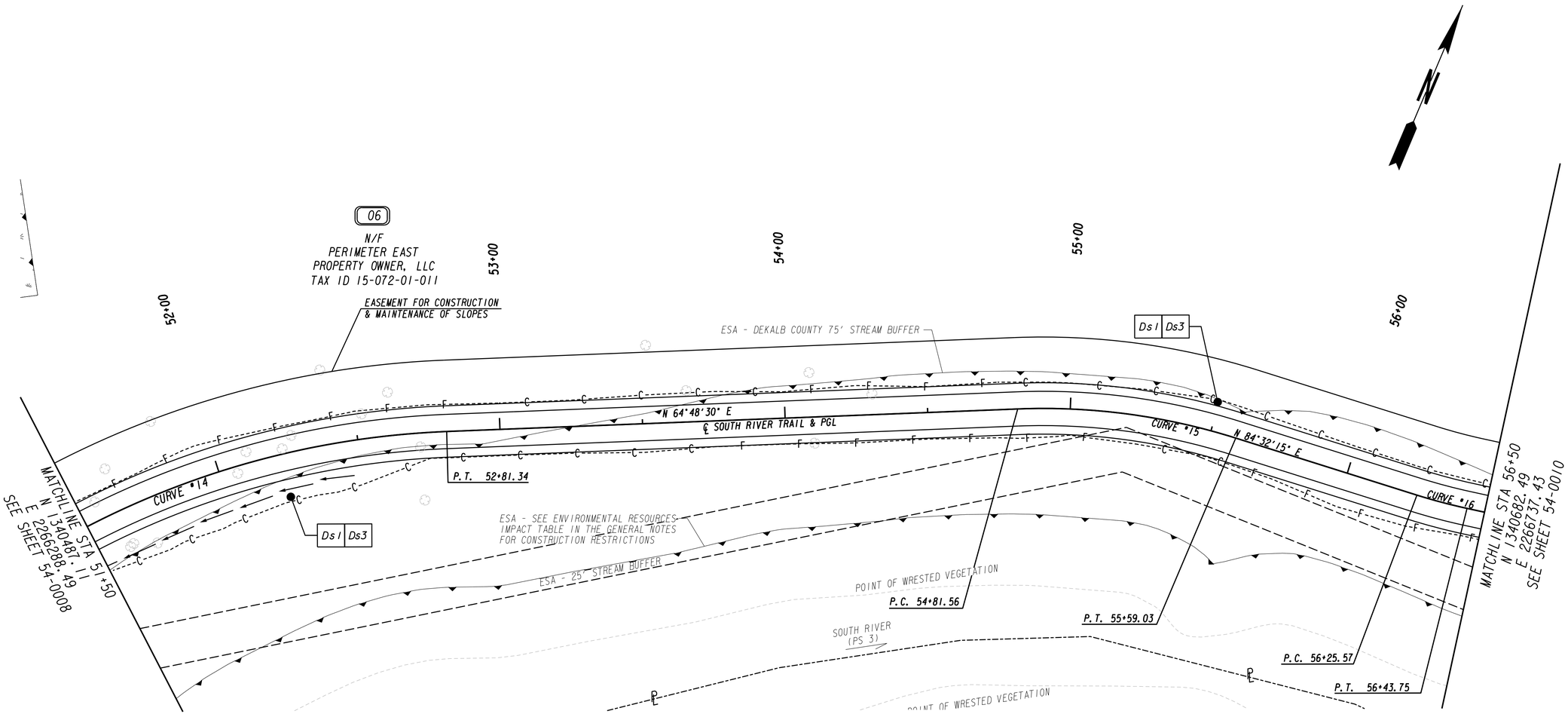
REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS
STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE: 04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE: 05-07-2018	
CORRECTED:	AE & PAL	DATE: 05-07-2018	54-0056
VERIFIED:	MWH	DATE: 05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

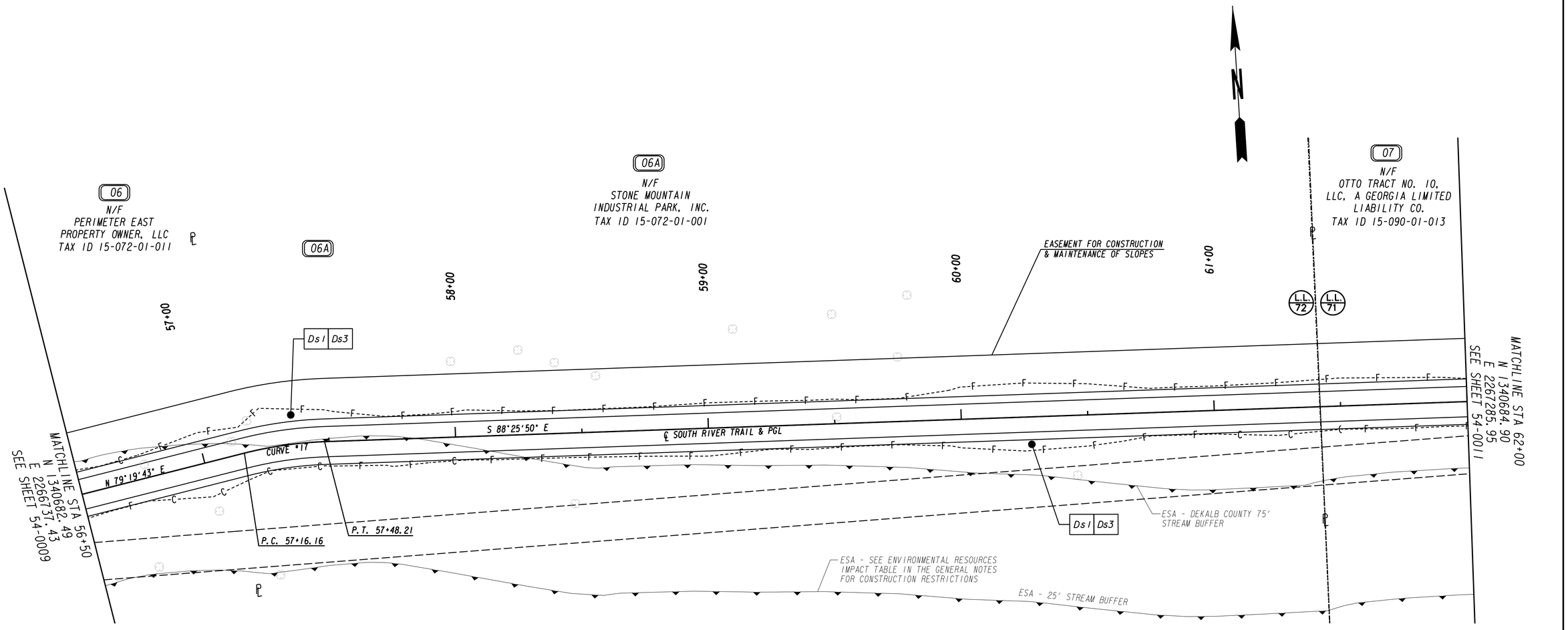
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0057



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

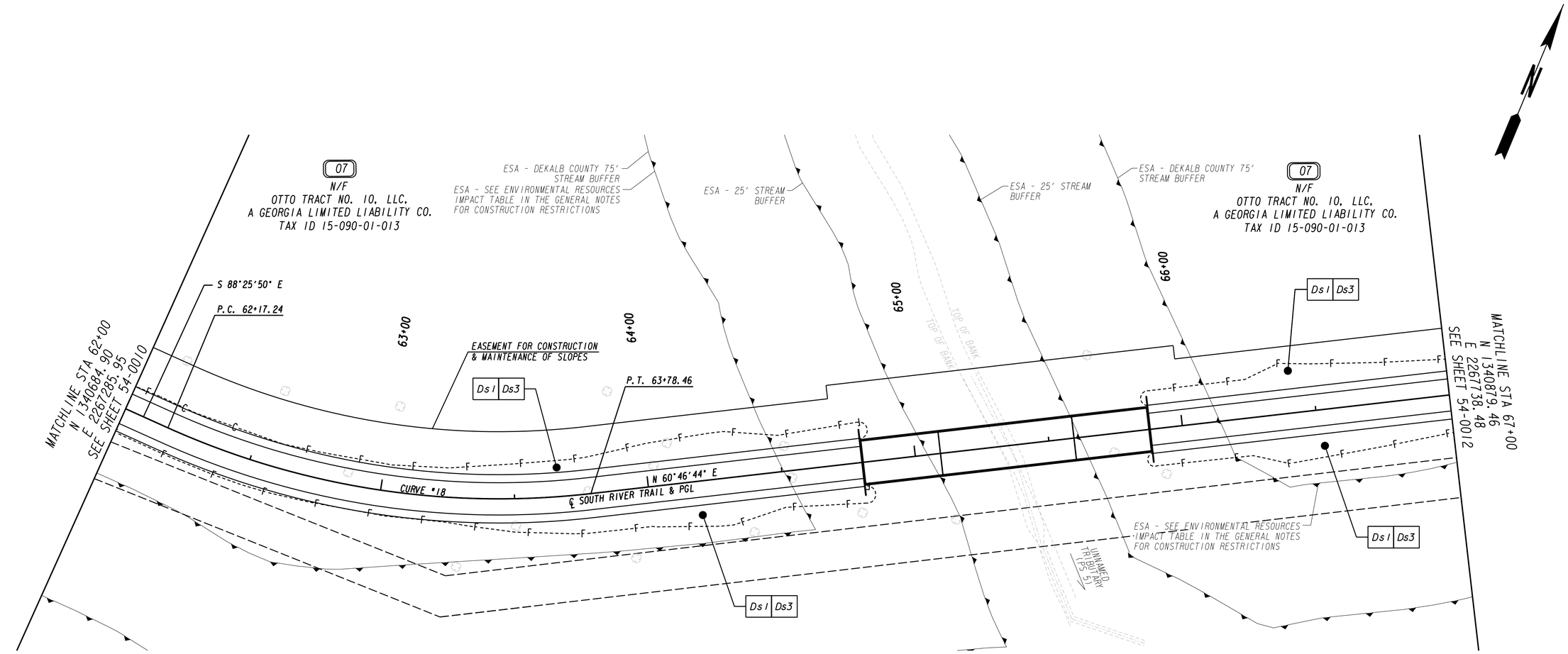
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0058
VERIFIED:	WMH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

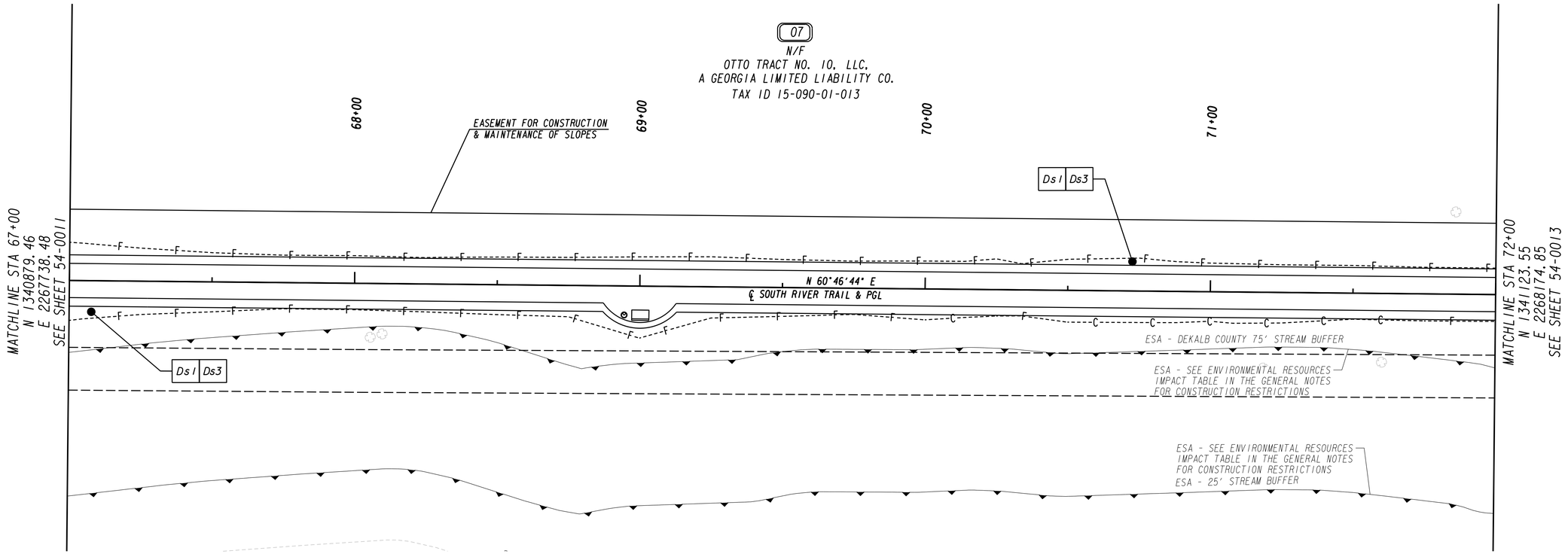
BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0059

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

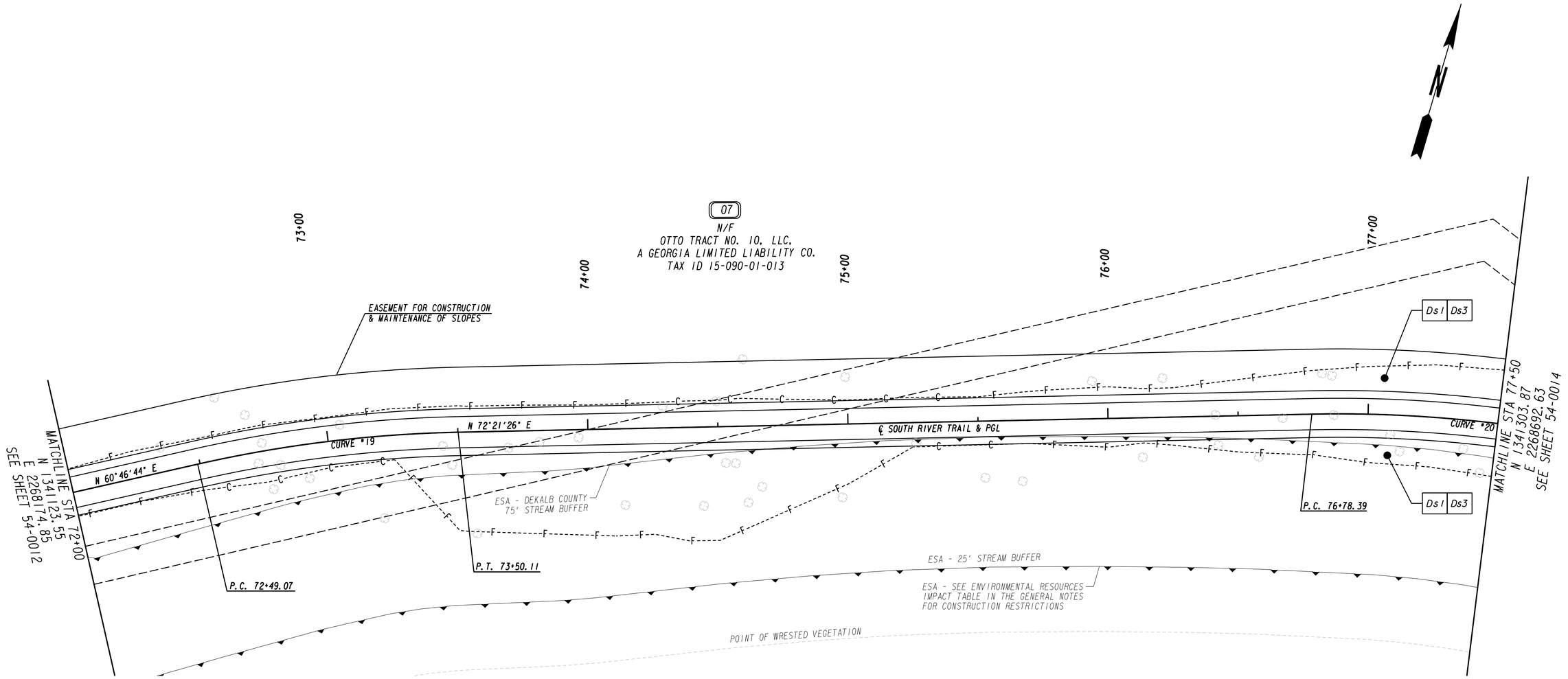
BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0060

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

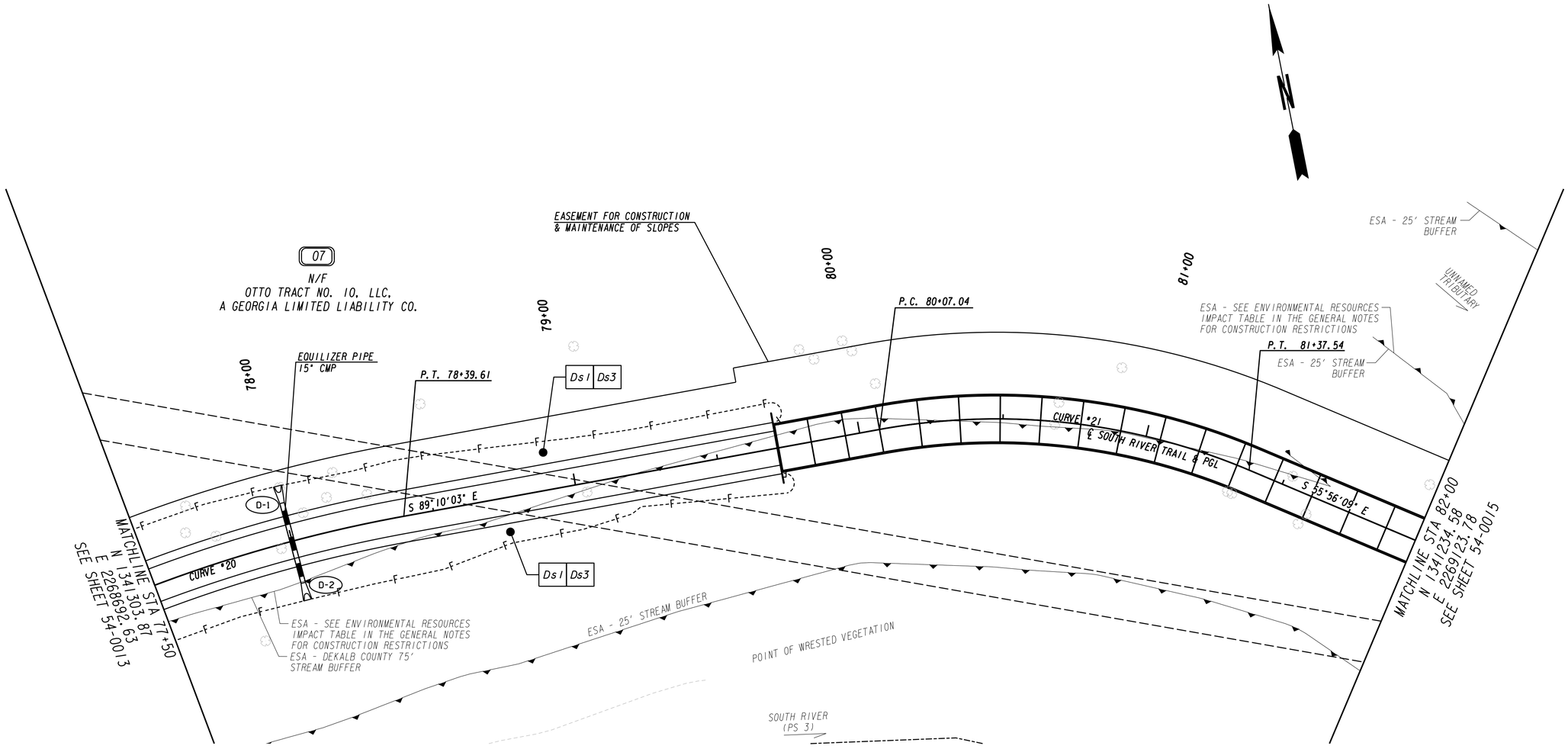
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0061
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

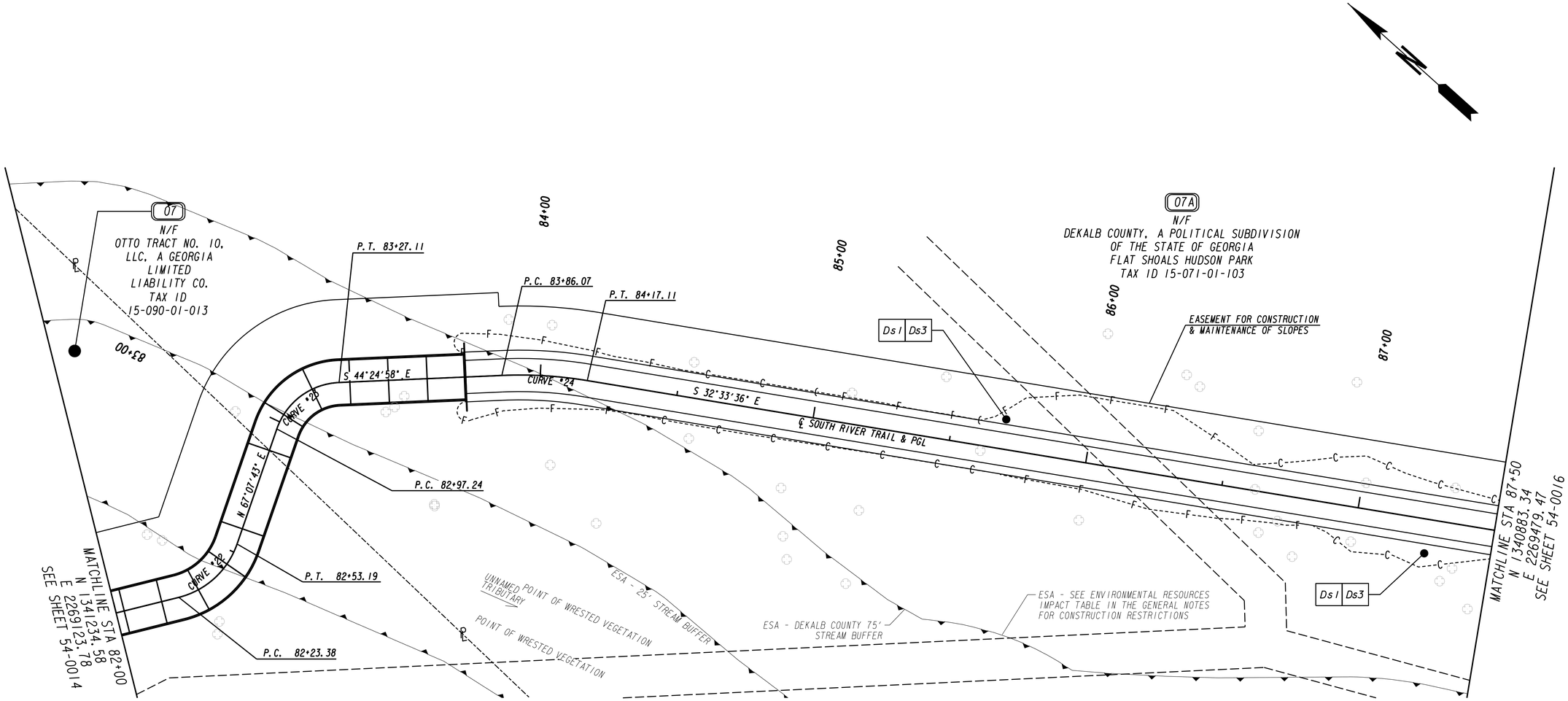
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0062
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

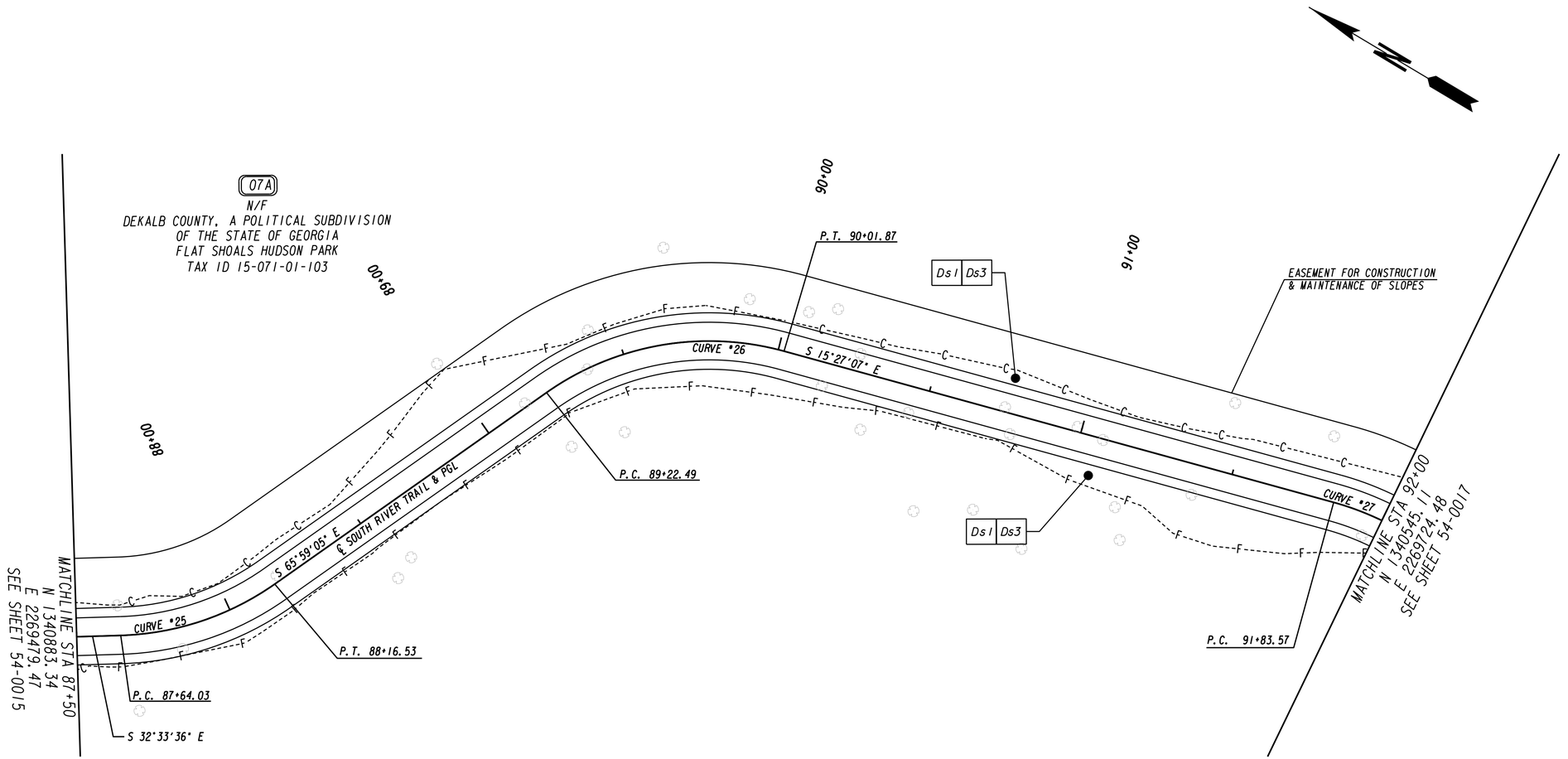
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS
STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0063

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

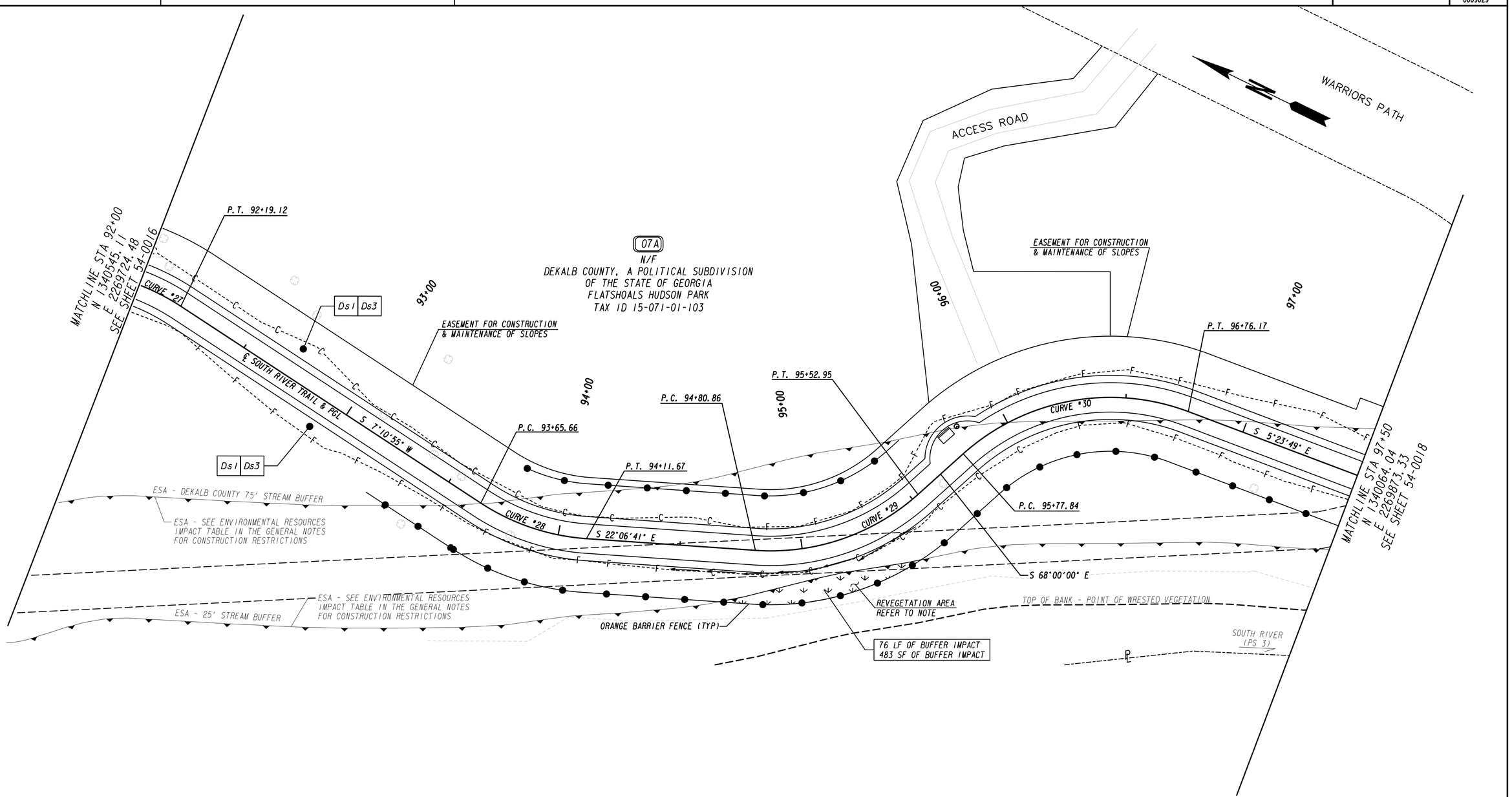
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0064



NOTE: REVEGETATION AREAS REQUIRE RIPARIAN SEED MIX PER GDOT STANDARD SPECIFICATIONS SECTION 700.

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE
REVEGETATION AREA

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

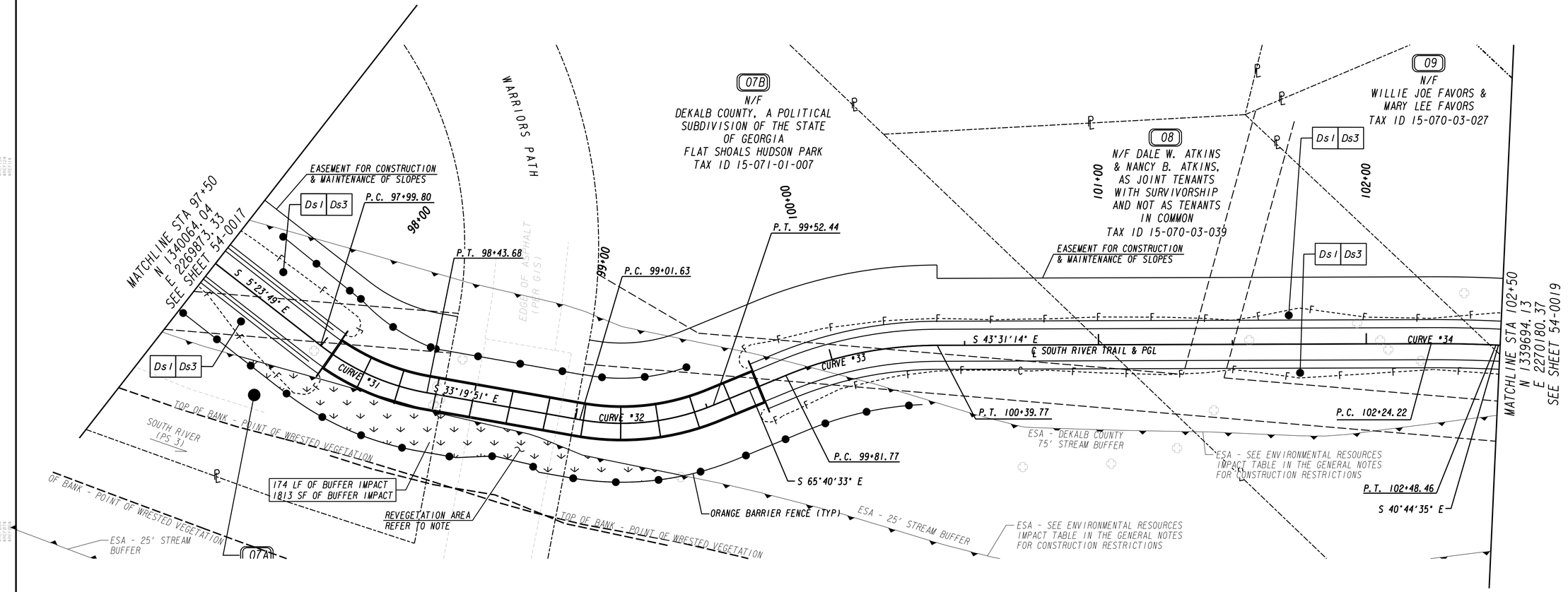
SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS
STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	54-0065
CORRECTED:	AE & PAL	DATE:	05-07-2018	
VERIFIED:	MWH	DATE:	05-07-2018	



NOTE: REVEGETATION AREAS REQUIRE RIPARIAN SEED MIX PER GDOT STANDARD SPECIFICATIONS SECTION 700.

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE
REVEGETATION AREA

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

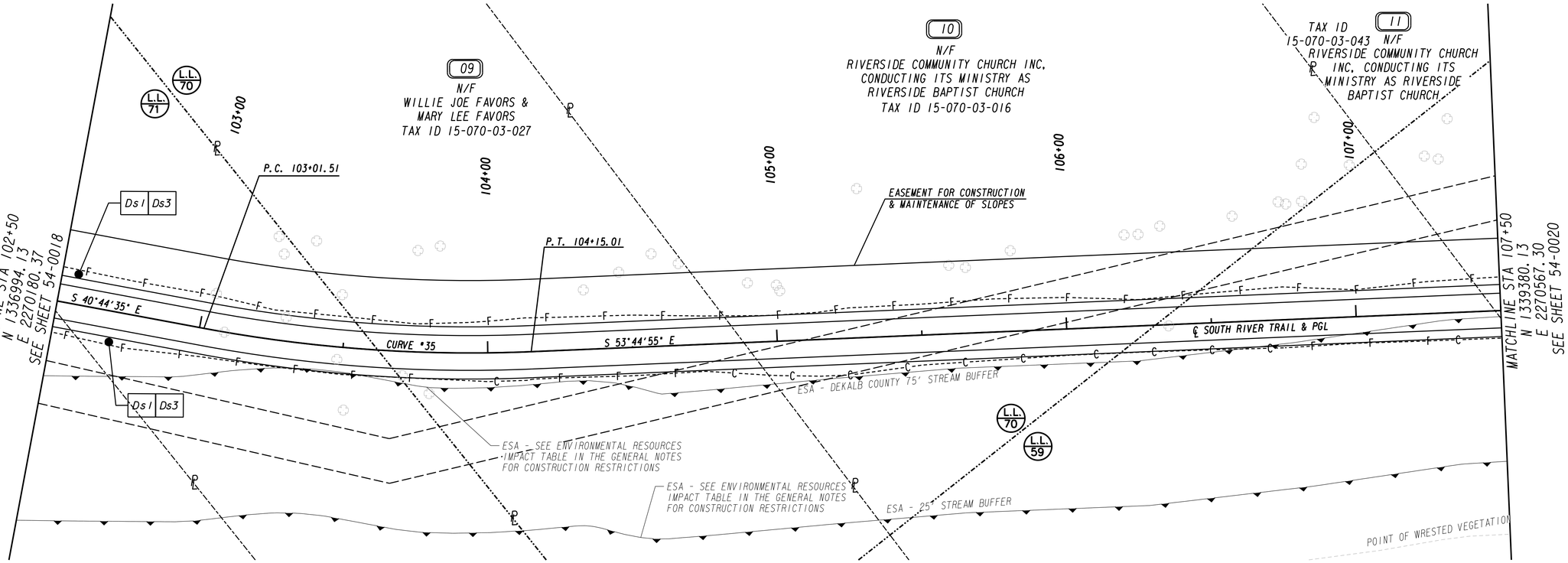
BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE

SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MHH	DATE:	05-07-2018

DRAWING No. 54-0066



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

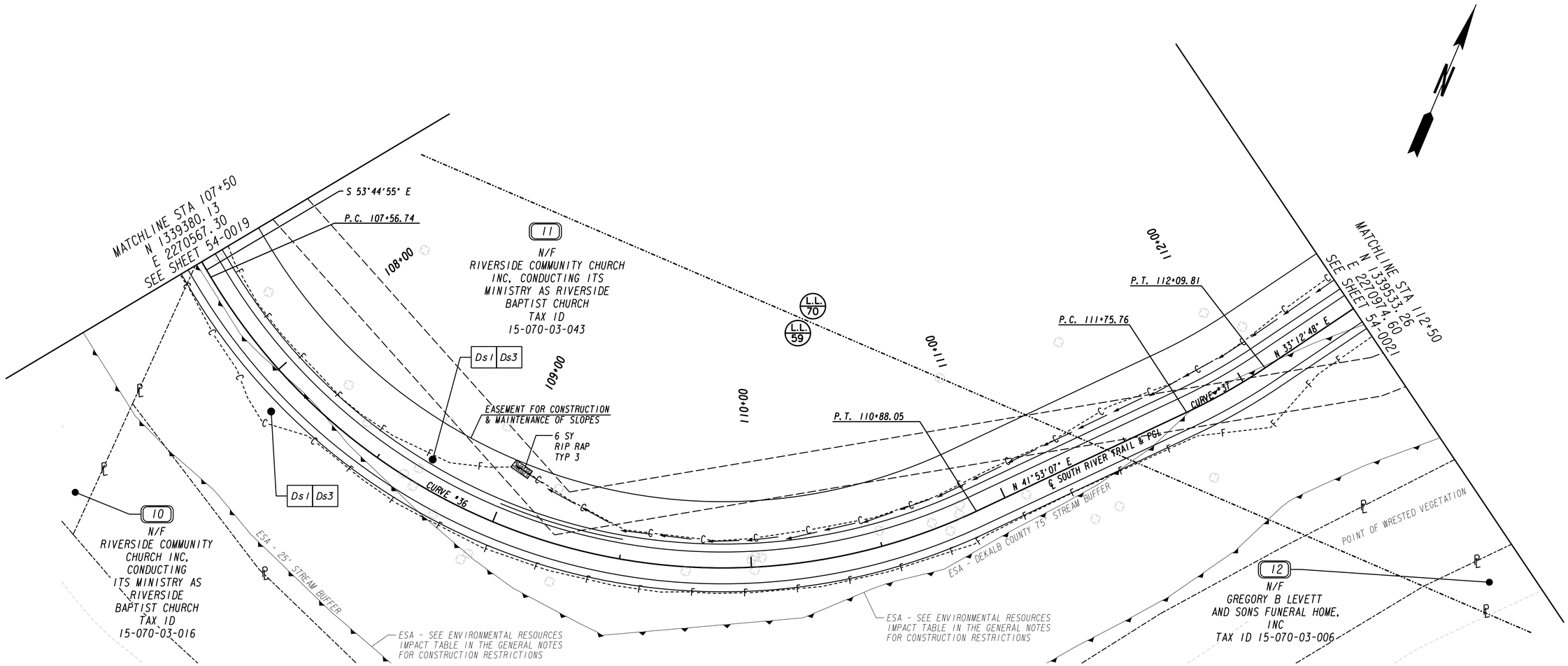
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0067
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

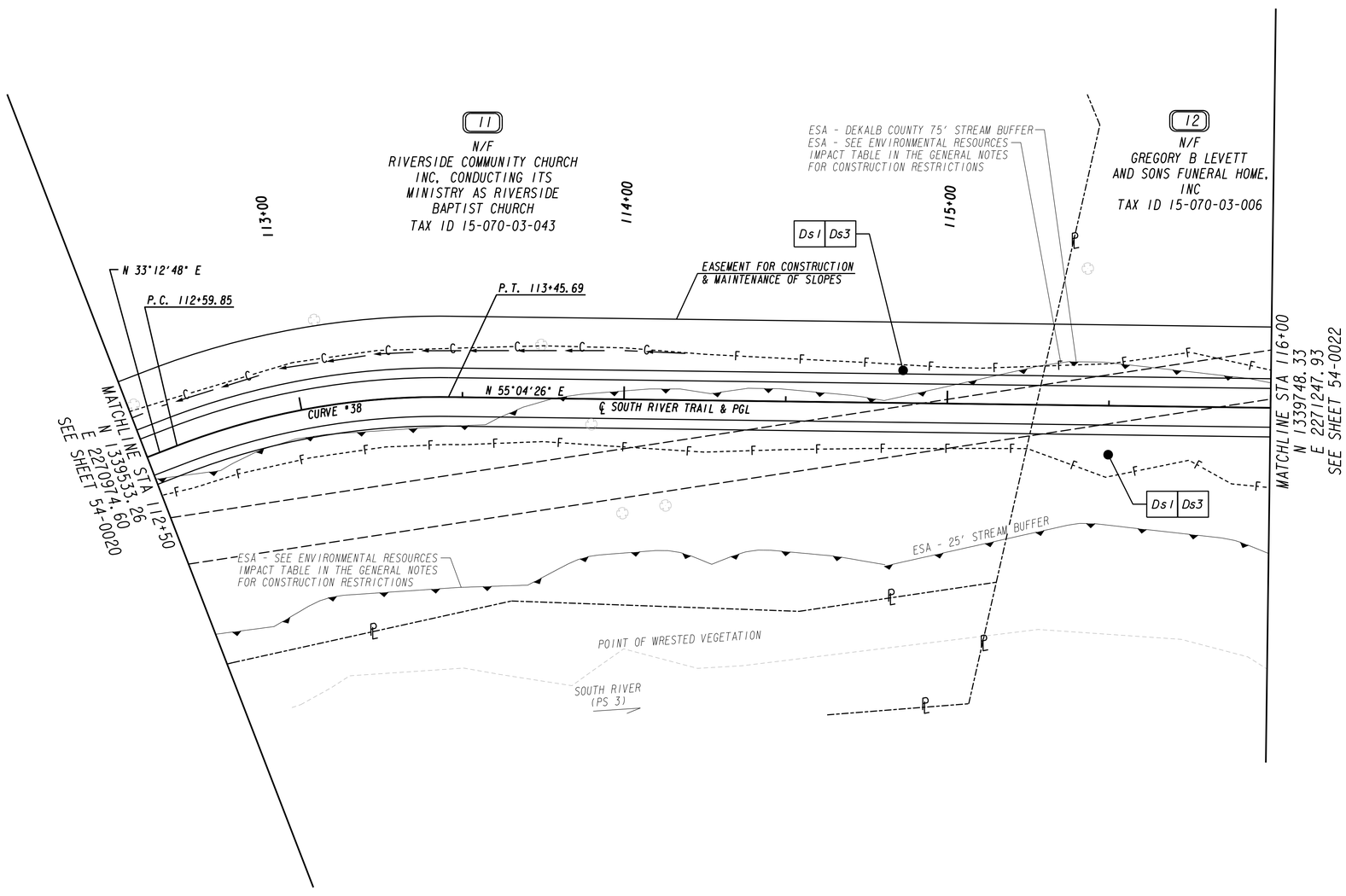
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0068



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

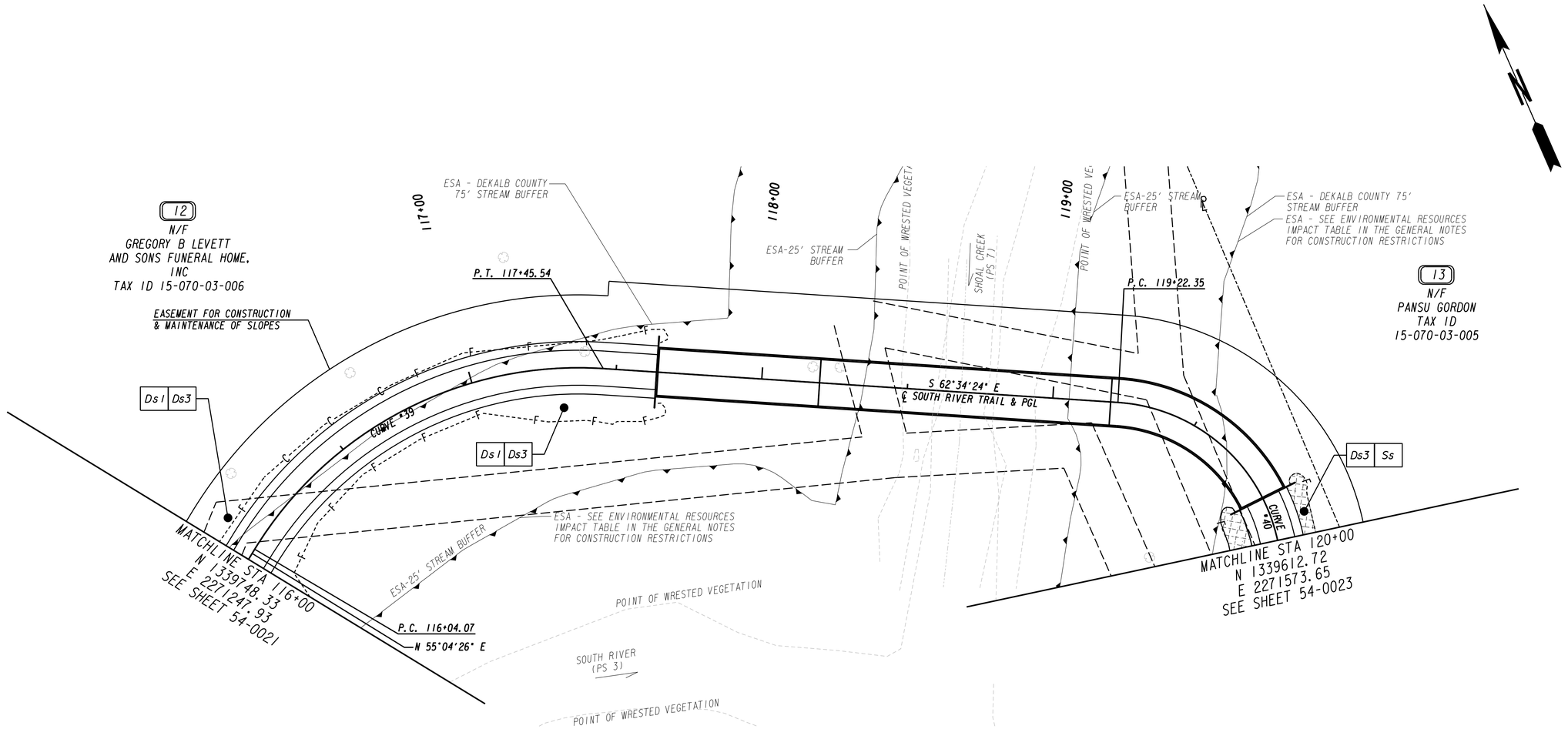
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0069
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

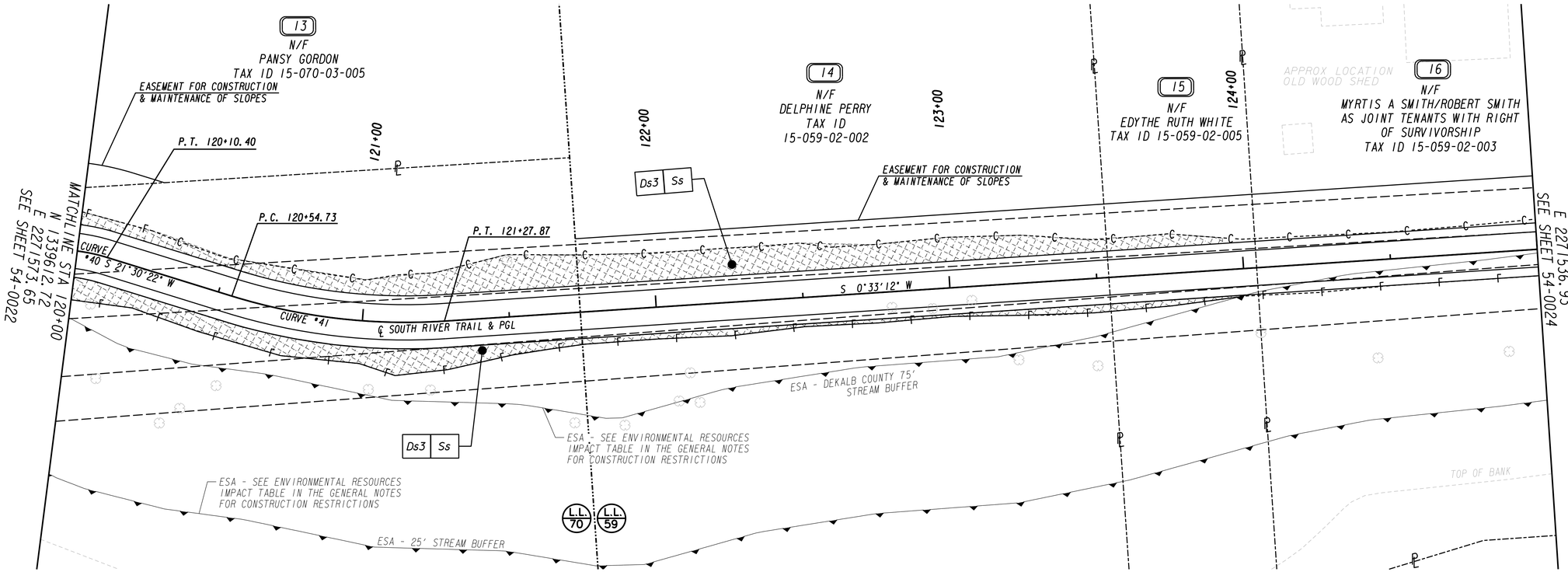
BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	MWH	DATE:	05-07-2018

DRAWING No. 54-0070

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

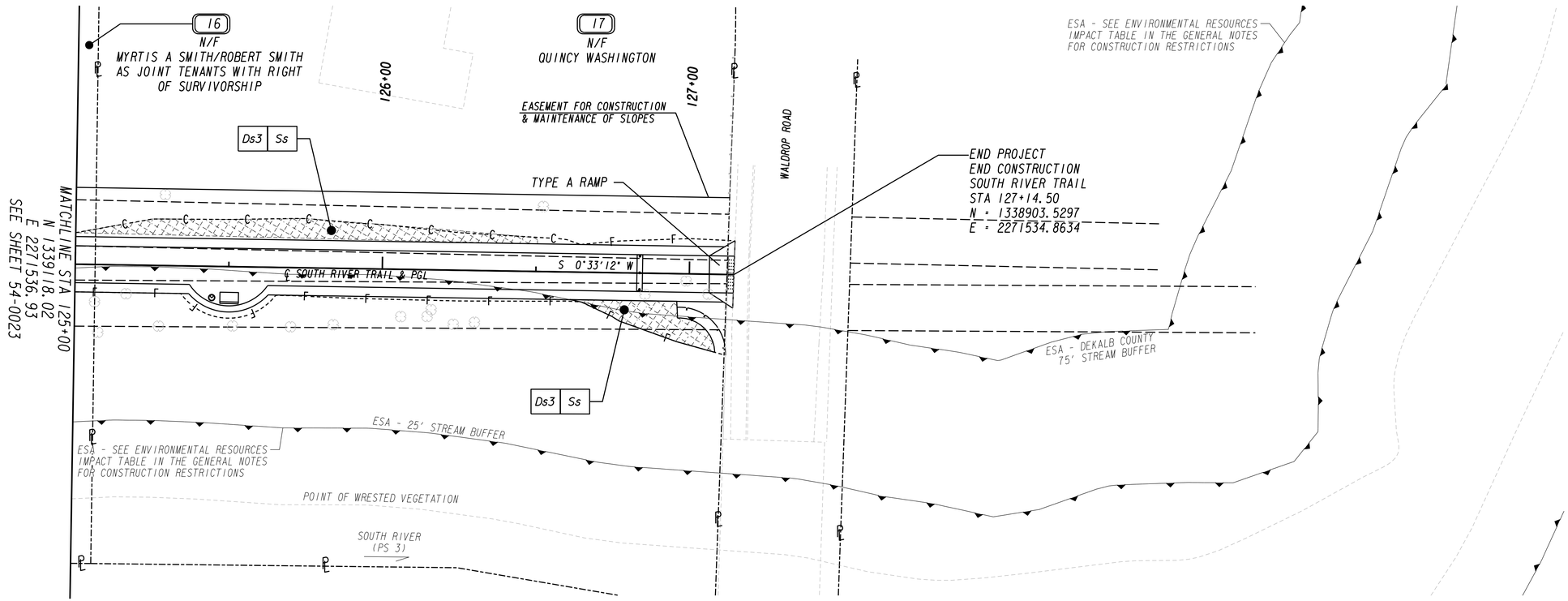
DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018	DRAWING No.
BACKCHECKED:	CAD	DATE:	05-07-2018	
CORRECTED:	AE & PAL	DATE:	05-07-2018	54-0071
VERIFIED:	MWH	DATE:	05-07-2018	

7/31/2015 GPLN



PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR
& MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS
ORANGE BARRIER FENCE

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 20 40 80

REVISION DATES
03/14/19

DEKALB COUNTY & PATH FOUNDATION

BMP LOCATION DETAILS

STAGE 3 - FINAL PHASE
SOUTH RIVER TRAIL, PHASE 5

CHECKED:	PTP	DATE:	04-21-2018
BACKCHECKED:	CAD	DATE:	05-07-2018
CORRECTED:	AE & PAL	DATE:	05-07-2018
VERIFIED:	WMH	DATE:	05-07-2018

DRAWING No. 54-0072

3/20/2019 9:18:00 AM $PRF8$ J:\2012019\0009029\DGN\0009029_55-0001.dgn

USER:cdean

P. I. No. 0009029

CONTRIBUTING DRAINAGE AREA OF DOOLITTLE CREEK UPSTREAM OF PROJECT = 7.0 SQ. MILES

CONTRIBUTING DRAINAGE AREA OF SOUTH RIVER UPSTREAM OF PROJECT = 82.3 SQ. MILES

ESA - SEE ENVIRONMENTAL RESOURCES IMPACT TABLE IN THE GENERAL NOTES FOR CONSTRUCTION RESTRICTIONS
ESA - 25' STREAM BUFFER

ESA - 75' STREAM BUFFER

BEGIN PROJECT
BEGIN CONSTRUCTION
SOUTH RIVER TRAIL
STA 10+11.00
N = 1341591.5549
E = 2263154.0625

END PROJECT
STA 127+14.50
END CONSTRUCTION
SOUTH RIVER TRAIL
N = 1338903.5297
E = 2271534.8634

OUTFALL 1
PRIMARY SAMPLING LOCATION
STA 10+56.03, 51.24' RT

OUTFALL 5
PRIMARY SAMPLING LOCATION
STA 24+25.68, 13.42' RT

OUTFALL 2
PRIMARY SAMPLING LOCATION
STA 12+16.00, 19.72' RT

SOUTH RIVER

DOOLITTLE CREEK

ESA - 25' STREAM BUFFER

FOR DRAINAGE AREAS, SEE DRAWING 53-001
FOR ESA BOUNDARIES AND ORANGE BARRIER FENCE, SEE 54 SERIES DRAWINGS.
TOTAL PROJECT AREA = 12.28 AC
TOTAL PROJECT DISTURBED AREA = 10.45 AC

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

SCALE IN FEET
0 2000 4000 8000

REVISION DATES
03/14/19

WATERSHED MAP SITE MONITORING PLAN

CHECKED:		DATE:		DRAWING No.
BACKCHECKED:		DATE:		55-0001
CORRECTED:		DATE:		
VERIFIED:		DATE:		

7/31/2015 GPLN