ADDENDUM #1

November 3, 2023

Project: Bethel Park Restoration

This addendum #1 forms part of the Contract Documents and modifies the original bidding documents. All bidders shall acknowledge receipt of this addendum in the space provided in the Bidding Schedule section of the bid document.

FAILURE TO ACKNOWLEDGE RECEIPT OF AN ADDENDUM MAY RESULT IN THE BID BEING DISQUALIFIED.

Notice to Bidders:

This addendum shall be considered part of the Contract Documents for the above-mentioned project as though it were issued at the same time and incorporated therewith. Where provisions of the following supplementary data differ from those in the original Contract Documents, this addendum shall govern and take precedence. Work not specifically deleted, modified, changed, or altered by this addendum shall remain in effect as a part of the Contract Documents.

Bidders are hereby notified that they shall make the necessary adjustments in their proposals to account for this addendum.

1. A non-mandatory Prebid meeting was held October 31, 2023. The following information is provided as a summary of the meeting.
    a. Project due dates were stated as follows:
        i. Deadline for questions – November 7, 2023 by 5:00 pm EST. Questions should be submitted to Mario Sclarandis, MSclarandis@morgantonnc.gov with the City of Morganton.
        ii. Bids are due on or before November 16, 2023 at 2:00pm.
    b. Project schedule is as follows:
        i. Contract awarded on or before December 31, 2023
        ii. Notice to proceed February or March 2024
        iii. Contractor to mobilize to the site to install Phase I erosion and sediment control (ESC).
        iv. Following installation of Phase I ESC, Contractor will allow 30 days for the City to demolish park infrastructure as stated herein and in the plans and specifications.
        v. Construction to begin March or April of 2024.
    c. The project includes the restoration of two stream channels, installation of two bridges, installation of four (4) bioretention areas and grading for a revised walking trail within the park.
    d. Contractor shall submit an alternate bid for the paving of the walking trail. It is at the City's discretion to include this in the final contract.

e. The City is responsible for demolition of park infrastructure. The Contractor is responsible for the demolition of the two existing pedestrian bridges and the dual culverts on East Prong Hunting Creek.
f. The Contractor is responsible for removal of up to 10 trees within the limits of disturbance in accordance with the plans and specifications. There is the potential that additional trees greater than the DBH outlined in specification 5.2 may need to be removed by the Contractor based on the City's ability to reach the trees. Alt 10a has been added to the bid tab to serve as a line item unit cost in the event that additional tree removal is required.
g. All woody debris is to be repurposed on site. This will include using trees and brush in log structures, brush toe and floodplain sills. Unused woody debris should be chipped and used in the bioretention areas or otherwise stockpiled on-site for City use. Stumps may remain unless they impact the grading of the relocated stream channel. If they are in alignment of the proposed trail, they may be ground down 12" below finish grade. In the event that stumps cannot be repurposed at the discretion of the Engineer, they shall be hauled off and disposed of by the Contractor. To facilitate this activity, Alt 10b has been added to the bid tab. Contractor shall provide a unit cost item for haul off of a full dump truck of debris. On-site Engineer will confirm full loads for disposal.
h. Earthwork quantities were provided. Total quantity of cut is approximately 31,102 CY, fill quantity of 32,293 CY of fill. Fill quantity includes the required in-stream clay plugs and compacted clay fill for the bridges. The City has approximately 4,500 CY of suitable clay material that will be provided to the Contractor on an as-needed basis. This material is located at the City Landfill within 5 miles of the project site. The Contractor is responsible for transport of the material and should include it as part of Item 9 – Grading in the bid tab.
i. The City is responsible for closing access to the Park.
j. Contractor shall notify the Engineer or Owner 10 days before redirected flow into new stream channels to allow for relocation of crayfish species. Relocation of crayfish is not the responsibility of the Contractor.
k. Bridge support design is the responsibility of the Contractor. A geotechnical report for the foundation locations is provided as part of this Addendum.

2. Proposed conduit for the East Prong Hunting Creek Bridge as shown on Sheet 8.4 of the Plans will not be located along the bridge as shown on the Plans. The City will install conduit adjacent to the bridge to not impact the bridge footers and supports.
3. Revisions to Specifications Sections 8.1 and 8.2 are provided as part of this Addendum. Please replace specifications in full and utilize Specifications with the revision date of November 3, 2023. Changes are noted in red for clarity.
4. A revised Bid Tab dated November 3, 2023 has been included as part of this Addendum.
5. Attendees list from the pre-bid meeting has been included as part of this Addendum.

ATTACHMENTS:

Revised Specifications dated November 3, 2023

Revised Bid Tab dated November 3, 2023

Geotechnical Report

Pre-Bid Meeting Attendees List

END OF ADDENDUM #1

Bethel Park Restoration

Burke County, North Carolina

CONSTRUCTION SPECIFICATIONS

October 16, 2023
REVISED November 3, 2023

Prepared for:

City of Morganton, North Carolina
305 E. Union St. Suite A100
Morganton, NC 28655

Prepared by:

Wildlands Engineering, Inc.
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464

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Record of Revisions

Date	Description

GENERAL NOTES AND CONSTRUCTION SEQUENCE

All construction activities on this project shall be completed in accordance with the City of Morganton's stormwater management program, North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures as amended, NCDOT Best Management Practices for Construction and Maintenance Activities as amended, North Carolina Department of Environmental Quality (NCDEQ) Erosion and Sediment Control, Planning, and Design Manual, the project specific specifications (Specifications) contained herein and the approved construction plans (Plans). All information contained in the City of Morganton, NCDOT, and NCDEQ specifications referenced above shall carry their full weight and force as if included in this document verbatim and are hereby incorporated into this document by reference.

The Project Owner is the City of Morganton. Any reference in the Specifications or special provisions to the term "Owner" shall be interpreted as meaning the City of Morganton. References in the Specifications or special provisions to the term "County" refer to the Burke County Engineer or their designated representative.

The Contractor is responsible for applicable sections of the Specifications herein.

Definitions:

City – The City refers to the City of Morganton's Engineer, or their designated representative.
Contract Documents – Legal contract, and associated documentation, including approved Plans and Specifications, agreed to by the Owner and Contractor.
Contractor – Selected Contractor for the construction of the Project as approved by the Owner.
County – The County refers to the Burke County Engineer, or their designated representative.
Engineer – Where referenced herein, Engineer or Design Engineer refers to the engineer responsible for the implementation and final certification of the Project. This must be a registered Professional Engineer within the State of North Carolina, or adequately experienced designee as appointed by the Owner. Where applicable, modifications to the Plans and Specifications may be necessary as field conditions warrant. Changes to the Plans without consent of the Design Engineer absolve the Design Engineer and their representatives from liability associated with the performance and function of the modified portions of the Contract Documents.
Owner – The Owner herein shall refer to the City of Morganton. The Owner shall designate an Owner Representative to facilitate day-to-day activities associated with the Project including, but not limited to, contractual concerns, requests for information (RFIs), pay applications, construction administration and compliance with the approved Plans and Specifications. References to the Owner or the City of Morganton herein interchangeably refers to the Owner or their representative(s).
Plans – References to Plans herein refer to the approved construction plans entitled *Bethel Park Restoration* dated October 16, 2023.
Project – The Project referenced herein refers to the *Bethel Park Restoration* and associated Plans and Specifications.
Select Material – Select material used for backfilling structures and grading consists of clay, clay loam or sandy clay loam soil that is free of rock and organic debris.
Site – The Site referenced herein refers to the construction area as identified as the *Bethel Park Restoration* in the Plans and Specifications.
Specifications – Specifications include the general and technical requirements associated with the completion of the Project included within the Plans. Specifications, technical and otherwise, outlined as part of this document and identified on the accompanying Plans, are limited in their application to the Project and shall not be construed as design specifications or guidance beyond the limits and scope of the Project.
Work Zone – In general, the disturbed area within the Site limits that is disturbed and not stabilized. When working in an active watercourse, the work zone shall be limited such that the clearing, installation of in-stream structures, as applicable, finish grading and streambank stabilization with coir matting or other devices as specified in the Plans and Specifications, can be completed in one working day. Work zones outside of an active watercourse may be expanded at the discretion of the Engineer under the condition that proper sediment and erosion control practices are in place in accordance with the Plans and Specifications. Mass clearing and grubbing

or grading outside of the active work zone is prohibited. Work zone lengths may be modified at the discretion of the Engineer.

Construction Sequence:

The construction sequence outlined below represents general construction activities, sediment and erosion control measures and detailed measures to facilitate the construction of the Site. Prior to land disturbing activities, the Contractor shall provide the Engineer with a detailed sequence of construction. This sequence will include the proposed construction sequence for each restoration area, general timeline for completion and stabilization of each restoration area and any proposed stockpile areas that may deviate from the Plans. The Engineer will review this detailed sequence of construction for compliance with the erosion and sediment control (ESC) plan for the Site and applicable permit requirements. The Contractor will not commence land disturbing activities or mobilization prior to approval of the construction sequence by the Engineer.

Construction shall commence in accordance with the construction sequence as approved by the Engineer. In general, the construction sequence shall, at a minimum, include the initial site preparation, stream and floodplain bench construction, park grading, and construction demobilization steps listed below.

General Notes

1. All erosion and sediment control (ESC) practices shall comply with the 2013 North Carolina (NC) Erosion and Sediment Control Planning and Design Manual (NCESCPDM).
2. All graded areas with slopes steeper than 3:1 will be stabilized within seven working days. All other areas will be stabilized within fourteen days.
3. Staging and stockpile areas are depicted in the ESC plan sheets. Additional or alternative staging and/or stockpile areas may be utilized by the Contractor with prior approval from the Owner and the Engineer, provided that all practices comply with the NCESCPDM.
4. The Contractor will ensure that ESC practices are properly functioning in areas as shown on the ESC plan sheets.
5. The Contractor shall use care to avoid damaging or removing existing trees that are beyond the limits of disturbance (LOD).
6. The Contractor shall not exceed the LOD illustrated on the plans without prior approval from the Engineer and Owner.
7. The Contractor shall utilize a pump around system to divert flow around active work areas, as directed by the Engineer or defined in the Specifications, when conducting channel excavation or tying new channels into the existing channels.
8. The Contractor is responsible for removing and disposing of any vegetation, materials, or debris within the site limits as directed by the Engineer.
9. Any off-site borrow and/or waste required for the project must come from a site with an approved erosion control plan, a site regulated under the Mining Act of 1971, or a landfill regulated by the Division of Solid Waste Management. Trash or debris from demolition activities or generated by any activities on site must be disposed of at a facility regulated by the Division of Solid Waste Management or per Division of Solid Waste Management or Division of Water Resources Rules and Regulations.
10. Any unauthorized damage to existing structures or grounds due to construction activities will be repaired or replaced to a condition that meets or exceeds the previous standard. Repairs will occur at the expense of the Contractor.
11. The Contractor will coordinate with the Engineer and Owner to facilitate closing any parking lots, roadways, or park amenities (i.e., basketball courts, tennis courts, dog park, walking trail, playground, etc.). The City will be responsible for closing park facilities and establishing closure barricades and signage.
12. All instream structures shall be constructed as directed by the Engineer in the field.
13. The Engineer will provide (1) an Erosion and Sediment Control permit (2) 401/404 permits that authorize the land disturbance activities and impacts to the waters of the US as depicted on the plans (3) NCDOT

Encroachment Permit and (4) floodplain permit. The Contractor will be responsible for securing all other necessary permits and authorizations to complete the work.

14. An ESC permit and a Certificate of Coverage (COC) must be obtained by the Owner and/or Engineer before any land disturbing activities occur. The COC can be obtained by filling out the electronic notice of intent (e-NOI) form at deq.nc.gov/ncg01. Please note, the e-NOI form may only be filled out once the plans have been approved. A copy of the ESC permit, the COC, and a hard copy of the plans must be kept on site, preferably in a permits box, and accessible during inspection. Establishing and maintaining an on-site construction box is the responsibility of the Contractor.
15. The Contractor shall coordinate with the Engineer to setup a meeting with NCDEQ division of energy, Mineral and Land Resources (DEMLR) regional (Asheville) office, 828-296-4500, to notify them of the start date and schedule a pre-construction meeting at least 48 hours prior to project activation.
16. Equipment storage within the park when the site is not actively being worked on is prohibited. Equipment, fuel tanks, and facilities must be located within the two parking lot areas and adjacent stockpile areas when not in active use.
17. No major grading activities will take place during wet weather or periods of predicted wet weather.
18. The site must be storm ready at the end of each workday and before any extended breaks in demolition/construction activities, including weekends.
19. When the project is complete, the Permittee shall contact DEMLR to close out the ESC plan. After DEMLR informs the permittee of the project close out, via inspection report, the Permittee shall visit deq.nc.gov/ncg01 to submit an electronic notice of termination (e-NOT). A $100 annual general permit fee will be charged until the e-NOT has been filled out.

Erosion and Sediment Control Sequence

Phase 1 – Perimeter Control

1. Install turbidity curtain upstream of the existing box culvert on Bethel Road.
2. Establish the staging/stockpile area and associated silt fence along the parking lot in the eastern side of the Park.
3. Install a check dam downstream of the existing culverts in East Prong Hunting Creek.
4. Install silt fence along the west bank of East Prong Hunting Creek. Access for establishing silt fence shall occur by utilizing the existing stream crossings.
5. Install the stockpile area and associated silt fence in the southern portion of the Park.
6. Establish the stockpile area and associated silt fence along the parking lot in the northwest corner of the Park.
7. Install silt fence along the existing wetlands to the west of Fiddlers Run. Access for establishing the silt fence shall occur from the existing parking lot in the northwest corner of the Park.
8. Install silt fence along the east bank of Fiddlers Run. Access for establishing silt fence shall occur by utilizing the existing stream crossing.

Phase 2 – Stream Construction

1. Establish the temporary culvert stream crossing on East Prong Hunting Creek as shown on the Plans.
2. Install the temporary timber mat stream crossings and associated downstream check dams along Fiddlers Run as shown on the Plans.
3. Stockpile areas may be installed and utilized at the Contractor's discretion. Each active stockpile area shall be surrounded with silt fence on the downstream side as shown in the Plans.
4. Temporary stream crossings on Fiddlers Run shall be removed concurrent with filling the existing channel and grading the floodplain bench.
5. Install the temporary stream crossings in the areas shown on the Plans to facilitate access across the newly constructed portion of East Prong Hunting Creek.

6. Once grading and stabilization of East Prong Hunting Creek is completed, and flow has been redirected into the new channel, remove Phase 1 silt fence from the left bank of the existing channel and place along the left bank of the new channel.
7. Upon completion of grading and stabilization of Fiddlers Run and redirection of flow into the newly graded channel, Phase 1 silt fence shall be moved to the right top-of-bank of Fiddlers Run to facilitate floodplain grading.

Phase 3 – Park Improvements

1. Begin grading and stabilizing the proposed walking trail at the southern limits of the park and work concurrently along both sides of the trail until finish grade elevations of the trail have been achieved. This shall be completed prior to interior grading of the Park.
2. The proposed walking trail shall act as a diversion berm for Park interior earthwork.

Construction Sequence

1. The Contractor shall contact North Carolina 811 prior to site mobilization.
2. Prior to site mobilization, the Contractor shall document the condition of on-site access points and existing park infrastructure (e.g., park signage, gates, parking lots, etc.) via video or still photography and provide to the Engineer of Record. Prior to demobilization activities, access points must be restored, at a minimum, to existing site conditions.
3. Prior to site mobilization, the Contractor shall erect signage designating Bethel Park as a construction zone with typical work hours displayed.
4. Set up temporary facilities and mobilize equipment and materials to the site.
5. Install perimeter ESC measures (phase 1) as shown on the plans and in the order listed in the ESC sequence including staging and stockpile areas, silt fence, a turbidity curtain, and temporary stream crossings. Place any imported materials within the limits of protected stockpile areas as shown in the ESC plans.
6. The Contractor shall install ESC measures as shown on the plans and notify the City when all necessary measures are complete. Allow the City 30 days for demolition of site features within the site as shown on the demolition plans.
7. Upon completion of ESC installation and demolition, begin the stream restoration and floodplain bench excavation following the sequence below.
8. Ensure that phase 1 of the ESC sequence is implemented and is functioning properly before any clearing or grubbing activities commence.
9. Clear any additional trees within the proposed stream corridor of Fiddlers Run necessary for proposed alignment excavation. Stockpile all trees on site within any established, protected, and approved stockpile area(s).
10. Perform excavation and grading of Fiddlers Run offline of the existing channel from approximate station 201+00 to 210+00 and from station 211+00 to the proposed confluence with East Prong Hunting Creek. Flow will be maintained in the existing channel.
11. Seed and mat stream banks and floodplain areas according to the plans and specifications.
12. Place all excavated material in designated and protected stockpile areas at least 50 feet from perimeter control ESC measures. The contractor will ensure that ESC practices are properly functioning in stockpile areas as shown on the ESC plans.
13. Contact NC Wildlife Resource Commission (NC WRC) 10 working days prior to diverting flow from the old channel to the new channel. NC WRC will be responsible for relocation of crayfish species.
14. Harvest reusable substrate from the existing channel as directed by the Engineer and stockpile within any approved and protected stockpile area(s).

15. Tie the newly excavated channel into the existing channel at the southern and northern extents of Fiddlers Run. A pump around may be utilized at the discretion of the Contractor and Engineer to work in dry conditions as outlined in the specifications.
16. Relocate the installed silt fence as defined in phase 2 of the ESC sequence to facilitate floodplain grading and filling the existing channel with the recently excavated material. The Engineer must approve the removed silt fence for reuse based on its condition after removal. If the Engineer deems it unfit for reuse, the Contractor must install new silt fence per the plans and specifications.
17. Any excess fill material will be stored in the approved stockpile area(s). If additional fill material is needed, the Contractor may begin clearing and offline channel excavation at the upstream extent of East Prong Hunting Creek.
18. Filling the abandoned channel should include installing channel plugs as noted in the plans and specifications.
19. Clearing and grubbing activities along East Prong Hunting Creek may not commence until phase 1 of the ESC sequence has been implemented and approved by the Engineer.
20. Clear any additional trees necessary to facilitate channel construction and grading at the upstream extent of East Prong Hunting Creek as shown on the plans. Stockpile all trees and brush in approved and protected stockpile area(s) or as directed by the Engineer.
21. Perform excavation and grading of East Prong Hunting Creek offline of the existing channel from approximate station 101+00 to 110+00. Flow will be maintained in the existing channel. Stockpile excavated material within any of the approved and protected stockpile area(s).
22. Tie the new channel into the existing channel at the southern extent of the park and downstream of station 110+00. A pump around may be utilized at the discretion of the Contractor and Engineer to work in dry conditions as outlined in the specifications.
23. Fill the existing channel and grade the floodplain bench concurrently to the grades shown on the plans. The installed silt fence along the west bank of East Prong Hunting Creek may be relocated as defined in phase 2 of the ESC sequence.
24. Utilize a pump around to excavate the proposed stream while filling the old channel concurrently until approximate station 118+00. The constructed channel must be tied into the existing channel and stabilized at the end of each workday to facilitate flow through East Prong Hunting Creek at all times.
25. When the new channel is tied into the existing channel at station 118+00, excavate the remainder of East Prong Hunting Creek to the confluence with Fiddlers Run. Upon completion, fill both of the existing channels and allow both streams to flow through the newly constructed channels.
26. When stream grading is complete, the proposed bridge crossings may be installed. The Contractor must ensure that flow will be maintained through or around East Prong Hunting Creek and Fiddlers Run throughout the duration of the bridge installation process.
27. Bridge abutments will utilize concrete as outlined on sheet 8.3. As such, concrete washout locations will be determined in the field by the Engineer. The Contractor is responsible for installing and maintaining the washouts as outlined on sheet 7.9.
28. Grade any remaining extents of the floodplain bench as shown on the plans. Any excess material will be stored in any of the approved stockpile area(s).
29. Once all phases of channel and floodplain bench grading are complete, prepare the floodplain bench for planting per the specifications.
30. Apply permanent seed and plant vegetation along the stream banks and in the floodplain bench per the plans and specifications.
31. Upon completion of stream bank and floodplain bench excavation and planting, begin interior park grading.

32. Grade the proposed walking trail loop and connecting trails to the elevations shown on the plans.
33. Transport excess fill material from the stockpile area(s) to the stockpile area at the southern extent of the park to facilitate grading south of the proposed walking trail as shown on the plans.
34. Complete final grading within the proposed walking trail from the southern extent and the northern extent concurrently.
35. Install the drainpipes in the park at the locations and elevations specified in the plans. Following pipe installation, return any disturbed trail to the proposed grade in the plans.
36. Upon reaching final grade, transport any excess fill material out of the interior of the park to a disposal site as directed by the City, if necessary.
37. Plant the remainder of the areas in the park per the plans and specifications.
38. Once permanent seed is established, minimum 70% coverage is achieved, and the Engineer of Record approves, remove any remaining temporary stream crossings, stockpile areas, and ESC practices. No ESC practices shall be removed without prior approval from the Engineer.
39. The Contractor shall remove all trash, debris, and any leftover construction materials prior to demobilization.
40. Demobilize equipment from the site.
41. Demobilize all equipment, offices, buildings, and other temporary facilities assembled on site.

SPECIFICATIONS

1.0 Special Conditions

1.1 Note on Quantity Take–Off and Type of Contract

The Contractor shall verify the estimated quantities and bid accordingly. In general, lump sum items within this contract are to be considered immeasurable and will be paid for as a lump sum price. The Contractor must be able to perform all activities (all equipment, labor, materials, and incidentals) necessary to complete the lump sum items unless specifically listed as a unit price cost item. In general, for unit price bid items, overruns and under runs may be adjusted based on the difference between the quantity estimated and quantity used if approved by the Engineer prior to installation. Overruns will not be eligible for payment if installed before Engineer approval. For lump sum bid items, a change order is applicable only to modifications in scope of the work and shall not be adjusted based on quantity take-off.

1.2 List Sources of Standards

The Contractor shall follow the standards and regulations of the A.G.C. Accident Prevention Manual in Construction as amended, the NCDOT Standard Specifications for Roads and Structures as amended, the NC Erosion and Sediment Control Planning and Design Manual as amended, and the City of Morganton stormwater management program. The Contractor shall adhere to the rules, regulations and interpretations of the North Carolina Department of Labor's Occupational Safety and Health Standards for the Construction Industry (Title 29, Code of Federal Regulations, Part 1926 published in Volume 39, Number 122, Part 11, June 24, 1974 Federal Register) and any revisions including thereto as adopted by General Statutes of North Carolina 95-126 through 155.

1.3 Contractor's Liability for Damage

The Contractor is responsible for the entire Site during construction. The Contractor is required to provide all the necessary safeguards as required by laws or ordinances governing such conditions and any Engineer required safeguards. The Contractor is responsible for identifying existing utilities, both above and below ground, and avoid impacts to these structures unless noted for removal in the Plans. The Contractor is encouraged to coordinate with the Engineer prior to mobilization regarding existing infrastructure that shall be avoided during construction. The Contractor shall be responsible for any damage to the Owner and Engineer's property or that of others on the job, by himself, his personnel, or his subcontractors, and shall make good such damages. He shall be responsible for and pay for any claims against the Engineer arising from such damages. Important Note: Existing right of ways and roads used as construction entrances and access roads must be restored to their original condition at the completion of construction.

The 25-year 24-hour storm event for Morganton, NC (NOAA Station ID: 31-5838) is 6.60 inches of rainfall. The Contractor is responsible for reporting all storm events resulting in 0.5 inches of rainfall measured over a 24-hour period within the on-site rain gages. The Contractor is responsible for repairing and restoring any damage to the Site as a result of flooding events associated with a 25-year 24-hour storm event or less from the initiation of clearing and grubbing activities until the date construction and stabilization is complete and accepted by the Engineer. Repair costs for damage caused by events greater than a 25-year 24-hour storm event may be negotiated with the Owner on a case-by-case basis.

1.4 Construction Warranty

The Contractor shall provide a one-year construction warranty on all workmanship and materials associated with the construction of the Site. The Engineer shall attend the six- and twelve-month warranty inspections. These inspections will include visual inspection of stream restoration and grading activities and structures for stability and compliance with the finish grade identified in the as-built drawings. The Engineer will provide a warranty inspection report to the Contractor identifying areas to be remediated.

The Engineer will meet with the Contractor on-site to review activities to be addressed. After the Contractor has notified the Engineer that the warranty items have been addressed, the Engineer will inspect warranty work and

make recommendations for acceptance of work. The Engineer will notify the Owner of warranty items that have not been addressed.

The warranty period for construction shall begin following acceptance of final site stabilization by the Engineer and Owner. All work completed under this section shall be considered incidental to mobilization/demobilization activities, therefore no separate pay item for the construction warranty is provided.

1.5 Safety Measures and Traffic Coordination

The Contractor is expected to perform Site construction safely and in accordance with all applicable rules and regulations. All necessary safety measures for the protection of all persons at work, including the requirements of the A.G.C. Accident Prevention Manual in Construction as amended, shall be provided by the Contractor. All safety measures shall also comply with all state laws or regulations and North Carolina State Building Code requirements to prevent accidents or injury to persons on or about the location of the work. Existing hazards shall be clearly marked with warnings, and any excavations or similar hazards shall be barricaded. Hard hats and any required head gear shall be worn when working near heavy machinery in accordance with 29 CFR 1926.100 and 29 CFR 1910.135 and the Contractor shall protect against potential damage or injury which could result from falling materials. Protective devices and signs shall be maintained throughout the work's progress.

The Contractor is responsible for any necessary traffic control while entering and exiting the construction Site. The Contractor is responsible for conducting due diligence on subsurface information for this Site ("One Call" 1-800-632-4949).

1.6 Contract Period

The Contractor shall commence work to be performed under this agreement on a date to be specified in a written Notice to Proceed. The Contractor shall fully complete stream construction and planting according to the Contract Periods listed in the table below. Stream construction includes all grading and installation of in-stream structures, floodplain bench grading, and grading within the park as identified in the Plans and directed by the Engineer in the field. Stream construction and planting will not be considered fully complete until the Engineer inspects the Site, any necessary deficiencies are addressed by the Contractor and the Engineer provides their approval. The Contractor is responsible for coordinating with the Owner/Engineer to define limitations on construction activity scheduling.

Activity	Responsible Party	Completion Date
Notice to Proceed	Owner / Engineer	On or before March 1, 2024
Stream Construction	Contractor	On or before September 1, 2024
Planting	Contractor	On or before December 31, 2024

2.0 Site Preparation

2.1 Construction Survey

Description

The construction survey shall be performed in accordance with Section 801 of the NCDOT Standard Specifications for Roads and Structures and shall include but not be limited to the layout of the stream channel, limits of disturbance, temporary and permanent easements and all sensitive areas associated with the implementation of the design as indicated in the Plans.

The Contractor shall always maintain a GPS and/or level and rod on-site for use by the Engineer to evaluate stream grades and structure elevation. This condition will not alleviate the Contractor's responsibility to make certain that the stream is constructed in accordance with the project Plans and Specifications.

Construction Methods

Refer to Section 801, NCDOT Standard Specifications for Roads and Structures.

The Engineer shall provide the grading model and Plans for the Site. The Contractor shall verify and establish control points as needed. Full stakeout of the stream channel and associated structures may not be required if GPS equipment is utilized to support grading activities. The use of GPS equipment will only be accepted if the accuracy and tolerances for finish grading and structures identified on the Plans and outlined in these Specifications can be achieved. The Contractor is liable for verifying GPS accuracy prior to conducting the construction survey. The Engineer may field-verify the accuracy of the construction survey, as deemed necessary. Resurveying due to discrepancies in GPS accuracy, outside of project tolerances, is the responsibility of the Contractor.

If GPS equipment is not used by the Contractor, stakeout of the stream channel in its entirety shall be performed under the supervision of a Professional Land Surveyor in such a way that the Engineer can verify the layout of the stream channel prior to construction activities commencing. The Contractor shall mark the proposed location of the centerline of the channel at 50-foot intervals, at the head of each riffle/shallow and at maximum pool depth locations within the proposed channel. Upon completion of the stakeout and prior to beginning construction, the Contractor shall give the Engineer a 48-hour notice in order to approve the stream alignment. Stakes should be maintained until construction in the work area is approved by the Engineer. There will be no additional payment for re-staking. Sensitive areas requiring safety fence shall be staked by the Contractor under the supervision of a Professional Land Surveyor.

Measurement and Payment

The construction survey will be measured and paid for as a lump sum price in accordance with Article 801-3 of the NCDOT Standard Specifications for Roads and Structures. Such price and payment will be full compensation for all work covered by this Specification, including but not limited to construction layout, boundary surveying and engineering necessary for the proper construction of the project in accordance with the project Plans and Specifications. Any adjustments to the stream alignment, structure placement, grading limits or elevations shall be considered incidental to the lump sum price for construction survey.

All work completed under this Specification shall be considered incidental to mobilization and demobilization (Specification 2.2); therefore, no separate pay item for this work is provided.

2.2 Mobilization and Demobilization

Description

This work consists of the mobilization and demobilization of the Contractor's equipment, materials and personnel necessary to perform the work required in the Plans. Mobilization will not be considered as work in fulfilling the requirement for commencement of work.

Construction Methods

Refer to Section 800, NCDOT Standard Specifications for Roads and Structures. Mobilization includes all activities and costs for transportation of personnel, equipment, materials, and operating supplies to the Site; establishment of offices and other necessary 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 as specified in this specification.

Demobilization includes all activities and costs for transportation of personnel, equipment and supplies not included in the contract from the Site; the disassembly, removal, and Site cleanup; and repair of offices, buildings and other facilities assembled on the Site for this contract.

The Contractor shall provide and pay for toilet facilities for all workmen, as required by local ordinances for complete and adequate sanitary arrangements as part of mobilization and demobilization. Sanitary facilities and the surrounding area shall be kept clean and neat at all times. They shall be located on the project Site as approved by the Engineer.

The Contractor will provide and pay for temporary utilities including electricity, telephone, and water as part of mobilization and demobilization. All temporary facilities will be available for the duration of the project. The Contractor will be responsible for compliance with code ordinances and requirements of local officials for temporary facilities, controls and related health and safety requirements. It will be the responsibility of the Contractor to coordinate electrical service. In the event that electrical power will not be available, it will be the Contractor's responsibility to provide any necessary generator(s) to facilitate construction.

The Contractor may provide a temporary field office complete with lights, telephone and proper climate conditioning as required by weather conditions. A portion of the field office, if provided, shall be designated for the use of the Engineer or their representatives. This area shall be of adequate size and contain an adequate layout board and adequate plan rack. The field office, if provided, shall not be removed from the project without the approval of the Engineer. Each Contractor may provide any necessary storage shed for its own use. All temporary structures shall be constructed in a sound waterproof manner and located on the project Site as approved by the Engineer. All temporary structures shall remain on the project Site until the Engineer approves their removal.

Measurement and Payment

All work completed under this Specification will be measured and paid for as a lump sum for mobilization and demobilization, in accordance with Section 800 of the NCDOT Standard Specifications for Roads and Structures. This work includes mobilization and demobilization required by the contract at the time of the award. If additional mobilization and demobilization activities and costs are required during the performance of the contract because of the 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. One properly installed construction sign is considered incidental to mobilization.

The payment schedule for this item will be 50% upon mobilization of equipment and materials to the Site and installation of the project sign, and 50% upon completion of demobilization and removal of all equipment and excess materials from the Site at project completion.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
1	Mobilization and Demobilization	Lump Sum (LS)

2.3 Staging and Stockpiling

Description

This work consists of staging construction equipment for storage and refueling purposes and stockpiling Site materials in staging areas. In addition, this Specification covers the initial stockpiling of trees for use as in-stream structures. The Contractor may establish staging areas as appropriate for phasing purposes with Engineer's approval. All staging areas must be located within the limits of disturbance (LOD) identified on the Plans.

Construction Methods and Materials

Prior to construction activities, the Contractor shall identify staging areas throughout the Site and review these areas with the Engineer. Harvested trees, stone, woody debris, and topsoil shall be transported to these staging areas. The Contractor shall also adhere to Section 6.01 of the NC Erosion and Sediment Control Planning and Design Manual. Stockpiles shall be monitored daily for signs of erosion, material loss and/or accumulation of stormwater runoff. The Contractor is responsible for conducting and the cost of all repairs necessary for stockpile maintenance. All refueling equipment (tanks, trucks and otherwise) shall be located within the existing parking lot areas. Placement of non-mobile refueling equipment within the limits of the park between East Prong Hunting Creek and Fiddlers Run is prohibited.

Measurement and Payment
All work completed under this Specification shall be considered incidental to mobilization and demobilization (Specification 2.2); therefore, no separate pay item for this work is provided.

2.4 Video Existing Conditions

Description
The Contractor is required to provide existing site documentation in the form of video footage or still photography to the Engineer prior to construction. This is required to document the Site condition and prevent claim of damages not incurred by the Contractor.

Sensitive areas that require documentation include, but aren't limited to, existing park infrastructure that will remain such as gates, asphalt parking lots, entrance signage, basketball courts, tennis courts, and playground equipment.

Measurement and Payment
All work completed for video and photographic documentation shall be considered incidental to mobilization and demobilization (Section 2.2); therefore, no separate pay item for this work is provided.

3.0 Erosion and Sediment Control

This work consists of installation and maintenance of erosion and sedimentation control devices to conform to the Plans, permits, local laws, state regulations and federal requirements.

The quantity of erosion control devices to be installed will be affected by the actual conditions that occur during the construction of the project. The quantity of erosion control devices may be increased, decreased, or eliminated entirely as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Refer to the NC Erosion and Sediment Control Planning and Design Manual as amended. Stone for erosion control practices can be quarry or re-purposed on-site stone. Payment for each erosion control item shall be considered full compensation for the items of work including the cost for furnishing all materials, labor, equipment, tools, and incidentals required to implement the item.

The Contractor must follow the requirements in accordance with the Plans and Specifications and the requirements of General Permit No. NCG010000 (General Permit to Discharge Stormwater under the National Pollutant Discharge Elimination System) at all times, including the following:

1. Erosion and sediment control devices shall be inspected once a week at a minimum and within 24 hours following any rainfall event in excess of 0.25" per 24-hour period. The results of these inspections shall be documented and any devices that are not functioning properly shall be immediately repaired.
2. The Contractor is required to maintain a rain gauge on the Site and keep daily a record of rainfall amounts and dates.
3. The Contractor is required to complete milestone erosion control inspections as part of the NCDEQ Self-Inspection program. Milestones include: after perimeter erosion control installation, after clearing and grubbing, after completion of slope/fill grading, after construction completion and after permanent ground cover establishment.
4. The Plans, a copy of permit NCG010000, rainfall records and inspection reports must be kept on the Site and must be accessible at all times.

3.1 Silt Fence

Description
This work consists of installation and maintenance of geotextile silt fences and silt fence gravel outlets to trap sediment from limited runoff areas. In general, standard silt fence shall be used on the Site as noted on the Plans

and as directed by the Engineer. Reinforced silt fence may be required as necessary to maintain Site stability and fulfill erosion and sediment control requirements, only as directed by the Engineer. Silt fence shall be properly trenched to prevent stormwater discharge or erosion under the fence. Silt fence and silt fence gravel outlets are considered temporary control measures and shall be removed after permanent stabilization of contributing areas.

Construction Methods and Materials

Materials for silt fence shall conform to the sediment fence specifications (Section 6.62) in the NC Erosion and Sediment Control Planning and Design Manual. Use a 36-inch-wide synthetic filter cloth consisting of at least 95% by weight polyolefins or polyester and conforming with the requirements in ASTM D 6461, shown in the table below.

Property	Test Material	Units	Supported Silt Fence	Un-Supported Silt Fence	Type of Value
Grab Strength – Machine Direction	ASTM D 4632	lbs	90	90	MARV
Grab Strength – X-Machine Direction	ASTM D 4632	lbs	90	90	MARV
Permittivity	ASTM D 4491	sec-1	0.05	0.05	MARV
Apparent Opening Size	ASTM D 4751	US Sieve #	30	30	Max ARV
Ultraviolet Stability	ASTM D 4355	% Retained Strength	70% after 500h of exposure	70% after 500h of exposure	Typical

MARV: minimum average roll value

The posts for silt fence shall be 1.25lb/linear ft minimum steel with a minimum length of 5 ft. Posts shall have projections to facilitate fastening the filter fabric.

For supported silt fence, reinforce the standard filter cloth with a minimum 14-gauge steel wire with a maximum mesh spacing of 6 inches. The hardware cloth used in silt fence gravel outlets shall be welded galvanized screen with square 1/4-1/2 inch holes.

Stone for silt fence gravel outlets shall be 0.5" to 1.5" washed stone consistent with section 5.1 of these Specifications. The hardware cloth for the silt fence gravel outlet shall be welded galvanized wire screen with 1/4 - 1/2-inch holes.

Construction methods for silt fence shall conform to the sediment fence specifications (Section 6.62) in the NC Erosion and Sediment Control Planning and Design Manual. The above ground height of the silt fence shall not exceed 24 inches to avoid impounding large volumes of water. Construct the filter cloth from a continuous roll cut to the length of the barrier identified in the Plans to avoid the use of joints. When joints are necessary, securely fasten the filter cloth at a support post with a minimum 4 ft overlap to the next post. If reinforced silt fence is required by the Engineer, fasten the wire reinforcement to the upslope side of the posts and filter cloth.

Drive the posts 2 ft into the ground at locations identified in the Plans and as directed by the Engineer. Posts shall be installed at 6 ft max offsets for standard silt fence and 8 ft max offsets for reinforced silt fence. Excavate a trench approximately 4 inches wide and 8 inches deep along the line of posts and upslope of the barrier. Place 12 inches of the filter cloth along the bottom and side of the trench. Backfill the trench with soil placed over the filter cloth and compact. Secure the filter cloth to the posts using plastic or wire ties.

Maintain or replace silt fence as needed and as directed by the Engineer. Remove sediment accumulated along the fence when it reaches 1/3 the height of the fence.

Measurement and Payment

Silt fence will be measured and paid for in linear feet, accepted in place, along the ground line of the fence. No direct payment will be made for posts, woven wire fence, filter fabric, staples, gravel outlets and any other material components; these will be considered incidental to the work covered by silt fence. No additional payment shall be made for overlapping silt fence.

Such price and payment shall be full compensation for the items of work, including the cost for furnishing all materials, labor, equipment, tools, incidentals, storage, preparation, installation, removal, and proper disposal of the silt fence required by the above specification.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
2	Silt Fence	Linear Feet (LF)

3.2 Safety Fence/Tree Protection Fencing

Description

This work consists of installation and maintenance of safety fence to protect desirable trees and wetlands, to remain, from damage during staging, construction, and grading activities. Safety fence is a temporary measure and may be removed after completion of construction activities within the daily work zone with the approval of the Engineer.

Construction Methods and Materials

Safety fence shall have the following properties or be approved by the Engineer prior to installation:

Physical Property	Tests	Requirements
Material	N/A	Polyethylene
Recommended color	N/A	“International Orange”
Tensile Yield	ASTM D638	Ave. 2000 lbs. per 4’ wide
Ultimate tensile strength	ASTM D638	Ave. 2900 lbs. per 4’ wide
Elongation at break (%)	ASTM D638	Greater than 1000%
Chemical resistance	N/A	Inert to most chemicals and acids

The Contractor shall install tall, bright, protective fencing durable to last throughout the construction project. Orange safety fence is preferred. Safety fence may be installed at the drip line of the tree being protected to limit compaction of the root zone. Signage shall be installed along all sides of fencing saying, “Keep Out”. Safety fence shall be installed and maintained according to specifications from the Engineer. Safety fence shall not be removed without Engineer approval.

Measurement and Payment

Safety fence will be measured and paid for in linear feet, accepted in place, along the ground line of the fence. No direct payment will be made for posts, signage, fencing and other material components; these will be considered incidental to the work covered by safety fence.

Such payment shall be considered full compensation for the items of work, including the cost for furnishing all materials, labor, equipment, tools, incidentals, storage, preparation, installation, removal, and proper disposal of the safety fence and components.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
Alt 1	Safety Fence/Tree Protection Fencing	Linear Feet (LF)

3.3 Temporary Rock Check Dam

Description

This work consists of installation and maintenance of temporary rock check dams as a sediment control BMP. Temporary rock check dams are temporary measures and shall be removed after completion of construction activities within phase of the project. The quantity of temporary rock check dams may be increased, decreased, or eliminated entirely as directed by the Engineer. Such variations in quantity will not be will not be considered as alterations in the details of construction or a change in the character of the work.

Construction Methods and Materials

Each check dam shall be composed of 5" to 12" stone and 0.5" to 1.5" gravel. Place 5" to 12" stone in the existing stream channel to a minimum height of 3-feet and the width of the channel. Place 0.5" to 1.5" gravel on top of the 5" to 12" stone to 6-inches below the existing top of bank such that a low flow channel equivalent of 2/3 of the stream width is maintained, as shown in the Contract Documents, and as directed by the Engineer.

The contractor shall remove sediment from between the check dams when the depth reaches a maximum of 9-inches. All temporary check dams shall be removed by the Contractor after completion of construction activities within each phase of the project.

Measurement and Payment

Temporary rock check dams shall be paid per each structure installed and accepted by the Engineer in the field. Such price and payment shall be full compensation for the items of work, including the cost for furnishing all materials, labor, equipment, tools, and incidentals required by the above specification.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
3	Temporary Rock Check Dam	Each (EA)

3.4 Erosion Control Matting

Description

This work consists of furnishing and installing erosion control matting on finished grade as shown on the Plans, or as directed by the Engineer.

The quantity of erosion control matting to be installed will be affected by the actual conditions that occur during the construction of the project. The quantity of erosion control matting may be increased, decreased, or eliminated entirely as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Construction Methods and Materials

Erosion control matting will be machine-produced mat made of 100% coconut fiber with properties as follows:

Property	Requirement	Test Method
matrix	100% coconut fiber	ECTC*
roll size	6.6 feet x 164 feet	ECTC*
thickness	0.30" (minimum)	ASTM D5199
elongation	34% x 38% (maximum)	ECTC*
flexibility	65030 x 29590 mg cm	ECTC*
mass per unit area	20 ounces per square yard (minimum)	ASTM D5261
stable flow velocity	11 feet per second (minimum)	ECTC*
open area (measured)	50% (maximum)	ECTC*
tensile strength	1348 x 626 pounds per foot	ASTM D5035
'C' factor	0.002	ASTM D5035

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

A hardwood Eco-STAKE™ or similar biodegradable stakes shall be used to secure matting. Stakes used to secure fabric at the top and toe of bank will be wooden stakes 12" in length with a square cross-section of 2" by 2", with a notch cut 1" from the top or a 6" nail driven through the top. No metal stakes will be used on the project.

The Contractor will install erosion control matting in locations and to the widths and lengths as shown on the Plans, or as directed by the Engineer. Matting will be secured with stakes installed at three (3) feet on-center spacing in offset rows in a diamond pattern. Fabric overlap at seams will be a minimum of 6". Fabric will be overlapped so that the upstream mat end is on top of the downstream mat start. Stakes will secure fabric at three (3) foot spacing on the overlapping seams. Matting will be dry when installed. Matting will be installed to lie on slopes not too loosely but not in tension.

Prior to matting placement, proposed grades shall be achieved, and no voids will occur in the slope. The area will be treated with fertilizer, soil amendments and temporary and permanent seeding as specified in the Plans and Specifications. Straw mulch will be used to cover the finished grade to achieve 60% coverage on the soil prior to placement of the matting.

Measurement and Payment

Erosion control matting will be measured and paid for in square yards measured along the surface of the ground over erosion control matting that has been acceptably placed. No separate measurement will be made for overlapping fabric at seams.

Such price and payment will be full compensation for all work covered for erosion control matting, including but not limited to all labor, machinery, maintenance, hauling, preparation, and installation to complete the work in an acceptable manner. Wooden stakes and straw placement will be considered incidental to erosion control matting installation.

Stabilization measures required prior to streambank matting installation including, but not limited to, seeding, soil amendments and fertilizers will be measured and paid under temporary seeding and permanent seeding.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
4	Erosion Control Matting	Square Yard (SY)

3.5 Temporary Stream Crossing – Culvert

Description

This work consists of installation and maintenance of a temporary culvert stream crossing to provide a means for construction vehicles and equipment to cross East Prong Hunting Creek without moving sediment to the stream or damaging the channel. The culvert stream crossing is a temporary measure and should be removed after completion of construction activities at the location of the crossing near the parking lot along East Prong Hunting Creek as approved by the Engineer. The quantity of temporary culvert stream crossings to be installed will be affected by the construction sequence submitted by the Contractor and approved by the Engineer. The quantity of temporary culvert stream crossings may be increased, decreased, or eliminated entirely as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Construction Methods and Materials

The Contractor may utilize alternative stream crossing measures than those shown on the Contract Documents with prior approval from the Engineer. The culvert crossing will be constructed with a minimum of one 72" diameter pipe and stone that shall be of a size conforming with specifications as outlined in the Contract Documents. Pipe material may be corrugated metal, corrugated plastic, or any other alternative recommended by the Contractor and accepted by the Engineer. Pipe shall be 20' in length.

The temporary culvert stream crossing shall be constructed perpendicular to flow in the existing channel according to the Contract Documents or as directed by the Engineer in the field. The temporary culvert stream

crossing shall only be constructed over stream channels within the active work zone and shall be removed once the channel is abandoned.

The culvert stream crossing consists of pipe and coarse aggregate backfill. Place the pipe (minimum 72" diameter) in the center of the existing channel and backfill with a mix of 2" to 6" stone and 5" to 12" stone to a minimum 12" above the top of the pipe. Place a minimum 6" of coarse aggregate (minimum D_{50} = 6") on top of the backfilled stone and a minimum 25' outside of the top of bank.

Measurement and Payment
Temporary culvert stream crossings shall be paid per each structure installed and accepted by the Engineer in the field.

Such price and payment will be full compensation for all work covered for temporary culvert stream crossings, including but not limited to all labor, machinery, maintenance, hauling, preparation, and installation to complete the work in an acceptable manner. Pipe, stone, and coarse aggregate backfill will be considered incidental to temporary culvert stream crossing installation.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
5	Temporary Stream Crossing - Culvert	Each (EA)

3.6 Temporary Stream Crossing – Timber Mat

Description
This work consists of installation and maintenance of temporary timber mat stream crossings to provide a means for construction vehicles and equipment to cross streams without moving sediment to streams or damaging the channel. The timber mat stream crossings are temporary measures and should be removed after completion of construction activities at the location of the crossing as approved by the Engineer. The quantity of temporary timber mat stream crossings to be installed will be affected by the construction sequence submitted by the Contractor and approved by the Engineer. The quantity of temporary timber mat stream crossings may be increased, decreased, or eliminated entirely as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Construction Methods and Materials
The Contractor may utilize alternative stream crossing measures than those shown on the Contract Documents with prior approval from the Engineer. Timber mat stream crossings will be constructed with mud mats, logs, filter fabric, and rock according to the Contract Documents.

All temporary timber mat stream crossings shall be constructed perpendicular to flow in the existing channel according to the Contract Documents or as directed by the Engineer in the field. Temporary timber mat stream crossings shall only be constructed over existing or recently constructed stream channels within the active work zone and shall be removed once the existing channel is abandoned.

Timber mat stream crossings consist of mud mats (composed of hardwood timbers), logs, and rock. Place support logs (minimum diameter = 12") at both top of banks. Place the mud mats on top of the support logs. Mud mats shall be 16' long or a minimum of 4' longer than the existing top of bank width. 16' long mud mats shall be constructed with minimum 8" W x 8" H hardwood timbers. Mud mats that are longer than 16' shall be constructed with minimum 12" W x 12" H hardwood timbers. Mud mats shall have no gaps between the timbers. All mud mats shall be 4' in width.

Measurement and Payment
Temporary timber mat stream crossings shall be paid per each structure installed and accepted by the Engineer in the field.

Such price and payment will be full compensation for all work covered for temporary timber mat stream crossings, including but not limited to all labor, machinery, maintenance, hauling, preparation, and installation to complete the work in an acceptable manner. Logs and timber will be considered incidental to temporary timber mat stream crossing installation.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
6	Temporary Stream Crossing – Timber Mat	Each (EA)

3.7 Pump-Around System

Description

The work for the pump-around system shall consist of maintaining stream flow through the Site, isolating work areas from stream flow and dewatering the work areas in accordance with the Plans and Specifications, or as directed by the Engineer. In-stream work shall be performed in the dry using pump-around methods as needed. The work covered by this section consists of furnishing, installing, maintaining, and removing any and all temporary pump-around operations used on this project to facilitate stream restoration construction or bridge crossing installation.

Construction Methods and Materials

Refer to the pump-around system detail in the Plans. The pump-around pump assembly, utilizing one or more pumps, shall have a capacity sufficient to convey the normal stream flow. The Contractor shall determine the required pumping capacity and select the appropriate, reliable, sufficient equipment to accomplish the diversion, including all necessary intake and discharge hoses, couplings, intake screens, filters, ventures, suction lines and so forth.

The pump-around operation shall provide a passageway for the stream flow around portions of the work Site where construction of the channel is occurring. Pumping shall be maintained such that sediment laden water does not enter the downstream watercourse outside of the active work zone. During anticipated larger storm events, channel construction areas shall be stabilized to reduce erosion. Pumping shall continue until construction and stabilization of the channel banks and in-stream structures is completed in an active work zone. Pumping activities may be removed at the end of each workday at the discretion of the Engineer.

Refer to the Plans for pump-around details. The pump-around system shall be operational at all times during the periods of in-stream work. The sequence of construction, including the utilization of pump-arounds, shall be provided by the Contractor, and approved by the Engineer prior to construction. The Contractor's project schedule shall address maintenance of stream flow and dewatering practices. The Contractor is advised to address all permit requirements and restrictions, or any revisions thereto, in the project schedule. Modifications to the pump-around system application during construction are permitted with prior approval from the Engineer. No time extension will be granted for work shutdown due to pumping equipment inadequacy, malfunction, or disrepair.

Flow will be maintained in the existing channels of East Prong Hunting Creek and Fiddlers Run to the extent practical, however a pump around shall be utilized to work in dry conditions once channel excavation can no longer occur offline. The contractor should only begin work in an area which can be completed by the end of the day. At the end of each workday, the work area must be stabilized and the pump around removed from the channel. Sandbag dikes should be situated at the upstream and downstream ends of the work area, and stream flow should be pumped around the work area. The pump should discharge onto a stable velocity dissipater made of sandbags or other approved material. Water from the work area should be pumped to a sediment filtering measure such as a dewatering basin, sediment bag, or other approved source. The measure should be located such that the water drains back into the channel below the downstream sandbag dike. After an area is completed and stabilized, the clean water dike should be removed. After the first sediment flush, a new clean water dike should be established upstream from the old sediment dike. Finally, upon establishment of a new sediment dike

below the old one, the old sediment dike should be removed. The pump around system for both streams shall be implemented in a similar fashion as described herein.

Measurement and Payment
Materials and equipment necessary for pump-around systems will be considered incidental to Grading and no separate measurement or payment will be made.

3.8 Turbidity Curtain

Description
This work consists of furnishing and installing turbidity curtains to reduce downstream turbidity and sedimentation.

Construction Methods and Materials
The turbidity curtain shall be installed at the downstream limits of Site disturbance according to manufacturer's instructions and as shown on the Contract Documents. The turbidity curtain should intercept all stream flow that contacts the work zone or displays increased turbidity related to construction activities. The curtain should be inspected, maintained, and adjusted daily to ensure proper function. The curtain should remain in the stream as long as non-stabilized work zones exist within the project area and until project completion.

The turbidity curtain shall be suitable for use in moving water and installed according to manufacturer's recommendations and the Contractor shall provide an appropriate turbidity curtain and anchor system. The Contractor shall provide all personnel required to adequately position, install and maintain the turbidity curtain until the project is complete. Provide floating turbidity barrier meeting the following minimum requirements:

- Fabric – Polyester Reinforced Vinyl 18 oz/yd2
- Flotation – 13 lbs/ft
- Rope Retainer – ⅝ inch Polypropylene
- Grommets #4 Brass #4 Brass #4 Brass
- Seams Heat Welded
- Bottom Load Chain – 0.63 lbs/ft (min) (¼ inch, galvanized)
- Connecting Hardware – Galvanized Steel

Measurement and Payment
All work completed under this section will be measured and paid for as a lump sum for turbidity curtain. The payment schedule for this item will be 50% upon mobilization of equipment and materials to the Site, and 50% upon completion of demobilization and removal of all equipment and excess materials from the Site at project completion. This work includes materials, labor, and equipment required by the above specification. Payment will be made under:

Payment will be made under:

Bid Item	Pay Item	Pay Unit
7	Turbidity Curtain	Lump Sum (LS)

4.0 Demolition

4.1 Site Demolition

Description
This work consists of the demolition and removal of all existing structures and disconnecting, capping or sealing, and removing utilities from the Site according to the Contract Documents and as directed by the Engineer. The quantity of existing structures to be demolished may be increased, decreased, or eliminated entirely as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

This City is responsible for demolition of park infrastructure including, but not limited to, the existing asphalt trail, dog park fencing and structures, disc golf baskets and structures and field light poles including de-energizing of the subsurface utilities. The City will also fell all trees identified to be removed on the plans, to the maximum extent practicable given their equipment capacity and access to wetter areas of the site.

The Contractor is responsible for removal and demolition of the two (2) existing pedestrian bridges on the site. The Contractor is responsible for the demolition and removal of the existing dual 60" culverts at the southern end of the parking lot along East Prong Hunting Creek. The Contractor is responsible for stockpiling, limbing and cutting to length of the felled trees for reuse as in-stream structures. See Section 5.2 for details on tree work.

Demolition Methods and Materials

The Contractor is responsible for contacting NC-811 to verify the location of any utilities within the proximity of the demolition area prior to initiating any demolition activities. The City will locate, identify, disconnect and seal or cap off indicated utilities serving buildings and structures to be demolished. Contractor shall coordinate with the City to arrange for the shut off of existing utilities.

Hazardous materials are defined as asbestos, petroleum storage tanks or other material that could pose an environmental risk in the event of damage or misuse. The Contractor shall take care during the course of the demolition to identify any potential hazardous materials that are encountered. If hazardous materials are identified, demolition activities shall cease immediately, and the location of the hazardous materials reported to the Engineer. The Engineer will notify the Owner and a proper course of protection and action shall be determined prior to resumption of demolition activities. No hazardous material has been identified on site. However, this must be verified by the Contractor prior to and during demolition activities. Hazardous material removal/disposal is not included as part of site demolition. If encountered, Contractor shall notify Owner and Engineer to determine appropriate means and methods of disposal.

Abandon existing utilities and below-grade utility structures as noted on the plans. Where de-energized utility lines are encountered during grading activities, they should be removed to a minimum distance of 5' from the proposed finish grade, or a minimum of 12" below finish grade. Remove demolition waste materials from the Site and legally dispose of them in an approved landfill acceptable to authorities having jurisdiction.

Measurement and Payment

All work completed under this section will be measured and paid for as a lump sum for Site Demolition. This work includes mobilization, materials, labor, and equipment required by the above specification. The payment schedule for this item will be 100% upon completion of structure demolition and utility removal accepted by the Engineer.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
8	Site Demolition	Lump Sum (LS)

5.0 Earthwork

5.1 Grading

Description

This work involves the excavation of floodplains, floodplain benches, new channels, bioswale and bioretention areas, placement of fill in the abandoned channel, construction of stormwater conveyance features, designated stockpiles, proposed walking trail sub-grade, and permanent fill locations. The Contractor shall perform excavation and grading as necessary to attain final surface elevations along the stream corridor, within the bench extents, and within Bethel Park as shown on the Plans.

Construction Methods

All work shall be completed in accordance with the Plans and Specifications and NCDOT Standard Specifications for Roads and Structures, including but not limited to sections 225 (Roadway Excavation), 230 (Borrow Excavation) and 235 (Embankments).

Site Grading

The Contractor shall perform grading as necessary to attain final surface elevations as shown on the Plans. Field modifications shall be approved by the Engineer. Final elevations for channel grade and stream dimensions shall be within a vertical tolerance of +/- 0.1 feet (1.2-inches) and a horizontal tolerance of +/- 0.2 feet (2.4-inches). Final floodplain grades shall be within a vertical tolerance of +/- 0.2 feet (2.4-inches) and a horizontal tolerance of +/- 0.4 feet (4.8-inches). Sensitive areas to be protected, as noted in the Plans, include existing wetlands designated for avoidance. Damage to these areas will be the Contractor's responsibility for re-establishment.

Bedrock Excavation

The Contractor shall immediately notify the Engineer if bedrock is encountered on the Site that impedes the Contractor from achieving finish grade as identified in the Contract Documents. Where possible, the Engineer will work with the Contractor to adjust channel or floodplain grades to avoid bedrock. Channel realignment or finish grade amendments for the purposes of bedrock avoidance will be considered incidental to grading and no additional pay item will be allowable. Where, as determined by the Engineer, bedrock excavation is unavoidable in the channel or floodplain, a rock hammer shall be used in place of blasting to remove bedrock. Bedrock is defined as native material that cannot be excavated with a large track-mounted excavator equipped with rock teeth. Isolated boulders that can be moved with a large track-mounted excavator do not qualify as bedrock. Bedrock excavation approved by the Engineer will be paid at the bedrock unit price included with the Contractor's bid.

Channel Construction

In areas where channels are to be constructed or old channel areas are to be filled, the Contractor shall comply with the requirements of Subarticle 235-4(C) of the NCDOT Standard Specifications for Roads and Structures to obtain a minimum 95% compaction rate. Lift thickness shall not exceed 12" and compaction shall be achieved by use of mechanical compaction equipment. Organic material shall not exceed 10% of the total volume of the fill material used. No compaction shall be performed for graded areas unless directed by Engineer.

Channel banks will be graded evenly and smoothly at the slopes and dimensions indicated on the Plans. The top of slopes and embankments will match surrounding adjacent grade such that after compaction and settlement, grades will be at proper elevation. The Contractor will be required to address any settlement that occurs prior to final project approval by the Engineer. Existing drainage patterns should remain unchanged on the adjacent floodplain, unless otherwise noted in the Plans.

Trail Grading

The Contractor shall grade the proposed walking trail to the elevations and dimensions as shown on the Plans using Select Material as approved by the Engineer. The Select Material must be free of rock or organic material. The Contractor shall comply with the requirements of Subarticle 235-4(C) of the NCDOT Standard Specifications for Roads and Structures to obtain a minimum 95% compaction rate. Compaction shall be achieved by use of mechanical compaction equipment.

Topsoil Harvesting

Topsoil harvesting and reuse shall be at the discretion of the Engineer based on Site conditions and project value. The Contractor shall only harvest and reuse topsoil as directed by the Engineer. Topsoil shall be obtained in areas that are already being graded or disturbed, stockpiled for reuse and reapplied. Topsoil may not always be encountered at the ground surface but may have been buried by prior Site activities. Buried topsoil may be required to be harvested if the same soil is already being excavated and relocated as part of grading activities. Harvesting of topsoil outside of the project area as shown on the Plans is prohibited. Topsoil shall be reapplied within stream corridors, and within other disturbed areas as directed by Engineer. Topsoil shall be incorporated

into the top 6" of the soil column and tamped to create a loose yet firm structure. Stream corridors shall be all areas within the excavated floodplain bench area. Topsoil shall be harvested to the depth deemed appropriate in the field (by Engineer) and shall be reapplied to a depth of 2-4" as determined by availability of harvested material. The Engineer shall determine the reapplication depth upon completion of harvesting activities in each work area.

Channel Plugs

Channel plugs shall follow the detail in the Plans. Channel plugs shall be installed at all locations identified in the Plans, and as directed by the Engineer, to prevent flow from returning to the existing channel to be abandoned. Channel plugs shall be constructed with material consisting of clay, clay loam or sandy clay loam, and must be free of rock and organic material. The material to be used for channel plug construction must be approved by the Engineer prior to construction of each channel plug. The Contractor shall comply with the requirements of Section 235-3 (C) of 2018 NCDOT Standard Specifications for Roads and Structures to obtain a minimum 95% compaction rate. Lift thickness shall not exceed 12" and compaction shall be achieved by use of mechanical compaction equipment. Along the proposed channel, the channel plug side slope shall conform to the side slopes specified in the Plans. Along the abandoned channel, the channel plug side slope shall not exceed 1:1 (H:V). Channel plugs shall have a minimum length of 40 linear feet (LF) along the abandoned channel, unless otherwise directed by Engineer, a width that is equal to the top width of the abandoned channel and a depth that is equal to the depth of the abandoned channel. The channel plug near the tie in of East Prong Hunting Creek shall be 80 LF along the abandoned channel.

Measurement and Payment

All work completed under this Specification will be measured as lump sum for grading, and paid based on the percent approved, completed, and accepted by the Engineer. The payment schedule for grading will be based on the percent of grading completed at the end of each month. The Contractor is required to submit a certified statement at the end of each month that documents the percent grading completed during a given month.

The quantity of earthwork may be increased or decreased due to field adjustments to grading limits as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work. No separate or additional payment or credit is due if the amount of cumulative increase or decrease from one or multiple field adjustments is less than 10% of the total earthwork quantity. Measurement and contract adjustments for cumulative increases or decreases greater than 10% of the total earthwork quantity will be negotiated on a case-by-case basis. The burden of proof is on the Contractor for quantity increases exceeding 10%; the burden of proof is on the Engineer for quantity decreases exceeding 10%.

The above prices and payments will be full compensation for all work covered by this Specification including, but not limited to, accessing the Site, channel bank excavation, channel realignment, over-excavating unsuitable materials, placing and compacting select material, backfilling undercut areas, constructing embankments in eroded areas, channel bank sloping and hauling of suitable and/or unsuitable excavated material to a location approved by the Engineer for disposal.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
9	Grading	Lump Sum (LS)
Alt 2	Bedrock Excavation	Cubic Yard (CY)
Alt 3	Topsoil Harvesting	Cubic Yard (CY)

5.2 Tree Removal

Description

The work under this specification consists of the removal, clearing, and disposal of trees from the project area that are denoted on the Contract Documents or specified by the Engineer in the field. Trees shall not be removed

without the final approval of the Engineer in the field. All materials that will be reused on the Site shall be removed, preserved, and protected in a manner to facilitate reuse. Removal and subsequent handling of organic materials shall be referred to as clearing and grubbing.

The City is responsible for cutting all trees identified on the plans for removal, to the maximum extent practicable. The Contractor is responsible for moving the felled trees to the stockpile areas identified on the plans, limbing the trees and cutting them to appropriate lengths for reuse as in-stream structures in accordance with the Plans. Stumps located in the proposed stream alignment shall be removed by the Contractor. Stumps outside of the proposed alignment may remain within the floodplain as woody debris. The Contractor is responsible for cutting stumps to remain to lower height, as directed by the Engineer, to reduce floodplain and erosion impacts.

All woody debris shall remain on site and used as in-stream or floodplain structures as identified on the plans. Any remaining vegetation shall be chipped by the Contractor and used as topdressing for bioretention areas or stockpiled for use by the City.

Construction Methods and Materials

Refer to the Plans for the identification of trees to be removed. All tree removals (even those already marked on the Plans) shall be approved by the Engineer in the field. Removal of trees with a Diameter at Breast Height (DBH) of less than 12" and brush from the Site are considered incidental to Grading. Mark trees proposed on the Contract Documents for removal and review with the Engineer to verify that removal is necessary. Do not damage or remove trees 12" or larger without approval of the Engineer. Harvested trees with a DBH of 12" or greater may be reused on-site for the construction of in-stream structures at the discretion of the Engineer. All trees to remain that need to be trimmed must be neatly trimmed using accepted industry standards for pruning. The Contractor is responsible for relocation and trimming of felled trees by the City.

Removed trees, vegetative material, and excess soil shall be disposed of in a manner that complies with the Clearing, Grubbing, and Debris Removal specification outlined in Section 5.3.

Measurement and Payment

Tree removal is anticipated to be completed by the City. However, it is possible that the City may not be able to reach all trees to be removed, and additional tree removal may be required. Tree removal for the Contractor is estimated to be the relocation and trimming of approximately 80 felled trees. The Contractor shall consider the potential for removal of up to 10 additional trees. Tree removal is to be paid on a lump sum basis for the relocation, limbing and trimming of approximately 80 trees, the removal of up to an additional 10 trees 12" DBH or greater, stump removal (as directed by the Engineer), chipping of excess woody material, and the trimming of stumps at the discretion of the Engineer and shall be paid on a lump sum basis. Such payment shall be considered full compensation for the items of work, including the cost of furnishing all materials, moving material within the Site, labor, equipment, tools, and incidentals required.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
10	Tree Removal	Lump Sum (LS)

5.3 Clearing, Grubbing and Debris Removal

Description

The work under this specification consists of clearing, grubbing and disposal of organics (trees, snags, logs, brush, stumps, root mass, shrubs) from the project area as identified on the Plans. All materials that will be re-used on the Site shall be removed, preserved, and protected in a manner to facilitate reuse.

Removal and subsequent handling of organic materials (live or dead plant material), debris, and trash within the limits of disturbance shall be referred to as clearing and grubbing. Areas identified by the Engineer as having

suitable herbaceous species for juncus, woody material or transplants shall be protected from clearing and grubbing or other activities under this specification until they can be harvested and transplanted. This Specification also covers harvesting on-site stone and other materials that are necessary for the construction of the project and are not identified in subsequent Specifications of this document. Excess material shall be disposed of as shown on the Plans or as directed by the Engineer. No suitable materials shall be removed from the Site unless specifically approved by the Engineer. The Contractor is responsible for obtaining all appropriate permits for off-site disposal locations from NCDEQ and other applicable agencies.

Construction Methods

Refer to Section 200, NCDOT Standard Specifications for Roads and Structures. Refer to the limits of disturbance depicted on the Plans for limits of clearing and grubbing. The Contractor shall minimize land disturbance and the removal of clusters of trees within the limits of disturbance to the extent practical. Safety fence shall be utilized to protect trees as identified in the Plans and Section 3.2 of these Specifications. The Engineer may identify additional areas to avoid land disturbance than are identified in the Plans. The Contractor is responsible for complying with all applicable local, state, or federal regulations for off-site disposal of materials. Burning of materials not suitable for in-stream structures is prohibited. Excess woody materials that cannot be utilized for structures as shown on the Plans shall be chipped or otherwise reused on site at the discretion of the Owner and Engineer.

Grubbing and debris removal includes all trash and old structures found in the project area to be removed as specified in the Plans or directed by the Engineer; including, but not limited to: bridges, pipe, fencing, concrete material, asphalt, plastics and household appliances. Trees, understory brush and woody debris will be removed and stockpiled for on-site use at the direction of the Engineer and as noted in the Plans.

Burial of materials generated by clearing, grubbing and debris removal is prohibited, unless otherwise approved by the Engineer. Wood and soil not used in the construction of the project shall be disposed of on-site per the Engineer's direction. Crushed concrete, asphalt, pipe, metal, fencing and other inorganic debris shall be disposed of off-site at the Contractor's expense and at the direction of the Owner. Metal should be recycled when metal recycling facilities exist within the same County as the project Site, or within a distance of 25 miles, unless otherwise directed by the Engineer.

All hardwood trees with a 12" diameter at breast height (DBH) or larger will be stockpiled for use on in-stream structures on Site. Tree trunks that can be utilized for construction of project features will be protected from damage during removal, transport, and storage. No materials suitable for use in project features (such as brush for use in brush toe or brush riffles, tree trunks for use in log structures, etc.) will be removed from the Site without Engineer's approval. Removal of trees and brush from the Site will not be paid for and shall be incidental to mobilization and demobilization. The Contractor shall not damage or remove trees with a DBH larger than 12" without the consent of the Engineer except for those that must be removed for construction of the proposed stream channel as shown on the Plans.

Stone encountered during grading and demolition shall be stockpiled for reuse, at the discretion of the Engineer, to the extent that it is free of trash, debris, and waste asphalt. Stone containing any of these materials may not be utilized in the stream. The Engineer may reject harvested stone if unsuitable materials are mixed with stone. The Contractor shall harvest stone from the existing channels to the maximum extent practicable, prior to backfilling the existing channel. Harvested stone will be utilized for riffle construction.

Measurement and Payment

All work completed under this Specification shall be considered incidental to grading (Specification 5.1); therefore, no separate pay item for this work is provided.

6.0 Materials

6.1 Stone

Description

This work consists of furnishing and stockpiling approved stone used to construct in-stream structures, stream crossings and for use in other locations as directed by the Engineer. Boulders and stone shall be harvested on site whenever possible and shall conform to the size requirements specified below. There is likely some stone on site for use in in-stream structures; however, structures requiring additional stone or larger boulders will likely require materials to be imported. This stone harvest area is located in the existing stream bed of Fiddlers Run. Stone harvested on-site is preferred. If imported rock is necessary, it shall be mixed with available on-site rock to achieve a heterogeneous mixture.

All rock used for in-stream structures shall be clean and free of trash and debris. Native rock encountered during channel excavation shall be identified and stockpiled for use as rock for in-stream structures. The Contractor may supplement native rock with imported rock that resembles the rock found on-site. Rip rap or other non-native gravel aggregates may be utilized as sub-grade material, unless otherwise identified on the Contract Documents. Rock utilized as top dressing, as identified in the Contract Documents, must consist of on-site native rock or similar imported material. Riprap is not permissible as top dressing. The Contractor shall refer to the Contract Documents specific to each in-stream structure for rock sizing requirements. The Engineer shall approve all rock prior to use in in-stream structures to ensure conformity. The Contractor shall discard Engineer-rejected rock from the work zone and replace with suitable material at no additional cost to the Owner. Rejected rock may be disposed of on-site as directed by the Engineer.

The quantity of stone to be installed will be influenced by actual field conditions that occur during the construction of the project. The quantity of stone may be increased, decreased, or eliminated entirely as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Construction Methods and Materials

Refer to the NCDOT Standard Specifications for Roads and Structures, Divisions 5 and 10 and the sections listed below. In addition, all Stone shall be composed of clean, tough, durable fragments free of organic matter or fines.

Item	Section
No. 57 Stone and ABC	1005
Riprap Class A, B, 1 and 2	1042

Aggregates, including #57 stone and ABC, shall be obtained from sources participating in the NCDOT Aggregate QC/QA Program. Aggregates shall consist of rock that meets the gradations listed in the table below.

Aggregate Gradation (% of total weight passing)								
Standard Size	1-1/2”	1”	1/2”	#4	#8	#10	#40	#200
#57	100	95-100	25-60	0-10	0-5	-	-	-
ABC	100	75-97	55-80	35-55	-	25-45	14-30	4-12

Use field stone or rough unhewn stone meeting the sizes listed in the table below for riprap. Stone of a specified class shall have an equal distribution of various sizes of stone within the required size range. No more than 5% of the material furnished can be less than the minimum size specified and no more than 10% of the material can exceed the maximum size specified. Stone shall be sound, tough, dense, resistant to the action of air and water and free of organic debris and trash. Broken concrete or other rubble shall not be used as stone material for any part of this project. A sample of the stone to be used for each class shall be submitted to the Engineer for approval prior to its use on site.

Riprap Stone Sizes (inches)			
Class	Minimum	Midrange	Maximum
A	2	4	6
B	5	8	12
1	5	10	17
2	9	14	23

Boulders shall be sized to have minimum dimensions as indicated on the Plans, shall be relatively flat on either side in the same dimension, preferably the long dimension, and shall be harvested on-site if possible.
The Contractor shall place stone in locations and to the thickness, widths, and lengths as shown on the Plans or as directed by the Engineer. All stone shall be placed neatly and uniformly with an even surface in accordance with the Plans and approved by the Engineer.

Measurement and Payment
Measurement and payment for stone and boulders used in in-stream structures will be incidental to in-stream structures as described in Section 7.0 of these Specifications. Measurement and payment for stone and boulders used in erosion and sediment control features will be incidental to the erosion control structures as described in Section 3.0 of these Specifications.

Such price and payment will be full compensation for all work covered by this section, including but not limited to furnishing, weighing, stockpiling, handling, and installation of imported stone not available on site.

Should additional stone or boulders be required by the Engineer above the scope of the Plans and Specifications, the quantity to be measured for payment will be the actual tons of stone delivered and accepted by the Engineer. This payment will be considered full compensation for all labor, equipment, and any related expenses.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
Alt 4	Misc. Boulders	Tons (TONS)
Alt 5	Misc. Gravel - #57 Stone	Tons (TONS)
Alt 6	Misc. Class ABC	Tons (TONS)
Alt 7	Misc. Class A Stone	Tons (TONS)
Alt 8	Misc. Class B Stone	Tons (TONS)
Alt 9	Misc. Class 1 Stone	Tons (TONS)
Alt 10	Misc. Class 2 Stone	Tons (TONS)

6.2 Filter Fabric

Description
This work consists of furnishing and installing filter fabric as shown on the Plans. Filter fabric is used for stabilization, reinforcement, erosion control and filtration for in-stream structures.

The quantity of filter fabric to be installed will be influenced by the actual conditions that occur during the construction of the project. The quantity of filter fabric may be increased, decreased, or eliminated entirely as directed. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Materials
Refer to Section 1056 for Type 2 Filter Fabric in the NCDOT Standard Specifications for Roads and Structures. All filter fabric used in log structures shall be woven. All filter fabric used in rock structures shall be non-woven. Filter fabric shall meet the requirements listed in the table below. The Engineer shall visually inspect and verify the filter fabric to be used prior to its installation. The product name or label shall be attached to the filter fabric while stockpiled on site to allow for efficient verification of filter fabric properties by the Engineer. Filter fabric

with defects, flaws, deterioration, or damage will be rejected.

Filter Fabric Requirements	
Property	Requirement (MARV)
Elongation (MD & CD)	>50%
Grab Strength (MD & CD)	AASHTO M 288 Table 1 Class 1
Tear Strength (MD & CD)	
Puncture Strength	
Permittivity	AASHTO M 288 Table 6 15% to 50% in Situ Soil Passing 0.075 mm
Apparent Opening Size	
UV Stability (Retained Strength)	

Construction Methods
The Contractor shall install filter fabric in locations and to the widths and lengths as shown on the Plans, or as directed by the Engineer.

Measurement and Payment
Measurement and payment for filter fabric used in in-stream structures will be incidental to in-stream structures as described in Section 7.0 of these Specifications. Measurement and payment for filter fabric used erosion and sediment control features will be incidental to the erosion control structures as described in Section 3.0 of these Specifications.

6.3 Logs

Description
Logs used for in-stream structures shall be harvested on site or supplied by the Contractor. Native hardwood trees encountered during clearing and grubbing shall be identified and stockpiled for use as logs in in-stream structures. All logs should be recently harvested and relatively straight hardwood species, unless otherwise approved by the Engineer. Preservative treated logs or split logs are not acceptable. Use of old logs for in-stream structures, either dead or harvested prior to Site mobilization activities, is prohibited. Logs shall be free of soil and debris prior to installation.

All logs used for in-stream structures must have a minimum 12" DBH, or as noted, per the Plans. The required lengths for each type of in-stream structure are detailed on the Plans. Remaining smaller logs may be utilized in floodplain sills at the discretion of the Engineer.

Nails used to secure filter fabric to log structures will be 3" 10d galvanized nails or standard 3" roofing nails.

Measurement and Payment
Measurement and payment for logs used in in-stream structures will be incidental to individual in-stream structures. The quantity of logs to be installed will be impacted by the actual conditions that occur during the construction of the project. The quantity of logs may be increased or decreased as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

6.4 Brush and Woody Debris

Description
Woody debris shall consist of 3" to 6" diameter woody branches and logs generated on site, which are free of decay and disease. Woody debris shall be hardwood and free from invasive species. The required lengths for woody debris are detailed on the Plans. Split branches or damaged logs are not acceptable for reuse, unless otherwise approved by the Engineer. Woody debris shall be free of soil and debris prior to installation.

Brush consists of larger and smaller woody branches. Branches will be a minimum of five feet in length. Larger branches will have a minimum 3" diameter stem while smaller branches will have a minimum 1" diameter stem. Branches will be hardwood and free of decay or invasive species. Split branches are not acceptable.

Live cuttings consist of live branches cut from healthy, dormant parent plants which are properly adapted to the Site conditions. It is ideal to harvest material for brush toes from on-site plants whenever possible. Live, woody branches no greater than 1" in diameter and between 5 to 10 feet in length shall be used for brush toes. Brush toe material shall be harvested from the same species identified in the live staking plant list or they should be otherwise approved by the Engineer.

Measurement and Payment

Measurement and payment for brush and woody debris is incidental to in-stream structures. The quantity of brush and woody debris to be installed will be influenced by the actual conditions that occur during the construction of the project. The quantity of brush and woody debris may be increased or decreased as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

7.0 In-Stream Structures

Description

The work covered by this Specification consists of the construction of wood and/or boulder or rock structures placed in and along the stream at locations designated on the Plans to provide bank stability and in-stream habitat. The quantity of wood and/or boulder or rock structures to be installed will be affected by the actual conditions that occur during the construction of the project. The quantity of structures may be increased, decreased, or eliminated entirely as directed by the Engineer. Measurement and payment for changes to the quantity of in-stream structures is defined in each individual section below.

In-stream structures consist of the following grade control structures: constructed riffle (CR-CR), angled log riffle (CR-ALR), chunky riffle (CR-CH), log sills, log j-hooks, and a w-weir. Other in-stream structures include brush toe and crayfish glides. Footer rocks or logs used in in-stream structures shall extend inward toward the center of the channel, past the header rocks or logs so that the footers act as a splash rock or log. The elevation tolerance for in-stream structures will be +/-0.1 ft across the entire structure.

Materials

All materials used in in-stream structures shall comply with criteria outlined in Specification 6.0 and 7.0 of these Specifications. The Engineer shall approve all materials prior to use in in-stream structures to ensure conformity. The Contractor shall remove Engineer-rejected materials from the Site and replace at no additional cost.

7.1 Log Sill

Description

This work consists of constructing log sill structures in sections of channel as indicated on the Plans and as directed by the Engineer. Log sills involve constructing log structures in and along the stream at locations designated on the Plans to direct stream flow and to provide grade control.

Construction Methods and Materials

Log sills shall be constructed using the materials listed in the table below having properties consistent with those detailed in Section 6.0 of these Specifications. Logs shall be long enough to be embedded into both banks a minimum of 5 ft beyond toe of slope, or to bankfull, whichever is greater as directed by the Engineer. The backfill material for log sills shall be consistent with the type of riffle that is adjacent to the log sill in the Plans. Riprap is suitable for backfill in the subpavement layer. Top 4" of backfill shall be native or imported cobble material.

Structure	Material	Section
Log Sill	Filter Fabric	6.2

	Logs	6.3
	Nails	6.3

Log sills shall be constructed according to the Plans or as directed by the Engineer. Excavate a trench along the stream bed and bank to allow for a minimum one footer log and one header log. The trench shall be wide enough to allow the logs to be embedded into each bank to bankfull, long enough to allow for filter fabric to be buried a minimum of 5 ft upstream from the header log, and deep enough to facilitate a sill elevation that corresponds with the Plans. Typical minimum log lengths for East Prong Hunting Creek structures shall be a minimum of 35 feet and for Fiddler's Run a minimum of 25 feet, both at a minimum of 24" in diameter. Place the filter fabric along the base of the trench with enough excess material to cover the face of the footer log and header log. Place the footer log at the downstream extent of the trench, pull the excess filter fabric over the footer log, and backfill the trench with sufficient riffle material to meet the top of the footer log. Lay the excess filter fabric back over top of the backfilled material and place the header log on top of the footer log at a 0.25-0.5 ft upstream offset. Pull the excess filter fabric across the upstream side of the header log and secure the fabric to the header log using roofing nails at a minimum offset of 12". Secure the roofing nails approximately 4" below the top of the footer log to ensure they are not exposed when the trench is backfilled. Backfill the trench with the appropriate riffle material to the proposed grades shown on the Plans and trim any exposed filter fabric.

Measurement and Payment

Log sills shall be paid per each structure installed and accepted by the Engineer. Such price and payment shall be full compensation for the items of work, including the cost for furnishing all materials, labor, equipment, tools and incidentals required by the above specification.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
11	Log Sill	Each (EA)

7.2 Log J-Hook

Description

The work covered by this section consists of the construction of log j-hooks placed in and along the stream at locations designated on the Plans to reduce water velocity and direct stream flow away from the bank.

Construction Methods and Materials

Logs used for log j-hooks shall be harvested on site or supplied by the Contractor and shall be a minimum of 12" in diameter (see construction methods below) and of appropriate length to be embedded in each bank a minimum of 12' as shown on the Contract Documents. Refer to Section 6.0 of this document for filter fabric. Boulders used for log j-hooks shall be harvested on site or supplied by the Contractor and shall be a minimum of 4' L x 3' W x 2' H.

Log j-hooks shall be constructed according to the log j-hook detail as shown on the Contract Documents or as directed by the Engineer. Excavate a trench along the stream bed and bank to allow for a minimum one footer log and one header log to be placed at a 25° angle from the bank and a negative slope as shown in the Contract Documents. The trench shall be wide enough to allow the logs to embedded into the bank a minimum of 12', long enough to allow for filter fabric to be buried a minimum of 5' upstream from the header log, and deep enough to facilitate a vane elevation that corresponds with the Contract Documents. Place the filter fabric along the base of the trench with enough excess material to cover the face of the footer log and header log. Place the footer log at the downstream extent of the trench, pull the excess filter fabric over the footer log, and backfill the trench with sufficient native or imported rock (D50 = 2-4") to meet the top of the footer log. Lay the excess filter fabric back over top of the backfilled material and place the header log on top of the footer log at a 0.25-0.5' upstream offset. Pull the excess filter fabric across the upstream side of the header log and secure the fabric to the header log using roofing nails at a minimum offset of 12". Secure the roofing nails approximately 4" below the top of the footer log to ensure they are not exposed when the trench is backfilled. Backfill the trench with

cobble/gravel bed material (D50 = 2-4") to the proposed grades shown on the Plans and trim any exposed filter fabric. Stabilize the log j-hook by placing a boulder (minimum 4' H x 3' W x 2' L) at each end of the header log as shown in the Contract Documents.

Starting from the upstream end of the header log, place footer boulders in an arching pattern toward the opposite stream bank as shown in the Contract Documents; continue placing footer boulders until the boulders are a minimum of 5' into the stream bank. There shall be no gaps or spaces between footer boulders. Place header boulders on top of the footer boulders to the elevations listed in the Contract Documents at a 0.25-0.5' upstream offset. Header boulders within the base flow channel shall be placed with 1-2' spaces between each subsequent boulder. Header boulders that are buried into the channel banks shall be placed with no spaces between each subsequent boulder.

Measurement and Payment

Log j-hooks shall be paid per each structure installed and accepted by the Engineer in the field. Such price and payment shall be full compensation for the items of work including cost for furnishing all materials, labor, equipment, tools, and incidentals required by the above specification.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
12	Log J-Hook	Each (EA)

7.3 W-Weir

Description

The work covered by this section consists of collection, storage, preparation, and installation of all materials required for installation of a w-weir. W-weir structures are constructed to provide grade control at the confluence of two streams, reduce near bank shear stress, and enhance habitat for fish and benthic macroinvertebrates.

Construction Methods and Materials

W-weirs shall be constructed of angular, flat or cubed boulders with a minimum size of 4' x 3' x 2' (L x W x H). Rock should be of sufficient hardness to resist weathering and shall be free of cracks and other blemishes. Porous rock, such as some limestones, and soft rock, such as shales are not allowed. W-weirs shall be installed according to the Plans, the following specifications, and as directed in the field by the Engineer.

W-weirs shall be constructed with two (2) rock vanes on opposing sides of the stream channel forming the outside legs of the w-weirs and two opposing vanes in the center of the channel to complete the w-weir. w-weirs may be staggered, such that one leg of the w-weirs is offset either upstream or downstream of the opposite leg. The "w" shape is seen when viewing the w-weirs from upstream looking downstream.

The outside rock vane components shall extend to the streambed invert in an upstream direction forming the outside legs of the w-weir. The inside legs of the w-weir shall be constructed similar to a rock vane with the exception that the apex (joining point) of the inner legs is at the elevations as shown on the Plans. The w-weir shall be constructed so that adjoining rocks taper in an upstream direction (outside legs) from the bankfull elevation to the stream invert. The inside legs shall extend from the streambed invert in a downstream direction and shall be tapered to a point one-half (½) the bankfull elevation. The elevation of the apex of the w-weir may be adjusted as required or as directed by the Engineer. The upstream end of the outside legs of the w-weir is set at an angle of 20 -30 degrees tangent to the bank.

The downstream end of the outside legs of the w-weir shall be keyed into the streambank at the bankfull elevation. The w-weir shall be keyed a minimum of eight feet (8') into the streambank. The upstream end of the outside legs as well as the upstream end of the inside legs, will be keyed into the streambed at the invert elevation. The w-weir legs shall be installed with a slope of 4% to 7% from the streambed invert to the tie in

point along the bank. Footer rocks shall be installed as shown in the Plans and shall be firmly keyed into the streambed. All w-weir rocks shall be placed behind footers.

Rocks placed to construct the legs of the w-weir shall be placed in a linear fashion to produce a sloping surface. Rock shall be placed with a tight, continuous surface contact between adjoining rock. Rock shall be placed to have no significant gap between adjoining rock. Rock shall be placed to have a final smooth surface along the top plane of the w-weir. No rock shall protrude higher than the other rock in the w-weir leg. A completed w-weir has a smooth, continuous finish grade from the bankfull elevation to the streambed.

Measurement and Payment

W-weirs shall be paid per each structure installed and accepted by the Engineer in the field. Such price and payment shall be full compensation for the items of work including cost for furnishing all materials, labor, equipment, tools, and incidentals required by the above specification.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
13	W-Weir	Each (EA)

7.4 Brush Toe

Description

The work covered by this section consists of collection, storage, preparation, and installation of all materials required for installation of brush toe protection. Brush toe structures are installed along the outer bends of pools as indicated in the Plans and are intended to stabilize the stream bank while providing cover and habitat for fish and benthic macroinvertebrates.

Construction Methods and Materials

Brush toe shall be constructed using the materials listed in the table below having properties consistent with those detailed in Section 3.0 and 6.0 of these Specifications. The backfill material for brush toe shall be Select Material consisting of clay, clay loam or sandy clay loam soil that is free of rock and organic debris.

Structure	Material	Section
Brush Toe	Erosion Control Matting	3.4
	Brush and Woody Debris	6.4

Brush toe protection will be constructed according to the brush toe detail shown on the Plans or as directed by the Engineer. Refer to the Plans for brush toe start station and length along streambank requirements. Over-excavate the stream bank to 5 ft outside bankfull and 0.5 ft below the thalweg. Place a dense layer of woody debris consisting of small branches and roots collected on site and backfill material to fill void spaces. Brush shall be aligned such that the stems are roughly parallel to one another and pointing slightly upstream. Lightly compact the woody debris layer. The top of the woody debris layer shall be at the elevation 1.0 ft above the downstream head of riffle invert elevation following compaction. Place coir matting over the woody debris layer according to the Plans. Place and compact fill material over the coir matting according to the slopes and dimensions in the typical sections. Seed, mulch and install coir matting to the top of bank as shown in the Plans.

Measurement and Payment

Brush toe protection shall be paid per linear foot measured along the bankfull elevation of the structure installed and accepted by the Engineer in the field. Such payment shall be considered full compensation for the items of work, including the cost for furnishing all materials, labor, equipment, tools and incidentals required to construct the brush toe protection.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
14	Brush Toe	Linear Feet (LF)

7.5 Crayfish Glide

Description
The work covered by this section consists of constructing crayfish glide features for the purpose of providing habitat for native crayfish species in the constructed streams.

Construction Methods and Materials
Crayfish glides shall be constructed using selected slab rocks meeting 2' x 2' or 2' x 3' size requirements, or as approved by the Engineer. Slab rocks shall be a minimum 2-3".

All crayfish glides shall be constructed by stacking these selected slab rocks in the glide portion of the stream as located in the Plans. The Contractor shall place the stacks of slab rocks such that the current is swift enough to prevent sediment deposition under or on top of the slab rocks during a flood event. The Contractor shall target five larger stacked slab rock structures per specified glide as identified in the Plans. If larger rocks are unavailable, the Contractor may utilize ten to fifteen smaller slab rocks per structure as approved by the Engineer.

Measurement and Payment
Crayfish glides shall be paid per each glide where the specified number of structures are installed and accepted by the Engineer in the field. Such price and payment shall be full compensation for the items of work including cost for furnishing all materials, labor, equipment, tools, and incidentals required by the above specification.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
15	Crayfish Glide	Each (EA)

7.6 Constructed Riffles

Description
The work covered by this section consists of the construction of various riffle types constructed with on-site or off-site rock and wood and any other materials indicated by details and Specifications. Riffles are installed once local channel excavation is complete.

Construction Methods and Materials
Riffles shall be constructed using the materials having properties consistent with those detailed in Section 6.0 of these Specifications. All riffle types shall be constructed according to the Plans, or as directed by the Engineer in the field. All materials shall be placed neatly and uniformly with an even surface in accordance with the Plans and shall meet the approval of the Engineer. All riffles shall have a low flow channel (thalweg) that does not concentrate flow against the toe of the bank in the form of 0.3'-0.5' V notch.

Native rock encountered during channel excavation shall be identified and stockpiled for use as rock for riffles. The Contractor may supplement native rock with imported rock that resembles the rock found on-site. Rip rap or other non-native gravel aggregates may be utilized as sub-grade material, unless otherwise identified on the Contract Documents. Rock utilized as top dressing (top 6"), as identified in the Contract Documents, must consist of on-site native rock or similar imported material. Riprap is not permissible as top dressing. The Contractor shall refer to the Contract Documents specific to each in-stream structure for rock sizing requirements. The Engineer shall approve all rock prior to use in in-stream structures to ensure conformity. The Contractor shall discard Engineer-rejected rock from the work zone and replace with suitable material at no additional cost to the Owner. Rejected rock may be disposed of on-site as directed by the Engineer.

<u>Constructed Riffle (CR-CR)</u>
Riffles consisting of primarily mixed stone of similar size and distribution of existing bed material. Existing channel substrate will be harvested and used to the extent practicable. Excavate the stream bed in the riffle section and backfill with the stone of the specified size to meet the minimum depth and final grades shown on the Plans.

Angled Log Riffle (CR-ALR)

Angled log riffles are constructed in a manner that incorporates angled logs in and along the stream at locations designated on the Plans, and as directed by the Engineer, to diversify the low flow path. If there is a lack of on-site logs to use in construction of this structure, boulders may be used in their place. Substitution of these materials is considered incidental to the cost of the structure and not considered a change in project scope or activities. Substitutions must be approved by Engineer.

To construct the angled log riffle, excavate the stream bed in riffle sections, place the log or boulder structures to diversify the low flow path, line log or boulder with appropriate filter fabric and then backfill with native stone of the specified size to meet the minimum depth and final grades shown on the Plans. Install logs/boulders with fabric in sequence, with armored glides that cover fabric and protect the log drops. Armored glide shall have a minimum thickness specified in detail at the abutment to log/boulder drops. Armored glides shall be tamped and compacted into place. All stone shall be placed neatly and uniformly with an even surface in accordance with the Plans and shall meet the approval of the Engineer. There shall be a minimum of four logs/boulder sills per structure. The low point of the first and last log in each angled log riffle shall be on the point bar side of the channel. Drops over each log/boulder sill shall not exceed 0.5 feet in height and drops shall be of approximately equal height to equal the total drop over the riffle as depicted on the profile.

Chunky Riffle (CR-CH)

Chunky riffles consist of large cobble/gravel bed material (D_{50} = 6") and boulders (minimum 0.5' H x 1.0' W x 1.5' L). To construct a chunky riffle, over-excavate riffle bed as required to install larger rock, typically boulders. Place boulders in the channel at an irregular pattern such that at least 3 boulders occur every square yard within the chunky riffle according to the Contract Documents or as directed by the Engineer. Place riffle material to within 4" of the total required riffle depth and tamp to compact. Backfill with native sediment and fine sands to establish solid base substrate for placement of finish riffle material. Re-compact as necessary. This is intended to help lock the base substrate in place. It may be necessary to water the sediment in to ensure it mixes in with the base substrate. Place top 4" of riffle material over the base substrate to meet final riffle design per the structure table and the profile. After rock placement is complete, tamp a meandering low flow channel through the riffle substrate. Keep the low flow channel away from the toe of slope.

Measurement and Payment

Constructed riffles shall be paid per linear foot measured along the thalweg of the structure installed and accepted by the Engineer. Such price and payment shall be full compensation for the items of work, including the cost for furnishing all materials including on-site harvest of stone and wood, labor, equipment, tools, and incidentals required by the above specification.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
16	Constructed Riffle (CR-CR)	Linear Feet (LF)
17	Angled Log Riffle (CR-ALR)	Linear Feet (LF)
18	Chunky Riffle (CR-CH)	Linear Feet (LF)

7.7 Floodplain Sill

Description

The work covered by this section consists of the construction of floodplain sill structures placed perpendicular to flow across a floodplain for the purpose of reducing water velocities on the floodplain and preventing concentrated flow paths.

Materials

Refer to Section 6.0 for the material specification for logs.

Construction Methods
Floodplain sills shall be constructed at locations shown on the Plans or as adjusted by the Engineer in the field. A trench shall be dug wide enough and deep enough to place the 8" to 12" diameter logs and 4" of cover soil over the log. Each log shall overlap others by a minimum of 12 inches. Logs should be embedded 5 feet into the valley wall.

Measurement and Payment
The contractor shall provide all labor, materials and equipment required to harvest and install the floodplain sill. Floodplain sills will be paid on a linear foot basis. Such payment shall be considered full compensation for the items of work including the cost for furnishing all materials, labor, equipment, tools, and incidentals required to construct the floodplain sill.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
19	Floodplain Sill	Linear Feet (LF)

8.0 Bridge Crossings

8.1 Prefabricated Pedestrian/Vehicle Bridges

Description
The work covered by this section consists of the installation of two prefabricated span bridge crossings – one each on Fiddlers Run and East Prong Hunting Creek. Bridge design and minimum requirements are listed below. Throughout this section, where specifications vary based on bridge type, variations are identified for individual bridges corresponding to Fiddlers Run (FR) and East Prong Hunting Creek (EPHC):

<u>Fiddlers Run (FR):</u>

Bridge Model: Pedestrian Truss Bridge - Connector - Half Through H Section - Parallel Chords - Pratt Diagonals
Length: 50 ft. (End to End of Truss)
Width: 12 ft. (Between Inside Face of Top Chords)
Design Code: AASHTO LRFD Guide Specifications for Design of Pedestrian Bridges 9th Edition
Design Vehicle: H10 Design Vehicle 90 psf.
Number of Pieces: 1
Finish: A847/A588 (Weathering) SP7
Bridge Decking: Cast-In-Place Reinforced Composite Concrete
Wearing Surface: Concrete
Railing Type: Horizontal L1.25x1.25x1/8 Safety Rails with 4 inch maximum openings
Railing Height: 48 inches

<u>East Prong Hunting Creek (EPHC):</u>

Bridge Model: Site-Specific Modular
Length: 75 ft (out to out girder dimension)
Width: 12 ft (clear between rails)
Design Code: AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020
Live Load: HL-93 Design Vehicle
Max LL Deflection: Length/ 500
Finish: Weathering, SP1 Clean
Bridge Decking: Cast-In-Place Reinforced Composite Concrete
Wearing Surface: Concrete
Railing Type: Horizontal L1.25x1.25x1/8 Safety Rails with 4 inch maximum openings
Railing Height: 48 inches

8.1.0 General

These specifications are for fully engineered half through truss (no overhead bracing) bridge of steel construction and shall be regarded as minimum standards for design and fabrication. The work included under this item shall consist of design, fabricating, finishing and transporting the steel truss bridge superstructure including bearings. These specifications are based on products designed and manufactured by Contech Engineered Solutions LLC.

Definitions

- *Owner*: Entity who ultimately will own the bridge.
- *Engineer*: Engineering Entity or Firm who will be representing the Owner.
- *Contractor*: Entity who will be installing, and/or purchasing, the bridge.
- *Foundation Engineer*. Engineering Entity or Firm who will be designing and detailing the foundation system. The Contractor is responsible for providing foundation shop drawings to the Owner and Engineer.
- *Geotechnical Engineer*. Engineering Entity or Firm who will be responsible for providing the Geotechnical information necessary to design the foundation system. The Owner will provide the Contractor with a geotechnical report. The Contractor is not responsible for geotechnical investigation.
- *Bridge Manufacturer*: Firm who will be designing and supplying the bridge in accordance with these Special Provisions. The Contractor is responsible for determining the qualified bridge manufacturer.

Qualified Bridge Manufacturer

Each Contractor is required to identify their intended Bridge Manufacturer as part of the bid submittal. Qualified Bridge Manufacturers must have at least 5 years of experience fabricating these types of structures and shall have an up-to-date quality certification by AISC as Certified Bridge Fabricator - Advanced (Major) with Fracture Critical Endorsement and Sophisticated Paint Endorsement. All suppliers shall fabricate their product utilizing a modern fabrication facility owned and operated by the Bridge Manufacturer that includes the use of CNC beam drilling machines, no brokers are allowed.

Pre-Approved Bridge Manufacturer:

Contech Engineered Solutions LLC
(803) 216-4274
Jim Campbell – Bridge Consultant
Jim.Campbell@ContechES.com

Bridge Manufacturers, other than those listed above, may be used provided the Engineer receives a written request at least 10 days prior to the bid. The written request shall accompany the following information:

- Bridge Manufacturer's Product Literature,
- Name and resume of Bridge Manufacturer's design professional who will be signing and sealing the engineering submittals,
- Copy of current AISC certification,
- Representative copies of detailed drawings, field procedures, calculations, quality control manual, welder's certifications, proof of in-house C.W.I.,
- Listing of projects including owner, location, size, year of fabrication, contact person,
- Certification by the Bridge Manufacture's Design Professional that the bridge proposed will be in accordance with all project development done up to the date of these specifications.

The above will be evaluated by the Engineer for accuracy and ability to provide the bridge in accordance with these specifications. Bridge Manufactures other than those listed above may only be used if the Engineer provides written approval 5 days prior to the bid. The Engineer's ruling shall be final.

Bridge Manufacturer's Design Professional and Submittals

The Bridge Manufacturer shall have as a direct employee, an engineer who is experienced in bridge design to be in responsible charge of all engineering related task and design. The Bridge Manufacturer's design engineer shall have a minimum of 10 years of experience in bridge design and be a currently licensed civil or structural engineer in the State of North Carolina who will seal and sign the plans.

Engineering drawings, 11x17 format, shall be prepared and submitted to the Contractor or Owner for their review after receipt of the order. Submittal drawings shall be unique drawings, prepared to illustrate the specific portion of the bridge being fabricated. All relative design information such as member size, ASTM/AASHTO material specification, dimensions necessary to fabricate and required welding shall be clearly shown on the drawings. Drawings shall have referenced details and sheet numbers. All drawings shall be stamped, signed and dated by the Bridge Manufacturer's Design Professional.

Structural calculations for the design of the bridge superstructure shall be prepared by the Bridge Manufacturer and submitted for review after receipt of the order. Calculations shall include complete design, analysis and code checks for the controlling members, connectivity and support conditions, truss stability checks, deck design, deflection checks, bearings and all splices.

8.1.1 Applicable Codes and Standards

Governing Specifications

Bridge shall be designed in compliance with the AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges, 2009 (*AASHTO Ped*). Calculations shall be in accordance with this document, and formulas shall reference the appropriate sections.

Other References, Codes, Specifications and Standards

- AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020 (*AASHTO LRFD*)
- AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition, 2005 (*AASHTO Signs*)
- AISC Steel Construction Manual, 15th Edition, 2017 (*AISC*)
- American Welding Society, Structural Welding Code, D1.1, 2015 (*AWS D1.1*)
- ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures, 2010 (*ASCE 7*)
- Setra Technical Guide for Footbridges, 2006 (Setra)
- ANSI/AWC NDC-2015 National Design Specification for Wood Construction, 2015 (*NDS*)
- Tropical Timbers of the World, US Forest Products Laboratory

The AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges shall control if any conflicting requirements occur with the Other Reference Documents and/or other local Codes.

8.1.2 Bridge System Type

FR:

Truss Style

The truss style shall be a Connector®. The vertical trusses shall be designed such that the top and bottom chord members are parallel for the entire length of bridge. The interior verticals of the trusses shall be perpendicular to the top face of the bottom chord and the end verticals of the trusses shall be plumb. Trusses shall be laid out such that diagonals shall be at an angle of 30-degrees or more with respect to the bottom chord.

Diagonal Style

The vertical truss shall use a single-diagonal, Pratt configuration, where all the diagonals are in tension for gravity loads.

Floor Beam Location

The bridge shall utilize an H-Section configuration where the ends of the floor beams are welded only to the interior face of the verticals. The distance from the top of deck to the bottom of the bottom chord shall be determined by the Bridge Manufacturer during final design.

EPHC:

Rolled Girder Style (East Prong Hunting Creek)
The Rolled Girder style shall be a modular design, prefabricated, beam vehicular bridge meeting AASHTO HL-93 loading. Structural longitudinal beams shall be domestic melt Wide Flange and meet ASTM A709 Grade 50W with a minimum yield (Fy) of 50,000 psi or greater. Steel plate members should meet ASTM A242 or ASTM A588. Bridge should be designed in compliance with AASHTO LRFD bridge design, 9th Edition. Fabrication shall be in accordance with AISC, Steel Construction Manual, 15th Edition and American Welding Society, Structural Welding code D1.5. All structural members shall have a minimum thickness of material in accordance with AASHTO section 6.7.3.

Concrete Decks with Stay in Place Forms
Stay in place (SIP) corrugated Metal deck forms shall have a minimum depth of 2". The minimum thickness of the SIP forms shall be not less than 18 gauge and shall have G165 galvanized coating. The bridge superstructure designer shall perform the structural design of the concrete deck slab and steel reinforcing size and spacing. All formwork for concrete floor: side forms and end dams along with deck pans shall be supplied by bridge manufacturer. If required, polystyrene insulation in the SIP forms shall be provided and installed by the purchaser or installer.

Providing, pouring and finishing of 4000 psi concrete and the furnishing and installing the reinforcement shall be the responsibility of the contractor or owner.

8.1.3 Bridge Geometry

Span Length
FR - The bridge span length shall be 50'-0" (horizontal straight line dimension) and measured from end to end of the bridge truss, not including the end dam, any deck extension or bearing that extends beyond the end of the truss.

EPHC - The bridge span length shall be 75'-0" (straight line dimension) and measured from end to end of the bridge structure, not including the end angle or any deck extension beyond the end of the stringer.

Width
The bridge width shall be 12'-0" and shall be as measured from the inside face of structural truss elements at the deck level.

Top of Truss Height Above Deck
The top of the top chord shall not be less than 48" above the deck (measured from the high point of the deck). Note that this dimension may be exceeded due to truss height requirements for structural, deflection and vibration requirements.

Lower Steel Clearance
The bridge manufacturer shall determine the distance from the top of the deck (measured from the highest point of the deck) to the bottom of any steel member.

Truss Bay Spacing
The number of bays and the dimension of the panel points shall be determined by the Bridge Manufacturer.

Camber
A single simple-span bridge shall have a vertical camber dimension at the mid-span equal to 100% of the anticipated full dead load deflection. If beam mill camber is adequate to accommodate full dead load deflection, then indicate so on drawings.

Elevation Difference
The top of the decks shall be at the same elevation at each end of the bridge.

Deck
Concrete deck shall have a minimum thickness of 8-inches above the top of the stay-in place forms. Concrete deck shall be flat from one the edge of the traffic lanes to the other edge of the traffic lanes.

8.1.4 Structural Design Loads

Dead Load
The bridge structure shall be designed for the total bridge weight including the final deck system.

Pedestrian Loading (PL)
The bridge structure shall be designed for a uniform pedestrian loading of 90 psf. This loading shall be patterned to produce the maximum load effects. Consideration of dynamic load allowance is not required with this loading.

Vehicle Loading (VL)
FR - When vehicular access is not prevented by permanent physical methods, the superstructure and deck system shall be designed for each of the following concentrated/vehicular loads:

- A concentrated load of 1,000 pounds placed on any area 2.5' by 2.5' square.
- A single truck shall be placed to produce the maximum load effects and shall not be placed in combination with the pedestrian load. The dynamic load allowance need not be considered for this loading. The truck shall be the following:
    - H10 vehicle (20,000 pound two-axle vehicle with 80% to rear axle).

EPHC - Bridge shall be designed for one lane of traffic, supporting HL-93 design vehicle plus Dynamic Load Allowance. The maximum design ADTT (Average Daily Truck Traffic) shall be determined during design by Bridge Manufacture's Engineering Department. Bridge shall also be designed for a T370 Series Conventional Full Truck Owner Specified Vehicle.

Wind Load (WS)
Pedestrian bridges shall be designed for wind loads as specified in *AASHTO Signs*, Articles 3.8 and 3.9. The loading shall be applied over the exposed area in front elevations of both trusses including all enclosures.

In addition to the wind load specified above, a vertical uplift line load as specified in *AASHTO LRFD* Article 3.8.2 and determined as the force caused by a pressure of 20 psf over the full deck width, shall be applied concurrently. This loading shall be applied at the windward quarter point of the deck width.

Seismic (EQ)
The bridge structure shall be designed for seismic loading as specified in Section 3.10 of *AASHTO LRFD*. The transverse loads shall be calculated considering the transverse period of the bridge and longitudinal loads shall be calculated using a period of zero. A response modification factor of 0.8 shall be used for the calculation of forces applied to the bridge anchorage. A response modification factor of 1.0 shall be used for the calculation of bearing reactions. The transverse seismic load shall be applied to all the bearings and the longitudinal seismic load shall be applied to the fixed bearings only. The vertical bearing reactions shall be calculated using an overturning force on the bridge based on the center of gravity of the bridge times the transverse seismic load.

Fatigue Load (FL)
FR - The fatigue loading shall be as specified in Section 11 of *AASHTO Signs*. The Natural Wind Gust specified in Article 11.7.1.2 and the Truck-Induced Gust specified in Article 11.7.1.3 of *AASHTO Signs* only need only be considered, as appropriate.

EPHC - The fatigue loading shall be as specified in AASHTO LRFD Article 6.6.

Combination of Loads
The load combinations and load factors to be used shall be as specified in *AASHTO LRFD* Table 3.4.1-1, with the following exceptions:

- Load combinations Strength II, Strength IV, and Strength V need not be considered.
- The load factor for Fatigue I load combination shall be taken as 1.0, and Fatigue II load combination need not be considered.

8.1.5 Structural Design Criteria

Modeling
The bridge shall be modeled and analyzed utilizing a three-dimensional computer software which shall account for moments induced in members due to joint fixity where applicable. Moments due to both truss deflection and joint eccentricity must be considered. All loads listed in Section 8.5 of these specifications shall be applied to the model and analyzed appropriately.

Lateral Frame Design
The bridge shall be designed and proportioned such that appropriate lateral stiffness is provided locally and globally, to ensure that the structure is stable.

For bridges without any overhead members (Half-Through Trusses), the vertical truss members, the floor beams and their connections shall be proportioned to resist a lateral force applied at the top of the truss verticals at the center of the top chord. This lateral force shall be applied as an additional load to the top of the vertical at the center of the top chord, creating a cantilever moment, which is then added to the forces obtained from the three-dimensional model. The magnitude of this lateral force shall not be less than 0.01/K times the average factored design compressive force in the two adjacent top chord members increased by a factor of safety of 1.33.

The top chord shall be analyzed as a column with elastic lateral supports at the panel points, considering all moments due to in-plane and out-of-plane bending, along with moments due to eccentricities of the members.

The U-Frame Stiffness of the verticals and floor beams shall be as specified in *AASHTO Ped* Article 7.1.2, assuming that the vertical and floor beam connection is rigid. This means that the following must be met:

- On H-Section floor beam connections, the floor beam width shall be at least 80% of the vertical face width in order to prevent any deformation due to tube wall plastification of the vertical member faces under service loads. The connection design will be checked at Strength I & Strength III load combinations.
- On Underhung floor beam connections, the vertical width shall match the bottom chord width in order to transfer vertical moments through the walls of the bottom chord to the verticals with no deformation of the chord side walls due to sidewall yielding or crippling under service loads. The connection design will be checked at Strength I & Strength III load combinations.
- The vertical and floor beam members shall not be connected to faces of the bottom chord at a 90-degrees to one another.
- All fixed end moments in the floor beams and verticals due to floor beam rotations, in addition to the loads derived from a U-Frame analysis have been accounted for in the strength design of the connections.

At no time shall a K>2.0 be used in the design of the top chord.

The end verticals shall be designed as a simple cantilever to carry the loads obtained from the three-dimensional model, plus the cantilever moment due to a lateral load of 0.01 times the axial force in the

end vertical, applied laterally at the top end of the end vertical at the center of the top chord.

The floor beams shall be sized for the forces obtained from a simple span, pinned end analysis, or from the forces obtained from the three-dimensional model, whichever controls.

The diagonals and brace diagonals shall be analyzed as pinned-end connection members.

Interior verticals shall be analyzed as pinned-end connections unless longitudinal forces are applied to the verticals such as when the brace diagonals are connected to floor beams on an H-Section floor beam configuration. When longitudinal forces are applied to the verticals they shall be analyzed as fixed-end connections.

All other members shall be analyzed as fixed-end connections.

Deflections

FR - The vertical deflection of the bridge due to the unfactored pedestrian live loading shall not exceed 1/360 of the span length. The horizontal deflection of the bridge under unfactored wind loading shall not exceed 1/360 of the span length.

EPHC - Per the AASHTO LRFD Article 2.5.2.6.2, vehicle load deflection limits are considered optional and are not being used. However, the Bridge Manufacturer will provide an anticipated vehicle load deflection of no more than Span/500.

Fracture

FR - The fracture toughness requirements and designation of Fracture Critical Member and Main Member designation are hereby waived for these structures.

EPHC - The structural system shall be considered a redundant system with Nonfracture-Critical members. The girders shall meet Zone 2 CVN requirements for Nonfracture-Critical members.

Wheel Load Distribution

EPHC - The deck shall be designed to support the maximum wheel load from the design vehicle or owner specified vehicle. For design vehicle or owner specified vehicle, the tire contact area is to be assumed to be 20" transverse and 10" longitudinal.

Concrete Deck Composite Design

EPHC - The concrete deck shall be designed to act as a composite system with the steel stringers. Shear studs shall be shop welded to the top flange of the stringers to ensure composite action and be designed as specified in AASHTO LRFD Article 6.10.10.

Vibrations

Vibration of the structure shall not cause discomfort or concern to the users of the bridges. To assure this, the fundamental frequency (f) of the pedestrian bridge in the vertical direction, without live load, shall be greater than 3.0 hertz (Hz) to avoid the first harmonic. The fundamental frequency of the pedestrian bridge in the lateral direction, shall be greater than 1.3 Hz. If the fundamental frequency cannot satisfy these limitations, then the bridge should be proportioned such that either of the following criteria are satisfied:

$$f \geq 2.86 * \ln(180/W)$$

or

$$W \geq 180 * e^{(-0.35 * f)}$$

Where W is the weight of the bridge in kips and f is the fundamental frequency in the vertical direction in Hz.

For bridges longer than 85 ft and shorter than 125 ft the vertical and horizontal vibration must also meet the requirements for Bridge Class III with a Mean comfort level in accordance with *Setra*.

8.1.6 Deck System

FR - Deck to be comprised of Reinforced Concrete designed to span from floor beam to floor beam.

Reinforced concrete shall be normal weight concrete (145 pounds per cubic foot maximum) and shall have a minimum compressive strength of 4,500 psi at 28 days, with an air content of 6% +/- 1.5%.

Concrete mix design, materials, quality, mixing, placement, finishing and testing shall be in accordance with the requirements of Section 552 of Federal Highway Administration Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-14). FP-14 can be viewed or downloaded at: http://flh.fhwa.dot.gov/resources/specs

The surface of deck concrete shall be finished with a sidewalk finish per Section 552.14(c) of FP-14.

Stay-in-place galvanized (G90 coating) metal form deck shall be used and shall be designed to support the weight of the wet concrete plus a 20 pounds per square foot construction load. Form deck shall be shop attached to floor beams via self-drilling fasteners, welding or power actuated fasteners. Welding shall not be used on painted or galvanized bridges. The longitudinal sheet laps shall be attached with self-drilling self-tapping fasteners at 36-inch maximum spacing. The attachment of the form deck to the floor beams is only necessary to keep the form deck in place during transportation and during the concrete placement. The form deck is not to be used for diaphragm action or composite action and provides no structural benefit to the truss or the deck after the concrete is set. Metal form deck panels shall be of a length to span a minimum of two bays of the truss supports. The top of deck to bottom of form deck shall be as required to support the anticipated loads but shall not be less than 5".

The concrete deck shall be designed to span longitudinally from floor beam to floor beam and to support the loads specified in Section 8.5 of these specifications.

A distribution width of deck is allowed, to support the anticipated vehicle wheel loads. This distribution width (E in feet) shall be the narrower of the following:

- E = 4 + .06S
    - Where S is the floor beam spacing minus one-half of the floor beam width.
- One-half of the total driving width of the bridge deck.
- 0.75 times the lateral wheel spacing of the vehicle.
- 0.6S + Wheel Width
    - Where S is the floor beam spacing minus one-half of the floor beam width.
    - The Wheel Width (in inches) is $2.5 * \sqrt{(\frac{0.01*P}{2.5})}$, where P is the wheel load in pounds

Reinforcing steel shall be ASTM A615 Grade 60 non-coated bars. All bar bends, anchorage and splices shall be in accordance with AASHTO Specifications. Top reinforcing shall have a minimum clearance of 2" to the top of deck.

Bridge Manufacturer shall designate the estimated slab thickness and reinforcing requirements at time of quotation. These estimates are to be used for quoting purposes only. Actual quantities may vary during the final design process, with costs variances due to any changes to the quantities being the sole responsibility of the contractor. Contractor shall supply all concrete and reinforcing materials.

EPHC - Metal stay-in-place forms shall be used for forming the concrete deck and shall be of zinc-coated (galvanized) structural steel sheet conforming to ASTM Specification A653 with a coating class of G165. The stay-in-place form shall be designed to support all dead loads plus an additional 50 psf for construction loads. The unit working stress in the steel sheet shall not exceed 0.725 times the specified minimum yield strength of the material, or 36ksi, whichever is smaller. Deflection of the stay-in-place form under all dead loads shall not exceed 1/180 of the form span or ½-inch, whichever is less. The Bridge Manufacturer is responsible for the design of the stay-in-place forms. Stay-in place forms shall be shop installed by the

Bridge Manufacturer as much as possible to minimize field installation.

All reinforcing steel shall be in accordance with ASTM A615 Grade 60 and ASTM A775 for Epoxy-Coated. Size and spacing of the reinforcing steel shall be as designed by the Bridge Manufacturer.

Concrete shall have a minimum 28-day compressive strength (f'c) of 4500 psi, air content of 5.5% +/- 1% and a maximum unit weight of 145 lb/ft3.

Concrete mix design, materials, quality, mixing, placement, finishing and testing shall be in accordance with the requirements of Section 552 of Federal Highway Administration Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-14). FP-14 can be viewed or downloaded at: http://flh.fhwa.dot.gov/resources/specs.

8.1.7 Materials of Construction

Structural Steel

All members of the truss and deck support system shall be fabricated from square or rectangular hollow structural shapes (HSS), with the exception that floor beams may be wide flange shapes. All open ends of end posts and floor support beams shall be capped. Drain holes shall be provided for all sections at the low point of the member that may become filled with water.

All bridges shall be fabricated using A847 for HSS sections and A588 for structural shapes and plates.

Minimum nominal thickness of primary hollow structural shapes shall be 1/4". Rolled shapes shall have a minimum thickness of 1/4".

Fasteners

Structural bolts used to field splice or connect all main members shall be ASTM F3125 Grade A325. The nuts for these structural bolts shall be ASTM A563. The Bridge Manufacturer shall determine the finish of the structural bolts. They will be either Type 3 (Weathering) or Type 1 (Hot-Dipped or Mechanically Galvanized) as specified by the Bridge Manufacturer.

Bolts used for the connection of a wood rub rail shall be 18-8 or 316 Stainless Steel, ¼" diameter carriage bolts.

Screws for the attachment of wood deck shall be steel, 5/16" diameter, six lobe drive, self-tapping screws. The screws shall have flat heads for the screws in the wood and round heads for the screws on the edge cover. The screws shall have a protective coating that will prevent corrosion due to contact with treated wood and environmental exposure.

Self-drilling fasteners for attachment of the form decking shall be #14 x 1" zinc plated hex washer head Tek screws.

Power Actuated fasteners shall be Hilti sheet metal nail X-ENP-19 fastener.

Other miscellaneous fasteners shall be ASTM A307 zinc plated or galvanized, as determined by the Bridge Manufacturer.

8.1.8 Finish

For corrosion resistant high-strength low-alloy (weathering) steel no surface finish treatment is necessary. All exposed surfaces of structural steel to be cleaned in accordance with Steel Structures Painting Council Surface Preparation Specifications No. 7, SSPC -SP7 brush-off blast cleaning. Exposed surfaces of steel shall be defined as those surfaces seen from the deck or from the outside and bottom of the structure. All other surfaces to have standard mill finish. The steel will be allowed to form a protective weathering patina over time.

8.1.9 Attachments

Safety Rails

Safety rail system shall be placed on the inside of the structure, spaced so as to prevent a 4" sphere from passing through the side truss for the full height of the side truss, or 48" , whichever is less. The top of the top chord may be considered the top of the rail system.

Rails system shall consist of horizontal rails. Rails shall be L 1 ¼ x 1 ¼ x 1/8 placed at a 45-degree orientation with both legs welded to truss verticals and with a maximum unsupported length of 6'-0" if placed on the inside of the structure and 7'-0" if placed on the outside of the structure. If the truss vertical spacing is greater than the maximum unsupported length, mid-bay supports will be required. When safety rails are placed on the inside of the structure and not covered by the end vertical, the ends of rail near the end of the bridge shall be mitered at a 45-degree angle, capped and ground smooth. No solid plate covering all rails as a unit will be allowed. Spec Image-Safety Rail TypeSpec Image-Safety Rail SystemSpec Image-Safety Rail System Type

Each element of the pedestrian rail system shall be designed to support a uniformly applied load of 50 pounds per lineal foot, both transversely and vertically, acting simultaneously. In addition, each longitudinal element shall be designed to support a concentrated load of 200 pounds, which will act simultaneously with the above uniform loads at any point and in any direction at the top of the longitudinal element.

The posts of the pedestrian rail system shall be designed for a concentrated load applied at either the center of gravity of the upper longitudinal element or 60" above the top of the walkway, whichever is less. This concentrated load shall be equal to 200 pounds plus 0.05 times the post spacing in feet.

Toe Plate
Toe Plates shall be steel channel shape section, 4" high by 1" wide minimum with the end of the channel legs welded directly to the inside face of the truss verticals. The maximum unsupported length shall be 7'-0". If the vertical spacing is greater than the maximum unsupported length, mid-bay supports will be required. When the ends of the toe plates near the end of the bridge are not covered by the end verticals, they shall be capped and ground smooth. The bottom of the toe plate shall be placed 2" above the finished height of the deck. All seams of the toe plates shall be fully welded to give the appearance of a continuous member (welding should be located at a support member). If toe plates are incorporated into a safety rail system, they may be modified as needed but shall be a minimum of 4" high.

Expansion Joint
The gap between the end of the bridge deck and the back wall of the foundation system be sized to accommodate bridge movements due to thermal expansion of the bridge over the design temperature range. The gaps shall be covered with a steel cover which attaches to the bridge and extends over the gap and onto the top of the foundation system back wall. The steel cover shall have its edges rounded or beveled at a 45-degree angle. A compression seal sized for movement and rated for pedestrian traffic may be used in place of the steel cover.

8.1.10 Bearings

Bearing Type
Bearing type and size shall be designed by the Bridge Manufacturer based on anticipated loads and movements.

Design Temperature Range
The Design Temperature Range will be site specific and will be determined per *AASHTO LRFD* Article 3.12.2.

Non-Shrink Grouting
The bridge will be supplied with a lower setting plate. This setting plate shall be leveled and shimmed to the proper elevation. The space between the lower surface of the setting plate and the foundation surface

shall be filled with a non-shrink grout capable of achieving a minimum compressive strength equal to or greater than the strength of the foundation concrete. The cost of the leveling, shimming, and non-shrink grout shall be the responsibility of the Contractor.

Bearing Plates (EPHC)
Bearing plates shall be used under the stringers at both ends of the bridge and shall be designed to support the anticipated reactions. Bearing plate material shall be ASTM A588. The Bridge Manufacturer should design the bearing plates such that one end of the bridge is fixed, and the other end allows for expansion. All bearing plates should have a minimum of two holes to receive anchor bolts (one on each side of the stringer). For the expansion base plates, holes shall be slotted with a minimum slot length to allow for expansion and contraction. All bearing plates shall be shipped loose for field installation by others; field welded to the stringers by an AWS D1.5 certified welder.

If the longitudinal grade of the bridge is greater than 1.5%, then the bearing plates shall be beveled across their width in order to provide a level bearing condition on the elastomeric pads.

Elastomeric Pads (EPHC)
The Bearing plates will be placed on top of elastomeric pads. Elastomeric pads shall be Grade 4, 60-Durometer Neoprene or natural rubber. Pads may not meet AASHTO LRFD design criteria and are to be used only as leveling pads only.

8.1.11 Foundations

Foundation System
Foundation system shall utilize abutments designed by the Contractor's Foundation Engineer in conjunction with the bridge bearing requirements and dimensions provided by the Bridge Manufacturer and the site-specific geotechnical information provided by the Geotechnical Engineer. All abutment dimensions and materials shall be shown on the final contract plans.

Anchor Bolts
Bridge Manufacturer shall design the diameter and grade of anchor bolts, based on the shear and tensile strength of the anchor bolt material only. All design considerations regarding concrete breakout strength in shear and tension, pullout strength, concrete side-face blowout strength, concrete pry out strength, embedment depth, type of anchorage or any other concrete failure modes are the responsibility of the Foundation Engineer and shall be shown on the final contract plans. All anchor bolts shall be galvanized. The Foundation Engineer shall determine if the anchor bolts shall be cast-in-place, drilled/epoxy, or expansion anchors. Anchor bolts shall be provided and installed by the Contractor.

8.1.12 Fabrication

Welding
Welding procedures and weld qualification test procedures shall conform to the provisions of *AWS D1.1*. Filler metal shall be in accordance with the applicable AWS Filler Metal Specification and shall match the corrosion properties of the base metal.

Welders
Welders shall be qualified for each process and position used while fabricating the bridge. Qualification tests shall be in accordance with AWS D1.1. All weld qualifications and records shall be kept in accordance with the Fabricator's Quality Assurance Manual which has been approved and audited by AISC as the basis for certification.

8.1.13 Quality Control

AISC Certification
The bridge shall be fabricated in a shop owned by the Bridge Manufacturer. This facility shall have up to date quality certification by AISC per Section 8.1.3 of these specifications.

Certified Welder Inspector

The bridge manufacturer shall employ a Certified Weld Inspector (CWI), with endorsement by AWS QC1. This CWI shall be present during the complete fabrication of the bridge. The CWI shall provide written documentation that the bridge has been fabricated in accordance with these specifications and the approved design drawings.

Documentation
Material Certifications shall be available for review for all materials within the bridge. Traceability of heat numbers is required for all structural steel.

Documentation showing the performance of all critical quality checks shall also be made available for review by the Engineer or Owner.

Non-Destructive Testing
All welds within the structure, shall be visually inspected for conformance to size, under cut, profile and finish. All shop splices of main truss members shall be magnetic particle tested.

8.1.14 Delivery and Erection

Delivery
Delivery shall be made via truck to a location nearest the site which is accessible to normal over-the-road equipment. All trucks delivering bridge materials will need to be unloaded at the time of arrival. If the erection Contractor needs special delivery or delivery is restricted, they shall notify the Bridge Manufacturer prior to bid date. This includes site issues which may prevent over-the-road equipment from accessing the site. Steerable dollies are not used in the cost provided by the Bridge Manufacturer. Determining the length of bridge section which can be delivered is the responsibility of the Contractor and shall be communicated to the Bridge Manufacturer prior to the bid date.

Installation & Lifting Procedures
The Bridge Manufacturer will provide standard typical written procedures for lifting and splicing the bridge. All actual means, methods, equipment and sequence of erection used are the responsibility of the Contractor.

8.1.15 Warranty

The Bridge Manufacture shall warrant, at the time of delivery, that it has conveyed good title to its steel structure, free of liens and encumbrances created by the Bridge Manufacture, and that its steel structure is free of defects in design, material and workmanship. This warranty shall be valid for a period of one (1) year from the earlier date of delivery or 60 days after final fabrication is complete. Durable tropical hardwood decking and hardwood attachments shall carry a one (1) year warranty against rot, termite damage, or fungal decay. This warranty shall specifically exclude all softwood and decking material such as Treated Southern Yellow Pine, Douglas Fir and Wood thermoplastic composite lumber (e.g. Trex). Paint, galvanizing and other special coatings, if warranted, shall be warranted by the coating manufacturer in accordance with their warranty provisions and are not covered under the Bridge Manufacturer's warranty.

This warranty shall not cover defects in the steel structure caused by abuse, misuse, overloading, accident, improper installation, maintenance, alteration, or any other cause not expressly warranted. This warranty shall not cover damage resulting from or relating to the use of any kind of de-icing material. This warranty shall be void unless owner's records are supplied that show compliance with the minimum guidelines specified in the in the Bridge Manufacture's inspection and maintenance procedures.

Repair, replacement, or adjustment, in Bridge Manufacture's sole discretion, shall be the exclusive remedy for any defects under this warranty. This warranty shall exclude liability for any indirect, consequential, or incidental damages.

Measurement and Payment
Bridge crossings will be measured and paid for per each bridge crossing, including footer installation. No direct payment will be made for other material components; these will be considered incidental to the work covered by the bridge crossings.

Such payment shall be considered full compensation for the items of work, including the cost for furnishing all materials, labor, equipment, tools, incidentals, storage, preparation, installation, removal, and proper disposal of the bridge crossing and components.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
20	Fiddlers Run Bridge Crossing	Each (EA)
21	East Prong Hunting Creek Bridge Crossing	Each (EA)

8.2 Floodplain Culverts

Description
The work in this section consists of installing six (6) 48" smooth-walled corrugated plastic pipe culverts within the floodplain on East Prong Hunting Creek in alignment with the proposed 75' prefabricated bridge as shown on the Plans. Final location and alignment of the culverts may be adjusted in the field as directed by the Engineer.

Materials
Floodplain culvert installation shall consist of smooth-walled corrugated plastic pipe (CPP), bedding material (#57 stone), backfill material, and ABC stone. Pipes to be used for the culvert replacements include six 40' long pipes mitered to slope. Approach slope and miter angle may be adjusted in the field by the Engineer. Backfill material shall be soil that is free of rock and debris consisting of clay, clay loam, or sandy clay loam. Riprap to be used for culvert replacements include Class A, Class B, and #57 stone. Refer to the NCDOT Standard Specifications for Roads and Structures, Divisions 5 and 10 for sizing requirements.

Construction Methods
Contractor to provide Engineer with installation sequence for floodplain culverts. Installation may occur prior to, concurrent with, or following installation of bridge footers and prefabricated bridge structure. Excavate bedding trench as shown on the Plans. Place #57 stone in the excavated trench to a minimum depth of 6" as shown in the Plans. The bed of #57 stone shall be the full width of the floodplain culvert installation section. Place the pipe on top of the bedding in the trench and backfill with a 50/50 mix of Class A and Class B riprap to a minimum height of 1/3 of the placed culvert, for the length of the culvert, and extending laterally from the culvert a minimum of 12 inches, as shown in the Plans and as directed by the Engineer. Backfill the remaining trench with soil consisting of clay, clay loam, or sandy clay loam in maximum 12" compacted lifts to the proposed trail elevation. Upon achieving final grade, miter pipe to match ground sideslopes on upstream and downstream slopes. Pipe sections may be pre-mitered or cut in the field. Pipes shall not extend more than 6" from finish grade sideslopes, unless otherwise directed by the Engineer.

Fill above native grade within the limits of the two bridges will be backfilled with material consisting of GC, SC or CL soils with a minimum clay percentage of 20% to prevent seepage. The Contractor shall submit their proposed material specification for the backfill to mobilizing the materials to the Site. No additional payment will be made for materials that are delivered to the site prior to approval by the Engineer and subsequently rejected.

The bridge approaches shall be constructed in lifts not to exceed 8-inches in thickness that are compacted to 95% compaction. Compacted fill should be tested for density and water content for each vertical lift of 1 foot and a horizontal frequency of once every 5,000 ft2. Compaction requirements for the fill is 95% of the material's maximum Standard Proctor dry density (ASTM D698). Moisture content shall be between the ranges of -2% and +3% of optimum moisture content value as determined by the Standard Proctor test (ASTM D698). Where

floodplain culverts are to be placed along the bridge alignment (East Prong Hunting Creek Bridge), Contractor shall mechanically compact soil to within 3 feet of the culverts and utilize hand tampers adjacent to the culverts. Compaction tests should not be taken within 5 horizontal feet of the culverts. Contractor shall make every attempt to compact soil adjacent to the culverts to the maximum extent possible, but testing adjacent to the culverts is not required.

Measurement and Payment

Floodplain culverts shall be paid as a lump sum item for the installation of the six (6) floodplain culverts. Such price and payment will be full compensation for all work covered for floodplain culverts, including but not limited to all labor, machinery, maintenance, hauling, preparation, and installation to complete the work in an acceptable manner. Pipe, stone, and coarse aggregate backfill will be considered incidental to temporary floodplain culvert installation.

Bid Item	Pay Item	Pay Unit
22	Floodplain Culverts	Lump Sum (LS)

9.0 Planting

9.1 Temporary Seeding

Description

The work in this section consists of furnishing and installing temporary seed in areas specified in the Plans and includes Site preparation and seed bed preparation.

The quantity of temporary seed to be installed will be influenced by the actual conditions that occur during the construction of the project. The quantity of temporary seeding may be increased, decreased, or eliminated entirely as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Refer to Section 1620 of the NCDOT Standard Specifications for Roads and Structures for Temporary Seeding.

Construction Methods and Materials

Temporary seeding shall follow the planting schedule presented in the Plans.

All seed and seed varieties must be free of state and federal noxious weed seed. In addition, none of the following seed will occur in the mix:

- beach vitex
- bushkiller
- Canada thistle
- Crested floating heart
- Eurasian watermilfoil
- loosestrife
- musk thistle
- oxygen-weed
- puncturevine
- round leaf bittersweet
- spiny plumless thistle
- swamp stonecrop
- water chestnut
- water primrose
- water snowflake
- watermoss
- yellow fieldcress
- yellow floating heart

Temporary seed will include the species listed below and will be applied according to the following schedule:

Temporary Seeding				
Pure Live Seed				
Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
September 15 – April 1	*Secale cereale*	Rye grain	Herb	140
April 1 – September 15	*Setaria italica*	German Millet	Herb	50

All disturbed areas will be seeded with temporary seed. Seeding will be performed using a broadcast spreader. Other methods may be used but must be approved by the Engineer in advance of installation. No seeding will be performed when ambient temperature is below 32° F or 0° C. No seeding will occur when ground is frozen. Groundcover must be established on exposed slopes within 21 calendar days following the completion of grading activities within the active work zone. Permanent groundcover must be established for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction. The Contractor must guarantee 80% temporary seeding coverage for a term of 1 year following acceptance by the Engineer.

Measurement and Payment

Temporary seeding will be paid per acre broadcasted and accepted by the Engineer in place. Such payment shall be considered full compensation for the items of work, including the cost for furnishing all materials, labor, equipment, tools, incidentals, storage, preparation, and planting of the temporary seed.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
23	Temporary Seeding	Acres (AC)

9.2 Permanent Seeding

Description

This work consists of furnishing and installing permanent seed in areas specified in the Plans. Permanent seeding includes the Floodplain Bench Planting Zones, Bioretention Planting Zones, Park/Bioswale Planting Zone, and the Bioretention Planting Zone identified in the Plans. This work consists of Site preparation, soil amendments, seedbed preparation, seeding and mulching.

The quantity of permanent seeding to be installed will be dependent on the actual conditions that occur during the construction of the project. The quantity of permanent seeding may be increased, decreased, or eliminated entirely as directed. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Refer to Section 1660 in the NCDOT Standard Specifications for Roads and Structures for Seeding and Mulching.

Constructed Methods and Materials

Refer to Section 1060-4 for Seed in the NCDOT Standard Specifications for Roads and Structures. Seed may be mixed by the supplier and is not required to be mixed on Site. All plant sources and materials shall be submitted to the Engineer for approval. Seed will have a Pure Live Seed (PLS) certification equal to or greater than that rate specified on the plant schedules. If the PLS is less than specified, the Contractor will increase the seeding rate to compensate for the PLS difference.

Permanent seed will include the species listed below:

Floodplain Bench Planting Zone Permanent Seeding (20lbs/ac)			
Species	Common Name	Stratum	Density (lbs/ac)
Coreopsis tinctoria	Golden Tickseed	Herb	2.0
Rudbeckia hirta	Blackeyed Susan	Herb	2.0
Sisyrinchium angustifolium	Blue-eyed grass	Herb	1.5
Juncus tenuis	Path Rush	Herb	1.5
Juncus effusus	Common Rush	Herb	1.5

Chamaecrista fasciculata	Patridge Pea	Herb	1.5
Carex cherokeensis	Cherokee Sedge	Herb	1.5
Pycnanthemum tenuifolium	Narrowleaf Mountainmint	Herb	1.5
Helenium autumnale	Sneezeweed	Herb	1.5
Carex crinite	Fringed Sedge	Herb	1.5
Dichanthelium clandestinum	Deer Tongue	Herb	1.0
Conoclinium coelestinum	Blue mistflower	Herb	1.0
Chasmanthium latifolium	River Oats	Herb	1.0
Schizachyrium scoparium	Little Bluestem	Herb	1.0

Bioretention Planting Zone Permanent Seed Mix (20lbs/ac)			
Species	Common Name	Stratum	Density (lbs/ac)
Coreopsis tinctoria	Golden Tickseed	Herb	3.0
Rudbeckia hirta	Blackeyed Susan	Herb	3.0
Juncus tenuis	Path Rush	Herb	2.0
Chamaecrista fasciculata	Patridge Pea	Herb	2.0
Carex cherokeensis	Cherokee Sedge	Herb	2.0
Pycnanthemum tenuifolium	Narrowleaf Mountainmint	Herb	2.0
Conoclinium coelestinum	Blue mistflower	Herb	1.5
Chasmanthium latifolium	River Oats	Herb	1.5
Schizachyrium scoparium	Little Bluestem	Herb	1.5
Panicum virgatum	Switchgrass	Herb	1.5

Park/Bioswale Planting Zone Permanent Seed Mix (20lbs/ac)			
Species	Common Name	Stratum	Density (lbs/ac)
Festuca arundinacea,'Teton'	Tall Fescue, 'Teton'	Herb	10
Festuca arundinacea, 'FoxHound'	Tall Fescue, 'FoxHound'	Herb	10
Festuca arundinacea, 'Turismo'	Tall Fescue, 'Turismo'	Herb	10

All seed and seed varieties must be free of state and federal noxious weed seed. In addition, none of the following seed will occur in the mix:

- beach vitex
- bushkiller
- Canada thistle
- Crested floating heart
- Eurasian watermilfoil
- loosestrife
- musk thistle
- oxygen-weed
- puncturevine
- round leaf bittersweet
- spiny plumless thistle
- swamp stonecrop
- water chestnut
- water primrose
- water snowflake
- watermoss
- yellow fieldcress
- yellow floating heart

Fertilizer

Refer to Section 1060-2 for Fertilizer in the NCDOT Standard Specifications for Roads and Structures. Fertilizer will be organic fertilizer and not petroleum-based fertilizer. The Contractor is encouraged to conduct an independent soil test and is responsible for recommending soil amendment application rates prior to construction. All soil amendment applications shall occur prior to seeding.

Limestone

Refer to Section 1060-3 for Limestone in the NCDOT Standard Specifications for Roads and Structures. The Contractor is responsible for recommending soil amendment application rates prior to construction.

Mulch

Refer to Section 1060-5 for Mulch in the NCDOT Standard Specifications for Roads and Structures. Seed mulch will consist of straw or wood cellulose mulch. No tacking agent is necessary for areas under erosion control matting.

Water

Water used in the planting or care of vegetation will meet Section 1060-9 requirements of the NCDOT Standard Specifications for Roads and Structures.

The Contractor is responsible for applying soil amendments per these Specifications. All soil amendment applications shall occur prior to seeding.

No seeding will be performed when ambient temperature is below 32° F or 0° C. No seeding will occur when ground is frozen. Seeding will be performed using a broadcast spreader. Other methods may be used but must be approved by Engineer in advance of installation. Seed will be applied within the top ¼" of soil. The seed-to-soil contact will be maximized by firming the soil around the seed with a cultipacker, other similar equipment, or by dragging the surface of the soil with a chain link fence. Immediately after seeding the Site shall be watered lightly but thoroughly so that the top 3" of soil is saturated.

Groundcover must be established on exposed slopes within 21 calendar days following the completion of grading activities within the active work zone. Permanent groundcover must be established for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction. The Engineer will monitor the Site in the late summer/fall after planting in the previous dormant season. It is the Contractor's responsibility to ensure a dense stand of herbaceous vegetation on the Site during the first year of growth. The Contractor shall reseed any bare spots greater than 200 square feet to the Specifications at no additional cost. The Contractor is required to complete this within 31 days of the Engineer's notification.

Measurement and Payment

Permanent seeding will be measured and paid for in acres measured along the surface of the ground that has been completed and accepted by the Engineer. Acreage permanently seeded with Permanent Floodplain Bench Seed Mix will be counted and paid for separately as Permanent Floodplain Bench Seeding, acreage permanently seeded with Permanent Bioretention Seed Mix will be counted and paid for as Permanent Bioretention Seed Mix, and acreage permanently seeded with Park/Bioswale Seed Mix will be counted and paid separately as Permanent Park/Bioswale Seeding. No direct payment will be made for furnishing and applying soil amendments, fertilizer, mulch, or water; such work and materials will be considered incidental to the work covered by Permanent Seeding.

Such payment shall be considered full compensation for the items of work, including the cost for furnishing all materials, labor, equipment, tools, incidentals, storage, preparation, planting, and maintenance of the permanent seed.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
24	Permanent Seeding – Floodplain Bench Planting Zone	Acres (AC)
25	Permanent Seeding – Bioretention Planting Zone	Acres (AC)
26	Permanent Seeding – Park/Bioswale Planting Zone	Acres (AC)

9.3 Live Stakes & Herbaceous Plugs

Description

The work in this section consists of furnishing and installing live stakes on stream banks and other areas in accordance with the Plans and Specifications. Live staking is a standard bioengineering technique which involves

planting of dormant plant cuttings using species known to produce roots from cuttings. This section also includes furnishing and installing herbaceous plugs as indicated in the Plans.

The quantity of live stakes and herbaceous plugs to be installed will be influenced by the actual conditions that occur during the construction of the project. The quantity of live stakes and herbaceous plugs may be increased, decreased, or eliminated entirely as directed. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Construction Methods and Materials

Live stake cuttings shall be generally be 0.5" to 1.5" in diameter and shall not exceed two inches (2") in diameter and shall not be less than 0.25" in diameter. Cuttings shall be two feet (2') to three feet (3') in length and reasonably straight.

Live stakes shall be cut at a 45° angle at the basal end and cut flat on the top end. The basal end is the end that will take root and will be the end installed in the ground.

Live stake cuttings shall consist of a mix of the approved plant species as set forth in the Plans. Species selection and percentages may be adjusted based on availability and approval of the Engineer prior to purchase and installation. Final locations and configurations will be determined in the field by the Engineer.

Herbaceous plugs shall consist of the species listed in the Plans. All plant sources and materials will be submitted to the Engineer for approval. The supplier will certify that the origins of the seed for the plants supplied were produced from Hardiness Zone 7b, east of the Mississippi River. Plant material collected from the wild is not allowed unless plant material and source is approved by the Engineer. The Engineer must approve any plant substitutions. Any substitutions must be native to the site's state and physiographic region.

Live stakes shall be planted between November 15 and March 15 and herbaceous plugs shall be planted between April and June unless otherwise approved by the Engineer.

The Engineer is responsible for marking the planting zones prior to the Contractor initiating any permanent vegetative planting. Following the completion of grading and seeding activities, the Engineer shall mark the vegetative planting zones using GPS equipment prior to installing planting. This applies to the limits of permanent vegetation and is not applicable to temporary or permanent seed mixtures.

Plant material with excessive damage or oblique cuts, or with excessive damage to the bark, will not be acceptable. All live materials shall be properly stored to ensure viability. Contractors shall protect plant materials from drying and overheating during transport and during the installation process. Live plant material shall receive continuous shade as well as protection from the wind. Shade fabric, heeling, mulches, plastic covering, and watering are all techniques that may be used.

Live stake harvesting and installation shall occur during the dormant season as determined by local NRCS WETS data. Using the published growing season dates for a local WETS station, the dormant season will be defined as that period of time with a 50% probability that the average daily temperature is less than 28 degrees, based on historic weather data.

Live stakes shall be installed in accordance with the Plans and Specifications. Live stakes will be installed in the ground using a dead blow hammer. The top end of the stake will protrude approximately 3" above the finished ground elevation. On sloped ground surfaces, stakes will be installed perpendicular to the finished grade slope. The live stakes shall be placed so that 80% of their length is buried. All live stakes shall be planted such that the stake is tamped and has full contact between the soil and cutting. In the event of hard ground, a 0.5" metal bar may be used to initiate a pilot hole for live stakes. The rod must be carefully removed without rotating to enlarge the hole.

Live stakes shall be installed at the spacing and density as shown in the project drawings or as directed by the Engineer.

Live stakes should not be split during installation. Live stakes which are split shall be removed and replaced, or if the split is less than 1/6 of the cutting length, the top may be re-trimmed after installation to remove the damaged portion.

Herbaceous plugs will be installed in the constructed wetland planting zones as identified in the Plans. Herbaceous plugs will be installed at the spacing specified in the Plans.

Measurement and Payment
Live stakes and herbaceous plugs will be measured and paid for at the unit price per each unit installed and accepted by the Engineer. Such payment shall be considered full compensation for the item of work, including the cost for furnishing all materials, labor, equipment, incidentals, storage, preparation, and planting of the live stakes and herbaceous plugs.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
27	Live Stakes	Each (EA)
28	Herbaceous Plugs – In-stream	Each (EA)
29	Herbaceous Plugs – Bioretention	Each (EA)

9.4 Containerized Plants

Description
The work in this section includes the furnishing and installation of 5-gallon containerized plants per location and spacing requirements listed in the Plans. 5-gallon containerized plants shall be planted under the direction of the Owner.

Construction Methods and Materials
Containerized plants shall be installed as indicated on the Plans and at the spacing listed in the Plans, or as directed by the Engineer. Care should be taken to mix species in different planting regions throughout the project. A hole should be dug approximately twice the container diameter at the specified locations. Hole depth should be approximately 2 times the depth of the container. The bottom third of the hole should be backfilled with excavated soil. The container should be removed, and plant placed in the hole with remaining void space backfilled with the excavated soil. A small ridge of soil should be constructed around the backfilled hole to help puddle water over the roots.

Containerized plants shall be a minimum of 18 inches in height (excluding roots and container) and shall be between 0.5 inches and 1.5 inches in diameter. All plant material shall be purchased from a local nursery, with the approval of the Engineer. All containerized plants shall be dormant at the time of acquisition and planting. Outside storage locations should be continually shaded and protected from wind and direct sunlight to prevent trees and shrubs from drying. Species selection may be adjusted depending on availability. Substitute species must be approved by the Owner and Engineer prior to installation.

Measurement and Payment
Containerized plants will be measured and paid for at the unit price per each unit installed and accepted by the Engineer. Such payment shall be considered full compensation for the item of work, including the cost for furnishing all materials, labor, equipment, incidentals, storage, preparation, and planting of the containerized plants.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
30	5-Gallon Containerized Plants	Each (EA)

9.5 Bare Root Planting

Description

The work in this section consists of furnishing and installing riparian and upland plants in the form of bare root plants and trees. The quantity of plants may be increased, decreased, or eliminated entirely as directed by the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

Construction Methods and Materials

All plant sources and materials will be submitted to the Engineer for approval. The supplier will certify that the origins of the seed for the plants supplied were produced from Hardiness Zone 8, east of the Mississippi River. Plant material collected from the wild is not allowed unless plant material and source is approved by the Engineer. The Engineer must approve any plant substitutions. Any substitutions must be native to the Site's state and physiographic region.

Species selection may be adjusted depending on availability. Substitute species must be approved by the Engineer prior to installation. Plant harvesting and installation shall occur during the dormant season. Refer to the Contract Documents for areas to be planted, types of plants and size of plants to be installed, and spacing. Installation may require cutting a hole in the installed coir matting.

For bare roots, root stock of the plants will be kept moist during transport and storage until planted. Roots stock will be soaked in tree gel consisting of a mixture of endomycorrhizal and ectomycorrhizal fungi. Any undisturbed areas will be mowed to the maximum height of six inches prior to planting. Planting holes will be dug using a mattock or dribble bar. Planting holes will be deep enough that the first lateral root of the root mass will be flush with the surrounding grade. Non-organic debris will be removed from the hole and loose soil will be tamped in the bottom of the hole by hand. Spread plant roots in hole and backfill with oil. Standard landscape staples six (6) inches in length may be used to secure tublings in the stream bank as approved by the Engineer. No planting holes will remain open at the end of each day. All tags, labels, strings, and wire will be removed from the plants unless otherwise directed by the Engineer. No guy wires will be used on any plants unless otherwise directed by the Engineer.

Trees will be planted staggered in rows spaced as stated on the Contract Documents and running in a perpendicular manner to the valley contour. The Planting Contractor will conduct a 'band spray' of a preemergent (Oust ® or similar) along the row of trees running perpendicular to the valley contour only within the undisturbed areas. Preemergent will not be applied to recently seeded areas including the proposed stream channel. The preemergent will include a dye and will be sprayed in a manner such that ground, or vegetation contact is no greater than two feet in width.

Water will be supplied by the Contractor as needed for plant installation, maintenance, and survival. Furnishing water, as well as equipment and labor to administer water is considered incidental to bare root planting.

Measurement and Payment

Each size of riparian planting will be measured and paid for at the unit price per stem or per each for the herbaceous plugs. Such payment shall be considered full compensation for the items of work, including the cost for furnishing all materials, labors, equipment, tools, incidentals, storage, preparation, planting, short-term maintenance period and extended warranty period of the riparian plants. The Contractor will submit a certified statement each month that documents the quantity of completed units listed below.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
31	Bare Roots	Each (EA)

9.6 Planting Warranty

Description

The work in this section consists of the replanting of permanent vegetation during the warranty period to meet the required performance standards. The Contractor shall warrant vegetation per the terms listed in the table below.

Construction Methods and Materials

The Engineer will inspect the project after completion of planting and the growing season. The Engineer will initially conduct a visual assessment of the floodplains and streambanks to identify areas that may not meet the required survival rates. Upon identification of potentially insufficient survival rates, the Engineer shall inventory representative areas to verify the plant survival rates. The term shall include at least two full growing seasons and will initiate on the date the full site planting is complete and accepted by the Engineer. The following warranty terms shall apply to vegetation:

Type of Vegetation	Performance Standard	Warranty Terms
Permanent Seeding	90% Coverage	One-Year Term
Bare Root Plants	80% Survival	Two-Year Term
Live Stakes	80% Survival	Two-Year Term
Herbaceous Plugs	80% Survival	Two-Year Term

The Engineer shall identify the area(s) that are to be reseeded or replanted and notify the Contractor in writing. The Contractor must return to the Site and reseed or replant within 45 calendar days from the postmarked written notification, or as directed by the Engineer. All replacement seed and plants shall be furnished and installed as specified herein. The cost of replacement shall be borne by the Contractor.

Measurement and Payment

All work completed under this section will be measured and paid for a lump sum for the Planting Warranty. This work includes mobilization, materials, labor, and equipment required by the above specification. The payment schedule for these items will be 100% upon completion of the warranty term (two full growing seasons).

Payment will be made under:

Bid Item	Pay Item	Pay Unit
32	Planting Warranty	Lump Sum (LS)

10.0 Park Features

10.1 Bioswales

Description

A Bioswale is a shallow open-channel drainage way stabilized with turf grass or other vegetation used to convey runoff and filter pollutants. Bioswales capture, treat, and release the stormwater quality runoff volume. Bioswales are vegetated channels that include a 12” thick filter media.

Construction Methods and Materials

Media

Filter media should be developed by removing the existing soil and replacing it with mix of imported or recovered sand, woodchips generated onsite or imported and soil and organic material in the planting layer. Filter media shall be consistent with the following recommendations or as otherwise approved by the Engineer:

- Coarse sand: 50 to 65 percent
- Topsoil: 25 to 35 percent
- Compost or other organic material: 10 to 15 percent

Suitable topsoil should be stockpiled for use in this application from other grading activities. Contractor is responsible for mixing materials. The soil and sand must be uniformly mixed and graded. Organic amendment shall be uniformly mixed into the top 6 inches of the bed.

No other materials or substances must be mixed or dumped within the bioswale area that may be harmful to plant growth or prove a hindrance to the planting or maintenance operations. The soil must be free of noxious weeds.

Excavate a 5' wide, 12" deep trench along the alignment shown on the plans. Backfill with 12" of filter media. Bioswale should be constructed to allow for positive flow through the bioswale, drainage towards the bioretention areas shown on the plans.

Measurement and Payment

Bioswales shall be paid per each linear foot of bioswale installed and accepted by the Engineer in the field. Such price and payment shall be full compensation for the items of work including cost for furnishing all materials, labor, equipment, tools, and incidentals required by the above specification.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
33	Bioswales	Linear Foot (LF)

10.2 Bioretention Areas

Description

The purpose of bioretention areas is to treat stormwater for water quality benefit. The Contractor must protect the bioretention from construction sediment or from excessive flows during construction. Bioretention is built with a sand-based media with other minor constituents, primarily for the purpose of supporting plant growth. The bioretention media mix should have low nutrient content and phosphorous index. The outlets shall be constructed per the Plans and Specifications herein. The bed of the basins will be stabilized with permanent vegetation per the Plans.

If sediment enters the bioretention from the project limits of construction or from the diversion inflow, the Contractor shall be responsible to removed sediment and remediate any sediment contamination of the bioretention media or stone to the satisfaction of the engineer.

Construction Methods and Materials

Media

Filter media should be developed by removing the existing soil and replacing it with mix of imported or recovered sand, woodchips generated onsite or imported and soil and organic material in the planting layer. Filter media shall be consistent with the following recommendations or as otherwise approved by the Engineer:

- Coarse sand: 50 to 65 percent
- Topsoil: 25 to 35 percent
- Compost or other organic material: 10 to 15 percent

Suitable topsoil should be stockpiled for use in this application from other grading activities. Contractor is responsible for mixing materials. The soil and sand must be uniformly mixed and graded. Organic amendment shall be uniformly mixed into the top 6 inches of the bed.

No other materials or substances must be mixed or dumped within the bioretention area that may be harmful to plant growth or prove a hindrance to the planting or maintenance operations. The soil must be free of noxious weeds.

Media depth shall be installed to a minimum depth of 12" below finish grade. Media shall be installed to finish grade (+/- 0.1') as shown on the Plans or as directed in the field by the Engineer.

Mulch layer
Contractor shall apply a minimum of 3" of mulch within the bioretention area atop the media layer, so that the final grade of media and mulch is 3" above finish grade as shown in the Plans.

Outlet Pipe
Contractor shall implement the outlet structure as shown on the Plans. Outlet shall consist of black smooth walled 12" corrugated plastic pipe. Excavate bedding trench a minimum of 6" below and 6" on either side of the proposed pipe location. Place #57 stone in the excavated trench to a minimum depth of 6". The bed of #57 stone shall extend laterally 6" from the pipe wall. Place the pipe on top of the bedding in the trench and backfill with #57 stone to a minimum height of 1/3 of the placed culvert, for the length of the culvert, and extending laterally from the culvert a minimum of 6 inches, as shown in the Plans and as directed by the Engineer. Backfill the remaining trench with soil consisting of clay, clay loam, or sandy clay loam in maximum 12" compacted lifts to the proposed trail elevation.

Upon achieving final grade, miter pipe to match ground sideslopes on upstream side of culvert. The downstream side of the culvert shall be fitted with a galvanized, 12 Ga. 304 stainless steel standard flap gate. Flap gate should be placed downslope of the soil/pipe interface, a minimum of 12", but no more than 24", to limit exposure of the pipe.

Provide all necessary fittings to convert between size and types and to provide tee, angle, or other connections.

The bioretention areas must not be backfilled with media until all contributing drainage areas, including the swale delivering stormwater to it, are stabilized with vegetation or other acceptable methods.

Excavation
Minimize compaction of both the base of the bioretention area (subsoil) and the required backfill by using wide track equipment. Ripping with track hoe teeth, or other suitable method, deep enough to address compaction issues resulting from construction operations (compaction will significantly contribute to reduced hydraulic performance and may result in design failure).

Cells must be dry before backfilling media, pump any excess water prior to backfilling. Use excavator teeth to address compaction, and at a minimum rake top layer of subsoil before placing sand-based media. In the top layer of bioretention media, unless organic matter is pre-mixed into media, place organic matter/soil over the sand, then rototill or surface mix to create a gradation zone. Backfill the remainder of the organic layer to the finish elevation.

Excavated material for media placement must be removed and suitable material may be reused elsewhere within the project area as part of comprehensive grading; unsuitable material shall be removed from the project area. The bottom dimensions of the bioretention media shall be as shown on the plans. The sidewalls of the facility must be roughened. The bottom of the facility should be graded flat with microtopography as directed.

Backfill
The Bioretention media must be placed in lifts of 6" inches. No heavy equipment is allowed in the basin area. If the Bioretention media becomes contaminated during the construction of the facility or during the course of construction thereafter, the contaminated material must be removed and replaced with uncontaminated material.

The planting soil specifications provide enough organic material to adequately supply nutrients from natural cycling. Do not add fertilizer but do add amendments to container planting as indicated on the plans.

Measurement and Payment
Bioretention areas shall be paid per each area installed and accepted by the Engineer in the field. Such price and payment shall be full compensation for the items of work including cost for furnishing all materials, labor, equipment, tools, and incidentals required by the above specification.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
34	Bioretention	Each (EA)

10.3 Asphalt Trail

Description
The work in this section consists of installing the asphalt walking trail as shown on the plans.

Construction Methods and Materials

Materials
Material for this Contract is commonly known as Asphalt Binder and Asphalt Surface

All trails shall be improved with a surface course to the required width of the Greenway Trail Detail.

Plant mixed asphalt shall conform in all aspects to the latest NCDOT Standard Specification. To include design limits, asphalt cement content, and temperature range. A prime coat shall be applied when the base has been in place for seven (7) days or more. The compacted surface shall not be less than one and on-half (1 ½) inched thick.

City Engineer shall be notified prior to use of recycled asphalt.

Materials and workmanship are subject to twelve (12) months guarantee after acceptance of completed work.

Schedule
A paving schedule shall be submitted to the Engineer one (1) week in advance of beginning in order that emergency organizations may be notified and detours arranged if necessary. Work shall be so scheduled as to avoid extremely late working hours in attempts to complete specified phase of work.

Traffic Maintenance
The Contractor shall handle vehicular traffic in the area of work. Signs and flagmen shall be provided during working hours; and signs and lights required for safety reasons shall be maintained by Contractor. Methods and signs must comply with all NCDOT Standards and Regulations.

Temperature Limitations
Surface Course materials being placed in a layer less than 1" thick shall not be placed at an air temperature less than 50 degrees F. Surface course materials being placed at 1" or greater thickness shall not be placed at a temperature less than 40 degrees F.

Spreadings and Finishing
The bituminous mixtures shall be spread by an approved self-contained powered propelled paver. The bituminous mixture shall be placed so as to provide required thickness after compaction. The paver shall be equipped with an activated screen strike off assembly which is designed to be preheated and shall have a sliding shoe attachment which will form a slope on the edge of the mixture which will prevent raveling of the edge when the mixture is compacted.

Pavers shall be operated at forward speeds consistent with satisfactory laying of the mixture. Unevenness of texture, tearing, or shaving occurring during the pavement operation will be considered unsatisfactory and unacceptable work. Throwing back excess material will not be permitted. Pavers shall be equipped with a joint mating device so as to provide a smooth joint after compaction.

Compaction
The latest NCDOT approved mix shall be compacted to a 95% density. Rollers used for compaction shall be equipped with wetting and cleaning devices. Freshly laid asphalt shall first be compacted with tandem steel wheel rollers with maximum weight of ten (10) tons. No more than two (2) passes shall be made over the fresh asphalt with the steel rollers. The asphalt shall then be rolled with a pneumatic tire roller until required density

and smoothness of surface is achieved. A final rolling with a steel wheel roller may be required to achieve a smooth riding surface.

Application
Trails shall receive a compacted layer of the latest NCDOT approved mix of the thickness specified on the detail. Tolerances to be as specified in Section 610, Standard Specifications, Jan 1, 1991 Edition. Contractor shall haul stone and asphalt to project site using dump trucks that will not comprise the compacted soil and create rutting of the soil or stone while being installed.

Base and Prime Coat
All surfaces receiving an asphalt coat shall be thoroughly cleaned. The street shall then receive a NC Highway approved tack coat (RS-1H) as described in Section 605 of NCDOT Standard Specifications, January 1, 1990 Edition in an amount of from (.02 to .08 gallons per square yard), sufficient to thoroughly bond existing surface and new bituminous concrete surface. Tack coat will not be applied during foggy, wet or threatening weather. Tack coat will not appear as a separate bid item. Payment for tack coat shall be included in the contract unit prices for SF9.5A mix as stated in the proposal.

Clean Up
Removal of excess bituminous materials shall not lag out of proportion with progress of resurfacing. Where pedestrian traffic is encountered, excess materials shall be immediately removed.

Joints
Placing of surface course shall be as nearly continuous as possible. The roller shall pass over the unprotected end of the freshly laid mixture only when the laying of this course is discontinued for such length of time as to permit the mixture to become chilled or unworkable.

In all cases, including the formation of the joints as hereinafter specified, provision shall be made for proper bond with new surface mixture by cutting and trimming back the joint in order to expose an unsealed or granular surface for the full specified depth of the course.

At the end of the day's work on the surface mixture, joints shall be formed by laying and rolling against boards of the thickness of the compacted mixture placed across the entire width of the pavement, or by such other methods as may be approved by the Engineer. When the laying of surface mixture is resumed, the exposed edge of the joint shall be painted with a thin coat of hot asphalt cement or asphalt cement thinned with naphtha, and the fresh mixture shall be raked against the joint, thoroughly tamped and rolled.

Base Course for Asphalt Paving
Immediately after approval of the sub-grade by the Engineer, a course aggregate base course meeting the requirements of these Specifications shall be placed.

The contractor shall provide adequate and suitable equipment of such capacity and character as will insure the consolidation of the base. The equipment shall be of approved design and shall be maintained in good mechanical condition.

It is the intent of these specifications that the full thickness of base course be placed in successive layers as early as practicable, as work progresses. The next working day after the first layer of base course is placed and compacted; the second layer shall be placed thereon and compacted. Subsequent layers shall follow on the next working day until the full thickness of base course is laid and compacted.

In handling and placing the base course material, care shall be taken to prevent segregation. Each layer of base course shall be of such thickness that it can be compacted to the proper density. No layer shall have a compacted thickness greater than 8 inches.

Each layer of base course shall be immediately and continually machined with motor graders maintaining the required section until it has been thoroughly compacted to 95 percent of the density determined by AASHTO Test Method T-99.

The base course shall be maintained in a moist condition during the compaction operation.

When completed, the base course shall be smooth, hard, dense, unyielding, and well bonded. A broom drag constructed to have at least four transverse rows of broom shall be used in connection with the final finishing and conditioning of the surface of the course aggregate base course if deemed necessary by the engineer.

Measurement and Payment

Asphalt trail shall be paid for in accordance with the following itemized descriptions. Such price and payment shall be full compensation for the items of work including cost for furnishing all materials, labor, equipment, tools, and incidentals required by the above specification.

Trail Grading – Bid price per lump sum for grading of trail and removal of soil to prepare for trail, also backfilling of trail once asphalt has been installed, per plans and specifications.

Trail Stone Base – Bid price per ton for ABC Stone base installed, rolled and compacted to prepare for asphalt pavement, per plans and specifications. Tickets will be collected for payment of item.

Trail Asphalt Binder – Bid price per ton of asphalt binder. Tickets will be collected for payment of item. 2-Inch depth binder to be used at trail entrances and tail leading to Basketball Court area.

Trail Asphalt Surface S9.5B or Equal with Tack Coat – Bid price per ton of S9.5B or equal installed, per plans and specifications. Tickets will be collected for payment of item.

Payment will be made under:

Bid Item	Pay Item	Pay Unit
Alt 11	Trail Grading	Lump Sum (LS)
Alt 12	Trail Stone Base	Tons (TN)
Alt 13	Trail Asphalt Binder	Tons (TN)
Alt 14	Trail Asphalt Surface S9.5B	Tons (TN)

Revised 11/3/23

BID PROPOSAL FORM
City of Morganton, North Carolina
Project Name: Bethel Park Restoration
Project Location: City of Morganton
Project Number: N/A

To: The City of Morganton, North Carolina

In compliance with the Bids dated _____, the undersigned bidder hereby offers, for the amount stated below, to furnish all labor, materials, tools, equipment, apparatus, facilities, transportation and permits for the construction of the Project referenced above (or that portion of the Work for the Project assigned to the bidder) described above and hereby agrees to enter into an agreement for the construction of the Project, if accepted by the City Council of the City of Morganton in the amount of:

Bid proposal for Bethel Park Restoration $_____

Bid proposal for Asphalt Trail Improvements (bid alternate) $_____

Total amount of Base Bid for the combine proposals: $_____

The above amount is stated in figures only and is the total amount bid for the entire contract work including all applicable taxes. The undersigned bidder agrees that, if awarded the contract, it will enter into the Agreement providing for the construction of the Work and will commence the Work within the time specified in the written Notice to Proceed and that all work will be completed within the

Contract Times:
Bethel Park Restoration: **240** calendar days.
Asphalt Trail Improvements **60** calendar days.

Further, the undersigned acknowledges receipt of the following addenda:

_____
(addenda dated _____)

_____
(addenda dated _____)

_____
(addenda dated _____)

The bidder should fill in the words “not applicable” for any of the lines left blank above. To be considered, this bid proposal must include a bid bond in the amount and form specified in the Instructions to Bidders.

By submitting a bid, the bidder acknowledges that it has carefully reviewed the bid documents, the General Conditions, any supplemental conditions, all Drawings and Specifications and that it carefully inspected the Project site for any conditions that may affect the Work required by the Contract Documents.

The bidder also acknowledges that Minority Business Enterprise requirements apply to this Project and that the bidder will make a good faith effort at meeting the Minority Business Enterprise goals established by the City of Morganton.

Respectfully submitted,

_____
(Firm Name)

By: _____

Title: _____

License #: _____

Address: _____
_____

					Contractor's Bid Tab	
Item	Spec Section	Description	Quantity	Unit	Unit Price	Extended Total
		Site Preparation				
1	2.2	Mobilization and Demobilization	1	LS		
		Erosion and Sediment Control				
2	3.1	Silt Fence	8781	LF		
3	3.3	Temporary Rock Check Dam	5	EA		
4	3.4	Erosion Control Matting	9555	SY		
5	3.5	Temporary Stream Crossing - Culvert	1	EA		
6	3.6	Temporary Stream Crossing - Timber Mat	4	EA		
7	3.8	Turbidity Curtain	1	LS		
		Demolition				
8	4.1	Site Demolition	1	LS		
		Earthwork				
9	5.1	Grading	1	LS		
10	5.2	Tree Removal	1	LS		
		In-Stream Structures				
11	7.1	Log Sill	5	EA		
12	7.2	Log J-Hook	10	EA		
13	7.3	W-Weir	1	EA		
14	7.4	Brush Toe	990	LF		
15	7.5	Crayfish Glide	5	EA		
16	7.6	Constructed Riffle - CR	559	LF		
17	7.6	Constructed Riffle - ALR	204	LF		
18	7.6	Constructed Riffle - CH	353	LF		
19	7.7	Floodplain Sill	500	LF		
		Bridge Crossing				
20	8.0	Fiddlers Run Bridge Crossing	1	EA		
21	8.1	East Prong Hunting Creek Bridge Crossing	1	EA		
22	8.2	Floodplain Culverts	1	LS		
		Planting				
23	9.1	Temporary Seeding	22.0	AC		
24	9.2	Permanent Seeding - Floodplain Bench Planting Zones	7.8	AC		
25	9.2	Permanent Seeding - Bioretention Planting Zone	0.24	AC		
26	9.2	Permanent Seeding - Park/Bioswale	9.8	AC		

		Planting Zone				
27	9.3	Livestakes	2770	EA		
28	9.3	Herbaceous Plugs - In-stream	2309	EA		
29	9.3	Herbaceous Plugs - Bioretention	642	EA		
30	9.4	5-Gallon Containerized Plants	12	EA		
31	9.5	Bare Roots	2363	EA		
32	9.6	Planting Warranty	1	LS		
		Park Features				
33	10.1	Bioswales	1400	LF		
34	10.2	Bioretention Areas	4	EA		
					Total Base Bid	

					Unit Price	
		Alternate Bid Items - Provide Unit Costs ONLY				
Alt 1	3.2	Safety Fence/Tree Protection Fencing		LF		----------
Alt 2	5.1	Bedrock Excavation		CY		----------
Alt 3	5.1	Topsoil Harvesting		CY		----------
Alt 4	6.1	Misc. Boulders		TONS		----------
Alt 5	6.1	Misc. Gravel - #57 Stone		TONS		----------
Alt 6	6.1	Misc. Class ABC		TONS		----------
Alt 7	6.1	Misc. Class A Stone		TONS		----------
Alt 8	6.1	Misc. Class B Stone		TONS		----------
Alt 9	6.1	Misc. Class 1 Stone		TONS		----------
Alt 10	6.1	Misc. Class 2 Stone		TONS		----------
Alt 10a	5.2	Individual Tree Removal		TONS		----------
Alt 10a	5.2	Haul off of stumps		TRUCK		----------

					Unit Price	Extended Total
		Alternate Bid Item - Asphalt Trail Improvements – Provide Full Costs				
Alt 11	10.3	Trail Grading	1	LS		
Alt 12	10.3	Trail Stone Base	2,100	TONS		
Alt 13	10.3	Trail Asphalt Binder	165	TONS		
Alt 14	10.3	Trail Asphalt Surface S9.5B	775	TONS		
					Sub-total Asphalt Trail Alt	

Sign-In Sheet – Bethel Park Restoration – Pre-Bid Meeting 10/31/23 @ 11:00am

Name:	Organization:	Phone:	Email:	Current Planholder (Y/N)
Geoff Smith	Wildlands	813-814-3308	gsmith@wildlandseng.com	
Ty Williams	Wildlands			
Riley Locke	Wildlands Const	828-260-1883	rlocke@wildlandsbuild.com	Y
JAMES POE	HGS, LLC	(336) 500-1316	JPOE@RES.US	Y
Jordan Mattar	VPC Builders	888-406-0200	estimating@VPCbuilders.com	

Sign-In Sheet – Bethel Park Restoration – Pre-Bid Meeting 10/31/23 @ 11:00am

Name:	Organization:	Phone:	Email:	Current Planholder (Y/N)
David Stamey	J.T. Russell & Sons	828-464-0328	dastamey@jtrussellandsons.com	N
Robert Dukes	Shamrock	336-207-4009	bdukes@shamrockconstruct.com	Y
AARON PEACOCK	Baker Grading & Landscaping	828-484-3215	estimating@bakergrading.com aaron@bakergrading.com	Y

Sign-In Sheet – Bethel Park Restoration – Pre-Bid Meeting 10/31/23 @ 11:00am

Name:	Organization:	Phone:	Email:	Current Planholder (Y/N)
Stephen Joyce	North State Environmental	336 399-2523	Sjoyce@nsenv.com	

November 3, 2023

Mr. Geoff Smith, P.E.
Wildlands Engineering, Inc.
497 Bramson Ct, Suite 104
Mount Pleasant, SC 29464
gsmith@wildlandseng.com

Report of Geotechnical Exploration
Bethel Park Restoration - Bridges
Morganton, North Carolina
KEG Project No. JA23-4712-01

Mr. Smith:

Kessel Engineering Group, PLLC (KEG) is pleased to present this report of geotechnical exploration for the abutments of two proposed bridges at the existing Bethel Park located in Morganton, North Carolina. The purpose of this exploration was to determine the general subsurface conditions at the project site and to provide geotechnical recommendations for foundation design. Our services were performed in general accordance with our proposal PA23-4086-01, dated October 3, 2023.

PROJECT INFORMATION

Project information was provided by Mr. Geoff Smith, P.E. of Wildlands Engineering, Inc. during telephone and email correspondences with our Mr. Ian Johnson, P.E. Additional information was gathered during an October 3, 2023 site visit by Mr. Johnson. We have also been provided with the following digital documents:

- *Bethel Park Restoration*, Sheets 0.4, 2.1.3, and 2.2.3, by Wildlands Engineering, Inc., with *.pdf file dates of 10/02/2023, and indicating existing site features and topographic contours, as well as two proposed bridge locations.
- *Preliminary Anchor Bolt Layout & Bearing Reactions*, by Contech Engineered Solutions, Job No. 767220, dated 10/13/2023, and showing bearing reactions for the 50-foot span (assumed unfactored).
- *Preliminary Bridge Layout and Bearing Reactions*, by Contech Engineered Solutions, Job No. 767220, dated 10/13/2023, and showing unfactored bearing reactions for the proposed 75-foot span.

The project site is located at Bethel Park off Bethel Road in Morganton, North Carolina (see Figure 1). The overall project site is comprised of paved walking trails, soccer fields, tennis courts, and a dog park. The project site is relatively flat, and is grassed with sporadic shade trees present (see Photos 1 to 3). Two creeks (Fiddlers Run and East Prong Hunting Creek) are located near the west and eastern borders of the property and join near the north end of the park adjacent Bethel Road. Creek elevations appear to be on the order of 5 to 6 feet below the adjacent top of bank elevations.

Project plans include construction of two new vehicular/pedestrian bridges that will cross the two creeks at the site (Fiddlers Run on the west side of the project site, and East Prong Hunting Creek on the east side of the project site). Based on the provided information, the bridge spanning Fiddlers Run will have a deck span of approximately 12 feet by 50 feet, and maximum abutment loading on the order of 75 kips per abutment. The bridge spanning East Prong Hunting Creek will have a deck span of approximately 12 feet by 75 feet, and maximum abutment loading on the order of 192 kips per abutment. Earthwork fills associated with construction of the approach embankments at each bridge abutment are planned. Plans indicate maximum earthwork fills on the order of 4 to 6 feet at each embankment, with inclinations of 3H:1V (horizontal to vertical). Permanent earthwork cuts are not indicated on the attached plans.

SITE GEOLOGY

The project site is located in the Piedmont Physiographic Province, an area underlain by ancient igneous and metamorphic rocks. The virgin soils encountered in this area are the residual product of in-place chemical weathering of rock. In areas not altered by erosion or disturbed by the activities of man, the typical residual soil profile consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands.

The boundary between soil and rock is not sharply defined and there is often a transitional zone, termed "partially weathered rock" overlying the parent bedrock. Partially weathered rock (PWR) is defined, for engineering purposes, as residual material with a standard penetration resistance in excess of 100 blows per foot. Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. Consequently, the profile of the partially weathered rock is irregular even over short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and/or zones of partially weathered rock within the soil mantle, well above the general bedrock level.

Quite often, the upper soils along drainage features and in flood plain areas are water-deposited (alluvial) materials that have been eroded and washed down from adjacent higher ground. These alluvial soils are usually soft and compressible, having never been consolidated by pressures in excess of their present overburden.

FIELD EXPLORATION

Our exploration included performing three (3) soil test borings (B-1 to B-3) at the approximate locations as indicated on the attached Field Exploration Plan (see Figure 2). Two (2) soil test borings (B-1, B-2) were performed at the approximate abutment locations for the proposed west bridge (crossing Fiddlers Run). One (1) soil test boring (B-3) was performed at the approximate east bridge abutment location for the proposed east bridge (crossing East Prong Hunting Creek). No boring was performed at the approximate west bridge abutment location for the proposed east bridge due to existing obstructions limiting access to the area. The borings were located in the field by Mr. Johnson by referencing the provided site plan, identifiable site landmarks, and scaling distances.

The soil test borings were performed by utilizing a utilizing a Mobile B-57 truck-mounted drill rig. Borings were advanced by mechanically twisting a continuous flight steel auger into the soil. Soil sampling and penetration testing were performed in general accordance with ASTM D 1586. At assigned intervals, soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches was recorded and is designated the "standard penetration resistance." The penetration resistance, once properly evaluated, is an index to the strength of the soil and foundation supporting capability. Prior to removing the augers, groundwater elevations were measured. After removal of the augers, caving depths were measured at each location. End of day groundwater measurements were performed at each test location. The boreholes were backfilled with the soil cuttings brought to the surface by the augers prior to demobilizing from the project site.

Representative portions of the soil samples, thus obtained, were placed in plastic bags and transported to the laboratory. In the laboratory, the samples were examined by a geotechnical engineer to verify the field classifications made by the driller. Soil descriptions and penetration resistances are tabulated on the attached Soil Test Boring Logs.

Top of boring elevations provided in this report are based on the provided topographic survey information. Boring logs are presented in the appendix of this report. The boring locations and elevations shown in the appendix should be considered approximate.

SUBSURFACE CONDITIONS

Beneath a surficial layer of grass and topsoil of approximately 1 inch, soil test borings encountered existing fill soils to depths of approximately 3 feet below the existing ground surface. Existing fill soils typically consisted of very loose to loose, silty sands (SM) with N-values ranging from N = 3 to 9. Existing fill was underlain by alluvial soils in each soil test boring.

Alluvial soils extended to depths of 17 feet in boring B-1, 8 feet in boring B-2, and 5.5 feet in boring B-3. Encountered alluvium consisted of very loose to very firm silty sands (SM), very loose, well-graded sand with gravel (SW), soft, sandy silt (ML), and firm, sandy clay (SC) with N-values ranging from N = WOH (weight-of-hammer) to 21. Trace roots were encountered in the alluvium at boring B-2 at depths of 3.5 to 5 feet. Alluvial soils were typically noted as being moist to wet. Very loose soils encountered at boring B-2 at depths of approximately 8 to 17 feet likely consisted of alluvial soils; however, due to the very loose and wet characteristics of these soils, split spoons sampling of these soils was unsuccessful, and the soil strata could not be definitively determined. Alluvial soils were underlain by residual soils at each of the soil test borings.

Encountered residual soils consisted of very loose to very dense silty sands (SM) with N-values ranging from N = 1 to 72. Residual soils exhibited varying amounts of mica content. Residual soils were typically noted as being moist. Partially weathered rock (PWR) was encountered at depths of approximately 41 feet at boring B-1, and 37 feet at boring B-3.

Each boring performed during this exploration was extended beyond its assigned termination depths of 30 in order to gather additional information in order to develop geotechnical recommendations for foundation design. Boring B-1 encountered auger refusal materials at a depth of approximately 42.3 feet. Borings B-2 and B-3 were terminated at depths of 50 feet and 40 feet, respectively.

Refusal materials encountered in boring B-1 are those materials which are sufficiently hard to prevent the vertical advancement of the soil test boring auger. Refusal may result from very dense soils, partially weathered rock, boulders, lenses, ledges, or layers of relatively hard rock underlain by partially weathered rock or residual soil; refusal may also represent the surface of relatively continuous bedrock. Core drilling procedures are required to penetrate refusal materials and to determine their character and continuity. Core drilling was beyond the scope of this exploration.

Groundwater was encountered in each of the borings performed during this exploration. Groundwater was encountered at the time of boring at depths ranging from approximately 8.3 to 10.4 feet beneath the existing ground surface. End of day groundwater measurements were also performed and encountered groundwater at depths ranging from approximately 5.0 to 6.4 feet beneath the existing ground surface, which corresponds to approximate bottom of creek elevations in these areas. Groundwater levels will fluctuate several feet with seasonal and rainfall variations as well as the water level in the adjacent creeks. Normally, the highest groundwater levels occur in late winter and spring and the lowest levels occur in late summer and fall.

A summary of subsurface conditions encountered during this geotechnical exploration is provided below in Table 1. The above descriptions provide a summary of the subsurface conditions encountered by the borings. Boring logs included with this report contain information recorded at each boring location. The boring logs performed for this exploration represent our interpretation of the field logs based on examination of the field samples. The lines designating the interfaces between various strata represent approximate boundaries and the transition between strata may be gradual. Soil conditions may vary between boring locations.

TABLE 1
SUMMARY OF SUBSURFACE CONDITIONS ENCOUNTERED BY SOIL TEST BORINGS
(MEASURED IN FEET BELOW THE EXISTING GROUND SURFACE)

Soil Test Boring No.	General Location*	Specific Location	Fill (feet)	Alluvium		Residuum			Boring Depth** (feet)	Groundwater Elevation at End of Day (feet)	Caving Depth at Time of Boring (feet)
				V. Loose to Loose/ Soft (feet)	Firm to V. Firm (feet)	V. Loose to Loose (feet)	Firm to V. Dense (feet)	PWR (feet)			
B-1	West Bridge	West Abutment	0 to 3	3 to 12	12 to 17	17 to 37	37 to 41	41 to 42.3	42.3 (r)	5.0	14.2
B-2		East Abutment	0 to 3	3 to 8	-	17 to 37	37 to 50	-	50 (t)	5.5	10.2
B-3	East Bridge	East Abutment	0 to 3	-	3 to 5.5	5.5 to 27	27 to 37	37 to 40	40 (t)	6.4	11.4

- Not encountered in soil test boring.
* See Figure 2 for boring locations.
** (t) = Soil test boring terminated. (r) = Soil test boring encountered auger refusal.
Note: See logs for surficial materials. No split spoon sample recovery at boring B-2 from 8 to 17 feet due to very loose materia

ANALYSIS AND DESIGN RECOMMENDATIONS

Overview

As previously described, shallow existing fill at the site was underlain by alluvial soils to depths of up to approximately 5.5 to 17 feet below existing grade, after which very loose to loose residual soils were typically encountered. These materials are not suitable for shallow foundation support of the proposed bridge abutments given the provided loading conditions. It is therefore our opinion that the proposed bridge abutments should be supported by a system of deep foundations at each abutment location. Grouping effects must be considered during deep foundation design. A minimum center-to-center spacing of 3 pile diameters is recommended. Battered piles may be required to take up lateral loads. Piles should be sufficiently stiff to develop the required lateral capacity, if applicable.

Deep foundations options are provided below for your consideration. Load testing of deep foundations should be performed, at a minimum, where required by the North Carolina State Building Code (NCSBC). Provisions of ASTM D-1143 may be used as a guide in the performance of the load tests and modified as required by the NCSBC.

Abutment Foundation Support: Option 1 - Helical Piles

The proposed bridge abutments can be supported by helical piles. Helical piles consist of single flights of screw helix along a shaft installed with rotary installation equipment. They can be installed in relatively rapidly, and the installation produces minimal vibration. The shafts are designed to withstand the compressive and tensile foundation loads which are then transferred through the existing fill and alluvial layers to suitable bearing materials (i.e., underlying very firm / dense residual soils, partially weathered rock and/or refusal materials). Should the soils be corrosive, special coatings are applied at the time of installation or cathodic protection can be used. Torque value should be monitored during installation to estimate soil consistency as the helix penetrates through the different subsurface strata.

Helical piles will likely need to be extended at least 35 to 50 feet to bear into suitable residual materials. Due to the very loose soil profile encountered at the boring locations, buckling of the slender helical pile sections may be the controlling factor for design. The use of thicker steel sections, large wall diameter, inclined piles, or some combination thereof may be required to control buckling and to provide lateral stability for the pile caps. Allowable capacities on the order of 20 to 25 kips per pile can be utilized in

initial feasibility planning; however, the final design capacity should be determined by the design engineer. Helical piles should be designed to limit total and differential settlement of foundations to 1-inch and ½-inch, respectively.

We recommend that a specialty contractor with experience in helical pile design and installation and working under a "design/build performance" specification be retained to install the foundation system. The helical pile design should be provided by a professional engineer licensed in the State of North Carolina. The pile spacing, sizing, proposed depths, and connections to proposed pile caps should be determined/designed by the design engineer. The bidding foundation contractors should be provided a copy of this report.

While not encountered in the borings performed during this exploration, alluvial soils containing cobbles can cause helical piles to encounter moderate to extreme difficulties when attempting to advance the piles. Alluvial soils consisting of gravels and/or a cobble layer can sometimes prevent and/or damage helical plates during pile advancement. If these materials are encountered during helical pile installation, pre-auguring below the alluvial strata may be required prior to helical pile installation, or offsetting of the helical piles (as directed by the Structural Engineer) may be required. Alternatively, the use of special lead sections designed to penetrate rockier soils could be attempted at the specialty contractor's discretion and risk.

The helical pile installation QC program should be monitored full time by a Kessel Engineering Group representative within the scope of the project Statement of Special Inspections. The QC program would include conducting verification of placement, installation depths, and observed torque/pressure. These items should be documented for each helical pile element installed to provide a complete record of foundation quality. We recommend Kessel Engineering Group be consulted to review the design developed from the recommendations provided in our report. We would then suggest any modifications so that our recommendations are properly interpreted and implemented.

Abutment Foundation Support: Option 2 – Timber Piles

The proposed bridge abutments can be supported by timber piles. Timber piles have the advantage of being readily available and relatively easily cut-off to accommodate length variations. They are also easy to handle and the tapered sections provide higher resistance in granular soils than uniform piles. They have the disadvantage, however, of being more difficult to splice and having lower axial capacity than comparable steel or prestressed concrete piles. The quality of timber piles should meet the requirements of ASTM D-25 for round timber tip bearing piles and conform with applicable building codes. Piles must meet project specifications with respect to length, butt and tip diameter, sapwood, straightness, twist of grain, knots, pressure treatment and should be relatively free of defects and have water content greater than approximately 20 percent (to minimize "breaking") and less than about 50 percent (to minimize "brooming"). After the pile butt has been cut off after installation, chemical additives should be used to treat the cutoff surface to prevent organic degradation.

Driven timber piles could develop the anticipated high compression capacities needed with end bearing in the very firm to dense residuum and/or PWR at depths of generally 35 to 50 feet below the ground surface. Piles should be driven to this depth range to assure that the pile tip is seated in recommended bearing material. Frictional resistance in overlying existing fill and alluvial soils should be ignored during design of timber piles.

Piles should be driven continuously in the residual soils to the recommended bearing material. The initial driving resistance should be determined by an acceptable dynamic pile driving formula that considers the weight of the pile. The Wave Equation is recommended. Compatibility of the pile driving equipment and the pile type being driven is an essential element in achieving the required penetration and a satisfactory pile foundation.

We recommend that a specialty contractor with experience in timber pile design and installation and working under a "design/build performance" specification be retained to install the foundation system. The timber pile design should be provided by a professional engineer licensed in the State of North Carolina. The pile spacing, sizing, proposed depths, and connections to proposed pile caps should be determined/designed by the design engineer. The bidding foundation contractors should be provided a copy of this report.

Pile load testing for pile capacities should be implemented for the purpose of assisting in the development of final tip elevations and to confirm that the contractor's equipment and installation methods are acceptable. The test program should involve test piles to provide an indication of various driving and/or installation conditions. A KEG representative should monitor the driving of test piles. Depending on the resistance to penetration during initial driving, the geotechnical engineer may require some or all of the test piles to be re-tapped following a waiting period of 24 to 48 hours to check for pile/soil setup. Provisions of ASTM D-1143 may be used as a guide in the conduct of the load tests and modified as required by the North Carolina code.

A KEG representative should be on site during construction to verify the piles are being installed per the design requirements. During pile installation the KEG representative should be on site to verify the piles have been extended to the appropriate depths based on the provided design information. The discovery of site or subsurface conditions during construction which deviate for the data obtained in the geotechnical exploration should be reported to us for our evaluation. We recommend KEG be consulted to review the design developed from the recommendations provided in our report. We would then suggest any modifications so that our recommendations are properly interpreted and implemented.

General Foundation Requirements

We recommend that abutment pile caps bear at least 24 inches below final exterior grade to provide frost protection and protective embedment. We recommend that the minimum widths for pile caps be 24 inches. Scour protection should be installed upon completion of the pile and pile cap installation. Scour analyses and recommendations were beyond our area of expertise and scope of work for this exploration.

We recommend that once each pile cap excavation is extended to final grade, the member be constructed as soon as possible in order to minimize the potential for damage to bearing soils. The foundation bearing area should be level or benched and free of loose soil, ponded water and debris. Foundation concrete should not be placed on soils that have been disturbed by seepage. If surface water intrusion or exposure softens the bearing soils, the softened soils must be removed from the foundation excavation bottom prior to placement of concrete. If the excavations must remain open for an extended period of time, or if rainfall becomes imminent while the bearing soils are exposed, we recommend that a 2-inch to 4-inch mudmat of lean (2,000 psi) concrete be placed on the bearing soils before the placement of reinforcing steel for protection.

SITE PREPARATION AND CONSTRUCTION RECOMMENDATIONS

Clearing and Grubbing

Existing topsoil, vegetation, stumps, trees, and soils containing organic matter or other deleterious materials should be removed from the area of the proposed construction. Organic soils may be stockpiled for later use in areas to be landscaped. Stumps and other deleterious materials should be disposed of offsite or in areas of the site that will not be developed. Future construction of the earthwork fills or other structures in areas containing organic soils or other deleterious materials will first require that these materials be removed.

Earthwork Embankments and Proofrolling

Existing fill and alluvium encountered by the borings near existing grades are generally not suitable (or only marginally suitable) for direct support of earthwork fills associated with construction of the approach embankments at each bridge abutment. After removal of the topsoil layer, areas to provide support for earthwork fills should be observed for soft soils and proofrolled with a 25 to 35 ton, four wheeled, rubber-tired roller or similar approved equipment. The areas should first be proofrolled with an empty, four wheeled, rubber-tired dump truck. If the areas successfully pass proofrolling with an empty dump truck, the truck should be loaded and the area proofrolled again as described above.

The proofroller should make at least four passes over each location, with the last two passes perpendicular to the first two. Areas which wave, rut, or deflect excessively and continue to do so after several passes of the proofroller should be stabilized as directed by the geotechnical engineer at the time of construction. Excavated areas should be backfilled in thin (8-inch to 10-inch) lifts with engineered fill, as recommended later in this report. The proofrolling and excavating operations should be monitored by a KEG engineering technician working under the direction of the geotechnical engineer. Proofrolling should not be performed immediately following periods of precipitation or on frozen, wet or saturated subgrade.

The need for subgrade remediation should be determined in the field by the geotechnical engineer during construction on a case-by-case basis. However, it is likely that biaxial geogrid will be required in order to accommodate the placement of earthwork fills and achieve the recommended compaction at these locations. For planning purposes, the bidding Contractor(s) should anticipate typical undercuts of 1 to 2 feet below existing grade, and two (2) layers of biaxial geogrid (Tensar BX1200 or approved equivalent) within or below the fill embankment. Biaxial geogrid should extend a minimum of 2 feet beyond the edge of the fill embankment footprint.

The surface of the existing fill soils can deteriorate and lose its support capabilities when exposed to environmental changes and construction traffic. The removal or recompaction of these surficial soils may be required prior to further construction of earthwork fills. The extent of removal, if necessary, should be determined during construction by proofrolling.

Engineered Fill

Fill used for raising site grades or for replacement of undercut materials should be uniformly compacted in thin lifts (8-inch to 10-inch loose measure) to at least 95 percent of the standard Proctor maximum dry density (ASTM D-698) and within ±3% of the material's optimum moisture content. In addition, the upper 18 inches of subgrade fill beneath grade slabs and/or pavements should be compacted to at least 98 percent of the same specification.

Soils having a Plasticity Index (PI) greater than 30 (less than 15 is preferable) should not be used for fill. Soils utilized as engineered fill should also have a maximum dry density of at least 90 pcf (95 pcf or heavier is preferable). Before filling operations begin, representative samples of each proposed fill material should be collected and tested to determine the compaction and classification characteristics. The maximum dry density and optimum moisture content should be determined. Once compaction begins, a sufficient number of density tests should be performed by a KEG engineering technician working under the direction of the geotechnical engineer to measure the degree of compaction being obtained.

The surface of compacted subgrade soils can deteriorate and lose its support capabilities when exposed to environmental changes or construction activity. Deterioration can occur from, but is not limited to, the effects of freezing temperatures, the formation of erosion gullies, exposure to extreme drying conditions, long term exposure to natural elements, and rutting caused by construction traffic. We recommend that surfaces of the subgrade that have deteriorated or softened be recompacted immediately prior to construction of grade slabs. Additionally, excavations through the subgrade soils, such as utility trenches, should be properly backfilled with compacted lifts of engineered fill. Recompaction of subgrade surfaces and compaction of backfill should be checked with a sufficient number of density tests to determine if adequate compaction is being achieved.

Groundwater and Surface Water

As previously described in the *Subsurface Conditions* section of this report, groundwater was encountered at each soil test boring near or at existing creek elevation. Groundwater will likely be encountered during construction, especially if excavations near creek level are are planned. Adequate control of groundwater could likely be accomplished by means of gravity ditches, and/or pumping from gravel-line cased sumps. The contractor should be prepared to promptly remove surface water from the general construction area by similar methods.

Slopes and Excavations

Confined excavations such as for utility installation should conform to OSHA regulations. For slopes that are not confined, our experience suggests that temporary cuts through existing fill and alluvium should be laid back at a 2.5H:1V (horizontal to vertical) slope, or flatter, with maximum heights not exceeding 5 feet. Temporary excavations associated with foundation/pile cap excavations may be vertical, provided they are no more than 3 feet in depth. No persons should enter any temporary excavation at the project site if groundwater seepage is observed to be entering or seeping into the excavation through excavation sidewalls. If this condition occurs, the geotechnical engineer should be contacted immediately to provide recommendations. Permanent cut slopes through existing fill and alluvium are not recommended nor anticipated.

Permanent fill slopes constructed with newly placed engineered fill should be placed on a suitable foundation approved by the geotechnical engineer and should be constructed at 3H:1V, or flatter. Fill slope surfaces should be protected from erosion by grassing or by other means. In general, it is recommended that the edge of fill should extend at least 5 feet horizontally beyond paved areas.

SPECIFICATIONS REVIEW

We recommend that we be retained to make a review of the foundation and earthwork plans and specifications prepared from the recommendations presented in this report. We would then suggest any modifications so that our recommendations are properly interpreted and implemented. An additional fee would apply for review of plans and specifications.

BASIS OF RECOMMENDATIONS

Our evaluation of foundation support conditions and site preparation recommendations has been based on our understanding of the project information and data obtained in our geotechnical exploration as well as our experience on similar projects. The general subsurface conditions utilized in our foundation evaluation have been based on interpolation of the subsurface data between the widely spaced borings. Subsurface conditions between the borings may differ. If the project information is incorrect or the structure location (horizontal to vertical) and/or dimensions are changed, please contact us so that our recommendations can be reviewed. The discovery of site or subsurface conditions during construction which deviate from the data obtained in this exploration should be reported to us for our evaluation. The assessment of site environmental conditions for the presence or absence of pollutants in the soil, rock and groundwater of the site was beyond the scope of this exploration. Design and recommendations for scour are beyond the scope of this report and our area of expertise, as are structural and civil design recommendations for the proposed bridge construction.

We appreciate the opportunity to offer our professional geotechnical services on this project. We also provide construction materials testing and Special Inspections services and hope that you will consider Kessel Engineering Group for these services as the project nears construction. Please contact us with questions regarding this report or if we may be of further assistance.

Sincerely,
KESSEL ENGINEERING GROUP, PLLC (NC Firm License No. P-0420)

NORTH CAROLINA PROFESSIONAL SEAL 38637 11/03/2023 ENGINEER IAN JOHNSON

Ian Johnson, P.E.
Senior Engineer
Registered, North Carolina 38637

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Senior Engineer
Registered, North Carolina 33838

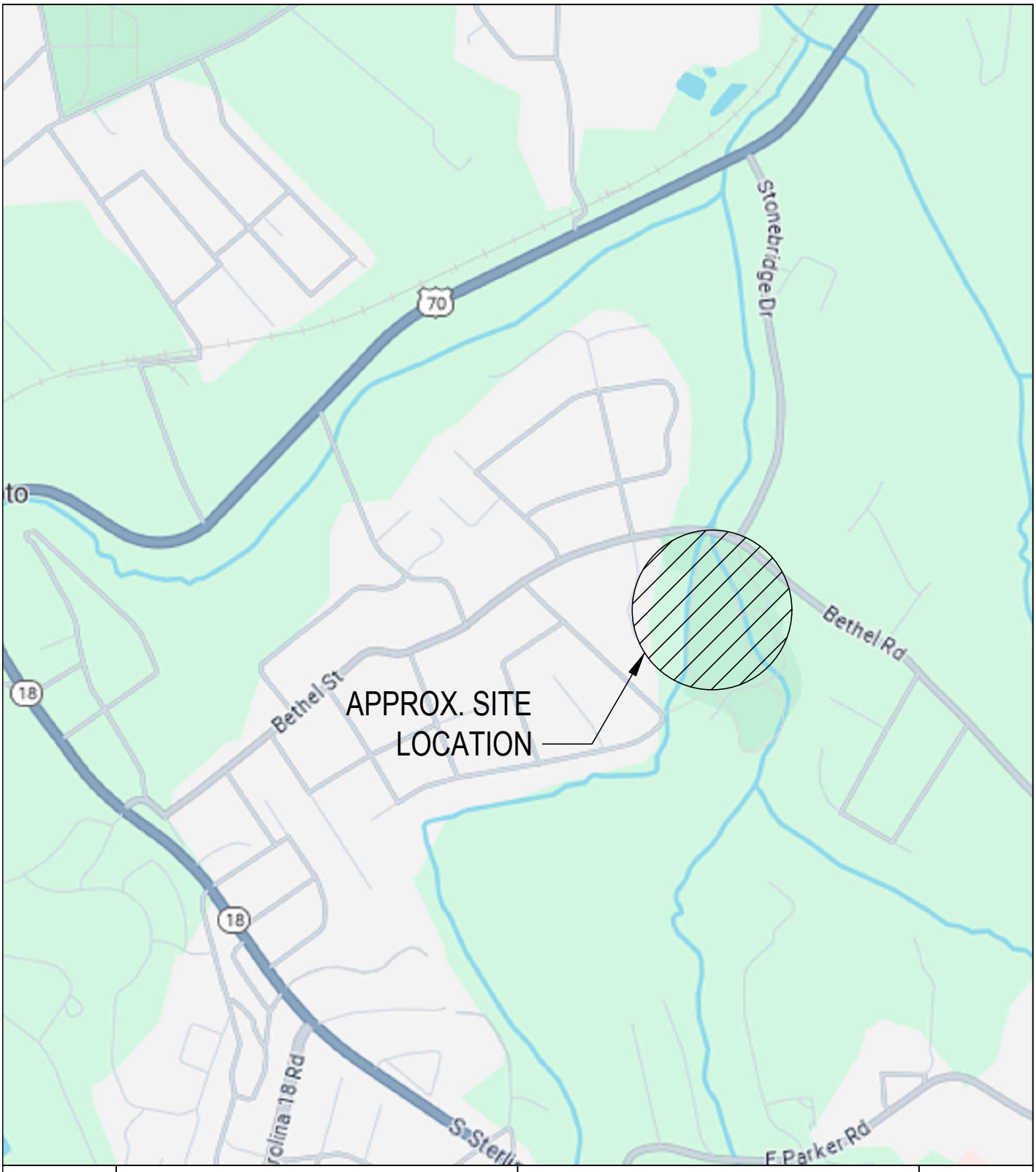
Attachments: Photos 1 to 3
Site Location Plan – Figure 1
Field Exploration Plan – Figure 2
Soil Test Boring Logs (B-1 to B-3)
Key to Soil Classifications and Consistency Descriptions

Distribution: Mr. Geoff Smith, P.E., Wildlands Engineering, Inc.; gsmith@wildlandseng.com

Photo 1: General area of proposed footprint for west bridge, west abutment

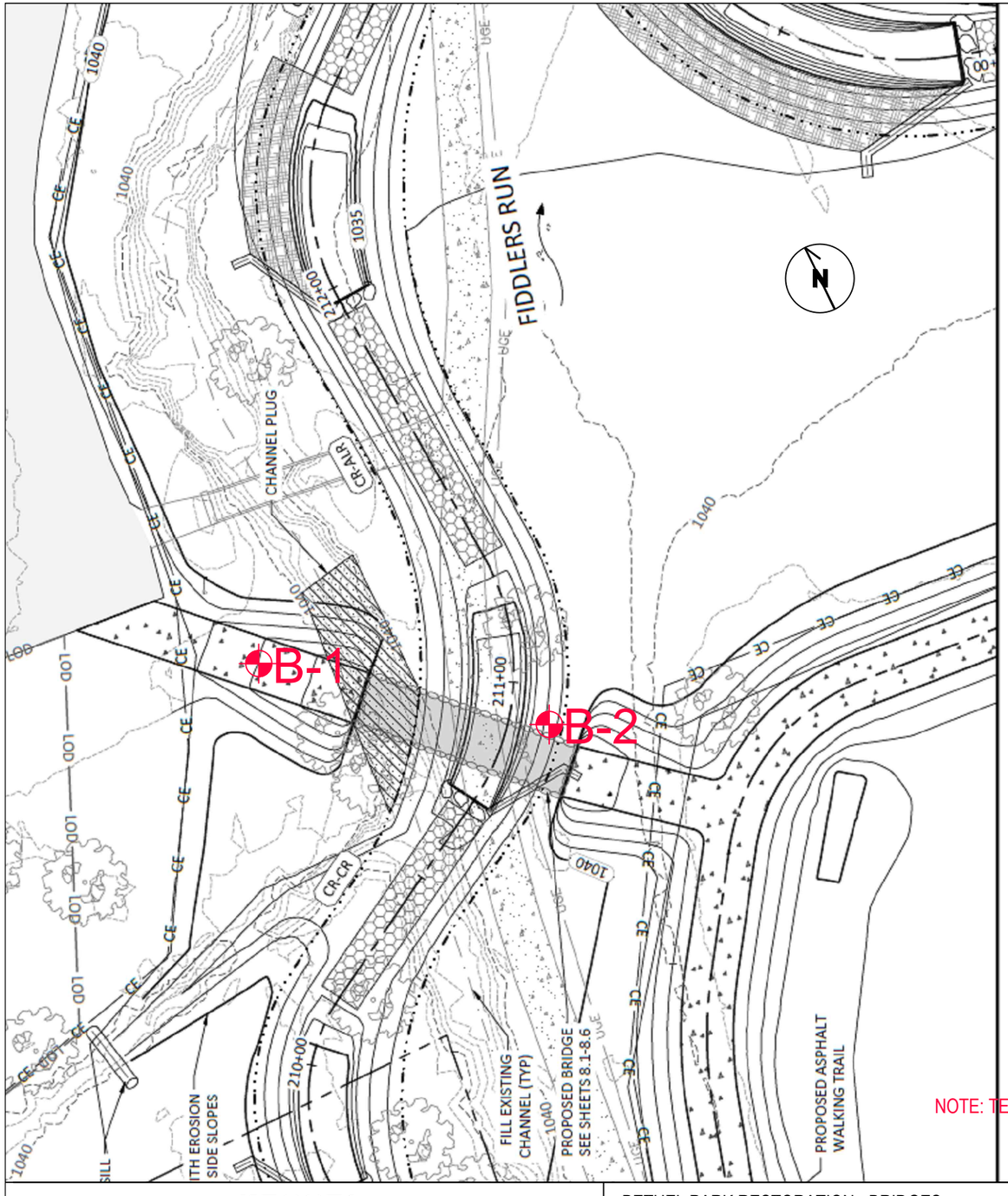
Photo 2: General area of proposed footprint for west bridge, east abutment

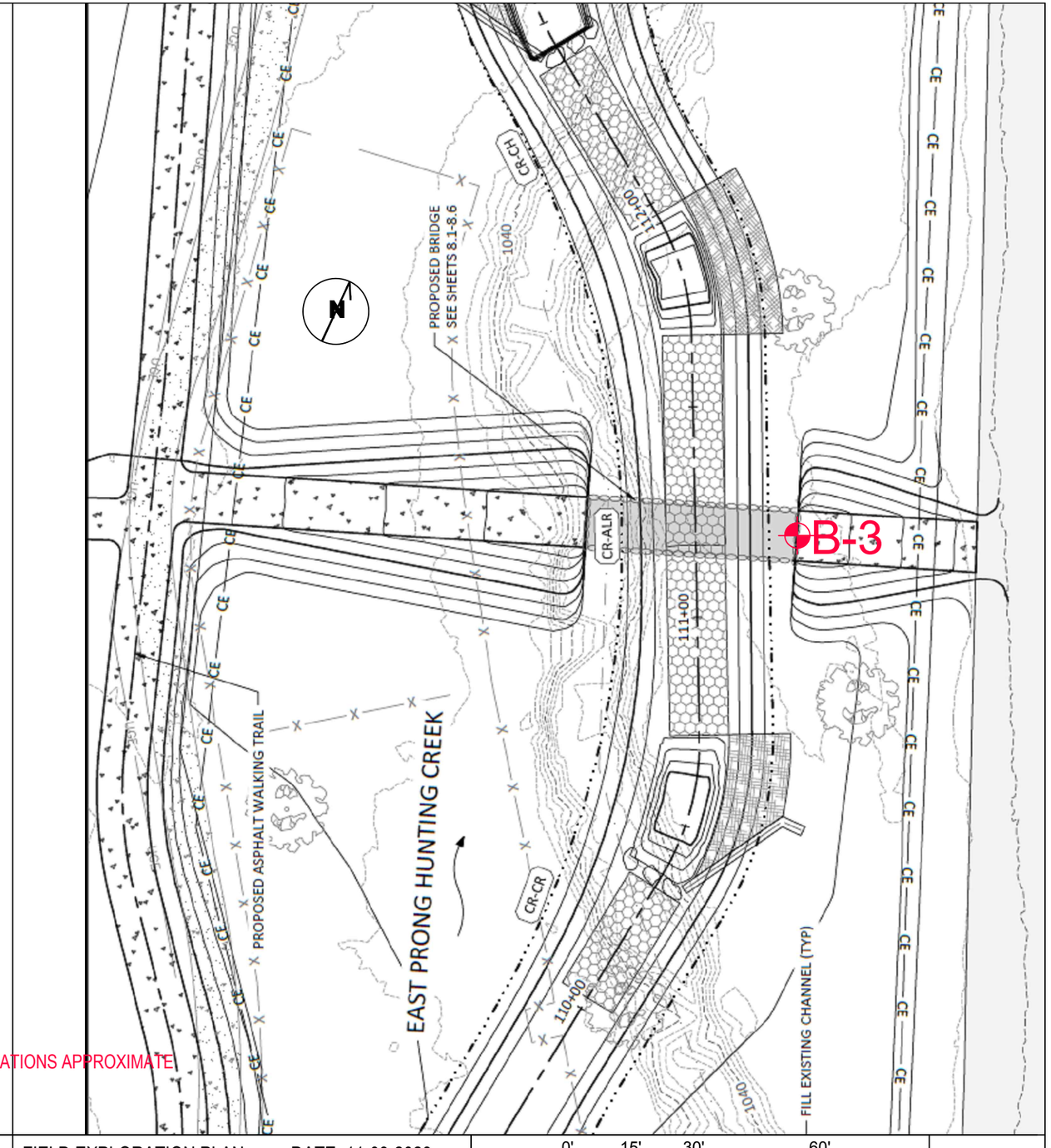
Photo 3: General area of proposed footprint for east bridge, east abutment



N	SITE LOCATION PLAN KEG PROJECT NO. JA23-4712-01 DATE: 11-03-2023	BETHEL PARK RESTORATION - BRIDGES MORGANTON, NORTH CAROLINA	FIGURE 1

KESSEL ENGINEERING GROUP
582 HENDERSONVILLE ROAD SUITE ONE | ASHEVILLE NC 28803 | P:[828] 277-6351 | F:[828] 277-6355
WWW.THEKESSELGROUP.COM





NOTE: TEST LOCATIONS APPROXIMATE

KESSEL ENGINEERING GROUP

BETHEL PARK RESTORATION - BRIDGES
MORGANTON, NORTH CAROLINA

KEG PROJECT NO. JA23-4712-01

FIELD EXPLORATION PLAN DATE: 11-03-2023

REFERENCE: Bethel Park Restoration, Sheets 2.1.3, and 2.2.3, by Wildlands Engineering, Inc., with *.pdf file dates of 10/02/2023.

0' 15' 30' 60'

SCALE: 1" = 30'-0"

FIGURE
2

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582 HENDERSONVILLE ROAD SUITE ONE I ASHEVILLE NC 28803 I P:[828] 277-635 I I F:[828] 277-6355
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SOIL TEST BORING NO. B-1

PROJECT: Bethel Park Restorations - Bridges | PROJECT NO.: JA23-4712-01

CLIENT: Wildlands Engineering | DATE START: 10-10-23 END: 10-10-23

LOCATION: See Figure 2 | ELEVATION: 1040 (feet)

DRILLER: M&M Drilling | LOGGED BY: I. Johnson

DRILLING METHOD: Hollow Stem Auger

DEPTH TO - WATER> INITIAL: 8.3 ft AFTER 4 HOURS: 5 ft CAVING>: 14.2 ft

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT
	1-Inch TOPSOIL / ROOTMAT			
	Loose, Brown, Slightly Micaceous, Silty, Fine SAND (Fill)		3 4 4	N = 8
	Very Loose, Brown to Gray, Moist to Wet, Slightly Micaceous, Silty, Fine to Medium SAND (Alluvium)		1 1 WOH	N = WOH
			WOH WOH WOH	N = WOH
1030 — 10			1 1 1	N = 2
	Very Firm, Tan, Wet, Siilty, Fine to Coarse SAND with Fine Gravel (Alluvium)		7 9 12	N = 21
	Very Loose, Light Tan with Gray and White, Wet, Silty, Fine to Medium SAND (Residuum)		WOH WOH 1	N = 1
1020 — 20				
	Loose, Brown to White, Wet, Slightly Micaceous, Silty, Fine to Coarse SAND with Trace Fine Gravel		2 3 4	N = 7
			3 4 5	N = 9
1010 — 30			3 2 3	N = 5
	Very Firm, Dark Gray with White, Moist, Silty, Fine to Medium SAND		11 11 12	N = 23
1000 — 40				
	PARTIALLY WEATHERED ROCK with No Sample Recovery		50/0	N = 50/0
	Auger refusal encountered at 42.3 feet. Groundwater encountered at 8.3 feet at time of boring and 5 feet at end of day. Borehole caved at 14.2 feet at time of boring.			

STANDARD PENETRATION RESULTS BLOWS/FOOT

2 5 10 20 30 40 50 70 90

SOIL TEST BORING REVISED 4712-01 BETHEL PARK RESTORATIONS - BRIDGES.GPJ KESSEL GROUP.GDT 10/13/23

SOIL TEST BORING NO. B-2

PROJECT: Bethel Park Restorations - Bridges | PROJECT NO.: JA23-4712-01

CLIENT: Wildlands Engineering | DATE START: 10-10-23 END: 10-10-23

LOCATION: See Figure 2 | ELEVATION: 1041 (feet)

DRILLER: M&M Drilling | LOGGED BY: I. Johnson

DRILLING METHOD: Hollow Stem Auger

DEPTH TO - WATER> INITIAL: 10.4 ft AFTER 4 HOURS: 5.5 ft CAVING>: 10.2 ft

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT
1040	1-Inch TOPSOIL/ ROOTMAT			
	Loose, Brown, Silty, Fine SAND (Fill)		3 4 5	N = 9
	Soft, Brown, Sandy SILT with Trace Roots (Alluvium)		2 2 2	N = 4
	Very Loose, Dark Gray, Wet, Fine to Coarse SAND with Fine Gravel (Alluvium)		WOH 1 1	N = 2
	Very Loose Soil with No Sample Recovery		WOH WOH 1	N = 1
1030	10			
			2 1 1	N = 2
	Loose, Orangish Brown to Tan and White, Very Moist, Micaceous, Silty, Fine to Medium SAND (Residuum)		2 4 5	N = 9
1020	20			
			2 3 5	N = 8
			1 2 3	N = 5
1010	30			
			1 2 3	N = 5
	Firm, Tan to White, Moist, Silty, Fine to Coarse SAND		3 6 8	N = 14
1000	40			
			2 5 10	N = 15
			3 4 6	N = 10

Boring terminated at 50.0 feet. Groundwater encountered at 10.4 feet at time of boring and 5.5 feet at end of day. Borehole dry and caved at 10.2 feet at time of boring.

KESSEL ENGINEERING GROUP

SOIL TEST BORING NO. B-3

PROJECT: Bethel Park Restorations - Bridges | PROJECT NO.: JA23-4712-01

CLIENT: Wildlands Engineering | DATE START: 10-10-23 END: 10-10-23

LOCATION: See Figure 2 | ELEVATION: 1043 (feet)

DRILLER: M&M Drilling | LOGGED BY: I. Johnson

DRILLING METHOD: Hollow Stem Auger

DEPTH TO - WATER> INITIAL: 9.8 ft | AFTER 4 HOURS: 6.4 ft | CAVING>: 11.4 ft

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT	
1040	1-Inch TOPSOIL / ROOTMAT Very Loose, Dark Brown, Silty, Fine to Medium SAND (Fill)		2 2 1	N = 3	
	Firm, Light Gray, Slightly Moist, Sandy CLAY (Alluvium)		2 3 3	N = 6	
	Very Loose, Tan, Moist, Micaceous, Silty, Fine SAND (Residuum)		1 1 1	N = 2	
10			WOH 1 1	N = 2	
1030	Loose and Firm, Brown with White, Moist, Micaceous, Silty, Fine to Medium SAND		2 3 5	N = 8	
			3 5 6	N = 11	
20 1020			2 4 6	N = 10	
	Firm, Brown and White, Silty, Fine to Medium SAND		7 10 10	N = 20	
30 1010	Very Dense, Dark Gray, Silty, Fine to Medium SAND		23 32 40	N = 72	
	PARTIALLY WEATHERED ROCK whcih sampled as White and Gray, Silty, Fine to Medium SAND		30 41 50/6	N = 50/6	
40 1000	Boring terminated at 40.0 feet. Groundwater encountered at 9.8 feet at time of boring and 6.4 feet at end of day. Borehole caved at 11.4 feet at time of boring.				

2 5 10 20 30 40 50 70 90

SOIL TEST BORING NO. B-3
Sheet 1 of 1

SOIL TEST BORING REVISED 4712-01 BETHEL PARK RESTORATIONS - BRIDGES.GPJ KESSEL GROUP.GDT 10/13/23

KEY TO SOIL CLASSIFICATIONS AND CONSISTENCY DESCRIPTIONS

Penetration Resistance* Blows per Foot	Relative Density
SANDS	
0 to 4	Very Loose
5 to 10	Loose
11 to 20	Firm
21 to 30	Very Firm
31 to 50	Dense
over 50	Very Dense

Particle Size Identification

Boulder: Greater than 300 mm
Cobble: 75 to 300 mm
Gravel:
Coarse - 19 to 75 mm
Fine - 4.75 to 19 mm
Sand:
Coarse - 2 to 75 mm
Medium - 0.425 to 2 mm
Fine - 0.075 to 0.425 mm
Silts & Clay: Less than 0.075 mm

Penetration Resistance* Blows per Foot	Consistency
SILTS and CLAYS	
0 to 2	Very Soft
3 to 4	Soft
5 to 8	Firm
9 to 15	Stiff
16 to 30	Very Stiff
31 to 50	Hard
over 50	Very Hard

* ASTM D 1586

KEY TO DRILLING SYMBOLS


Grab Sample


Split Spoon Sample

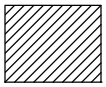

Undisturbed Sample

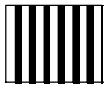

Groundwater Table at Time of Drilling

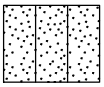

Groundwater Table 24 Hours after Completion of Drilling

KEY TO SOIL CLASSIFICATIONS

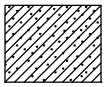

Well-graded Gravel
GW

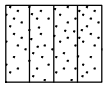

Low Plasticity Clay
CL

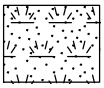

Clayey Silt
MH


Silty Sand
SM

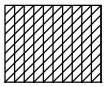

Poorly-graded Gravel
GP

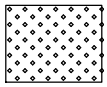

Sandy Clay
CLS

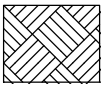

Sandy Silt
MLS

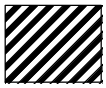

Topsoil
TOPSOIL


Partially Weathered Rock
BLDRCBBL

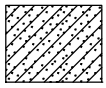

Silty Clay
CL-ML

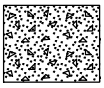

Sand
SW


Bedrock
BEDROCK


High Plasticity Clay
CH


Silt
ML


Clayey Sand
SC


Concrete
AS