Public Works
Duplin County
N.C. Cooperative Extension – Duplin County Center
165 Agriculture Dr.
Kenansville, NC, 28349

DUPLIN COUNTY
NORTH CAROLINA
duplincountync.com

Addendum Number 1

Hurricane Florence EWP (Environmental Watershed Protection) – Construction Phase Bid

August 12th, 2022

To all holders of Bid Documents, please be advised of the following:

The Bid Due Date is here by changed to **Friday August 26, 2022 at 2:00pm**. Contractors shall acknowledge receipt of this addendum in their bid submittal package. Contractors shall utilize updated bid tabs included within this addenda in order to considered an acceptable bid, failure to utilize updated bid tabs will result in automatic bid rejection. The County may include or reject any bid at their sole discretion.

Included within this addenda is the following information

1. Prebid attendance list and meeting notes.
2. Response to questions received.
3. Updated Bid Tabs.
4. Revised Construction Specifications – “Issue for Construction Addenda #1”.
5. Revised Construction Drawing Sheets #10 - 2, #14 - 2, #15 - 2, #16 – 2, #17 - 2, #18 -2, & #22 - 2.

The contractor is required to acknowledge receipt of this addendum in their bid submittal package.

Pre-Bid meeting:

Notes: please notify the project engineer if there are forecasted delays due to material shortages.

Attendees:

Angie Quinn, Duplin Soil & Water	Billy Ivey, Duplin Soil & Water
Jonathan Hinkle, GPI	Steve Lord, GPI
William Sally, GPI	Joshua Cagle, Wildlands Construction
Charles Hill, Land Mechanic Design	Andrew Simonsky, RES Carolina
Dan Best, Murphy Family Ventures	

Pre-Bid Questions:

Tandam Creek Site:

1. Since the staging area is across the road will the contractor need to put down plates to walk equipment back and forth.

   Please contact NCDOT Division Engineering Staff for road crossing and traffic control requirements.

2. Will all materials need to be brought in from off-site (IE woody material for structures)?

   Materials may be used from the site if available and suitable.

3. Are there any drainage pipes coming out into the construction area from the fields?

   No pipes or sock-tile lines (typical of this area) were seen running into the proposed work area; however, it is the contractor's responsibility to assess site conditions prior to construction. If drainage tiles are encountered the contractor will be responsible for ensuring positive drainage to the stream channel.

4. Is there a waste site located nearby for the extra dirt?

   It is up to the contractor to manage.

5. Do any local landowners need cut/soil from the site?

   The contractor is responsible for contacting local landowners if they need soil.

6. What is the cut/fill?

   Please refer to the construction documents. These are estimates and the contractor is responsible for making their own quantity estimates.

7. Is pine acceptable for instream structures?

   No, hardwood is preferred unless otherwise approved by the Project Engineer.

8. Can the contractors come back out to the sites and view them after the site showing?

   The contractor shall contact and coordinate with the County if they want to revisit the sites.

Dark Branch Site:

9. Is HDPE an option for the pipe encasement?

   No.

10. What is needed with the center pivot bridges?

    Contractor shall coordinate with the landowner to set bridges to the side of the construction area during construction and attempt not to damage, landowner will reinstall.

11. Will a restraint joint be acceptable on the irrigation pipe if ductile iron is used as encasement?

    Yes, restraint joints will be acceptable for DIP casing.

Sarecta Road Site:

12. Will any landowner need brush to be cleared to be used in instream structures?

    Contractor is responsible for material (on and off site) coordination and delivery.

13. Are the projects already permitted and ready to go once awarded?

    Yes, they are permitted.

14. Will planting be required within the given time constraints?

    Yes.

Post Pre-Bid Questions:

15. Under the General Planting Notes, the third highlighted section “Tree Seedlings”, we’d like to clarify what size plants are to be used. The descriptions of how planting is to occur appears to reference bare roots. However, the last sentence of the third bullet down under “Tree Seedlings” reads (1) Gallon Nursery Stock. Please clarify what size plants are to be used, bare roots or (1) Gallon plants. Thank you and please advise as soon as possible.

    Trees seedlings have been removed from this project.

16. When is the projected notice to procced?

    Within a reasonable timeframe following receipt of bids and any bid/contract evaluation that needs to be performed to satisfy the granting agency.

17. Where will the waste dirt be disposed of if any?

    See question/response #4 above.

18. Is there enough timber to provide the number of logs needed for the project? If not is there a location that can provide this material.

    See question/response #12 above.

19. Is there enough brush material for the Project? If not is there a location that can provide this material.

    See question/response #12 above.

20. What are the thoughts on the center pivot bridges (leave them and work around them?).

    See question/response #10 above.

21. Please confirm the method of clearing required (conventional clearing and grubbing or mulching).

    Clearing shall be performed via mulching unless otherwise directed by the project engineer, see revised Construction Specification.

22. Please confirm the need to provide a storage container for NRCS use as noted in Construction Specification 8.

    No, see revised Construction Specification.

23. Please confirm the requirement to have a geotechnical representative, hired by the contractor, to perform up to 10 density tests and soil analysis.

    No, see revised Construction Specification. Contractor shall be required to meet Method A 90% standard proctor per ASTM D-698.

24. Please confirm that four containerized trees are incidental to each log sill. Also, confirm Juncus plugs are incidental as well and provide a length upstream and downstream for their installation.

    Tree seedlings have been removed from this project. Juncus plugs shall be planted according to updated detail per revised Construction Drawing Sheet #14 – 2, #17 – 2, & #22 - 2. Please note that Juncus plugs are subsidiary to stream structures: “Log Rollers Structures” and “Log Sill Structures”.

25. Please confirm that the gravel base and gravel leveling base for the wood toe are incidental to this item.

    Please see revised Wood Toe Detail, Construction Drawing Sheet #16 - 2.

26. Please confirm that the carrier pipe will be 12” PVC. Also, it appears that the 45 deg fittings are to be restrained. Please confirm this requirement.

    Please see revised Pipe Casement Detail, Construction Drawing Sheet #18 - 2. In addition, please see question/response #11 above.

27. Please confirm the requirement for certified as-builts.

    Per Construction Specification #7 – Construction Surveys Section 9A.

28. Will pump around be required?

    The two stream projects have a drainage area larger the 1 square mile, contractor shall be responsible for following North Carolina DEQ requirements for clean water discharge.

29. Are those fields tiled and do they have to be tied back in?

    See question/response #3 above.

30. For the “Tandam” site will material have to be hauled across DOT road?

    See question/response #1 above. If contractor desires additional staging area this can be discussed with County and Landowner

31. Will contractor be able to utilize GPS models for this site? Please advise.

    See Construction Specification #21 section 10 paragraph 3:
    All earthwork shall be performed with 3D survey grade machine control devices (conventional or RTK); contractor shall submit to engineer make, model, and specifications for approval. Contractor shall make equipment available to project engineer/inspector for periodic inspection.

NOTE ALL BIDDERS MUST ACKNOWLEDGE RECEIPT OF THIS ADDENDUM WITHIN THEIR BID RESPONSE.

Preliminary Bid Tab
DSR#: 37-07-18-5038 039
Duplin County Hurricane Florance EWP
Date: 08/11/2022
Site 039 TANDAM RD

Item	Spec	Description	Qty.	Unit	Unit Price	Total Price
039-1	8	Mobilization and Demobilization	1	LS		
039-2	7	Construction Surveys	1	LS		
039-3	5	Furnish, Install, and Remove Temporary Silt Fence	250	LF		
039-4	5	Furnish, Install, and Remove Turbidity Curtain	1	EA		
039-5	5	Furnish and Install Temporary Construction Entrance	2	EA		
039-6	2	Clearing & Grubbing	2.8	AC		
039-7	21	Stream Grading	930	LF		
039-8	405	Furnish and Install Log Roller Structures	250	LF		
039-9	405	Furnish and Install Log Sill Structures	6	EA		
039-10	405	Furnish and Install Wood Toe Structures	380	LF		
039-11	404	Furnish and Install Erosion Control Matting	3000	SY		
039-12	6	Furnish and Install Temporary Seeding	2.8	AC		
039-13	6	Furnish and Install Permanent Seeding	1.3	AC		
039-14	402	Furnish and Install Live Stakes	0.2	SY		
				Total		

Preliminary Bid Tab
DSR#: 37-07-18-5038 040
Duplin County Hurricane Florance EWP
Date: 08/11/2022
Site 040 DARK BRANCH

Item	Spec	Description	Qty.	Unit	Unit Price	Total Price
040-1	8	Mobilization and Demobilization	1	LS		
040-2	7	Construction Surveys	1	LS		
040-3	5	Furnish, Install, and Remove Temporary Silt Fence	100	LF		
040-4	5	Furnish, Install, and Remove Turbidity Curtain	1	EA		
040-5	5	Furnish and Install Temporary Construction Entrance	1	EA		
040-6	2	Clearing & Grubbing	2.8	AC		
040-7	21	Stream Grading	1100	LF		
040-8	401	Pipe encasement	1	LS		
040-9	405	Furnish and Install Log Roller Structures	300	LF		
040-10	405	Furnish and Install Log Sill Structures	17	EA		
040-11	405	Furnish and Install Wood Toe Structures	670	LF		
040-12	404	Furnish and Install Erosion Control Matting	3600	SY		
040-13	6	Furnish and Install Temporary Seeding	2.8	AC		
040-14	6	Furnish and Install Permanent Seeding	2.5	AC		
040-16	402	Furnish and Install Live Stakes	0.3	SY		
				Total		
040-8 ALT	401	Pipe encasement BID ALTERNATE	1	LS		

Preliminary Bid Tab
DSR#: 37-07-18-5038 041
Duplin County Hurricane Florance EWP
Date: 08/11/2022
Site 041 SARECTA RD

Item	Spec	Description	Qty.	Unit	Unit Price	Total Price
041-1	8	Mobilization and Demobilization	1	LS		
041-2	7	Construction Surveys	1	LS		
041-3	5	Furnish, Install, and Remove Temporary Silt Fence	60	LF		
041-4	2	Clearing & Grubbing	0.2	AC		
041-5	21	Bank Grading	1	LS		
041-6	406	Furnish and Install Articulating Concrete Block	1500	SF		
041-7	6	Furnish and Install Temporary Seeding	0.2	AC		
041-8	6	Furnish and Install Commercial Seeding Mix	0.2	AC		
041-9	5	Furnish and Install Construction Fencing	100	LF		
				Total		

Construction and Material Specifications

Project:

Duplin County, North Carolina

EWP Stream Restoration and Bank Stabilization Project

DSR# 37-07-18-5038-039 Tandam Branch
DSR# 37-07-18-5038-040 Dark Branch
DSR# 37-07-18-5038-041 Saracta Rd.

Issue:

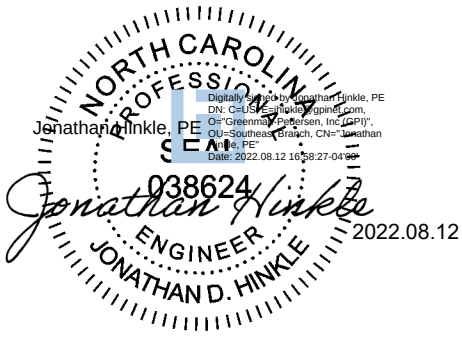
ISSUED FOR CONSTRUCTION Addenda #1

Date: 08/11/2022

To the best of my professional knowledge, judgment, and belief, these plans meet applicable NRCS standards.

By: Jonathan Hinkle

Date: 2022.08.12



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Construction Specification 2—Clearing and Grubbing

1. Scope

The work consists of clearing and grubbing and disposal of trees, snags, logs, brush, stumps, shrubs, and rubbish from the designated areas.

2. Protection of Existing Vegetation

Trees and other vegetation designated to remain undisturbed shall be protected from damage throughout the duration of the construction period. Any damages resulting from the contractor's operations or neglect shall be repaired by the contractor.

Earthfill, stockpiling of materials, vehicular parking, and excessive foot or vehicular traffic shall not be allowed within the drip line of vegetation designated to remain in place. Vegetation damaged by any of these or similar actions shall be replaced with viable vegetation of the same species, similar condition, and like size unless otherwise approved by the contracting officer.

Any cuts, skins, scrape, or bruises to the bark of the vegetation shall be carefully trimmed and local nursery accepted procedures used to seal damaged bark.

Any limbs or branches 0.5 inch or larger in diameter that are broken, severed, or otherwise seriously damaged during construction shall be cut off at the base of the damaged limb or branch flush with the adjacent limb or tree trunk. All roots 1-inch or larger in diameter that are cut, broken, or otherwise severed during construction operations shall have the end smoothly cut perpendicular to the root. Roots exposed during excavation or other operations shall be covered with moist earth or backfilled as soon as possible to prevent the roots from drying out.

3. Marking

The limits of the area(s) to be cleared and grubbed will be marked by stakes, flags, tree markings, or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunk about 6 feet above the ground surface.

4. Clearing and Grubbing

All trees not marked for preservation and all snags, logs, brush, stumps, shrubs, rubbish, and similar materials shall be cleared from within the limits of the designated areas. Unless otherwise specified, all stumps, roots, and root clusters that have a diameter of 1 inch or larger shall be grubbed out to a depth of at least 2 feet below subgrade for concrete structures and 1 foot below the ground surface at embankment sites and other designated areas.

5. Disposal

All materials cleared and grubbed from the designated areas shall be disposed of at locations shown on the drawings or in a manner specified in **section 7**. The contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from disposal at locations away from the project site.

6. Measurement and payment

Method 1—For items of work for which specific units prices are established in the contract, the cleared and grubbed area is measured to the nearest 0.1 acre. Payment for clearing and grubbing is made for the total area within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the length of the cleared and grubbed area is measured to the nearest full station (100 feet) along the line designated on the drawing or identified in the specifications. Payment for clearing and grubbing is made for the total length within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 3—For items of work for which specific unit prices are established in the contract, each tree, stump, and snag having a diameter of 4 inches or larger and each log having a diameter of 4 inches or larger and a length of 10 feet are measured before removal. The size of each tree and snag is determined by measuring its trunk at breast height above the natural ground surface. The size of each log is determined by measuring the butt and by measuring its length from butt to tip. The size of each stump is measured at the top. Diameter is determined by dividing the measured circumference by 3.14.

Payment for clearing and grubbing of each tree, stump, and snag having a diameter of 4 inches or larger and each log having a diameter of 4 inches or larger and a length of 10 feet or larger is made at the contract unit price for its size designation as determined by the following schedule:

Measured diameter (in)	Size designation (in)
4 to 86	
8 to 12	10
12 to 24	18
24 to 36	30
36 to 60	48
Over 60	60

The sum of such payments shall constitute full compensation for clearing and grubbing (including the clearing and grubbing of smaller trees, stumps, snags, logs, brush, shrubs, and roots), applicable permits and associated fees, and rubbish removal. Such payment shall constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 4—For items of work for which specific lump sum prices are established in the contract, payment for clearing and grubbing is made at the contract lump sum price. Such payment shall constitute full

compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in **section 7**.

7. Items of work and construction details

A. Bid Item #039-6, 040-6 and 041-4 Clearing and Grubbing.

1) This item shall consist of all work associated with clearing and grubbing areas as identified on the construction drawings.

2) Areas shall be flagged by contractor in accordance with **Section 3** of this specification and **Construction Specification 7**.

3) Grubbing shall be as follows:
Construction Specification #2 Table #1: Grubbing Requirements

Bid Items	**Grubbing Requirement**
039-7, 040-7 Stream Grading	No grubbing
041-5, Bank Grading	Six (6) inches below ground surface

4) Clearing via **mulching** shall be performed with two types of equipment, unless otherwise listed on the plan set:
   a. A low ground pressure track-driven (< 5 psi) cutting machine which is designed to cut, chip, and mow brush and small trees without penetrating the topsoil. The equipment shall produce mulched vegetation. A rotary cutter and/or flail style cutting head is not acceptable. Vegetation shall be cut flush with ground surface. Minimum cutting width shall be 72 inches. Contractor shall submit to project engineer cutting head specs prior to use on site.
   b. A hydraulic excavator mounted cutting head which is designed to cut, chip, and mow brush and small trees without penetrating the topsoil. The equipment shall produce mulched vegetation. A rotary cutter and/or flail style cutting head is not acceptable. Vegetation shall be cut flush with ground surface. Minimum cutting width shall be 50 inches. Contractor shall submit to project engineer cutting head specs prior to use on site.
   c. Either a or b above (machine mounted or excavator mounted) shall be attached to a machine with a minimum 125 engine horsepower. The mulch produced by the machine shall be no larger than 1 ½ inches in diameter and 18 inches in length.
   d. Clearing via mulching shall be limited to areas as defined in Table 3 below. Construction Specification #2 Table #3: Clearing Requirements via mulching.

Bid Items	Clearing Requirement
039-7 040-7 041-5	Clearing via Mulching, unless otherwise directed by Project Engineer.

5) All material removed from clearing and grubbing activities shall be disposed of in designated areas as shown on the construction drawings.

6) Contractor shall avoid trees which have been marked on construction plans; contractor shall mark trees as indicated in **Section 3** of this specification.

7) All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

8) The measurement and payment shall be **Method 1** in **Section 6** of this construction specification. Measurement and payment shall be **per Acre (AC)**, rounded to the nearest 0.1 acres. Payment shall constitute full compensation for all work associated with **Bid Line Item 039-06, 040-06, and 041-04.**

9) The following items are subsidiary to this item:
   a) Pollution Control, as specified in Construction Specification 5.
   b) Removal of Water, as specified in Construction Specification 11.
   c) Contractor Quality Control, as specified in Construction Specification 94.

List of Construction Specifications

- 002 Clearing and Grubbing
- 005 Pollution Control
- 006 Seeding, Sprigging, and Mulching
- 007 Construction Surveys
- 008 Mobilization and Demobilization
- 010 Water for Construction
- 011 Removal of Water
- 021 Excavation
- 023 Earthfill
- 032 Structural Concrete
- 061 Rock Rip Rap
- 065 Articulating Concrete Block
- 094 Contractor Quality Control
- 095 Geotextile
- 401 Pipe Casing
- 402 Live Stakes
- 404 Erosion Control Matting
- 405 Log In-stream Structures

List of Material Specifications

- 522 Aggregates for Portland Cement Concrete
- 532 Supplementary Cementous Materials
- 553 Ductile Iron Pipe
- 592 Geotextile
- 593 Lime

Construction Specification 5—Pollution Control

1. Scope

The work consists of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air from construction activities.

The following BioPreferred® product categories are applicable to this specification: — mulch and compost materials

- erosion control materials
- fertilizers
- dust suppressants
- agricultural spray adjuvants

2. Material

Silt fence shall conform to the requirement of Materials Specification 592, Geotextile. All other material furnished shall meet the requirements of the material specifications listed in section 8 of this specification.

3. Erosion and sediment control measures and works

The measures and works shall include, but are not limited to, the following:

Staging of earthwork activities—The excavation and moving of soil materials shall be scheduled to minimize the size of areas disturbed and unprotected from erosion for the shortest reasonable time.

Seeding—Seeding to protect disturbed areas shall occur as soon as reasonably possible following completion of that earthwork activity.

Mulching—Mulching to provide temporary protection of the soil surface from erosion.

Diversions—Diversions to divert water from work areas and to collect water from work areas for treatment and safe disposition. They are temporary and shall be removed and the area restored to its near original condition when the diversions are no longer required or when permanent measures are installed.

Stream crossings—Culverts or bridges where equipment must cross streams. They are temporary and shall be removed and the area restored to its near original condition when the crossings are no longer required or when permanent measures are installed.

Sediment basins—Sediment basins collect, settle, and eliminate sediment from eroding areas from impacting properties and streams below the construction site(s). These basins are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

Sediment filters—Straw bale filters or geotextile silt fences trap sediment from areas of limited runoff. Sediment filters shall be properly anchored to prevent erosion under or around them. Silt fences shall be installed and maintained in accordance with ASTM D6462. These filters are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

Waterways—Waterways for the safe disposal of runoff from fields, diversions, and other structures or measures. These works are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

Other—Additional protection measures as specified in section 8 of this specification or required by Federal, State, or local government.

4. Chemical pollution

The contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to collect and temporarily contain chemical pollutants, such as drained lubricating or transmission fluids, grease, soaps, concrete mixer washwater, or asphalt, produced as a by-product of the construction activities. Pollutants shall be disposed of in accordance with appropriate state and Federal regulations. At the completion of the construction work, tanks, barrels, and sumps shall be removed and the area restored to its original condition as specified in section 8 of this specification. Sump removal shall be conducted without causing pollution.

Sanitary facilities, such as chemical toilets, or septic tanks shall not be located next to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water source. At the completion of construction activities, facilities shall be disposed of without causing pollution as specified in section 8 of this specification.

5. Air pollution

The burning of brush or slash and the disposal of other materials shall adhere to state and local regulations.

Fire prevention measures shall be taken to prevent the start or spreading of wildfires that may result from project activities. Firebreaks or guards shall be constructed and maintained at locations shown on the drawings.

All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust. All dust control methods shall ensure safe construction operations at all times. If chemical dust suppressants are applied, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be provided to the engineer 5 working days before the first application.

6. Maintenance, removal, and restoration

All pollution control measures and temporary works shall be adequately maintained in a functional condition for the duration of the construction period. All temporary measures shall be removed and the site restored to near original condition.

7. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, each item is measured to the nearest unit applicable. Payment for each item is made at the contract unit price for that

item. For water or chemical suppressant items used for dust control for which items of work are established in section 8 of this specification, measurement for payment will not include water or chemical suppressants that are used inappropriately or excessive to need. Such payment will constitute full compensation for the completion of the work.

Method 2—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds and supported by invoices presented by the contractor that reflect actual costs. If the total of all progress payments is less than the lump sum contract price for this item, the balance remaining for this item will be included in the final contract payment. Payment of the lump sum contract price will constitute full compensation for completion of the work.

Method 3—For items of work for which lump sum prices are established in the contract, payment will be prorated and provided in equal amounts on each monthly progress payment estimate. The number of months used for prorating shall be the number estimated to complete the work as outlined in the contractor's approved construction schedule. The final month's prorate amount will be provided with the final contract payment. Payment as described will constitute full compensation for completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items, and the items to which they are made subsidiary, are identified in section 8 of this specification.

8. Items of work and construction details

A. Subsidiary to Bid Line Items 039-1, through 039-16; 040-1, through 040-17 & 041-1, through 041-11, Pollution Control.

1) This item shall consist of the installation of all measures to control pollution and "sediment and erosion control" including disposal of chemical pollutants, air pollutions, etc. which shall be disposed of by the contractor in accordance with local, state, and federal guidelines.

2) Contractor shall provide water tight containers for disposing of chemical pollutants, and shall notify proper agency and the Contract Officers Technical Representative immediately after discovering a spill. Contractor shall be responsible for clean-up and any remediation required, at their own expense.

3) Seeding of disturbed areas shall be performed as specified in Construction Specification #6, within this specification package.

4) No separate payment shall be made for **Pollution Control**. Compensation for this item shall be included in the payment for **Bid Line Items 039-1, through 039-16; 040-1, through 040-17 & 041-1, through 041-11.**

B. Bid Line Item 039-3, 040-3 & 041-3, Furnish, Install, and Remove Temporary Silt Fence.

1) This item shall consist of the furnishing, installation, maintain, and removing temporary silt

fencing (from here on known as "Silt Fence"). The silt fence shall be installed prior to any land disturbing activities. Maintain the silt fence until the project is accepted or until the fence is removed. Remove and replace deteriorated or ineffective filter fabric. Remove and dispose of silt accumulations (>0. 5 feet measured from average ground to apex of accumulation) in appropriate disposal areas as shown on construction drawings when necessary or as directed. Leave silt fence in place until site stabilization and remove at project completion. Removed silt fence becomes the property of the Contractor. Dress, seed, and mulch all areas where silt fence is removed in accordance with **Construction Specification 6**.

2) Materials

a. Posts

i. Steel Post meeting the following requirements: Minimum 5 feet long, minimum 1 3/8 inches wide measured parallel to the fence, minimum weight of 1.25 lbs/ft of length, equipped with an anchor plate with a minimum area of 14.0 square inches, and having a means of retaining fabric in the desired position without displacement.

b. Filter Fabric

i. The fabric shall consist of strong rot-proof synthetic fibers formed into a woven fabric or a non-woven needle-punched fabric meeting all applicable requirements of this section.

The fabric shall be free from any treatment or coating that might significantly alter its physical properties before or after installation. The fabric fibers shall contain stabilizers and/or inhibitors to make the filaments resistant to deterioration resulting from ultraviolet or heat exposure. The fabric shall be a pervious sheet of synthetic fibers oriented into a stable network so that the fibers retain their relative position with respect to each other. Finish the edge of the fabric to prevent the outer fibers from pulling away from the fabric. The fabric shall be free of defects or flaws which significantly affect its physical and/or filtering properties. Sheets of fabric may be bonded together or sewn with a fungus resistant material. Do not use nylon thread for sewn seams. No deviation from any physical requirements will be permitted due to the presence of the seam.

During all periods of shipment and storage, wrap the fabric in a heavy duty protective covering to protect the fabric from direct sunlight, mud, dust, dirt, and debris. Do not expose the fabric to temperatures greater than 140°F.

ii. Physical Properties:
Grab Tensile Strength: 50 lbs
Elongation: 30 % max
Puncture Strength: 30 lbs.
Apparent Opening Size: #30 sieve

Ultraviolet Exposure Strength Retention (at 500 hrs): 70 %
Permittivity: 0.15 sec^{-1}
Exhibit no fungal growth as tested by ASTM G21
All minimum strength requirements are minimum average roll values in the weakest principal direction.

c. Attachment Device:
    i. Provide wire, zip tie, or other approved attachment device with a minimum tensile strength of 50 pounds (lbs.).

3) Install in accordance with construction drawings.

4) Maintenance

    a. Inspect silt fences at least once a week and after each rainfall. Make any required repairs immediately and report to Project Engineer.

    b. Should the silt fence collapse, tear, decompose, or become ineffective replace it immediately.

    c. Remove sediment deposits upon accumulating greater than or equal to 0.25 feet as measured from average ground to the apex of accumulation, or at the direction of Inspector/COTR. Take care to avoid undermining the fence during the cleanout.

    d. Remove all fencing material and unstable sediment deposits and bring the area to grade and stabilize upon request and approval of the site being deemed stable by the COTR/Engineer.

5) Measurement and payment shall be **Method 1**, as outlined in **Section 7** of this specification.

6) All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

7) Payment shall be paid under **Bid Items 039-3, 040-3 & 041-3**; compensation for this item shall be made on a **per linear foot (LF)** basis.

    a. **Seventy Percent (70%)** of the contractors unit bid price shall be made available for progress payment upon installation of the silt fence.

    b. **Thirty Percent (30%)** of the contractors unit bid price shall be made available for progress payment upon removal of the silt fence.

8) The following shall be subsidiary to this specification:

    a) Pollution Control as specified Construction Specification #05.
    b) Removal of water as specified in construction specification #11.
    c) Contractor Quality Control, as specified in Construction Specification #94.

C. Bid Line Items 039-4 & 040-4, Furnish, Install, and Remove Turbidity Curtain.

1) This item shall consist of the furnishing, installation, maintain, and removing temporary turbidity curtain (from here on known as "Turbidity Curtain"). The turbidity curtains shall be installed prior to any disturbing activities. Maintain the turbidity curtain until the project is accepted or until it's removed. Remove and replace deteriorated or ineffective turbidity curtain floats, screen, buoys, or ineffective equipment. Maintain and install in accordance with manufactures specifications. Remove and dispose of silt accumulations in appropriate disposal areas as shown on construction drawings when necessary or as directed. Leave turbidity curtain in place until site stabilization and remove at project completion. Removed turbidity curtains become the property of the Contractor. Contractor shall submit to the engineer a detailed diagram of installation guide, material specifications, and maintenance recommendations from the manufacture two (2) weeks prior to any disturbing activities and/or installation of turbidity curtain.

2) Materials

   a. Floatation: Eight (8) inch floatation constructed of expanded polystyrene ("logs") placed end to end in the top fabric pocket with separations between logs.

   b. Top Tension: Steel Cable (9,800 lb breaking strength); contained in polyethylene tubes or galvanized; one above and one below the float.

   c. Bottom Tension: A galvanized chain (7,600 lb breaking strength); 0.93 lb/ft weight.

   d. Screen Fabric:
   Base Fabric: 6.0 oz/yd^2 Woven Polyester
   Coated Fabric Weight: 22 oz/yd^2
   Type of Coating: PVC
   Coating Distribution: 60/40
   Tensile Strength
   Grab Warp: 500 lbs
   Fill: 450 lbs
   Tear Strength
   Tongue Wrap: 110 lbs
   Fill: 110 lbs
   Puncture
   Screwdriver: 100 lbs
   Ball: 400 lbs

3) Install according to manufactures recommendations.

4) Measurement and payment shall be **Method 1**, as outlined in **Section 7** of this specification.

5) All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

6) Payment shall be paid under **Bid Item 039-4 & 040-4** compensation for this item shall be made on a **per each (EA)** basis.

   a. **Seventy Percent (70%)** of the contractors unit bid price shall be made available for progress payment upon installation of the turbidity curtain.

   b. **Thirty Percent (30%)** of the contractors unit bid price shall be made available for progress payment upon removal of the turbidity curtain.

7) The following shall be subsidiary to this specification:

   a) Pollution Control as specified Construction Specification #05.
   b) Removal of water as specified in Construction Specification #11.
   c) Contractor Quality Control, as specified in Construction Specification #94.

E. **Bid Line Items 039-5 & 040-5, Furnish and Install Temporary Construction Entrance.**

1) This item shall consist of the furnishing, installation, and maintaining temporary construction entrance (from here on known as "Construction Entrance"). The construction entrance shall be installed prior to any disturbing activities. Maintain the construction entrance until the project is accepted or until it's removed. Maintain and install in accordance drawing detail within the construction drawings plan set. Remove and dispose of silt accumulations in appropriate disposal areas as shown on construction drawings when necessary or as directed. Construction entrance shall remain at the completion of the construction project.

2) Materials: All materials shall comply with material specification 523 Rock for Riprap. Rock shall be NCDOT Class 'A' stone.

3) Install construction entrance in accordance with detail within construction drawing set.

4) All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

5) Payment shall be paid under **Bid Items 039-5 & 040-5** compensation for this item shall be made on a **per each (EA)** basis. Payment will be made as follows.

   a. **Seventy Percent (70%)** of the contractor's unit bid price shall be made available for progress payment upon installation of the construction entrance.

   b. **Thirty Percent (30%)** of the contractor's unit bid price shall be made available for progress payment upon project completion.

6) The following shall be subsidiary to this specification:

a) Pollution Control as specified Construction Specification #05.
b) Removal of water as specified in construction specification #11.
c) Contractor Quality Control, as specified in Construction Specification #94.

F. Bid Line Items 41-8, Furnish and Install Temporary Construction Fence.

1) This item shall consist of the furnishing, installation, and maintaining temporary construction fencing (from here on known as "Construction Fence"). The construction fence shall be installed prior to any disturbing activities. Maintain the construction fence until the project is accepted or until it's removed. Maintain and install in accordance drawing detail within the construction drawings plan set. Construction fence shall remain at the completion of the construction project.

2) Install construction fence in accordance with detail within construction drawing set.

3) All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

4) Payment shall be paid under **Bid Items 041-8** compensation for this item shall be made on a **per linear foot (LF)** basis. Payment will be made as follows.

   a. **Seventy Percent (70%)** of the contractor's unit bid price shall be made available for progress payment upon installation of the construction entrance.

   b. **Thirty Percent (30%)** of the contractor's unit bid price shall be made available for progress payment upon project completion.

5) The following shall be subsidiary to this specification:

   a) Pollution Control as specified Construction Specification #05.
   b) Removal of water as specified in construction specification #11.
   c) Contractor Quality Control, as specified in Construction Specification #94.

Construction Specification 6—Seeding, Sprigging, and Mulching

1. Scope

The work consists of preparing the area for treatment; furnishing and placing seed, sprigs, mulch, fertilizer, inoculant, lime, and other soil amendments; and anchoring mulch in designated areas as specified.

The following BioPreferred® product categories are applicable to this specification:

- mulch and compost materials
- erosion control materials
- fertilizers
- agricultural spray adjuvants

2. Material

Seed—All seed shall conform to the current rules and regulations of the state where it is being used and shall be from the latest crop available. It shall meet or exceed the standard for purity and germination listed in **section 7**.

Seed shall be labeled in accordance with the state laws and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures are evidence of purity and germination. No seed will be accepted with a test date of more than 9 months before the delivery date to the site.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable shall be as defined in the current State laws relating to agricultural seeds. Each type of seed shall be delivered in separate sealed containers and fully tagged unless exception is granted in writing by the contracting officer.

Fertilizer—Unless otherwise specified, the fertilizer shall be a commercial grade fertilizer. It shall meet the standard for grade and quality specified by State law. Where fertilizer is furnished from bulk storage, the contractor shall furnish a supplier's certification of analysis and weight. When required by the contract, a representative sample of the fertilizer shall be furnished to the contracting officer for chemical analysis.

Inoculants—The inoculant for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculant to the seed. Two times the amount of the inoculant recommended by the manufacturer shall be used except four times the amount shall be used when seed is applied using a hydraulic seeder. Seed shall be sown within 24 hours of treatment and shall not remain in the hydraulic seeder longer than 4 hours.

Lime and other soil amendments—Lime shall consist of standard ground agriculture limestone, or approved equivalent. Standard ground agriculture limestone is defined as ground limestone meeting current requirements of the State Department of Agriculture. Other soil amendments shall meet quality criteria and application requirements specified in **section 7**.

Mulch tackifiers—Asphalt emulsion tackifiers shall conform to the requirements of ASTM D 977, Specification for Emulsified Asphalt. The emulsified asphalt may be rapid setting, medium setting, or slow setting. Nonasphaltic tackifiers required because of environmental considerations shall be as specified in **section 7**.

Straw mulch material—Straw mulch shall consist of wheat, barley, oat or rye straw, hay, grass cut from native grasses, or other plants as specified in **section 7**. The mulch material shall be air-dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds is not permitted. The contractor shall provide a method satisfactory to the contracting officer for determining weight of mulch furnished.

Other mulch materials—Mulching materials, such as wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh, are other mulching materials that may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturer's recommendations for methods of application.

3. Seeding mixtures, sod, sprigs, and dates of planting

The application rate per acre for seed mixtures, sprigs, or sod and date of seeding or planting shall be as shown on the plans or as specified in **section 7**.

4. Seedbed preparation and treatment

Areas to be treated shall be dressed to a smooth, firm surface. On sites where equipment can operate on slopes safely, the seedbed shall be adequately loosened (4 to 6 inches deep) and smoothed. Depending on soil and moisture conditions, disking or cultipacking, or both, may be necessary to properly prepare a seedbed. Where equipment cannot operate safely, the seedbed shall be prepared by hand methods by scarifying to provide a roughened soil surface so that broadcast seed will remain in place.

If seeding is to be accomplished immediately following construction operations, seedbed preparation may not be required except on a compacted, polished, or freshly cut soil surface.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance operations shall be removed or disposed of as specified in **section 7**.

Seedbed preparation shall be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the contracting officer's technical representative (COTR).

5. Seeding, sprigging, fertilizing, mulching, and stabilizing

All seeding or sprigging operations shall be performed in such a manner that the seed or sprigs are applied in the specified quantities uniformly in the designated areas. The method and rate of seed application shall be as specified in **section 7**. Unless otherwise specified, seeding or sprigging shall be accomplished within 2 days after final grading is completed and approved.

Fertilizer, lime, and other soil amendments shall be applied as specified in **section 7**. When specified, the fertilizer and soil amendments shall be thoroughly incorporated into the soil immediately following surface application.

The rate, amount, and kind of mulching or mesh shall be as specified in **section 7**. Mulches shall be applied uniformly to the designated areas. They shall be applied to areas seeded not later than 2 working days after seeding has been performed. Straw mulch material shall be stabilized within 24 hours of application using a mulch crimper or equivalent anchoring tool or by a suitable tackifier. When the mulch crimper or equivalent anchoring tool is used, it shall have straight blades and be the type manufactured expressly for and capable of firmly punching the mulch into the soil. Where the equipment can be safely operated, it shall be operated on the contour. Hand methods shall be used where equipment cannot safely operate to perform the work required.

The tackifier shall be applied uniformly over the mulch material at the specified rate, or it shall be injected into the mulch material as it is being applied. Mesh or netting stabilizing materials shall be applied smoothly, but loosely on the designated areas. The edges of these materials shall be buried or securely anchored using spikes or staples as specified in **section 7**.

The contractor shall maintain the mesh or netting areas until all work under the contract has been completed and accepted. Maintenance shall consist of the repair of areas damaged by water erosion, wind, fire, or other causes. Such areas shall be repaired to reestablish the intended condition and to the design lines and grades required by the contract. The areas shall be refertilized, reseeded, and remulched before the new application of the mesh or netting.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, each area treated is measured as specified in **section 7** and the area calculated to the nearest 0.1 acre. Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

When specified as an item of work, mesh or netting is measured to the nearest square yard of surface area covered and accepted. Payment is made at the contract unit price and will constitute full compensation for completion of the work.

Method 2—For items of work for which specific lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item is made at the contract lump sum price for the item and will constitute full compensation for the completion of the work.

Method 3—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds. Progress payments will be determined as specified in **section 7**. Payment of the lump sum contract price will constitute full compensation for completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the item(s) to which they are made subsidiary are identified in **section 7**.

7. Items of work and construction details

The following items shall be subsidiary to the items below:

a) Pollution Control, as specified in construction specification #5.

b) Water for Construction, as specified in construction specification #10.
c) Removal of Water, as specified in construction specification #11.
d) Contractor Quality Control, as specified in construction specification #94

All material shall conform to the requirements of this specification; delivery tickets showing quantity and quality of materials shall be furnished to the engineer one (1) week prior to using materials. Payment shall not be made unless delivery tickets are received by project engineer prior to contractor using material.

The measurement and payment shall be **Method 1** in **section 6** of this construction specification. Measurement and payment shall be rounded to the nearest 0.1 acres.

Per section 2 of this specification "each seed type shall be delivered in separate sealed containers and fully tagged unless exception is granted in writing by contract officer"; NRCS shall consider native seed mix and nurse crop as separate seed types. Therefore contractor shall have native seed mix and nurse crops in separate bags. Contractor shall submit to project engineer a seed tag and bill of laden for native mix and nurse crop separately.

A. Bid Line Item #039-12, #040-12 & 041-9 Furnish and Install Temporary Seeding:

1) This item shall consist of all work necessary to establish interim cover on all disturbed areas this may included but is not limited to stream grading, slope protection, areas adjacent to the disposal areas, spoil piles, pathway slopes, and other areas of disturbance as shown on the planting plan. All disturbed areas shall be seeded when they are expected to be bare of ground cover for more than 15 calendar days; where active construction is not being undertaken, or as directed by the engineer/inspector. These areas shall be seeded at the end of each day unless otherwise directed by the engineer/inspector.

2) The engineer/inspector shall designate the area to be interim seeded. Once designated the area shall be promptly seeded. It is anticipated that interim seeding shall be performed at least weekly and more frequently if designated by the Engineer/inspector.

3) Seeding shall be in accordance with the approved dates using the seed and rates per acre as shown below in Construction Specification 6 Table 1.

Construction Specification 6 Table 1

Date	Seed Mixture	Application Rate (lbs/Ac.)
April 1 to August 31	Sudex (Sudan-sorghum hybrid)	60
	Browntop Millet	60
September 1 to March 31	Wheat	40

4) Apply forty (40) pounds per acre of nitrogen immediately following seeding from one of the following sources: Ammonium nitrate, sodium nitrate, calcium nitrate.

5) The materials shall conform to the requirements of this specification. Delivery tickets showing

quantity and quality of materials shall be furnished to the engineer prior to using materials.

6) The application of seed and nitrogen by hand is permissible.

7) All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

8) Payment shall constitute full compensation for all work associated with **Bid Line Item #039-12, #040-13 & 041-9.**

B. Bid Line Items #039-13 & #040-13, Furnish and Install Permanent Seeding.

1) This item shall consist of final shaping and smoothing, applying lime and fertilizer, preparing a seedbed, seeding, and mulching to establish permanent vegetation on stream grading, berms, earthfill areas, areas adjacent to the disposal areas, spoil piles, haul roads, and other areas of disturbance as shown on the planting plan.

2) Prior to smoothing, all disturbed areas will have the finished grade established as shown on the construction drawings.

3) Seeding shall be accomplished within two (2) days after final grading is completed and approved by the engineer.

4) Fertilizer shall be applied at the rate of 1,000 lbs. per acre. The fertilizer shall be 10-10-10, or equivalent. Lime shall be applied at the rate of two (2) tons per acre. Mulch shall be applied at a rate of two (2) tons per acre. All soil amendments shall be thoroughly incorporated, as specified in **Section 5** of this construction specification. The area should then be smoothed and any debris larger than 3 inches in diameter or which would interfere with mowing shall be removed from the surface. A cyclone seeder, drill or cultipacker seeder shall be used to apply the specified seed evenly on the freshly prepared seedbed. When seed is broadcast, a cultipacker or other appropriate equipment shall be used immediately following seeding to incorporate the seed.

5) Contractor shall dewater such that all stream side slopes can be seeded.

6) Seeding shall be in accordance with the approved dates using the seed and rates per acre as follows:

7) Permanent seeding shall be in accordance with the construction drawings as well as Construction Specification 6 Table 3, Permanent Seed Mixture.

Construction Specification 6 Table 3: Bid Item 039-14 & 040-14, Zone 1 Seeding Mix

ZONE 1 PLANTING PLAN		
SEEDING MIX*		
COMMON NAME	SCIENTIFIC NAME	PERCENTAGE
Deertongue, 'Tioga'	Panicum clandestinum, 'Tioga'	21.5%

Virginia Wildrye, PA Ecotype	*Elymus virginicus, PA Ecotype*	20.0%
Big Bluestem, 'Niagara'	Andropogon gerardii, 'Niagara'	16.6%
Japanese Miller	*Echinochloa crusgalli var. frumentacea*	15.0%
Fox Sedge, PA Ecotype	*Sorghastrum nutans, PA Ecotype*	10.0%
Switchgrass, 'Shawnee'	*Panicum virgatum, 'Shawnee'*	8.0%
Partridge Pea, PA Ecotype	*Chamaecrista fasciculata, PA Ecotype*	4.0%
Blue Vervain, PA Ecotype	*Verbena hastata, PA Ecotype*	1.5%
Oxeye Sunflower, PA Ecotype	*Heliopsis helianthoides, PA Ecotype*	1.0%
Soft Rush	*Juncus effusus*	1.0%
Autumn Bentgrass, Albany Pine Bush-NY Ecotype	*Agrostis perennans, Albany Pine Bush-NY Ecotype*	0.8%
Swamp Milkweed, PA Ecotype	*Asclepias incarnata, PA Ecotype*	0.1%
New England Aster, PA Ecotype	*Aster novae-angliae, PA Ecotype*	0.1%
Joe Pye Weed, PA Ecotype	*Eupatorium fistulosum, PA Ecotype*	0.1%
Boneset, PA Ecotype	*Eupatorium perfoliatum, PA Ecotype*	0.1%
Wild Bergamot, Fort Indiantown Gap-PA Ecotype	*Monarda fistulosa, Fort Indiantown Gap-PA Ecotype*	0.1%
Narrowleaf Mountianmint	*Pycanthemum tenuifolium*	0.1%
*SEED AT 20 LBS (PLS) TO ACRE		
Soft Rush, Coastal Plain NC Ecotype	*Juncus effusus, Coastal Plain NC Ecotype*	100.0%
*SEED AT 2 LBS (PLS) TO ACRE		
NURSE CROP SEED		
AUG. 15 - APR 15		
COMMON NAME	SCIENTIFIC NAME	RATE
Wheat	*Triticum aestivum*	40 LBS
APR 15 - AUG 15		
COMMON NAME	SCIENTIFIC NAME	RATE
Browntop millet	*Urochloa ramosa*	60 LBS

8) Upon completion of seeding and mulching the contractor shall avoid trafficking in order to promote successful plant germination and establishment.

9) All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

10) The measurement and payment shall be **Method 1** in **section 6** of this construction specification. Measurement and payment shall be rounded to the nearest 0.1 acres. Payment shall constitute full compensation for all work associated with **Bid Lines #039-13 & #040-14**.

C. Bid Line Item #041-10, Furnish and Install Permanent Commercial Seeding Mix:

1) This item shall consist of final shaping and smoothing, applying lime and fertilizer, preparing a seedbed, seeding, and mulching to establish permanent vegetation under flexible matting material, earthfill areas, areas adjacent to the disposal areas, spoil piles, haul roads, and other areas of disturbance as shown on the planting plan.

2) Prior to smoothing, all disturbed areas will have the finished grade established as shown on the construction drawings.

3) Seeding shall be accomplished within two (2) days after final grading is completed and approved by the engineer.

4) Fertilizer shall be applied at the rate of 1,000 lbs. per acre. The fertilizer shall be 10-10-10, or equivalent. Lime shall be applied at the rate of two (2) tons per acre. Mulch shall be applied at a rate of two (2) tons per acre. All soil amendments shall be thoroughly incorporated, as specified in **Section 5** of this construction specification. The area should then be smoothed and any debris larger than 3 inches in diameter or which would interfere with mowing shall be removed from the surface. A cyclone seeder, drill or cultipacker seeder shall be used to apply the specified seed evenly on the freshly prepared seedbed. When seed is broadcast, a cultipacker or other appropriate equipment shall be used immediately following seeding to incorporate the seed.

5) Contractor shall dewater such that all stream side slopes can be seeded.

6) Seeding shall be in accordance with the approved dates using the seed and rates per acre as follows:

7) Permanent seeding shall be in accordance with the construction drawings as well as Construction Specification, Permanent Seed Mixture for this bid item shall be as follows:

8) The kinds of seed and fertilizer, and the rates of application of seed, fertilizer, and limestone, shall be as stated below. During periods of overlapping dates, the kind of seed to be used shall be determined. All rates are in pounds per acre.

All Roadway Areas

March 1 - August 31		**September 1 - February 28**	
50#	Tall Fescue	50#	Tall Fescue
10#	Centipede	10#	Centipede
25#	Bermudagrass (hulled)	35#	Bermudagrass (unhulled)
500#	Fertilizer	500#	Fertilizer
4000#	Limestone	4000#	Limestone

Waste and Borrow Locations

March 1 – August 31		**September 1 - February 28**	
75#	Tall Fescue	75#	Tall Fescue

25#	Bermudagrass (hulled)	35#	Bermudagrass (unhulled)
500#	Fertilizer	500#	Fertilizer
4000#	Limestone	4000#	Limestone

Note: 50# of Bahiagrass may be substituted for either Centipede or Bermudagrass only upon Engineer's request.

Approved Tall Fescue Cultivars

06 Dust	Escalade	Justice	Serengeti
2nd Millennium	Essential	Kalahari	Shelby
3rd Millennium	Evergreen 2	Kitty Hawk 2000	Sheridan
Apache III	Falcon IV	Legitimate	Signia
Avenger	Falcon NG	Lexington	Silver Hawk
Barlexas	Falcon V	LSD	Sliverstar
Barlexas II	Faith	Magellan	Shenandoah Elite
Bar Fa	Fat Cat	Matador	Sidewinder
Barrera	Festnova	Millennium SRP	Skyline
Barrington	Fidelity	Monet	Solara
Barrobusto	Finelawn Elite	Mustang 4	Southern Choice II
Barvado	Finelawn Xpress	Ninja 2	Speedway
Biltmore	Finesse II	Ol' Glory	Spyder LS
Bingo	Firebird	Olympic Gold	Sunset Gold
Bizem	Firecracker LS	Padre	Taccoa
Blackwatch	Firenza	Patagonia	Tanzania
Blade Runner II	Five Point	Pedigree	Trio
Bonsai	Focus	Picasso	Tahoe II
Braveheart	Forte	Piedmont	Talladega
Bravo	Garrison	Plantation	Tarheel
Bullseye	Gazelle II	Proseeds 5301	Terrano
Cannavaro	Gold Medallion	Prospect	Titan ltd
Catalyst	Grande 3	Pure Gold	Titanium LS
Cayenne	Greenbrooks	Quest	Tracer
Cessane Rz	Greenkeeper	Raptor II	Traverse SRP
Chipper	Gremlin	Rebel Exeda	Tulsa Time
Cochise IV	Greystone	Rebel Sentry	Turbo
Constitution	Guardian 21	Rebel IV	Turbo RZ
Corgi	Guardian 41	Regiment II	Tuxedo RZ
Corona	Hemi	Regenerate	Ultimate
Coyote	Honky Tonk	Rendition	Venture
Darlington	Hot Rod	Rhambler 2 SRP	Umbrella
Davinci	Hunter	Rembrandt	Van Gogh
Desire	Inferno	Reunion	Watchdog
Dominion	Innovator	Riverside	Wolfpack II

Dynamic	Integrity	RNP	Xtremegreen
Dynasty	Jaguar 3	Rocket	
Endeavor	Jamboree	Scorpion	

9. On cut and fill slopes 2:1 or steeper Centipede shall be applied at the rate of 5 pounds per acre and add 20# of Sericea Lespedeza from January 1 - December 31.

10. All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

11. The measurement and payment shall be **Method 1** in **section 6** of this construction specification. Measurement and payment shall be rounded to the nearest 0.1 acres. Payment shall constitute full compensation for all work associated with **Bid Lines #041-10**.

Construction Specification 7—Construction Surveys

1. Scope

The work consists of performing all surveys, measurements, and computations required by this specification.

2. Equipment and material

Equipment for construction surveys shall be of a quality and condition to provide the required accuracy. The equipment shall be maintained in good working order and in proper adjustment at all times. Records of repairs, calibration tests, accuracy checks, and adjustments shall be maintained and be available for inspection by the engineer. Equipment shall be checked, tested, and adjusted as necessary in conformance with manufacturer's recommendations.

Material is field notebooks, stakes, templates, platforms, equipment, spikes, steel pins, tools, and all other items necessary to perform the work specified.

3. Quality of work

All work shall follow recognized professional practice and the standards of the industry unless otherwise specified in **section 9** of this specification. The work shall be performed to the accuracy and detail appropriate for the type of job. Notes, sketches, and other data shall be complete, recorded neatly, legible, reproducible and organized to facilitate ease in review and allow reproduction of copies for job documentation. Survey equipment that requires little or no manual recording of field data shall have survey information documented as outlined in **section 9** of this specification.

All computations shall be mathematically correct and shall include information to identify the bid item, date, and who performed, checked, and approved the computations. Computations shall be legible, complete, and clearly document the source of all information used including assumptions and measurements collected.

If a computer program is used to perform the computations, the contractor shall provide the engineer with the software identification, vendor's name, version number, and other pertinent data before beginning survey activities. Computer generated computations shall show all input data including values assigned and assumptions made.

The elevations of permanent and temporary bench marks shall be determined and recorded to the nearest 0.01 foot. Differential leveling and transit traverses shall be of such precision that the error of vertical closure in feet shall not exceed plus or minus 0.1 times the square root of the traverse distance in miles. Linear measurements shall be accurate to within 1 foot in 5,000 feet, unless otherwise specified in **section 9** of this specification. The angular error of closure for transit traverses shall not exceed 1 minute times the square root of the number of angles turned.

The minimum requirements for placing slope stakes shall be at 100-foot stations for tangents, as little as 25 feet for sharp curves, breaks in the original ground surface and at any other intermediate stations necessary to ensure accurate location for construction layout and measurement. Slope stakes and cross sections shall be perpendicular to the centerline. Significant breaks in grade shall be determined for cross

sections. Distances shall be measured horizontally and recorded to the nearest 0.1 foot. Side shots for interim construction stakes may be taken with a hand level.

Unless otherwise specified in **section 9** of this specification, measurements for stationing and establishing the location of structures shall be made to the nearest 0.1 foot.

Elevations for concrete work, pipes, and mechanical equipment shall be determined and recorded to the nearest 0.01 foot. Elevations for earth work shall be determined and recorded to the nearest 0.1 foot.

4. Primary control

The baselines and bench marks for primary control, necessary to establish lines and grades needed for construction, are shown on the drawings and have been located on the job site.

These baselines and bench marks shall be used as the origin of all surveys, layouts, and measurements to establish construction lines and grades. The contractor shall take all necessary precautions to prevent the loss or damage of primary control points. Any stakes or control points lost or damaged by construction activity will be reestablished by the contractor or at contractor expense.

5. Construction surveys

Before work starts that requires contractor performed surveys, the contractor shall submit in writing for the engineer's review: the name, qualifications, and experience of the individuals to be assigned to the survey tasks.

Method 1—Contractor performed surveys shall include:

- checking and any supplemental or interim staking
- performing quantity surveys, measurements, and computations for progress payment
- other surveys as described in **section 9** of this specification

Method 2—Contractor performed surveys shall consist of all work necessary for:

- establishing line and grade for all work
- setting slope stakes for all work
- checking and any supplemental or interim staking
- establishing final grade stakes
- performing quantity surveys, measurements, and computations for progress payment
- other surveys as described in **section 9** of this specification

Method 3—Contractor performed surveys shall consist of all work necessary for:

- establishing line and grade for all work
- setting slope stakes for all work
- checking and any supplemental or interim staking

- establishing final grade stakes
- performing quantity surveys, measurements, and computations for progress payments
- performing original (initial) and final surveys for determinations of final quantities
- other surveys as described in **section 9** of this specification.

6. Staking

The construction staking required for the item shall be completed before work on any item starts. Construction staking shall be completed as follows or as otherwise specified in **section 9** of this specification:

Clearing and grubbing—The boundary of the area(s) to be cleared and grubbed shall be staked or flagged at a maximum interval of 200 feet, closer if needed, to clearly mark the limits of work. When contractor staking is the basis for determining the area for final payment, all boundary stakes will be reviewed by the engineer before start of this work item.

Excavation and fill—Slope stakes shall be placed at the intersection of the specified slopes and ground line. Slope stakes and the reference stakes for slopes shall be marked with the stationing, required cut or fill, slope ratio, and horizontal distance from the centerline or other control line. The minimum requirements for placing slope stakes is outlined in **section 3**, Quality of work.

Structures—Centerline and offset reference line stakes for location, alignment, and elevation shall be placed for all structures.

7. Records

All survey data shall be recorded in fully identified standard hard-bound engineering survey field notebooks with consecutively numbered pages. All field notes and printed data shall include the purpose or description of the work, the date the work was performed, weather data, sketches, and the personnel who performed and checked the work. Electronically generated survey data and computations shall be bound, page numbered, and cross referenced in a bound field notebook containing the index for all survey activities. All work shall follow recognized professional practice.

The construction survey records shall be available at all times during the progress of the work for examination and use by the engineer and when requested, copies shall be made available. The original field notebooks and other records shall be provided to and become the property of the owner before final payment and acceptance of all work.

Complete documentation of computations and supporting data for progress payments shall be submitted to the engineer with each invoice for payment as specified in **section 9** of the specification. When the contractor is required to conduct initial and final surveys as outlined in **section 5**, Construction Surveys, notes shall be provided as soon as possible after completion to the engineer for the purpose of determining final payment quantities.

8. Payment

Method 1—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds, after presentation of correct and accurate invoices by the contractor showing

related costs and evidence of the charges of suppliers, subcontractors, and others for supplies furnished and work performed. Invoices for the total amount of the contract price will not be accepted until all surveys are complete and required documentation has been determined complete. If the total of such payments is less than the lump sum contract price for this item, the unpaid balance will be included in the final contract payment. Payment of the lump sum contract price will constitute full compensation for completion of all work under the bid item.

Method 2—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds with progress payment amounts determined as a percentage of the total work planned as projected from the contractor's approved construction schedule. Payment of the lump sum contract price will constitute full compensation for completion of all work under this bid item.

All Methods—Payment will not be provided under this item for the purchase price of materials or equipment having a residual value.

Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item to which they are made subsidiary are identified in **section 9** of this specification.

9. Items of work and construction details

A. Bid Item #039-2, #040-2 & #041-2 Construction Surveys:

1) This item shall include all work, equipment and materials required to assure construction to the lines and grades shown on the drawings. All surveys shall be completed by a licensed Professional Land Surveyor (PLS), licensed in the state of North Carolina. Contractor shall submit in writing the surveyors credentials prior to any staking activity.

2) Contractor shall field verify all elevations indicated on construction drawings, prior to any construction activities. Contractor shall notify NRCS Project Engineer upon discovering any discrepancies between the construction drawings and field conditions.

3) Contractor shall utilize and perform all staking activities referenced to NRCS benchmarks as shown on sheet 3 of the construction drawings. Should the contractor's surveyor become aware of any discrepancies between NRCS elevations and field verified elevation, surveyor shall contact Project Engineer and Contract Officer immediately. Contractor shall verify NRCS benchmarks within four (4) weeks of receiving the notice to proceed, results shall be submitted to Project Engineer within one (1) week of verification.

4) In **Section 3 and Section 6** of this specification, Quality Control and Staking, respectively; Contractor staking for stream, berms, and slough alignments maybe limited to offset staking at 500 foot stations, locations of visual barriers (as determined by project engineer), and locations of structures (in-stream, culverts, and/or water control structures) if and only if contractor is utilizing survey grade machine control equipment per **Construction Specification 21 and 23**. Contractor shall stake all construction practices as necessary in order to perform the work with the survey grade machine control devices. All other staking activities shall follow this specification **Sections 3** and **Section 6** above.

5) In **Section 4** of this specification, Primary Control, control points are provided for surveys. The contractor shall take necessary precautions to prevent the loss or damage of these control points and temporary benchmarks. Benchmarks replacement shall be at the contractor's expense.

6) In **Section 5** of this specification, Construction Surveys, **Method 2** shall apply. In addition, it is the responsibility of the contractor to replace any lost or disturbed staking or flagging previously set by NRCS.

7) In **Section 7,** contractor is responsible for record keeping and submitting layout, checkout, and as-built records with each payment. All data shall be kept within a bound field book and available to the project engineer and inspector at all times. Records shall be in accordance with NRCS TR62, which can be found at:

   http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=18637.wba

   Field book records for processing payments will need to be scanned to a PDF format and submitted with each payment. All survey shot or construction check records shall be provided with data in a PNEZD (Point, Northing, Easting, Elevation, Description) .csv, comma delimited file format. Construction check point file shall also accompany each payment request. Contractor shall submit a comma delimited file with each pay application containing survey check shots in a Point, Northing, Easting, Elevation, and Description format. File shall be tied to NC 83 State Plane coordinate system and NAVD 88 elevation datum. **No payment shall be processed without survey information as described in section 7 and as outlined herein**. In addition to items listed and outlined in **section 7** of this specification, contractor shall keep a log of all survey grade machine control calibration checks. All records outlined in **section 7** interim and/or final shall be made available to NRCS Project Engineer upon request. Upon receipt of this request from NRCS Project Engineer contractor shall have one (1) business day to furnish documents in print and electronic format. Records shall follow industry standard format and shall be provided in such a manner that NRCS can easily understand the information.

8) Elevation verification of installed structures (instream or water control) shall have not only survey grade control but a double check control with a laser or auto- level. Documentation shall be recorded in a field book and made available as outlined in section 7 and item 7 above.

9) Contractor shall submit final digital as-built drawings (red-line) four (4) weeks following substantial completion letter from NRCS Project Engineer. Showing final as-built grades on the NRCS design sheets with as-built information in red color. As-builts shall be printed on NRCS page layout on ANSI 'D' 22 inch by 34 sheets. Information shall not be hand written. As-builts shall be certified by professional land surveyor (PLS) and accompanied by a certification statement as required by the board. Sealing officials shall be licensed in the state of North Carolina and in good standing with the board. All drawings shall be submitted in DWG, DWF, and PDF formats. As-builts shall follow NRCS National Engineering Manual, National Engineering Handbook, all applicable Technical Releases, and recognized industry standards. As-builts drawings shall depict the as-built conditions of "all" constructed items. As-builts shall reflect design and constructed elevations on all structures, including but not limited to water control structures, pipe inverts, flow transfer structures, instream structures, etc. As-builts shall include but not limited to:

a) Limits of Disturbance
b) Scale Text and Bar
c) North Arrow
d) Firm Name and Contact Information
e) P.L.S. seal and certification statement
f) Legend and symbols
g) Abbreviations
h) Any special notes on changes/modifications
i) Point File in a LandXML file
j) TIN Surface in a LandXML file
k) Topographic Contours at a maximum interval of 0.5 feet.
l) Cross-sections (channel bottom, bankfull bench, dike, berms, pathway, ditch plug, capping, etc.)
m) Profiles (channel bottom, bankfull bench, dike, berms, pathway, ditch plug, capping, etc.)
n) Plan/Profile/Cross-section views depicting as-built information in a red color overlaying a shaded black "design" set in the background.
o) Structure information showing the design information in black text and the as-built information in red text. Labels shall include but not limited to: structure name, location, size, elevation, northing, easting, inverts, permanent weir, etc.

10) All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

11) Measurement and payment shall **NOT** be in accordance with **Section 8, Method 1**.

a) NRCS shall hold twenty-five percent (25%) of contractors lump sum bid price until final acceptance of As-Built Drawings as identified in **Section 9 Item 6**.
b) Seventy-five percent (75%) shall be available for progress payments; these payments shall be prorated and provided in equal amounts on each monthly progress payment estimate. The number of months used for prorating shall be the number estimated to complete the work as outlined in the contractor's approved construction schedule. The final month's prorate amount will be provided with the final contract payment. Payment as described will constitute full compensation for completion of the work. Should the contractor fall behind schedule greater than 5% then payments shall be held and prorated based on a recovery schedule.

12) Payment shall constitute full compensation for all work associated with **Bid Line Item ##039-2, #040-2 & #041-2.** Measurement and payment shall be on a lump sum (LS) basis.

13) The following items shall be subsidiary to this bid item:

a) Pollution Control, as specified in construction specification #05.
b) Contractor Quality Control, as specified in construction specification #94.

Construction Specification 8—Mobilization and Demobilization

1. Scope

The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

2. Equipment and material

Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in **section 4** of this specification.

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.

This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

3. Payment

Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

4. Items of work and construction details

A. **Bid Item #039-1, #040-1 & #041-1, Mobilization and Demobilization.**

1) This item shall consist of the mobilization and demobilization required by the contractor to perform the work under this contract.

2) In **Section 3**, of this specification payment shall **not** be made as work proceeds. Payment shall be prorated and provided in equal amounts on each monthly progress payment estimate. The

number of months used for prorating shall be the number estimated to complete the work as outlined in the contractor's approved construction schedule. The final month's prorate amount will be provided with the final contract payment. Payment as described will constitute full compensation for completion of the work.

3) Contractor shall provide:

a) Construction Site Plan: Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

b) Bulletin Board: Immediately upon beginning of work, provide a weatherproof covered (glass, acrylic glass, or plastic) bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster (if applicable), and other information approved by the Contracting Officer. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

c) Haul Roads: At contractor’s expense construct access and haul roads necessary for proper prosecution of the work under this contract. Construct with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic are to be avoided. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads are subject to approval by the Contracting Officer. Haul roads shall be maintained such that there are no detriments to the integrity of the road, nor does the road condition endanger on site personnel. Haul roads shall be graded at a minimum of once (1) per week. Haul roads which at the direction of the project engineer are becoming excessively rutted shall be graveled at the contractor’s expense. Haul roads shall be remediated to pre-existing conditions prior to demobilization.

d) Barricades: Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

e) Fencing: Provide fencing along the construction site at all open excavations and tunnels to

control access by unauthorized people. Fencing must be installed to be able to restrain a force of at least 250 pounds against it.

f) Employee Parking: Contractor employees will park privately owned vehicles in an area designated on the construction drawings unless otherwise approved by the Contract Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking must not interfere with existing and established parking requirements of the government installation.

g) Temporary Wiring and Connections: At the Contractors expense and in a manner satisfactory to the Contracting Officer, provide and maintain necessary temporary connections, distribution lines, and meter bases Contractor shall coordinate all temporary connections with the local utility authority. Include frequent inspection of all equipment and apparatus.

h) Restoration of Storage Areas: Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor. Restore to the original or better condition, areas used by the Contractor for the storage of equipment or material, or other use. Gravel used to traverse grassed areas must be removed and the area restored to its original condition, including top soil and seeding as necessary.

i) Traffic Control: Contractor shall provide all necessary traffic control per NCDOT guidance.

j) Temporary Sanitation Facilities: Provide temporary sewer and sanitation facilities that are self-contained units with both urinals and stool capabilities. Ventilate the units to control odors and fumes and empty and clean them at least once a week or more often if required by the Contracting Officer. The doors shall be self-closing. In accordance with OSHA requirements.

4) All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

5) Payment shall constitute full compensation for all work associated with **Bid Line Item #39-1, #040-1 & #041-1**. Measurement and payment shall be on a lump sum (LS) basis.

6) The following items are subsidiary to this item:
   a. Pollution Control, as specified in Construction Specification #5.
   b. Contractor Quality Control, as specified in Construction Specification #94.

Construction Specification 10—Water for Construction

1. Scope

The work consists of furnishing, transporting, measuring, and applying water as specified.

2. Facilities and equipment

The contractor shall install and maintain access and haul roads and furnish, operate, and maintain all pumps, meters, piping, tanks, storage, and other facilities required to load, transport, store, distribute, and use construction water as specified.

These facilities shall be equipped with accurate, work dedicated meters; tanks of known volume; or other devices that provide a correct measurement of water supplied. Meters shall be installed at the point of delivery into water hauling equipment or application system, such as sprinkler systems or flooding systems, as specified.

3. Dust abatement and haul road maintenance

Water for dust abatement and haul road maintenance shall be applied to haul roads and other dust producing areas as needed to prevent air pollution or excessive dust (which causes impaired vision on trafficked roads and in work areas) and to maintain the roads in good condition for safe and efficient operation during periods of use. Roads that may be jointly used with the public and by the contractor's equipment shall have dust abatement provisions acceptable to the public entity that has road maintenance responsibility. Compensation for water used for dust abatement and haul road maintenance shall be as specified in **section 8** of this specification.

4. Earthfill, drainfill, and rockfill

Water required for proper installation of earthfill, drainfill, and/or rockfill shall be used in the fill materials as specified in the applicable construction specification(s). Compensation for construction water used for earthfill, drainfill, and/or rockfill shall be as specified in **section 8** of this specification.

5. Concrete, mortar, and grout

Water required in the mixing or curing of concrete, shotcrete, roller compacted concrete, or other portland cement mortar or grout shall meet the requirements of the applicable construction specifications and shall be used in conformance with those specifications. Payment for construction water used in these items is covered by the applicable concrete, mortar, or grout specification, or a combination of these.

6. Other construction requiring water

Water required and used for other construction activities under this contract, but not specifically covered by this specification shall be considered subsidiary to the item(s) of work that requires its use.

7. Measurement and payment

Method 1—For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1,000 gallons.

Payment for water is made at the contract unit price. Such payment will constitute full compensation for the direct costs of water. All other costs necessary for transportation, distribution, and application are subsidiary to the items of work with which they are associated.

Method 2—For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1,000 gallons.

Payment for water and the cost associated with transportation, distribution, and application is made at the contract unit price. Such payment will constitute full compensation for completion of the work.

Method 3—For water items for which specific unit prices are established in the contract, the volume of water used in accordance with the specifications will be measured to the nearest 1,000 gallons.

Payment for water is made at the contract unit price. Such payment, excluding water cost, will constitute full compensation for completion of the work.

All methods—The following provisions apply to all methods of measurement and payment:

- The measurement for payment will include all water used except as noted in **sections 5, 6, and 8** of this specification. Measurement for payment will not include water that is used inappropriately or in excess of that needed to accomplish the specified task.
- Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in **section 8** of this specification.

8. Items of work and construction details

A. **Subsidiary to Bid Line Items #039-7 through #039-14, #040-7 through #040-15 & #041-3 through #041-7, Water for Construction.**

1) This item shall consist of the construction water required by the contractor to perform the work under this contract.

2) Contractor shall provide a watering plan two weeks prior to installation activities, this includes but is not limited to water required for achieve optimum moisture conditions for earthfill compaction associated with Stream and Bank Grading.

3) No separate payment shall be made for Water for Construction. Compensation for this item shall be included in the payment for **Bid Line Items #039-7 through #039-14, #040-7 through #040-15 & #041-3 through #041-7.**

Construction Specification 11—Removal of Water

1. Scope

The work consists of the removal of surface water and ground water as necessary to perform the construction required by the contract in accordance with the specifications. It shall include: (1) constructing, installing, building, and maintaining all necessary temporary water containment facilities, channels, and diversions; (2) furnishing, installing, and operating all necessary pumps, piping, and other facilities and equipment; and (3) removing all such temporary works and equipment after their intended function is no longer required.

2. Diverting surface water

The contractor shall install, maintain, and operate all cofferdams, channels, flumes, sumps, and all other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site. Control of surface water shall be continuous during the period that damage to construction work could occur. Unless otherwise specified and/or approved, the diversion outlet shall be into the same drainageway that the water would have reached before being diverted.

The contractor shall furnish the contracting officer, in writing, a proposed plan for diverting surface water before beginning any construction activities for which a diversion is required, unless waived in **section 8** of this specification. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities related to this activity during the process of completing the work as specified.

3. Dewatering the construction site

Foundations, cutoff trenches, and all other parts of the construction site shall be dewatered and kept free of standing water and muddy conditions as necessary for the proper execution of the work. The contractor shall furnish, install, operate, and maintain all drains, sumps, pumps, casings, well points, and all other equipment required to properly dewater the site as specified. Dewatering systems that cause a loss of soil fines from the foundation areas will not be permitted.

The contractor shall furnish the contracting officer, in writing, a proposed plan for dewatering before commencing with any construction activity for which dewatering may be required, unless waived in **section 8** of this specification. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities for completing the specified work.

4. Dewatering borrow areas

The contractor shall maintain all borrow areas free of surface water or otherwise provide for timely and effective removal of surface and subsurface water that accumulates within the borrow area, unless waived in **section 8** of this specification. Borrow material shall be processed as necessary to achieve proper and uniform moisture content at the time of placement.

If pumping to dewater borrow areas is included as a bid item of work in the bid schedule, each pump discharge pipe shall be equipped with a water meter. The meter shall be such that the measured quantity of water is accurate within 3 percent of the true quantity. The contractor shall provide necessary support to perform accuracy tests of the water meter when requested by the contracting officer.

5. Erosion and pollution control

Removal of water from the construction site, including the borrow areas, shall be accomplished so that erosion and the transporting of sediment and other pollutants are minimized. Dewatering activities shall be accomplished in a manner that the water table water quality is not altered. Pollution control activities shall not conflict with the requirements of Construction Specification 5, Pollution Control, if it is a part of this contract.

6. Removal of temporary works

When temporary works are no longer needed, the contractor shall remove and return the area to a condition similar to that which existed before construction. Areas where temporary works were located shall be graded for sightly appearance with no obstruction to natural surface waterflows or the proper functioning and access to the works of improvement installed. The contractor shall exercise extreme care during the removal stages to minimize the loss of soil sediment and debris that was trapped during construction.

Pipes, casings, and any other material used to dewater the site shall be removed from temporary wells. The wells shall be filled to ground level with clean gravel or other suitable material approved by the contracting officer. The contractor shall exercise extreme care to prevent pollution of the ground water by these actions.

7. Measurement and payment

Method 1—Items of work listed in the bid schedule for removal of water, diverting surface water, and dewatering construction sites and borrow areas are paid for at the contract lump sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2—Items of work listed in the bid schedule for removal of water, diverting surface water, dewatering construction sites, and dewatering borrow areas are paid for at the contract lump sum prices. Such payment will constitute full compensation for furnishing, installing, operating, and maintaining the necessary trenches, drains, sumps, pumps, and piping and for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work. The exception is that additional payment for pumping to dewater borrow areas and the removal of water will be made as described in the following paragraph.

If pumping to dewater borrow areas is a contract bid item, payment is made at the contract unit price, which shall be the price per 1,000 gallons shown in the bid schedule. Such payment will constitute full compensation for pumping only. Compensation for equipment and preparation and for other costs associated with pumping is included in the lump sum payment for removal of water or the lump sum payment for dewatering the borrow areas. Payment is made only for pumping that is necessary to dewater borrow areas that cannot be effectively drained by gravity or that must have the water table lowered to be usable as a suitable borrow source. Pumping for other purposes will not be included for payment under this item.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the contract line item to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in **section 8** of this specification.

8. Items of work and construction details

A. **Subsidiary to Bid Line Items #039-3 through #039-14, #040-3 through #040-15 & #041-3 through #041-7, Removal of Water.**

1) This item shall consist of the removal and/or control of surface, ground, and stream flow waters as needed to perform the required construction in accordance with the drawings and specifications.

2) Contractor is responsible for developing a project dewatering plan, this plan shall be submitted to project engineer for review within ten (10) days of receiving the notice to proceed. Throughout the duration of the project contractor shall submit to project engineer updated dewatering plans as the plan changes prior to any commencement of new dewatering activity.

3) The contractor is responsible for clean discharge of water from the construction area into the receiving waters, the use of a pumped sediment erosion control device maybe necessary in order to ensure there are no downstream impacts to water quality. Install the pumped sediment and erosion control device in accordance with manufactures recommendations. Contractor shall submit to engineer product information and planned placement/pumping location one week prior to commencing with dewatering activities.

4) No separate payment shall be made for **Removal of Water**. Compensation for this item shall be included in the payment for **Bid Line Items #039-3 through #039-14, #040-3 through #040-15 & #041-3 through #041-7.**

Construction Specification 21—Excavation

1. Scope

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. Classification

Excavation is classified as common excavation, rock excavation, or unclassified excavation in accordance with the following definitions.

Common excavation is defined as the excavation of all materials that can be excavated, transported, and unloaded using heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by excavators having a rated capacity of one cubic yard or larger and equipped with attachments (shovel, bucket, backhoe, dragline, or clam shell) appropriate to the material type, character, and nature of the materials.

Rock excavation is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of ripping and excavating equipment larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

For the purpose of these classifications, the following definitions shall apply:

Heavy ripping equipment is a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a track type tractor having a power rating of at least 250 flywheel horsepower unless otherwise specified in **section 10**.

Wheel tractor-scraper is a self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 cubic yards.

Pusher tractor is a track type tractor having a power rating of at least 250 flywheel horsepower equipped with appropriate attachments.

Unclassified excavation is defined as the excavation of all materials encountered, including rock materials, regardless of their nature or the manner in which they are removed.

3. Blasting

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person(s) of proven experience and ability who is authorized and qualified to conduct blasting operations.

Blasting shall be done in a manner as to prevent damage to the work or unnecessary fracturing of the underlying rock materials and shall conform to any special requirements in **section 10** of this specification. When specified in **section 10**, the contractor shall furnish the engineer, in writing, a blasting plan before blasting operations begin.

4. Use of excavated material

Method 1—To the extent they are needed, all suitable material from the specified excavations shall be used in the construction of required permanent earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer. The contractor shall not waste or otherwise dispose of suitable excavated material.

Method 2—Suitable material from the specified excavations may be used in the construction of required earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer.

5. Disposal of waste materials

Method 1—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of at the locations shown on the drawings.

Method 2—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of by the contractor at sites of his own choosing away from the site of the work. The disposal shall be in an environmentally acceptable manner that does not violate local rules and regulations.

6. Excavation limits

Excavations shall comply with OSHA Construction Industry Standards (29CFR Part 1926) Subpart P, Excavations, Trenching, and Shoring. All excavations shall be completed and maintained in a safe and stable condition throughout the total construction phase. Structure and trench excavations shall be completed to the specified elevations and to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work. Excavations outside the lines and limits shown on the drawings or specified herein required to meet safety requirements shall be the responsibility of the contractor in constructing and maintaining a safe and stable excavation.

7. Borrow excavation

When the quantities of suitable material obtained from specified excavations are insufficient to construct the specified earthfills and earth backfills, additional material shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as specified in **section 10** or as approved by the engineer.

Borrow pits shall be excavated and finally dressed to blend with the existing topography and sloped to prevent ponding and to provide drainage.

8. Over excavation

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the engineer. Concrete that will be exposed to the atmosphere when construction is completed shall meet the requirements of concrete selected for use under Construction Specification 31, Concrete for Major Structures, or 32, Structure Concrete, as appropriate.

Concrete that will be permanently covered shall contain not less than five bags of cement per cubic yard. The concrete shall be placed and cured as specified by the engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved, compacted earthfill. The exception to this is that if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding, or drainfill. Before correcting an overexcavation condition, the contractor shall review the planned corrective action with the engineer and obtain approval of the corrective measures.

9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas or by methods outlined in **section 10** of this specification. Regardless of quantities excavated, the measurement for payment is made to the specified pay limits except that excavation outside the specified lines and grades directed by the engineer to remove unsuitable material is included. Excavation required because unsuitable conditions result from the contractor's improper construction operations, as determined by the engineer, is not included for measurement and payment.

Method 1—The pay limits shall be as designated on the drawings.

Method 2—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

Method 3—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower and lateral limits shall be the true surface of the completed excavation as directed by the engineer.

Method 4—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.

b. The lower limit shall be at the bottom surface of the proposed structure.

c. The lateral limits shall be 18 inches outside of the outside surface of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d below.

d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the underside of the proposed lining or structure.

e. For the purposes of the definitions in b, c, and d, above, any specified bedding or drainfill directly beneath or beside the structure will be considered to be a part of the structure.

All methods—The following provisions apply to all methods of measurement and payment.

Payment for each type and class of excavation is made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work except that extra payment for backfilling overexcavation will be made in accordance with the following provisions.

Payment for backfilling overexcavation, as specified in **section 8** of this specification, is made only if the excavation outside specified lines and grades is directed by the engineer to remove unsuitable material and if the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in **section 10** of this specification.

10. Items of work and construction details

In **Sections 4 and 5** of this specification, Excavation, **Method 1** shall apply.

Contractor shall be responsible for the protection of underground and aerial utilities. Contractor shall coordinate with appropriate utility authorities for marking. Contractor shall repair any broken utility service as directed by the governing utility authority, at the contractor's own expense.

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7 and 94**.

All earthwork shall be performed with 3D survey grade machine control devices (conventional or RTK); contractor shall submit to engineer make, model, and specifications for approval. Contractor shall make equipment available to project engineer/inspector for periodic inspection.

During hauling activities of this construction project, road maintenance shall be done on a weekly basis to maintain a safe working environment.

Soil material classification shall be in accordance with ASTM D 2487; any reference to "mineral" material shall be defined as "inorganic" in accordance with the reference standard.

A. **Bid Line Item #039-7, 040-7, & 041-5 Stream and Bank Grading, Tandam Branch, Dark Branch, & Saracta Road.**

1) This item shall consist of the excavation required for the stream as shown on the drawings. Earthwork shall be performed to the lines and grades indicated on the plans. All excavated material not required for the project shall be considered waste and disposed of as indicated on the construction drawings.

2) All suitable organic and/or inorganic soils excavated shall be deposited in the temporary stock pile areas as shown on the drawings or as directed by the engineer for use as earthfill material. Soils excavated that are unsuitable for construction shall be separated within the debris and spoil areas as shown on the drawings or as directed by the engineer. The existing vegetation and root mat will be removed prior to the placement of earthfill. Areas that are trafficked by equipment shall be scarified prior to establishment of final grade.

3) Contractor shall compact fill areas within these bid items in accordance with **Construction Specification 23 Section 6**, class **'C'** compaction. All fill areas shall be compacted by trafficking a minimum of three (3) passes with a 35,000 lb tracked type tractor. Fill shall be installed in lifts with a maximum lift thickness of eight (8) inches. Material shall be suitable inorganic material obtained from the excavation activities.

4) Rough Grade – Contractor shall establish "Rough Grade" which shall be defined as within two (2) inches conformance with the lines, grades, and cross-sections indicated on the plans. Contractor shall set slope stakes as specified with **Construction Specification 7**.

5) Final Grade – After establishment of "Rough Grade" contractor shall then set "Final Grade" stakes and then the final process of meeting proposed lines, grades, and cross-sections as indicated on the plans may begin. Contractor shall set slope stakes as specified with **Construction Specification 7**.

6) Payment for **Bid Line Items #039-7, 040-7, 41-05 Stream & Bank Grading**; shall be a unit quantity of **per linear foot (LF) for Stream Grading (Sites 039 & 041) and lump sum (LS) for Bank Grading (Site 041)**.

   a) Contractor shall receive a separate payment for "Rough Grading" work as specified within this Construction Specification, on a linear foot basis. **Ninety Percent (90%)** of the contractors unit bid price shall be made available for progress payment upon successful checkout survey of the rough grading.
   b) Contractor shall receive a separate payment for "Final Grading" work as specified within this Construction Specification, on a linear foot basis. **Ten Percent (10%)** of the contractors unit bid price shall be made available for progress payment upon successful checkout survey of the final grading.

7) The following items are subsidiary to this item:

   a) Pollution Control, as specified in Construction Specification #5.

b) Water for Construction, as specified in Construction Specification #10.
c) Removal of Water, as specified in Construction Specification #11.
d) Common Backfill, as specified in Construction Specification #23.
e) Class 'A' Riprap, as specified in Construction Specification #61.
f) Contractor Quality Control, as specified in construction specification #94.
g) Geotextile, as specified in construction specification #95.

B. **Subsidiary to Bid Line Items #039-8 through #039-11, #040-8 through #040-12, & #041-6, Stream Structures, Erosion Control Matting, ACB, & Pipe Encasement; Common Excavation.**

1) This item shall consist of all excavation required to install the instream structures, pipe encasement, ACB, and erosion control matting as shown on the drawings.

2) All suitable organic and/or inorganic soils excavated shall be deposited in the temporary stock pile areas as shown on the drawings or as directed by the engineer for use as earthfill material. Soils excavated that are unsuitable for construction shall be separated within the debris and spoil areas as shown on the drawings or as directed by the engineer. The existing vegetation and root mat will be removed prior to the placement of earthfill. Areas that are trafficked by equipment shall be scarified prior to establishment of final grade.

3) Inorganic soils excavated that are determined suitable by the project engineer shall be utilized as earthfill around the in-stream structures as show on the drawings.

4) No separate payment shall be made for the Common Excavation associated with the installation of the instream structures, riffle plantings, and erosion control matting. Compensation for this item shall be made under **Bid Line Items #039-8 through #039-11, #040-8 through #040-12 & #041-6**.

Construction Specification 23—Earthfill

1. Scope

The work consists of the construction of earth embankments, other earthfills, and earth backfills required by the drawings and specifications.

Earthfill is composed of natural earth materials that can be placed and compacted by construction equipment operated in a conventional manner.

Earth backfill is composed of natural earth material placed and compacted in confined spaces or adjacent to structures (including pipes) by hand tamping, manually directed power tampers or vibrating plates, or their equivalent.

2. Material

All fill material shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of material in the various fills shall be subject to approval by the engineer.

Fill materials shall contain no frozen soil, sod, brush, roots, or other perishable material. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The types of material used in the various fills shall be as listed and described in the specifications and drawings.

3. Foundation preparation

Foundations for earthfill shall be stripped to remove vegetation and other unsuitable material or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface material of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of 2 inches in depth normal to the slope and shall be at such a moisture content that the earthfill can be compacted against them to produce a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose material by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be no steeper than one horizontal to one vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be placed upon the foundation.

4. Placement

Earthfill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the engineer. Earthfill shall not be placed upon a frozen surface nor shall snow, ice, or frozen material be incorporated in the earthfill matrix.

Earthfill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified in **section 10** or shown on the drawings. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted.

Hand compacted earth backfill shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of earth backfill compacted by manually directed power tampers.

Earth backfill shall be placed in a manner that prevents damage to the structures and allows the structures to assume the loads from the earth backfill gradually and uniformly. The height of the earth backfill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earthfill and earth backfill in dams, levees, and other structures designed to restrain the movement of water shall be placed to meet the following additional requirements:

(a) The distribution of materials throughout each zone shall be essentially uniform, and the earthfill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material. Zone earthfills shall be constructed concurrently unless otherwise specified.

(b) The surface of each layer shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

(c) The top surface of embankments shall be maintained approximately level during construction with two exceptions: A crown or cross-slope of about 2 percent shall be maintained to ensure effective drainage, or as otherwise specified for drainfill or sectional zones.

(d) Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of streamflow during construction are specifically authorized in the contract.

(e) Embankments built at different levels as described under (c) or (d) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all material not meeting the requirements of this specification and shall be scarified, moistened, and recompacted when the new earthfill is placed against it. This ensures a good bond with the new earthfill and obtains the specified moisture content and density at the contact of the inplace and new earthfills.

5. Control of moisture content

During placement and compaction of earthfill and earth backfill, the moisture content of the material being placed shall be maintained within the specified range.

The application of water to the earthfill material shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the material after placement on the earthfill, if necessary. Uniform moisture distribution shall be obtained by disking.

Material that is too wet when deposited on the earthfill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted earthfill or a foundation or abutment surface in the zone of contact with the earthfill becomes too dry to permit suitable bond, it shall either be removed or scarified and moistened by sprinkling to an acceptable moisture content before placement of the next layer of earthfill.

6. Compaction

Earthfill—Earthfill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction—Each layer of earthfill shall be compacted as necessary to provide the density of the earthfill matrix not less than the minimum density specified in **Section 10** or identified on the drawings. The earthfill matrix is defined as the portion of the earthfill material finer than the maximum particle size allowed in the reference compaction test method specified (ASTM D698 or ASTM D1557).

Class B compaction—Each layer of earthfill shall be compacted to a mass density not less than the minimum density specified.

Class C compaction—Each layer of earthfill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Earth backfill—Earth backfill adjacent to structures shall be compacted to a density equivalent to that of the surrounding inplace earth material or adjacent required earthfill or earth backfill. Compaction shall be accomplished by hand tamping or manually directed power tampers, plate vibrators, walk-behind, miniature, or self-propelled rollers. Unless otherwise specified heavy equipment including backhoe mounted power tampers or vibrating compactors and manually directed vibrating rollers shall not be operated within 3 feet of any structure. Towed or self-propelled vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist is not permitted.

The passage of heavy equipment will not be allowed:

- Over cast-in-place conduits within 14-days after placement of the concrete
- Over cradled or bedded precast conduits within 7 days after placement of the concrete cradle or bedding

- Over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 3 feet, whichever is greater, except as may be specified in **section 10**.

Compacting of earth backfill adjacent to structures shall not be started until the concrete has attained the strength specified in **section 10** for this purpose. The strength is determined by compression testing of test cylinders cast by the contractor's quality control personnel for this purpose and cured at the work site in the manner specified in ASTM C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of earth backfill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

Structure	**Time interval** (days)
Vertical or near-vertical walls with earth loading on one side only	14
Walls backfilled on both sides simultaneously	7
Conduits and spillway risers, cast-in-place (with inside forms in place)	7
Conduits and spillway risers, cast-in-place (inside forms removed)	14
Conduits, pre-cast, cradled	2
Conduits, pre-cast, bedded	1
Cantilever outlet bents (backfilled both sides simultaneously)	3

7. Reworking or removal and replacement of defective earthfill

Earthfill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable earthfill. The replacement earthfill and the foundation, abutment, and earthfill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control, and compaction.

8. Testing

During the course of the work, the contractor shall perform quality control tests, as applicable, to identify earthfill and earth backfill materials; determine the reference maximum density and optimum moisture content; and document that the moisture content of material at the time of compaction and the density of earthfill and earth backfill in place conform to the requirements of this specification.

Determining Reference Maximum Density and Optimum Moisture Content—For Class A compaction, the reference maximum density and optimum moisture content shall be determined in accordance with the compaction test and method specified on the drawings or in **section 10**.

Documenting Specification Conformance—In-place densities of earthfill and earth backfill requiring Class A compaction shall be measured in accordance with ASTM D1556, D2167, D2937, or D6938. Moisture contents of earthfill and earth backfill at the time of compaction shall be measured in accordance with ASTM D2216, D4643, or D6938. Values of moisture content determined by ASTM D2216 are considered the true value of the soil moisture. Values of moisture content determined by ASTM D4643 or D6938 shall be verified by comparison to values obtained by ASTM D2216. Values of in-place density and moisture content determined by these tests shall be compared to the minimum density and moisture content range specified on the drawings or in **section 10**.

Correction for Oversize Particles—If the materials to be used for earthfill or earth backfill contain more than 5 percent by dry weight of oversize rock particles (particles larger than those allowed in the specified compaction test and method), corrections for oversize particles shall be made using the appropriate procedures explained in ASTM D4718.

9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill and earth backfill within the specified zone boundaries and pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified in **section 10**, no deduction in volume is made for embedded items, such as, but not limited to, conduits, inlet structures, outlet structures, embankment drains, sand diaphragm and outlet, and their appurtenances.

The pay limits shall be as defined below, with the further provision that earthfill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only under the following conditions:

- Where such overexcavation is directed by the engineer to remove unsuitable material, and
- Where the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Earthfill beyond the specified lines and grades to backfill excavation required for compliance with OSHA requirements will be considered subsidiary to the earthfill bid item(s).

Method 1—The pay limits shall be as designated on the drawings.

Method 2—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the specified neat lines of the earthfill surface.

Method 3—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the measured surface of the completed earthfill.

Method 4—The pay limits shall be the specified pay limits for excavation and the specified neat lines of the earthfill surface.

Method 5—The pay limits shall be the specified pay limits for excavation and the measured surface of the completed earthfill.

Method 6—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work.

Method 7—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work except furnishing, transporting, and applying water to the foundation and earthfill material. Water applied to the foundation and earthfill material is measured and payment made as specified in Construction Specification 10.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in **section 10** of this specification.

10. Items of work and construction details

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

All earthwork shall be performed with 3D survey grade machine control devices (conventional or RTK); contractor shall submit to engineer make, model, and specifications for approval. Contractor shall make equipment available to project engineer/inspector for periodic inspection.

Soil material classification shall be in accordance with ASTM D 2487; any reference to "mineral" material shall be defined as "inorganic" in accordance with the reference standard.

Per section 8 of this specification contractor is responsible for quality control testing, electronic copies of these tests results shall be given to Project Engineer at the end of each week. These notes shall be legible and clearly document including but not limited to: date, location, elevation, soil sample number, reference proctor curve utilized, reference optimum moisture, tested moisture, specified compaction, tested compaction, reference maximum density, tested density, etc.

A. **Subsidiary to Bid Line Items #039-7 through #039-11, #040-7 through #040-12, & #041-5 through #041-6; Common Backfill.**

1) This item shall consist of all earthfill required to install the stream bank grading, bank grading, instream structures, erosion control matting, pipe encasement, and ACB as shown on the drawings and as stated within these specifications.

2) Material shall be suitable inorganic soil obtained from the excavation of all project components

as shown on the construction drawings. Woody debris larger than two (2) inches in diameter or longer than two (2) feet in length shall NOT be incorporated into the earthfill. These materials shall be disposed of in the designated spoil areas as indicated on the construction drawings.

3) In **Section 6** of this construction specification, compaction shall be **Class 'A',** with a **MINIMUM** compacted density equal to at least **90%** of the maximum dry density by compacting a sample in accordance with **ASTM D 698 Method A.** Contractor shall be responsible for determining the maximum dry density in accordance with ASTM D 698, for all backfill material. Contractor shall submit to NRCS project engineer the lab analysis reports (including but not limited to soils classification (Unified Soils Classification System), sieve analysis, standard proctor curves, etc) from a licensed Professional Engineer registered in the state of North Carolina.

4) The moisture content of the fill materials shall be suitable to achieve proper compaction of these materials utilizing the spreading or shaping equipment. Fill material that is too wet (i.e. pumping under the weight of the construction equipment) when deposited in the backfill of the instream structures shall be removed and dried sufficiently so that an effective job of compaction can be done without the material adhering significantly to the wheels or treads of the shaping equipment. If fill materials are too dry to achieve proper compaction, the contractor shall evenly mix water with the fill material to yield moisture content suitable for compaction of the fill material. Fill material shall not be placed into water or saturated soils

5) No separate payment shall be made for the **Common Backfill** associated with the installation of stream bank grading, bank grading, instream structures, erosion control matting, pipe encasement, and ACB. Compensation for this item shall be made under **Items #039-7 through #039-11, #040-7 through #040-12, & #041-5 through #041-6**.

Construction Specification 32—Structure Concrete

1. Scope

The work shall consist of furnishing, forming, placing, finishing, and curing portland cement concrete as required to build the structures described in section 24 of this specification.

The following BioPreferred® product category is applicable to this specification:

— Concrete release fluids (aka form-release agents)

2. Material

Aggregates shall conform to the requirements of Material Specification 522, Aggregates for Portland Cement Concrete, unless otherwise specified. The grading of coarse aggregates shall be as specified in section 24.

Portland cement shall conform to the requirements of Material Specification 531, Portland Cement, for the specified type.

Fly ash shall conform to the requirements of Material Specification 532, Supplementary Cementitious Materials.

Air-entraining admixtures shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete. If air-entraining cement is used, any additional air-entraining admixture shall be of the same type as that in the cement.

Water reducing and/or retarding admixtures shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete.

Curing compound shall conform to the requirements of Material Specification 534, Concrete Curing Compound.

Preformed expansion joint filler shall conform to the requirements of Material Specification 535, Preformed Expansion Joint Filler.

Waterstops shall conform to the requirements of Material Specifications 537, Nonmetallic Waterstops, and 538, Metal Waterstops, for the specified kinds.

Water used in mixing and curing concrete shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter, or other deleterious substances.

3. Class of concrete

Concrete for structure concrete shall be classified as follows:

Class of concrete	**Maximum net water content (gal/bag)**	**Minimum cement content (bags/yd^3)**
3000M	6	5.5
4000M	6	6

4. Air content and consistency

Unless otherwise specified, the slump shall be 3 to 5 inches. If air entrainment is specified, the air content, by volume, shall be 4 to 7 percent of the volume of the concrete. When specified, directed, or approved by the engineer, a water-reducing, set-retarding, or other admixture shall be used. High range, water reducing agents (superplasticizers) may be used to increase workability, reduce water content, and control concrete temperature in hot weather. The maximum slump after adding high range water reducing agents shall be 7.5 inches.

5. Design of the concrete mix

The proportions of the aggregates shall be such as to produce a concrete mixture that works readily into the corners and angles of the forms and around reinforcement when consolidated, but does not segregate or exude free water during consolidation.

Fly ash may be used as a partial substitution for portland cement in an amount of no more than 25 percent (by weight) of the cement in the concrete mix, unless otherwise specified.

The maximum water to cement ratio shall be 0.5 unless otherwise specified. When more than one cementitious material is used, the maximum water to cementitious materials ratio shall be 0.5 unless otherwise specified.

Before the concrete is placed, the contractor shall furnish the contracting officer, for approval, a statement of the materials and mix proportions (including admixtures, if any) intended for use. The statement shall include evidence satisfactory to the contracting officer that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the "job mix." After a job mix has been approved, neither the source, character, or grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to the contracting officer. If such changes are necessary, no concrete containing such new or altered material shall be placed until the contracting officer has approved a revised job mix.

6. Inspection and testing

The engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the engineer to inspect materials, equipment, and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

7. Handling and measurement of material

Materials shall be stockpiled and batched by methods that prevent segregation or contamination of aggregates and ensure accurate proportioning of the ingredients of the mix. Except as otherwise provided in section 8, cement and aggregates shall be measured as follows:

Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weight. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

Water shall be measured, by volume or by weight, to an accuracy within 1 percent of the total quantity of water required for the batch.

Admixtures shall be measured within a limit of accuracy of 3 percent.

8. Mixers and mixing

Concrete shall be uniform and thoroughly mixed when delivered to the work site. Variations in slump of more than 1 inch within a batch are considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other acceptable alternative.

For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall be not less than 1.5 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than 100.

Unless otherwise specified, volumetric batching and continuous mixing at the construction site are permitted. To produce concrete meeting the specified proportioning and uniformity requirements, the batching and mixing equipment shall conform to the requirements of ASTM C685 and shall be demonstrated by tests with the job mix before the concrete is placed. Concrete made by this method shall be produced, inspected, and certified in conformance with sections 6, 7, 8, 13, and 14 of ASTM C685. No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

9. Forms

Forms shall be of wood, plywood, steel, or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags, or other irregularities. Forms shall be coated with a nonstaining form release agent before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least 1 inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed to view when the structure is completed shall be chamfered, unless finished with molding tools as specified in Section l8.

10. Preparation of forms and subgrade

Prior to placement of concrete, the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings and the temperature of all surfaces to be in contact with the new concrete shall be not be less than 40 degrees Fahrenheit. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting, or wire brush scrubbing, as necessary, and shall be wetted immediately before placement of concrete. The earth surface shall be firm and damp. Placement of concrete on mud, dried earth, or uncompacted fill or frozen subgrade is not permitted.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous material.

11. Conveying

Concrete shall be delivered to the site and discharged into the forms within l-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

The engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that prevent segregation of the aggregates and assure no loss of mortar occurs.

12. Placing

Concrete shall not be placed until the subgrade, forms, steel reinforcement, and embedded items have been inspected and approved. No concrete shall be placed except in the presence of the engineer. The contractor shall give reasonable notice to the engineer each time concrete is to be placed. Such notice shall provide sufficient time for the engineer to inspect the subgrade, forms, steel reinforcement, and other preparations for compliance with the specifications. Other preparations include, but are not limited to, the concrete mixing plant; delivery equipment system; placing, finishing, and curing equipment and system; schedule of work; workforce; and heating or cooling facilities, if applicable. Deficiencies are to be corrected before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms. It shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation. When high range water reducing agents are used, the concrete shall not be allowed to drop more than 10 feet. Hoppers and chutes, pipes, or "elephant trunks" shall be used as necessary to prevent segregation and the splashing of mortar on the forms and reinforcing steel above the layer being placed.Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tamping, or vibration as necessary to ensure a smooth surface and dense concrete. Each layer shall be consolidated to ensure monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified in section 13.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

13. Construction joints

Construction joints shall be made at the locations shown on the drawings. If construction joints are needed that are not shown on the drawings, they shall be placed in locations approved by the engineer.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns, as each lift is completed, the top surface shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

The surface of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the engineer. The surface shall be kept moist for at least 1 hour before the new concrete is placed.

14. Expansion and contraction joints

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

When open joints are specified, they shall be constructed by the insertion and subsequent removal of a wooden strip, metal plate, or other suitable template in such a manner that the corners of the concrete are not chipped or broken. The edges of open joints shall be finished with an edging tool before the joint strips are removed.

15. Waterstops

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be soldered, brazed, or welded. Joints in rubber or plastic waterstops shall be cemented, welded, or vulcanized as recommended by the manufacturer.

16. Removal of forms

Forms shall not be removed without the approval of the engineer. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that permits the concrete to take the stresses of its own weight uniformly and gradually.

17. Finishing formed surfaces

Immediately after the forms are removed:

a. All fins and irregular projections shall be removed from exposed surfaces.

b. The holes produced on all surfaces by the removal of form ties, cone-bolts, and she-bolts shall be cleaned, wetted, and filled with a dry-pack mortar. The mortar will consist of one part Portland Cement, three parts sand that will pass a No. 16 sieve, and just sufficient water to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

18. Finishing unformed surfaces

All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft is not permitted.

Adding dry cement or water to the surface of the screeded concrete to expedite finishing is not allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

19. Curing

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding, or fog spraying, or by covering with continuously moistened canvas, cloth mats, straw, sand, or other approved material. Wood forms left in place during the curing period shall be kept continuously wet. A formed surface shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Concrete, except at construction joints, may be coated with the approved curing compound instead of continued application of moisture, except as otherwise specified in section 24. The compound shall be sprayed on the moist concrete surface as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs, and finishing of that surface are completed. The compound shall be applied at a uniform rate of not less than 1 gallon per 175 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall be thoroughly mixed before applying and continuously agitated during application. Curing compound shall not be applied to a surface requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel, and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified above. Any surface covered by the membrane shall not be trafficked unless protected from wear.

20. Removal and replacement or repair

When concrete is honeycombed, damaged, or otherwise defective, the contractor shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective parts. The contracting officer determines the required extent of removal, replacement, or repair. Before starting repair work, the contractor shall obtain the contracting officer's approval of the plan for repairs. The contractor shall perform all repair work in the presence of the engineer.

21. Concreting in cold weather

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40 degrees Fahrenheit unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds is not allowed.

22. Concreting in hot weather

The contractor shall apply effective means to maintain the temperature of the concrete below 90 degrees Fahrenheit during mixing, conveying, and placing.

23. Measurement and payment

For items of work for which specific unit prices are established in the contract, concrete is measured to the neat lines shown on the drawings and the volume of concrete is computed to the nearest 0.1 cubic yard. Measurement of concrete placed against the sides of an excavation without using intervening forms is made only to the neatness or pay limits shown on the drawings. No deduction in volume is made for chamfers, rounded or beveled edges, or for any void or embedded item that is less than 5 cubic feet in volume.

Payment for each item of structure concrete is made at the contract unit price or the contract lump sum; whichever is applicable for that item. Such payment constitutes full compensation for all labor, material, equipment, transportation, tools, forms, falsework, bracing, and all other items necessary and incidental to the completion of the work except items listed for payment elsewhere in the contract. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 24 of this specification.

24. Items of work and construction details

A. Subsidiary Item, Bid Items #40-8 Pipe Encasement – BID ALTERNATE, Concrete.

1) This item shall consist of furnishing and installing concrete encasement as shown on the drawings.

2) Concrete shall be 4,000 PSI concrete meeting Material Specifications 531 and 532.

3) No separate payment will be made for Concrete. Compensation for this item will be included in the payment for **Bid Items #040-8, BID ALTERNATE**.

Construction Specification 61—Rock Riprap

1. Scope

The work shall consist of the construction of rock riprap revetments and blankets, including filter or bedding where specified.

2. Material

Rock riprap shall conform to the requirements of Material Specification 523, Rock for Riprap, or if so specified, shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines, and other material not meeting the required gradation limits.

At least 30 days before rock is delivered from other than designated sources, the contractor shall designate in writing the source from which rock material will be obtained and provide information satisfactory to the contracting officer that the material meets contract requirements. The contractor shall provide the contracting officer's technical representative (COTR) free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in section 8.

Rock from approved sources shall be excavated, selected, and processed to meet the specified quality and grading requirements at the time the rock is installed.

Based on a specific gravity of 2.65 (typical of limestone and dolomite) and assuming the individual rock is shaped midway between a sphere and a cube, typical size/weight relationships are:

Sieve size of rock	Approx. weight of rock	Weight of test pile
16 inches	300 pounds	6,000 pounds
11 inches	100 pounds	2,000 pounds
6 inches	15 pounds	300 pounds

When specified in Section 8 or when it is necessary to verify the gradation of the rock riprap, a particle size analysis shall be performed in accordance with ASTM D5519, Test Method A or B. The analysis shall be performed at the work site on a test pile of representative rock. The mass of the test pile shall be at least 20 times the mass of the largest rock in the pile The results of the test shall be compared to the gradation required for the project. Test pile results that do not meet the construction specifications shall be cause for the rock to be rejected. The test pile that meets contract requirements shall be left on the job site as a sample for visual comparison. The test pile shall be used as part of the last rock riprap to be placed.

Filter or bedding aggregates when required shall conform to Material Specification 521, Aggregates for Drainfill and Filters, unless otherwise specified. Geotextiles shall conform to Material Specification 592, Geotextile.

3. Subgrade preparation

The subgrade surface on which the rock riprap, filter, bedding, or geotextile is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved material and shall conform to the requirements of the specified class of earthfill.

Rock riprap, filter, bedding, or geotextile shall not be placed until the foundation preparation is completed and the subgrade surface has been inspected and approved.

4. Equipment-placed rock riprap

The rock riprap shall be placed by equipment on the surface and to the depth specified. It shall be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock for riprap shall be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.

Rock riprap shall be placed in a manner to prevent damage to structures. Hand placing is required as necessary to prevent damage to any new and existing structures.

5. Hand placed rock riprap

The rock riprap shall be placed by hand on the surface and to the depth specified. It shall be securely bedded with the larger rocks firmly in contact one to another without bridging. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute for larger rock. Flat slab rock shall be laid on its vertical edge except where it is laid like paving stone and the thickness of the rock equals the specified depth of the riprap course.

6. Filter or bedding

When the contract specifies filter, bedding, or geotextile beneath the rock riprap, the designated material shall be placed on the prepared subgrade surface as specified. Compaction of filter or bedding aggregate is not required, but the surface of such material shall be finished reasonably smooth and free of mounds, dips, or windrows.

7. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest ton by actual weight. The volume of each type of filter or bedding aggregate is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. For each load of rock riprap placed as specified, the contractor shall furnish to the COTR a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest 0.1 ton by actual weight. The quantity of each type of filter or bedding aggregate delivered and placed within the specified limits is computed to the nearest 0.1 ton. For each load of rock riprap placed as specified, the contractor shall furnish to the engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton. For each load of filter or bedding aggregate, the contractor shall furnish to the COTR a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

Method 3—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap and filter or bedding aggregate is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap, filter, or bedding. Such payment is considered full compensation for completion of the work.

Method 4—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap, including filter and bedding aggregate, is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap, including filter and bedding. Such payment is considered full compensation for completion of the work.

Method 5—For items of work for which specific unit prices are established by the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest ton by actual weight. For each load of rock for riprap placed as specified, the contractor shall furnish to the COTR a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap, and includes compensation for any aggregate or geotextile installed as specified for filter or bedding. Such payment is considered full compensation for completion of the work.

Method 6—For items of work for which specific unit prices are established by the contract, the volume of each type of rock riprap is measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas.

Payment is made at the contract unit price for each type of rock riprap, and includes compensation for any aggregate or geotextile installed as specified for filter or bedding. Such payment is considered full compensation for completion of the work.

All methods—The following provision applies to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 8.

No separate payment is made for testing the gradation of the test pile. Compensation for testing is included in the appropriate bid item for riprap.

8. Items of work and construction details

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

A. Subsidiary to Bid Items #039-9, #040-10, Structure Stone.

1) This item shall consist of furnishing and installing the boulders, and securing stones for the foundation of the in-stream structure as shown on the drawings.

2) The stone shall meet the requirements of Material Speciation 523, Rock Riprap. The stone gradation shall be per detail for the respective in-stream structure.

3) Stone shall have a dry density equal to or greater than 165 lb/ft^3.

4) No separate payment will be made for Securing Stone. Compensation for this item will be included in the payment for **Bid Items #039-9 and #040-10**.

B. Subsidiary to Bid Item #039-7, #039-9, & #040-9, Class 'A' Riprap.

1) This item shall consist of furnishing and placement of Class 'A' Riprap for slope protection where bank grading meets the existing roadway culverts and pipes, as well as grade control for log rollers.

2) Class 1 non-woven geotextile fabric shall be placed under Class 'A' riprap in accordance with construction specification 95.

3) The Class 'A' stone shall meet the requirements of Material Speciation 522, Aggregates for Portland Cement Concrete. The stone gradation shall be NCDOT size Class 'A'.

4) No separate payment will be made for Class 'A' Riprap. Compensation for this item will be included in the payment for **Bid Items #039-7, #039-9, & #040-9**.

Construction Specification 94—Contractor Quality Control

1. Scope

The work consists of developing, implementing, and maintaining a quality control system to ensure that the specified quality is achieved for all materials and work performed.

2. Equipment and materials

Equipment and material used for quality control shall be of the quality and condition required to meet the test specifications cited in the contract. Testing equipment shall be properly adjusted and calibrated at the start of operations and the calibration maintained at the frequency specified. Records of equipment calibration tests shall be available to the engineer at all times. Equipment shall be operated and maintained by qualified operators as prescribed in the manufacturer's operating instructions, the references specified, and as specified in section 10 of this specification. All equipment and materials used in performing quality control testing shall be as prescribed by the test standards referenced in the contract or in section 10.

All equipment and materials shall be handled and operated in a safe and proper manner and shall comply with all applicable regulations pertaining to their use, operation, handling, storage, and transportation.

3. Quality control system

Method 1—The contractor shall develop, implement, and maintain a system of quality control to provide the specified material testing and verification of material quality before use. The system activities shall include procedures to verify adequacy of completed work, initiate corrective action to be taken, and document the final results. The identification of the quality control personnel and their duties and authorities shall be submitted to the contracting officer in writing within 15 calendar days after notice of award.

Method 2—The contractor shall develop, implement, and maintain a system adequate to achieve the specified quality of all work performed, material incorporated, and equipment furnished before use. The system established shall be documented in a written plan developed by the contractor and approved by the contracting officer. The system activities shall include the material testing and inspection needed to verify the adequacy of completed work and procedures to be followed when corrective action is required. Daily records to substantiate the conduct of the system shall be maintained by the contractor. The quality control plan shall cover all aspects of quality control and shall address, as a minimum, all specified testing and inspection requirements. The plan provided shall be consistent with the planned performance in the contractor's approved construction schedule. The plan shall identify the contractor's onsite quality control manager and provide an organizational listing of all quality control personnel and their specific duties. The written plan shall be submitted to the contracting officer within 15 calendar days after notice of award. The contractor shall not proceed with any construction activity that requires inspection until the written plan is approved by the contracting officer.

All methods—The quality control system shall include, but not be limited to, a rigorous examination of construction material, processes, and operation, including testing of material and examination of manufacturer's certifications as required, to verify that work meets contract requirements and is performed in a competent manner.

4. Quality control personnel

Method 1—Quality control activities shall be accomplished by competent personnel. A competent person is: One who is experienced and capable of identifying, evaluating, and documenting that materials and processes being used will result in work that complies with the contract; and, who has authority to take prompt action to remove, replace, or correct such work or products not in compliance. Off-site testing laboratories shall be certified or inspected by a nationally recognized entity. The Contractor shall submit to the Contracting Officer, for approval, laboratory certification or inspection

information. The Contractor shall submit to the Contracting Officer, for approval, the names, qualifications, authorities, certifications, and availability of the competent personnel who will perform the quality control activities.

Method 2—Quality control activities shall be accomplished by competent personnel who are separate and apart from line supervision and who report directly to management. A competent person is one who is experienced and capable of identifying, evaluating, and documenting that material and processes being used will result in work that complies with the contract, and who has authorization to take prompt action to remove, replace, or correct such work or products not in compliance. Offsite testing laboratories shall be certified or inspected by a nationally recognized entity. The Contractor shall submit to the Contracting Officer, for approval, laboratory certification or inspection information. The contractor shall submit to the contracting officer, for approval, the names, qualifications, authorities, certifications, and availability of the competent personnel who will perform the quality control activities.

5. Post-award conference

The contractor shall meet with the contracting officer before any work begins and discuss the contractor's quality control system. The contracting officer and the contractor shall develop a mutual understanding regarding the quality control system, including procedures for correcting quality control issues.

6. Records

The contractor's quality control records shall document both acceptable and deficient features of the work and corrective actions taken. All records shall be on forms approved by the contracting officer, be legible, and be dated and signed by the competent person creating the record.

Unless otherwise specified in section 10 of this specification, records shall include:

a. Documentation of shop drawings including date submitted to and date approved by the contracting officer, results of examinations, any need for changes or modifications, manufacturer's recommendations and certifications, if any, and signature of the authorized examiner.

b. Documentation of material delivered including quantity, storage location, and results of quality control examinations and tests.

c. Type, number, date, time, and name of individual performing quality control activities.

d. The material or item inspected and tested, the location and extent of such material or item, and a description of conditions observed and test results obtained during the quality control activity.

e. The determination that the material or item met the contract provisions and documentation that the engineer was notified.

f. For deficient work, the nature of the defects, specifications not met, corrective action taken, and results of quality control activities on the corrected material or item.

7. Reporting results

The results of contractor quality control inspections and tests shall be communicated to the engineer immediately upon completion of the inspection or test. Unless otherwise specified in section 10, the original plus one copy of all records, inspections, tests performed, and material testing reports shall be submitted to the engineer within one working day of completion. The original plus one copy of documentation of material delivered shall be submitted to the engineer before the material is used.

8. Access

The contracting officer and the engineer shall be given free access to all testing equipment, facilities, sites, and related records for the duration of the contract.

9. Payment

Method 1—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds, after presentation by the contractor of invoices showing related costs and evidence of charges by suppliers, subcontractors, and others for furnishing supplies and work performed. If the total of such payments is less than the lump sum contract price for this item, the remaining balance is included in the final contract payment. Payment of the lump sum contract price constitutes full compensation for completion of the work.

Payment is not made under this item for the purchase cost of material and equipment having a residual value.

Method 2—For items of work for which lump sum prices are established in the contract, payment is prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating shall be the number estimated to complete the work. The final month's prorate amount is made with the final payment. Payment as described above constitutes full compensation for completion of the work.

Payment is not made under this item for the purchase cost of material and equipment having a residual value.

All methods—Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 10.

10. Items of work and construction details

A. Subsidiary to Bid Line Items ##039-1 through #039-14, #040-1 through #040-15 and #041-1 through #041-09.

1) This item shall consist of the installation of all measures to ensure adherence to contract requirements. All records outlined in section 6 interim and/or final shall be made available to Project Engineer upon request. Upon receipt of this request from Project Engineer contractor shall have **one (1) business day** to furnish documents in print and electronic format. Records shall follow industry standard format and shall be provided in such a manner that NRCS can easily understand the information.

2) In **section 3** above, **Method 2** shall apply. In **section 4** above, **Method 1** shall apply. In section 4 above a competent person shall meet the following education requirements:

    a. The Contractor's site superintendent shall have completed a minimum of four (4) weeks training in Natural Stream Restoration, Natural Channel Design, or Fluvial Geomorphology as approved by North Carolina NRCS. Conferences shall not qualify as training to meet this qualification.
    b. At least one of the Contractor's employees directly involved with the project shall have completed a minimum of six (6) weeks training in Natural Stream Restoration, Natural Channel Design, or Fluvial Geomorphology as approved by North Carolina NRCS. Conferences shall not qualify as training to meet this qualification.
    c. Superintendent must have completed 30,000 linear feet of stream restoration utilizing in-stream natural channel stabilization structures (i.e. cross vanes, j-hooks, log vanes, rootwads,

bioengineering). Experience with plant materials and transplanted vegetation (i.e. native seed mix, bare root seedlings, live stakes, container and balled burlap trees).

3) No separate payment shall be made for **Quality Control**. Compensation for this item shall be included in the payment for **Bid Line Items #039-1 through #039-14, #040-1 through #040-15 and #041-1 through #041-09.**

Construction Specification 95—Geotextile

1. Scope

This work consists of furnishing all material, equipment, and labor necessary for the installation of geotextiles.

2. Quality

Geotextiles shall conform to the requirements of Material Specification 592 and this specification.

3. Storage

Before use, the geotextile shall be stored in a clean, dry location out of direct sunlight, not subject to extremes of either hot or cold temperatures, and with the manufacturer's protective cover undisturbed. Receiving, storage, and handling at the job site shall be in accordance with the requirements listed in ASTM D 4873.

4. Surface preparation

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. It shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions, and standing or flowing water (unless otherwise specified in **section 7** of this specification).

5. Placement

Before the geotextile is placed, the soil surface will be reviewed for quality assurance of the design and construction. The geotextile shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings and specified in **section 7** of this specification. It shall be unrolled along the placement area and loosely laid, without stretching, in such a manner that it conforms to the surface irregularities when material or gabions are placed on or against it. The geotextile may be folded and overlapped to permit proper placement in designated area(s).

Method 1— The geotextile shall be joined by machine sewing using thread material meeting the chemical requirements for the geotextile fibers or yarn. Thread shall be polypropylene, polyester, or KevlarTM aramid thread, unless a specific thread type is specified. The thread shall be consist of two parallel stitched rows at a spacing of about 1 inch and shall not cross (except for any required re-stitching). The stitching shall be a lock-type stitch. Each row of stitching shall be located a minimum of 2 inches from the geotextile edge. Unless otherwise specified, the seam tensile strength as measured according to ASTM D4884 shall be a minimum of 90 percent of the geotextile tensile strength in the weakest principal direction as measured according to ASTM D4632.

The geotextile shall be temporarily secured during placement of overlying material to prevent slippage, folding, wrinkling, or other displacement of the geotextile. Unless otherwise specified, methods of securing shall not cause punctures, tears, or other openings to be formed in the geotextile..

Method 2—The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified) and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a U, L, or T

shape or contain "ears" to prevent total penetration through the geotextile. Steel washers shall be provided on all but the U-shaped pins. The upstream or upslope geotextile shall overlap the abutting downslope geotextile. At vertical laps, securing pins shall be inserted through the bottom layers along a line through approximately the mid-point of the overlap. At horizontal laps and across slope labs, securing shall be inserted through the bottom layer only. Securing pins shall be placed along a line about 2 inches in from the edge of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate to prevent any undue slippage or movement of the geotextile. The use of securing pins will be held to the minimum necessary. Pins are to remain in place unless otherwise specified.

Should the geotextile be torn or punctured, or the overlaps or sewn joint disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or grade distortion, the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of geotextile being used and overlaying the existing geotextile. When the geotextile seams are required to be sewn, the overlay patch shall extend a minimum of 1 foot beyond the edge of any damaged area and joined by sewing as required for the original geotextile except that the sewing shall be a minimum of 6 inches from the edge of the damaged geotextile. Geotextile panels joined by overlap shall have the patch extend a minimum of 2 feet from the edge of any damaged area.

Geotextile shall be placed in accordance with the following applicable specification according to the use indicated in **section 7**:

Slope protection—The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. In no case shall material be dropped on uncovered geotextile from a height of more than 3 feet.

Subsurface drains—The geotextile shall not be placed until drainfill or other material can be used to provide cover within the same working day. Drainfill material shall be placed in a manner that prevents damage to the geotextile. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet.

Road stabilization—The geotextile shall be unrolled in a direction parallel to the roadway centerline in a loose manner permitting conformation to the surface irregularities when the roadway fill material is placed on its surface. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet. Unless otherwise specified, the minimum overlap of geotextile panels joined without sewing shall be 24 inches. The geotextile may be temporarily secured with pins recommended or provided by the manufacturer, but they shall be removed before the permanent covering material is placed.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed within the specified limits is determined to the nearest specified unit by measurements of the covered surfaces only, disregarding that required for anchorage, seams, and overlaps. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed with the specified limits is determined to the nearest specified unit by computing the area of the actual roll size or partial roll size installed. The computed area will include the amount required for overlap, seams, and anchorage as specified. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

Method 3—For items of work for which specific lump sum prices are established in the contract, the quantity of geotextile is not measured for payment. Payment for geotextiles is made at the contract lump sum price and constitutes full compensation for the completion of the work.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in **section 7** of this specification.

7. Items of work and construction details

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

A. Subsidiary Item, Bid Items #039-7 through #039-11, #040-8 through #040-11, & #041-6, Geotextile Fabric.

1) This item shall consist of furnishing and installing geotextile fabric as shown on the drawings.

2) Placement shall be by **Method #2**, as specified in **Section 5** of this **Construction Specification**.

3) The geotextile fabric shall be class I nonwoven meeting Material Specification 592.

4) No separate payment will be made for Geotextile Fabric. Compensation for this item will be included in the payment for **Bid Items ##039-7 through #039-11, #040-8 through #040-11, & #041-6**.

Construction Specification 400—Tree Planting

1. Scope

The work consists of furnishing materials and planting trees in proper locations as shown on the drawings and as specified within this specification. Harvesting, transporting, and installation shall take place when plants are dormant (December 1 through April 1); unless otherwise directed by Project Engineer.

2. Materials

Plant materials shall be grown from seedlings or seed sources that originated within plant hardiness zones 7 or 8.

Trees:

1) Seedling Size Requirements
   a. Seedlings shall conform to the following minimum sizes
   Table 400-1 Tree Species

Species (Scientific Name)	Species (Common Name)	Root Collar Diameter (inch)	Root Length (inch)	Stem Length (inch)
Taxodium distichum	Bald cypress	3/8	8	24
Quercus nuttallii	Nuttall Oak	3/8	8	24
Quercus lyrata	Overcup Oak	3/8	8	24
Quercus pagoda raf.	Cherry Bark Oak	3/8	8	24
Quercus shumardii	Shumard Oak	3/8	8	24
Quercus nigra	Water Oak	3/8	8	24
Quercus phellos	Willow Oak	3/8	8	24
Nyssa sylvatica var biflora	Swamp Tupelo (Blackgum)	3/8	8	24
Quercus michauxii	Swamp Chestnut Oak	3/8	8	24
Quercus bicolor	Swamp White Oak	3/8	8	24
Fraxinus pennsylvanica	Green Ash	3/8	8	24

   b. All seedlings shall have at least 5 primary roots 1/10 diameter or larger. Roots shall be pruned to a length of 8 inches, as necessary. Contractor shall not remove lateral roots from remaining primary root system. Seedlings shall be in a dormant state prior to digging from the nursery.
   c. Contractor shall submit to project engineer five (5) live seedlings of each species above, four (4) weeks prior to planting for approval. Contractor shall not plant any seedlings until project engineer approves of submitted seedling stock. Submittal shall be made in an approved nursery tree bag along with seedling and nursery information. Seedlings shall be clearly marked for identification purposes.

3. Construction Methods

1) Layout – The contractor shall layout rows of trees using the spacing and/or alignment shown in **section 3.2.e** of this specification.
2) Planting - Planting shall be done according to the method described herein, appropriate to the type stock specified in the plant materials list. No material shall be planted when the ground or backfill is in a frozen condition, or conditions are unusually wet, as determined by the NRCS Contracting Officer's Technical Representative (COTR).

    a. Bare Root Stock – Roots of bare root stock shall be spread out to their original downward position, care being taken that no roots double back toward the center of the plant nor have twisted or balled roots. All broken or frayed roots shall be cut off cleanly. The earth backfill material shall be worked in and around the roots so that each root is individually packed and air pockets are eliminated.

    b. Seedlings – Shall be planted in a hole made with a tree planting bar, dibble, mattock, or other appropriate tool. The hole shall be large enough to accommodate the entire root system. Each seedling shall be planted at the same depth as it grew in the nursery. Each seedling shall be given a light tug to ensure proper planting. Any seedling not snug must be reset. Seedlings shall be kept moist until planted. Seedlings that are to be planted later in the day shall be kept in the bag or container and left in a cool, moist, shady area. Seedlings shall be stored in a cooler that maintains a temperature between 35 degrees and 55 degrees Fahrenheit. Seedlings shall be watered as necessary to ensure survival. Watering shall be done through one end of the bundle, and excess water shall be allowed to drain. Seedlings may be field stored in a shed, barn or dense shade for up to 7 calendar days when the temperature adjacent to the seedlings can be maintained from 30 degrees to 60 degrees Fahrenheit throughout the field storage period.

    c. Transporting - Seedling bundles shall be covered during transport to the site. Seedling bundles shall be treated with care and shall not be thrown or dropped at any time.

    d. Planting Mixture – the site shall be planted with the following ratio of tree species as shown in **Section 5**.

    e. Stockng Rate – Seedlings shall be planted on a 8 FT by 12 FT, 12 FT by 12 FT, or 8 FT by 8 FT (L X R) grid uniformly yielding 454, 303, or 680 seedlings per acre. Seedlings shall be planted in zones in accordance with construction drawings.

3) Inspection - Inspection of seedling quality by the NRCS shall be performed under this contract prior to or at the beginning of the planting of the seedlings. The NRCS shall be given at least one (1) week notice of the anticipated arrival of seedlings and planting crew to each site to facilitate the completion of this inspection requirement. Inspection of the tree planting by the NRCS shall be performed under this contract by measuring sample plots. In the event a sample plot fails to meet contract requirements, the Contractor will be required to re-work the representative area prior to re-inspection. The re-inspection sample plot shall not be the original sample plot.

4. Guarantee

Contractor shall guarantee seedling survival rate of 85% minimum one year from the date of the punch list walk through. Contract shall submit this date in writing to the Contract Officer and the Project Engineer. Contractor shall coordinate with Project Engineer during the planting season of the following year to schedule one-year inspection. If the contractor fails to meet the 85% survival rate, the contractor shall replant the areas failing to meet the survival rate at his/her own expense.

5. Measurement and Payment

Method 1—For items of work for which specific unit prices are established in the contract, each area treated is measured as specified in **section 5** and the area calculated to the nearest 0.1 acre. Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

Method 2—For items of work for which specific lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item is made at the contract lump sum price for the item and will constitute full compensation for the completion of the work.

Method 3—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds. Progress payments will be determined as specified in **section 5**. Payment of the lump sum contract price will constitute full compensation for completion of the work.

6. Items of Work and construction details.

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

A. Bid Item #039-16 and #040-17, Furnish and Install Seedlings.

1) This item shall consist of furnishing and planting seedlings as shown on the drawings and specified herein.

2) Tree seedlings shall be planted in accordance with Table 400-2 Zone 4.

Construction Specification 400 Table 2: Zone 4 Tree Seedlings 680 Seedling Stocking Rate

TREE SEEDLINGS**		
COMMON NAME	SCIENTIFIC NAME	PERCENTAGE
Bald cypress	*Taxodium distichum*	40%
Oaks	*Quercus****	20%
Swamp Tupleo (Blackgum)	*Nyssa sylvatica var biflora*	30%
Longleaf Pine	*Pinus palustris*	10%
**TREE STOCKING RATE SHALL BE 680 STEMS PER ACRE		

3) Oaks shall in accordance with Table 400-1 with a minimum of 6 species. Oaks shall be of equal percentages throughout mixture. Oaks shall be evenly distributed throughout the planting area as shown within Zone 4 & 5.

4) Planting dates for seedlings within Zones 4 & 5 shall be from December 1st through April 1st, unless otherwise directed by Project Engineer. Contractor shall follow NC Forest Service recommendations for planting weather days, contractor shall not plant seedlings on a severe day. Contractor shall document weather conditions for each day of planting, daily planting locations, and give data to project engineer at the end of each week.

Construction Specification 400 Table 4 NC Forest Service Classification of Weather Days

Satisfactory Day	
Air Temperature:	33°F to 75°F
Relative Humidity	50%+
Winds	Less than 10 mph
Soil Moisture:	Moist to touch
Marginal Day	
Air Temperature:	76°F to 85°F
Relative Humidity	30% to 50%
Winds	10 to 15 mph
Soil Moisture:	Upper 1-inch dry
Severe Day	
Air Temperature:	32°F or below, or 85°F+
Relative Humidity	30% or less
Winds	15 mph or stronger
Soil Moisture:	Upper 3-inches dry, or ground is frozen

5) Payment for **Bid Line Item #039-16 and #040-17**; shall be made in accordance with **Method 1** as outlined in **section 4** of this construction specification.

6) The following items are subsidiary to the above items:

   a. Pollution Control, as specified in Construction Specification #5.
   b. Water for Construction, as specified in Construction Specification #10.
   c. Removal of Water, as specified in Construction Specification #11.
   d. Contractor Quality Control, as specified in Construction Specification #94.

B. Subsidiary Item, Bid Items #039-16 and #040-17, Tree Seedling.

1) This item shall consist of furnishing and installing tree seedlings as shown on the drawings for the in-stream structures. Tree seedlings shall meet material specifications as outlined above and

shall consist of 50% Bald Cypress (*Taxodium distichum)* and 50% Swamp Black Gum (*Nyssa sylvatica var biflora).*

2) No separate payment will be made for Tree Seedling. Compensation for this item will be included in the payment for **Bid Items #039-16 and #040-17**.

Construction Specification 401—Pipe Casing

1. Scope

The work consists of furnishing and installing pipe and the necessary fittings and appurtenances as shown on the drawings and as outlined in this specification.

2. Material

a. Steel Pipe. Steel casing pipe shall have a minimum yield strength of 35,000 psi. Casing shall meet ASTM A-36, ASTM A-568, ASTM A-135, ASTM A-139, or approved equal. Pipe shall be coated and lined in accordance with AWWA C-210 or approved equal. Pipe joints shall be welded in accordance with AWWA C-206. After pipe is welded, coating and lining shall be repaired. Unless specified otherwise, the minimum wall thickness of steel casing pipe shall be as follows:

Casing Diameter	Wall Thickness
4″ - 24″	0.25″
25″ - 42″	0.375″
43″ - 60″	0.50″

The pipe shall be appropriately marked with ASTM or AASHTO designation.

b. Casing Insulators. Use casing insulators for any type of carrier pipe. Insulators shall consist of pre-manufactured steel bands with plastic lining and plastic runners. Insulators shall fit snug over the carrier pipe and position the carrier pipe approximately in the center of the casing pipe, to provide adequate clearance between the carrier pipe bell and the casing pipe. Fasteners for insulators shall be stainless steel or cadmium-plated. Insulators shall be as manufactured by Cascade Waterworks Manufacturing Company or Pipeline Seal and Insulators, Incorporated or Perry Equipment Corporation.

c. Mortar Bands. Concrete cylinder pipe and mortar coated steel pipe may have thickened outside mortar bands in lieu of casing insulators. Mortar bands shall be properly position the pipe within the casing.

d. Concrete shall conform to Construction Specification #32 and Material Specification #531 & 532.

3. Handling and storage

a. Pipe shall be delivered to the job site and handled by means that provide adequate support to the pipe and do not subject it to undue stresses or damage. When handling and placing pipe, care shall be taken to prevent impact blows,

abrasion damage, and gouging or denting (by metal edges and/or surface or rocks). The manufacturer's special handling requirements shall be strictly observed.

b. Pipe shall be stored on a relatively flat surface so that the full length of the pipe is evenly supported.

4. Excavation

a. Pipe shall be stored on a relatively flat surface so that the full length of the pipe is evenly supported.

b. Unless otherwise specified or approved by the engineer, excavation for and subsequent installation of each section of pipeline shall begin at the outlet end and progress upgrade. The trench or excavation for the pipe shall be constructed to the lines, depths, cross sections, and grade shown on the drawings, specified in **Section 9** of this specification, or as approved by the engineer.

c. Trench shields, shoring and bracing, or other suitable methods necessary to safeguard the contractor's employees and the works of improvement and to prevent damage to the existing improvements shall be furnished, placed, and subsequently removed by the contractor.

d. When a granular filter or envelope is specified, the filter or envelope material shall be placed in the bottom of the trench just before the pipe is laid. The pipe shall then be laid and the filter and envelope material placed to a depth over the top of the pipe of not less than that shown on the drawings or as specified in **section 9** of this specification.

e. When a granular filter or envelope is not specified, the bottom of the trench shall be shaped to form a semicircular or trapezoidal groove in its center. This groove shall provide support for not less than a fourth of the outside circumference of the pipe. After the pipe is placed in the excavated groove, it shall be capped with friable material from the sides of the trench. The friable material shall be placed around the pipe, completely filling the trench to a depth of at least 3 inches over the top of the pipe. For material to be suitable, it must not contain hard clods, rocks, frozen soil, or fine material that will cause a silting hazard to the drain. Pipe placed during any day shall be blinded (place required soil material around and over pipe) and temporarily capped before construction activities are completed for that day.

f. All pipe shall be installed to grade as shown on the drawings. After the pipe is placed in the trench and blinded, allow sufficient time for the pipe to adapt to the soil temperature before backfilling.

g. Unless otherwise specified in **section 7** of this specification or shown on the drawings, connections are made with manufactured junctions comparable in strength with the specified pipe. All fittings shall be completed, to include securely fastened and sealed before any backfill is placed.

5. Installing Carrier Pipe In Casings.

a. Pipe to be installed within the casing shall meet the requirements for this type of pipe as specified. Where indicated, place, align, and anchor guide rails and/or casing insulators inside the casing. If guide rails are used, place cement mortar on both sides of the rails. Pull or skid pipe into place inside the casing. Lubricants such as flax soap or drilling mud may be used to ease pipe installation. Do not use petroleum products, oil or grease for this purpose. If guide rails are used, install pipe and hold down jacks after installation of carrier pipe.

b. After installation of the carrier pipe, mortar inside and outside of the joints as applicable.

c. After carrier pipe installation is complete, seal or plug the ends of the casing.

6. Backfilling

a. Unless otherwise specified in **section 8** of this specification, the backfilling of the trench shall be as shown on the drawings and completed as rapidly as is consistent with the soil conditions. Automatic backfilling machines may be used only when approved by the engineer. Backfill shall extend above the ground surface and be well rounded and centered over the trench.

7. Measurement and payment

a. Payment for shall be made at the contract unit price lump sum (LS) for the pipe encasement, which will constitute full compensation for completion of the work.

8. Items of work and construction details

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

A. Bid Item #040-8 Furnish and Install 12" Ductile Iron Pipe (Encasement) Option 1. ASTM A536.

1. This item shall consist of furnishing and installing the Ductile Iron pipe as shown on the drawings and specified herein.

2. Pipe Material:

    i. Steel Pipe**.** Steel casing pipe shall have a minimum yield strength of 35,000 psi. Casing shall meet ASTM A-36, ASTM A-568, ASTM A-135, ASTM A-139, or approved equal. Pipe shall be coated and lined in accordance with AWWA C-210 or approved equal. Pipe joints shall be welded in accordance with AWWA C-206. After pipe is welded, coating and lining shall be repaired. Unless specified otherwise, the minimum wall thickness of steel casing pipe shall be as follows:

Casing Diameter	Wall Thickness
4″ - 24″	0.25″
25″ - 42″	0.375″
43″ - 60″	0.50″

3. Fill material placed over the structure shall comply with Construction Specification #23.

4. Excavation shall comply with Construction Specification #21.

5. Payment for **Bid Line Items #040-8** shall be **Lump Sum (LS)** per **Section 7** of this construction specification**.**

6. The following items are subsidiary to the above items:

    a. Pollution Control, as specified in Construction Specification 5.
    b. Water for Construction, as specified in Construction Specification 10.
    c. Removal of Water, as specified in Construction Specification 11.
    d. Common Backfill, as specified in Construction Specification 23.
    e. Excavation, as specified in Construction Specification 21.
    f. Contractor Quality Control, as specified in Construction Specification 94.
    g. Geotextile, as specified in Construction Specification 95.

B. Bid Item #040-8 – BID ALTERNATE Option 2 - Furnish and Install Concrete Pipe Encasement

1. This item shall consist of furnishing and installing the concrete pipe encasement as shown on the drawings and specified herein.

2. Fill material placed over the structure shall comply with Construction Specification #23.

3. Excavation shall comply with Construction Specification #21.

4. Concrete shall comply with Construction Specification #32.

5. Payment for **Bid Line Items #040-8** BID ALTERNATE shall be **Lump Sum (LS)** per **Section 7** of this construction specification**.**

6. The following items are subsidiary to the above items:
    a. Pollution Control, as specified in Construction Specification 5.
    b. Water for Construction, as specified in Construction Specification 10.
    c. Removal of Water, as specified in Construction Specification 11.
    d. Common Backfill, as specified in Construction Specification 23.
    e. Excavation, as specified in Construction Specification 21.
    f. Concrete, as specified in Construction Specification 32.
    g. Contractor Quality Control, as specified in Construction Specification 94.
    h. Geotextile, as specified in Construction Specification 95.

Construction Specification 402—Live Stakes

1. Scope

The work consists of harvesting, transporting, installing, and maintaining live stake materials; installed in the stream bank as show on the construction drawings. Live stakes may also be purchased at the discretion of the contractor, with prior approval from the project engineer.

Three (3) weeks prior to installation of live stakes contractor shall submit a proposed harvesting and construction schedule, including source of supply of live cutting, to project engineer for review and approval. No work shall be performed until project engineer approves the source and schedule. Harvesting, transporting, and installation shall take place when plants are dormant (December 1 through April 1). If due to construction scheduling live stakes cannot be used based on the timeframes set above, live tubelings of the same species may be substituted with approval for the project engineer.

2. Materials

Plant materials shall be from sources that originated within plant hardiness zones 7 or 8. Live cuttings for live stakes shall be 0.75 inches to 2.0 inches in diameter and 3 feet in length. Side branches shall be removed and bark left intact prior to installation. Buds on the stakes shall be oriented in an upward position. Contractor shall scrape a portion of the cambium layer off each live stake at the basal end approximately two (2) inches in length by 0.25 inches wide to stimulate root growth. The basal ends shall be dipped in a root stimulating growth hormone approved by the Project Engineer. The basal ends shall be tapered to a point for easy insertion into the soil. The top shall be cut smooth and square. The tops of the live stakes shall be painted with latex tree marking paint to ensure correct planting direction. Mark species with different colors. Live stake cuttings shall consist of the species as listed on the construction drawings.

3. Construction Methods

All material and construction techniques shall be inspected and approved by project engineer prior to installation.

1) Transporting – During transport, live cuttings should be bundled tightly together by species at the construction site for easy loading handling, and protection. If vehicles are necessary for transportation, then the bundles should be moistened covered with tarpaulin, and taken in unheated vehicles to prevent the live stakes from drying. Within 8 hours of harvest, live stakes should be transported and installed. If live cuttings are not immediately installed they must be refrigerated at 34-42 degrees F and cared for until installation. Live branch cuttings can be stored no longer than 3 days. Any storing of live stakes must be approved by project engineer prior to storing.

2) Harvesting –The source of all live cuttings shall be from: (1) purchased stock or (2) within twenty-five (25) miles of the project site. The contractor shall locate, flag, and code the live cutting sites. The contractor shall notify the project engineer one (1) week prior to harvesting to review and approve all harvesting sites. Upon approval by the project engineer, the contractor shall be responsible for harvesting and transporting the cuttings to the job site.

3) Purchasing – If the contractor is unable to locate sufficient harvesting sites for the cuttings, upon approval from the project engineer, the contactor may purchase cuttings from a State certified nursery. The material shall meet all of the specifications as outlined within the construction documents.

4) Live Material Preparation – Shrubs and young trees used in preparation of live stakes shall be cut directly above the ground. All cuts shall be smooth and the cut surface kept small. The use of large pruning shears or power saws may be required. Trees that are more than 3 inches in diameter shall be topped. The live materials shall be transported to the construction site within 8 hours of harvesting and then cut to size, as specified above and on the details. Live materials must be protected against drying out and overheating before/during transport (e.g., they shall be covered, transported in unheated vehicles, moistened, kept in soak pits) and on-site prior to installation (e.g., by storing in controlled conditions, storing in shade, covering with evergreen branches or plastic, placing moist soil, or spraying with anti-transpirant chemicals). Live materials shall receive continuous shade, shall be sheltered from the wind, and shall be continuously protected from drying by heeled into moist soils. Live branch cuttings shall be sprayed or immersed in water if stored for more than 8 hours. Warm water (over 59°F) stimulates growth and should be used only upon the approval by project engineer. Any costs associated with such storage are incidental to the overall unit costs. Live materials shall be installed the same day that the cuttings are harvested. If installation of live materials cannot be accomplished on the same day and storage is required, live materials shall be stored for a period no longer than two (2) days. Any storage of live materials must be approved by the project engineer.

5) Live Stake Installation - Live stakes should be installed from December 1- April 1. Drive live stakes into the ground so that seventy-five percent (75%) of the stake is below the ground surface. For easy insertion into the soil the bottom end of the stake should be cut at an angle of 30 to 45 degrees. To ensure a flat surface for hammering into the slope, the top should be cut at 90-degree angle. For larger branches the use of pruning shears or power saw may be necessary. All buds of the live branch should be faced upwards during taking. As shown on the detailed plans the live stakes should be installed perpendicular to the bank slope. The contractor shall use a deadpan hammer for driving the stake directly into the ground or drive a pilot hole, smaller in diameter then the live stake, and then driving the live stake into the pilot hole. Spacing shall be as dedicated on the planting schedule. A triangular grid pattern will be used for installing the stakes at one foot on center spacing. Three fourths of the live stake length should be installed into the ground. Rebar may be used to make a plot hole for installing stakes in firm soil. Placement of the live stakes shall be as indicated on the Contract Drawings and details. Live stake buds shall be facing upward. Make sure that there is adequate soil contact along the entire length of the portion of the live stake installed in the ground. Fill all voids and air pockets. Soil can be filled in and lightly foot compacted around the live stake fill voids and air pockets. All live stakes split during installation may be left in place but must be supplemented with a new live stake that remains unsplit after installation. Lives stakes should receive proper watering and weeding through landscape construction phase.

6) Inspection – The NRCS project engineer shall make a final inspection with the contractor to ensure all live stakes have been installed according to the specification, plans, and details. The

contractor shall be responsible for correcting all deficiencies within ten (10) calendar days of the inspection. The NRCS project engineer and contractor prior to final completion shall perform a final inspection of the corrected actions.

7) Maintenance – The Contractor shall perform maintenance as follows: a) Replace all diseased and dead vegetation caused by factors other than stream erosion; b) Keep vegetation cleared of debris after all storm events; and c) Prune all dead wood and vegetation as needed. It shall be the Contractor's responsibility to supply water if there is none available on the site. Any costs associated with supplying water shall be the responsibility of the Contractor and shall be included in the unit cost of the live branch stake installation.

4. Guarantee

Contractor shall guarantee live stake survival rate of 85% minimum one year from the date of the punch list walk through. Contract shall submit this date in writing to the Contract Officer and the Project Engineer. Contractor shall coordinate with Project Engineer during the planting season of the following year to schedule one-year inspection. If the contractor fails to meet the 85% survival rate, the contractor shall replant the areas failing to meet the survival rate at his/her own expense.

5. Measurement and Payment

Method 1—For items of work for which specific unit prices are established in the contract, each area planted calculated to the nearest square yard. Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

Method 2—For items of work for which specific lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item is made at the contract lump sum price for the item and will constitute full compensation for the completion of the work.

Method 3—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds. Progress payments will be determined as specified in **section 5**. Payment of the lump sum contract price will constitute full compensation for completion of the work.

6. Items of Work and construction details.

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

A. Bid Item #039-14 and #040-15, Furnish and Install Live Stakes.

1) This item shall consist of furnishing and planting live stakes as shown on the drawings and specified herein.

2) Live stakes shall be in accordance with Table 402-1.
Construction Specification 402 Table 1: Zone 3 Live Stakes

LIVE STAKES**		
COMMON NAME	SCIENTIFIC NAME	PERCENTAGE
Black Willow	*Salix nigra*	15%
Silky Willow	*Salix sericea*	15%
Elderberry	*Sambucus nigra*	15%
Buttonbush	*Cephalanthus occidentalis*	20%
Redosier dogwood	*Cornus serciea*	15%
Silky dogwood	*Cornus amomum*	20%
**LIVE STAKES SHALL BE PLANTED 3 FT O.C. PER DETAIL		

3) Contractor shall stagger species as directed by Project Engineer.

4) Payment for **Bid Line Item #039-14 and #040-15**; shall be made in accordance with **Method 1** as outlined in **section 5** of this construction specification.

5) The following items are subsidiary to the above items:

   a. Pollution Control, as specified in Construction Specification #5.
   b. Water for Construction, as specified in Construction Specification #10.
   c. Removal of Water, as specified in Construction Specification #11.
   d. Contractor Quality Control, as specified in Construction Specification #94.

Construction Specification 404—Erosion Control Matting and Blanketing

1. Scope

This work shall consist of furnishing, transporting, maintaining, and installing erosion control matting on disturbed areas as shown on the construction drawings. Slopes with erosion control matting and blanketing shall receive mulch and permanent seeding prior to placement of matting and blanketing. Three (3) weeks prior to installation of erosion control matting and blanketing contractor shall submit to project engineer for approval a sample of product and technical specifications.

2. Materials

Erosion Control Matting

Provide coir fiber mat to meet the following requirements:

100% coconut fiber (coir) twine woven into high strength matrix	
Weight (ASTM D 3776)	20 oz/SY
Thickness (ASTM D 1777)	0.35 in. minimum
Dry Tensile Strength (ASTM D 4595)	
Machine Direction	1740 lbs/ft minimum
Cross Direction	1176 lbs/ft minimum
Wet Tensile Strength (ASTM D 4595)	
Machine Direction	1488 lbs/ft minimum
Cross Direction	1032 lbs/ft minimum
Elongation (ASTM D 4595)	
Machine Direction	38 %
Cross Direction	25%
Open Area (measured)	48%
Minimum Twine Count per foot	
Machine Direction	27
Cross Direction	18

Erosion Control Blanketing

Provide coir fiber blanketing to meet the following requirements:

Matrix	100 % coconut Fiber
Netting	woven 100% biodegradable jute (9.3 lbs/1000sq ft)
Thickness	0.23inches (minimum)
Elongation	16.2% (MD) x 12.9% (TD)
Stiffness	0.11 oz-in
Mass per unit area	9.79 oz/sy (minimum)
Stable flow velocity	10 fps (minimum)
Resiliency	85%
tensile strength	206.4 lbs/ft (MD), 145.2 lbs/ft (SD)
Water absorbency	365%
Swell	40%
Smolder resistance	Yes
Biomass improvement	473%

*Testing methods specified by Erosion Control Technology Council (ECTC) guidelines.

3. Construction Methods

All material and construction techniques shall be inspected and approved by project engineer prior to installation.

1) Seeding and mulch shall be installed prior to installation of erosion control matting and blanketing.

2) The contractor shall unroll the coir fiber matting and blanketing along the slope face anchoring the mat and blanket into the top end of the slope by 'keying' the mat and blanket a minimum of one (1) foot into the existing ground. Matting and blanketing shall be placed loosely and in full contact with the soil. Matting and blanketing shall be 'keyed' into ground one (1) foot on the top and bottom of slopes.

3) Mat and blanket edges (mat and blanket side by side at a given elevation) shall overlap approximately six (6) inches, with the upstream mat and blanket on top. Stakes shall straddle the edges of the mat and blanket on top and the underlying blanket. Mat and blanket ends (mats and blankets ending upslope from down slope mats and blankets) shall overlap approximately six (6) inches with the upslope mat and blanket over the down slope mat and blanket.

4) The overlapping area and termination area shall be secured with stakes spaced at a minimum of one (1) stake every two (2) linear feet on center. In addition to the stakes located at the overlapping and termination area, stake matting and blanketing at a minimum rate of two (2) per square yard. As shown on the typical detail on the construction drawings.

5) All stakes for securing matting blanketing shall be 18"x2"x4" wooden "wedge" stakes.

4. Measurement and Payment

Method 1—For items of work for which specific unit prices are established in the contract, each area treated calculated to the nearest square yard (SY). Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

Method 2—For items of work for which specific lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item is made at the contract lump sum price for the item and will constitute full compensation for the completion of the work.

Method 3—For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds. Progress payments will be determined as specified in **section 5**. Payment of the lump sum contract price will constitute full compensation for completion of the work.

5. Items of Work and construction details.

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

A. Bid Item #039-11 and #040-12, Furnish and Install Erosion Control Matting.

1) This item shall consist of furnishing and installing erosion control matting and blanketing as shown on the drawings and specified herein.

2) Contractor shall submit a sample of Erosion Control Matting and Erosion Control Blanketing along with technical product specifications three (3) weeks prior to installation for approval.

3) Contractor shall install matting and blanketing from the upstream riffle grade bottom elevation to the halfway point of the bankfull bench, as shown on typical cross-sections within construction drawings. The matting and blanketing limits as shown in the plan and profile drawings are for graphical representation purposes only as the matting and blanketing installation limits may vary depending on field elevations.

4) Payment for **Bid Line Item #039-11 and #040-12**; shall be made in accordance with **Method 1** as outlined in **section 4** of this construction specification.

5) The following items are subsidiary to the above items:
   a. Pollution Control, as specified in Construction Specification #5.
   b. Water for Construction, as specified in Construction Specification #10.
   c. Removal of Water, as specified in Construction Specification #11.
   d. Common Excavation, as specified in Construction Specification #21.
   e. Common Backfill, as specified in Construction Specification #23.
   f. Contractor Quality Control, as specified in Construction Specification #94.

B. Subsidiary to Bid Items #039-8 through #039-10 and #040-9 through #040-11, Erosion Control Matting and Erosion Control Blanketing.

1) This item shall consist of furnishing and installing the erosion control matting and erosion control blanketing for the in-stream structure as shown on the drawings.

2) Contractor shall submit a sample of Erosion Control Matting and Erosion Control Blanketing along with technical product specifications three (3) weeks prior to installation for approval.

3) No separate payment will be made for Erosion Control Matting and Erosion Control Blanketing. Compensation for this item will be included in the payment for **Bid Items #039-8 through #039-10 and #040-9 through #040-11**.

Construction Specification 405—Log In-stream Structures

1. Scope

Log in-stream structures are used as a stream revetment meant to constrict stream flow, develop point bars or create contraction scour holes. Natural logs are placed in the ground per dimensions and elevations as listed in the Construction Drawings. They can constrict base flow and storm flow, protect banks, create meander patterns or create terraces and point bars.

2. Materials

Logs: Logs are to be one of the following allowable species:

- Cypress (*Taxodium sp.*)
- American Sycamore (*Plantanus occidentalis*)
- All Oaks (*Quercus sp.)*
- Ironwood (*Carpinus* caroliniana)
- Green or White Ash (*Fraxinus pennsylvanica, Fraxinus americana*)
- All Hickories (*Carya spp*.)

All other species are not acceptable. Logs are to have dimensions as shown on structure tables on the construction drawings. Diameters given are average diameter; contactor shall take multiple diameters minimum five (5) at equal intervals along the log and average these values. This average diameter shall be stenciled on the larger cut end of the tree. The logs are to be free of rot or cavities. Logs shall be free of branches. Logs shall not be de-barked, contractor shall avoid any damage to bark, and Project Engineer shall reject any log with excessive bark damage, appearance of rot, and/or not straight. Buried dead man logs do not need to be notched.

Anchor Stone: where required, shall be of size and class as shown on the construction drawings. Stone shall conform to Construction Specification 61.

Fabric: geotextile shall be class 1 nonwoven in accordance with Construction Specification 95.

Fastners: shall be galvanized ring shank roofing nail with head size 7/16 inch or greater, nails shall be two (2) inches in length. Unless otherwise approved by project engineer.

3. Construction Methods

All work covered under this specification shall be as required to furnish and install the in-stream structure as depicted on details as shown on the construction drawings.

4. Measurement and Payment

Payment for Log Sills is made at the contract unit price per each (EA) for the designated in-stream structure, which will constitute full compensation for completion of the work. Payment for Log Rollers and Wood Toe is made at the contract unit price per Linear Foot (LF) for the designated in-stream structure, which will constitute full compensation for completion of the work.

5. Items of Work and construction details.

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

A. Bid Item #039-8 through #039-10 and #040-9 through #040-11, Furnish and Install In-stream Structure: Log Rollers, Log Sills, and Wood Toe Structures.

1) This item shall consist of furnishing and installing in-stream structures as shown on the drawings and specified herein.

2) Geotextile fabric shall be class I non-woven per Construction Specification 95.

3) Erosion control matting shall be per Construction Specification 404.

4) Erosion control blanketing shall be per Construction specification 404.

5) Securing stone shall be per Construction Specification 61.

6) Juncus plugs shall be 1-inch planting/nursery tubes with a minimum 4-inch root ball.

7) Payment for **Bid Line Item #039-8 through #039-10 and #040-9 through #040-11, Furnish and Install In-stream Structure: Log Rollers, Log Sills, and Wood Toe Structures.** shall be made in accordance with **section 4** of this construction specification.

   a. 85% of the payment for structures requiring vegetative treatment per detail sheets shall be made upon installation of log structure.
   b. 15% of the payment for structures requiring vegetative treatment per detail sheets shall be made upon installation of the vegetation.

8) The following items are subsidiary to the above items:

   a. Pollution Control, as specified in Construction Specification 5.
   b. Water for Construction, as specified in Construction Specification 10.
   c. Removal of Water, as specified in Construction Specification 11.
   d. Common Excavation, as specified in Construction Specification 21.
   e. Common Backfill, as specified in Construction Specification 23.
   f. Securing Stone, as specified in Construction Specification 61.
   g. Contractor Quality Control, as specified in Construction Specification 94.
   h. Geotextile, as specified in Construction Specification 95.
   i. Erosion Control Matting, as specified in Construction Specification 404.
   j. Erosion Control Blanket, as specified in Construction Specification 404.

Construction Specification 406 —Articulating Concrete Block Revetment System

1. Scope

The work consists of furnishing and installing an articulating concrete block (ACB) revetment system in accordance with the drawings and as specified herein.

2. Material

Articulating Concrete Blocks (ACBs)—ACBs including blocks, cables, and fittings must conform to ASTM D6684, Standard Specification for Materials and Manufacture of Articulating Concrete Block (ACB) Revetment Systems.

When specified in section 7, ACBs must be tested for freeze-thaw durability according to ASTM C666/C666M, Test Method for Resistance of Concrete to Rapid Freezing and Thawing, or ASTM C1262, Test Method for Evaluating the Freeze-Thaw Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units, as applicable. Freeze-thaw durability must be based on tests, conducted not more than 24 months prior to delivery of units made with the same materials, mix proportioning, manufacturing process, and curing method as the blocks installed under this specification. Representative specimens must comply with either of the following: the weight loss of each of five test specimens at the conclusion of 100 cycles must not exceed 1 percent of its initial weight or the weight loss of each of four of the five test specimens at the conclusion of 150 cycles must not exceed 1.5 percent of its initial weight.

ACBs must be tested according to ASTM D7277, Standard Test Method for Performance Testing of Articulating Concrete Block (ACB) Revetment Systems for Hydraulic Stability in Open Channel Flow, and meet the physical and performance properties specified in section 7. Conduct the performance test using the same size and shape of block as the blocks installed under this specification with the density of the tested blocks being equal to or less than that installed under this specification.

Bedding or filter material—Bedding or filter material must meet the gradation stated on the drawings or in section 7 and conform to Material Specification 523.

Concrete or grout—Concrete or grout for filling voids must conform to Construction Specification 31, Concrete for Major Structures, or Construction Specification 32, Structure Concrete, as specified.

Geogrid—Biaxial geogrid must meet the requirements in section 7. Geogrid must be supplied separate from and not affixed to the blocks or mattresses.

Geotextile—Geotextile must meet the requirements in section 7 and Material Specification 592, Geotextile. Geotextile must be supplied separate from and not affixed to the blocks or mattresses.

3. Submittals

At least 14 days prior to delivery of materials, provide material submittals to the engineer that verify that all materials to be incorporated into the work conform to this specification.

At least 2 days prior to manufacturing the ACBs, submit a schedule showing anticipated production start and stop times for the manufacture of ACBs that will be incorporated into the work specified herein. Provide the

manufacturing location and manufacturing facility contact information. Include the same information for the concrete production facility if different from the ACB manufacturing facility.

At least 7 days prior to the start of any installation of the ACB revetment system, submit to the engineer shop drawings for the layout and details including layout sequence and details of joining and anchoring blocks or mats.

Prior to delivery, submit ACB concrete compressive strength test results to verify the strength at the time of delivery will meet or exceed the strength required by ASTM D6684.

4. Subgrade preperation

Subgrade preparation includes excavation, earthfill, installation of bedding or filter material, and geotextile installation. Prepare the subgrade in accordance with ASTM D6884, Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems.

Compact the subgrade to the density specified on the drawings or in section 7. Earthfill necessary to prepare the subgrade must be of the type and class specified on the drawings or in section 7. Complete the subgrade to within plus or minus a half inch of the grade shown on the drawings.

Compact bedding or filter material to the density specified on the drawings or in section 7. Grade the surface to within plus or minus a quarter inch of the grade shown on the drawings.

Do not place ACBs, bedding, or geotextiles until the subgrade preparation is completed and inspected by the engineer.

5. Installation

Install the system according to ASTM D6884.

Cover geotextile with granular material or other specified product the same day it is placed.

Unless specified in section 7, individual blocks must not protrude more than a half inch above the plane of the finished system.

If assembled and placed as large mats, a spreader bar must be used to evenly distribute the load between lifting points. The spreader bar must provide full width support at each end of the mat.

If lacing and anchoring the mats is required by the manufacturer or specified in section 7 of this specification, lace or anchor mats prior to filling or grouting.

Fill the open area of the ACB system with soil or granular material specified on the drawings or in section 7 before the occurrence of any rainfall runoff or other event that may damage or contaminate the subgrade. The open area must be filled within 3 days after the revetment has been installed. If the subgrade (including the earth, geotextile, filter or bedding) is damaged or contaminated, remove and replace the damaged or contaminated portion. Remove or replace the damaged or contaminated portion a minimum of 1 foot laterally beyond the damaged or contaminated area to ensure complete removal and replacement of all damaged or contaminated subgrade.

6. Measurement and payment

For items of work for which specific unit prices are established in the contract, the area of coverage is measured and computed to the nearest square yard based on slope distances.

Method 1— Payment for the ACB revetment system is made at the contract unit price for the blocks, cables, and fittings and includes, as applicable, payment for excavation, earthfill, concrete, grout, bedding material, geogrid, and geotextile. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work.

All methods—The following provisions apply to all methods of measurement and payment. Unless otherwise specified in section 7, no deduction in coverage area is made for any void or embedded item (e.g., a pipe passing through the revetment system). Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Each item and the items to which they are made subsidiary are identified in section 7 of this specification.

7. Items of work and construction details

All payment requests, with each invoice, shall be accompanied by complete documentation and supporting data in accordance with **Construction Specification 7**.

A. Bid Line Items #041-6, Furnish and Install Articulating Concrete Block

1) This consist of Articulating Concrete Block, a Tied Concrete Block Mat with Doubled Layered Underlayment. This work shall consist of furnishing and placing the system in accordance with this specification and conforming with the lines, grades, design, and dimensions shown on the plans.

2) Materials - manufactured from individual concrete blocks tied together with high strength knitted polypropylene bi-axial geogrid. Each block is tapered, beveled and interlocked and includes connections that prevent lateral displacement of the blocks within the mats when they are lifted for placement.

3) Blocks - Furnish blocks manufactured with concrete conforming to the cement requirements of ASTM C150 and to the aggregate requirements of ASTM C33. Blocks shall have a minimum weight of 3 lb. per block and placed no further than 2 in. apart. Material weight per square foot shall not exceed 10 lbs. Blocks shall have a 2.25" profile, a flat-top pyramid shape, and a coarse finish without protrusions. Concrete shall have a minimum compressive strength requirement of Table1 and certified by a third party.

Table 1
Concrete Compressive Strength Requirements

Age	Required Compressive Strength psi
7 - Day	5000 psi
14 – Day	6000 psi
28 - Day	6900 psi

4) Polypropylene Bi-Axial Geogrid - the interlocking geogrid shall be an open knitted fabric composed of high tenacity, multifilament polypropylene yarns knitted and coated in tension with an acrylic based coating which is designed to resist degradation in environments with exposure to water and low pH (,4 pH) and high pH (>9 pH). When combined with the revetment mat, this will yield a high tenacity, low elongating, and continuous filament polypropylene geogrid that is embedded within the base of the concrete blocks. Ensure the geogrid meets the requirements of Table 2.

Table 2
Polypropylene Bi-Axial Geogrid

Property	Unit	Test	Requirement
Mass/Unit Area	oz/yd²	ASTM D5261	6.5 oz/yd²
Aperture Size	English units	Measured	1.4x 1.4 inch
Ultimate Wide Width Tensile Strength (MD x CMD)	lb/ft	ASTM D6637	2,055 lb/ft
Elongation at Ultimate Tensile Strength (MD x CMD)	%	ASTM D6637	6%
Wide Width Tensile Strength @ 2% (MD x CMD)	lb/ft	ASTM D6637	822 lb/ft
Wide Width Tensile Strength @ 5% (MD x CMD)	lb/ft	ASTM D6637	1,640 lb/ft
Tensile Modulus @ 2% (MD x CMD)	lb/ft	ASTM D6637	41,100 lb/ft
Tensile Modulus @ 5% (MD x CMD)	lb/ft	ASTM D6637	32,800 lb/ft

5) Underlayment Materials. ACB a three-layered system, includes, in order from top to bottom, 1) Concrete block mat 2) 5-Pick Leno Weave and 3) wood excelsior. The underlayment materials shall be packaged within the roll of the ACB.

Leno weave properties:

Index Property	Units	Value
GSM	g/m²	118 (-3˜ +3)
Density	Picks/10cm	62 x 24 (+/- 2)
Warp Strength	N/5cm	≥ 350
Warp Elongation	%	20 - 50
Weft Strength	N/5cm	≥ 280
Weft Elongation	%	20 - 50
Warp Shrinkage	%	≤ 7
Weft Shrinkage	%	≤ 9

Wood excelsior properties:

Index Property	Test Method	Value
Thickness	ASTM D 6525	0.418 in (10.62 mm)
Light Penetration	ASTM D 6567	34.6%
Resiliency	ASTM D 6524	64%
Mass per Unit Area	ASTM D 6475	0.57 lb/yd² (309 g/m²)
MD-Tensile Strength Max.	ASTM D 6818	127.0 lb/ft (1.9 kN/m)
TD-Tensile Strength Max.	ASTM D 6818	50.9 lb/ft (0.7 kN/m)
MD-Elongation	ASTM D 6818	28.64%
TD-Elongation	ASTM D 6818	29.84%
Swell	ECTC Procedure	89%
Water Absorption	ASTM D 1117/ECTC	199%
Bench-Scale Rain Splash	ECTC Method 2	SLR = 6.84 @ 2 in/hr [2,3]
Bench-Scale Rain Splash	ECTC Method 2	SLR = 7.19 @ 4 in/hr [2,3]
Bench-Scale Rain Splash	ECTC Method 2	SLR = 7.56 @ 6 in/hr [2,3]
Bench-Scale Shear	ECTC Method 3	2.6 lb/ft² @ 0.5 in soil loss [3]
Germination Improvement	ECTC Method 4	645%

6) Performance - Full-Scale laboratory testing performed by an independent 3rd party testing facility with associated engineered calculations certifying the hydraulic capacity of the proposed Tied-Concrete Block Erosion Control Mat meets the following requirements:

Test	Tested Value	Bed Slope	Soil Classification	Limiting Value
ASTM 6460	Shear Stress	30%	Sandy Loam (USDA)	24lb./ft²
ASTM 6460	Velocity	20%	Loam (USDA)	30 ft./sec

7) This item shall be installed per the drawings and manufactures specifications.

8) Payment for **Bid Line Item #041-6;** shall be **Method 1** per unit quantity of **per Square Foot (SF).**

9) The following items are subsidiary to the above items:

a. Pollution Control, as specified in Construction Specification #5.
b. Water for Construction, as specified in Construction Specification #10.
c. Removal of Water, as specified in Construction Specification #11.
d. Common Excavation, as specified in Construction Specification #21.
e. Common Backfill, as specified in Construction Specification #23.
f. Contractor Quality Control, as specified in Construction Specification #94.
g. Geotextile, as specified in Construction Specification #95.

Material Specification 522—Aggregates for Portland Cement Concrete

1. Scope

This specification covers the quality of fine aggregate and coarse aggregate for use in the manufacture of portland cement concrete.

2. Quality

Aggregate shall conform to the requirements of ASTM Specification C 33 for the specified sizes. Aggregates that fail to meet any requirement may be accepted only when either:

a. The specified alternate conditions of acceptance can be proven before the aggregates are used on the job and within a period such that no work under the contract will be delayed by the requirements of such proof,

   or

b. The specification for concrete expressly contains a provision of special mix requirements to compensate for the effects of the deficiencies.

3. Reactivity with alkalies

The potential reactivity of aggregates with the alkalies in cement shall be evaluated by petrographic examination and, where applicable, the chemical method of test, ASTM Designation C 289, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM Specification C 33, appendix A1.

Aggregates indicated by any of the above to be potentially reactive shall not be used except under one of the following conditions:

a. Applicable test results of mortar bar tests made according to ASTM Method C 227 are available which indicate an expansion of less than 0.10 percent at 6 months in mortar bars made with cement containing not less than 0.8 percent alkalies expressed as sodium oxide; or

b. Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

Aggregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with low alkali cement, containing less than 0.60 percent alkalies expressed as sodium oxide.

4. Storing and handling

Aggregates of each class and size shall be stored and handled by methods that prevent segregation of particles sizes or contamination by intermixing with other material.

Material Specification 532—Supplementary Cementitious Materials

1. Scope

This specification covers the quality of supplementary cementitious materials for concrete.

2. Quality

Fly ash used as a partial substitution of Portland cement shall conform to the requirements of ASTM C618, Class Cor F except the loss on ignition shall not exceed 3 percent, unless otherwise specified. Lot-to-lot variation in the loss on ignition shall not exceed 1 per- cent. When specified, fly ash shall conform to one or more of the supplementary optional physical requirements listed in ASTM C618.

Blast-furnace slag used as a partial substitution of portland cement shall conform to ASTM Standard C989 for ground granulated blast-furnace slag.

Silica fume used as a partial substitution of Portland Cement shall conform to ASTM C1240.

Material Specification 553 —Ductile Iron Pipe

1. Scope
This specification covers the quality of ductile-iron pipe and fittings.

2. Pipe
Ductile-iron pipe shall conform to the requirements of ANSI/AWWA C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids, and ANSI/AWWA C115/A21.15, Flanged Ductile-Iron Pipe with Threaded Flanges.

3. Fittings
Ductile-iron pipe fittings shall conform to the requirements of ANSI/AWWA C110/A21.10, Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids, and ANSI/AWWA C153/A21.53, Ductile-Iron Compact Fittings, 3-inch through 12-inch, for Water and Other Liquids.

4. Joints
Rubber-gasket joints for ductile-iron pipe and fittings where either mechanical or push-on joints are used shall conform to the requirements of ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

5. Lining
Interior lining for ductile-iron pipe and fittings shall conform to the requirements of ANSI/AWWA C104/ A21.4, Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

6. Encasement
Encasement for ductile-iron pipe and fittings shall conform to the requirements of ANSI/AWWA C105/A21.5- 88, Polyethylene Encasement for

Material Specification 592—Geotextile

1. Scope

This specification covers the quality of geotextile, including geotextile for temporary silt fence.

2. General requirements

Fibers (threads and yarns) used in the manufacture of geotextile shall consist of synthetic polymers composed of a minimum of 85 percent by weight polypropylenes, polyesters, polyamides, polyethylene, polyolefins, or polyvinylidene-chlorides. They shall be formed into a stable network of filaments or yarns retaining dimensional stability relative to each other. The geotextile shall be free of defects, such as holes, tears, and abrasions. The geotextile shall be free of any chemical treatment or coating that significantly reduces its porosity. Fibers shall contain stabilizers, inhibitors, or both to enhance resistance to ultraviolet light. Geotextile other than for temporary silt fence shall conform to the requirements in tables 592–1 or 592–2, as applicable. Geotextile for temporary silt fence shall conform to the requirements in table 592–3.

Thread used for factory or field sewing shall be of contrasting color to the fabric and made of high strength polypropylene, polyester, or polyamide thread. Thread shall be as resistant to ultraviolet light as the geotextile being sewn.

3. Classification

Geotextiles shall be classified based on the method used to place the threads or yarns forming the fabric. The geotextiles will be grouped into woven and nonwoven types. Geotextile for temporary silt fence may be either woven or nonwoven. Slit film woven geotextile may not be used except for temporary silt fence.

Woven—Fabrics formed by the uniform and regular interweaving of the threads or yarns in two directions. Woven fabrics shall be manufactured from monofilament yarn formed into a uniform pattern with distinct and measurable openings, retaining their position relative to each other. The edges of fabric shall be selvedged or otherwise finished to prevent the outer yarn from unraveling.

Nonwoven— Fabrics formed by a random placement of threads in a mat and bonded by needle punching, heat- bonding, or resin-bonding. Nonwoven fabrics shall be manufactured from individual fibers formed into a random pattern with distinct, but variable small openings, retaining their position relative to each other when bonded by needle punching, heat-, or resin-bonding. The use of heat- or resin-bonded nonwovens is restricted as specified in note 2 of table 592–2.

4. Sampling and testing

The geotextile shall meet the specified requirements (tables 592–1, 592–2, or 592-3, as applicable) for the product type shown on the label. Product properties as listed in the latest edition of the "Specifiers Guide," Geosynthetics, (Industrial Fabrics Association International, 1801 County Road B, West Roseville, MN 55113-4061 or at http://www.geosindex.com) and that represent minimum average roll values, are acceptable documentation that the product style meets the requirements of these specifications.

For products that do not appear in the above directory or do not have minimum average roll values listed, typical test data from the identified production run of the geotextile will be required for each of the specified tests (see table 592–1, 592–2, or 592-3, as applicable) as covered under clause AGAR 452.236-76.

5. Shipping and storage

The geotextile shall be shipped and transported in rolls wrapped with a cover for protection from moisture, dust, dirt, debris, and ultraviolet light. The cover shall be maintained undisturbed to the maximum extend possible before placement.

Each roll of geotextile shall be labeled or tagged to clearly identify the brand, class, and the individual production run in accordance with ASTM D 4873.

Table 592–1 Requirements for woven geotextiles

Property	Test Method	Units	Class I	Class II	Class III	Class IV
Grab Tensile Strength	ASTM D 4632	pounds	247 min.	180 min.	180 min.	315 min.
Elongation at Failure	ASTM D 4632	percent	< 50	<50	<50	<50
Trapezoidal Tear Strength	ASTM D 4533	pounds	90 min.	67 min.	67 min.	112 min.
Puncture Strength	ASTM D 6241	pounds	495 min.	371 min.	371 min.	618 min.
Ultraviolet Stability (retained strength)	ASTM D 4355	percent	50 min.	50 min.	50 min.	50 min.
Permittivity	ASTM D 4491	sec^{-1}	as specified			
Apparent Opening Size (AOS) 2/	ASTM D 4751	mm	as specified			
Percent Open Area (POA)	USACE CWO-02215	percent	as specified			

1/ All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

2/ Maximum average roll value.

Note: CWO is a USACE reference.

Table 592–2 Requirements for nonwoven geotextiles

Property	Test Method	Units	Class I 2/	Class II 2/	Class III 2/	Class IV 2/
Grab Tensile Strength	ASTM D 4632	pounds	202 min.	157 min.	112 min.	202 min.
Elongation at Failure	ASTM D 4632	percent	50 min.	50 min.	50 min.	50 min.
Trapezoidal Tear Strength	ASTM D 4533	pounds	79 min.	56 min.	40 min.	79 min.
Puncture Strength	ASTM D 6241	pounds	433 min.	309 min.	223 min.	433 min.
Ultraviolet Stability (retained strength)	ASTM D 4355	percent	50 min.	50 min.	50 min.	50 min.
Permittivity	ASTM D 4491	sec^{-1}	0.7 min. or as specified			
Apparent Opening Size (AOS) 3/	ASTM D 4751	mm	0.22 max. or as specified			

1/ All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.

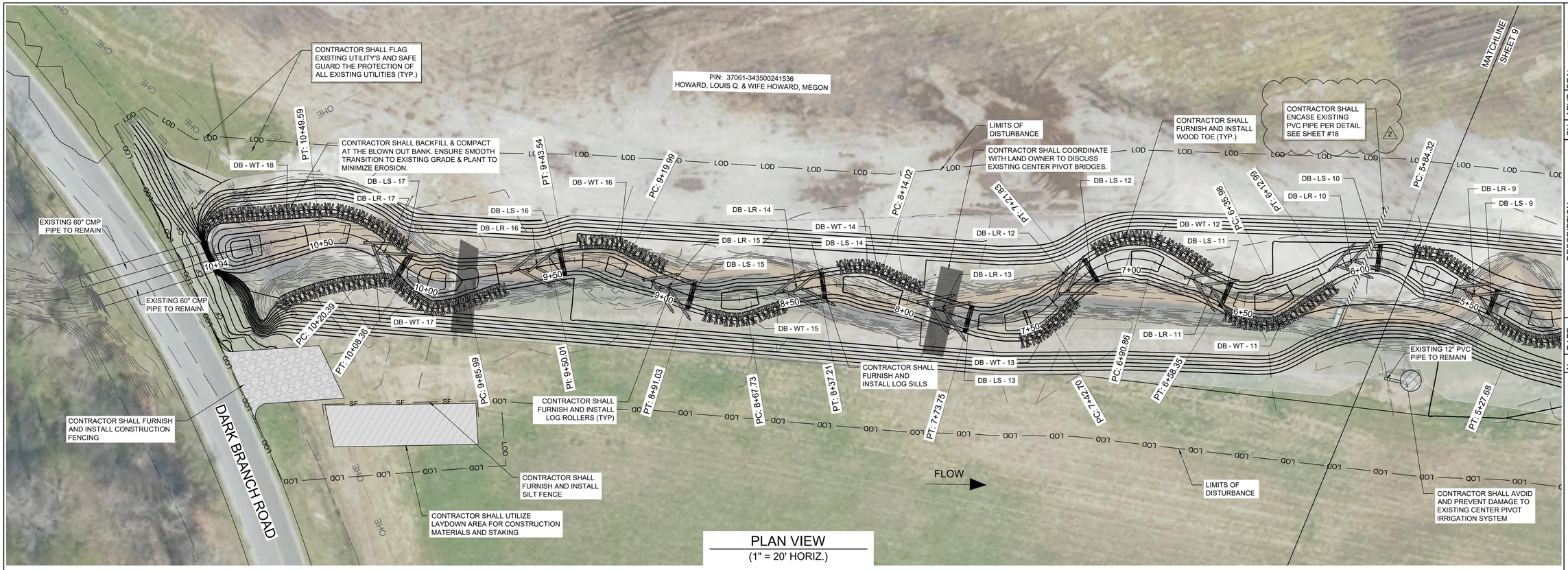
2/ Needle punched geotextiles may be used for all classes. Heat-bonded or resin-bonded geotextiles may be used for classes III and IV only. They are particularly well suited to class IV.

3/ Maximum average roll value.

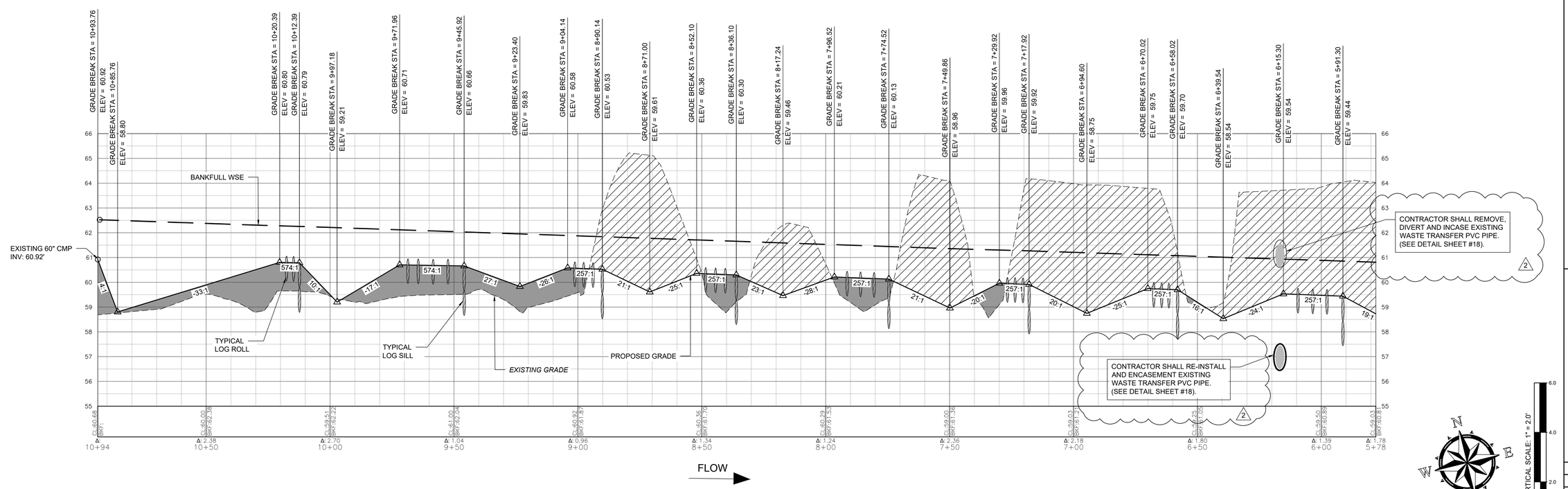
Table 592–3 Requirements for Temporary Silt Fence 1/

Property	Test Method	Units	Requirements, Supported Silt Fence 2/	Requirements, Unsupported Silt Fence 2/	
				Woven Geotextile (Elongation < 50% 3/)	Nonwoven Geotextile (Elongation > 50% 3/)
Maximum Post Spacing		ft	4	6.5	4
Grab Tensile Strength:	ASTM D 4632	pounds			
Machine Direction			90	124	
X-Machine Direction			90	101	
Permittivity	ASTM D 4491	sec-1	0.05	0.05	
Apparent Opening Size (AOS) 4/	ASTM D 4751	mm	0.60	0.60	
Ultraviolet Stability (retained strength)	ASTM D 4335	%	70% after 500 hours of exposure	70% after 500 hours of exposure	

1/ All values are minimum average roll values (MARV) in the weakest principal direction, unless otherwise noted.
2/ Silt fence support shall consist of 14-gage steel wire with a mesh spacing of 6 inches each way or prefabricated polymeric mesh of equivalent strength.
3/ As measured in accordance with ASTM D 4632.
4/ Maximum average roll value.



PLAN VIEW
(1" = 20' HORIZ.)



PROFILE VIEW
(1" = 20' HORIZ., 1" = 2.0' VERT.)

ISSUED FOR: CONSTRUCTION ADDENDUM 1 8/12/22

HORIZONTAL SCALE: 1" = 20'

VERTICAL SCALE: 1" = 2.0'

No.	DATE	DESCRIPTION	BY	APVD
1	7/18/22	ISSUE FOR CONSTRUCTION	JDH	JDH
2	8/09/22	ADDENDUM 1	JDH	JDH
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

DSGN: JDH DR: KAS/SDL CHK: JDH APVD: JDH DATE: 8/12/22

SEAL 038624 8/12/22 ENGINEER

HURRICANE FLORENCE EWP - ENGINEERING ASSISTANCE

DARK BRANCH P&P - 5+78.00 TO 10+94.00

Formerly LDSI, Inc.
GPI
MANY TALENTS, ONE FIRM
CHARLOTTE OFFICE: 301 W 29TH STREET, CHARLOTTE NC 28206
KINSTON OFFICE: 1308 HWY 258 N., KINSTON NC 28504
PHONE: 704.357.8329 FAX: 704.360.5183
WEBSITE: WWW.GPINET.COM NC FIRM #: P-0441

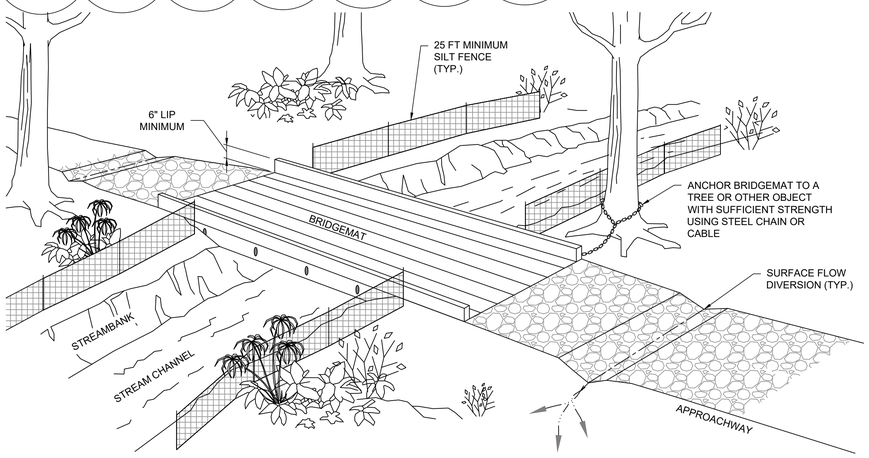
SCALE AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

DATE: 6/1/21
PROJ: 4520018
DWG: Addendum 1
SHEET: 10 of 22

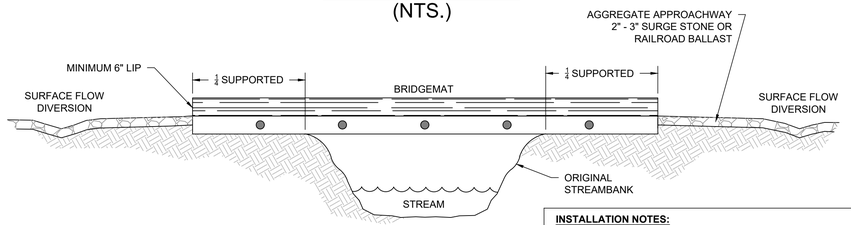
STREAM PARAMETERS

PARAMETER	039 - TANDAM	040 - DARK BRANCH
A_{BKF} (FT^2)	21	25
W_{BKF} (FT)	13	15
D_{BKF} (FT)	1.5	1.5
D_{MAX} (FT)	2.3	2.2
W/D (FT)	9	10
D_{MAX}/D_{BKF}	1.5	1.5
S. (FT/FT)	0.003	0.004
A_{POOL} (FT^2)	27.2	37.5
W_{POOL} (FT)	13.0	15.0
D_{POOL} (FT)	2.1	2.5
D_{MPOOL} (FT)	2.8	3.0
A_{POOL}/A_{BKF} (FT^2/FT^2)	1.3	1.5
W_{POOL}/W_{BKF} (FT/FT)	1.0	1.0
D_{MAX}/D_{BKF} (FT/FT)	1.3	1.2
$D_{INNER\ BERM}$ (FT)	0.7	0.8
$W_{BOTTOM\ RIFFLE}$ (FT)	6.0	6.0
$W_{BOTTOM\ POOL}$ (FT)	3.0	3.2

2



PERSPECTIVE VIEW
(NTS.)



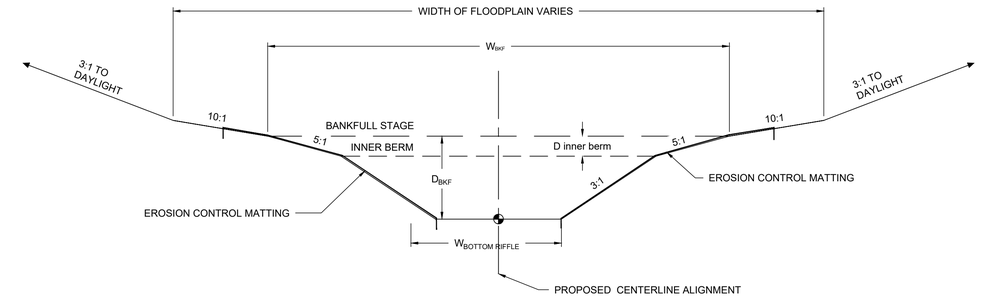
SIDE VIEW
(NTS.)

INSTALLATION NOTES:
1. REFER TO "NORTH CAROLINA DIVISION OF FOREST RESOURCES" LITERATURE, INSTALLATION MAINTENANCE GUIDELINES, & "NORTH CAROLINA FORESTRY BMP MANUAL - 2006"
2. INSTALL WATER DIVERSION DEVICES (WATER BARS, TURNOUTS, BROAD-BASED DIPS, ETC.) ON BOTH SIDES OF THE MATS.
3. STABILIZE EXPOSED MINERAL SOIL WITH TREE TOPS OR BRUSH DURING MAT INSTALLATION, AND SEEDING/MULCH AFTER REMOVAL.
4. INSTALL MATS TO CREATE A MINIMUM TEN FOOT BRIDGE WIDTH.
5. INCLUDE COARS AGGREGATE ON THE APPROACHWAY FOR A MINIMUM OF 25 FEET SILT FENCE ALONG STREAMBANKS ADJACENT TO CROSSING FOR A MINIMUM OF 25 FEET.

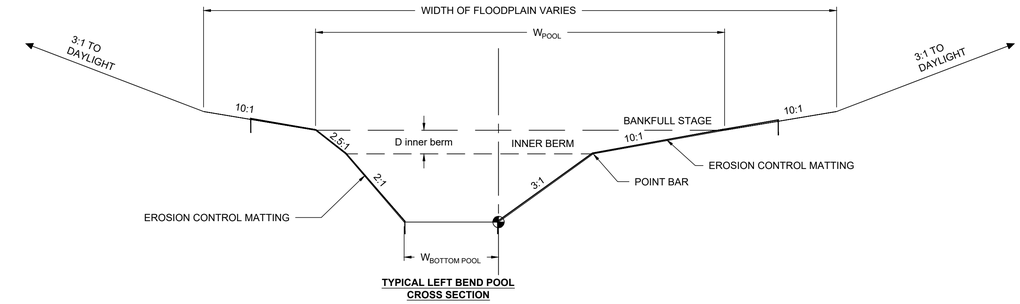
MAINTENANCE NOTES:
1. KEEP MATS' SURFACE FREE OF MINERAL SOIL AND DEBRIS THAT COULD ENTER STREAM.
2. PERIODICALLY CHECK MAT HARDWARE; RETIGHTEN NUTS & CABLE CLAMPS AS NECESSARY TO MAINTAIN BRIDGE STRENGTH AND INTEGRITY.
3. IMMEDIATELY REMOVE ANY DEBRIS WHICH ENTERS THE STREAM AT THE CROSSING LOCATION.

REMOVAL NOTES:
1. CLEAN OFF BRIDGE SURFACE.
2. REMOVE MATS BY USING MAT CABLE LOOP OR SKIDDER GRAPPLE.
3. PERMAENTLY STABILIZE DISTURBED PORTIONS OF STREAMBANK AND APPROACH ROADS WITH PERENNIAL GRASSES/MULCH (OR WETLAND MIX WHEN APPLICABLE.)
4. LEAVE APPROPRIATE WATER DIVERSION STRUCTURES IN PLACE ON BOTH SIDES OF STREAM.
5. RESTORE THE STREAM CHANNEL TO ITS ORIGINAL CROSS-SECTION, SMOOTH, AND APPROPRIATELY STABILIZE ALL DISTURBED AREAS.

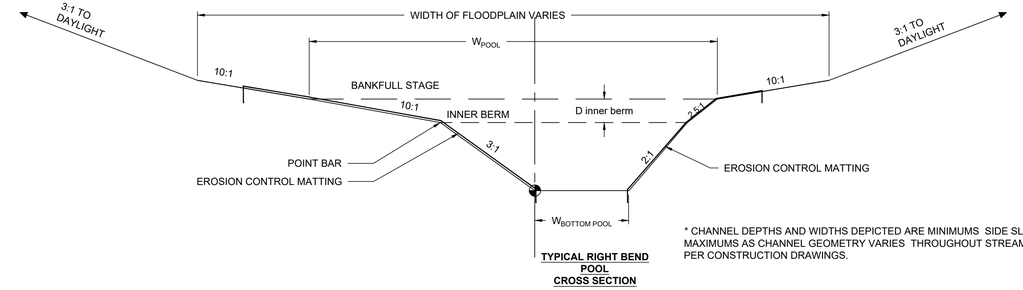
TEMPORARY STREAM CROSSING
(NTS.)



TYPICAL RIFFLE CROSS SECTION



TYPICAL LEFT BEND POOL CROSS SECTION



TYPICAL RIGHT BEND POOL CROSS SECTION

* CHANNEL DEPTHS AND WIDTHS DEPICTED ARE MINIMUMS SIDE SLOPES ARE MAXIMUMS AS CHANNEL GEOMETRY VARIES THROUGHOUT STREAM REACH PER CONSTRUCTION DRAWINGS.

ISSUED FOR: CONSTRUCTION ADDENDUM 1 8/12/22

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038624 8/12/22 JONATHAN D. HINKLE

No.	DATE	DESCRIPTION	BY	APVD	SEAL	DATE: 8/12/22
1	7/18/22	ISSUE FOR CONSTRUCTION	JDH	JDH		APVD: JDH
2	8/09/22	ADDENDUM 1	JDH	JDH		CHK: JDH
						DR: KAS/SDL
						DSGN: JDH

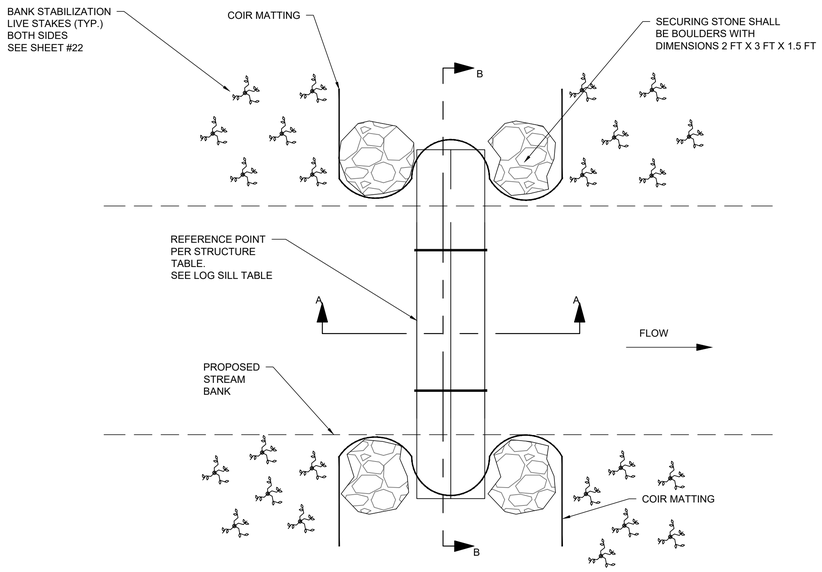
HURRICANE FLORENCE EWP - ENGINEERING ASSISTANCE

TYPICAL CROSS SECTIONS

GPI LDSI
Formerly LDSI, Inc.
MANY TALENTS, ONE FIRM
CHARLOTTE OFFICE: 511 W 36TH STREET, CHARLOTTE NC 28206
KINSTON OFFICE: 1308 HWY 258 N., KINSTON NC 28504
PHONE: 910.683.4123
WEBSITE: WWW.GPIGEO.COM NCF FIRM #: F-0441

SCALE AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

DATE: 6/1/21
PROJ: 4520018
DWG: Addendum 1
SHEET: 14 of 22



PLAN VIEW
(NTS.)

LOG SILL (LS)
NOTES

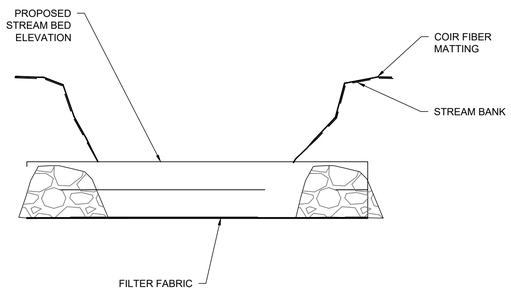
1. LOGS SHALL BE 2 TIMES THE BANKFUL WIDTH, WITH AN AVERAGE DIAMETER OF 12".
2. IF AVAILABLE LOGS MAY BE SALVAGED FROM PROJECT AREA, CONTRACTOR SHALL SUBMIT TO ENGINEER PROPOSED HARVEST LOCATIONS FOR VIEWING. SPECIES PER CONSTRUCTION SPECIFICATIONS.
3. NAIL FILTER FABRIC USING 3" ROOFING NAILS AT 4 INCH INTERVALS ALONG LOG.
4. FILTER FABRIC USED SHALL BE NON-WOVEN GEOTEXTILE FABRIC PER CONSTRUCTION SPECIFICATIONS.
5. COVER LOGS SHALL BE A SINGLE LOG INSTEAD OF THE THREE AS SHOWN IN SECTION A-A.
6. COIR MATTING (PER SECTION 404 OF THE SPECIFICATIONS) SHALL BE FOLDED 3 TIMES (THEREFORE) 4 PLY AND PLACED UNDER UPSTREAM SECURING STONE, WRAPPED OVER LOG STRUCTURE THEN UNDER DOWN STREAM SECURING STONES.

BANK STABILIZATION PLANTING NOTES:

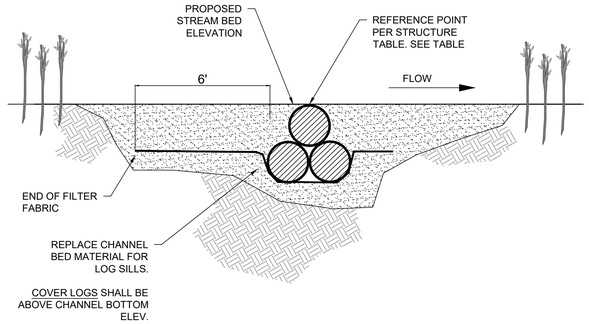
1. PLANTINGS SHALL BE INSTALLED FROM THE TOE OF SLOPE TO THE OUTSIDE EDGE OF THE BANKFULL BENCH.
2. JUNCUS PLUGS SHALL BE PLANTED AT A HIGH DENSITY RATE NEAR INSTREAM STRUCTURES, AT A RATE OF 1 PER SQUARE FOOT. HIGH DENSITY PLANTING SHALL BE FROM 5 FEET UPSTREAM OF LOG INVERT TO 5 FEET DOWNSTREAM OF LOG TIE.
3. JUNCUS PLUGS SHALL BE A SUBSIDIARY ITEM TO THIS BID ITEM, AND SHALL BE INCLUDED IN THE PAYMENT.
2. JUNCUS SHALL BE PLANTED 1' (ONE) O.C. OFFSET ROWS FROM THE TOE OF SLOPE TO THE OUTSIDE EDGE OF THE BANKFULL BENCH.
5. CONTRACTOR SHALL INSURE THAT JUNCUS REMAINS 6 INCHES OFF LOG STRUCTURE AND TREE STOCK IN NOT PLANTED ANY CLOSER THAT 3 FOOT FROM LOG STRUCTURE.

LOG SILL (LS)

Structure	Alignment	Station	Elev	Log Dia	Log Length
TD-LS-01	Tandam	1+77.82	58.12	12	18
TD-LS-02	Tandam	3+05.74	58.17	12	18
TD-LS-03	Tandam	4+43.11	58.35	12	18
TD-LS-04	Tandam	5+16.79	58.56	12	18
TD-LS-05	Tandam	6+28.91	58.80	12	18
TD-LS-06	Tandam	9+05.73	59.12	12	18
DB-LS-01	Dark	0+36.67	57.52	12	18
DB-LS-02	Dark	0+97.74	57.74	12	18
DB-LS-03	Dark	1+48.15	58.00	12	18
DB-LS-04	Dark	1+98.47	58.18	12	18
DB-LS-05	Dark	2+67.77	58.42	12	18
DB-LS-06	Dark	3+40.66	58.59	12	18
DB-LS-07	Dark	4+20.89	58.86	12	18
DB-LS-08	Dark	4+90.97	59.02	12	18
DB-LS-09	Dark	5+41.68	59.23	12	18
DB-LS-10	Dark	5+91.30	59.44	12	18
DB-LS-11	Dark	6+58.02	59.70	12	18
DB-LS-12	Dark	7+17.93	59.92	12	18
DB-LS-13	Dark	7+74.52	60.13	12	18
DB-LS-14	Dark	8+36.10	60.30	12	18
DB-LS-15	Dark	8+90.14	60.53	12	18
DB-LS-16	Dark	9+45.92	60.66	12	18
DB-LS-17	Dark	10+12.39	60.79	12	18



SECTION B-B
(NTS.)



SECTION A-A
(NTS.)

LOG SILL STRUCTURE
(NTS.)

ISSUED FOR: CONSTRUCTION ADDENDUM 1 8/12/22

SEAL
038624
8/12/22
NORTH CAROLINA PROFESSIONAL ENGINEER JONATHAN D. HINES

No.	DATE	DESCRIPTION	BY	APVD
1	7/18/22	ISSUE FOR CONSTRUCTION	JDH	JDH
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.	.	.	.	.
.	.	.	.	.

DSGN: JDH DR: KAS/SDL CHK: JDH APVD: JDH DATE: 8/12/22

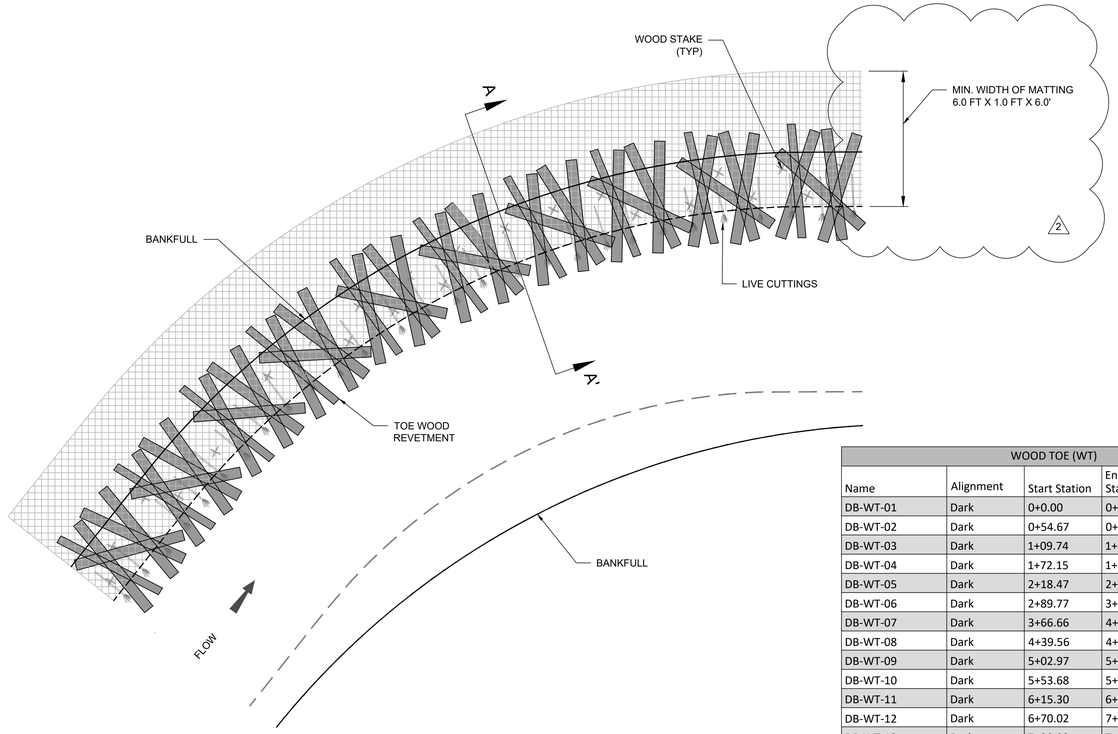
HURRICANE FLORENCE EWP - ENGINEERING ASSISTANCE

LOG SILL

GPI
Formerly LDSI, Inc.
MANY TALENTS, ONE FIRM
CHARLOTTE OFFICE: 801 W 29TH STREET, CHARLOTTE NC 28206
KINSTON OFFICE: 1338 HWY 258 N., KINSTON NC 28504
PHONE: 910.683.4123
WEBSITE: WWW.GPINET.COM NC FIRM #: F-0441

SCALE AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

DATE: 6/1/21
PROJ: 4520018
DWG: Addendum 1
SHEET: 15 of 22



WOOD TOE STRUCTURE
(NTS.)

WOOD TOE (WT)					
Name	Alignment	Start Station	End Station	Bank	Length
DB-WT-01	Dark	0+0.00	0+33.00	RIGHT	33.0
DB-WT-02	Dark	0+54.67	0+94.88	LEFT	40.2
DB-WT-03	Dark	1+09.74	1+39.28	RIGHT	29.5
DB-WT-04	Dark	1+72.15	1+92.57	LEFT	20.4
DB-WT-05	Dark	2+18.47	2+61.52	RIGHT	43.1
DB-WT-06	Dark	2+89.77	3+29.23	LEFT	39.5
DB-WT-07	Dark	3+66.66	4+12.42	RIGHT	45.8
DB-WT-08	Dark	4+39.56	4+87.50	LEFT	48.0
DB-WT-09	Dark	5+02.97	5+36.05	RIGHT	33.1
DB-WT-10	Dark	5+53.68	5+79.85	LEFT	26.2
DB-WT-11	Dark	6+15.30	6+52.34	RIGHT	37.0
DB-WT-12	Dark	6+70.02	7+13.52	LEFT	43.5
DB-WT-13	Dark	7+29.93	7+55.00	RIGHT	25.1
DB-WT-14	Dark	7+96.52	8+28.84	LEFT	32.3
DB-WT-15	Dark	8+52.10	8+82.66	RIGHT	30.6
DB-WT-16	Dark	9+04.14	9+35.17	LEFT	31.0
DB-WT-17	Dark	10+12.00	10+80.00	RIGHT	68.0
DB-WT-18	Dark	10+20.39	10+94.00	LEFT	73.6
TD-WT-01	Tandam	3+60.50	4+15.76	RIGHT	55.3
TD-WT-02	Tandam	3+59.68	4+15.69	LEFT	56.0
TD-WT-03	Tandam	4+56.64	5+09.33	RIGHT	52.7
TD-WT-04	Tandam	5+62.12	6+18.31	LEFT	56.2
TD-WT-05	Tandam	7+04.92	7+62.74	RIGHT	57.8
TD-WT-06	Tandam	7+02.71	7+60.58	LEFT	57.9
TD-WT-07	Tandam	8+30.17	8+79.11	LEFT	48.9
TD-WT-08	Tandam	8+30.10	8+74.94	RIGHT	44.8

WOOD TOE (WT) NOTES

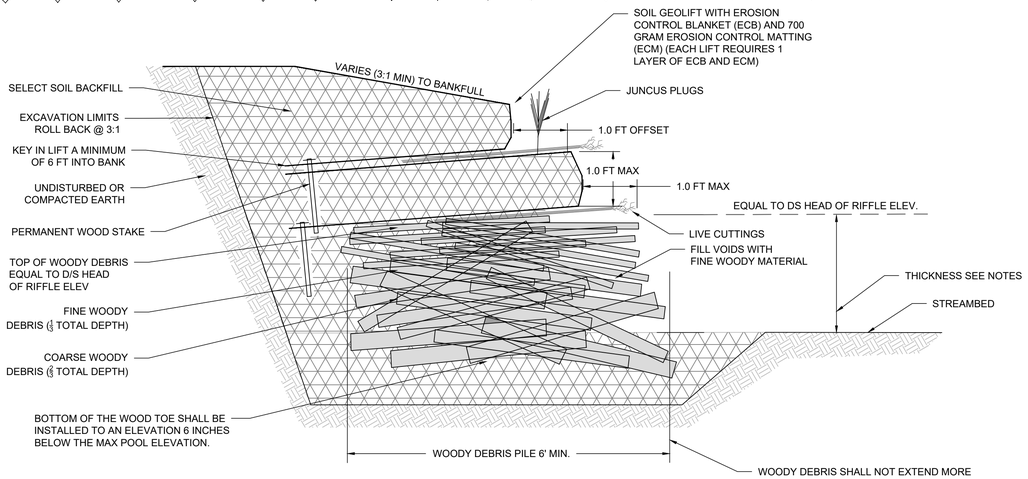
2

1. CONTRACTOR SHALL INSURE ROLL WIDTH IS SUFFICIENT TO FULLY ENCAPSULATE THE TOP,FRONT AND BOTTOM OF EACH GEO-LIFT SUCH THAT EACH LIFT IS 6 FOOT WIDE.
2. COARSE WOODY DEBRIS (4 IN TO 6 IN MEAN DIAMETER) SHALL CONSIST OF LOGS, ROOTWADS, AND LARGE BRANCHES NOT SUITABLE FOR CONSTRUCTION OF LOG STRUCTURES. ALL MATERIALS ARE TO BE APPROVED BY THE ENGINEER. COARSE WOODY DEBRIS SHALL BE CONSTRUCTED WITH THE LARGEST MATERIAL PLACED FIRST. NO LOGS SHALL BE PLACED PARALLEL TO THE FLOW OF WATER, UNLESS DIRECTED BY THE ENGINEER. LOGS SHALL BE PLACED IN A CROSSING PATTERN OR WEAVE SUCH THAT EACH LOG IS ANCHORED BY ANOTHER LOG.
3. SMALL/FINE WOODY DEBRIS (2 IN TO 4 IN MEAN DIAMETER) SHALL CONSIST OF MEDIUM TO SMALL LIMBS, BRANCHES, BUSHES, AND/OR LOGS. INVASIVE SPECIES SHALL NOT BE USED. SMALL/FINE WOODY DEBRIS SHALL BE PLACED ABOVE THE COARSE WOODY DEBRIS WITH THE LARGEST MATERIAL BEING PLACED FIRST AND THE SMALLEST MATERIAL PLACED LAST.
4. INSTALLATION THICKNESS OF THE WOODY MATERIAL SHALL EQUAL TO THE DOWNSTREAM HEAD OF RIFFLE ELEVATION.
5. ALL WOODY DEBRIS SHALL BE COMPACTED WITH THE EXCAVATOR BUCKET TO REDUCE THE PRESENCE OF VOIDS IN THE SMALL/FINE WOODY DEBRIS LAYER.
6. THE SOIL BACKFILL USED FOR LIFTS AND TOPSOIL USED FOR LAYERING WITH THE LIVE BRANCHES SHALL BE FREE OF ANY LARGE ROOTS OR WOODY DEBRIS AND SHALL GENERALLY BE FREE FROM ANY GRAVEL OR COBBLE MATERIAL.
7. SOIL BACKFILL SHALL BE COMPACTED SUCH THAT FUTURE SETTLING WILL BE KEPT TO A MINIMUM; YET, NOT SUCH THAT THE UNDERLYING BRUSH IS DISPLACED OR DAMAGED. THE TOP OF THE BACKFILL FOR THE FIRST LIFT SHALL BE SLOPED AT APPROXIMATELY 5% AWAY FROM THE STREAM.
8. PLACE A LAYER OF TOPSOIL AND LIVE BRANCHES ON THE GRAVEL LEVELING BASE SUCH THAT APPROXIMATELY 6 IN TO 1 FT OF EACH LIVE BRANCH WILL BE EXPOSED AND THE REMAINDER (2 FT TO 4 FT) OF EACH LIVE BRANCH WILL BE COVERED BY THE SOIL LIFT. LIVE BRANCHES SHALL BE OF THE SPECIES SPECIFIED FOR LIVE STAKES OR APPROVED BY THE ENGINEER. LIVE BRANCHES SHALL BE SPREAD SO THE EXPOSED PORTION FORM A CONTINUOUS LAYER ON THE SHELF. SPACING MAY VARY DEPENDING ON THE PLANT SPECIES AND/OR BENCHING.
9. PLACE A LAYER OF 6.0 FT WIDE BIODEGRADABLE EROSION CONTROL BLANKET AND 700 GRAM EROSION CONTROL MATTING, ON TOP OF THE TOPSOIL, WRAP 1.0 FT VERTICALLY ON THE FACE OF THE SOIL LIFT. THE REMAINING 6.0 FT OF THE BLANKET WILL PULLED SNUGGLY OVER COMPACTED SOIL AND FASTENED WITH WOOD STAKES CREATING THE BASE FOR THE NEXT SOIL LIFT.
10. SOIL CAN BE COMPACTED BY STACKING PIECE OF 2 X 6 SAWN LUMBER EDGEWAYS UP TO THE LIFT HEIGHT SPECIFIED IN THE STRUCTURE TABLE AND SECURING IT WITH WOODEN STAKES TO PROVIDE A TEMPORARY RIGID BACK STOP FOR COMPACTING THE SOIL LIFT.
11. LIVE BRANCHES SHALL BE SLIGHTLY SEPARATED WHEN DRIVING TEMPORARY STAKE SO THAT NO LIVE BRANCHES ARE DAMAGED.
12. PLACE SOIL BACKFILL UP TO THE LIFT HEIGHT SPECIFIED OF NO GREATER THAN 1.0 F00T BEING CAREFUL NOT TO PUSH/PULL OR TEAR THE FABRIC PREVIOUSLY PLACED.
13. TOP DRESS THE SOIL LIFT WITH TOPSOIL FROM THE FACE OF THE SOIL LIFT BACK INTO THE FLOODPLAIN AT LEAST 6 FT.
14. THE CONTRACTOR INTEGRATE SEED AND FERTILIZER INTO THE SOIL LIFT PRIOR TO COVERING WITH EROSION CONTROL MATTING AND BLANKETING TO ENSURE GOOD SEED SOIL CONTACT.
15. CONTRACTOR SHALL REMOVE THE SAWN LUMBER AND WOODEN STAKED FROM THE FACE OF THE SOIL LIFT AND RESTORE THE LIVE BRANCHED TO THEIR ORIGINAL PLACEMENT BEFORE TEMPORARY STAKING.
16. THE EROSION CONTROL FABRICS SHALL BE PULLED AS TIGHT AS POSSIBLE WITHOUT TEARING OR EXCESSIVELY DISTORTING THE FABRIC. SECURE THE EROSION CONTROL AND NON-WOVEN MATTING IN PLACE BY STAKING THE END OF THE EROSION CONTROL FABRIC WITH WOODEN STAKES ON 1.5-FT CENTERS.
17. REPEAT STEPS 8 THROUGH 15 AS NEEDED TO BUILD SOIL LIFTS UP TO DESIGN BANKFULL ELEVATION.
18. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR ELEVATIONS SHALL BE WITHIN 0.1 FT OF THE GRADES AND ELEVATIONS INDICATED OR APPROVED BY THE ENGINEER.
19. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
20. COIR LOG TOE PROTECTION MAY USED AS ALTERNATIVE BANK REVETMENT WHERE TOE WOOD IS NOT FEASIBLE DUE TO FIELD CONDITIONS.

BANK STABILIZATION PLANTING NOTES:

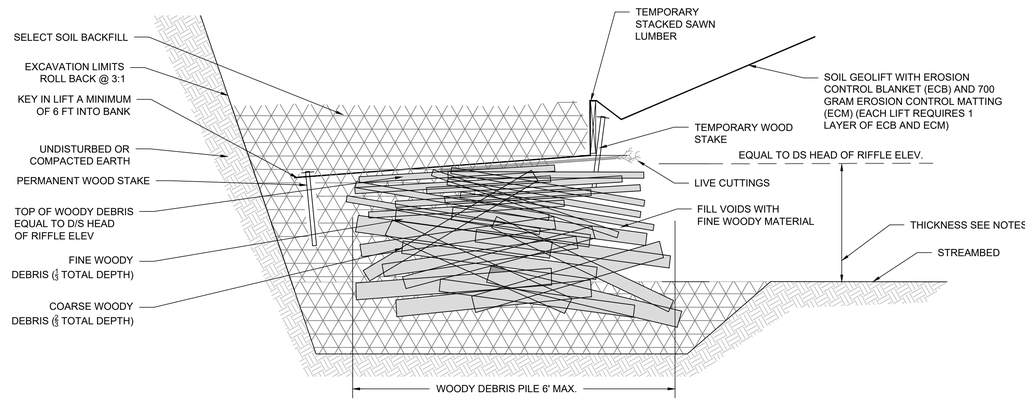
1. PLANTINGS SHALL BE INSTALLED FROM THE TOE OF SLOPE TO THE OUTSIDE EDGE OF THE BANKFULL BENCH.
2. JUNCUS PLUGS SHALL BE PLANTED AT A HIGH DENSITY RATE NEAR INSTREAM STRUCTURES, AT A RATE OF 1 PER SQUARE FOOT. HIGH DENSITY PLANTING SHALL BE FROM 5 FEET UPSTREAM OF LOG INVERT TO 5 FEET DOWNSTREAM OF LOG TIE.
3. JUNCUS PLUGS SHALL BE A SUBSIDIARY ITEM TO THIS BID ITEM, AND SHALL BE INCLUDED IN THE PAYMENT.
4. JUNCUS SHALL BE PLANTED 1' (ONE) O.C. OFFSET ROWS FROM THE TOE OF SLOPE TO THE OUTSIDE EDGE OF THE BANKFULL BENCH.
5. CONTRACTOR SHALL INSURE THAT JUNCUS REMAINS 6 INCHES OFF LOG STRUCTURE AND TREE STOCK IN NOT PLANTED ANY CLOSER THAT 3 FOOT FROM LOG STRUCTURE.

2



2

WOOD TOE SECTION A - A
(NTS.)



WOOD TOE SECTION A - A DEPICTING TEMPORARY SAWN LUMBER COMPACTION
(NTS.)

ISSUED FOR: CONSTRUCTION ADDENDUM 1 8/12/22

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038624 8/12/22 JONATHAN D. HANK

No.	DATE	DESCRIPTION	BY	APVD
1	7/18/22	ISSUE FOR CONSTRUCTION	JDH	JDH
2	8/09/22	ADDENDUM 1	JDH	JDH

DSGN: JDH DR: KAS/SDL CHK: JDH APVD: JDH DATE: 8/12/22

HURRICANE FLORENCE EWP - ENGINEERING ASSISTANCE

WOOD TOE

GPI LDSI
Formerly LDSI, Inc.
MANY TALENTS, ONE FIRM
CHARLOTTE OFFICE: 301 W 29TH STREET, CHARLOTTE NC 28206
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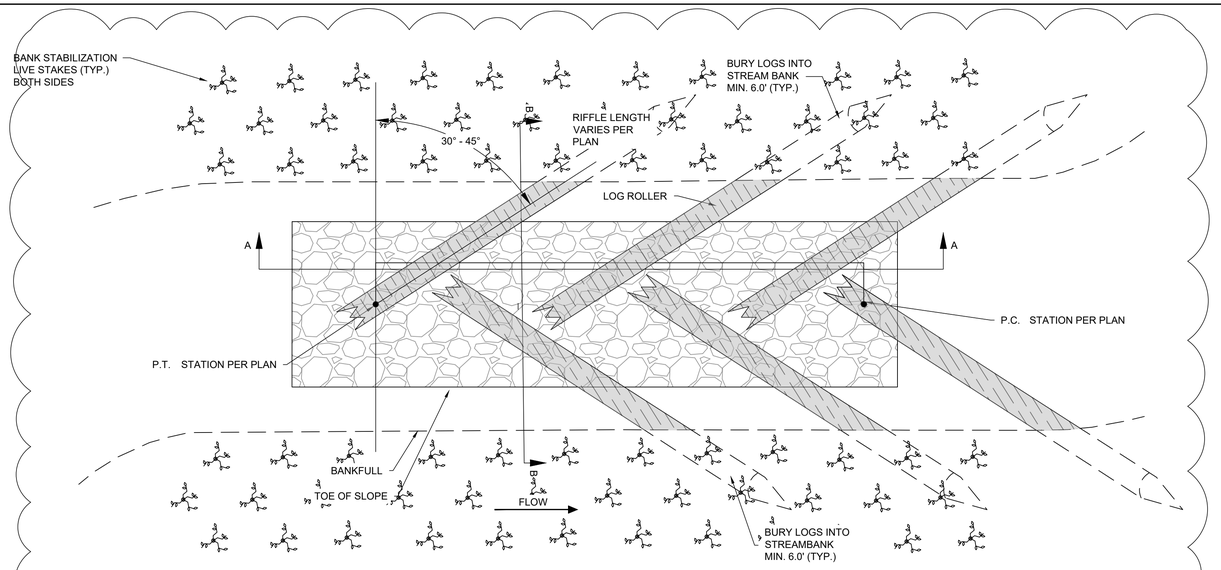
SCALE AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

DATE: 6/1/21
PROJ: 4520018
DWG: Addendum 1
SHEET: 16 of 22



RIFFLE WITH LOG ROLLERS STRUCTURE DETAIL

(NTS.)

CONSTRUCTED RIFFLE WITH LOG ROLLERS (CRL) NOTES

1. ALL LOGS SHALL BE RELATIVELY STRAIGHT AND LIMBS AND BRANCHES SHALL BE TRIMMED FLUSH. LOGS SHALL HAVE MINIMUM DIAMETER OF 1.0 FT. LOGS SHALL HAVE A MINIMUM LENGTH OF 20 FT.
2. HEADER LOGS SHALL BE UNDERLAIN BY FOOTER LOGS TO PROVIDE A SILL UNLESS OTHERWISE DIRECTED BY THE ENGINEER. HEADER LOGS SHALL BE OFFSET SLIGHTLY DOWNSTREAM OF THE FOOTER LOG.
3. SET SILL INVERTS AT ELEVATION SHOWN ON THE PLAN AND PROFILE SHEETS. NO ELEVATION OF THE SOIL SILLS MAY VARY FROM THE PLAN SHEETS WITHOUT THE DIRECTION FROM THE ENGINEER.
4. THE VERTICAL SLOPE OF EACH LOG SHALL NIT EXCEED 1% UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
5. ON THE UPSTREAM SIDE OF THE SILL LOGS, NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED ON THE ENTIRE LENGTH OF THE STRUCTURE. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER BOULDER TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE. RIFFLE MATERIAL SHALL BE USED AS BACKFILL MATERIAL AROUND THE LOGS AND MICROPOOLS SHALL BE ESTABLISHED BELOW EACH LOG.
6. FINE WOODY MATERIAL LESS THAN 3 IN. DIAMETER MAY BE INCORPORATED INTO THIS STRUCTURE TO INCREASE THE IN-STREAM ORGANIC MATERIAL AND ENHANCE FLOW DIVERSITY.
7. RIFFLE MATERIAL SHALL HAVE A GRADATION AS DEFINED IN THE TABLE OR WITHIN THIS DETAIL. SELECT RIFFLE MATERIAL SHALL BE WELL-GRADED AND MIXED WITH EARTH WHEN IT IS PLACED IN THE CHANNEL.
8. CONSTRUCTED RIFFLE MATERIAL SHALL EXTEND A MINIMUM OF 6.0 FT U/S OF THE P.T. INTO THE GLIDE AND A MINIMUM OF 6.0 FT. D/S OF THE P.C. INTO THE RUN.
9. RIFFLE MATERIAL SHALL BE PLACED AT A UNIFORM THICKNESS SUCH THAT, IN CROSS-SECTION, ITS LOWEST ELEVATION OCCURS IN THE CENTER OF THE CHANNEL. RIFFLE MATERIAL SHALL BE COMPACTED USING AN EXCAVATOR BUCKET SUCH THAT FUTURE SETTLEMENT OF THE MATERIAL IS KEPT TO A MINIMUM.
10. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.1 FT. OF THE GRADES AND ELEVATION INDICATED.
11. RE-DRESSING OF THE SHALL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION
12. SEE TYPICAL RIFFLE CROSS SECTION FOR DIMENSIONS
13. JUNCUS PLUGS SHALL BE PLANTED AT A HIGH DENSITY RATE NEAR INSTREAM STRUCTURES, AT A RATE OF 1 PER SQUARE FOOT. HIGH DENSITY PLANTING SHALL BE FROM 5 FEET UPSTREAM OF LOG INVERT TO 5 FEET DOWNSTREAM OF LOG TIE.

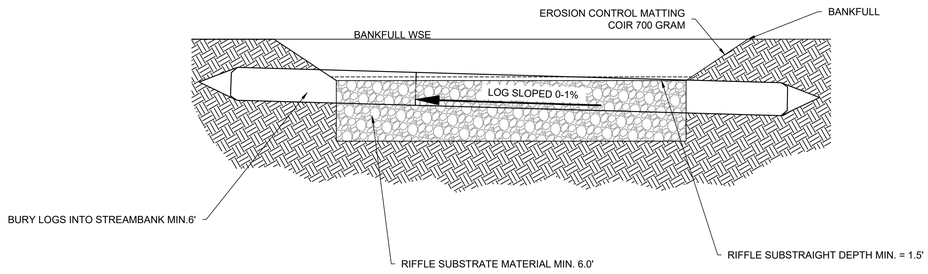
BANK STABILIZATION PLANTING NOTES:

1. PLANTINGS SHALL BE INSTALLED FROM THE TOE OF SLOPE TO THE OUTSIDE EDGE OF THE BANKFULL BENCH.
2. JUNCUS PLUGS SHALL BE PLANTED AT A HIGH DENSITY RATE NEAR INSTREAM STRUCTURES, AT A RATE OF 1 PER SQUARE FOOT. HIGH DENSITY PLANTING SHALL BE FROM 5 FEET UPSTREAM OF LOG INVERT TO 5 FEET DOWNSTREAM OF LOG TIE.
3. JUNCUS PLUGS SHALL BE A SUBSIDIARY ITEM TO THIS BID ITEM, AND SHALL BE INCLUDED IN THE PAYMENT.
4. JUNCUS SHALL BE PLANTED 1' (ONE) O.C. OFFSET ROWS FROM THE TOE OF SLOPE TO THE OUTSIDE EDGE OF THE BANKFULL BENCH.
5. CONTRACTOR SHALL INSURE THAT JUNCUS REMAINS 6 INCHES OFF LOG STRUCTURE AND TREE STOCK IN NOT PLANTED ANY CLOSER THAT 3 FOOT FROM LOG STRUCTURE.

CONSTRUCTED RIFFLE WITH LOG ROLLERS								
Structure	Alignment	Start Station	Start Elev	End Station	End Elev	Approx Riffle Length (LF)	Log Dia (IN)	Log Spacing (FT)
TD-LR-01	Tandam	3+05.74	58.17	3+55.07	58.26	49	12	7 to 12
TD-LR-02	Tandam	5+16.79	58.56	5+56.16	58.72	39	12	6 to 10
TD-LR-03	Tandam	6+28.91	58.80	6+99.53	59.15	71	12	11 to 18
TD-LR-04	Tandam	9+05.73	59.12	9+79.19	59.29	73	12	11 to 18
DB-LR-01	Dark	0+36.67	57.52	0+54.67	57.66	18	12	3 to 5
DB-LR-02	Dark	0+97.74	57.74	1+09.74	57.83	12	12	2 to 3
DB-LR-03	Dark	1+48.15	58.00	1+72.15	58.09	24	12	4 to 6
DB-LR-04	Dark	1+98.47	58.18	2+18.47	58.26	20	12	3 to 5
DB-LR-05	Dark	2+67.77	58.42	2+89.77	58.51	22	12	3 to 6
DB-LR-06	Dark	3+40.66	58.59	3+66.66	58.69	26	12	4 to 7
DB-LR-07	Dark	4+20.89	58.86	4+39.56	58.93	19	12	2 to 4
DB-LR-08	Dark	4+90.97	59.02	5+02.97	59.06	12	12	2 to 3
DB-LR-09	Dark	5+41.68	59.23	5+53.68	59.28	12	12	2 to 3
DB-LR-10	Dark	5+91.30	59.44	6+15.30	59.54	24	12	4 to 6
DB-LR-11	Dark	6+58.02	59.70	6+70.02	59.75	12	12	2 to 3
DB-LR-12	Dark	7+17.93	59.92	7+29.93	59.96	12	12	2 to 3
DB-LR-13	Dark	7+74.52	60.13	7+96.52	60.21	22	12	3 to 6
DB-LR-14	Dark	8+36.10	60.30	8+52.10	60.36	16	12	2 to 4
DB-LR-15	Dark	8+90.14	60.53	9+04.14	60.58	14	12	2 to 4
DB-LR-16	Dark	9+45.92	60.66	9+71.96	60.71	26	12	4 to 6
DB-LR-17	Dark	10+12.39	60.79	10+20.39	60.80	8	12	4 to 6

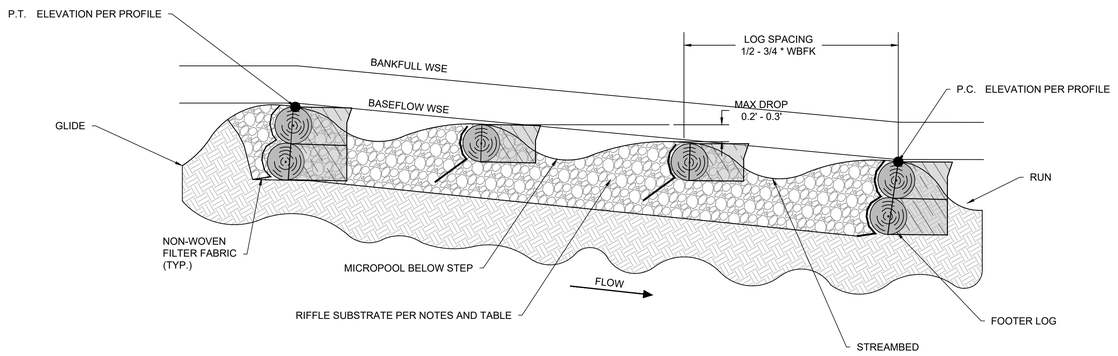
RIFFLE GRADATION

REACH	TD	DB
NC DOT CLASS	%	%
A	100	100
B	0	0
1	0	0



RIFFLE WITH LOG ROLLERS STRUCTURE SECTION A - A

(NTS.)



RIFFLE WITH LOG ROLLERS STRUCTURE SECTION B - B

(NTS.)

ISSUED FOR: CONSTRUCTION ADDENDUM 1 8/12/22

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038624 8/12/22 JOHN D. HINES

No.	DATE	DESCRIPTION	BY	APV'D	DATE: 8/12/22
1	7/18/22	ISSUE FOR CONSTRUCTION	JDH	JDH	
2	8/09/22	ADDENDUM 1	JDH	JDH	
DSGN: JDH	DR: KAS/SDL	CHK: JDH	APV'D: JDH		

HURRICANE FLORENCE EWP - ENGINEERING ASSISTANCE

RIFFLE WITH LOG ROLLERS

GPI — Formerly LDSI, Inc. — MANY TALENTS, ONE FIRM
CHARLOTTE OFFICE: 831 W 99TH STREET, CHARLOTTE NC 28206
KINSTON OFFICE: 1309 HWY 258 N., KINSTON NC 28504
PHONE: 910.653.4125
WEBSITE: WWW.GPINET.COM FAST FIRM #: F-0441

SCALE AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

DATE: 6/1/21
PROJ: 4520018
DWG: Addendum 1
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ZONE 1 PLANTING PLAN

SEEDING MIX*		
COMMON NAME	SCIENTIFIC NAME	PERCENTAGE
Deertongue, Tioga	*Panicum clandestinum, Tioga*	21.5%
Virginia Wildrye, Madison-NY Ecotype	*Elymus virginicus, Madison-NY Ecotype*	20.0%
Big Bluestem, 'Niagara'	*Andropogon gerardii, 'Niagara'*	16.6%
Japanese Millet	*Echinochloa crusgalli var. frumentacea*	15.0%
Fox Sedge, PA Ecotype	*Carex vulpinoidea, PA Ecotype*	10.0%
Switchgrass, 'Shawnee'	*Panicum virgatum, 'Shawnee'*	8.0%
Partridge Pea, PA Ecotype	*Chamaecrista fasciculata, PA Ecotype*	4.0%
Blue Vervain, PA Ecotype	*Verbena hastata, PA Ecotype*	1.5%
Oxeye Sunflower, PA Ecotype	*Heliopsis helianthoides, PA Ecotype*	1.0%
Soft Rush	*Juncus effusus*	1.0%
Autumn Bentgrass, Albany Pine Bush-NY Ecotype	*Agrostis perennans, Albany Pine Bush-NY Ecotype*	0.8%
Swamp Milkweed, PA Ecotype	*Asclepias incarnata, PA Ecotype*	0.1%
New England Aster, PA Ecotype	*Aster novae-angliae, PA Ecotype*	0.1%
Joe Pye Weed, PA Ecotype	*Eupatorium fistulosum, PA Ecotype*	0.1%
Boneset, PA Ecotype	*Eupatorium perfoliatum, PA Ecotype*	0.1%
Wild Bergamot, Fort Indiantown Gap-PA Ecotype	*Monarda fistulosa, Fort Indiantown Gap-PA Ecotype*	0.1%
Narrowleaf Mountainmint	*Pycanthemum tenuifolium*	0.1%
*SEED AT 20 LBS (PLS) TO ACRE		
Soft Rush, Coastal Plain NC Ecotype	*Juncus effusus, Coastal Plain NC Ecotype*	100.0%
*SEED AT 2 LBS (PLS) TO ACRE		

NURSE CROP SEED

AUG. 15 - APR 15		
COMMON NAME	SCIENTIFIC NAME	RATE
Wheat	Triticum aestivum	40 LBS
APR 15 - AUG 15		
COMMON NAME	SCIENTIFIC NAME	RATE
Browntop millet	*Urochloa ramosa*	60 LBS

LIVE STAKES**

COMMON NAME	SCIENTIFIC NAME	PERCENTAGE
Black Willow	*Salix nigra*	15%
Silky Willow	*Salix sericea*	15%
Elderberry	*Sambuscus nigra*	15%
Buttonbush	*Cephalanthus occidentalis*	20%
Redosier dogwood	*Cornus serciea*	15%
Silky dogwood	*Cornus amomum*	20%

**LIVE STAKES SHALL BE PLANTED 3 FT O.C. PER DETAIL

ZONE 2 PLANTING PLAN

SEEDING MIX*		
COMMON NAME	SCIENTIFIC NAME	PERCENTAGE
Deertongue, Tioga	*Panicum clandestinum, Tioga*	21.5%
Virginia Wildrye, Madison-NY Ecotype	*Elymus virginicus, Madison-NY Ecotype*	20.0%
Big Bluestem, 'Niagara'	*Andropogon gerardii, 'Niagara'*	16.6%
Japanese Millet	*Echinochloa crusgalli var. frumentacea*	15.0%
Fox Sedge, PA Ecotype	*Carex vulpinoidea, PA Ecotype*	10.0%
Switchgrass, 'Shawnee'	*Panicum virgatum, 'Shawnee'*	8.0%
Partridge Pea, PA Ecotype	*Chamaecrista fasciculata, PA Ecotype*	4.0%
Blue Vervain, PA Ecotype	*Verbena hastata, PA Ecotype*	1.5%
Oxeye Sunflower, PA Ecotype	*Heliopsis helianthoides, PA Ecotype*	1.0%
Soft Rush	*Juncus effusus*	1.0%
Autumn Bentgrass, Albany Pine Bush-NY Ecotype	*Agrostis perennans, Albany Pine Bush-NY Ecotype*	0.8%
Swamp Milkweed, PA Ecotype	*Asclepias incarnata, PA Ecotype*	0.1%
New England Aster, PA Ecotype	*Aster novae-angliae, PA Ecotype*	0.1%
Joe Pye Weed, PA Ecotype	*Eupatorium fistulosum, PA Ecotype*	0.1%
Boneset, PA Ecotype	*Eupatorium perfoliatum, PA Ecotype*	0.1%
Wild Bergamot, Fort Indiantown Gap-PA Ecotype	*Monarda fistulosa, Fort Indiantown Gap-PA Ecotype*	0.1%
Narrowleaf Mountainmint	*Pycanthemum tenuifolium*	0.1%
*SEED AT 20 LBS (PLS) TO ACRE		
Soft Rush, Coastal Plain NC Ecotype	*Juncus effusus, Coastal Plain NC Ecotype*	100.0%
*SEED AT 2 LBS (PLS) TO ACRE		

NURSE CROP SEED

AUG. 15 - APR 15		
COMMON NAME	SCIENTIFIC NAME	RATE
Wheat	*Triticum aestivum*	40 LBS
APR 15 - AUG 15		
COMMON NAME	SCIENTIFIC NAME	RATE
Browntop millet	*Urochloa ramosa*	60 LBS

2

GENERAL PLANTING NOTES:

SEEDING TEMPORARY & PERMANENT

- AREAS TO BE SEEDED SHALL BE DRESSED TO A SMOOTH, FIRM SURFACE. ON SITES WHERE EQUIPMENT CAN OPERATE ON SLOPES SAFELY, THE SEEDBED SHALL BE ADEQUATELY LOOSENED (4 TO 6 INCHES DEEP) AND SMOOTHED. DEPENDING ON SOIL AND MOISTURE CONDITIONS, DISKING OR CULTIPACKING, OR BOTH, MAY BE NECESSARY TO PROPERLY PREPARE A SEEDBED. WHERE EQUIPMENT CANNOT OPERATE SAFELY, THE SEEDBED SHALL BE PREPARED BY HAND METHODS BY SCARIFYING TO PROVIDE A ROUGHENED SOIL SURFACE SO THAT BROADCAST SEED WILL REMAIN IN PLACE.
- FERTILIZER, LIME, AND OTHER SOIL AMENDMENTS SHALL BE APPLIED AS SPECIFIED IN SPECIFICATIONS. THE FERTILIZER AND SOIL AMENDMENTS SHALL BE THOROUGHLY INCORPORATED INTO THE SOIL IMMEDIATELY FOLLOWING SURFACE APPLICATION.
- ALL DISTURBED AREAS SHALL BE SEEDED WHEN THEY ARE EXPECTED TO BE BARE OF GROUND OVER FOR MORE THAN 15 CALENDAR DAYS; WHERE ACTIVE CONSTRUCTION IS NOT BEING UNDERTAKEN, OR AS DIRECTED BY THE ENGINEER/INSPECTOR. THESE AREAS SHALL BE SEEDED (TEMPORARY SEED MIX) AT THE END OF EACH DAY UNLESS OTHERWISE DIRECTED BY THE ENGINEER/INSPECTOR.
- SEEDING (PERMANENT SEED MIX) SHALL BE ACCOMPLISHED WITHIN TWO (2) DAYS AFTER FINAL GRADING IS COMPLETED AND APPROVED BY THE ENGINEER.
- FERTILIZER SHALL BE APPLIED AT THE RATE OF 1,000 LBS. PER ACRE. THE FERTILIZER SHALL BE 10-10-10, OR EQUIVALENT. LIME SHALL BE APPLIED AT THE RATE OF TWO (2) TONS PER ACRE. STRAW SHALL BE APPLIED AT A RATE OF TWO (2) TONS PER ACRE. THE AREA SHOULD THEN BE SMOOTHED AND ANY DEBRIS LARGER THAN 3 INCHES IN DIAMETER OR WHICH WOULD INTERFERE WITH MOWING SHALL BE REMOVED FROM THE SURFACE. A CYCLONE SEEDER, DRILL OR CULTIPACKER SEEDER SHALL BE USED TO APPLY THE SPECIFIED SEED EVENLY ON THE FRESHLY PREPARED SEEDBED. WHEN SEED IS BROADCAST, A CULTIPACKER OR OTHER APPROPRIATE EQUIPMENT SHALL BE USED IMMEDIATELY FOLLOWING SEEDING TO INCORPORATE THE SEED.

LIVE STAKES

- THREE (3) WEEKS PRIOR TO INSTALLATION OF LIVE STAKES CONTRACTOR SHALL SUBMIT A PROPOSED HARVESTING AND CONSTRUCTION SCHEDULE, INCLUDING SOURCE OF SUPPLY OF LIVE CUTTING, TO PROJECT ENGINEER FOR REVIEW AND APPROVAL. NO WORK SHALL BE PERFORMED UNTIL PROJECT ENGINEER APPROVES THE SOURCE AND SCHEDULE. HARVESTING, TRANSPORTING, AND INSTALLATION SHALL TAKE PLACE WHEN PLANTS ARE DORMANT (DECEMBER 1 THROUGH APRIL 1). IF DUE TO CONSTRUCTION SCHEDULING LIVE STAKES CANNOT BE USED BASED ON THE TIMEFRAMES SET ABOVE, LIVE TUBELINGS OF THE SAME SPECIES MAY BE SUBSTITUTED WITH APPROVAL FOR THE PROJECT ENGINEER.
- PLANT MATERIALS SHALL BE FROM SOURCES THAT ORIGINATED WITHIN PLANT HARDINESS ZONES 7 OR 8. LIVE CUTTINGS FOR LIVE STAKES SHALL BE 0.75 INCHES TO 2.0 INCHES IN DIAMETER AND 3 FEET IN LENGTH. SIDE BRANCHES SHALL BE REMOVED AND BARK LEFT INTACT PRIOR TO INSTALLATION. BUDS ON THE STAKES SHALL BE ORIENTED IN AN UPWARD POSITION. CONTRACTOR SHALL SCRAPE A PORTION OF THE CAMBIUM LAYER OFF EACH LIVE STAKE AT THE BASAL END APPROXIMATELY TWO (2) INCHES IN LENGTH BY 0.25 INCHES WIDE TO STIMULATE ROOT GROWTH. THE BASAL ENDS SHALL BE DIPPED IN A ROOT STIMULATING GROWTH HORMONE APPROVED BY THE PROJECT ENGINEER. THE BASAL ENDS SHALL BE TAPERED TO A POINT FOR EASY INSERTION INTO THE SOIL. THE TOP SHALL BE CUT SMOOTH AND SQUARE.
- THE TOPS OF THE LIVE STAKES SHALL BE PAINTED WITH LATEX TREE MARKING PAINT TO ENSURE CORRECT PLANTING DIRECTION. MARK SPECIES WITH DIFFERENT COLORS. LIVE STAKE CUTTINGS SHALL CONSIST OF THE SPECIES AS LISTED ON THE CONSTRUCTION DRAWINGS.
- LIVE STAKE INSTALLATION - DRIVE LIVE STAKES INTO THE GROUND SO THAT SEVENTY-FIVE PERCENT (75%) OF THE STAKE IS BELOW THE GROUND SURFACE. FOR EASY INSERTION INTO THE SOIL THE BOTTOM END OF THE STAKE SHOULD BE CUT AT AN ANGLE OF 30 TO 45 DEGREES. TO ENSURE A FLAT SURFACE FOR HAMMERING INTO THE SLOPE, THE TOP SHOULD BE CUT AT 90-DEGREE ANGLE. FOR LARGER BRANCHES THE USE OF PRUNING SHEARS OR POWER SAW MAY BE NECESSARY. ALL BUDS OF THE LIVE BRANCH SHOULD BE FACED UPWARDS DURING STAKING. AS SHOWN IN THE DETAILED PLAN ABOVE. THE CONTRACTOR SHALL USE A DEADPAN HAMMER FOR DRIVING THE STAKE DIRECTLY INTO THE GROUND OR DRIVE A PILOT HOLE, SMALLER IN DIAMETER THEN THE LIVE STAKE, AND THEN DRIVING THE LIVE STAKE INTO THE PILOT HOLE.
- CONTRACTOR SHALL STAGGER SPECIES AS DIRECTED BY PROJECT ENGINEER.
- THE PROJECT ENGINEER SHALL MAKE A FINAL INSPECTION WITH THE CONTRACTOR TO ENSURE ALL LIVE STAKES HAVE BEEN INSTALLED ACCORDING TO THE SPECIFICATION, PLANS, AND DETAILS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CORRECTING ALL DEFICIENCIES WITHIN TEN (10) CALENDAR DAYS OF THE INSPECTION. THE PROJECT ENGINEER AND CONTRACTOR PRIOR TO FINAL COMPLETION SHALL PERFORM A FINAL INSPECTION OF THE CORRECTED ACTIONS.

2

GENERAL PLANTING NOTES:

STABILIZATION REQUIREMENTS:

STABILIZATION FOR THIS PROJECT SHALL COMPLY WITH THE TIME FRAME GUIDELINES AS SPECIFIED BY THE NCG-010000 GENERAL CONSTRUCTION PERMIT EFFECTIVE APRIL 1, 2019 ISSUED BY THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF WATER RESOURCES. TEMPORARY OR PERMANENT GROUND COVER STABILIZATION SHALL OCCUR WITHIN 7 CALENDAR DAYS FROM THE LAST LAND-DISTURBING ACTIVITY, WITH THE FOLLOWING EXCEPTIONS IN WHICH TEMPORARY OR PERMANENT GROUND COVER SHALL BE PROVIDED IN 14 CALENDAR DAYS FROM THE LAST LAND-DISTURBING ACTIVITY:

- SLOPES BETWEEN 2:1 AND 3:1, WITH A SLOPE LENGTH OF 10 FT. OR LESS
- SLOPES 3:1 OR FLATTER, WITH A SLOPE OF LENGTH OF 50 FT. OR LESS
- SLOPES 4:1 OR FLATTER

THE STABILIZATION TIMEFRAME FOR HIGH QUALITY WATER (HQW) ZONES SHALL BE 7 CALENDAR DAYS WITH NO EXCEPTIONS FOR SLOPE GRADES OR LENGTHS. HIGH QUALITY WATER ZONES (HQW) ZONES ARE DEFINED BY NORTH CAROLINA ADMINISTRATIVE CODE 15A NCAC 04A.0105 (25). TEMPORARY AND PERMANENT GROUND COVER STABILIZATION SHALL BE ACHIEVED IN ACCORDANCE WITH THE PROVISIONS IN THIS CONTRACT AND AS DIRECTED.

SEEDING AND MULCHING: (East)

THE KINDS OF SEED AND FERTILIZER, AND THE RATES OF APPLICATION OF SEED, FERTILIZER, AND LIMESTONE, SHALL BE AS SHOW IN NCDOT PLANTING PLAN TABLE. DURING PERIODS OF OVERLAPPING DATES, THE KIND OF SEED TO BE USED SHALL BE DETERMINED. ALL RATES ARE IN POUNDS PER ACRE.

ON CUT AND FILL SLOPES 2:1 OR STEEPER CENTIPEDE SHALL BE APPLIED AT THE RATE OF 5 POUNDS PER ACRE AND ADD 20# OF SERICEA LESPEDEZA FROM JANUARY 1 - DECEMBER 31.

FERTILIZER SHALL BE 10-20-20 ANALYSIS. A DIFFERENT ANALYSIS OF FERTILIZER MAY BE USED PROVIDED THE 1-2-2 RATIO IS MAINTAINED AND THE RATE OF APPLICATION ADJUSTED TO PROVIDE THE SAME AMOUNT OF PLANT FOOD AS A 10-20-20 ANALYSIS AND AS DIRECTED.

TEMPORARY SEEDING:

FERTILIZER SHALL BE THE SAME ANALYSIS AS SPECIFIED FOR *SEEDING AND MULCHING* AND APPLIED AT THE RATE OF 400 POUNDS AND SEEDED AT THE RATE OF 50 POUNDS PER ACRE. SWEET SUDAN GRASS, GERMAN MILLET OR BROWNTOP MILLET SHALL BE USED IN SUMMER MONTHS AND RYE GRAIN DURING THE REMAINDER OF THE YEAR. THE ENGINEER WILL DETERMINE THE EXACT DATES FOR USING EACH KIND OF SEED.

FERTILIZER TOPDRESSING:

FERTILIZER USED FOR TOPDRESSING ON ALL ROADWAY AREAS EXCEPT SLOPES 2:1 AND STEEPER SHALL BE 10-20-20 GRADE AND SHALL BE APPLIED AT THE RATE OF 500 POUNDS PER ACRE. A DIFFERENT ANALYSIS OF FERTILIZER MAY BE USED PROVIDED THE 1-2-2 RATIO IS MAINTAINED AND THE RATE OF APPLICATION ADJUSTED TO PROVIDE THE SAME AMOUNT OF PLANT FOOD AS 10-20-20 ANALYSIS AND AS DIRECTED.

FERTILIZER USED FOR TOPDRESSING ON SLOPES 2:1 AND STEEPER AND WASTE AND BORROW AREAS SHALL BE 16-8-8 GRADE AND SHALL BE APPLIED AT THE RATE OF 500 POUNDS PER ACRE. A DIFFERENT ANALYSIS OF FERTILIZER MAY BE USED PROVIDED THE 2-1-1 RATIO IS MAINTAINED AND THE RATE OF APPLICATION ADJUSTED TO PROVIDE THE SAME AMOUNT OF PLANT FOOD AS 16-8-8 ANALYSIS AND AS DIRECTED.

SUPPLEMENTAL SEEDING:

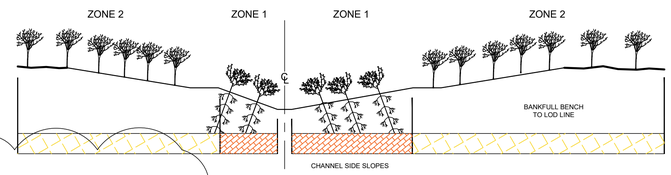
THE KINDS OF SEED AND PROPORTIONS SHALL BE THE SAME AS SPECIFIED FOR *SEEDING AND MULCHING*, WITH THE EXCEPTION THAT NO CENTIPEDE SEED WILL BE USED IN THE SEED MIX FOR SUPPLEMENTAL SEEDING. THE RATE OF APPLICATION FOR SUPPLEMENTAL SEEDING MAY VARY FROM 25# TO 75# PER ACRE. THE ACTUAL RATE PER ACRE WILL BE DETERMINED PRIOR TO THE TIME OF TOPDRESSING AND THE CONTRACTOR WILL BE NOTIFIED IN WRITING OF THE RATE PER ACRE, TOTAL QUANTITY NEEDED, AND AREAS ON WHICH TO APPLY THE SUPPLEMENTAL SEED. MINIMUM TILLAGE EQUIPMENT, CONSISTING OF A SOD SEEDER SHALL BE USED FOR INCORPORATING SEED INTO THE SOIL AS TO PREVENT DISTURBANCE OF EXISTING VEGETATION. A CLODBUSTER (BALL AND CHAIN) MAY BE USED WHERE DEGREE OF SLOPE PREVENTS THE USE OF A SOD SEEDER.

MOWING:

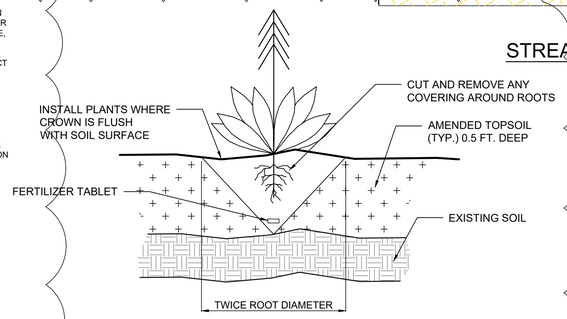
THE MINIMUM MOWING HEIGHT ON THIS PROJECT SHALL BE 4 INCHES.

NCDOT PLANTING PLAN

ALL ROADWAY AREAS			
March 1 - August 31		September 1 - February 28	
50 lbs.	Tall Fescue	50 lbs.	Tall Fescue
10 lbs.	Centipede	10 lbs.	Centipede
25 lbs.	Bermudagrass (Hulled)	35 lbs.	Bermudagrass (Hulled)
500 lbs.	Fertilizer	500 lbs.	Fertilizer
4000 lbs.	Limestone	4000 lbs.	Limestone
Waste and Borrow Locations			
March 1 - August 31		September 1 - February 28	
75 lbs.	Tall Fescue	75 lbs.	Tall Fescue
25 lbs.	Bermudagrass (Hulled)	35 lbs.	Bermudagrass (Hulled)
500 lbs.	Fertilizer	500 lbs.	Fertilizer
4000 lbs.	Limestone	4000 lbs.	Limestone
Note: 50# of Bahiagrass may be substituted for either Centipede or Bermudagrass only upon Engineer's request.			
06 Dust	Escalade	Justice	Serengeti
2nd Millennium	Essential	Kalahari	Shelby
3rd Millennium	Evergreen 2	Kitty Hawk 2000	Sheridan
Apache III	Falcon IV	Legitimate	Signia
Avenger	Falcon NG	Lexington	Silver Hawk
Barlexas	Falcon V	LSD	Sliverstar
Barlexas II	Faith	Magellan	Shenandoah Elite
Bar Fa	Fat Cat	Matador	Sidewinder
Barrera	Festnova	Millennium SRP	Skyline
Barrington	Fidelity	Monet	Solara
Barrobusto	Finelawn Elite	Mustang 4	Southern Choice II
Barvado	Finelawn Xpress	Ninja 2	Speedway
Biltmore	Finesse II	Ol' Glory	Spyder LS
Bingo	Firebird	Olympic Gold	Sunset Gold
Bizem	Firecracker LS	Padre	Taccoa
Blackwatch	Firenza	Patagonia	Tanzania
Blade Runner II	Five Point	Pedigree	Trio
Bonsai	Focus	Picasso	Tahoe II
Braveheart	Forte	Piedmont	Talladega
Bravo	Garrison	Plantation	Tarheel
Bullseye	Gazelle II	Proseeds 5301	Terrano
Cannavaro	Gold Medallion	Prospect	Titan ltd
Catalyst	Grande 3	Pure Gold	Titanium LS
Cayenne	Greenbrooks	Quest	Tracer
Cessane Rz	Greenkeeper	Raptor II	Traverse SRP
Chipper	Gremlin	Rebel Exeda	Tulsa Time
Cochise IV	Greystone	Rebel Sentry	Turbo
Constitution	Guardian 21	Rebel IV	Turbo RZ
Corgi	Guardian 41	Regiment II	Tuxedo RZ
Corona	Hemi	Regenerate	Ultimate
Coyote	Honky Tonk	Rendition	Venture
Darlington	Hot Rod	Rhambler 2 SRP	Umbrella
Davinci	Hunter	Rembrandt	Van Gogh
Desire	Inferno	Reunion	Watchdog
Dominion	Innovator	Riverside	Wolfpack II
Dynamic	Integrity	RNP	Xtremegreen
Dynasty	Jaguar 3	Rocket	
Endeavor	Jamboree	Scorpion	
On cut and fill slopes 2:1 or steeper Centipede shall be applied at the rate of 5 pounds per acre and add 20# of Sericea Lespedeza from January 1 - December 31.			



STREAM PLANTING ZONE PROFILE
(NTS)

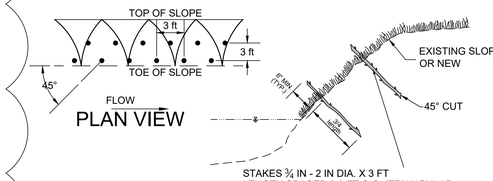


GENERAL PLANTING NOTES:

1. DO NOT COMPACT TOPSOIL, TO PROMOTE HEALTHY ENVIRONMENTAL CONDITIONS FOR THE PLANTS.
2. ALL PLANTS SHOULD BE PLANTED IN THE INDICATED RANGE TO ENSURE SURVIVAL.
3. CONTRACTOR SHALL FURNISH AND INSTALL SLOW RELEASE FERTILIZER TABLETS AT EACH PLUG LOCATION. TABLETS SHALL BE BURIED WITHIN THE PLUG INSTALLATION HOLE.
4. JUNCUS PLUGS SHALL BE PLANTED AT A HIGH DENSITY RATE NEAR INSTREAM STRUCTURES, AT A RATE OF 1 PER SQUARE FOOT. HIGH DENSITY PLANTING SHALL BE FROM 5 FEET UPSTREAM OF LOG INVERT TO 5 FEET DOWNSTREAM OF LOG TIE.
5. JUNCUS PLUGS SHALL BE 1" PLANTING / NURSERY TUBES WITH A MINIMUM 4" ROOT BALL.
6. JUNCUS PLUGS SHALL BE SUBSIDIARY TO THE LOG INSTREAM STRUCTURES.

2

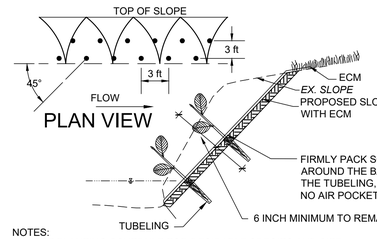
TYPICAL HIGH DENSITY JUNCUS PLANTING DETAIL
(NTS)



STAKES ¾ IN - 2 IN DIA. X 3 FT
LENGTH SPACED 3.0 FT O.C. (TRIANGULAR
SPACING) ANGLES AT 45° TO DOWNSTREAM FLOW

NOTES:
1. ACCEPTABLE SPECIES: SEE CONSTRUCTION SPECIFICATIONS
2. INSTALL PER CONSTRUCTION SPECIFICATIONS.
3. USE ½ IN -3/4 IN REBAR FOR PILOT HOLES PRIOR TO DRIVING LIVE STAKES INTO GROUND
4. DRIVE LIVE STAKE 3/4 OF ITS LENGTH INTO THE GROUND
5. RECUT ANY LIVE STAKE TIPS DAMAGED BY INSTALLATION
6. STAKES TO BE ¾ IN TO 2 IN DIAMETER, 3 FT LONG
7. 6 INCH MINIMUM TO REMAIN ABOVE GROUND.

LIVE STAKE DETAILS
(NTS)



NOTES:
1. SEE PLANTING SCHEDULE FOR DESIRABLE SPECIES AND SIZE.
2. SPACE AT 3.0' O.C. (TRIANGULAR SPACING).
3. ALL TUBELINGS SHALL COMPLY WITH THE RECOMMENDATIONS AND REQUIREMENTS OF ANSI Z60.1 "AMERICAN STANDARD FOR NURSERY STOCK."
4. CUT AND FOLD BACK SLOT IN MAT TO INSTALL TUBELING. SEAL SLOT WITH COMPOST AND STAPLE. ALLOW 6" DIAMETER AROUND TUBELING WITH NO ECM.
5. PLANT THE ROOT BALL SLIGHTLY DEEPER THAN IT WAS IN THE TUB.

TUBELING DETAILS
(NTS)

PLANTING ZONE ACREAGE

SITE	ZONE 1 (ACRES)	ZONE 2 (ACRES)	NCDOT MIX
039 - TANDAM	0.2	1.1	--
040 - DARK	0.2	2.2	--
SARECTA ROAD	--	--	0.25

ISSUED FOR: CONSTRUCTION ADDENDUM 1 8/12/22

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038624 JOHN DAVID HENDRICK 8/12/22

No.	DATE	DESCRIPTION	DSGN:	DR:	CHK:	APVD:	BY	APVD	SEAL	DATE:
1	7/18/22	ISSUE FOR CONSTRUCTION	JDH	KAS/SDL	JDH	JDH	JDH	JDH		8/12/22
2	8/09/22	ADDENDUM 1								

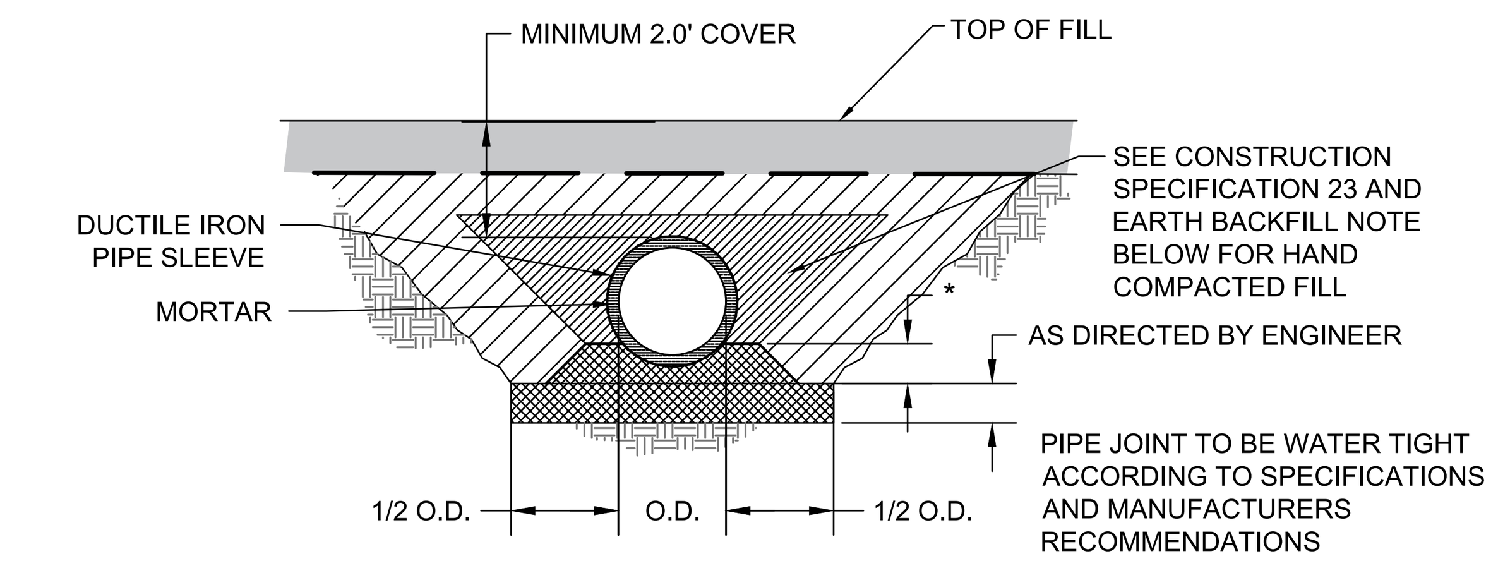
HURRICANE FLORENCE EWP - ENGINEERING ASSISTANCE

PLANTING DETAILS

GPI LDSI
Formerly LDSI, Inc.
MANY TALENTS, ONE FIRM
CHARLOTTE OFFICE: 201 W 20TH STREET, CHARLOTTE NC 28206
KINSTON OFFICE: 1309 HWY 258 N., KINSTON NC 28504
PHONE: 910.683.4123
WEBSITE: WWW.GPIPET.COM NC# FIRM #: F-0441

SCALE AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

DATE: 6/1/21
PROJ: 4520018
DWG: Addendum 1
SHEET: 22 of 22



SINGLE PIPE

GENERAL NOTES:
OD. = THE MAXIMUM HORIZONTAL OUTSIDE DIMENSION

DO NOT OPERATE HEAVEY EQIPMENT OVER ANY STRUCTURAL PLATE PIPE UNTIL THE STRUCTURAL PLATE PIPE HAS BEEN PROPERLY BACKFILLED AND COVERED WITH AT LEAST 2.0 FEET OF APPROVED MATERIAL.

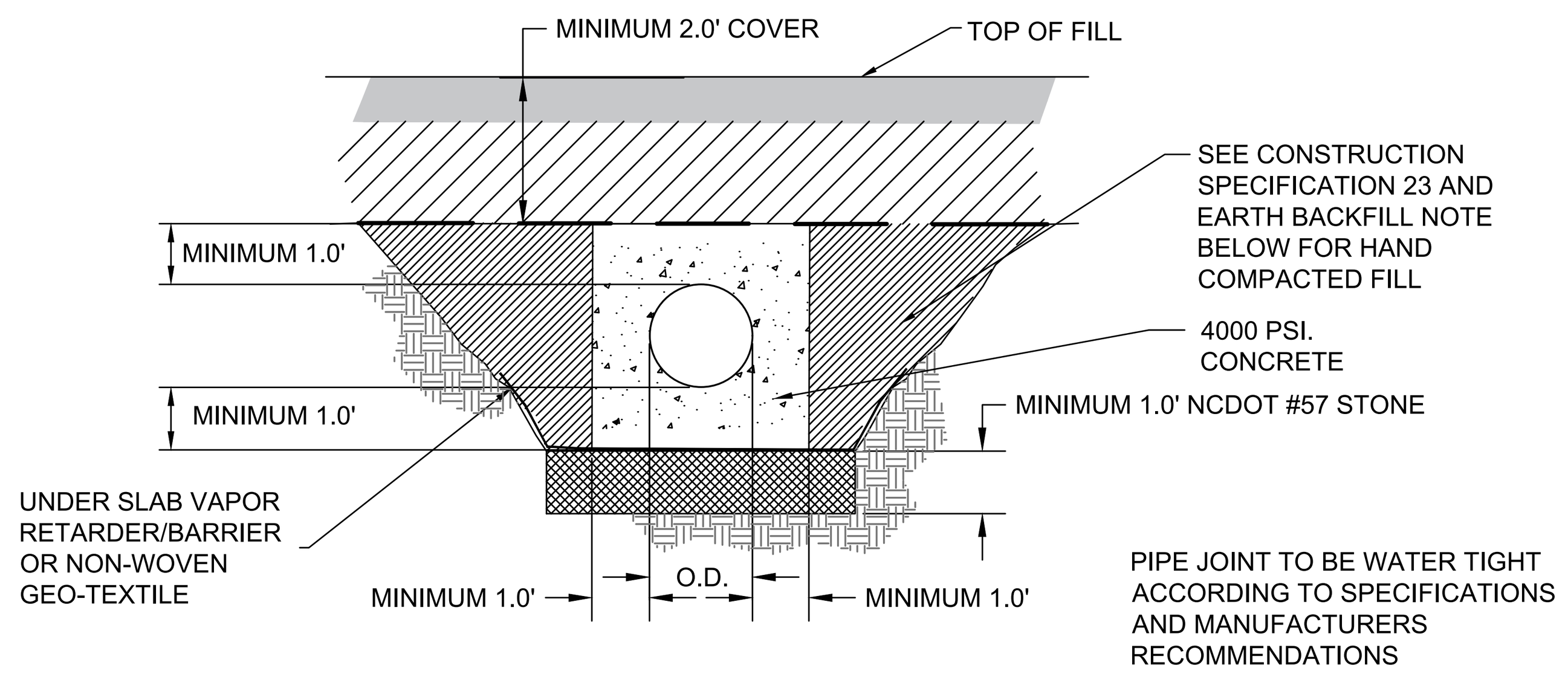
* O.D. / 12 NOT LESS THAN 6" MIN.

- APPROVED SUITABLE LOCAL MATERIAL OR SELECT MATERIAL FOR FOUNDATION CONDITIONING AS DIRECTED BY ENGINEER
- APPROVED BACKFILL OR SELECT MATERIAL
- UNDISTURBED EARTH MATERIAL
- COMPACTED FILL

EARTH BACKFILL ADJACENT TO STRUCTURES SHALL BE COMPACTED TO A DENSITY AS SPECIFIED WITHIN CONSTRUCTION SPECIFICATION 23. COMPACTION SHALL BE ACCOMPLISHED BY HAND TAMPING OR MANUALLY DIRECTED POWER TAMPERS, PLATE VIBRATORS, WALK-BEHIND, MINIATURE, OR SELF-PROPELLED ROLLERS. UNLESS OTHERWISE SPECIFIED HEAVY EQUIPMENT INCLUDING BACKHOE MOUNTED POWER TAMPERS OR VIBRATING COMPACTORS AND MANUALLY DIRECTED VIBRATING ROLLERS SHALL NOT BE OPERATED WITHIN 3 FEET OF ANY STRUCTURE. TOWED OR SELF-PROPELLED VIBRATING ROLLERS SHALL NOT BE OPERATED WITHIN 5 FEET OF ANY STRUCTURE. COMPACTION BY MEANS OF DROP WEIGHTS OPERATING FROM A CRANE OR HOIST IS NOT PERMITTED.

PIPE ENCASEMENT

NTS



GENERAL NOTES:
OD. = THE MAXIMUM HORIZONTAL OUTSIDE DIMENSION

DO NOT OPERATE HEAVEY EQIPMENT OVER ANY STRUCTURAL PLATE PIPE UNTIL THE STRUCTURAL PLATE PIPE HAS CURED AND BEEN PROPERLY BACKFILLED AND COVERED WITH AT LEAST 2.0 FEET OF APPROVED MATERIAL.

- 4000 PSI. CONCRETE
- NCDOT #57 STONE
- APPROVED BACKFILL OR SELECT MATERIAL
- UNDISTURBED EARTH MATERIAL
- COMPACTED FILL

EARTH BACKFILL ADJACENT TO STRUCTURES SHALL BE COMPACTED TO A DENSITY AS SPECIFIED WITHIN CONSTRUCTION SPECIFICATION 23. COMPACTION SHALL BE ACCOMPLISHED BY HAND TAMPING OR MANUALLY DIRECTED POWER TAMPERS, PLATE VIBRATORS, WALK-BEHIND, MINIATURE, OR SELF-PROPELLED ROLLERS. UNLESS OTHERWISE SPECIFIED HEAVY EQUIPMENT INCLUDING BACKHOE MOUNTED POWER TAMPERS OR VIBRATING COMPACTORS AND MANUALLY DIRECTED VIBRATING ROLLERS SHALL NOT BE OPERATED WITHIN 3 FEET OF ANY STRUCTURE. TOWED OR SELF-PROPELLED VIBRATING ROLLERS SHALL NOT BE OPERATED WITHIN 5 FEET OF ANY STRUCTURE. COMPACTION BY MEANS OF DROP WEIGHTS OPERATING FROM A CRANE OR HOIST IS NOT PERMITTED.

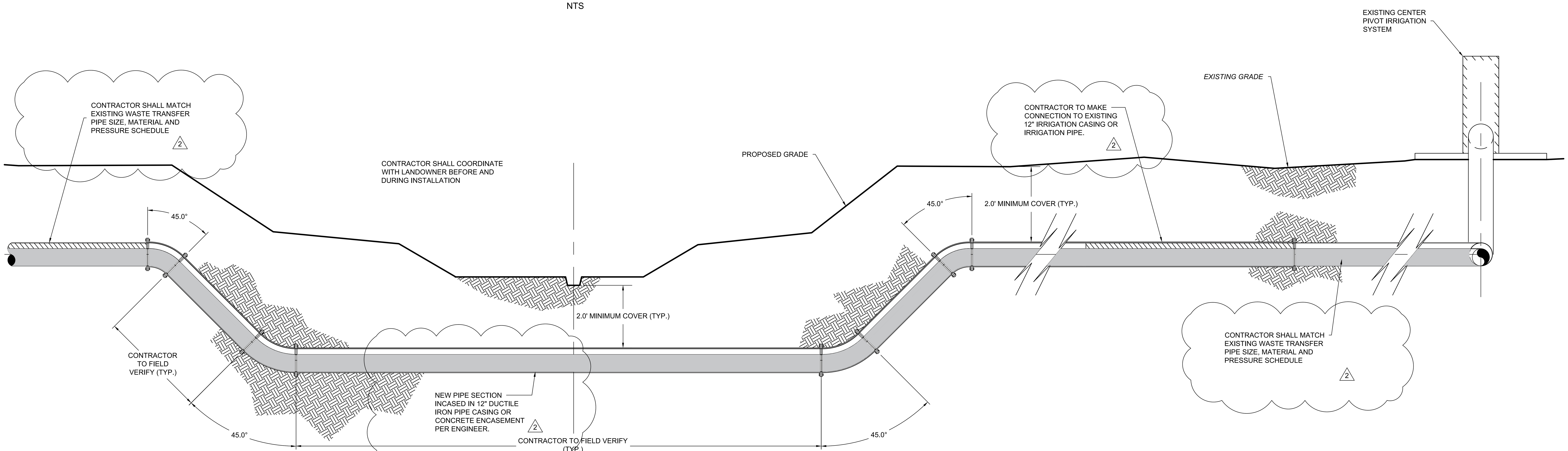
PIPE ENCASEMENT - BID ALTERNATIVE

NTS

CASING DETAIL SECTION NOTES

PIPE CASEMENT NOTES:

1. CONTRACTOR WILL PROVIDE ALL MUNICIPLE, COUNTY, STATE AND FEDERAL PERMITS AS REQUIRED FOR THE INSTALLATION.
2. CONTRACTOR SHALL ADHERE TO ALL E&SC MEASURES AS DEFINED IN THESE PLANS, SPECIFICATIONS AND AS DIRECTED BY THE PROJECT ENGINEER.
3. CONTRACTOR SHALL INSTALL PIPE CASING AS DEFINED IN NRCS 634-CPS-1 WASTE TRANSFER PRACTICE STANDARD.
4. CONTRACTOR SHALL MAINTAINE A MINIMUM, OF 2.0' FOOT CLEARANCE FROM FINISHED GRADE OF EXISTING GROUND OR FUTURE CONSTRUCTION.
5. CONTRACTOR SHALL COORDINATE WITH LANDOWNER / FACILITY OPERATOR TO ENSURE INSTALLATION DOES NOT INTERFEAR WITH NORMAL IRRIGATION SCHEDULE.
6. CASING MATERIAL TO BE 12" DIP. RATED ACCORDINGLY TO THE IRRIGATION SYSTEMS REQUIREMENTS. OR CONCRETE ENCASEMENT PER ENGINEER. (2)
7. CONTRACTOR TO INSTALL PLASTIC "BURIED PIPE" MARKERS ON BOTH SIDES OF CASEMENT FOR FUTURE IDENTIFICATION.



PIPE CASING SECTION DETAIL OPTION 1

(NTS.)

ISSUED FOR: CONSTRUCTION ADDENDUM 1 8/12/22

No.	DATE	DESCRIPTION	BY	APVD
1	7/18/22	ISSUE FOR CONSTRUCTION	JDH	JDH
2	8/09/22	ADDENDUM 1	JDH	JDH

SEAL: NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038624 8/12/22 JONATHAN D. HINKLE

DATE: 8/12/22
DSGN: JDH DR: KAS/SDL CHK: JDH APVD: JDH

HURRICANE FLORENCE EWP - ENGINEERING ASSISTANCE

PIPE CASEMENT DETAIL

GPI LDSI Formerly LDSI, Inc. MANY TALENTS. ONE FIRM

SCALE AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING

DATE: 6/1/21
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