City of Charlottesville, Virginia

Department of Public Works



PROJECT MANUAL FOR

SCHENKS BRANCH TRIBUTARY STREAM RESTORATION PROJECT APRIL 2022

100% DESIGN SUBMITTAL

SECTION 00 01 01 PROJECT TITLE PAGE

PROJECT MANUAL

FOR

SCHENKS BRANCH TRIBUTARY

STREAM RESTORATION PROJECT

APRIL 2022

Professional Engineer Certifications



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SECTION 01 11 00 SUMMARY OF WORK

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Summary
 - 2. Location and Description of Work
 - 3. Construction Contracts, This Project
 - 4. Construction Contracts, Other Projects
 - 5. Work by Others
 - 6. Work by Owner
 - 7. Owner Furnished Equipment and Materials
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 - 12. Easements and Rights-of-Way
 - 13. Notices to Owners and Authorities of Properties Adjacent to the Work
 - 14. Salvage of Equipment and Materials
 - 15. Partial Utilization by Owner

1.02 LOCATION AND DESCRIPTION OF WORK

- A. The Work is located at the following Site:
 - 1. 950 Melbourne Road, Charlottesville, VA 22902
- B. The Work to be performed under this Contract includes, but is not limited to, constructing the Work described below and all appurtenances related to the Work. The Work shall be as follows:

- 1. Temporary and permanent erosion and sedimentation control.
- 2. Grading and stabilization within the floodplain to achieve stream restoration.
- 3. Furnishing and installing in-stream structures such as cross vanes, log j-hooks, riffle grade controls, and a cascade.
- 4. Furnishing and installing toe wood protection and soil lifts for stream stability.
- 5. Furnishing and installing native seed, plugs, live stakes, container plants, and caliper trees for revegetation.
- 6. Traffic control during construction.
- 7. All associated miscellaneous work, including site restoration and cleanup.

1.03 CONSTRUCTION CONTRACTS, THIS PROJECT

- A. The Contracts under which the Project will be constructed are:
 - 1. Work specified in Divisions 01 through 35 (inclusive) of the Specifications.
 - 2. Work shown on sheets 1 through 34 (inclusive) of the Drawings.

1.04 CONSTRUCTION CONTRACTS, OTHER PROJECTS (NOT USED)

1.05 WORK BY OTHERS (NOT USED)

1.06 WORK BY OWNER

A. The Owner or Owner's Representative is responsible for staking out each individual planting pit for shrubs and trees and approving plant spacing and planting techniques prior to proceeding with plant installation.

1.07 OWNER-FURNISHED EQUIPMENT AND MATERIALS (NOT USED)

1.08 OWNER ASSIGNED PROCUREMENT DOCUMENTS (NOT USED)

1.09 OWNER PRE-SELECTED EQUIPMENT AND MATERIALS (NOT USED)

1.10 SEQUENCE AND PROGRESS OF WORK

A. Requirements for sequencing and coordinating with Owner's operations, including maintenance of on-site infrastructure during construction, and requirements for tie-ins and shutdowns, are specified in the General Conditions.

1.11 CONTRACTOR'S USE OF SITE

- A. Contractors' use of the Site shall be confined to the areas shown. Contractors shall share use of the Site with other contractors and others specified in this Section.
- B. Contractor shall move stored products that interfere with operations of Owner, other contractors, or others performing work for Owner.

1.12 EASEMENTS AND RIGHTS-OF-WAY

A. Easements and rights-of-way will be provided by Owner in accordance with the General Conditions. Confine construction operations to within Owner's property, public rights-ofway, easements obtained by Owner, and the limits shown. Use care in placing construction tools, equipment, excavated materials, and products to be incorporated into the Work to avoid damaging property and interfering with traffic. Do not enter private property outside the construction limits without permission from the owner of the property.

1.13 NOTICES TO OWNERS AND AUTHORITIES OF PROPERTIES ADJACENT TO THE WORK

- A. Notify owners of adjacent property and utilities when execution of the Work may affect their property, facilities, or use of property.
- B. When it is necessary to temporarily obstruct access to property, or when utility service connection will be interrupted, provide notices sufficiently in advance to enable affected persons to provide for their needs. Conform notices to Laws and Regulations and, whether delivered orally or in writing, include appropriate information concerning the interruption and instructions on how to limit inconvenience caused.
- C. Notify utility owners and other concerned entities at least 48 hours prior to cutting or closing streets or other traffic areas or excavating near Underground Facilities or exposed utilities.

1.14 SALVAGE OF EQUIPMENT AND MATERIALS

- A. Existing equipment and materials removed and not shown or specified to be reused in the Work will be Contractor's property.
- B. Existing equipment and material removed by Contractor shall not be reused in the Work, except where specified or indicated.
- C. Carefully remove in manner to prevent damage all equipment and materials specified or indicated to be salvaged and reused or to remain property of Owner. Store and protect salvaged items specified or indicated to be used in the Work. Replace in kind or with new items equipment, materials, and components damaged in removal, storage, or handling through carelessness or improper procedures.

D. Contractor may furnish and install new items, with Engineer's approval, instead of those specified or indicated to be salvaged and reused, in which case such removed items will become Contractor's property.

1.15 PARTIAL UTILIZATION BY OWNER

- A. Owner reserves the right to enter and use portions of the Work prior to Certificate of Substantial Completion is issued by Engineer.
- B. Owner shall be responsible to prevent premature connections by private and public parties, persons or groups of persons, before Engineer issues Certificate of Substantial Completion for the portion of Work being partially utilized by Owner.
- C. Contractor shall cooperate with Owner, Owner's agents, and Engineer to accelerate completion of Work designed for partial utilization by Owner in accordance with Contractor's progress schedule.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 20 00 MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Items listed in this Section refer to and are the same pay items listed in the Bid Form and constitute all pay items for completing the Work.
 - 2. Compensation for all services, items, materials, and equipment shall be include in prices stipulated for lump sum and unit price pay items listed in this Section and included in the Contract.
 - 3. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, bonds, insurance, or other requirements of the General Conditions, Supplementary Conditions, General Requirements, and other requirements of the Contract Documents.
 - 4. Each lump sum and unit bid price shall include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- B. Related Sections:
 - 1. Payments to Contractor: Refer to General Conditions, Supplementary Conditions, and Agreement.
 - 2. Changes to Contract Price: Refer to General Conditions.
 - 3. Schedule of Values: Refer to General Conditions.

1.02 ENGINEER'S ESTIMATE OF QUANTITIES

A. ENGINEER'S and OWNER's estimated quantities for unit price pay items, as listed in the Bid Form, are approximate only and are included solely for the purpose of comparison of Bids. Owner does not expressly or by implication agree that the nature of the materials encountered below the surface of the ground or the actual quantities of material encountered or required will correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity as Owner may deem necessary. Contractor will not be entitled to any adjustment in a unit bid price as a result of any change in an estimated quantity and agrees to accept the aforesaid unit bid prices as complete and total compensation for any additions caused by changes or alterations in the Work ordered by Owner.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Contractor shall include all additional Work items, services, goods, resources, and manpower necessary for installation of the Work to provide a completely functional system in accordance with the Contract Documents. Contractor shall include these costs associated with providing a completely functional system within the listed items on the Bid Form and as specified herein.

B. Bid Items:

- 1. Item 1: Mobilization & Demobilization
 - Method of Measurement and Basis for Payment: Mobilization and a. Demobilization shall be at the lump sum price established in the Bid Schedule and shall not exceed 10% of the Cost Proposal total. This lump sum amount provided in the Proposal is allowed by the City to defray some of the Contractor's costs associated with mobilization and demobilization of equipment, staging areas, project controls, site safety and security measures, project management, and all other work and materials required in the general and special conditions not otherwise covered by a pay item. The Contractor shall not consider this entirely representative of its costs to be incurred before any other items of work become eligible for payment. The Contractor shall, however, consider this a limit of the City's obligation for any costs incurred before any actual work being performed on the Project site. Payment will be remitted for mobilization up to a maximum of 50% the proposed cost upon Owner/Owner's Representative verification that the Contractor has fully provided all administrative items, etc. necessary to commence the Work. The remainder of the mobilization and demobilization cost will be remitted upon satisfactory provision of all project record documentation and any other close-out type of documentation required at the end of the contract including any term renewal or extensions.
- 2. Item 2: Survey and Staking
 - a. Method of Measurement and Basis for Payment: Survey and Staking shall be at the lump sum price established in the Bid Schedule. This item shall consist of all materials, equipment, labor, and maintenance to stake out control points, lines, and grades. The Contractor shall be responsible for the preservation of all stakes and marks, and no charge to the Owner shall be allowed for resetting stakes. Work shall be performed by a licensed surveyor registered in the Commonwealth of Virginia, in accordance with Section 01 32 00B - Stream Restoration Construction Survey and Stakeout.

- 3. Item 3: Dewatering and Flow Diversion for Streamwork
 - a. Method of Measurement and Basis for Payment: Dewatering and Flow Diversion for Streamwork shall be at the lump sum price established in the Bid Schedule. This item shall consist of all materials, equipment, labor, fuel, and maintenance to perform the work fully or partially dewater the stream channel as needed to facilitate construction, in accordance with Section 01 57 52 (Dewatering and Flow Diversion for Streamwork). Multiple pumps may be required to achieve necessary level of dewatering under this unit item.
- 4. Item 4: Earthwork Excavated Earth, Spread On Site
 - a. Method of Measurement:
 - Excavated earth, spread on site, shall be measured by the actual number of cubic yards of excavated soil spread on site to complete the work, as authorized by Owner and/or Owner's Representative. Measurement shall be based on the initial native pre-excavation state.
 - Excavated earth, while stored in temporary stockpiles on-site, will not be eligible to be measured for payment. Excavated earth will be eligible to be measured for payment following accepted placement of material as fill or spread on site.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 31 00 01 (Earthwork), including furnishing all materials, labor, equipment, tools, and incidentals necessary to handle, dewater, and place excavated earth on site to grade.
 - 2) On site handling of excavated earth is incidental to this pay item. No separated measurement for payment will be made associated with handling or filling or material within a contiguous site from which it was excavated.
 - 3) The Contractor shall provide progress surveys of the Work, verifying the field location of points and elevations shown on the Contract Documents, prior to acceptance of the amount measured for payment and is considered incidental to the pay item.
- 5. Item 5: Earthwork Excavated Earth, Hauled Off Site
 - a. Method of Measurement: excavated earth, hauled off site, shall be measured by the actual number of cubic yards of excavated soil hauled off to complete the work, as authorized by Owner and/or Owner's Representative.

Measurement shall be based on the actual truck volume hauled from the site.

- b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 31 00 01 (Earthwork), including furnishing all materials, labor, equipment, tools, and incidentals necessary to handle, dewater, remove, and haul excavated earth from the site.
 - 2) On site handling is incidental to this pay item. No separate measurement for payment will be made for associated with handling material within a contiguous site from which it was excavated.
 - 3) Should rock be encountered on site, material generated from rock excavation activities are not eligible for measurement under this items.
 - 4) The Contractor shall provide progress surveys of the Work, verifying the field location of points and elevations shown on the Contract Documents, prior to acceptance of the amount measured for payment
 - 5) Payment for this item shall be considered full compensation for any fees related to hauling or disposal. Unit of payment will be tons, computed by the truck load when haul tickets are submitted and approved by the Owner.
- 6. Item 6: Clearing and Grubbing (Including Trees <12" BDH), Mulch On Site (Except Where Specified)
 - a. Method of Measurement: clearing and grubbing shall be measured per acre of area cleared and/or grubbed and mulched on site as measured in the horizontal plane where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 31 10 00 (Clearing, Grubbing, and Site Preparation), including furnishing all materials, labor, equipment, tools, and incidentals necessary to clear, mulch, and grub the work area of all trees (less than or equal to 12" DBH), shrubs, and undergrowth.
 - All specified trees marked for removal within this specified range (i.e., <12" DBH) shall be kept, stored, and maintained on site for reuse where specified in the Contract Documents.

- 7. Item 7: Tree Removal 13" to 18"
 - a. Method of Measurement: tree removal, between 13" to 18" DBH, shall be measured by the actual number of trees removed and root wads preserved where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 31 10 00 (Clearing, Grubbing, and Site Preparation), including furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work. All specified trees marked for removal shall be kept, stored, and maintained on site for reuse where specified in the Contract Documents.
 - 2) Work outside of the defined project area where selective tree removal was performed without prior approval by the Owner and/or Owner's representative shall not be included in measurement for payment.
- 8. Item 8: Tree Removal 19" to 24"
 - a. Method of Measurement: tree removal, between 19" to 24" DBH, shall be measured by the actual number of trees removed and root wads preserved where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 31 10 00 (Clearing, Grubbing, and Site Preparation), including furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work. All specified trees marked for removal shall be kept, stored, and maintained on site for reuse where specified in the Contract Documents.
 - 2) Work outside of the defined project area where selective tree removal was performed without prior approval by the Owner and/or Owner's representative shall not be included in measurement for payment.
- 9. Item 9: Tree Removal Greater than 24"
 - a. Method of Measurement: tree removal, greater than 24", shall be measured by the actual number of trees removed and root wads preserved where

specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.

- b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 31 10 00 (Clearing, Grubbing, and Site Preparation), including furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work. All specified trees marked for removal shall be kept, stored, and maintained on site for reuse where specified in the Contract Documents.
 - 2) Work outside of the defined project area where selective tree removal was performed without prior approval by the Owner and/or Owner's representative shall not be included in measurement for payment.
- 10. Item 10: Temporary Tree Protection Tree Fencing
 - a. Method of Measurement: tree fencing shall be measured by the actual linear feet of tree fence installed, accepted, and maintained in place and where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 31 25 00 (Erosion and Sediment Control) and the Virginia Erosion and Sediment Control Handbook (latest edition), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, removal, inspection, monitoring, and reporting on the tree fencing.
 - 2) No additional payment shall be made for maintenance or replacement of tree fence.
- 11. Item 11: Erosion and Sediment Control Inlet Protection
 - a. Method of Measurement: inlet protection shall be measured for the actual number of inlet protection installed, accepted, and maintained in place and where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 31 25 00 (Erosion and Sediment Control) and the Virginia

Erosion and Sediment Control Handbook (latest edition), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, removal, inspection, monitoring, and reporting on the inlet protection.

- 2) No additional payment shall be made for maintenance or replacement of inlet protection.
- 12. Item 12: Erosion and Sediment Control Silt Fence
 - a. Method of Measurement: silt fence shall be measured by the actual linear feet of silt fence installed, accepted, and maintained in place and where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 31 25 00 (Erosion and Sediment Control) and the Virginia Erosion and Sediment Control Handbook (latest edition), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, removal, inspection, monitoring, and reporting on the silt fence.
 - 2) No additional payment shall be made for maintenance or replacement of silt fence.
- 13. Item 13: Erosion and Sediment Control Temporary Seed & Straw
 - a. Method of Measurement: temporary seed and straw shall be measured for the square yards of seed at the specified coverage rate where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 31 25 00 (Erosion and Sediment Control) and the Virginia Erosion and Sediment Control Handbook (latest edition), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, mulching, sowing, fertilizing/soil preparation, and maintaining the temporary erosion control seeding to create a satisfactory stabilization.
 - 2) Payment shall be compensation in full for maintenance of the seed, including additional application or replacement.

- Payment shall be compensation for all soil preparation and mulching but does not include the application of topsoil during seedbed preparation which shall be paid for under Bid Item 15.
- 14. Item 14: Erosion and Sediment Control Stabilized Construction Entrance
 - a. Method of Measurement: stabilized construction entrances shall be measured by the actual number of entrances installed and accepted where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 31 25 00 (Erosion and Sediment Control), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, maintaining, removal, inspection, monitoring, and reporting on the construction entrance.
 - 2) No additional payment shall be made for the re-application or maintenance of construction entrances.
- 15. Item 15: Topsoil for Streamwork
 - a. Method of Measurement: topsoil shall be measured by the actual cubic yards of topsoil installed and accepted where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 90 22 (Topsoil for Streamwork), including furnishing all materials, labor, equipment, tools, and incidentals necessary to import/deliver, spread at a uniform thickness, and amend the soil within the defined project area or as further directed by Owner and/or Owner's Representative.
 - 2) Any additional topsoil added outside of the defined work area will be considered beyond the limits of measurement and will be considered incidental to the work.
 - 3) No payment will be made under this item for the stripping, stockpiling, spreading, or incorporation of on-site topsoil.
- 16. Item 16: Live Plantings Plugs

- a. Method of Measurement: live plantings, plugs, shall be measured by the actual number of specified plugs planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
- b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the plugs.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - 3) Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the plug's root zone shall be considered incidental to the pay item.
- 17. Item 17: Container Plantings, 1-Gallon
 - a. Method of Measurement: container plantings, 1-gallon, shall be measured by the actual number of specified container plants planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the container planting.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the container planting's root zone shall be considered incidental to the pay item.
- 18. Item 18: Container Plantings, 3-Gallon
 - a. Method of Measurement: container plantings, 3-gallon, shall be measured by the actual number of specified container plants planted, accepted, and

complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.

- b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the container planting.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the container planting's root zone shall be considered incidental to the pay item.
- 19. Item 19: Bare Root Trees
 - a. Method of Measurement: bare root trees, shall be measured by the actual number of specified bare root trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the bare root tree.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the bare root tree's root zone shall be considered incidental to the pay item.
- 20. Item 20: Caliper Trees, 1"
 - a. Method of Measurement: caliper trees, 1", shall be measured by the actual number of specified caliper trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.

- b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the caliper tree.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - 3) Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the caliper tree's root zone shall be considered incidental to the pay item.
- 21. Item 21: Caliper Trees, 1.5"
 - a. Method of Measurement: caliper trees, 1.5", shall be measured by the actual number of specified caliper trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the caliper tree.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the caliper tree's root zone shall be considered incidental to the pay item.
- 22. Item 22: Caliper Trees, 2"
 - a. Method of Measurement: caliper trees, 2", shall be measured by the actual number of specified caliper trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:

- The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the caliper tree.
- 2) Replacements during the warranty period are incidental to the pay item.
- 3) Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the caliper tree's root zone shall be considered incidental to the pay item.
- 23. Item 23: Single Stem Trees, 7' Height
 - a. Method of Measurement: single stem trees, 7' height, shall be measured by the actual number of specified single stem trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the single stem tree.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - 3) Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the single stem tree's root zone shall be considered incidental to the pay item.
- 24. Item 24: Multi-Stemmed Trees, 7' Height
 - a. Method of Measurement: multi-stemmed trees, 7' height, shall be measured by the actual number of specified multi-stemmed trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing

all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the multistemmed tree.

- 2) Replacements during the warranty period are incidental to the pay item.
- Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the multi-stemmed tree's root zone shall be considered incidental to the pay item.
- 25. Item 25: Specialty Seeding Stream Side Seed Mix Zone 1
 - a. Method of Measurement: stream side seed mix specialty seeding shall be measured for the square yards of seed application where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 92 30 (Specialty Seeding), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, sowing, and maintaining the stream side specialty seeding.
 - 2) Payment shall be compensation in full for maintenance of the seed, including additional application or replacement.
 - Payment shall be compensation for all soil preparation and mulching but does not include the application of topsoil during seedbed preparation which shall be paid for under Bid Item 15.
- 26. Item 26: Specialty Seeding Riparian Buffer Seed Mix Zones 2 through 4
 - a. Method of Measurement: riparian buffer seed mix specialty seeding shall be measured for the square yards of seed application where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 92 30 (Specialty Seeding), including furnishing all materials, labor, equipment, tools, and incidentals necessary for

furnishing, placing, sowing, and maintaining the riparian buffer specialty seeding.

- 2) Payment shall be compensation in full for maintenance of the seed, including additional application or replacement.
- Payment shall be compensation for all soil preparation and mulching but does not include the application of topsoil during seedbed preparation which shall be paid for under Bid Item 15.
- 27. Item 27: Specialty Seeding 5311 Conservation Mix, Full Sun
 - a. Method of Measurement: conservation seed mix specialty seeding shall be measured for the square yards of seed application where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 92 30 (Specialty Seeding), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, sowing, and maintaining the conservation mix specialty seeding.
 - 2) Payment shall be compensation in full for maintenance of the seed, including additional application or replacement.
 - Payment shall be compensation for all soil preparation and mulching but does not include the application of topsoil during seedbed preparation which shall be paid for under Bid Item 15.
- 28. Item 28: Live Stakes
 - a. Method of Measurement: live stakes shall be measured by the actual number of live stakes installed and accepted in place as specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 93 50 (Live Stakes), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintain, and protecting the live stake.

- 2) Replacements during the warranty period are incidental to the pay item.
- 3) Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the plant's root zone shall be considered incidental to the pay item.
- 29. Item 29: Erosion and Sediment Control Coir Mat
 - a. Method of Measurement: coir matting shall be measured by the actual square yards of coir matting installed and accepted in place as specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 35 42 57 (Coir Mat), including but not limited to grading, installation, adjusting, excavating, placing backfill, maintaining the feature through acceptance, and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work as specified in the Contract Documents.
 - No additional payment shall be made for dead stout stakes, overlapping, or trenching in of fabric edges as shown in the supporting details, maintenance, and replacement or coir mat.
- 30. Item 30: Soil Lift/Encapsulated Fill
 - a. Method of Measurement: soil lift/encapsulated fill shall be measured by the actual linear feet of each lift installed and accepted in place as specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 35 42 63 (Double Layer Soil Lift), including but not limited to grading, installation, adjusting, excavating, placing backfill, maintaining the feature through acceptance, and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work as specified in the Contract Documents.
 - 2) Included shall be the cost of excavation beyond final dimensions to provide firm foundation, dead stout stakes, and trenching in of fabric edges as shown in the supporting details, and any costs for furnishing

necessary work beyond the limits of measurement as defined under the specification.

- 31. Item 31: Wood Toe
 - a. Method of Measurement: wood toe shall be measured by the actual linear feet of wood toe along the stream bank, installed in place as required in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative. Contractor shall notify Owner and/or Owner's representative for measurement inspection of structure prior to backfill. Payment for structure submitted without measurement inspection by Owner and/or Owner's Representative will not be accepted.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 35 42 72 (Wood Toe), including but not limited to grading, handling of materials, installation, adjusting, maintaining the feature through acceptance, and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work as specified in the Contract Documents.
 - 2) Felled, on-site trees produced during site clearing activities shall be used as construction material for this line item if the woody material meets specifications with the Contract Documents and approved by Owner and/or Owner's Representative. Trees selected for reuse have been identified within the Contract Documents and payment for felling and storing these trees and their rootwads on site are included under Bid Items 7 through 9.
 - 3) No separate measurement of materials shall be made under this item for coarse backfill, fabric, anchors, and/or other incidental items.
 - 4) Payment shall be compensation for installation of toe wood but does not include necessary earth excavation and haul off which shall be paid for under Bid Item 5.
- 32. Item 32: Riffle Grade Control
 - Method of Measurement: riffle grade control shall be measured by the actual linear feet of riffle grade control installed and accepted into the final Work. Contractor shall notify Owner and/or Owner's representative for measurement inspection of structure prior to backfill. Payment for structure submitted without measurement inspection by Owner and/or Owner's Representative will not be accepted.

- b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 35 43 63 (Riffle Grade Control), including but not limited to grading, installation, adjusting, maintaining the feature through acceptance, and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work as specified in the Contract Documents.
 - Payment shall be compensation for installation of riffle grade control but does not include necessary earth excavation, backfill, and haul off which shall be paid for under Bid Items 4 and 5.
- 33. Item 33: Rock Cross Vane
 - a. Method of Measurement: rock cross vane shall be measured by the actual number of rock cross vanes installed and accepted into the final Work. Contractor shall notify Owner and/or Owner's representative for measurement inspection of structure prior to backfill. Payment for structure submitted without measurement inspection by Owner and/or Owner's Representative will not be accepted.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 35 43 65 (Rock Cross Vane), including but not limited to grading, installation, adjusting, maintaining the feature through acceptance, and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work as specified in the Contract Documents.
 - 2) No separate measurement of materials shall be made under this item for coarse backfill, fabric, anchors, and/or other incidental items.
 - Payment shall be compensation for installation of rock cross vane but does not include necessary earth excavation and haul off which shall be paid for under Bid Items 5.
- 34. Item 34: Rock Cascade
 - a. Method of Measurement: rock cascade shall be measured by the actual number of rock cascade installed and accepted into the final Work. Contractor shall notify Owner and/or Owner's representative for measurement inspection of structure prior to backfill. Payment for structure submitted without measurement inspection by Owner and/or Owner's Representative will not be accepted.

- b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 35 43 69 (Rock Cascade), including but not limited to grading, installation, adjusting, maintaining the feature through acceptance, and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work as specified in the Contract Documents.
 - 2) No separate measurement of materials shall be made under this item for coarse backfill, fabric, anchors, and/or other incidental items.
 - Payment shall be compensation for installation of rock cascade but does not include necessary earth excavation and haul off which shall be paid for under Bid Item 5.
- 35. Item 35: Log J-Hook Vane (with Root Wad)
 - a. Method of Measurement: log j-hook vane shall be measured by the actual number of j-hook log vanes installed and accepted into the final Work. Contractor shall notify Owner and/or Owner's representative for measurement inspection of structure prior to backfill. Payment for structure submitted without measurement inspection by Owner and/or Owner's Representative will not be accepted.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered Section 35 43 74 (Log J-Hook), including but not limited to grading, installation, adjusting, maintaining the feature through acceptance, and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work as specified in the Contract Documents.
 - 2) Felled, on-site trees during site clearing activities shall be used as construction material for this line item if product meets specifications with the Contract Documents and approved by Owner and/or Owner's Representative. Trees selected for reuse have been identified within the Contract Documents and payment for felling and storing these trees and their rootwads on site are included under Bid Items 7 through 9.
 - 3) No separate measurement of materials shall be made under this item for coarse backfill, fabric, anchors, and/or other incidental items.

- 4) Payment shall be compensation for installation of log j-hook vane but does not include necessary earth excavation and haul off which shall be paid for under Bid Item 5.
- C. Add-Alternate Bid Items:
 - 1. Item 17-ALT: Container Plantings, 1-Gallon
 - a. Method of Measurement: container plantings, 1-gallon, shall be measured by the actual number of specified container plants planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the container planting.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the container planting's root zone shall be considered incidental to the pay item.
 - 2. Item 18-ALT: Container Plantings, 3-Gallon
 - a. Method of Measurement: container plantings, 3-gallon, shall be measured by the actual number of specified container plants planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the container planting.
 - 2) Replacements during the warranty period are incidental to the pay item.

- Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the container planting's root zone shall be considered incidental to the pay item.
- 3. Item 19-ALT: Bare Root Trees
 - a. Method of Measurement: bare root trees, shall be measured by the actual number of specified bare root trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the bare root tree.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the bare root tree's root zone shall be considered incidental to the pay item.
- 4. Item 20-ALT: Caliper Trees, 1"
 - a. Method of Measurement: caliper trees, 1", shall be measured by the actual number of specified caliper trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the caliper tree.
 - 2) Replacements during the warranty period are incidental to the pay item.

- Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the caliper tree's root zone shall be considered incidental to the pay item.
- 5. Item 24-ALT: Multi-Stemmed Trees, 7' Height
 - a. Method of Measurement: multi-stemmed trees, 7' height, shall be measured by the actual number of specified multi-stemmed trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - 1) The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the multistemmed tree.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the multi-stemmed tree's root zone shall be considered incidental to the pay item.
- 6. Item 36-ALT: Caliper Trees, 3/4"
 - a. Method of Measurement: caliper trees, 3/4", shall be measured by the actual number of specified caliper trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the caliper tree.
 - 2) Replacements during the warranty period are incidental to the pay item.

- 3) Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the caliper tree's root zone shall be considered incidental to the pay item.
- 7. Item 37-ALT: Single Stem Trees, 5' Height
 - a. Method of Measurement: single stem trees, 7' height, shall be measured by the actual number of specified single stem trees planted, accepted, and complete in place where specified in the Contract Documents or as otherwise directed by Owner and/or Owner's Representative.
 - b. Basis of Payment:
 - The unit price shall be compensation in full for all work covered under Section 32 91 24 (Streamwork Plant Installation), including furnishing all materials, labor, equipment, tools, and incidentals necessary for furnishing, placing, staking, maintaining, and protecting the single stem tree.
 - 2) Replacements during the warranty period are incidental to the pay item.
 - 3) Any removal of temporary vegetation, excavation, soil amendments, and mulching, within the footprint of the single stem tree's root zone shall be considered incidental to the pay item.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 19 PROJECT MEETINGS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Pre-Construction Meeting:
 - a. Purpose of conference is to designate responsible personnel, establish working relationships, discuss preliminary schedules submitted by Contractor, and review administrative and procedural requirements for the Project. Matters requiring coordination will be discussed and procedures for handling such matters will be established.
 - b. Date, Time and Location: Conference will be held after execution of the Contract and before Work starts at the Site. Engineer will establish the date, time, and location of conference and notify the interested and involved parties.
 - 2. Progress Meetings:
 - Progress meetings will be held throughout the Project. Contractor shall attend each progress meeting prepared to discuss in detail all items on the agenda.
 - b. Engineer will preside at progress meetings and will prepare and distribute minutes of progress meetings to all meeting participants and others as requested.
 - c. Date, Time, and Location:
 - 1) Regular Meetings: Every month on a day and time agreeable to Owner, Engineer, and Contractor.
 - 2) Engineer's Field Office at the Site or other location mutually agreed upon by Owner, Contractor, and Engineer.
 - d. Additional meetings may be conducted as progress of Work requires at a mutually agreed date, time and location.

1.02 ADMINSTRATIVE REQUIREMENTS

A. Pre-Construction Meeting:

- 1. Contractor shall provide pre-construction meeting submittals with sufficient number of copies for each attendee:
- 2. Required Attendees:
 - a. Contractor
 - 1) Project manager.
 - 2) Site superintendent.
 - 3) Safety representative.
 - 4) Major Subcontractors.
 - b. Owner.
 - c. Engineer.
 - d. Resident Project Representative (RPR).
 - e. Owner's Site Representative (OSR).
 - f. Representatives of governmental or other regulatory agencies, if required.
- 3. Contractor shall prepare and submit a health and safety plan as specified in this Section prior to the pre-construction meeting.
- 4. Agenda, minimum:
 - a. Procedural requirements:
 - 1) Designation of responsible personnel
 - 2) Use of Site and Owner's requirements, including general regards for community relations
 - 3) Delivery of materials and equipment to the Site
 - 4) Safety and first aid procedures
 - 5) Security procedures
 - 6) Housekeeping procedures
 - b. Administrative requirements:
 - 1) Distribution of Contract Documents.
 - 2) Shop Drawing submittal procedures.

- 3) Maintaining record documents at the Site.
- 4) Contract modification procedures
- 5) Processing of Payment Application
- c. Site mobilization requirements:
 - 1) Working hours, overtime, and holidays.
 - 2) Field offices, trailers, and staging areas.
 - 3) Temporary facilities and utilities, including usage and coordination.
 - 4) Temporary controls, such as sediment and erosion control, noise, dust, storm water, and other measures.
 - 5) Access to Site, access roads, and parking for construction vehicles.
 - 6) Protection of traffic and existing property, including site barriers and temporary fencing.
 - 7) Security
 - 8) Storage of materials and equipment.
 - 9) Reference points and benchmarks, surveys and layouts.
 - 10) Site maintenance during the project, including cleaning and removal of trash and debris.
 - 11) Site restoration.
- d. Schedules
 - 1) Preliminary construction schedule
 - 2) Critical work sequencing
 - 3) Preliminary Shop Drawing submittal schedule
 - 4) Preliminary Schedule of Values
- B. Progress Meetings:
 - 1. Progress meetings frequency shall be conducted as specified in this Section, unless modified and agreed upon by Owner, Contractor, and Engineer. Additional meetings may be conducted as progress of Work requires.

- 2. Contractor shall provide submittals specified in this Section prior to each progress meeting.
- 3. Attendance:
 - a. Contractor, including project manager, site superintendent, safety representative, and representatives of Subcontractors and Suppliers as required.
 - b. Engineer, including project manager (or designated representative), Resident Project Representative (if any), others as required by Engineer.
 - c. Owner, including Owner's Site Representative (if any).
 - d. Subcontractors, only with Engineer's approval or request, as required in the agenda.
- 4. Agenda, minimum:
 - a. Review, comment, and amendment (if required) of minutes of previous progress meeting.
 - b. Review of progress since the previous progress meeting.
 - c. Planned progress through next 30 60 days.
 - d. Review of Progress Schedule
 - 1) Contract Times, including Milestones (if any)
 - 2) Critical path.
 - 3) Schedules for fabrication and delivery of materials and equipment.
 - 4) Corrective measures, if required.
 - e. Submittals:
 - 1) Review of status of critical submittals.
 - 2) Review revisions to schedule of submittals.
 - f. Contract Modifications:
 - 1) Requests for interpretation
 - 2) Clarification notices
 - 3) Field Orders
- 4) Proposal requests
- 5) Change Proposals
- 6) Work Change Directives.
- 7) Change Orders.
- 8) Claims.
- g. Applications for progress payments.
- h. Problems, conflicts, and observations.
- i. Quality standards, testing, and inspections.
- j. Coordination between parties.
- k. Site management issues, including access, security, maintenance and protection of traffic, maintenance, cleaning, and other Site issues.
- I. Safety.
- m. Permits.
- n. Record documents status.
- o. Punch list status, as applicable.
- p. Other business.

1.03 SUBMITTALS

- A. Pre-Construction Meeting Submittals:
 - 1. Prior to the conference, submit the following preliminary schedules in accordance with the General Conditions:
 - 1) Progress schedule
 - 2) Schedule of submittals
 - 3) Schedule of values
 - 2. Contractor's safety and first aid procedures.
 - 3. List of emergency contact information
- B. Progress Meeting Submittals:

- 1. List of Work accomplished since the previous progress meeting.
- 2. Up-to-date Progress Schedule.
- 3. Up-to-date Schedule of Submittals.
- 4. Detailed "look-ahead" schedule of Work planned through the next progress meeting, with specific starting and ending dates for each activity, including shutdowns, deliveries of important materials and equipment, Milestones (if any), and important activities affecting the Owner, Project, and Site.
- 5. When applicable, list of upcoming, planned time off (with dates) for personnel with significant roles on the Project, and the designated contact person in their absence.

1.04 EMERGENCY CONTACT INFORMATION

- A. Contractor shall provide list of emergency contact information for 24-hour use throughout the Project. Emergency contact information shall be updated and kept current throughout the Project. If personnel or contact information change, provide updated emergency contact information list at the next progress meeting.
- B. Contractor's list of emergency contact information shall include:
 - 1. Contractor's project manager's office, field office, cellular, and home telephone numbers.
 - 2. Contractor's Site superintendent's office, field office, cellular, and home telephone numbers.
 - 3. Contractor's foreman's field office, cellular (if available), and home telephone numbers.
 - 4. Major Subcontractors' and Suppliers' office, cellular, and home telephone numbers of project manager and foreman (when applicable).
- C. Additional Emergency Contact Information:
 - 1. Owner's Project Manager: office, cellular, and home telephone numbers.
 - 2. Owner's central 24-hour emergency telephone number.
 - 3. Engineer's project engineer's office, cellular, and home telephone numbers.
 - 4. Resident Project Representative's office, field office, cellular, and home telephone numbers.
 - 5. Owner's Site Representative's office, field office, cellular, and home telephone numbers.

- 6. Emergency telephone numbers, including: "Emergency: Dial 911", and seven-digit telephone numbers for the hospital, ambulance, police, and fire department nearest to the Site. Provide names of each of these institutions.
- 7. Other involved entities as applicable.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 CONSTRUCTION PROGRESS SCHEDULE

PART 1 – GENERAL

1.01 SUMMARY

- A. Contractor shall prepare and submit Progress Schedules and related documents in accordance with the General Conditions, as may be modified by the Supplementary Conditions, and this Section, unless otherwise accepted by Engineer.
 - 1. Maintain and update Progress Schedules and related documents.
 - 2. Progress Schedule shall be a Critical Path Method (CPM) Progress Schedule.
- B. Engineer's acceptance of the Progress Schedule or related documents, and comments or opinions concerning activities in the Progress Schedule and related documents shall not control independent judgment of Contractor concerning means, methods, techniques, sequences and procedures of construction, unless the associated means, method, technique, sequence, or procedure is directed by the Contract Documents. Contractor is solely responsible for complying with the Contract Times.

1.02 REFERENCES

- A. Definitions:
 - 1. Activity: An element of the construction work that has the following specific characteristics: consumes time, consumes resources, has a definable start and finish, is assignable, and is measurable.
 - 2. Constraint: An imposed date on the Progress Schedule or an imposed tie between Activities. The Contract Times are Constraints.
 - 3. CPM Progress Schedule: Computerized Progress Schedule in Critical Path Method (CPM) format which accounts for the entire Work, defines the interrelationships between elements of the Work, reflects the uncompleted Work, and indicates the sequence with which the Work has been completed, indicates the sequence in which uncompleted Work will be completed, and indicates the duration of each Activity.
 - 4. Critical Path: The continuous chain of Activities with the longest duration for completion within the Contract Times.
 - 5. Early Start: The earliest possible date an Activity can start according to the assigned relationships among Activities.

- 6. Early Finish: The earliest date an Activity can finish according to the assigned relationships among the Activities.
- 7. Late Finish: The latest date an Activity can finish without extending the Contract Times.
- 8. Late Start: The latest date an Activity can start without extending the Contract Times.
- 9. Float: The time difference between the calculated duration of the Activity chain and the Critical Path.
- 10. Total Float: The total number of days that an Activity (or chain of Activities) can be delayed without affecting the Contract Times.
- 11. Network Diagram: A time-scaled logic diagram depicting the durations and relationships of the Activities.
- 12. Work Areas, Area, or System: A logical breakdown of the Project elements or a group of Activities which, when collectively assembled, are readily identifiable on the Project (for example, yard piping, a structure or building, a treatment process, or other logical grouping).

1.03 ADMINSTRATIVE REQUIREMENTS

- A. Initial Progress Schedule:
 - 1. Type and Organization of Progress Schedules:
 - a. Prepare one Progress Schedule covering the entire Project using scheduling software that is acceptable to Engineer.
 - b. Sheet Size: 11" by 17", unless otherwise accepted by Engineer.
 - c. Time Scale: Indicate first date of each work week.
 - d. Activity Designations: Indicate title and related Specification Section number.
 - e. Organization:
 - 1) Indicate on the separate Schedule of Submittals dates for submitting and reviewing Shop Drawings, Samples, and other submittals.
 - 2) Group deliveries of materials and equipment into a separate subschedule that is part of the Progress Schedule.
 - 3) Group construction into Work Area sub-schedules (that are part of the Progress Schedule) by Activity.

- 4) Clearly indicate the Critical Path on the Progress Schedule.
- 5) Organize each Work Area sub-schedule by Specification Section number.
- 2. Preliminary Progress Schedule:
 - a. Contractor shall submit to Engineer the preliminary Progress Schedule with associated Network Diagrams within 30 days after the Contract Times commence running.
 - Submit three (3) copies of preliminary Progress Schedule and associated reports and schedule-related documents to accompany the preliminary Progress Schedule, in accordance with the Submittals Article of this Section. Submit in accordance with Section 01 33 00 – Submittal Procedures.
- 3. Initial Acceptance of Progress Schedule:
 - a. At least 10 days before submission of the first Application for Payment, Contractor shall schedule a conference at the Site for review of the preliminary Progress Schedule.
 - 1) Attendees shall include Contractor, Engineer, Owner and others as required.
 - Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the Progress Schedule and associated Network Diagram.
 - Owner reserves the right to not make progress payment to Contractor until acceptable Progress Schedule, Network Diagram, and other reports and schedule-related documents required are submitted to Engineer.
 - b. Submit three (3) copies each of acceptable Progress Schedule with Network Diagram, reports, and other schedule-related documents required to accompany the initial acceptable Progress Schedule, in accordance with the Submittals Article of this Section.
 - c. Initially-accepted Progress Schedule shall be identified as the baseline Progress Schedule.
- B. Progress Schedule Updates:
 - 1. Update the Progress Schedule each month. If during progress of the Work events develop that necessitate changes in the initially accepted Progress Schedule (i.e.,

baseline Progress Schedule), identify updated Progress Schedules sequentially as Progress Schedule Revision 1, 2, 3, and continuing in sequence as required.

- 2. The update to the Progress Schedule shall be based on retained logic. Progress override logic is not allowed.
- 3. Required scheduling software, and schedule organization, format, and content for updated Progress Schedules are identical to that required in this Section for initial Progress Schedules.
- 4. Submit to Engineer three (3) hard copies of the updated Progress Schedule, Network Diagram, narrative report, and other schedule-related reports and documents required.
- 5. Submit updated Network Diagrams when revisions are proposed to the logic. Indicate in the narrative report delays that have occurred since the previous updated Progress Schedule. Engineer will not recommend payment by Owner of progress payments until updated Progress Schedule is received, reviewed, and accepted by Engineer. Payment for out-of-sequence Work is not allowed.

1.04 NETWORK DIAGRAMS (PERT CHARTS)

- A. General:
 - 1. Contractor shall prepare and submit Network Diagrams, as generated using the scheduling software on paper of the size indicated for Progress Schedules in this Section.
 - 2. Group Network Diagrams by Area and show the order and interdependence of Activities and sequence and quantities in which the Work will be accomplished.
 - 3. Do not use match lines on Network Diagrams. Depict interrelationships to or from Activities outside the Area shown using an Activity symbol with Activity number and description.
 - 4. In preparing Network Diagrams, comply with the basic concept of precedence diagramming method (PDM) network scheduling to show how start of a given Activity depends on completion of preceding Activities, and how the Activity's completion may affect the start of subsequent Activities.
 - 5. Level of schedule detail shall define the day-to-day Activities of the Work.
- B. Content:
 - 1. Clearly indicate the Critical Path and distinguish the Critical Path from other paths on the network.

- 2. Organize Network Diagrams by grouping into major Work Areas, including one for procurement of materials and equipment, and by specific Activity within each Area.
- 3. Logic diagrams shall include the following:
 - a. Activity number.
 - b. Activity description.
 - c. Activity duration (in work days).
 - d. Critical Path denoted.
 - e. Float for each Activity.
 - f. Activity or System designation.
 - g. Coded Area designation.
 - h. Responsibility code (e.g., each prime contractor and their respective Subcontractors, trade, operation, Suppliers, or other entity responsible for accomplishing an Activity).
 - i. Shift number (if more than one shift per day is to be employed).
- C. Revisions:
 - When conditions develop that require revisions to logic or durations of the Network Diagram associated with the initially accepted Progress Schedule (i.e., baseline Progress Schedule), identify updates to the Network Diagram in the same manner required in this Section for Progress Schedule updates.
 - 2. Revision of the logic or durations from the baseline Progress Schedule initially accepted by Engineer shall be submitted to Engineer for acceptance.
 - 3. Incorporate into the Progress Schedule revisions to logic or duration accepted by Engineer and include in monthly narrative report both a description of revisions and listing of Activities affected by revisions.
 - 4. Changes resulting from Change Orders and other additions or deletions, shall be fully incorporated into the Progress Schedule and Network Diagram on the first update after the associated Change Order is approved by Owner, including adjustments to the Contract Price.

1.05 TIME IMPACT ANALYSIS

A. General:

- 1. Prepare and submit a time impact analysis when one or more of the following occurs:
 - a. Change Order proposal is prepared
 - b. Work Change Directive is issued that will affect the Progress Schedule
 - c. When delays are experienced.
- 2. Time impact analysis shall illustrate the influence of each Change Order, Work Change Directive, or delay.
- 3. Each time impact analysis shall include a sketch (fragnet) demonstrating how Contractor proposes to incorporate the changes in the Project or, as applicable, delays into the Progress Schedule. Fragnet shall include all logic, and additions required as result of said Change Order, Work Change Directive, or delay.
- 4. Fragnet shall show all CPM logic revisions for the Work associated with the Change Order, Work Change Directive, or delay and its relationship to other Activities in the Network Diagram.
- 5. Timing of Time Impact Analysis:
 - a. Submit each time impact analysis within 7 days after the following, as applicable:
 - 1) Start of the delay.
 - 2) After the submittal of Change Order proposal to Engineer
 - 3) After Contractor's Receipt of Work Change Directive.
 - b. Failure to Submit Time Impact Analysis: When General Contractor does not submit time impact analysis for a specific change or delay under the General Contract, within the specified period of time for such submittal, such nonsubmittal shall be construed that no extension of the Contract Times is required
- B. Evaluation by Engineer and Acceptance:
 - 1. Engineer's evaluation of each time impact analysis comprised of complete information will be completed in timely manner after Engineer's receipt. Changes in the Contract Times will be made only by Change Order.
 - 2. When mutual agreement is reached between the parties, on effect of the change or delay in the Project, incorporate into the next Progress Schedule update the associated fragments illustrating the influence of changes and delays.

1.06 RECOVERY SCHEDULES

- A. General:
 - 1. When updated Progress Schedule indicates that the ability to comply with the Contract Times falls 30 or more days behind schedule, and there is no excusable delay, Change Order, or Work Change Directive to support an extension of the Contract Times, Contractor shall prepare and submit a recovery Progress Schedule demonstrating Contractor's plan to accelerate the Project to achieve compliance with the Contract Times (i.e., "recovery" schedule) for Engineer's acceptance.
 - 2. Submit recovery schedule within 14 days after submittal of updated Progress Schedule where need for recovery schedule is indicated.
- B. Implementation of Recovery Schedule:
 - 1. At no additional cost to Owner, Contractor shall do one or more of the following:
 - a. Furnish additional labor and construction equipment
 - b. Employ additional work shifts
 - c. Expedite procurement of materials and equipment to be incorporated into the Work
 - d. Other measures necessary to complete the Work within the Contract Times.
 - 2. Upon acceptance of recovery schedule by Engineer, incorporate recovery schedule into the next Progress Schedule update.
- C. Lack of Action: Contractor's refusal, failure or neglect to submit a recovery schedule, shall constitute reasonable evidence that Contractor is not prosecuting the Work or separable part thereof with the diligence that will ensure completion within the Contract Times. Such lack of action shall constitute sufficient basis for Owner to exercise remedies available to Owner under the Contract Documents

1.07 USE OF FLOAT

- A. Total Float and Contract Float belong to the Project and may be used by Owner, Engineer, or Contractor to accommodate modifications, regardless of origination, in the Work or to mitigate the effect of events that may delay performance or completion of the Work.
- B. Changes or delays that influence scheduled Work Activities with Float and that do not extend the critical path will not be justification for an extension in Contract Times.

1.08 SUBMITTALS

- A. Action/Informational Submittals:
 - 1. Initial Progress Schedules:
 - a. Preliminary Progress Schedule with associated Network Diagrams.
 - b. Acceptable Progress Schedule with associated Network Diagrams.
 - 2. Progress Schedule Updates:
 - a. Progress Schedule updates shall comply with requirements of this Section, and shall include updated Progress Schedule, updated Network Diagram when relationships among Activities are changed.
 - b. Submit updated Progress Schedule at each progress meeting. If a Progress Schedule remains unchanged from one progress meeting to the next, submit a written statement to that effect.
 - 3. Time Impact Analyses: Submit in accordance with this Section.
 - 4. Recovery Schedule: Submit in accordance with this Section.
 - 5. Qualifications: Progress Schedule preparer, and other personnel that will assist Progress Schedule preparer in preparing and maintaining the Progress Schedule.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00B

STREAM RESTORATION CONSTRUCTION SURVEY AND STAKEOUT

PART 1 – GENERAL

1.01 SUMMARY

- A. Construction staking shall include all of the surveying work required to layout the Work and control the location of the finished Project. The Contractor is responsible for all construction surveying and stakeout required to initiate and maintain complete horizontal and vertical alignment, as shown on the Drawings, as specified, and/or as ordered by the Owner or Engineer.
- B. The Contractor shall assume all costs associated with rectifying work constructed in the wrong location.
- C. Survey control anticipated for the work includes, but is not limited to the following:
 - 1. Setting benchmarks for construction.
 - 2. Establish working limits.
 - 3. Construction staking for excavations, channel construction, in-stream features, and other facilities. Both horizontal and vertical control required.
 - 4. Interim As-Built surveys.
- D. Construction staking shall include all surveying work required to layout the work and control the location of the finished construction.
- E. Any deviations from the Drawings shall be confirmed by the Engineer prior to construction of that portion of the Project. A topographic survey is included in the drawings. The topographic information shown is believed to be correct. However, it shall be the Contractor's responsibility to determine any major differences which would affect the project.
- F. For areas designated for either excavation or fill, the Contractor shall be responsible for arranging and paying for surveys following earth moving activities.

1.02 REFERENCES

- A. Definitions:
 - 1. BP: Beginning Point
 - 2. EP: End Point

- 3. PC: Point of Curvature
- 4. PT: Point of Tangent

1.03 SCHEDULING AND SEQUENCING

- A. The Contractor is responsible for scheduling and coordination of all surveying activities.
- B. Prior to any clearing or tree removal activities, the Contractor shall flag all trees to be removed and install stakes at all control points shown in the drawings and at the top of stream banks, edge of stream bankfull bench, toe of stream banks and limits of grading approximately every 25-feet, or more if needed. Staking shall also include locating stream centerline BP, EP, PCs, and PTs for all curves, and locating in-stream structures including slope protection (start/end), constructed riffles (start, end, pool), j-hooks (crest and limits of arms), and cross vanes (crest and limits of arms) shall also be marked. The contractor shall also stake all other improvements shown on the construction drawings such as swales, buried rip rap, and other stream restoration elements. The stakes shall indicate the depth of cut or fill at that point. The Owner or Owner's Representative will review these trees and points with the Contractor in the field and make any necessary adjustments to tree removal and/or the layout. The Contractor will reflag and restake these changes and obtain Owner or Owner's Representative approval before proceeding with clearing, tree removal, and grading activities.
- C. Following completion of the flagging and staking and approval of the Owner or Owner's Representative, the Contractor may begin clearing and tree removal activities and shall complete the detailed layout of the proposed improvements. The survey layout shall include the location and elevation at the limits of in-stream structures and at 25-foot increments the stream channel thalweg, toe of bank, top of bank and back of bankfull bench, other slope breaks on channel side slopes, and all point bars, outer bends, pools, and riffles. Staking shall also include locating stream centerline BP, EP, PCs, and PTs for all curves, and locating in-stream structures including slope protection (start/end), riffle grade controls (start, end), j-hooks (apex, limits of arms, pool), cascade (start, end, pool), and cross vanes (apex, limits of arms, pool), shall also stake all other improvements shown on the construction drawings such as storm sewer improvements, swales, buried rip rap, and other stream restoration elements.
- D. The Owner or Owner's Representative will review the detailed layout points with the Contractor in the field and may make adjustments to the detailed layout. The Contractor will restake these changes and obtain Owner or Owner's Representative approval before proceeding with grading and structure installation activities.
- E. Once the Contractor has completed the grading of a project element (segment of stream), an interim as-built survey of the project element will be completed by the Contractor and provided to the Owner or Owner's Representative for review prior to placement of matting or other ground treatment. The survey shall include the location

and elevation at the limits of in-stream structures, and at 25-foot increments the stream channel thalweg, toe of bank, top of bank and bankfull bench, other slope breaks on channel side slopes, and all point bars, outer bends, pools, riffles. The survey shall also include all other stream restoration and stormwater improvement elements. If the grading and structures are not within the defined tolerances, the Contractor will regrade/reset areas and structures and re-survey until the areas are accepted by the Owner or Owner's Representative. An interim as-built survey shall be provided by the Contractor with the monthly pay application for any work submitted for payment.

1.04 QUALITY ASSURANCE

- A. The Contractor shall hire, at the Contractor's own expense, a Surveyor with current registration in the Commonwealth of Virginia, acceptable to the Owner, to provide project construction staking and confirmation of the vertical and horizontal alignment.
- B. The Contractor shall furnish documentation prepared by a Virginia licensed surveyor to provide ongoing confirmation that staking is being done to the lines and grades shown in the Contract Documents.

1.05 SUBMITTALS

- A. The Contractor shall provide the Owner with the name and address of the registered Surveyor and the survey company to be used for the work described herein.
- B. Submit documentation to verify accuracy of construction staking per Section 1.02, Scheduling and Sequencing.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROJECT CONDITIONS

- A. The Drawings provide the location of principal components of the Project. The Owner/Owner's Representative may order changes to the location of some of the components of the Project or provide clarification to questions regarding the correct alignment.
 - 1. The Engineer will provide the following:
 - a. One vertical control point on the Project site with its elevation shown on the Drawings.
 - b. A minimum of two horizontal control points on the Project site with their coordinates shown on the Drawings.

3.02 GENERAL

- A. From the information shown on the Drawings and the information to be provided as indicated in paragraph 3.01 above, the Contractor shall:
 - 1. Be responsible for establishing GPS control coordinate control system, setting reference points and/or offsets, establishment of baselines, and all other layout, staking, and all other surveying required for the construction of the Project.
 - The horizontal position of all points shall be referenced to the North American datum of 1983 in the Virginia State Plane South Zone Coordinate System.
 - b. The vertical position of all points shall be referenced to the North American Vertical datum of 1988.
 - c. All coordinate values shall be delivered as grid coordinates in US Survey Feet.
 - d. d. The minimum data accuracy required for all Record Drawings shall be +/-0.10 US FT (one tenth of one foot).
 - 2. Safeguard all reference points, stakes, grade marks, horizontal and vertical control points, baselines, centerlines, and temporary benchmarks, and shall bear the cost of re-establishing same if disturbed.
 - 3. Stake out as described herein.
 - 4. Maintain a complete, accurate log of all control and survey work as it progresses.
- B. Baselines shall be defined as the line to which the location of the Work is referenced.

3.03 STAKING PRECISION

A. The precision of construction staking shall match the precision of components location indicated on the Drawings. Staking of utilities shall be done in accordance with standard accepted practice for the type of utility.

END OF SECTION

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Contractor shall provide submittals in accordance with the General Conditions as modified by the Supplementary Conditions, and this Section.
 - 2. Contractor is responsible to confirm and correct dimensions at the Site, for information pertaining to the fabrication processes and to techniques of construction, and for coordinating the work of all trades. Contractor's signature of submittal's stamp and letter of transmittal shall be Contractor's representation that Contractor has met his obligations under the Contract Documents relative to that submittal.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Types of Submittals: When type of submittal is not specified and is not specified in this Section, Engineer will determine type of submittal.
 - 1. Action/Informational Submittals:
 - a. Shop Drawings.
 - b. Product data.
 - c. Delegated design submittals in accordance with the General Conditions and as modified by the Supplemental Conditions.
 - d. Samples.
 - e. Testing plans, procedures, and testing limitations.
 - f. Design data not sealed and signed by a design professional retained by Contractor, Subcontractor, or Supplier.
 - g. Pre-construction test and evaluation reports, such as reports on pilot testing, subsurface investigations, potential Hazardous Environmental Conditions, and similar reports.
 - h. Supplier instructions, including installation data, and instructions for handling, starting-up, and troubleshooting.

- i. Sustainable design submittals (other than sustainable design closeout documentation).
- j. Lesson plans for training and instruction of Owner's personnel.
- 2. Closeout Submittals:
 - a. Maintenance contracts.
 - b. Operations and maintenance data.
 - c. Bonds, such as maintenance bonds and bonds for a specific product or system.
 - d. Warranty documentation.
 - e. Record documentation.
 - f. Sustainable design closeout documentation.
 - g. Software.
- 3. Maintenance Material Submittals:
 - a. Maintenance materials schedule and checklist.
 - b. Spare parts.
 - c. Extra stock materials.
 - d. Tools.
- 4. Quality Assurance Submittals:
 - a. Performance affidavits.
 - b. Certificates.
 - c. Source quality control submittals (other than testing plans, procedures, and testing limitations), including results of shop testing.
 - d. Field or Site quality control submittals (other than testing plans, procedures, and testing limitations), including results of operating and acceptability tests at the Site.
 - e. Supplier reports.
 - f. Special procedure submittals, including health and safety plans and other procedural submittals.

- g. Qualifications statements.
- B. Submittal Requirements:
 - 1. Contractor shall submit electronic copy of submittals for Engineer's review. Acceptable electronic formats are Adobe PDF, Microsoft Word, Autodesk DWF and AutoCAD.
 - 2. Submittal shall be accompanied by letter of transmittal containing date, project title, Contractor's name, number and title of submittal, list of relevant Specification Sections, notification of deviations from Contract Documents, and other material required for Engineer's review.
- C. Scheduling:
 - 1. Provide submittals well in advance of the Work following Engineer's approval or acceptance of the associated submittal. Work covered by a submittal will not be included in progress payments until approval or acceptance of related submittals has been obtained in accordance with the Contract Documents.
 - 2. Submittals shall be provided by Contractor with at least thirty (30) working days for review and processing.

1.03 SCHEDULE OF SUBMITTALS

- A. Schedule of Submittals, as specified in this Section:
 - 1. Timing:
 - a. Provide submittal within time frames specified in the Contract Documents.
 - b. Provide updated Schedule of Submittals with each submittal of the updated Progress Schedule.
 - Content: In accordance with the General Conditions as modified by the Supplementary Conditions, and this Section. Requirements for content of preliminary Schedule of Submittals and subsequent submittals of the Schedule of Submittals are identical.
 - a. Identify submittals required in the Contract Documents. Updates of Schedule of Submittals shall show scheduled dates and actual dates for completed tasks. Indicate submittals that are on the Project's critical path.
 - b. Indicate the following for each submittal:
 - 1) Date when submittals are requested and received from Supplier.
 - 2) Date when certification is received from Supplier and when submitted to Engineer.

- 3) Date when submittals are submitted to Engineer and returned with disposition from Engineer.
- 4) Date when submittals are revised by Supplier and submitted to Engineer.
- 5) Date when submittals are returned with "Furnish as Submitted" (FAS) or "Furnish as Corrected" (FAC) disposition from Engineer.
- 6) Date when approved submittals are returned to Supplier.
- 7) Date of Supplier scheduled delivery of equipment and material.
- 8) Date of actual delivery of equipment and material.
- 9) Whether submittal will be for a substitution or "equal". Procedures for substitutions and "or equals" are specified in the General Conditions.
- 10) For submittals for materials or equipment, date by which material or equipment must be at the Site to avoid delaying the Work and to avoid delaying the work of other contractors.
- 3. Prepare Schedule of Submittals using same software, and in same format, specified for Progress Schedules.
- 4. Coordinate Schedule of Submittals with the Progress Schedule.
- 5. Schedule of Submittals that is not compatible with the Progress Schedule, or that does not indicate submittals on the Project's critical path, or that places extraordinary demands on Engineer for time and resources, is unacceptable. Do not include submittals not required by the Contract Documents.
- 6. In preparing Schedule of Submittals:
 - a. Considering the nature and complexity of each submittal, allow sufficient time for review and revision.
 - b. Reasonable time shall be allowed for: Engineer's review and processing of submittals, for submittals to be revised and resubmitted, and for returning submittals to Contractor.
 - c. Identify and accordingly schedule submittals that are expected to have long anticipated review times.

1.04 ACTION/INFORMATIONAL SUBMITTALS

A. Provide the following Submittals in accordance with the individual Specification Sections, including, but not limited to, the following:

1. Product Data:

- a. Catalog cut-sheets
- b. Descriptive bulletins/brochures/specifications
- c. Material of construction data, including details on all components including applicable ASTM designations.
- d. Lifting, erection, installation, and adjustment instructions, and recommendations.
- e. Finish/treatment data, including interior and exterior shop coating systems.
- f. Equipment/material weight/loading data, including total uncrated weight of the equipment plus the approximate weight of shipped materials. Support locations and loads that will be transmitted to bases and foundations following installation. Size, placement, and embedment requirements of anchor bolts.
- g. Complete information regarding location, type, size, and length of all field welds in accordance with "Standard Welding Symbols" AWS A2.0 of the American Welding Society. Special conditions shall be fully explained by notes and details.
- h. Motor data including horsepower; enclosure type; voltage; insulation class; temperature rise and results of dielectric tests; service-rating; rotative speed; motor speed-torque relationship; efficiency and power factor at ½, ¾, and full load; slip at full load; running, full load, and locked rotor current values; safe running time-current curves; motor protective devices; and interconnection diagrams.
- i. Engineering design data, calculations, and system analyses
- j. Digital system documentation
- k. Operating sequence descriptions
- I. Software/programming documentation
- m. Manufacturer's instructions
- 2. Shop Drawings:
 - a. Equipment and material layout drawings, including panel layout drawings.
 - System schematics and diagrams including, but not limited to, piping systems; HVAC and ventilation systems; process equipment systems;

electrical operating systems; wiring diagrams; controls, alarm and communication systems.

- c. Layout and installation drawings (interior and exterior) for all pipes, valves, fittings, sewers, drains, heating and ventilation ducts, all electrical, heating, ventilating and other conduits, plumbing lines, electrical cable trays, lighting fixture layouts, and circuiting, instrumentation, interconnection wiring diagrams, communications, power supply, alarm circuits, etc.
- d. Layout and installation drawings shall show connections to structures, equipment, sleeves, valves, fittings, etc.
- e. Drawings shall show the location and type of all supports, hangers, foundations, etc., and the required clearances to operate valves, equipment, etc.
- f. Drawings for pipes, ducts, conduits, etc., shall show all 3 inch and larger electrical conduits and pressure piping, electrical cable trays, heating and ventilation ducts or pipes, structure, manholes or any other feature within four (4) feet (measured as the clear dimension) from the pipe duct, conduit, etc., for which the profile is drawn.
- g. Equipment and material schedules.
- 3. Delegated design submittals, which include documents prepared, sealed, and signed by a design professional retained by Contractor, Subcontractor, or Supplier for materials and equipment to be incorporated into the completed Work. Delegated design submittals do not include submittals related to temporary construction unless specified otherwise in the related Specification Section. Delegated design submittals include: design drawings, design data including calculations, specifications, certifications, and other submittals prepared by such design professional.

B. Samples:

- 1. General Requirements:
 - a. Conform submittal of Samples to the General Conditions as modified by the Supplementary Conditions, this Section, and the Specification Section in which the Sample is specified.
 - b. Furnish at the same time Samples and submittals that are related to the same unit of Work or Specification Section. Engineer will not review submittals without associated Samples and will not review Samples without associated submittals.

- c. Samples shall clearly illustrate functional characteristics of product, all related parts and attachments, and full range of color, texture, pattern, and material.
- 2. Submittal Requirements:
 - Securely label or tag Samples with submittal identification number. Label or tag shall not cover, conceal, or alter appearance or features of Sample. Label or tag shall not be separated from the Sample.
 - b. Submit number of Samples required in Specifications. If number of Samples is not specified in the associated Specification Section, provide at least one identical Samples of each item required for Engineer's approval. If Contractor requires Sample(s) for Contractor's use, notify Engineer in writing and provide additional Sample(s). Contractor is responsible for furnishing, shipping, and transporting additional Samples.
 - c. Deliver one Sample to Engineer's field office at the Site. Deliver balance of Samples to location directed by Engineer.

1.05 CLOSEOUT SUBMITTALS

- A. Provide the following Closeout Submittals in accordance with the individual Specification Sections, including, but not limited to, the following:
 - 1. Maintenance contracts
 - 2. Bonds for specific products or systems
 - 3. Warranty documentation
 - 4. Sustainable design closeout documentation.
 - 5. Software programming and documentation.
- B. On documents such as maintenance contracts and bonds, include on each document furnished original signature of entity issuing the document.
- C. Record Documentation: Submit in accordance with Section 01 78 39 Project Record Documents.
- D. Disposition: Dispositions and meanings are the same as specified for Informational Submittals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. For spare parts, extra stock materials, and tools, submit quantity of items specified in associated Specification Section.

B. Disposition: Dispositions and meanings are the same as specified for Informational Submittals.

1.07 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall review, coordinate, and verify submittals with Subcontractors, Manufacturers, and Suppliers, including field measurements at Site, in accordance with the General Conditions and as modified by Supplemental Conditions prior to submitting material for Engineer's review.
- B. Contractor shall provide Contractor's stamp of approval certifying submittal material has been reviewed and conform to the Contract Documents prior to submitting material for Engineer's review.
- C. Contractor shall provide written notice of deviations or variations that submittal may have with the Contract Documents.
- D. Contractor shall provide bound, dated, labeled, tabulated, and consecutively numbered submittals as specified in the individual Specification Section. Label shall contain the following:
 - 1. Specification Section.
 - 2. Referenced Drawing number.
 - 3. Subcontractor or Supplier name.
 - 4. Type of equipment and/or materials.
- E. Contractor shall perform the following after receiving Engineer's review disposition:
 - 1. Order, fabricate, or ship equipment and materials included in the submittal (pending Engineer's review of source quality control submittals) with the following disposition:
 - a. "Furnish as Submitted" (FAS).
 - b. "Furnish as Corrected" (FAC).
 - c. "Furnish as Corrected Confirm" (FACC), only portions of Work that do not require resubmittal for Engineer's review.
 - 2. Resubmittal requirements:
 - Partial resubmittal of "Furnish as Corrected Confirm" (FACC) returned dispositions, until Engineer's disposition is either "Furnish as Submitted" (FAS) or "Furnish as Corrected" (FAC).

- Full resubmittal of material with Engineer's disposition of "Revise and Resubmit" (R&R), until Engineer's disposition is "Furnish as Submitted" (FAS), "Furnish as Corrected" (FAC), or "Furnish as Corrected – Confirm" (FACC) that requires a partial resubmittal.
- c. Contractor shall be responsible for Engineer's charges to Owner if submittals are not approved within the number of specified submittals in accordance with the General Conditions. Engineer's charges shall include, but not limited to, additional review effort, meetings, and conference calls with Contractor, Subcontractor, or Supplier.

1.08 ENGINEER'S REVIEW

- A. Engineer's review of the Contractor's submittal shall not relieve Contractor's responsibility under the Contract Document in accordance with the General Conditions and as modified in the Supplemental Conditions. An acceptance of a submittal shall be intended to mean the Engineer does not have specific objection to the submitted material, subject to conformance with the Contract Drawings and Specifications.
- B. Engineer's review of Contractor's submittal shall be confined to general arrangement and compliance with the Contract Documents, and shall not be for the purpose of checking dimensions, weights, clearances, fittings, tolerances, interferences, coordination of Subcontractor work, etc.
- C. Review Dispositions:
 - 1. "Furnish as Submitted" (FAS) No exceptions are taken.
 - 2. "Furnish as Corrected" (FAC) Minor corrections are noted for Contractor's correction.
 - 3. "Furnish as Corrected Confirm" (FACC) Corrections are noted and partial resubmittal shall be made as noted.
 - 4. "Revise and Resubmit" (R&R) Corrections are noted and complete resubmittal shall be made. Submittal does not conform to applicable requirements of the Contract Documents and is not acceptable. Revise submittal and re-submit to indicate acceptability and conformance with the Contract Documents.
 - 5. "Receipt Acknowledged" (RA)
 - a. Information included in submittal conforms to the applicable requirements of the Contract Documents and is acceptable. No further action by Contractor is required relative to this submittal, and the Work covered by the submittal may proceed, and products with submittals with this disposition may be shipped or operated, as applicable.

- b. Information included in submittal is for Project record purposes and does not require Engineer's review or approval.
- "Rejected" (R) Information included in submittal does not conform to the applicable requirements of the Contract Documents and is unacceptable. Contractor shall submit products and materials as specified in the Contract Documents or provide required information for substitution as specified in the Contract Documents for consideration by Engineer.
- D. Electronic Submittal Return to Contractor: Electronic submittals shall be returned electronically with dispositions provided.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 57 00 TEMPORARY CONTROLS

PART 1 – GENERAL

1.01 SUMMARY

- A. Contractor shall provide and maintain methods, equipment, and temporary construction as required to control environmental conditions at the Site and adjacent areas.
- B. Maintain controls until no longer required.
- C. Temporary controls include, but are not limited to, the following:
 - 1. Dust control.
 - 2. Noise controls.
 - 3. Pollution control.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 DUST CONTROL

- A. Contractor shall take measures to control dust from Contractor's operations and prevent spillage of excavated materials on public roads.
- B. Contractor shall remove spillage of excavated materials, debris and dust from public roads by methods approved by Engineer.
- C. Contractor shall refer to applicable sections of local and state/commonwealth regulations on dust control for additional guidance.
 - 1. Contractor shall apply water at locations, quantities, and frequencies required by Engineer to control dust for nuisance prevention to Owner, Engineer, and properties in the vicinity of the Site.
 - 2. Dust control and cleaning measures shall be provided at no additional cost to the Owner.

3.02 NOISE CONTROL

- A. Contractor's vehicles and equipment shall minimize noise emissions to greatest degree practicable. Provide mufflers, silencers, and sound barriers when necessary.
- B. Noise levels shall comply with Laws and Regulations, including OSHA requirements and local ordinances.
- C. Noise emissions shall not interfere with the work of Owner or others.

3.03 POLLUTION CONTROL

- A. General:
 - 1. Provide means, methods, and facilities required to prevent contamination of soil, water, and atmosphere caused by discharge of noxious substances from construction operations.
 - 2. Equipment used during construction shall comply with Laws and Regulations.
- B. Spills and Contamination:
 - 1. Provide equipment and personnel to perform emergency measures required to contain spills and to remove contaminated soils and liquids.
 - 2. Excavate contaminated material and properly dispose of off-site, and replace with suitable compacted fill and topsoil.
- C. Protection of Surface Waters: Implement special measures to prevent harmful substances from entering surface waters. Prevent disposal of wastes, effluents, chemicals, and other such substances in or adjacent to surface waters and open drainage routes, in sanitary sewers, or in storm sewers.
- D. Atmospheric Pollutants:
 - 1. Provide systems for controlling atmospheric pollutants related to the Work.
 - 2. Prevent toxic concentrations of chemicals and vapors.
 - 3. Prevent harmful dispersal of pollutants into atmosphere.
- E. Solid Waste:
 - 1. Provide systems for controlling and managing solid waste related to the Work.
 - 2. Prevent solid waste from becoming airborne, and from discharging to surface waters and drainage routes.

3. Properly handle and dispose of solid waste.

END OF SECTION

SECTION 01 57 40 TEMPORARY PUMPING SYSTEMS

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. Furnishing, installing, testing, operating, and maintaining temporary pumping systems.
- B. The temporary pumping system contractor shall also provide 5 references for projects that have been successfully completed in the last 5 years with firm capacities equal to or greater than that specified herein. The reference information shall include contact information for the Owner and the Contractor that the temporary pumping system contractor provided the services for. The number and size of the pumps; the size and length of the force mains and the duration of the temporary pumping system service shall also be included with the reference contact information. All the reference materials shall be submitted prior to any bypass pumping submittals. Contractors may submit this information prior to bidding if there is any concern of eligibility.
- C. Provide all materials, labor, equipment, power, maintenance, associated items and superintendence to implement temporary pumping systems for diverting flow as required to maintain continuous operation of existing facilities during construction. Provide all additional temporary pumping systems needed using Contractor's means and methods at no additional cost to Owner.

1.02 **DEFINITIONS**

- A. Bypass Pumping System: The bypass pumping system shall consist of all equipment, piping, valves, plugs, power supply, instrumentation, controls, and lines and other appurtenances required to divert flows from the facilities being rehabilitated to the discharge location illustrated on the drawings. The bypass pumping system shall be comprised of pumping setups in addition to all bypass piping necessary for bypass pumping. Temporary and bypass pumping systems are terms used to describe the same facilities in this specification. Temporary bypass pumping system contractor and supplier also have the same meaning in this specification.
- B. Bypass Pipe: The bypass pipe shall consist of the pipe, valves and other appurtenances including, but not limited to, air relief valves and dewatering connections. The bypass pipe includes both the suction and discharge pipe for each bypass pump setup.
- C. Primary Pump(s): The primary pump(s) is/are the main pump(s) located at each setup. The primary pump(s) shall be capable of pumping the peak flow, be connected to the bypass pipe, be isolated with valves, and be complete with power supplies.

- D. Backup Pump(s): The backup pump(s) is/are located at each primary setup. The backup pump(s) shall be capable of pumping peak flow, be operational, be connected to the bypass pipe, be isolated with valves, and be complete with power supplies.
- E. Standby Pump(s): The standby pump(s) shall be located within 30 minutes of the project site. The standby pump(s) shall be capable of pumping the peak flow and be able to be connected to the bypass pipe at each setup. The standby pump(s) shall have the capacity of the largest pump at each location.
- F. Discharge Connection: The discharge connection is where the pumped flow exits the bypass pipe and flows onward into a gravity system or force main.
- G. Interruption in Operations: Any activity that will result in a change in the current method of operation of an existing facility being bypassed. Contractor shall request such "interruption of operations" from the Owner in writing no less than three (3) weeks in advance with a subsequent written confirmation of date and time ninety-six (96) hours in advance of the "interruption of operations". Owner may reject the request if the change will increase project costs or negatively impact the operation of any existing facilities.
- H. Partial Utilization, Substantial Completion, and Warranty Period for Items in Continuous Service: Refer to the Contract Documents for definition.
- I. The terms "open, close, start, stop, operate, verify, energize, de-energize, transfer, switchover, etc." when used in conjunction with equipment that is in service or about to be placed in service are understood to mean: The Owner's operation or maintenance staff shall perform the operation upon written request from the Contractor.
- J. Operational Test: The period of specified duration that the installed system is tested to verify operational integrity of a system prior to placing the system in service. Operational testing requires that representatives of the equipment manufacturers be on site for timely identification and resolution of system issues.
- K. Firm Capacity: Shall be the capacity of the bypass pumping system with the largest pump included in the system out of service.
- L. Cycling Pump Control: Shall mean the use of starting and stopping of single speed and output pumps to achieve the bypass pumping requirements.
- M. Variable Pump Control: Utilizes variable speed and output pumps in the design of the system to try and match the output of the system with the variable flow conditions of the application.

1.03 REFERENCES

A. Publications are referred to in the text by basic designation only.

- 1. American Society for Testing and Materials (ASTM)
 - a. D1248 Polyethylene Plastics Extrusion Materials for Wire and Cable
 - b. D2657 Heat Fusion Joining of Polyolefin Pipe and Fittings
 - c. D3261 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

1.04 PERFORMANCE REQUIREMENTS

- A. Design the installation and operation of temporary pumping systems in accordance with Federal, Commonwealth, and Local Municipality Laws and Regulations, including local noise and light ordinances.
- B. The temporary pumping system shall be designed by the Contractor and provide uninterrupted service throughout construction.
- C. For all bypass pump arrangements, multiple pumps are necessary.
 - 1. One backup pump for each size pump utilized shall be installed at each bypass pump location, ready for use in the event of primary pump failure.
 - 2. One standby pump shall be required for each system. If the standby pump is placed in operation, an additional standby pump shall be delivered to the bypass pumping site within four hours.
 - 3. The backup pump shall be piped into the suction and discharge headers and shall have the capability of being brought online in the piping system by operating installed isolation valves.
- D. The system shall be designed to pump the following flows. Engineer may request the Contractor increase pump capacity based upon observations during construction.
 - 1. Service: Baseflow
 - 2. Firm Capacity Required: 2,700 gpm
 - 3. Minimum Flow: 600 gpm
- E. Install, test, and maintain remote telemetry to monitor operation of the pumps and wet well water levels. The telemetry system shall first notify the Contractor's local representative designated to monitor the pumps, then other individuals so designated by the Contractor and finally up to two individuals so designated by the Owner.
- F. Temporary pumping systems shall be equipped with noise reduction features that limit the noise output to 55 db[A] within 50 feet of the equipment or to 50 db[A] at the nearest

property line, whichever is less. Diesel-driven engines shall be equipped with criticalrated mufflers.

- G. Provide pressure and vacuum gauges on the suction and discharge headers.
- H. Provide level controls to start and stop the pumps. Each pump shall be equipped with a separate control panel. All pumps provided shall be variable speed and output type pumps such that the system design may operate as continuously as possible and spikes in flow conditions are minimized by the design. Cycling pumps shall not be an acceptable design unless allowed by this specification.

1.05 SUBMITTALS

- A. Bypass Pumping Plan: The Contractor shall submit to the Engineer for review and approval detailed drawings and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing flows. The plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials, and all other incidental items necessary and/or required to insure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No temporary pumping shall begin until all provisions and requirements have been reviewed and approved by the Engineer.
- B. All the descriptive terms used in the presentation of the plan shall be as defined in this specification. No other terms with similar meaning shall be used to prevent miscommunication of the prescribed plan.
- C. Submit a specific detailed description of each proposed temporary pumping system at least 30 days prior to intended use. The submittal shall include, but not be limited to, the following:
 - 1. A written description of the plan.
 - 2. Quantity, capacity, dimensions and location of all pumping equipment.
 - 3. Pump performance curves and head capacity curves demonstrating the capability to meet all required flows.
 - 4. Pump net positive suction head required (NPSH_r) curves demonstrating the net positive suction head available (NPSH_a) exceeds the NPSH_r by an acceptable margin defined by the manufacturer of the supplied pump.
 - 5. Pump power curves demonstrating the temporary power system is adequately sized for pump startup and operation.

- 6. Pump diesel engine sizing, dimensions, emissions data, and location plan.
- 7. Diesel engine fuel-consumption curves.
- 8. Fuel storage tank details, including spill containment.
- 9. The size, type and routing of all suction and discharge pipe and the means of connecting the system.
- 10. Calculations of static lift, frictional losses, all pipe velocities, total dynamic head (TDH) requirements, and net positive suction head available (NPSH_a).
- 11. Existing facility plugging or bulkheading plan, including type, location and manufacturer of plugs with emergency release procedures.
- 12. Thrust and restraint block sizes and locations, if necessary.
- 13. Any temporary pipe supports, location, and anchoring requirements.
- 14. Description of controls, monitoring, mode of operation, sequence of starting and stopping pumps, and emergency power source.
- 15. Method of noise control for each pump and/or generator for all operations.
- 16. Show force main pipe material and thickness can withstand all normal operating and surge pressures with a safety factor of 2.0.
- 17. Denote any conditions that will cause pumps to lose suction lift (prime) and describe procedures to rectify.
- 18. Show that the emergency switchover from primary to secondary pumping will be automatic should equipment fail.
- 19. Show emergency plan to be used if flooding occurs at work site.
- 20. Show suction and discharge piping is protected from possible damage from varying flood levels and construction activities.
- 21. Show any planned shifting of bypass equipment during construction.
- 22. Complete information on instruments, including calibration certificates.
- 23. Qualifications of pump supplier on-site operators.
- 24. Emergency contact telephone numbers.

- D. The plan must be signed and sealed by a Professional Engineer registered in the Commonwealth where the system will be installed and operated.
- E. Sequence of Construction Plan: Furnish in accordance with Section 01 33 00 Submittal Procedures and as shown in the Contract Drawings.
 - 1. Contractors Sequence of Construction defining work to be performed, including the following items:
 - a. Definition of the start date, duration, and end date
 - b. Define activities to be performed by or witnessed by the Owner and date on which these activities are to be performed.
 - c. Scheduling/timing of manufacturers field services required to train all personnel that will be responsible for the operation of the bypass system and to verify that all system components are installed as recommended by the manufacturer.

1.06 SPECIAL PRECAUTIONS AND LIABILITIES

- A. Contractor is responsible for fines levied on Owner by state/commonwealth, federal, and/or other agencies due to spills caused by failure of temporary pumping systems. The Contractor shall also be responsible for repairing any damage to existing facilities including erosion of soils or contamination caused by a spill that is a direct result of the bypass pumping system failure. The cost of all repair and the immediate action required to facilitate the repairs are also the responsibility of the Contractor. This liability is limited to the firm capacity of the bypass pumping system as defined by this specification.
- B. The Owner is not responsible for any damage to the bypass pumping system under any circumstance. The bypass pumping system supplier by submitting a design for approval accepts that temporary pumping facilities for collection and treatment facilities have unknown materials and debris in them and that any damage to any of the bypass pumping equipment due to unknown materials are the responsibility of the supplier. It shall be the responsibility of the suppler to take precautions as deemed necessary by the supplier against any and all materials that may be present in the liquid pumped by the system to prevent damage to the equipment and to prevent failures that may cause a spill.
 - C. Provide barriers in all locations where temporary pumps, pipe and other accessories are in roadways, driveways, and other vehicle-accessed areas.
 - D. When overnight pumping is necessary, provide security fencing for all temporary pumps when not located within a secured area to prevent tampering.

PART 2 – PRODUCTS

2.01 PUMPS

- A. The pumps and drives shall be rated for continuous duty and shall be capable of pumping the required flow ranges without surging, cavitation, or vibration. Pumps shall not overload drives at any point on the pump operating curve.
- B. Pumps shall be suitable for the service specified and the debris contained within it.
- C. Pumps shall be self-contained units designed for temporary use.
- D. Pumps shall have fully automatic self-priming units that do not require the use of footvalves, vacuum pumps, or diaphragm pumps in the priming system, or they shall be submersible.
- E. All pumps must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of flows.
- F. Provide the necessary start/stop/variable speed and level controls for each pump.
- G. The primary pumps shall be diesel powered.
 - 1. Contractor shall be responsible for providing and storing a sufficient quantity of diesel fuel on site to continually operate the pumps for the duration of the temporary bypass pumping period. If this is impractical for industry available fuel storage devices, a refueling plan shall be developed and submitted as part of the bypass pumping submittal. There shall be no excuses for not providing fuel to the bypass pumping system including any natural disaster or weather event. Once started the Contractor shall provide fuel until all work is complete and bypass pumping is no longer needed. Diesel-powered pumps shall have adequate fuel storage capacity to operate continuously for 24 hours without refueling.
 - 2. Contractor shall check the pump fuel levels and shall refill the tanks to full capacity at a frequency based on fuel consumption but not less than daily. Fuel deliveries shall only be made during normal daytime working hours.
 - 3. Each pump and drive shall be rated for continuous duty operation over the specified range of conditions without cavitating or overheating, and without excessive vibration or noise. In addition, each pump and drive shall be rated to operate intermittently at shutoff head against a closed discharge valve for periods of not less than 5 minutes without excessive cavitation, overheating, or vibration.
 - 4. All pumps are to be Godwin Dri-Prime Automatic self-priming pumps as manufactured by Xylem Dewatering Solutions, Inc., or Engineer approved equal.

- 5. Furnish each pump with the necessary stop/start controls.
- 6. Contractor will not be permitted to stop or impede the main flows under any circumstances except as otherwise defined under the Sequence of Construction.

2.02 PIPE

- A. In order to prevent accidental spillage, all temporary pipe must be constructed of rigid or semi-rigid pipe with positive, leak proof connections. All pipe materials and joints for temporary pipe systems must be High Density Black Polyethylene Pipe ANSI/ASTM D1248, butt heat fusion type joint fittings shall conform to ASTM D2657 and D3261. Flexible hose of any type shall not be permitted.
- B. Pump discharge piping shall be valved and manifolded so that pumped liquid can be conveyed to the dedicated discharge location. Provide check valves for each pump discharge. Air-relief valves shall be provided at high points in the discharge piping as required. Air-relief valves shall expel air upon pipe filling, admit air upon pipe dewatering, and release small amounts of entrained air during operation. Air-relief valves shall be suitable with the specified service.
- C. Different pipe diameter sizes can be used, as long as the maximum discharge pipe velocity at the exit does not exceed 10 feet per second.
- D. The bypass system pipe shall be rated for at least 3 times the shut off head of the largest pump supplied in the system. The rating of the pipe with supporting calculations and pump curves shall be part of the bypass pumping system submittal.
- E. The bypass pumping supplier shall provide a plan for freeze protection of all exposed piping that may be subject to freezing. The method and materials of freeze prevention will be the responsibility of the temporary pumping system supplier. Damage or spills caused by freezing piping shall be the sole responsibility of the bypass pumping system supplier.

2.03 TEMPORARY PLUGS AND BULKHEADS

- A. Provide temporary plugs and bulkheads, as required, for successful operation of the temporary pumping systems. Acceptable temporary plugs and bulkheads include inflatable dams specifically designed for such service, brick bulkheads, timer bulkheads, sandbags, and other bulkhead methods suitable for the specified service.
- B. Plugs shall be designed for the specific purpose of providing temporary plugging of active pipes. Each plug and temporary bulkhead shall be suitable for the maximum pressure encountered.
- C. All plugs shall be firmly attached to a stationary object at ground level by a cable in order to prevent loss of plugs in pipelines.
- D. Piping plugs shall be capable of accommodating the maximum allowable surcharge heads within the gravity system that may be experienced during construction. All plugs shall be designed with a minimum factor of safety of 1.5. Where temporary plugs and bulkheads are under pressure or surcharged, provide either two plugs or a plug and a temporary bulkhead.
- E. The plugs shall be readily removed from the system during emergency shutdowns and shall be operated pneumatically.

2.04 PIPE SUPPORTS

- A. Pipe supports shall be provided for all pipe that is elevated above the ground.
- B. The design, construction and dismantling of all temporary pipe supports shall be the responsibility of the Contractor. All pipe supports shall be designed using the required building codes and regulations and accounting for all potential loads including flood water hydrostatic and flotation loads.
- C. All piping systems shall be designed to resist all forces associated with liquid pumping. The pipe and supports shall resist all of these forces or the Contractor shall provide supports, thrust blocks or any other facility required to prevent damage to the bypass pumping system.

2.05 ALARM SYSTEMS

- A. The minimum acceptable alarm system shall consist of high-water float(s) and automatic dialer with a battery backup. The alarm system design shall be the responsibility of the bypass pumping system supplier. The alarm system must be capable of full operation in the absence of electrical power and must provide redundancy in case of alarm system component failure.
- B. The automatic dialer system shall be provided with either cellular or satellite phone as appropriate to provide reliable contact during any failures.

PART 3 – EXECUTION

3.01 GENERAL

- A. Install, operate and maintain temporary pumping systems and appurtenances, including but not limited to, associated pipe, valves, instrumentation, controls and accessories, in accordance with the manufacturer's instructions for each component and as required by the approved bypass pumping submittal.
- B. Provide all oil, fuel, grease, lubricants, tools and spare parts required for operation and maintenance of the temporary pumping systems for the duration of use. Spill

containment around diesel-powered pumps, including filling operations, shall be provided per applicable regulations.

- C. Adequate hoisting equipment for each pump and accessory shall be maintained on Site.
- D. Temporary pumping systems shall remain operable until all components of new work requiring temporary pumping systems have successfully completed all required testing and have been accepted by the Owner.
- E. The design of the bypass pumping system must allow for prompt dewatering of the system during periods of non-use or if leakage occurs.
- F. Before placing the system in operation, it shall be tested for at least 8 hours of continuous operation.
- G. The Contractor shall be responsible for the provision of temporary fall-protection devices around all removed manhole covers, grating, openings, etc.
- H. The Contractor shall assemble a list of 24-hour emergency telephone numbers that shall include the Contractor's project manager, the Contractor's foreman, and a responsible representative from the pump supplier, and submit it to the Engineer for review and approval.

3.02 SITING OF FACILITIES

- A. In all instances, unobstructed roadway access must be maintained as shown on the drawings. All driveways and connections to roadways must be kept clear.
- B. The pumps shall be placed in the locations designated on the drawings. All suction piping shall also be in this designated area and shall be placed in the temporary wet well as required to complete the bypass pumping system installation.
- C. A corridor for all bypass system piping has been delineated on the drawings and all piping and supports must be installed within this corridor.
- D. The discharge of the bypass pumping system shall be placed and designed in such a way to facilitate proper flow momentum on the direction of normal flow in the receiving facility structure. The bypass pumping contractor will be responsible for the design of the discharge piping and ensuring that no spills occur as a direct result of the design of the discharge.

3.03 PREPARATION

A. The Contractor is responsible for locating any existing utilities in the area selected for installation of the bypass pumps and pipelines. The Contractor shall minimize the disturbance to existing utilities and shall obtain approval from the Owner for any

relocation of the bypass pipeline. All costs associated with the relocation of utilities and obtaining approvals shall be included in the contract price.

- B. During all bypass pumping operations, the Contractor shall protect the bypass pumping facilities and existing collection system from damage inflicted by equipment. The Contractor shall be responsible for all intentional or accidental physical damage to the bypass pumping system caused by human or mechanical failure or interference.
- C. During installation of the bypass pumping pipes, the Contractor shall make every effort to minimize the disruption of normal facility flows and pump station operation.
- D. The Contractor shall protect all mature vegetation and structures or other obstacles in the path of the pipeline from damage through use of shields and buffering devices. All private property that must be relocated to construct the work must be stored at a location acceptable to the property owner.
- E. In instances where fences must be disturbed for the construction of the pipeline, temporary fencing shall be required.
- F. Temporarily burying the bypass piping may be required to provide access over the piping during operations. All fittings and costs associated with this temporary piping location shall be the responsibility of the Contractor. All locations where temporary burying of the pipe will be required shall be included in the bypass pumping system submittal. Rehabilitation and returning the area of temporary burying back to the original condition including paving or seeding or any other item removed to facilitate pipe installation shall also be the responsibility of the Contractor.

3.04 INSTALLATION AND REMOVAL

- A. The Contractor shall pipe sections or make connections to the existing piping systems and construct temporary bypass pumping structures only at the access location and as may be required to provide an adequate suction conduit.
- B. The temporary bypass pumping system shall be tested before placing the system in operation. Testing periods shall occur only between the hours of 8:30 a.m. and 3:00 p.m., Monday through Thursday. Testing of bypass pumping system shall NOT be allowed Friday through Sunday, on the Owner's scheduled Holidays, or on the day immediately prior to an Owner's scheduled Holiday. In addition, testing of bypass pumping system shall only be performed during the Owner's normally scheduled work days. Testing shall include leakage testing, pressure testing, operational testing, and alarm testing.
- C. Leakage and pressure test: Contractor shall perform leakage and pressure testing for a minimum of two (2) hours on the pump duty suction piping and duty discharge piping in accordance with Article 3.05, Paragraph A. Contractor shall then remove the duty piping

and shall install the standby suction piping and standby discharge piping and perform the same test for an additional two (2) hours.

- D. Operation test: Contractor shall operate the temporary bypass pumping system for as long as necessary, but no less than 8 hours, without failure to demonstrate reliable operation of the entire system, including but not limited to pumps and controls, to the satisfaction of the Owner.
- E. Plugging or blocking of flows shall incorporate primary and secondary plugging devices. When plugging or blocking is no longer needed for performance of the work, the plugs are to be removed in a manner that permits the flow to slowly return to normal without surge, surcharging, or causing other major disturbances upstream or downstream.
- F. The Contractor shall remove manhole sections or make connections to the existing gravity conveyance system and construct temporary bypass pumping structures only as the access locations indicated on the Contract Drawings and as may be required to provide adequate suction conduit.
- G. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public right of ways.

3.05 QUALITY CONTROL AND MAINTENANCE

- A. Testing: Contractor shall perform leakage and pressure tests of the bypass pump suction and discharge piping using potable or approved surface water prior to actual operation. Low pressure air test shall be conducted at a test pressure of 15 psi before any liquid is pumped to ensure the system is assembled correctly. The system will pass the low-pressure air test if it holds the test pressure for 2 hours. The Engineer shall be given 24 hours' notice prior to testing. The force main shall be tested to 1.5 times the normal working pressure of the system at the firm capacity specified and will be considered ready for service if the pressure is held for 2 hours. Surface water or potable water shall be supplied and used by the Contractor for this test.
- B. Once installation and testing of the temporary pumping systems are complete, a trained representative from the pump supplier shall inspect the installation and verify in writing that the installation is complete in all aspects and ready to run as intended on a continuous basis.
- C. Inspection: during operation of the temporary pumping system the Contractor shall inspect all components every two (2) hours to ensure that the system is working correctly and shall keep a written log of the system inspection results. Contractor shall inspect the bypass pumping fuel system a minimum of either one (1) time per day or as often as necessary to ensure full fuel tanks for the bypass pumps.

- D. Maintenance service: Contractor shall ensure that the temporary pumping system is properly maintained. The Contractor shall supply all necessary lubrication, fuel, and supplies necessary to maintain the entire installation.
- E. Besides the Owner and the Engineer, only employees of the Contractor or the system supplier are allowed on site.
- F. Someone with knowledge of the bypass pump system operation must arrive on site within one hour of any bypass pump start-up event. If the system must be operated continuously, then an operator that can troubleshoot failure and make repairs to the system must be on site while the system is in operation. The temporary pumping system must be monitored continuously during operation by a representative of the Contractor trained and certified by the pump supplier.

3.06 SEQUENCE OF CONSTRUCTION

- A. Contractor shall propose a Sequence of Construction incorporating all constraints detailed in this Section and shall secure concurrence of Owner prior to starting work.
- B. The Contractor shall submit a construction plan and schedule, which details the methods, means, techniques, and sequences to be used to establish a base element of surety against a spill, to the Engineer for review and approval by the Owner as part of the bypass pumping system submittal. One month prior to connections being made to existing structures or pipes, a coordination meeting shall be held between the Contractor, Engineer, and Owner to discuss the construction plan previously submitted by the Contractor. A detailed schedule of all construction activities requiring bypass pumping system operations shall be delivered in the meeting with the intention of discussing all major milestones. No temporary pumping shall take place until after satisfactory completion of the coordination meeting.
- C. Schedule of construction, interconnection details, and other revisions necessary for proper interfacing of the Work are to be subsequently modified by Contractor accounting for results of said coordination meeting. The Engineer and Owner are to be notified one week prior to any actual interruptions or connections being made. No work shall be undertaken prior to securing Owner's approval of respective connection plan and work schedule.

SECTION 01 57 52 DEWATERING AND FLOW DIVERSION FOR STREAMWORK

PART 1 – GENERAL

1.01 SUMMARY

- A. This work shall consist of flow diversion, dewatering and maintaining water level for preparing work areas when construction activities take place within stream areas as specified in the Contract Documents or as directed by the Owner or Owner's Representative, and shall be in accordance with the requirements of the applicable State, District or Commonwealth in which the project is located:
 - 1. Virginia: Erosion and Sediment Control Handbook (1992 or most current version) as developed by the Virginia Department of Environmental Quality (VA DEQ).
- B. This item includes placement, operation, maintenance and removal upon completion. Diversions are used to isolate work areas from flow during the construction of in-stream projects. Diversions which have an insufficient flow capacity can fail and severely erode the disturbed channel section under construction. Therefore, in-channel construction activities should occur only during conditions where the diversion is designed to convey the anticipated flow such as periods of low rainfall. The cost for maintenance of these devices is solely the Contractor's responsibility. These works are temporary and shall be removed and the area restored to its original state when they are no longer needed or permanent measures are installed.
- C. Related Sections:
 - 1. Section 31 00 01 Earthwork

1.02 SUBMITTALS

A. Product data for each type and/or size of dewatering coffer dam or pump around equipment as described on the Contract Documents.

1.03 QUALITY ASSURANCE

A. Contractor shall forward one copy of a stream Dewatering and Flow Diversion plan to the Owner or Owner's Representative for review and approval. The plan shall include a description of means and methods plus a list of materials including pump equipment, etc., that shall be employed. The Contractor shall document the flow volume anticipated to be passed around the work area during normal operations. Specifications for any proprietary devices will be required for review and approval by the Owner or Owner's Representative.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Coffers: It is suggested that the Contractor utilize sandbags with plastic sheeting to impound water as necessary to construct stream work. However, the Contractor may submit for review by the design Owner or Owner's Representative alternative methods for coffer systems including proprietary devices.
- B. Impervious Sheeting: Sheeting shall consist of ten (10) mil or thicker polyethylene plastic, which is impervious and resistant to puncture and tearing.
- C. Pump(s): Pump(s) shall be large enough for dewatering stream section in a timely fashion without creating unsafe conditions or producing additional erosion or sediment discharge. The pump around shall include a hose, high density polyethylene (HDPE) or metal pipe suitable to convey water overland to the downstream discharge point. Pump inlets will have a screen (mesh size <1 inch) over opening. The pump(s) shall be shut off at night unless otherwise indicated on the Construction Documents. The size and number of pumps shall be determined by the Contractor based on his/her review of field conditions, interpretation of the Contract Documents and experience. All pipe work shall be secured in place.</p>
- D. Sandbags: Sandbags shall consist of materials, which are resistant to ultraviolet radiation, tearing and puncture, and woven tightly enough to prevent leakage of fill material (i.e., sand, fine gravel, etc.).
- E. Filter Bags: Per Section 31 25 00 Erosion and Sediment Control
- F. Dewatering Sumps: Per Section 31 25 00 Erosion and Sediment Control

PART 3 – EXECUTION

3.01 INSTALLATION, OPERATION AND REMOVAL

A. Installation and Removal: Installation of piping, sandbags, sheeting and pump around shall be in accordance with the approved Erosion and Sediment Control Plan in the Contract Documents or as directed by the Owner or Owner's Representative. Unless otherwise specified on the Contract Documents, install diversion structures from upstream to downstream. The Contractor shall relocate the discharge pipe(s) as necessary to complete all work as shown on the Contract Documents at no additional expense to the Owner. Provide piping, sumps, sedimentation tanks, dewatering basins or non-woven dewatering bags as required by the Owner or Owner's Representative. The Contractor is responsible for ensuring water is adequately filtered or otherwise treated per State/Commonwealth, County, and City sediment control requirements before discharging into a stream or storm drain system. Contractor shall use filter bags

and dewatering sumps where directed by the Contract Documents or directed by the Owner or Owner's Representative. Cost of filter bags and dewatering sumps are considered incidental to this item and will not be paid for separately. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, Contractor shall restore damaged structures and foundation soils at no additional expense to the Owner. Remove dewatering system from project site upon completion of construction activities related to the dewatering areas only with the approval of the Owner or the Owner's Representative.

- B. Pump-around Length and Stream Aquatics: In order to protect the existing benthic, fish and other aquatic organisms, the Contractor is not to exceed the pump-around work area limits as shown on the Contract Documents (usually less than 300 feet) without written authorization from the Owner or Owner's Representative nor is he/she to operate the pumps beyond the time frames as specified on the Contract Documents. It is anticipated and necessary that base flow be passed back over work areas at night unless specifically called out as a "24 hour" dry work area on the Contract Documents. Fish trapped within "pockets" of water shall be removed by hand netting or sieving and shall be placed downstream of the work area or as directed by the Owner at the Contractor's expense.
- C. Disposal of Water: Dispose of water removed by dewatering in a manner that avoids sediment deposition, endangering public health, property, and portions of work under construction or completed.
- D. Daily Work Area Pump-down: The Contractor is expected to pump down any flooded work areas prior to each day's work so that operations are "in the dry". If water removed from work areas is turbid, it shall be pumped first to a filter bag or other approved filtration device prior to this water re-entering the stream; see Section 31 25 00 Erosion and Sediment Control for more detail.
- E. Hours of Operation: If pump operations occur between 5 PM and 7 AM, then the Contractor must have an employee on site at all times to monitor pumping operations.
- F. Noise: Pumps utilized in the stream diversion must be in compliance with Local Noise Ordinances and if necessary, the Contractor will construct devices to muffle pump noise at no additional compensation. Should noise reduction be required, then noiseabatement dewatering shall be accomplished by the use of a "quiet" brand of critically silenced Dri-Prime Pump(s) manufactured by Godwin or approved equal. These quiet pumps shall be enclosed in 14-gauge sheet metal lined with 1-inch and 2-inch layers of polydamp acoustical sound deadening material to achieve a noise reduction to 69dBA at 30 feet. All exhaust pipes must be muffled.

- G. Pump Line Placement: Any piping that crosses paved trails will have a wooden ramp at a slope of 1:20 (vertical: horizontal) for pedestrian and bike passage. A warning sign must also be placed in advance of the pipe crossing on both sides of trail.
- H. Inspection: Contractor to inspect pipes regularly for leaks and repair as necessary. Repairs are considered incidental to this item and will not be paid for separately.
- I. Elimination of Concentrated Flow Scour: All stream diversion outfalls will utilize a velocity reduction device such as a temporary riprap pad to prevent erosion.

SECTION 01 77 19 CLOSEOUT REQUIREMENTS

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. Final Cleaning
 - 1. At the completion of the work, the Contractor shall remove all rubbish from and about the site of the work, and all temporary structures, construction signs, tools, scaffolding, materials, supplies and equipment which they or any of their Subcontractors may have used in the performance of the work. Contractor shall broom clean paved surfaces and rake clean other surfaces of grounds.
 - 2. Contractor shall thoroughly clean all materials, equipment, and structures; all marred surfaces shall be touched up to match adjacent surfaces.
 - 3. Contractor shall maintain cleaning until project, or portion thereof, is accepted by the Owner.
- B. Final Cleanup; Site Rehabilitation
 - 1. Before finally leaving the site, the Contractor shall wash and clean all exposed surfaces which have become soiled or marked, and shall remove from the site of work all accumulated debris and surplus materials of any kind which result from their operation, including construction equipment, tools, sheds, sanitary enclosures, etc. The Contractor shall leave all equipment, fixtures, and work, which they have installed, in a clean condition. The completed project shall be turned over to the Owner in a neat and orderly condition.
 - 2. The site of the work shall be rehabilitated or developed in accordance with other sections of the Specifications and the Drawings. In the absence of any portion of these requirements, the Contractor shall completely rehabilitate the site to a condition and appearance equal or superior to that which existed just prior to construction, except for those items whose permanent removal or relocation was required in the Contract Documents or ordered by the Owner.
- C. Final Inspection
 - 1. Final cleaning and repairing shall be so arranged as to be finished upon completion of the construction work. The Contractor will make their final cleaning and repairing, and any portion of the work finally inspected and accepted by the Engineer shall be kept clean by the Contractor, until the final acceptance of the entire work.

- 2. When the Contractor has finally cleaned and repaired the whole or any portion of the work, they shall notify the Engineer that they is ready for final inspection of the whole or a portion of the work, and the Engineer will thereupon inspect the work. If the work is not found satisfactory, the Engineer will order further cleaning, repairs, or replacement.
- 3. When such further cleaning or repairing is completed, the Engineer, upon further notice, will again inspect the work. The "Final Payment" will not be processed until the Contractor has complied with the requirements set forth, and the Engineer has made their final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.
- D. Project Close Out
 - 1. As construction of the project enters the final stages of completion, the Contractor shall, in concert with accomplishing the requirements set forth in the Contract Documents, attend to or have already completed the following items as they apply to their contract:
 - a. Correcting or replacing defective work, including completion of items previously overlooked or work which remains incomplete, all as evidenced by the Engineer's "Punch" Lists.
 - b. Attend to any other items listed herein or brought to the Contractor's attention by the Engineer.
 - 2. In addition, and before the Certificate of Substantial Completion is issued, the Contractor shall submit to the Engineer (or to the Owner if indicated) certain records, certifications, etc., which are specified elsewhere in the Contract Documents. A partial list of such items appears below, but it shall be the Contractor's responsibility to submit any other items which are required in the Contract Documents:
 - a. Certification of equipment or materials in compliance with Contract Documents.
 - b. One set of neatly marked-up record drawings showing as-built changes and additions to the work under their Contract.
 - c. Any special guarantees or bonds (Submit to Owner).
 - 3. The Contractor's attention is directed to the fact that required certifications and information under Item 2 above, must be submitted earlier in accordance with other Sections of the Specifications.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

SECTION 01 78 39 PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Requirements for recording changes to record documents.
 - 2. Requirements for electronic files furnished by Engineer.
- B. Contractor shall maintain and submit to Engineer with record documents in accordance with the Specifications, General Conditions, and Supplementary Conditions.

1.02 ADMINSTRATIVE REQUIREMENTS

- A. Maintenance of Record Documents:
 - 1. The following record documents shall be maintained in the Contractor's field office:
 - a. Drawings, Specifications, and Addenda.
 - b. Shop Drawings, Samples, and other Contractor submittals, including records of test results, approved or accepted as applicable, by Engineer.
 - c. Change Orders, Work Change Directives, Field Orders, photographic documentation, survey data, and all other documents pertinent to the Work.
 - 2. Update record documents on a monthly basis, minimum.
 - 3. Provide files and racks for proper storage and easy access to record documents.
 - 4. Make record documents available for inspection upon request of Engineer or Owner.
 - 5. Do not use record documents for purpose other than serving as Project record. Do not remove record documents from Contractor's field office without Engineer's approval.
- B. Submittal of Record Documents:
 - 1. Submit to Engineer the following record documents: Drawings.
 - 2. Prior to readiness for final payment, submit to Engineer one copy of final record documents. Submit complete record documents; do not make partial submittals.

- 3. Submit record documents with transmittal letter on contractor letterhead complying with letter of transmittal requirements in Section 01 33 00 Submittal Procedures.
- 4. Record documents submittal shall include certification, with original signature of official authorized to execute legal agreements on behalf of Contractor.
- C. Electronic Files Furnished by Engineer:
 - 1. CADD files will be furnished by Engineer upon the following conditions:
 - a. Contractor shall submit to Engineer a letter on Contractor letterhead requesting CADD files and providing specific definition(s) or description(s) of how files will be used, and specific description of benefits to Owner (including credit proposal, if applicable) if the request is granted.
 - b. Contractor shall execute Engineer's standard agreement for release of electronic files and shall abide by all provisions of the agreement for release of electronic files.
 - c. Layering system incorporated in CADD files shall be maintained as transmitted by Engineer. CADD files transmitted by Engineer containing cross-referenced files shall not be bound by Contractor. Drawing crossreferences and paths shall be maintained. If Contractor alters layers or cross-reference files, Contractor shall restore all layers and cross-references prior to submitting record documents to Engineer.
 - d. Contractor shall submit record drawings to Engineer in same CADD format that files were furnished to Contractor.

1.03 SUBMITTALS

A. Closeout Submittals: Provide record documentation as specified in this Section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS:

- A. At the start of the Project, label each record document to be submitted as, "PROJECT RECORD" using legible, printed letters. Letters on record copy of the Drawings shall be two inches high.
- B. Keep record documents current. Make entries on record documents within two working days of receipt of information required to record the change.
- C. Do not permanently conceal the Work until required information has been recorded.

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- D. Accuracy of record documents shall be such that future searches for items shown on the record documents may rely reasonably on information obtained from Engineer-accepted record documents.
- E. Marking of Entries:
 - 1. Use erasable, colored pencils (not ink or indelible pencil) for marking changes, revisions, additions, and deletions to record documents.
 - 2. Clearly describe the change by graphic line and make notations as required. Use straight-edge to mark straight lines. Writing shall be legible and sufficiently dark to allow scanning of record documents into legible electronic files.
 - 3. Date all entries on record documents.
 - 4. Call attention to changes by drawing a "cloud" around the change(s) indicated.
 - 5. Mark initial revisions in red. In the event of overlapping changes, use different colors for subsequent changes.

3.02 RECORDING CHANGES TO DRAWINGS:

- A. Record changes on copy of the Drawings. Submittal of Contractor-originated or produced drawings as a substitute for recording changes on the Drawings is unacceptable.
- B. Record changes on plans, sections, schematics, and details as required for clarity, making reference dimensions and elevations (to Project datum) for complete record documentation.
- C. Record actual construction including:
 - 1. Depths of various elements of foundation relative to Project datum.
 - 2. Field changes of dimensions, arrangements, and details.
 - 3. Changes made in accordance with Change Orders, Work Change Directives, and Field Orders.
 - 4. Changes in details on the Drawings. Submit additional details prepared by Contractor when required to document changes.

3.03 RECORDING CHANGES FOR SCHEMATIC LAYOUTS:

 A. In some cases, on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items are shown schematically and are not intended to portray physical layout. For such cases, the final physical arrangement shall be determined by Contractor subject to acceptance by Engineer.

- B. Record on record documents all revisions to schematics on Drawings, including: piping schematics, ducting schematics, process and instrumentation diagrams, control and circuitry diagrams, electrical one-line diagrams, motor control center layouts, and other schematics when included in the Contract. Record actual locations of equipment, lighting fixtures, in-place grounding system, and other pertinent data.
- C. When dimensioned plans and dimensioned sections on the Drawings show the Work schematically, indicate on the record documents, by dimensions accurate to within one inch in the field, centerline location of items of Work such as conduit, piping, ducts, and similar items
 - 1. Clearly identify the Work item by accurate notations such as "cast iron drain", "rigid electrical conduit", "copper waterline", and similar descriptions.
 - Show by symbol or note the vertical location of Work item; for example, "embedded in slab", "under slab", "in ceiling plenum", "exposed", and similar designations. For piping not embedded, also provide elevation dimension relative to Project datum.
 - 3. Descriptions shall be sufficiently detailed to be related to Specifications.
- D. Engineer may furnish written waiver of requirements relative to schematic layouts shown on plans and sections when, in Engineer's judgment, dimensioned layouts of Work shown schematically will serve no useful purpose. Do not rely on waiver(s) being issued.

3.04 REQUIREMENTS FOR SUPPLEMENTAL DRAWINGS:

- A. In some cases, drawings produced during construction by Engineer or Contractor supplement the Drawings and shall be included with record documents submitted by Contractor. Supplemental record drawings shall include drawings provided with Change Orders, Work Change Directives, and Field Orders and that cannot be incorporated into the Drawings due to space limitations.
- B. Supplemental drawings provided with record drawings shall be integrated with the Drawings and include necessary cross-references between drawings. Supplemental record drawings shall be on sheets the same size as the Drawings.
- C. When supplemental drawings developed by Contractor using computer-aided drafting/design (CADD) software are to be included in record drawings, submit electronic files for such drawings in AutoCAD (latest version) as part of record drawing submittal.

3.05 RECORDING CHANGES TO SPECIFICATIONS AND ADDENDA:

- A. Mark each Section to record:
 - 1. Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually provided.

2. Changes made by Addendum, Change Orders, Work Change Directives, and Field Orders.

SECTION 01 78 60 SHORT TERM (30 DAY) PLANT WARRANTEE

PART 1 – GENERAL

1.01 SUMMARY

- A. The work specified in this special provision consists of the maintenance of the stream corridor planted areas and installed stream features in accordance with these specifications. This specification includes all the riparian areas, and floodplain areas shown to be planted in accordance with the planting plans. The short-term maintenance period is defined as the 30-day period following the date of completion of the stream corridor plant installation.
- B. Related Sections:
 - 1. Section 01 78 62 Long Term (1 Year) Plant Warrantee
 - 2. Section 31 25 00 Erosion and Sedimentation Control
 - 3. Section 32 01 92 Watering for Streamwork
 - 4. Section 32 91 24 Streamwork Plant Installation
 - 5. Section 32 92 30 Specialty Seeding
 - 6. Section 32 93 50 Live Stakes

1.02 SUBMITTALS

- A. Plant installation schedule, manifest, invoice or other documentation as to what plant species, size, were installed on the project and any deviations from the Contract Documents.
- B. Thirty-day site-specific checklist including watering method for approval by Engineer.

1.03 QUALITY ASSURANCE

- A. Prior to acceptance of plantings for start of "30-day clock", plants must be counted and evaluated by an independent party if requested by the Owner. "30-day clock" does not start until Engineer has given written acceptance of plantings (or previously agreed portion or phase of plantings).
- B. At end of 30-day period, surviving plants are to again be counted by the Owner, or an independent party. Any vegetation found deficient, damaged, missing, etc. shall be re-installed by Contractor at Contractor's expense and marked in the field. A new "30-day

clock" will be started for any replaced vegetation and the cost of independent verification will then be borne by the Contractor.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 WARRANTEE EXECUTION

- A. The work to be performed under this specification consists of the following:
 - 1. Plants: The Contractor shall ensure that the survival level of all planted vegetation is maintained at 100 percent during the short-term maintenance period. Replanting of all herbaceous plants shall conform to the requirements of the relevant planting sections of these specifications. A summary of plants re-installed shall be submitted to the Owner in a maintenance report.
 - 2. Seeding: The Contractor shall ensure that the seeded vegetation is progressing satisfactorily during the short-term maintenance period. Reseeding of all herbaceous seeded plant shall conform to the requirements of the relevant planting sections of these specifications. A summary of reseeded activities shall be submitted to the Owner in the maintenance report.
 - Watering: The Contractor will provide water. The Contractor shall furnish all material and accessory items as may be required to facilitate the continued establishment and success of all plants to be maintained. See Section 32 01 92 – Watering for Streamwork for more detail.
 - 4. Removal of dead material and trash: The Contractor shall remove and dispose of dead/decaying plants and trash/debris. The Contractor shall properly dispose of plants and debris within 10 days. The Contractor shall remove and properly dispose of, within 10 days, trash and obstructions from drainage structures and control devices within the project area.
 - 5. Site Visitation and Documentation: During the short-term maintenance period, the Contractor shall visit the site every 3 days. Contractor shall document each daily site visit. Failure to document shall be considered to be failure to provide services, and the short-term maintenance period shall be extended by 3 days. Contractor shall identify tasks performed on a daily checklist. Payment for short-term maintenance shall be paid following 30 days of site service.
 - 6. Criteria for Successful 30-day warrantee: At the end of the 30-day maintenance period, there shall be a complete stand of seeded plants and all individual planted herbaceous and tree plants shall be alive and growing. All seeded areas shall have a healthy stand of green and growing plants with no bare spots exceeding 36

square inches in area at any location. If necessary, Contractor is to extend the maintenance period at no cost to the Owner (including additional third-party verification) until above criteria is met. Upon satisfactory completion of the short-term maintenance period of the project as determined by inspection by the Engineer, the Contractor shall notify the Owner in writing.

7. Payment: Unless specifically stated in the Contract Documents, all costs associated with warranty are incidental and do not warrant additional payment.

SECTION 01 78 62 LONG-TERM (1-YEAR) PLANT WARRANTEE

PART 1 – GENERAL

1.01 SUMMARY

- A. The work specified in this special provision consists of the maintenance of the stream corridor planted areas and installed stream features in accordance with these specifications. This specification includes all the riparian areas, and floodplain areas shown to be planted in accordance with the planting plans. The long-term maintenance period is defined as the 365-day period following the date of completion of the all stream corridor plant installation which starts after the successful completion of the Short-Term (30-day) Plant Warrantee.
- B. Related Sections:
 - 1. Section 01 78 60 Short Term (30 Day) Planting Warrantee
 - 2. Section 31 25 00 Erosion and Sedimentation Control
 - 3. Section 32 09 92 Watering for Streamwork
 - 4. Section 32 92 30 Specialty Seeding
 - 5. Section 32 93 50 Live Stakes

1.02 SUBMITTALS

- A. Plant installation schedule, manifest, invoice or other documentation as to what plant species, size, were installed on the project and any deviations from the Contract Documents.
- B. Previously approved 30-day site-specific checklist.

1.03 QUALITY ASSURANCE

- A. Prior to acceptance of plantings for start of the "Long Term Warrantee", a completed and approved "30-day" evaluation must be received by the Engineer; see Section 01 78 60 – Short Term (30 Day) Planting Warrantee.
- B. At end of the 365-day period, surviving plants are to again be counted by the Owner, or an independent party if requested. Any vegetation found deficient, damaged, missing, etc., in excess of 85 percent of the quantities documented under the 30-day evaluation shall be replaced to achieve the required permit coverage. Replacements shall be the

same size as the surviving 1-year old on-site vegetation. The contractor is responsible for any increase in cost associated with installing larger stock than originally planted.

PART 2 – PRODUCTS – (NOT USED)

PART 3 – EXECUTION

3.01 WARRANTEE EXECUTION

- A. The work to be performed under this specification consists of the following:
 - 1. The Engineer or other designated independent representative shall inspect the plantings one time only in the spring or summer of the warranty period for any plants that were installed as bulbs, live stakes, container plants, or ball-and-burlap plants by the Contractor. Prior to the 365-day inspection, the Contractor is to remove plant stakes, guide wires, etc. from planted material.
 - 2. Plants: The Contractor shall ensure that the survival level of all planted vegetation is maintained at 85 percent during the long-term maintenance period. Replanting of all herbaceous plants shall conform to the requirements of the relevant planting sections of these specifications. A summary of replants installed shall be submitted to the Owner in a maintenance report.
 - 3. Seeding: The Contractor shall ensure that the seeded vegetation is progressing satisfactorily during the long-term maintenance period. Reseeding of all herbaceous seeded plant shall conform to the requirements of the relevant planting sections of these specifications. The Engineer will inspect seeded portions of the project, and any bare spots greater than 36 square inches in area shall be reseeded. The Engineer shall notify the Contractor in writing of the net area to be reseeded at no cost to the Owner. A summary of reseeding activities shall be submitted to the Owner in the maintenance report. The Contractor must return to the site and replace said plants and seeds within 30 days of written notification.
 - Watering: The Contractor will provide water. The Contractor shall furnish all material and accessory items as may be required to facilitate the continued establishment and success of all plants to be maintained. See Section 32 01 92 – Watering for Streamwork for more detail.
 - 5. Removal of dead material and trash: The Contractor shall remove and dispose of dead/decaying plants and trash/debris. The Contractor shall properly dispose of plants and debris within 10 days. The Contractor shall remove and properly dispose of, within 10 days, trash and obstructions from drainage structures and control devices within the project area.

- 6. Site Visitation and Documentation: During the long-term maintenance period, the Contractor shall visit the site as necessary to monitor planting survival and shall document plant survival issues (particularly watering needs) to the Owner.
- 7. Criteria for Successful 365-day warrantee: At the end of the 365-day maintenance period, there shall be a complete stand of seeded plants and 85% of individual planted herbaceous plants and trees shall be alive and growing. All seeded areas shall have a healthy stand of green and growing plants with no bare spots exceeding 36 square inches in area at any location. The Owner will supply the Contractor with either a written acceptance of plantings or repair/replacement instructions based on Engineer or other independent field analysis. If an 85% survival rate is not achieved, Contractor is to extend the maintenance period one year at no cost to the Owner (including additional third-party verification) until above criteria is met. Upon satisfactory completion of the long-term maintenance period of the project as determined by inspection by the Engineer or other third party, the Contractor shall notify the Owner in writing. Payment for long-term maintenance shall be paid within 30 days of receipt of Engineer or third-party acceptance of planting conditions.
- 8. Payment: Unless specifically stated in the Contract Documents, all costs associated with warranty are incidental and do not warrant additional payment.

SECTION 02 41 00 DEMOLITION

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish all labor, materials, and equipment in accordance with the requirements of the Contract Drawings.
- B. In addition, the Contractor shall demolish and remove all concrete and asphalt paving, curbs, sidewalk, and miscellaneous yard piping, utilities, wooden structures and other structures as required and shown on the Contract Drawings during the construction work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. None.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. References shall be in accordance with reference standards, codes, and specifications as set forth herein and in Section 31 10 00 – Clearing, Grubbing, and Site Preparation.

1.04 SUBMITTALS

- A. Contractor shall submit the following:
 - 1. Copies of pre-demolition photographs and other records for demolition items.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 DEMOLITION

- A. Existing concrete and asphalt paving, curbs, sidewalk and miscellaneous yard piping, utilities, wooden structures, and other structures within the areas designated for new construction work shall be completely demolished and all debris removed from the site.
- B. Excavation caused by demolition shall be backfilled with fill free from rubbish and debris.
- C. Work shall be performed in such manner as not to endanger the safety of the workmen or the public or cause damage to nearby structures.

- D. Provide all barriers and precautionary measures in accordance with Owner's requirements and other authorities having jurisdiction.
- E. Where parts of existing pavements or structures are to remain in service, demolish the portions to be removed, repair damage, and leave the pavement or structure in proper condition for the intended use. Remove asphalt or concrete pavement, concrete, and masonry to the lines designated by saw-cutting, drilling, chipping, or other suitable methods. Leave the resulting surfaces reasonably true and even, with sharp straight corners that will result in neat joints with new construction and be satisfactory for the purpose intended. Where existing reinforcing rods are to extend into new construction, remove the concrete so that the reinforcing is clean and undamaged. Cut off other reinforcing 1/2-inch below the surface and fill with epoxy resin binder flush with the surface.
- F. Prior to the execution of the work, the Contractor, Owner and Engineer shall jointly survey the condition of the adjoining and/or nearby pavements and structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims. Contractor shall provide Owner a copy of all records of the joint survey of conditions before demolition activities may begin. Contractor shall provide copies of the existing conditions survey report to the Owner and Engineer before any demolition or construction activities begin.

3.02 DISPOSAL OF MATERIAL

- A. All debris resulting from the demolition and removal work shall be disposed of by the Contractor at a properly permitted facility as part of the work of this Contract. Material designated by the Engineer to be salvaged shall be stored on the construction site as directed. All other material shall be disposed of off-site by the Contractor at his expense.
- B. Burning of any debris resulting from the demolition will not be permitted at the site.

SECTION 31 00 01 EARTHWORK

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish all labor, equipment, and materials required to complete all work associated with excavation (including off-site borrow excavation), fill and backfill placement and compaction, coordinate testing of soil materials and compaction by an independent Materials Testing Consultant if required by Owner, constructing embankments, dewatering, construction of drainage layers, installing foundation and backfill aggregate, placing filter and separation fabrics, stockpiling topsoil and any excess suitable material, designing, installing, maintaining and removing excavation support systems, disposing of all excess and unsuitable materials, providing erosion and sedimentation control, encasing utility conduits, site grading, preparation of pavement and structure subgrades, and other related and incidental work as required to complete the work shown on the Drawings and as specified herein.
- B. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Drawings or established by the Engineer.
- C. It is the intent of this Specification that the Contractor conduct the construction activities in such a manner that erosion of disturbed areas and off-site sedimentation be absolutely minimized.
- D. Earthwork performed under this Contract shall be done in conformance with these specifications. Items and activities not addressed herein shall be subject to the limitations of the latest editions of the Virginia Department of Transportation Road and Bridge Specifications. If there is a conflict between this specification and the Road and Bridge Specifications, the more conservative of the two shall take precedent.
- E. Erosion and Sediment Control shall be performed in accordance with Section 31 25 00 of these specifications and with the latest edition of the Virginia Erosion and Sediment Control Handbook (VAESCH). If there is a conflict between this specification and the ESCPDM, the more conservative of the two shall take precedent.
- F. All fill materials (soil, aggregate, topsoil, etc.) imported to the site and onsite materials to be reused as fill, backfill, or embankment shall be subjected to the testing requirements contained in Part 3.0 of this Section. The Contractor shall retain a Materials Testing Consultant who shall perform all testing. The test results shall be used to determine if a material meets the requirements included herein. The Contractor shall furnish all necessary samples for laboratory testing and shall provide assistance and cooperation during field tests. The Contractor shall plan their operations to allow adequate time for laboratory tests and to permit taking of field density tests during compaction.

G. Any costs for re-testing required as a result of failure to meet compaction requirements shall be borne solely by the Contractor.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements of related work are included in Divisions 02, 31, and 32 of these Specifications.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced Specifications, codes, and standards refer to the most current issue available at the time of Bid.
 - 1. Virginia Department of Transportation Road and Bridge Specification Book, latest edition.
 - 2. Virginia Department of Transportation, Virginia Test Methods Manual, May 2020.
 - 3. American Society for Testing and Materials (ASTM):
 - a. ASTM C 127 Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
 - b. ASTM C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - ASTM D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³))
 - d. ASTM D 1140 Standard Test Method for Determining the Amount of Material Finer than 75-μm (No. 200) Sieve in Soils by Washing
 - e. ASTM D 1556 Standard Test Method for Density and Unit Weight of Soil in Place by Sand Cone Method.
 - ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/lb³ (2,700 kNm/m³)).
 - g. ASTM D 1883 Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils.
 - h. ASTM D 2216 Test for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

- i. ASTM D 2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- j. ASTM D 4253 Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
- k. ASTM D 4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- I. ASTM D 6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- m. ASTM D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).

1.04 SUBSURFACE CONDITIONS

- A. Information on subsurface conditions is referenced under Division 01, General Requirements.
- B. Attention is directed to the possible location of water pipes, sanitary pipes, storm drains, and other utilities located in the area of proposed excavation. In the event excavation activities disrupt service, the Contractor shall perform all repairs at no additional cost to the Owner. The Contractor shall contact VA811.com or 1-800-552-3120 to request underground utility location mark-out at least three (3) working days, not including the day the request is called in, but no more than ten (10) working days prior to the beginning of excavation. The Contractor shall also contact and request utility location mark-out from buried utility owners with utilities on the project site that are not participants of VA811.com.

1.05 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01 33 00 Submittal Procedures, the Contractor shall submit the following:
 - 1. Evidence the Contractor has a minimum of five (5) years of experience performing excavation and backfill in environmental restoration projects similar in size to the work for this project.
 - 2. Name and location of all material suppliers.
 - 3. Certificate of compliance with the standards specified herein for each source of each material.
 - 4. List of disposal sites for waste and unsuitable materials and all required permits for use of those sites.

- 5. Plans and cross sections of open cut excavations showing side slopes and limits of the excavation at grade.
- 6. Procedures for dewatering proposed by the Contractor shall be submitted to the Engineer for review and approval prior to any earthwork operations.
- 7. Samples of synthetic filter fabric and reinforced plastic membrane with manufacturer's certificates or catalog cuts stating the mechanical and physical properties. Samples shall be at least one (1) foot wide and four (4) feet long taken across the roll with the warp direction appropriately marked.
- 8. Construction drawings and structural calculations for any types of excavation support required. Drawings and calculations shall be sealed by a currently registered Professional Engineer in the in the Commonwealth of Virginia.
- 9. Monitoring plan and pre-construction condition inspection and documentation of all adjacent structures, utilities, and roadways near proposed installation of excavation support systems and near areas where dewatering is required to facilitate construction.
- 10. The Contractor shall be required to submit plans of open cut excavation for review by the Engineer before approval is given to proceed.
- 11. Submit excavation support installer qualifications with installation history.
- 12. Drawings and calculations on proposed excavation support systems sealed by a Professional Engineer currently registered in the in the Commonwealth of Virginia.
- 13. Contractor shall also submit a monitoring plan developed by the excavation support design engineer.
- 14. Earthwork contractor qualifications.
- All required permits and a list of disposal sites for unsuitable materials within thirty (30) consecutive days after Notice to Proceed. If the disposal site is located on private property, the submittal shall also include written permission from the owner of record.
- 16. Except where borrow is to be obtained from a commercial source, a borrow source development, use, and reclamation plan jointly developed by the Contractor and the property owner prior to engaging in any land disturbing activity on the proposed source (other than material sampling that may be necessary). The Contractor's plan shall address the following
 - a. <u>Drainage</u>: The source shall be graded to drain such that no water will collect or stand and a functioning drainage system shall be provided. If drainage is not practical, and the source is to serve as a pond, the minimum average

depth below the water table shall be 4 feet or the source graded so as to create wetlands as appropriate, or as agreed to with the property owner

- b. <u>Slopes</u>: The source shall be dressed and shaped in a continuous manner to contours which are comparable to and blend in with the adjacent topography, but in no case will slopes steeper than 3:1 be permitted unless shown otherwise on the construction drawings.
- c. <u>Erosion Control</u>: Except where borrow is to be obtained from a commercial source, the Contractor and the property owner shall jointly submit a Borrow Source Development, Use, and Erosion Control Plan to the appropriate State or Local permitting authority for approval and provide evidence of such to the Engineer for their approval prior to engaging in any land disturbing activity on the proposed source other than material sampling that may be necessary.

1.06 PRODUCT HANDLING

A. Soil and rock material shall be excavated, transported, placed, and stored in a manner so as to prevent contamination, segregation and excessive wetting. Materials which have become contaminated or segregated will not be permitted in the performance of the work and shall be removed from the site.

1.07 USE OF EXPLOSIVES

A. The use of explosives will not be allowed for the prosecution of this work.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

- A. The contractor shall be responsible for providing fill materials meeting the gradation requirements included herein.
- B. All fill materials shall be free of organic material, environmental contaminants, snow, ice, frozen soil, or other unsuitable material.
- C. Bedding material installed above and below the water table shall meet the requirements of the VDOT Road and Bridge Standards.
- D. Below-grade walls shall be backfilled with Select Fill.
- E. When the excavated material from required excavations meets the requirements of Select Fill or Common Fill, but is replaced with off-site borrow material for the Contractor's convenience, the costs associated with such work and material shall be borne by the Contractor.

- F. Where excavated material does not meet requirements for Select Fill or Common Fill, the Contractor shall furnish off-site borrow material meeting the specified requirements herein. Determination of whether the borrow material will be paid for as an extra cost will be made based on the contract documents.
- G. Contractor may stockpile excavated material to be used as Select Fill, Common Fill, Drainage Fill or Topsoil on site in areas designated in the Contract Documents. Soil materials may be stockpiled as necessary to sort, segregate, test, and transfer the materials. Excess material and materials considered unsuitable for reuse by the Engineer shall be removed from the site for off-site disposal. No stockpiling of excavated material is allowed in a manner or location that would permit erosion and its subsequent sedimentation in wetlands or other natural areas.

2.02 SELECT FILL

- A. Select fill shall be used where shown on the Contract Drawings.
- B. Select fill shall not include particles or lumps larger than 3 inches.
- C. Select fill used as backfill against walls shall not contain any rock larger than 1¹/₂ -inches.
- D. Select fill shall consist of non-plastic materials classifying as GW, GW-GM, GP, SW, SW-SM, SP-SM, or SP per ASTM D-2487. Select fill shall be free of organic material, environmental contaminants, snow, ice, frozen soil, or other unsuitable material.
- E. Open-graded and dense-graded VDOT aggregates meeting the gradation requirements above may be used as Select Fill.
- F. Select Fill to be used as pavement subbase material shall be VDOT 21B dense-grading aggregate.
- G. Select Fill shall be placed in 8-inch-thick lifts, with the exception of VDOT No. 57 aggregate, which may be placed in 12-inch-thick lifts.
- H. Select Fill shall be compacted to not less than 95 percent of the maximum dry density obtainable by ASTM D 698 and does not contain unsuitable material.
- I. Select Fill shall be compacted at a moisture content within 20 percent of the optimum moisture content of the fill material in accordance with the ASTM D 698, Standard Proctor.
- J. All materials used as Select Fill are subject to approval by the Engineer.

2.03 DRAINAGE FILL

- A. Drainage Fill shall be used where shown on the Contract Drawings.
- B. Drainage Fill shall consist of VDOT No. 57 aggregate.

2.04 COMMON FILL

- A. Common Fill shall be used where shown on the Contract Drawings.
- B. Common Fill shall consist of non-organic on-site soils classifying as CH, MH, CL, ML, SC, SM, SP, SW, GC, GM, GP, or GW according to ASTM D 2487.
- C. Common Fill shall be placed in 8-inch-thick loose lifts.
- D. Common Fill shall be compacted to not less than 95 percent of the maximum dry density obtainable by ASTM D 698 and does not contain unsuitable material.
- E. Common Fill shall be compacted at a moisture content within 20 percent of the optimum moisture content of the fill material in accordance with the ASTM D 698, Standard Proctor.
- F. All material used as common fill is subject to approval by the Engineer. If there is insufficient suitable material onsite, import whatever additional material is required which conforms to the specifications, at no additional cost to the Owner.
- G. Select Fill may be used as Common Fill, subject to approval by the Engineer. Select fill may be used as Common Fill at no change in the Contract Price.

2.05 TOPSOIL

A. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam). It shall be free of debris, trash, stumps, rocks, roots, and noxious weeds, and shall give evidence of being able to support health vegetation. It shall contain no substance potentially toxic to plant growth. All topsoil shall be tested by a recognized laboratory for the following criteria: Organic matter content shall not be less than 1.5% by weight. pH range shall be from 6.0 -7.5. If pH is less than 6.0, lime shall be added in accordance with test results or in accordance with the recommendations of the vegetative establishment practice being used. Soluble salts shall not exceed 500 ppm. If additional topsoil is needed, it must meet the standards stated above.

2.05 GEOTEXTILES

 A. The Contractor shall provide geotextiles as indicated on the Contract Drawings and specified herein. The materials and placement shall be as indicated under Section 31 32 40 – Geotextile for Streamwork.

PART 3 – EXECUTION

3.01 STRIPPING OF TOPSOIL

- A. In all areas to be excavated, filled, or paved, the topsoil shall be stripped to its full depth.
- B. Stripped topsoil to be used as fill or removed from site.

3.02 EXCAVATION

- A. All material excavated, regardless of its nature or composition, shall be classified as UNCLASSIFIED EXCAVATION. Excavation shall include the removal of all soil, rock, weathered rock, rocks of all types, boulders, conduits, pipe, all other obstacles encountered, and all other obstacles shown to be removed within the limits of excavation shown on the Contract Drawings or specified herein. The cost of excavation shall be included in the Lump Sum Bid Price and no additional payment will be made for the removal of obstacles encountered within the excavation limits shown on the Drawings and specified herein.
- B. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders, and at such other places as may be indicated on the Drawings or indicated by the Engineer. No excavation shall be wasted except as may be permitted by the Engineer. Refer to the drawings for specific location and placement of suitable excavated materials in the formation of embankments, backfill, and structural and roadway foundations. THE ENGINEER AND/OR MATERIALS TESTING CONSULTANT WILL DESIGNATE MATERIALS THAT ARE UNSUITABLE. The Contractor shall furnish off-site disposal areas for the unsuitable material. Where suitable materials containing excessive moisture are encountered above grade in cuts, the Contractor shall construct above grade ditch drains prior to the excavation of the cut material when in the opinion of the Engineer and/or materials testing consultant such measures are necessary to provide proper construction.
- C. All excavations shall be made in the dry and in such a manner and to such widths as will give ample room for properly constructing and inspecting the structures and/or piping they are to contain and for such excavation support, pumping and drainage as may be required. Excavation shall be made in accordance with the grades and details shown on the Drawings and as specified herein.
- D. Excavation slopes shall be flat enough to avoid slides that will cause disturbance of the subgrade or damage of adjacent areas. Excavation requirements and slopes shall be as indicated in the Drawings.
- E. The Contractor shall intercept and collect surface runoff both at the top and bottom of cut slopes. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded as shown on the Drawings or as may be indicated by the Engineer. Concurrent with the excavation of cuts the Contractor

shall construct intercepting berm ditches or earth berms along and on top of the cut slopes at locations shown on the Drawings or designated by the Engineer. All slopes shall be finished to reasonably uniform surfaces acceptable for seeding and mulching operations. No rock or boulders shall be left in place which protrude more than 1 foot within the typical section cut slope lines, and all rock cuts shall be cleaned of loose and overhanging material. All protruding roots and other objectionable vegetation shall be removed from slopes.

- F. It is the intent of these Specifications that all structures shall bear on an aggregate base, crushed stone or screened gravel bedding placed to the thickness shown on the Drawings, specified in these Specifications, or not less than 3-inches.
- G. The bottom of all excavations for structures and pipes shall be examined by the Engineer and/or materials testing consultant for bearing value and the presence of unsuitable material. If, in the opinion of the Engineer and/or materials testing consultant, additional excavation is required due to the low bearing value of the subgrade material, or if the in place soils are soft, yielding, pumping or wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted select fill, and/or crushed stone or screened gravel as indicated by the Engineer. Payment for such additional work ordered by the Engineer shall be made as an extra by a Change Order in accordance with the General Conditions and Division 01. No payment will be made for subgrade disturbance caused by inadequate dewatering or improper construction methods.
- H. All cuts shall be brought to the grade and cross section shown on the Drawings, or established by the Engineer, prior to final inspection and acceptance by the Engineer.
- I. Slides and over-breaks which occur due to negligence, carelessness or improper construction techniques on the part of the Contractor shall be removed and disposed of by the Contractor as indicated by the Engineer at no additional cost to the Owner. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion and sedimentation control operations shall be performed.
- J. Where the excavation exposes sludge, sludge contaminated soil or other odorous materials, the Contractor shall cover such material at the end of each workday with a minimum of 6 inches and a maximum of 24-inches of Common fill. The work shall be an odor abatement measure and the material shall be placed to the depth deemed satisfactory by the Engineer for this purpose.

3.03 EXCAVATION SUPPORT

A. The Contractor shall furnish, place, and maintain such excavation support which may be required to provide safe working conditions and support sides of excavation or to protect structures, pipes, and utilities from possible. The Contractor shall be exclusively responsible for maintaining safe working conditions and structure integrity without

overstressing or damaging existing structures, pipes, and utilities resulting from the Contractor temporarily placing, moving, or removing loads on or adjacent to existing structures, pipes, and utilities. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, the Engineer may order additional supports put in at the expense of the Contractor. The Contractor shall be responsible for the adequacy of all supports used and for all damage resulting from failure of support system or from placing, maintaining and removing the support system.

- B. The selection of and design of any proposed excavation support systems is exclusively the responsibility of the Contractor. Contractor shall submit drawings and calculations to the Engineer on the proposed systems sealed by a Professional Engineer currently registered in the in the Commonwealth of Virginia.
- C. The excavation support system shall be installed by a specialized contactor with a minimum of five (5) years' experience installing the type of excavation support system proposed.
- D. The Contractor shall exercise caution in the installation and removal of supports to ensure no excessive or unusual loadings or vibrations are transmitted to any new or existing structure. The Contractor shall promptly repair at their expense any and all damage that can be reasonably attributed to installation or removal of excavation support system.
- E. Contractor shall monitor movement and vibration in the excavation support systems as well as movement and vibration at adjacent structures, utilities and roadways near excavation supports. Contractor shall submit a monitoring plan developed by the excavation support design engineer. All pre-construction condition assessment and documentation of adjacent structures on-site and off-site shall be performed by the Contractor. If any sign of distress such as cracking or movement occurs in any adjacent structure, utility or roadway during installation of supports, subsequent excavation, service period of supports, subsequent backfill and construction, or removal of supports, Engineer shall be notified immediately. The Contractor shall be exclusively responsible for repair of any damage to any roadway, structure, utility, pipes, etc. both on-site and off-site, as a result of their operations.
- F. All excavation supports shall be removed upon completion of the work except as indicated herein. The Engineer may permit supports to be left in place at the request and expense of the Contractor. The Engineer may order certain supports left permanently in place in addition to that required by the Contract. The cost of the materials so ordered left in place, less a reasonable amount for the eliminated expense of the removal work omitted, will be paid as an extra by a Change Order in accordance with the General Conditions and Division 01. Vibrations of new and existing structures shall be considered when the Contractor decides whether to remove excavation supports or leave them in place. Any excavation supports left in place shall be cut off at least two (2) feet below the finished ground surface or as directed by the Engineer.

3.04 PROTECTION OF SUBGRADE

- A. To minimize the disturbance of bearing materials and provide a firm foundation, the Contractor shall comply with the following requirements:
 - 1. Use of heavy rubber tired construction equipment shall not be permitted on the final subgrade unless it can be demonstrated that drawdown of groundwater throughout the entire area of the structure is at least 3 feet below the bottom of the excavation (subgrade). Even then, the use of such equipment shall be prohibited should subgrade disturbance result from concentrated wheel loads.
 - 2. Subgrade soils disturbed through the operations of the Contractor shall be excavated and replaced with compacted select fill or crushed stone at the Contractor's expense as indicated by the Engineer.
 - 3. The Contractor shall provide positive protection against penetration of frost into materials below the bearing level during work in winter months. This protection can consist of a temporary blanket of straw or salt hay covered with a plastic membrane or other acceptable means.

3.05 PROOF-ROLLING

A. The subgrade of all structures and all areas that will support pavements or select fill shall be proof-rolled. After stripping of topsoil, excavation to subgrade and prior to placement of fills, the exposed subgrade shall be carefully inspected by probing and testing as needed. Any topsoil or other organic material still in place, frozen, wet, soft, or loose soil, and other undesirable materials shall be removed. The exposed subgrade shall be proof-rolled with a heavily loaded tandem-wheeled dump truck to check for pockets of soft material hidden beneath a thin crust of better soil. Any unsuitable materials thus exposed shall be removed and replaced with an approved compacted material, as directed by the Materials Consultant.

3.06 DEWATERING

- A. The Contractor shall do all dewatering as required for the completion of the work. Procedures for dewatering proposed by the Contractor shall be submitted to the Engineer for review prior to any earthwork operations.
- B. All water removed by dewatering operations shall be disposed of in accordance with the Virginia State Water Control Act.
- C. The dewatering system shall be of sufficient size and capacity as required to control groundwater or seepage to permit proper excavation operations, embankment construction and reconstruction, subgrade preparation, and to allow concrete to be placed in a dry condition. The system shall include a sump system or other equipment, appurtenances and other related earthwork necessary for the required control of water..
- D. The Contractor shall control, by acceptable means, all water regardless of source. Water shall be controlled, and its disposal provided for at each berm, structure, etc. The entire periphery of the excavation areas shall be ditched and diked to prevent water from entering the excavation. The Contractor shall be fully responsible for disposal of the water and shall provide all necessary means at no additional expense to the Owner. The Contractor shall be solely responsible for proper design, installation, proper operation, maintenance, and any failure of any component of the system.
- E. The Contractor shall be responsible for and shall repair without cost to the Owner, any damage to work in place and the excavation, including damage to the bottom due to heave and including removal of material and pumping out of the excavated area. The Contractor shall be responsible for damages to any other area or structure caused by their failure to maintain and operate the dewatering system proposed and installed by the Contractor.
- F. The Contractor shall be responsible for and shall repair, without cost to the Owner, any damage to work in place and nearby structures, roadways, and utilities which can be reasonably attributed to dewatering operations. This includes settlement of structures, roadways, and utilities due to dewatering of soils supporting the structures, roadways, and utilities.
- G. The Contractor shall take all the steps that they consider necessary to familiarize himself with the surface and subsurface site conditions, and shall obtain the data that is required to analyze the water and soil environment at the site and to assure that the materials used for the dewatering systems will not erode, deteriorate, or clog to the extent that the dewatering systems will not perform properly during the period of dewatering.
- H. Prior to the execution of the work, the Contractor, Owner and Engineer shall jointly survey the condition of adjoining structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims.

3.07 FILL OR EMBANKMENTS

- A. Contractor shall perform the construction of fill or embankments in such a manner that cut and fill slopes will be completed to final slopes and grade in a continuous operation. The operation of removing excavation material from any cut and the placement of embankment in any fill shall be a continuous operation to completion unless otherwise permitted by the Engineer.
- B. Subgrades upon which fill or embankments are to be constructed shall be stripped of topsoil, organic material, rubbish and other extraneous materials. After stripping and prior to placing fill or embankment material, the Contractor shall compact the top 12inches of in place soil as specified under Paragraph 3.09, COMPACTION.

- C. Any soft or unsuitable materials revealed before or during placement fill or embankment placement shall be removed as indicated by the Engineer and/or materials testing consultant and replaced with select fill and compacted as required.
- D. Fill subgrades on which fill or embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the embankment with the existing surface. The fill or embankment soils shall be as specified under Part 2 - Products, and shall be deposited and spread in successive, uniform, approximately horizontal layers. The loose thickness of each lift shall not exceed the thickness for each fill type noted in Paragraph 3.09, COMPACTION.
- E. Hauling shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form during the construction of the embankment. Fill or embankment subgrades shall be properly drained at all times and kept free of flowing or ponding water, snow, ice and frozen soils. Saturated soils, snow, ice, or frozen soils shall be removed as recommended by the Engineer.
- F. Each layer of the embankment shall be thoroughly compacted to the density specified under Paragraph 3.09, COMPACTION.
- G. The embankment or fill material in the layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Moisture conditions and manipulation of the fill or embankment material, when necessary, shall be performed to maintain a uniform moisture content throughout the layer. Should the material be too wet or too dry to permit proper compaction, earthwork operations shall be delayed until the material is adequately moisture conditioned. Samples of all fill or embankment materials for testing, both before and after placement and compaction, will be taken at frequent intervals. From these tests, corrections, adjustments, and modifications of methods, materials, and moisture content will be made to construct the embankment.
- H. Where fill or embankments materials are to be placed and compacted on sloped subgrades steeper than 4:1 shall be benched. Benches shall be at least 6-feet wide.
- I. When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portions of the embankments and the other material which meets the requirements for select fill shall be incorporated into the formation of the embankments. Stones or fragmentary rock larger than 4inches in their greatest dimension will not be allowed within the top 6inches of the final grade. Stones, fragmentary rock, or boulders larger than 12inches in their greatest dimension will not be allowed in any portions of embankments and shall be disposed of by the Contractor as indicated by the Engineer. When rock fragments or stone are used in embankments, the material shall be brought up in layers as specified or directed and every effort shall be exerted to fill the voids with finer material to form a dense, compact mass which meets the densities specified for embankment compaction.

3.08 BACKFILLING

- A. All structures and pipes shall be backfilled with the type of materials shown on the Drawings and specified herein. Fill placed as structure or utility backfill shall be deposited in successive, uniform, approximately horizontal lifts. The thickness of each lift shall not exceed the requirements of Paragraph 3.09, COMPACTION.
- B. Each lift of fill placed backfill shall be thoroughly compacted to the density specified for each type of fill included in Paragraph 3.09, COMPACTION.
- C. Where excavation support is used, the Contractor shall take all reasonable measures to prevent loss of support beneath and adjacent to pipes and existing structures when supports are removed. If significant volumes of soil cannot be prevented from clinging to the extracted supports, the voids shall be continuously backfilled as rapidly as possible. The Contractor shall thereafter limit the depth below subgrade that supports will be installed in similar soil conditions or employ other appropriate means to prevent loss of support.
- D. Backfill against concrete or masonry structure shall not be performed until the Work has been reviewed and backfilling permitted. Backfill against walls shall also be deferred until the structural slab for floors above the top fill line have been placed and attained design strength or earlier at the discretion of the Engineer. Partial backfilling against adequately braced wall may be considered by the Engineer on an individual situation basis. Where walls are to be waterproofed, all Work shall be completed and membrane materials dried or cured according to the manufacturer's instructions before backfilling.
- E. Backfill against tanks and other structures which are to retain liquids shall not be performed until leakage tests are completed and accepted by the Engineer in accordance with the Section entitled "Water Tightness Testing".

3.09 COMPACTION

A. The Contractor shall compact embankments, backfill, crushed stone, aggregate base, and in place subgrade in accordance with the requirements of this Section. The densities specified herein refer to percentages of maximum density as determined by the noted test methods. Compaction of materials on the project shall be in accordance with the following schedule:

	Density % Standard Proctor (D 698)	Density % Mod. Proctor (D 1557)	Max. Lift Thickness as Compacted Inches
Embankments Beneath Structures, Roadways, and Sidewalks*	98	92	8
Common Fill Areas	95	90	8
Backfill Around Structures	95	90	8

	Density % Standard Proctor (D 698)	Density % Mod. Proctor (D 1557)	Max. Lift Thickness as Compacted Inches
Backfill in Pipe Trenches	95	90	8
Crushed Stone Beneath Structures	**	**	12
Select Sand	98	92	8
Aggregate Base Course (ABC) Beneath Structures, Roadways, and Sidewalks	**	**	8
Crushed Stone Backfill	**	**	12
Crushed Stone Pipe Bedding	**	**	12
In Place Subgrade Beneath Structures, Roadways, and Sidewalks	98	92	Top 12-inches

 * Embankments beneath structures shall be considered to include a zone 10 feet out from the foundation of the structure extending down to the natural ground on a 45° slope.
 ** The aggregate shall be compacted to a degree acceptable to the Engineer by use of a vibratory

- B. Compaction Near Existing Structures
 - 1. Vibratory equipment shall not be used with 25 feet of any existing structure.
 - 2. Within 25 feet of any existing structure, non-vibratory compaction equipment such as a drum roller with a maximum weight of 4 tons should be used. Within 5 feet of any existing structure, a walk behind vibratory sled or roller shall be used.
- C. Field density tests will be made by the Materials Testing Consultant to determine if the specified densities have been achieved, and these tests shall be the basis for accepting or rejecting the compaction. In-place density tests will be performed in accordance with ASTM D 1556, ASTM D 1557, or ASTM D 6938. The Engineer, in conjunction with the Materials Testing Consultant, will be the judge as to which test method will be the most appropriate. Failure to achieve the specified densities shall require the Contractor to recompact the material or remove it as required. The Contractor shall, if necessary, increase the compactive effort by increasing the number of passes, using heavier or more suitable compaction equipment, or by reducing the thickness of the layers. The Contractor shall adjust the moisture contents of the soils to bring them within the optimum range by drying them or adding water as required.
- D. Testing will be performed as frequently as deemed necessary by the Engineer and/or Materials Testing Consultant. As a minimum, one in place density test shall be performed for each 1000 cubic yards of embankment placed and 500 cubic yards of backfill placed or one test performed each day for either or as directed by the Engineer or recommended by Material Testing Consultant.

compactor and/or crawler tractor.

3.10 VIBRATION MONITORING

A. Vibration monitoring shall be performed at nearby structures when compaction work is ongoing and directed by the Owner. A single monitoring point using vibration monitoring equipment capable of detecting velocities of 0.1 inch/second or less and survey measurements shall be used for vibration monitoring at each of the nearest structures. An elevation measurement on nearby structures shall be taken before compaction work starts, and then at least twice a day during the work with one reading taken at the conclusion of the day's operations. Elevation measurements shall be recorded to an accuracy of 0.005 foot. If at any time the Contractor detects settlement or heave of 0.005-feet or more, or vibration levels of 1.0 inch/second or more, the vibratory compaction shall be stopped immediately, and the Engineer notified.

3.11 REMOVAL OF EXCESS AND UNSUITABLE MATERIALS

- A. The Contractor shall remove and dispose of off-site all excess and unsuitable materials. Within thirty (30) consecutive days after Notice to Proceed, the Contractor shall submit to the Engineer for review all required permits and a list of disposal sites for the unsuitable materials. If the disposal site is located on private property, the submittal shall also include written permission from the owner of record.
- B. All excess and unsuitable materials shall be disposed of in locations and under conditions that comply with federal, state/commonwealth and local laws and regulations.
- C. The Contractor shall obtain an off-site disposal area prior to beginning demolition or excavation operations.
- D. All excess and unsuitable materials shall be hauled in trucks of sufficient capacity and tight construction to prevent spillage. Trucks shall be covered to prevent the propagation of dust.
- E. When all excess and unsuitable material disposal operations are completed, the Contractor shall leave the disposal sites in a condition acceptable to the Owner and Owner(s) of the disposal site(s).

3.12 BORROW EXCAVATION

A. Description

1. The work covered by this section consists of the excavation of approved material from borrow sources and the hauling and utilization of such material as required on the Drawings or directed by the Engineer. It shall also include the removing, stockpiling, and replacement of topsoil on the borrow source; the satisfactory disposition of material from the borrow source which is not suitable for use; and the satisfactory restoration of the borrow source and haul roads to an acceptable condition upon completion of the work.

- 2. Borrow excavation shall not be used before all available suitable unclassified excavation has been used for backfilling and incorporated into the embankments.
- B. Coordination with Seeding Operations
 - The Contractor shall coordinate the work covered by this section with the construction of embankments and area fill so the requirements of Section 32 90 00

 Final Grading and Landscaping are met.
- C. Borrow Materials
 - 1. All material shall meet the requirements of Section 2 for Select Fill or shall meet the requirements of Common Fill and classify as SM or coarser according to ASTM D 2487.
- D. Construction Methods
 - 1. General
 - a. The surface of the borrow area shall be thoroughly cleared and grubbed and cleaned of all unsuitable material including all organics, topsoil, etc., before beginning the excavation. Disposal of material resulting from clearing and grubbing shall be in accordance with Section 31 10 00 – Clearing, Grubbing, and Site Preparation.
 - b. Each borrow operation shall not be allowed to accumulate exposed, erodible slope area in excess of 1 acre at any one given time without the Contractor's beginning permanent seeding and mulching of the borrow source or other erosion control measures as may be approved by the Engineer.
 - c. The topsoil shall be removed and stockpiled at locations that will not interfere with the borrow operations and that meet the approval of the Engineer. Temporary erosion control measures shall be installed as necessary to prevent the erosion of the stockpile material. Once all borrow material has been removed from the source or portion thereof, the stockpiled topsoil shall be spread uniformly over the source.
 - d. Where it is necessary to haul borrow material over existing roads, the Contractor shall use all necessary precautions to prevent damage to the existing roads. The Contractor shall also conduct hauling operations in such a manner as to not interfere with the normal flow of traffic and shall always keep the traffic lanes free from spillage.
 - 2. Owner Furnished Sources
 - a. Where borrow sources are furnished by the Owner the location of such sources will be as designated on the Drawings or as directed by the Engineer.

- b. The Owner will furnish the necessary haul road right-of-way at locations designated by the Engineer. All haul roads required shall be built, maintained, and when directed by the Engineer, obliterated, at no cost to the Owner. Where the haul road is to be reclaimed for cultivation the Contractor shall plow or scarify the area to a minimum depth of 8 inches, or to the depth requested by the property owner.
- c. The borrow sources shall be left in a neat and presentable condition after use. All slopes shall be smoothed, rounded, and constructed not steeper than 3:1. Where the source is to be reclaimed for cultivation the source shall be plowed or scarified to a minimum depth of 8 inches, disc harrowed, and terraces constructed. The source shall be graded to drain such that no water will collect or stand, and a functioning drainage system shall be provided.
- All sources shall be seeded and mulched in accordance with Section 31 25
 00 Erosion and Sedimentation Control.
- 3. Contractor Furnished Sources
 - a. Prior to the approval of any off-site borrow source(s) developed for use on this project, the Contractor shall obtain certification from the State/Commonwealth Historic Preservation Officer of the State/Commonwealth Department of Cultural Resources certifying that the removal of the borrow material from the borrow source(s) will have no effect on any known district, site building, structure, or object that is included or eligible for inclusion in the National Register of Historic Places. A copy of this certification shall be furnished to the Engineer prior to performing any work on the proposed borrow source.
 - b. The approval of borrow sources furnished by the Contractor shall be subject to the following conditions:
 - 1) The Contractor shall be responsible for acquiring the right to take the material and any rights of access that may be necessary; for locating and developing the source; and any clearing and grubbing and drainage ditches necessary.
 - a) Such right shall be in writing and shall include an agreement with the Owner that the borrow source may be dressed, shaped, seeded, mulched, and drained as required by these Specifications after all borrow has been removed.
 - 2) The Contractor and the property owner shall jointly submit a borrow source development, use, and reclamation plan to the Engineer, as described in Section 1.05, for approval prior to engaging in any land disturbing activity on the proposed source other than material sampling that may be necessary.

- 4. Maintenance
 - a. During construction and until final acceptance the Contractor shall use any methods approved by the Engineer which are necessary to maintain the work covered by this Section so that the work will not contribute to excessive soil erosion.

END OF SECTION

SECTION 31 10 00 CLEARING, GRUBBING, AND SITE PREPARATION

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. Includes all labor, material, equipment and appliances required for the complete execution of the work as shown on the Drawings and specified herein.
- B. Principal items of work include:
 - 1. Notifying all authorities owning utility lines running to or on the property. Protecting and maintaining all utility lines to remain and capping those that are not required in accordance with instructions of the Utility Companies, and all other authorities having jurisdiction.
 - 2. Clearing the site within the Contract Limit Lines (i.e., "Limits of Disturbance"), including removal of grass, brush, shrubs, trees, loose debris and other encumbrances except for trees marked to remain.
 - 3. Boxing and protecting all trees, shrubs, lawns and the like within areas to be preserved. Relocating trees and shrubs, so indicated on the Drawings, to designated areas.
 - 4. Repairing all injury to trees, shrubs, and other plants caused by site preparation operations shall be repaired immediately. Work shall be done by qualified personnel in accordance with standard horticultural practice and as approved by the Engineer.
 - 5. Removing topsoil to its full depth from designated areas and stockpiling on site where directed by the Engineer for future use.
 - 6. Disposing from the site all debris resulting from work under this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 31 00 01 Earthwork
- B. Section 31 25 00 Erosion and Sedimentation Control

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Virginia Administrative Code, Title 9, Agency 15.

1.04 STREET AND ROAD BLOCKAGE

A. Closing of streets and roads during progress of the work shall be in compliance with the requirements of the Owner and other authorities having jurisdiction. Access shall be provided to all facilities remaining in operation.

1.05 PROTECTION OF PERSONS AND PROPERTY

- A. All work shall be performed in such a manner to protect all personnel, workers, pedestrians and adjacent property and structures from possible injury and damage.
- B. All conduits, wires, cables, and appurtenances above or below ground shall be protected from damage.
- C. Provide warning and barrier fence where shown on the Drawings and as specified herein.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 CLEARING OF SITE

- A. Before removal of topsoil, and start of excavation and grading operations, the areas within the clearing limits shall be cleared and grubbed.
- B. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, fallen timber, brush, bushes, rubbish, sanitary landfill material, fencing, and other perishable and objectionable material within the areas to be excavated or other designated areas. Prior to the start of construction, the Contractor shall survey the entire Contract site and shall prepare a plan which defines the areas to be cleared and grubbed, trees to be pruned, extent of tree pruning, and/or areas which are to be cleared but not grubbed. This plan shall be submitted to the Engineer for approval. Should it become necessary to remove a tree, bush, brush or other plants adjacent to the area to be excavated, the Contractor shall do so only after permission has been granted by the Engineer.
- C. Excavation resulting from the removal of trees, roots and the like shall be filled with suitable material, as approved by the Engineer, and thoroughly compacted per the requirements contained in Section 31 00 01 Earthwork.
- D. Unless otherwise shown or specified, the Contractor shall clear and grub a strip at least 15-ft. wide along all permanent fence lines installed under this Contract.
- E. In temporary construction easement locations, only those trees and shrubs shall be removed which are in actual interference with excavation or grading work under this Contract, and removal shall be subject to approval by the Engineer. However, the Engineer reserves the right to order additional trees and shrubs removed at no additional Schenks Branch Tributary Stream Restoration Project 31 10 00-2 April 2022

cost to the Owner, if such, in his opinion, are too close to the work to be maintained or have become damaged due to the Contractor's operations.

3.02 STRIPPING AND STOCKPILING EXISTING TOPSOIL

- A. Erosion and sedimentation control measures shall be installed as per the Federal, State or Locally approved Erosion and Sedimentation Control Plan for the project and Specification Section 31 25 00 – Erosion and Sedimentation Control before any stripping and stockpiling of topsoil can occur.
- B. Existing topsoil and sod on the site within areas designated on the Drawings shall be stripped to whatever depth it may occur and stored in locations directed by the Engineer.
- C. The topsoil shall be free of stones, roots, brush, rubbish, or other unsuitable materials before stockpiling the topsoil.
- D. Care shall be taken not to contaminate the stockpiled topsoil with any unsuitable materials.

3.03 GRUBBING

- A. Grubbing shall consist of the removal and disposal of all stumps, roots, logs, sticks and other perishable materials to a depth of at least 6-inches below ground surfaces.
- B. Large stumps located in areas to be excavated may be removed during grading operations, subject to the approval of the Engineer.

3.04 DISPOSAL OF MATERIAL

- A. All debris resulting from the clearing and grubbing work shall be disposed of by the Contractor as part of the work of this Contract. Material designated by the Engineer to be salvaged shall be stored on the construction site as directed by the Engineer for reuse in this Project or removal by others.
- B. Burning of any debris resulting from the clearing and grubbing work is not permitted.

3.05 WARNING AND BARRIER FENCE

- A. The fence shall be made of a visible, lightweight, flexible, high strength polyethylene material. The fence shall be Guardian Visual Barrier as manufactured by TEMAX, or equal.
- B. Physical Properties

Fence	
Color	International Orange
Roll Size	4' x 100'
Roll weight	9 lbs.
Mesh opening	1-3/4" x 1-3/4"
Posts	
ASTM Designation:	ASTM 702
Length:	6 feet long (T-Type)
Weight:	1.25 #/Foot (min)
Area of Anchor Plate:	14 Sq. In.

- C. Drive posts 18 inches into ground every 8'. Wrap fence material around first terminal post allowing overlap of one material opening. Use metal tie wire or plastic tie wrap to fasten material to itself at top, middle and bottom. At final post, cut with utility knife or scissors at a point halfway across an opening. Wrap around and tie at final post in the same way as the first post.
- D. Use tie wire or tie wrap at intermediate posts and splices as well. Thread ties around a vertical member of the fence material and the post and bind tightly against the post. For the most secure fastening, tie at top, middle and bottom. Overlap splices a minimum of four fence openings, tie as above, fastening both edges of the fence material splice overlap.

END OF SECTION

SECTION 31 13 20 WOOD FOR STREAMWORK

PART 1 – GENERAL

1.01 SUMMARY

- A. This work shall consist of furnishing and preparing woody debris for stabilization, protection, and other purposes within stream channels or along bank slopes in accordance with the Construction Documents.
- B. Related Sections:
 - 1. Section 31 00 01 Earthwork
 - 2. Section 31 10 00 Clearing, Grubbing and Site Preparation
 - 3. Section 31 32 40 Geotextile for Streamwork
 - 4. Separate Revetment Execution: See Table 3 in Paragraph 3.01 C for additional related Specification Sections.

1.02 SUBMITTALS

- A. Contractor is required to flag all on-site standing timber slated for use for pre-approval by the Engineer prior to clearing and grubbing.
- B. The wood shall be obtained from on-site clearing and grubbing operations conducted as part of Section 31 10 00 Clearing, Grubbing and Site Preparation, and stockpiled for on-site use.
- C. Contractor shall provide a manifest or other documentation to identify source of wood (on-site or off-site), tree species, dimensions, and that the wood material is free from invasive plant parts (i.e., seeds, roots, tubers or stems) unless directed otherwise by Contract Documents. See Paragraph 2.01 C, Table 2 for assistance with manifest preparation.
- D. All wood material produced on-site or imported shall be separated by material type, size or other appropriate measure, and not stockpiled together.

1.03 QUALITY ASSURANCE

- A. The Engineer shall review and approve manifest as described under Paragraph 1.02 C prior to the harvest or delivery of any wood.
- B. The Engineer is also required to field-approve the first delivery or stockpile of all wood material (logs, wood chips, root wads, etc.) on-site. The Engineer shall reject any wood

not of the appropriate species, condition, dimension, or other specifications. Costs associated with provision of suitable replacement wood, as well as any time delays or costs due to the stockpiling, use, or removal of unapproved wood shall be borne by the Contractor.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Wood Source:
 - 1. On-Site Wood: Wood harvested on-site from clearing and grubbing operations.
 - 2. Imported Wood: Wood imported to the project site. Use of imported wood is only allowed if specified materials are not available on-site and with written approval by Engineer. With exception of wood dust, wood shall not be imported from farther than 20 miles from the project site unless specifically allowed per the Contract Documents.
- B. Wood Species:
 - 1. Hardwood Species: Native tree species of acceptable hardiness. Hardwood species acceptable for use in in-stream revetments are listed in Table 1.

Common Type	Scientific Name
All Oak Species	Quecus spp
American Sycamore	Platanus occidentalis
Green Ash	Fraxinus pennsylvanica
Black Locust	Robinia pseudoacacia
Tulip Poplar	Liriodendron tulipifera
Black Cherry	Prunus serotina
Black Walnut	Juglans nigra
All Maple Species	Acer spp
All Hickory Species	Carya spp

Table 1: Accepted Hardwood Species

2. Softwood Species: All species not defined as hardwood species.

- 3. Sucker Species: Tree species that can sprout suckers from their roots at a considerable distance from the parent plant. Species known to 'sucker,' such as box elder and black willow, shall not be buried within 20 feet of underground utilities.
- 4. Non-Native Species: Introduced tree species (intentionally or accidentally) not normally present within an area. Non-native species may not necessarily by invasive; see below.
- 5. Invasive Species: A plant that is non-native and able to establish on many sites, grow quickly, and spread to the point of disrupting plant communities or ecosystems. Plant species may be classified as non-native, exotic, and invasive per the United States Department of Agriculture and the Virginia Department of Forestry and other local/regional governing bodies, as applicable. The use of any invasive wood species is specifically banned from use for streamwork.
- C. Wood Products:
 - 1. Wood products for streamwork are sub-classified as listed below. For dimension requirements see Table 2.
 - a. Root wads: Tree trunk with root mass still intact produced by clearing and grubbing operations or hauled to site. Root wads shall have excess dirt knocked off prior to installation.
 - b. Clean-Cut Logs: Logs that have been crosscut cleanly on both ends with all limbs cut flush and no jagged edges that may puncture filter cloth.
 - c. Rough-Cut Logs: Logs that have been sectioned through crosscutting or snapped or otherwise broken; flush cutting of limbs optional, jagged edges acceptable.
 - d. Limbs: Sectioned branches of a prescribed diameter and length smaller than tree trunk or specified log diameters; flush-cutting of smaller branches optional.
 - e. Brush: All material smaller than "Limbs", but not chipped.
 - f. Wood Chips: Wood that has been chipped or shredded into smaller pieces produced through on-site mechanical operations (e.g., portable diesel-powered chipper), or imported from off-site. *No invasive material shall be chipped; no treated lumber shall be chipped.* If invasive material is inadvertently chipped, the contaminated chips must be removed from the site and the cost of disposal shall be borne by the Contractor. There is no limit on the size of woody material that may be chipped. Chips shall not be larger than two (2) inches in intermediate axis and no longer than four (4) inches in any axis and shall be free of dirt, trash and other deleterious material.

g. Wood Dust: Fine granular wood particles (sawdust) produced on-site through sawing operations or imported from an off-site lumber milling operation or wood processing facility. Wood dust shall be clean and bright and free of rot, insects, roots and other foreign bodies. Wood dust harvested from on-site sawing operations or imported shall be kept clean and dry and covered to prevent rot or contamination with invasive species prior to placement. Imported wood dust shall consist of 100% wood product and not contain adhesives, metal shavings, plastic, mud or other foreign bodies that may be produced by wood recycling operations. Wood dust shall not be made from chemically treated lumber. Wood dust shall be uniform in texture with no particle exceeding 0.1 inches in diameter. Wood dust may be sourced from hardwood or softwood species.

Wood Product	Source	Туре	Placement	Min Dia (in)	Max Dia (in)	Min Length (ft)	Max Length (ft)	Treatment
Root wad	On or off-site	Hardwood	Streambank	8	42	13	25	Length refers to trunk length; diameter refers to trunk diameter; root ball fan minimum 4 feet, maximum 8 feet
Clean-cut log	On or off-site	Hardwood	In-stream	8	42	13	25	Ends crosscut clean and all limbs cut flush
Rough-cut log	On or off-site	Hardwood	In-stream	8	42	13	25	Crosscut ends and removal of limbs optional
Limbs	On or off-site	Hardwood or softwood	In-stream	4	8	none	none	
Brush	On or off-site	Hardwood or softwood	In-stream	none	4	none	none	

Table 2: Wood Product Source, Type, Placement, Size and Treatment

PART 3 – EXECUTION

3.01 WOOD INSTALLATION

- A. Dewatering: Unless otherwise specified on the Contract Documents, excavation and/or fill placement required for in-stream wood installation shall occur in the dry per Section 01 57 52 Dewatering and Flow Diversion for Streamwork.
- B. Excavation for wood placement: Excavation shall be performed per methods described in Section 31 00 01 – Earthwork and must conform to the lines and grades specified in the Contract Documents. Should bedrock or other unsuitable soil be encountered, overexcavation beyond finished grade lines may be required. If these conditions occur, the

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Contractor is to immediately contact the Engineer for approval before excavating beyond lines and grades specified in the Contract Documents.

C. Specific wood installation methods: Several wood revetment practices have separate execution descriptions; please see Table 3. For practices not included in Table 3 that involve placement of wood, use methods specified by the Contract Documents.

Revetment	Specification
Wood Toe	35 42 72
Log J-Hook	35 43 74

Table 3: Separate Revetment Execution Descriptions

- D. Geotextiles: When wood revetment practices call for the use of geotextiles such as non-woven filter fabric, the product and installation shall meet the tenets of Section 31 32 40 Geotextile for Streamwork. The subgrade must be smooth and firm, free from protruding objects that would damage the geotextile. Unless specifically allowed by the Contract Documents, wood placed underneath or adjacent to geotextile material must be completely limbed to prohibit tearing or puncturing of placed geotextiles. Geotextile torn or damaged must be replaced or repaired at the Contractor's expense in a manner acceptable to the Engineer. Filter fabric shall be placed along all upstream faces of revetments unless otherwise specified by the Contract Documents. All fabric shall be cut such that six (6) inches of exposed fabric is visible above final grade.
- E. Exposed placement: Wood that is placed such that it is partially or completely exposed to the air (i.e., log vane where a portion of the log protrudes beyond the normal (sunnyday) baseflow water elevation). Exposed placement for instream structures requires hardwood species per Table 1 unless other species' use is specifically allowed by the Contract Documents. Hardwood or softwood may be placed on the floodplain.
- F. Wet Placement: Wood that is placed with intention to be entirely submerged below normal (sunny-day) baseflow water elevation. Portions of wet placement may also be buried below subgrade. Wet placement requires hardwood species per Table 1 unless other species' use is specifically allowed by the Contract Documents.
- G. Buried Placement: Wood that is buried entirely below finished grade, not exposed to the atmosphere or baseflow. Unless specifically prohibited by the Contract Documents, buried wood revetments may be hardwood or softwood.

END OF SECTION

SECTION 31 23 40 STREAMBED MATERIAL FOR STREAMWORK

PART 1 – GENERAL

1.01 SUMMARY

- A. This work shall consist of salvaging, stockpiling, sorting and then placing existing streambed and/or bar material (SBM) within the project area for channel and slope stabilization in accordance with the Construction Documents. Salvaged SBM may be used for "chinking", grade control or other purposes. If sufficient quantities of SBM are not available from the project site, additional material shall be furnished.
- B. Related Sections:
 - 1. Section 01 57 52 Dewatering and Flow Diversion for Streamwork
 - 2. Section 31 37 20 Stone for Streamwork

1.02 SUBMITTALS

A. Per Section 31 37 20 – Stone for Streamwork.

1.03 QUALITY ASSURANCE

A. Per Section 31 37 20 – Stone for Streamwork.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Where possible, existing SBM shall be harvested to a depth of eighteen (18) inches on portions of stream reach shown on the Contract Documents.
- B. Material shall be sorted into three categories as follows:
 - 1. SBM 1: Gravel to Small Cobble (0.5 to 2 inches)
 - 2. SBM 2: Small to Medium Cobble (2 to 4 inches)
 - 3. SBM 3: Medium to Large Cobble (4 to 8+ inches)
- C. Sorting can be made with visual judgment but stockpiled SBM must be field-approved by the Owner or the Owner's Agent prior to use; unsuitable material will be rejected. Effort for all sorting is considered incidental to work described under Section 31 00 01 – Earthwork, including any required sediment control work needed for stockpiling. Based on consultation with and approval by the Owner or the Owner's Agent (onsite,

documented inspection), SBM may be removed from the stream and placed directly onto work areas without intermediate stockpiling.

- D. SBM may contain fines and organic material (material smaller than 0.5 inches), so long as this percentage is no more than 20% for SBM 1 or 10% for SBM 2 or SBM 3.
- E. SBM 2 material may contain up to 20% of total material less than five (5) inches, including fines. SBM 3 material may contain up to 20% of total material less than twelve (12) inches, including fines.
- F. The presence of trash, domestic debris, toxins or other deleterious materials is not permitted. Unsuitable materials must be removed from the site and disposed of legally at the Contractor's expense.

PART 3 – EXECUTION

3.01 STREAM BED MATERIAL (SBM) PLACEMENT

- A. SBM shall be removed from the streambed by scraping with an excavator bucket or shovel and placed directly onto work areas or stockpiled for sorting and mixing.
- B. SBM used for chinking or filling of voids of other revetment/grade control practices shall be worked into the previously placed revetment material until voids are filled.
- C. SBM used as bedding material for other revetment/grade control practices shall be placed to the depth specified on the Construction Documents then tamped lightly with excavator bucket or equivalent.
- D. SBM used to augment purchased stone to be used for revetment/grade control material shall be mixed with purchased material, then placed.
- E. SBM placed as its own revetment/grade control material shall be placed as per Section 31 37 20 Stone for Streamwork.
- F. Payment: All costs associated with harvesting and placement of SBM are incidental and do not warrant additional payment.

END OF SECTION

SECTION 31 25 00 EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01 THE REQUIREMENTS

- A. The Contractor is responsible for implementing Virginia Best Management Practices (BMPs) to prevent and minimize erosion and resultant sedimentation in all cleared and grubbed areas during and after construction. This item covers the work necessary for the installation of structures and measures for the prevention of soil erosion and control of sedimentation. The Contractor shall furnish all material, labor and equipment necessary for the proper installation, maintenance, inspection, monitoring, reporting, and removal (where applicable) of erosion prevention and sediment control measures and, if applicable, to cause compliance with all local permits and the General Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation for Discharges of Storm Water From Construction Activities (9 VAC 25-180) and VPDES General Permit No. VAR10, under this Section 31 25 00 Erosion and Sedimentation Control.
- B. Any land disturbance as the result of modifications to a site's drainage features or topography requires protection from erosion and sedimentation.
- C. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Contract Drawings or established by the Engineer.
- D. It is the intent of this Specification that the Contractor conducts the construction activities in such a manner that erosion of disturbed areas and off-site sedimentation be absolutely minimized.
- E. All work under this Contract shall be done in conformance with and subject to the limitations of the Virginia Erosion and Sediment Control Handbook (VESCH) and the Virginia Erosion and Sediment Control Law, Regulations and Certification Regulations, as adopted in the Code of Virginia Title 10-1, Chapter 5, Article 4 and Sections 4VAC30-50 and 4VAC50-50 of the Virginia Administration Code.
- F. The Contractor shall comply with all applicable minimum standards set in the Virginia Erosion and Sediment Control Handbook. The following excerpts from the regulations are particularly important:
 - Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the site. Temporary soil stabilization shall be applied within seven days to denuded areas that may not be at final grade but will remain dormant (undisturbed) for longer than 14 days. Permanent stabilization shall be applied to areas that are to be left dormant for more than one year.

- 2. A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized. Permanent vegetation shall not be considered established until a ground cover is achieved that, in the opinion of the local program administrator or his designated agent, is uniform, mature enough to survive and will inhibit erosion.
- 3. Stabilization measures shall be applied to earthen structures such as dams, dikes and diversions immediately after installation.
- 4. All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization or after the temporary measures are no longer needed, unless otherwise authorized by the local program administrator. Trapped sediment and the disturbed soil areas resulting from the deposition of temporary measures shall be permanently stabilized to prevent further erosion and sedimentation.
- G. Due to the nature of the work required by this Contract, it is anticipated that the location and nature of the erosion and sediment control devices will be adjusted on several occasions to reflect the current phase of construction. The construction schedule adopted by the Contractor will impact the placement and need for specific devices required for the control of erosion. The Contractor shall develop and implement such additional techniques as may be required to minimize erosion and off-site sedimentation. The location and extent of erosion and sedimentation control devices shall be revised at each phase of construction that results in a change in either the quantity or direction of surface runoff from constructed areas. All deviations from the erosion and sedimentation control provisions shown on the Contract Drawings shall have the prior acceptance of the Engineer and shall be completed at no additional cost to the Owner.
- H. Erosion and sedimentation controls applicable to this project shall be as shown on the Contract Drawings, as specified herein, as indicated by the Engineer and as detailed in the Virginia Erosion and Sediment Control Handbook.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01 57 52 Dewatering and Flow Diversion for Streamwork
- B. Section 31 00 01 Earthwork
- C. Section 31 10 00 Clearing, Grubbing, and Site Preparation
- D. Section 31 32 40 Geotextiles for Streamwork
- E. Section 32 90 22 Topsoil for Streamwork
- F. Section 32 91 24 Streamwork Plant Installation
- G. Section 32 92 30 Specialty Seeding

- H. Section 32 93 50 Live Stakes
- I. Section 35 42 57 Coir Mat

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Without limiting the generality of other requirements of these specifications, all work hereunder shall conform to the applicable requirements of the referenced portions of the following documents, to the extent that the requirements therein are not in conflict with the provisions of this Section.
 - 1. Code of Virginia, Title 10.1, Chapter 5, Article 4
 - 2. Virginia Erosion and Sediment Control Handbook (VESCH), latest edition.
 - General Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation for Discharges of Storm Water From Construction Activities (9 VAC 25-180) and VPDES General Permit No. VAR10.
 - 4. Erosion and Sediment Control Plan as required by the VPDES Permit.
 - 5. Maintenance and Inspection Procedures as required by the VPDES Permit

1.04 REGULATORY COMPLIANCE

- A. Land disturbance activities are not authorized to begin until after all required erosion and sediment control permits are obtained from the United States, the Commonwealth of Virginia, and City of Charlottesville, as necessary. Contractor is the Co-Primary Permittee and Operator under the provisions of the NPDES Permit. As such, the Contractor will be required to sign certain certifications as described in the NPDES Permit. Contractor shall comply with requirements specified in the Contract Documents, on the approved Erosion Control Plan, and by the Engineer. Contractor shall also comply with all other laws, rules, regulations, ordinances, and requirements concerning soil erosion and sediment control established in the United States, the Commonwealth of Virginia and local authorities as applicable. The following documents and the documents referenced therein define the regulatory requirements for this Section:
 - VPDES PERMIT: The Virginia Pollution Discharge Elimination System (VPDES) General Permit (VAR 10) for Discharges of Storm Water from Construction Activity governs land disturbance or construction activities of one (1) acre or more. On applicable sites, Contractor is responsible for complying with terms and conditions of this permit.
 - 2. Manual for Erosion and Sediment Control: Contractor shall follow Practices and Standards of the Virginia Erosion and Sediment Control Handbook (VESCH), Third Edition, or latest.

- B. During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge stormwater associated with construction activity including clearing, grading and excavation activities resulting in the disturbance of land and related support activities. Such discharges shall be controlled, limited and monitored as specified below.
 - The Contractor, as Co-Primary Permittee and Operator under the provisions of the NPDES Permit, shall submit a plan for compliance with the Owner-provided approved erosion and sedimentation control plan to the Engineer for approval. Plans must include designation of where 7 and 14-day ground stabilization requirements and where basins which comply with surface-withdrawal requirements of the NPDES permit, if applicable, are located. Land disturbing activity shall not commence until the plan is approved by the Engineer. Maintain an up-to-date copy of the approved plan on the site.
 - 2. Implement the approved plan. Deviation from the plan is allowed only to correct emergency situations of sediment discharge offsite or when minor modifications are made to improve performance of the measures and the approval authority has been notified. Note allowed deviations on the plan maintained on the site.
 - 3. Manage onsite activities such that no adverse impacts to water quality occur from site activities or allowed discharges. The following activities, and others on a site-specific basis, require oversight throughout the construction and development process to assure that all water quality standards are protected.
 - a. Equipment Operation and Maintenance: Equipment utilized during the construction activity on a site must be operated and maintained in such a manner as to prevent the potential or actual pollution of the surface or ground waters of the State. Fuels, lubricants, coolants, and hydraulic fluids, or any other petroleum products, shall not be discharged onto the ground or into surface waters. Spent fluids shall be disposed of in a manner so as not to enter the waters, surface or ground, of the State and in accordance with applicable state and federal disposal regulations. Any spilled fluids shall be cleaned up to the extent practicable and disposed of in a manner so as not to allow their entry into the waters, surface or ground, of the State.
 - Material Handling: Herbicide, pesticide, and fertilizer usage during the construction activity shall be consistent with the Federal Insecticide, Fungicide, and Rodenticide Act and shall be in accordance with label restrictions.
 - c. Litter and Sanitary Waste: The Permittee shall control the management and disposal of litter and sanitary waste from the site.
- C. Violations and Fines

- Contractor shall be responsible for reimbursing the Owner for any fines incurred as a result of violations to the VA Erosion and Sediment Control Law, the VPDES General Permit for Discharges of Storm Water from Construction Activity, and any applicable delegated local program's sediment control regulations until construction activities are complete and the project is accepted by the Owner. These include fines levied by the VDEQ Enforcement Division and delegated local programs.
- 2. If violations result in the issuance of a Notice of Violation, the Contractor shall comply with the requirements of the Notice within the specified time period for compliance. Failure to comply could result in the assessment of a penalty for each day of the continuing violation, beginning with the date of the violation.
- 3. Violations may result in civil and/or criminal penalties which include fines and imprisonment.

1.05 SUBMITTALS

- A. Prior to the start of the work, the Contractor shall prepare and submit a plan for implementing the temporary and permanent erosion and sedimentation control measures as shown on the Erosion and Sediment Control Plan approved by the appropriate regulatory authority. Construction work shall not commence until the schedule of work and the methods of operations have been reviewed and approved.
- B. The Contractor shall perform inspections of erosion and sedimentation control measures and stormwater discharge outfalls and prepare inspection reports as described in Part 3.0 of this Section. Copies of the inspection reports shall be submitted to the Engineer on a monthly basis.
- C. In accordance with the procedures and requirements set forth in the General Conditions Division 01 and Section 01 33 00 Submittal Procedures, the Contractor shall submit the following:
 - 1. Name and location of all material suppliers.
 - 2. Certificate of compliance with the standards specified above for each source of each material.
 - 3. List of disposal sites for waste and unsuitable materials and evidence of all required permits for use of those sites.

1.06 GUARANTEE

A. All restoration and re-vegetation work shall be subject to the one-year guarantee period of the Contract as specified in the General Conditions.

PART 2 - MATERIALS

2.01 MATERIALS

- A. Materials for use in erosion and sedimentation control devices shall be in accordance with the VESCH.
- B. All erosion and sediment control bid prices shall include all excavation, grading, maintenance, legal sediment disposal, permits and all other work and appurtenances necessary to design, install and maintain the sediment and erosion control measures as detailed herein and in accordance with the VESCH.

2.02 SILT FENCE

- A. Silt (or sediment) fence shall be constructed as shown on the Contract Drawings, at other locations indicated by the Engineer, as specified herein, and as detailed in Section 3.05 of the VESCH. Silt fences shall be installed below small disturbed areas that are less than ¼ acre disturbed per 100-feet of fence when slopes are less than 2%. Contractor shall refer to Table 6.62a in the VESCH for criteria. Silt fence shall not be installed across streams, ditches, or waterways or other areas of concentrated flows.
- B. Silt fence shall be designed, installed and maintained in accordance with Part 3.0 of this Section and Section 3.05 of the VESCH. Silt fence shall be a woven geotextile filter fabric made specifically for sediment control. Filter fabric shall not rot when buried and shall resist attack from soil chemicals, alkalines and acids in the pH range from 2 to 13, and shall resist damage due to prolonged ultraviolet exposure. Filter fabric shall be C-50NW as manufactured by Contech Earth Stabilization Solutions, GT 142 as manufactured by SKAPS Industries, Soiltex ST 120N as manufactured by Geo-Synthetics, Inc., or approved equal. The cost of silt fence shall include the materials, excavation, backfill, aggregate, etc. and all maintenance and restoration activities required.
- C. Silt fence shall be stable for the 10-year peak storm runoff. Fabric shall meet the following specifications:

	Test Material	Units	Supported ¹ Silt Fence	Un-Supported ¹ Silt Fence	Type of Value
Grab Strength	ASTM D 4632	N (lbs)			
Machine Direction			400	550	MARV
			(90)	(90)	
x-Machine Direction			400	450	MARV
			(90)	(90)	

Temporary Silt Fence Material Property Requirements

	Test Material	Units	Supported ¹ Silt Fence	Un-Supported ¹ Silt Fence	Type of Value
Permittivity ²	ASTM D 4491	sec-1	0.05	0.05	MARV
Apparent Opening Size 2	ASTM D 4751	mm	0.60	0.60	Max. ARV ³
		(US Sieve #)	(30)	(30)	
Ultraviolet Stability	ASTM D 4355	% Retained Strength	70% after 500 hours exposure	70% after 500 hours exposure	Typical

Temporary Silt Fence Material Property Requirements

Notes:

1 Silt Fence support shall consist of 14 gage steel wire with a mesh spacing of 150 mm (6 inches), or prefabricated polymer mesh of equivalent strength.

2 These default values are based on empirical evidence with a variety of sediment. For environmentally sensitive areas, a review of previous experience and/or site or regionally specific geotextile tests in accordance with Test Method D 5141 should be performed by the agency to confirm suitability of these requirements.

3 As measured in accordance with Test Method D 4632.

- D. The synthetic filter fabric shall consist of at least 95% by weight of polyolefins or polyester, certified by the manufacturer, and as specified by Section 3.05of the VESCH.
- E. The posts for silt fences shall be 1.33 lb/linear feet steel with a minimum length of 5 feet; posts shall have projections to facilitate fastening of the fabric.
- F. For reinforcement of standard strength filter fabric use wire fence with a minimum 14 gauge and a maximum mesh spacing of 6 inches.

2.03 STONE FOR EROSION CONTROL

- A. The Contractor shall place stone for erosion control as shown on the Contract Drawings, as specified herein, as specified in Section 414 of the VDOT Road and Bridge Specifications. The stone for erosion control shall consist of field stone or rough un-hewn quarry stone. The stone shall be sound, tough, dense, and resistant to the action of air and water. The stone for erosion control shall be Class AI, Class I or Class II as specified in the VDOT Standard Specifications, Section 414, unless otherwise shown on the Contract Drawings.
- B. Stone for erosion control shall be designed, installed and maintained in accordance with Part 3.0 of this Section, Section 414 of the VDOT Standard Specifications, and Section 3.19 of the VESCH. The cost for stone for erosion control shall include furnishing, weighing, stockpiling, re-handling, placing and maintaining stone; disposal of any stone not incorporated into the project if directed by the Engineer; and any other incidentals necessary to complete the work.

2.04 RIP RAP

- A. The Contractor shall place rip rap as shown on the Contract Drawings, as specified in Section 414 of the VDOT Standard specifications for plain rip rap, and as detailed in Section 3.19 of the VESCH. The stone for rip rap shall consist of field stone or rough unhewn quarry stone. The rip rap shall be sound, tough, dense, and resistant to the action of air and water. Neither the width nor thickness of individual stones shall be less than one third their length. The rip rap shall be Class 1 or Class 2 as specified in the VDOT Standard Specifications, Section 414, unless otherwise shown on the Contract Drawings.
- B. Rip rap shall be designed, installed and maintained in accordance with Part 3.0 of this Section, Section 414 of the VDOT Standard Specifications, and Section 3.19 of the VESCH. The cost for rip rap shall include furnishing, weighing, stockpiling, rehandling, placing and maintaining rip rap; disposal of any rip rap not incorporated into the project if directed by the Engineer; and any other incidentals necessary to complete the work.

2.05 SOIL MATTING

- A. Soil Matting shall be installed as shown on the Contract Drawings, at other locations indicated by the Engineer, as specified herein, and as detailed in Section 3.36 of the VESCH. Soil Matting should be utilized to aid stabilization of slopes greater than 2:1 and with more than 10 feet of vertical relief. Soil Matting should also be used when mulch cannot be adequately tacked and where immediate ground cover is required to prevent erosion damage. Examples of Soil Mattings are blankets, nets and matting.
- B. Soil Mattings shall be designed, installed and maintained in accordance with Part 3.0 of this Section and Section 3.36 of the VESCH. The cost for Rolled Erosion Control Mattings (RECMs) shall include all excavation, grading, and materials, and all maintenance activities.
- C. Soil Mattings shall be used to aid in permanent stabilization of vegetated channels where runoff velocity will exceed 2 feet/second on bare earth during the 2-year rainfall event that produces peak runoff.
- D. Soil Mattings shall be chosen based on the Design Criteria detailed in Section 3.36 of the VESCH. Typically, nets shall be used in conjunction with mulch; the use of mulch is typically not required with excelsior, woven straw blankets and coir blankets.
- E. The recommended anchoring devices are 12-inch minimum length wooden stakes, 11gauge staples that are at least 6 inches long by 1 inch wide, or rigid, biodegradable stakes of a minimum of 6 inches in length. If Manufacturer's recommendations are more stringent, they shall supersede.

2.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCES/EXITS

- A. Temporary gravel construction entrances/exits shall be located at points where vehicles enter and leave a construction site, at other locations indicated by the Engineer, as specified herein, and as detailed in Section 3.02 of the VESCH.
- B. Temporary gravel construction entrances/exits shall be constructed with a minimum 6inch layer of 2 – 3 inch washed stone placed over a stable foundation and shall be a minimum of 100 feet in length and 20 feet in width. Geotextile fabric shall be used under stone as shown on the Contract Drawings.
- C. Temporary gravel construction entrances/exits shall be designed, installed and maintained in accordance with Part 3.0 of this Section and Section 3.02 of the VESCH, to the satisfaction of the Engineer, until the site has been stabilized. The cost of temporary gravel construction entrances/exits shall include the materials and all maintenance activities required, including additional tire washing as may be necessary.

2.07 TEMPORARY AND PERMANENT STABILIZATION OF DISTURBED AREAS

- A. Temporary and permanent stabilization of disturbed areas will be provided at the locations shown on the Contract Drawings, at other locations indicated by the Engineer, as specified herein, and as detailed in Sections 3.03, 3.22, 3.23 and 3.36 of the VESCH. The Contractor shall provide ground cover adequate to restrain erosion on disturbed areas that will be left un-worked for periods exceeding 7 to 14 days, as noted in Paragraph 1.01. F. of this Specification.
- B. Soil amendments, including lime and fertilizer, shall be as detailed in Sections 6.10, 6.11 and 6.12 of the VESCH.
- C. Seed mixtures shall be selected based on site location and seasonal recommendations outlined in Sections 3.31 and 3.32 of the VESCH. Sod shall be selected based on site location and intended use as outlined in Section 3.33 of the VESCH.
- D. Mulch shall be as detailed in Section 3.35 of the VESCH. Soil Matting shall be as detailed in 2.05 herein and in Section 3.36 of the VESCH.
- E. Temporary soil stabilizer shall consist of an especially prepared highly concentrated powder which, when mixed with water, forms a thick liquid such as "Enviroseal 2001" by Enviroseal Corporation, "Terra Control" by Quattro Environmental, Inc., or "CHEM-CRETE ECO-110" by International CHEM-CRETE Corporation, and having no growth or germination inhibiting factors. The agent shall be used for hydroseeding grass seed in combination with other approved amendments resulting in a highly viscous slurry which, when sprayed directly on the soil, forms a gelatinous crust.
- F. Temporary and permanent stabilization of disturbed areas shall be achieved in accordance with Part 3.0 of this Section and Sections 3.03, 3.22, 3.23 and 3.36 of the

VESCH. The cost of temporary and permanent stabilization of disturbed areas shall include all grading, excavation and materials as well as all reseeding and other maintenance activities required until stabilization is achieved.

2.08 OUTLET STABILIZATION STRUCTURE

- A. Outlet stabilization structures shall be constructed at the locations shown on the Contract Drawings, at other locations indicated by the Engineer, as specified herein, and as detailed in Section 3.18 of the VESCH. These structures shall be used where the discharge velocity of the upstream water conveyance structure exceeds the permissible velocity of the receiving channel or disposal area.
- B. Structures shall be sized for a capacity equivalent to a 10-year, peak runoff or design discharge of the water conveyance structure, whichever is greater. Riprap materials shall be as specified on the Contract Drawings. Filter fabric shall be Heavy-Duty cloth, as specified in Section 31 32 40 – Geotextile for Streamwork.
- C. Outlet stabilization structures shall be designed, installed and maintained in accordance with Part 3.0 of this Section and Section 3.18 of the VESCH. The cost of outlet stabilization structures shall include all excavation, grading and materials as well as all maintenance activities required.

2.09 TREE PROTECTION FENCE

- A. Tree protection fence shall be installed at the locations shown on the Contract Drawings, at other locations indicated by the Engineer, as specified herein, and as detailed in Section 3.38 of the VESCH.
- B. Tree protection fence shall be used to protect trees and their root zones during construction. Tree protection fence shall be brightly-colored, UV-resistant poly barricade fabric. Signs designating the area as protected shall be installed on all sides of the fence. Wording and spacing of the signage shall be as indicated on the Contract Drawings.
- C. Tree protection fence shall be installed and maintained in accordance with Part 3.0 of this Section and Section 3.38 of the VESCH. The cost of tree protection fence shall include all materials as well as all maintenance activities required.

2.10 FILTER BAGS

- A. Temporary filter bag sediment control bags for use in dewatering and retaining sediment pumped out of active 'dirty' project areas, such as stream restoration projects, where water is pumped from work area, sent through the bag and flow is then released from the bag to discharge on a stable flood plain or other secure area.
- B. The filter bag shall be a nonwoven bag which is sewn with a double needle matching using a high strength thread. The dewatering bag must be made of non-woven geotextile

with a minimum surface area of 225 square feet per side. Each sack is required to have a fill spout large enough to accommodate a 4-inch discharge hose. Straps are to be attached such that the hose is secure, and the hose prevents pumped water from escaping without being filtered.

Properties	Test Method	Units	Value
Weight	ASTM D-3776	Oz/yd	12
Grab Tensile	ASTM D-4632	lbs	300
Puncture	ASTM D-4833	lbs	180
Flow Rate	ASTM D-4491	gal/min/ft ²	75
Permittivity	ASTM D-4491	sec ⁻¹	1.1
Mullen Burst	ASTM D-3786	psi	550
UV Resistant	ASTM D-4355	%	70
AOS% Retained	ASTM D-4751	%	100

C. The geotextile fabric shall be non-woven and shall meet the following properties:

2.11 DEWATERING SUMPS

- A. This section includes installation of temporary sump pits from which pumping is conducted to remove excess water while minimizing sedimentation. The sump pit filters water being pumped to reduce sedimentation. Further sedimentation may be reduced when flow is pumped to a filter bag (if required) as part of the Contract Drawings.
- B. Non-woven Geotextile: Per Section 31 32 40 Geotextile for Streamwork.
- C. Stone: Shall be #57 clean gravel stone (3/4 to 1.5-inch max diameter).
- D. Hardware Cloth: Shall be one-quarter (1/4) inch metal hardware cloth.
- E. Standpipe to be twelve (12) to thirty-six (36) inch diameter perforated high density polyethylene (HDPE), polyvinyl chloride (PVC), or corrugated metal pipe (CMP) as per the Construction Documents and site conditions, with ½ inch by six (6) inch slits or one (1) inch diameter holes, six (6) inches on center. Bottom of pipe to have a watertight cap or plate attached.

PART 3 - EXECUTION

3.01 INSTALLATION AND MAINTENANCE

- A. All installation and maintenance shall be conducted in accordance with this specification and the VESCH. In the event of a discrepancy between this specification, Manufacturer's recommendations and the VESCH, the more stringent requirements shall take precedence.
- B. If applicable, all requirements of the NPDES Permit shall be followed. In the event of a discrepancy between this specification and the NPDES Permit requirements, the more stringent requirements shall take precedence.
- C. If possible, erosion and sedimentation control devices shall be established prior to clearing operations in a given area. Where such practice is not feasible, the erosion and sedimentation control device(s) shall be established concurrent with the clearing operations or immediately following completion of the clearing operations.
- D. The Contractor shall furnish the labor, materials and equipment required for routine maintenance of all erosion and sedimentation control devices. At a minimum, maintenance shall be scheduled as required for a particular device to maintain the removal efficiency and intent of the device. Note that specific maintenance intervals for various measures and practices are specified within the VESCH. Of the maintenance requirements specified herein and in the VESCH, the more stringent shall take precedence for each and every sediment and erosion control measure utilized on the site. Maintenance shall include but not be limited to 1) the removal and satisfactory, legal disposal of accumulated sediment from traps or silt barriers and 2) replacement of filter fabrics used for silt fences and stone impaired by sediment in stone filters, gravel construction entrances, etc. Maintenance as noted in items 1) and 2) above shall be performed as required, and at least once every 3 months for the duration of construction activities. Sediment removed from erosion and sedimentation control devices shall be disposed of in locations that will not result in off-site sedimentation as acceptable to the Engineer, at no additional cost to the Owner. If no suitable on-site locations are available, all such sediment will be legally disposed of off site, at no additional cost to the Owner.

3.02 SILT FENCE

A. Silt Fence shall be designed, installed and maintained in accordance with the requirements of Section 3.05 of the VESCH. Silt fence shall be erected at the locations shown on the Contract Drawings and at all other locations as may be directed by the Engineer. Silt fence shall be erected and maintained to the satisfaction of the Engineer until a vegetative ground cover has been established. Replacement of the filter fabric and its associated appurtenances, if required by the Engineer, will be at the Contractor's expense.

- B. Silt fence shall not be installed across streams, ditches, waterways or other areas of concentrated flow. Silt fence shall be placed at least 6 feet beyond the toe of slope of any embankment or stockpile area to allow space for ponding and maintenance access.
- C. Dig a trench approximately 8 inches deep and 4 inches wide and place the fabric in the bottom of the excavated ditch or use the slicing method to insert the fabric into a cut sliced in the ground with a disc. Ensure that the height of the sediment fence does not exceed 24 inches above the ground surface.
- D. Install posts 4 feet apart in critical areas and 6 feet apart on standard applications when extra strength filter fabric is used. When wire mesh support is used, posts shall be installed a maximum of 8 feet apart. Install posts 2 feet deep on the downstream side of the silt fence, as close as possible to the fabric.
- E. Joints should be avoided along the fencing. When joints are necessary, securely fasten the filter cloth only at a support post with 4 feet minimum overlap to the next post.
- F. Compaction is vitally important for effective results. Compact the soil immediately next to the silt fence fabric with the front wheel of the tractor, skid steer or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of 4 trips.
- G. Stabilized outlets for silt fence shall be provided at locations shown on the Contract Drawings. The outlet section shall have a maximum width of 4 feet. The height of silt fence at the outlet shall be a maximum of 1 foot. A 5 foot x 5 foot (minimum) apron of #57 washed stone shall be provided on the downstream side of the silt fence outlet.
- H. Silt fence shall be erected around all catch basins which are located downstream from any construction work unless other inlet protection is specified. Should any catch basins be indicated to be relocated or modified, silt fence shall be utilized until work is completed on the catch basins. Upon completion of the modification, the area shall be rough graded, as shown on the Contract Drawings, until the end of the project, at which time final grading shall occur.
- I. Inspect silt fence at least once a week and after each rainfall event. Make any required repairs immediately.
- J. Should the fabric of any silt fence collapse, tear, decompose or become ineffective, replace it promptly. All fabric shall be replaced after the first 6 months of construction activity and every 6 months thereafter until construction activities are complete, unless otherwise directed by the Engineer.
- K. Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.

L. Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized. Removal of any silt fence shall be permitted only with the prior approval of the Engineer or the local governing agency.

3.03 STONE FOR EROSION CONTROL

- A. Stone for erosion control shall be designed, installed, and maintained in accordance with the requirements of Section 414 of the VDOT Roads and Bridges Specifications. Stone for erosion control shall be dumped and placed in such manner that the larger rock fragments are uniformly distributed throughout the rock mass and the smaller fragments fill the voids between the larger fragments. Rearranging of individual stones by equipment or by hand shall only be required to the extent necessary to secure the results specified above, to protect structures from damage when rock material is placed against the structures, or to protect the underlying Separator Geotextile from damage during installation.
- B. Inspect at least weekly and within 24 hours after any storm event of greater than 1 inch of rain per 24-hour period. Remove accumulated sediment and replace stone impaired by sediment as necessary.

3.04 RIPRAP

- A. Riprap shall be designed, installed and maintained in accordance with the requirements of Section 3.19 of the VESCH. Riprap shall be graded so that the smaller stones are uniformly distributed through the mass. The Contractor may place the stone by mechanical methods, augmented by hand placing where necessary or ordered by the Engineer. The placed riprap shall form a properly graded, dense, neat layer of stone. The placed riprap shall have a minimum depth of 24 inches unless otherwise specified by the Engineer. Type II Separator Geotextile, as specified in Section 31 05 19 Geotextiles, shall be used under all riprap unless otherwise noted.
- B. Inspect periodically for scour or dislodged stones. Control of weed and brush growth may be needed.

3.05 SOIL MATTING

- A. Soil Mattings shall be designed, installed and maintained in accordance with the requirements of Section 3.36 of the VESCH. The Engineer may direct the Contractor to place RECMs in permanent channels or on slopes at other locations in addition to those shown on the Contract Drawings. If Manufacturer's instructions are more stringent, they shall supersede.
- B. The Contractor shall place the Soil Mattings where directed immediately after the channel or slope has been properly graded and, if applicable, prepared, fertilized, and seeded.

- C. Grade the surface of the installation area so that the ground is smooth and loose. When seeding prior to installation, follow the steps in Section 3.31 (Temporary Seeding) and 3.32 (Permanent Seeding) of the VESCH as applicable. Remove all large rocks, debris, etc. so as to ensure that good contact between the Soil Matting and the ground is maintained so that no erosion occurs beneath the Soil Matting. Terminal anchor trenches are required at Soil Matting ends and intermittent trenches must be constructed across channels at 25-foot intervals. Terminal anchor trenches should be a minimum of 12 inches in depth and 6 inches in width, while intermittent trenches should be a minimum of 6 inches deep and 6 inches wide. Take care to maintain direct contact between the soil and the Soil Matting.
- D. For slope installation, place RECM 2-3 feet over top of slope and into an approximately 12 inch deep by 6 inch wide excavated end trench. Using staples, stakes, or pins, anchor the RECM at 1 foot intervals along the bottom of the trench, backfill, and compact. Along the slope, pin the Soil Matting in a 3 foot center-to-center pattern; provide a minimum 3 inch overlap for adjacent rolls.
- E. For channel installations, excavate 12 inch deep by 6 inch wide terminal trenches across the upper and lower end of the lined channel. Anchor the Soil Matting at a minimum of 25 foot intervals utilizing either two rows of anchors or 6 inch by 6 inch cross trenches. Bury outside Soil Matting edges in longitudinal trenches 6 inches deep and wide along the channel edges. Pin the Soil Matting in at 1 foot intervals along the bottom of terminal trenches, backfill, and compact. Overlap adjacent rolls a minimum of 3 inches and pin at 1 foot intervals. Place the first Soil Matting at the downstream end of the channel and unroll upstream. When starting installation of a new roll, begin in a trench or shingle-lap ends of rolls a minimum of 1 foot with upstream Soil Matting on top to prevent uplifting.
- F. Staples, stakes, and pins shall be driven so that the top is flush with the ground.
- G. During the establishment period, check Soil Mattings at least weekly and within 24 hours after any storm event of greater than 1 inch of rain per 24-hour period. Immediately make repairs. Good contact with the ground must be maintained. Monitor and repair the RECM as necessary until ground cover is established.

3.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCES/EXITS

- A. Temporary gravel construction entrances/exits shall be designed, installed and maintained in accordance with the requirements of Section 3.02 of the VESCH. The Contractor shall provide temporary gravel construction entrances/exits at all locations noted on the Contract Drawings and at all other locations as may be directed by the Engineer.
- B. Maintain the gravel pad as specified in Section 3.02 of the VESCH and in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2 3 inch stone. Inspect each construction entrance at least weekly and after each rainfall event and replace stone impaired by sediment as necessary.

Immediately remove all objectionable materials spilled, washed, or tracked onto public roadways.

C. If, despite the use of a gravel construction entrance/exit, most of the mud and sediment are not removed from vehicle tires, tire washing may be necessary as detailed in Section 6.06 of the VESCH. If necessary, this shall be done at no additional cost to the Owner.

3.07 TEMPORARY AND PERMANENT STABILIZATION OF DISTURBED AREAS

- A. The Contractor shall temporarily stabilize disturbed areas that will not be brought to final grade within 14 calendar days unless as noted in Paragraph 1.01 F. of this Section. Temporary seeding shall be applied on areas that include diversions, dams, temporary sediment basins, temporary road banks and topsoil stockpiles. Areas to be stabilized with permanent vegetation must be seeded or planted within 14 working days after final grade is reached, unless temporary stabilization is applied. Temporary seeding provides protection for no more than 1 year, after which permanent stabilization should be initiated.
- B. Complete grading before preparing seedbeds and install all necessary erosion control measures. Minimize steep slopes. If soils become compacted during grading, loosen to a depth of 6-8 inches.
- C. Reseed and mulch temporary seeding areas where seedling emergence is poor, or where erosion occurs, as soon as possible. Do not mow. Protect from traffic as much as possible.
- D. Refer to Section 3.31 of the VESCH for additional information and specifications regarding seedbed requirements, plant selection, seeding and mulching for temporary seeding applications.
- E. The operation of equipment is restricted on slopes steeper than 3:1. Provisions for vegetation establishment can be made during final grading. Vegetation chosen for these sites must not require mowing or other intensive maintenance. Good mulching practices are critical for protecting against erosion on steep slopes.
- F. Generally, a stand of vegetation cannot be determined to be fully established until soil cover has been maintained for one full year from planting. Inspect seeded areas for failure and make necessary repairs and reseedings within the same season, if possible.
- G. Reseeding If a stand has inadequate cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand after seedbed preparation or overseed the stand. Consider seeding temporary, annual species if the time of year is not appropriate for permanent seeding.
- H. If vegetation fails to grow, soil must be tested to determine if acidity or nutrient imbalance is responsible.

- I. Fertilization On the typical disturbed site, full establishment usually requires refertilization in the second growing season. Fine turf requires annual maintenance fertilization. Use soil tests if possible or follow the guidelines given for the specific seeding mixture.
- J. Refer to Section 3.32 of the VESCH for additional information and specifications regarding seedbed requirements, plant selection, seeding and mulching for permanent seeding applications.
- K. Inspect all seeded areas weekly and after heavy rains until permanent cover is established. Inspect within 6 weeks of planting to see if stands are adequate. Fertilize, reseed and mulch damaged and sparse areas immediately.

3.08 INLET EROSION CONTROL MEASURES

- A. Inlet erosion control measures shall be designed, installed and maintained in accordance with the applicable requirements of Sections 6.50 through 6.55 of the VESCH. If inlet erosion control measures shown on the Contract Drawings are not included in the VESCH, Engineer's and Manufacturer's instructions for design, installation, and maintenance shall be followed, with more stringent instructions superseding. The Contractor shall provide inlet erosion control measures at all locations noted on the Contract Drawings, and at all other locations as may be directed by the Engineer.
- B. Excavated drop inlet protection shall be installed and maintained in accordance with Section 6.50 of the VESCH. Drainage area is limited to 1 acre. The minimum volume of excavated area around the drop inlet is 1800 ft3/acre disturbed. Minimum depth of the excavated area shall be 1 foot and maximum depth shall be 2 feet as measured from the crest of the inlet structure. Weep holes shall be protected by gravel. Inspect the excavated basin at least weekly and after every storm event until the contributing drainage area has been permanently stabilized. Remove sediment when the storage volume has been reduced by one-half.
- C. Block and gravel inlet protection shall be installed and maintained in accordance with Section 6.52 of the VESCH. Drainage area shall be limited to 1 acre unless site conditions allow for frequent removal of accumulated sediment. The height of the block barrier shall be no more than 12 inches and no less than 24 inches. On the bottom row, place some of the blocks on their side to allow for dewatering. Place wire mesh over all block openings to hold gravel in place. Lateral support may be provided by placement of 2 x 4 wood studs through block openings. Place gravel 2 inches below the top of the block barrier. The top elevation of the structure must be at least 6 inches below the ground elevation downslope from the inlet to ensure that all stormwater flows over the structure and enters the storm drain instead of bypassing the structure. Block and gravel inlet protection shall not be used near the edge of fill material and shall not divert water away from the storm drain. Inspect at least weekly and after every storm event until the contributing drainage area has been permanently stabilized. Remove sediment as
necessary to provide adequate storage volume for subsequent rains. Replace stone as needed.

D. Rock pipe inlet protection shall be installed and maintained in accordance with Section 6.55 of the VESCH. Rock pipe inlet protection may be used at pipes with a maximum diameter of 36 inches. It shall not be installed in intermittent or perennial streams. The minimum crest width of the riprap berm shall be 3 feet, with a minimum bottom width of 11 feet and minimum height of 2 feet. The top of the riprap shall be 1 foot lower than the shoulder of the embankment or diversions. The outside face of the riprap should be covered with a 12-inch thick layer of #5 or #57 washed stone. The sediment storage area should be excavated upstream of the rock pipe inlet protection, with a minimum depth of 18 inches below grade. The rock pipe inlet protection shall be inspected at least weekly and after any storm event of greater than 1 inch of rain per 24-hour period. Repairs shall be made immediately. Remove sediment when the volume of the sediment storage area has been decreased by one-half and replace the contaminated part of the gravel facing.

3.09 FIBER FILTRATION TUBES (FFTS) AND SEDIMENT LOGS

- A. FFTs and sediment logs shall be placed along slopes to function as slope breaks and to minimize sediment transport and in diversions/channels to serve as check dams. The Contractor shall provide FFTs and sediment logs at all locations noted on the Contract Drawings, and at all other locations as may be directed by the Engineer.
- B. FFTs and sediment logs shall be installed to maintain contact with the soil surface. Install prior to seeding. May be installed before or after installation of RECMs.
- C. Anchor the upstream/upslope side of the FFTs using wire staples or approved devices at 1-foot intervals. Drive wooden stakes through downstream/downslope side of the FFTs at 2-foot intervals. Take care not to compress the FFTs. Backfill and compact loose soil against the upstream/upslope side. Overlap adjacent FFT ends by a minimum of 1 foot.
- D. For channel installation, construct anchor trench 3 inches deep by FFT diameter and place loose soil against upstream side of FFT. For channel gradients of 2%, install trenches on 25-foot intervals. Decrease interval distance with steeper channel gradients or more highly erosive soils.
- E. Any sediment accumulation at the base of the FFT must be removed when it reaches one-third of the height of the tube. FFT may need to be removed if fully loaded with captured sediment for maximum product performance. FFTs are to be left in place or removed from the site as directed by the Engineer.
- F. Sediment logs do not require installation trenches. Wood stakes shall be placed at least every 2 feet along the length of the sediment log. Stakes shall only penetrate the netting around the log. They shall not be driven through the center of the log. Sediment logs are to be left in place or removed from the site as directed by the Engineer.

G. The FFTs and sediment logs shall be inspected at least weekly and within 24 hours after any storm event of greater than 1 inch of rain per 24-hour period. Look for signs of flow undercutting the logs. Re-anchor and replace as necessary.

3.10 OUTLET STABILIZATION STRUCTURE

- A. Outlet stabilization structures shall be designed, installed and maintained in accordance with the requirements of Section 3.18 of the VESCH.
- B. The Contractor shall ensure the subgrade, riprap and gravel filter conforms to the grading limits shown on the plans.
- C. Riprap shall be installed in accordance with the specifications contained herein, with filter fabric placed under the riprap.
- D. The apron shall be constructed on zero grade with no overfill. Ensure the apron is properly aligned with the receiving stream.
- E. All disturbed areas shall be stabilized with vegetation immediately after construction.
- F. Outlet stabilization structures shall be inspected at least weekly and within 24 hours after any storm event of greater than ½ inch of rain per 24-hour period to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Repairs shall be made immediately.

3.11 TREE PROTECTION FENCE

- A. Tree protection fence shall be installed and maintained in accordance with the requirements of Section 3.38 of the VESCH. If Manufacturer's recommendations are more stringent, they shall supersede.
- B. Install tree protection fence around all designated tree protection areas prior to clearing, deliveries, and other construction activities onsite. Post signs designating area as protected on all sides of the fencing.
- C. Inspect tree protection fence weekly. Repair and replace as needed.

3.12 FILTER BAG

- A. Install filter bag on a slope so incoming water flows downhill through the filter bag without creating more erosion. Strap the neck of the filter bag tightly to the discharge hose. To increase the efficiency of filtration, place the bag on an aggregate or hay bale bed to maximize water flow through the surface area of the bag.
- B. The filter bag is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of the filter bag, the type and amount of sediment discharged into the filter bag, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most

circumstances filter bags will accommodate flow rates of 1500 gallons per minute. Use of excessive flow rates or overfilling filter bag with sediment will cause ruptures of the bags or failure of the hose attachment straps. Damage and replacement costs for improper pumping shall be the responsibility of the Contractor.

- C. Full or partially full silt bags cannot be left in place and must be removed from site and legally disposed. If allowed, the filter bag may be cut open and the contents seeded after removing visible fabric. Filter bag is strong enough to be lifted with added straps. Off-site disposal may be facilitated by placing the filter bag in the back of a dump truck or flatbed prior to use and allowing the water to drain from the bag in place, thereby dismissing the need to lift the filter bag.
- D. The payment for any filter bag used during construction is to be included in the bid of overall erosion and sediment control plan unless a unit price is specified in the Contract Documents.

3.13 DEWATERING SUMP

- A. Excavate for pit installation. Pit dimensions are variable, with the minimum diameter being trice the diameter of the standpipe.
- B. A base of filter material consisting of clean gravel or #57 stone (1.5 inch max diameter) is to be placed in the pit to a depth of six (6) inches.
- C. The standpipe shall be wrapped with hardware cloth and approved non-woven geotextile fabric and placed in pit on clean gravel.
- D. After installing the standpipe, the pit surrounding the standpipe should then be backfilled with #57 stone to an elevation that is six (6) inches minimum above the anticipated highwater level.
- E. The standpipe shall extend twelve (12) inches minimum above the anticipated standing water level.
- F. Insert pumping mechanism. Connect to separate filter bag if required by the Contract Drawings.

3.14 ADDITIONAL REQUIREMENTS

- A. All storm sewer piping shall be blocked at the end of every working day until the inlet is constructed above grade.
- B. All streets around the construction area shall be scraped as necessary to prevent accumulation of dirt and debris.
- C. The Contractor shall provide adequate means to prevent any sediment from entering any storm drains, curb inlets (curb inlet filter box), ditches, streams, or bodies of water downstream of any area disturbed by construction. Excavation materials shall be placed

upstream of any trench or other excavation to prevent sedimentation of offsite areas. Silt fence will be provided, at no additional cost to the Owner, around excavation materials if deemed necessary by the Engineer. In areas where a natural buffer area exists between the work area and the closest stream or water course, this area shall not be disturbed.

D. The Engineer may direct the Contractor to place any additional sediment and erosion control devices at other locations not shown on the Drawings.

3.15 INSPECTIONS AND MAINTENANCE

- A. The Contractor shall designate an Authorized Representative to perform inspections and maintenance as described herein. Contractor shall perform regular inspections and maintain records as follows:
 - 1. Inspections shall be performed, at a minimum, once every seven calendar days and within 24 hours after any storm event of greater than 1 inch of rain per 24-hour period.
 - 2. A rain gauge shall be maintained in good working order on the site and all rainfall amounts recorded throughout the duration of construction activities.
 - 3. Inspection reports must be available on-site during business hours unless a sitespecific exemption is approved.
 - 4. Inspection records must be kept for 3 years following completion of construction and be available upon request.
 - 5. Electronically-available records may be substituted under certain conditions as approved by the Virginia Department of Environmental Quality (VADEQ).
- B. During inspections, the following will be observed and appropriate maintenance activities shall be performed:
 - 1. The conformance to specifications and current condition of all erosion and sediment control structures.
 - 2. The effectiveness and operational success of all erosion and sediment control measures.
 - 3. The presence of sediments or other pollutants in storm water runoff at all runoff discharge points.
 - 4. The presence of sediments or other pollutants in receiving waters.
 - 5. Evidence of off-site tracking at all locations where vehicles enter or exit the site.

- 6. Evidence of impacts to water quality due to site activities pertaining to equipment operation and maintenance, material handling, and material storage and construction laydown areas exposed to precipitation.
- C. Immediate action shall be taken to repair/maintain erosion and sediment control measures that are not performing as designed. The State/Commonwealth reserves the right to stop all construction activities not related to these measures until such deficiencies are repaired.
- D. In areas that have undergone final stabilization, inspections and, if necessary, maintenance by Contractor will occur at least once per month for the duration of the contract or project, whichever is longer.

3.16 MONITORING AND REPORTING

- A. The Contractor shall be responsible for the implementation of the Maintenance and Inspection Procedures as written by the Engineer. The implementation must comply with guidelines as set forth in General Virginia Pollutant Discharge Elimination System Permit Regulation for Discharges of Storm Water From Construction Activities (9 VAC 25-180) and VPDES General Permit No. VAR10.
- B. The Contractor shall designate a Qualified Person to perform inspections required by this Section. The following areas are to be inspected and maintenance performed, if needed, at least once every 14 calendar days and within 48 hours of the end of runoff producing storm event.
 - 1. Disturbed areas of the construction site that have not undergone final stabilization
 - 2. Erosion and sediment control structures
 - 3. All locations where vehicles enter or exit the site
 - 4. Material storage and construction laydown areas that are exposed to precipitation and have not been finally stabilized
- C. When a Storm Water Pollution Prevention Plan (SWP3) is provided in the Contract Documents, the Qualified Person shall follow the practices inspection and maintenance requirements described in the SWP3. (See the Appendix for the SWP3, if applicable). All appropriate records required by the SWP3 shall be maintained on site.
- D. Immediate action will be taken to correct deficiencies to BMP's. The State reserves the right to stop all construction activities not related to maintaining BMP's until such deficiencies are repaired.
- E. In areas that have been finally stabilized, inspections and, if necessary, maintenance by Contractor will occur at least once per month for the duration of the contract or project, whichever is longer.

- F. During inspections the following will be observed and appropriate maintenance procedures taken:
 - 1. The conformance to specifications and current condition of all erosion and sediment control structures.
 - 2. The effectiveness and operational success of all erosion and sediment control measures.
 - 3. The presence of sediments or other pollutants in storm water runoff at all runoff discharge points.
 - 4. If reasonably accessible, the presence of sediments or other pollutants in receiving Waters.
 - 5. Evidence of off-site tracking at all locations where vehicles enter or exit the site.
- G. An inspection checklist is included in the SWP3. This checklist must be completed during each inspection, dated, and signed by the Qualified Person conducting the inspection. Completed inspection checklist shall be kept on-site with the Contract Documents and submitted to the Engineer on a monthly basis. The Contractor will repair deficiencies within 24 hours of inspection.

3.17 REMOVAL OF TEMPORARY SEDIMENT CONTROL STRUCTURES

A. At such time that temporary erosion and sediment control structures are no longer required under this item, the Contractor shall notify the Engineer of its intent and schedule for the removal of the temporary structures. The Contractor shall obtain the Engineer's approval in writing prior to removal. Once the Contractor has received such written approval from the Engineer, the Contractor shall remove, as approved, the temporary structures and all sediments accumulated at the removed structure shall be returned upgrade and stabilized so they do not re-erode. In areas where temporary control structures are removed, the site shall be left in a condition that will restore original drainage. Such areas shall be evenly graded and stabilized with permanent vegetation as specified in Section 32 91 24 – Streamwork Plant Installation, Section 32 92 30 – Specialty Seeding, and Section 32 93 50 – Live Stakes.

SECTION 31 32 40 GEOTEXTILE FOR STREAMWORK

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes the furnishing and installation of permanent synthetic nonbiodegradable geotextile products within stream revetments where applicable.
- B. Related Sections:
 - 1. Section 31 37 20 Stone for Streamwork
 - 2. Section 35 42 63 Double Layer Soil Lift
 - 3. Section 35 43 65 Rock Cross Vane
 - 4. Section 35 43 74 Log J-Hook

1.02 SUBMITTALS

A. Provide to Engineer product data sheets for each type of geotextile identified on the Contract Documents prior to ordering and provide copies of all delivery tickets for geotextiles delivered onsite (prior to placement).

1.03 QUALITY ASSURANCE

- A. Filter Cloth and Heavy-Duty Filter Cloth: Fabric shall meet the testing requirements as listed under Paragraph 2.01, "Materials," subsection A.
- B. Bi-axial and Tri-axial Geogrid: Grid shall meet the testing requirements as listed under Paragraph 2.01, "Materials," subsection B.
- C. 3-D Geomat: Geomat shall meet the testing requirements as listed under Paragraph 2.01, "Materials," subsection C.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Filter Cloth and Heavy-Duty cloth shall be a non-woven geotextile composed of polypropylene fibers (Mirafi 160N or approved equal) and shall meet the following criteria:

Mechanical Properties	Test Method	Unit	Filter Cloth Min	Heavy Duty Min
Tensile Strength	ASTM D 4632	lbs	160	300
Tensile Elongation	ASTM D 4632	%	50	50
Weight	ASTM D 5261	oz/yd²	6.5	12
Trapezoid Tear	ASTM D 4533	lbs	60	115
CBR Puncture Strength	ASTM D 6241	lbs	410	800
Appar. Opening Size	ASTM D 4751	US sieve	70	100
Permittivity	ASTM D 4491	sec ⁻¹	1.5	0.80
Flow Rate	ASTM D 4491	gal/min/ft ²	110	65
UV Resist. (at 500 hrs)	ASTM D 4355	% strength	70	70
Thickness	ASTM D 5199	mm	1.7	2.7

B. Bi-axial geogrid shall be an integrally formed biaxial polypropylene geogrid (Tensar BX 1100 or approved equal). Tri-axial geogrid shall be an integrally formed triaxle polypropylene geogrid (Tensar TX 140 geogrid, or equal). Bi-axial and tri-axial grids shall meet the following specifications:

Property	Test Method	Unit	Biaxial MD ¹ Values	Triaxial MD ¹ Values
Aperture dimensions	nominal	in	1.0	1.6
Minimum Rib Thickness	nominal	in	0.03	0.04
Tensile Strength @ 2% strain	ASTM D 6637-01	lb/ft	280	-
Tensile Strength @ 5% strain	ASTM D 6637-01	lb/ft	580	-
Ultimate Tensile Strength	ASTM D 6637-01	lb/ft	850	-
Junction Efficiency	GRI-GG2-05	%	93	93
Flexural Stiffness	ASTM D 5732-01	mg-cm	250,000	250,000
Aperture Stability	USACE methods	kg-cm/deg	3.2	3.0
Resist. To long-term Degra.	EPA 9090	%	100	100
Resist. To UV Degra.	ASTM D 4355-05	%	100	100
Radial stiffness at low strain (0.5%)	ASTM D 6637-01	lb/ft	-	15,430

¹ Machine direction

C. 3D Geomat for root reinforcement use shall be a three-dimensional flexible mat (Enkamat 7020 or approved equal) meeting or exceeding these requirements:

Property	Test Method	Unit	MD ¹ Min Values
Mass/unit Area	ASTM D 5261	oz/yd2	12
Thickness	ASTM D 5199	mm	18
Tensile Strength ¹	ASTM D 5035 (mod)	Lb/ft	240
UV Stability	ASTM D G53, ASTM D 1682 (mod)	%	80
3D Volume	nominal	%	95

¹ Machine direction/cross machine direction

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Filter Cloth and Heavy-Duty Filter Cloth Installation: Install per manufacturer's installation procedures or as specified on the Contract Documents. Cut geotextile to proper width prior to placement. Width shall be enough to conform to the trench perimeter with at least a twelve (12) inch top overlap beyond trench limits. Anchor the edges of the geotextile to prevent the geotextile from falling into the trench. Where overlaps are necessary between rolls, allow for two (2) feet overlap from the upstream to the downstream roll.
- B. Bi-axial and Tri-axial Geogrid Installation: Install per manufacturer's installation procedures or as specified on the Contract Documents. A twenty-four (24) inch minimum material overlap required. Nylon zip ties are required for overlaps.
- C. 3D Geomat Installation: Install per manufacturer's installation procedures or as specified on the Contract Documents. Anchor trenches are required. A twelve (12) inch minimum material overlap is required. Four or more metal fasteners per square yard minimum are required if the Contract Documents do not otherwise call for triangular wood staking. If triangular staking is required, then two (2) wood stakes minimum per square yard shall be installed.

SECTION 31 37 20 STONE FOR STREAMWORK

PART 1 – GENERAL

1.01 SUMMARY

- A. This work shall consist of furnishing and placing stone for stabilization, protection, and other purposes within stream channels or along bank slopes in accordance with the Construction Documents.
- B. Related Sections:
 - 1. Section 01 57 52 Dewatering and Flow Diversion for Streamwork
 - 2. Section 31 00 01 Earthwork
 - 3. Section 31 23 40 Stream Bed Material for Streamwork
 - 4. Section 31 32 40 Geotextile for Streamwork
 - 5. Separate Revetment Execution: See Table 2 in Paragraph 3.01G for additional related Specification Sections.

1.02 SUBMITTALS

- A. Geotextile: Per Section 31 32 40 Geotextile for Streamwork.
- B. All stone: The Contractor shall identify potential sources (quarry, off-site, on-site, etc.) for stone and forward source information to Engineer for approval. The Contractor shall not be granted an extension of time or extra compensation due to delay caused by sampling, testing, approval or disapproval of stone material under the requirements of these Specifications. The Contractor shall obtain from the quarry and submit to the Engineer a certificate verifying the following:
 - 1. Stone Classification: Virginia Class AI, I, II, and III Riprap
 - 2. Weight per cubic foot.
 - 3. Weight range of stone being supplied.
 - 4. Stone D15, D50 and D100 weights.
- C. Riffle Grade Control Stone: Stone specified in Contract Documents as Riffle Grade Control Stone/Cobble shall meet all requirements per Section 35 43 63 – Riffle Grade Control and Section 31 23 40 – Stream Bed Material for Streamwork. The Contractor

shall provide the Engineer a sample of riffle grade control stone material thirty days prior to starting work for approval.

D. Imbricated Boulders: Contractor shall provide to the Engineer a written description of the Contractor's method for quality control so only block-like, flat, stackable stone of the size specified on the Contract Documents is delivered onsite. Contractor is responsible for costs associated with rejected stone.

1.03 QUALITY ASSURANCE

- A. Geotextile: Per Section 31 32 40 Geotextile for Streamwork.
- B. The Engineer is required to field-approve the first delivery of all stone (rip rap, imbricated riprap, chinking stone, bank run gravel, etc.) material delivered to the site. Stone should be separated into appropriate sizes and not stockpiled together. Engineer shall inspect stone prior to placement and has the right to reject stone not meeting specifications. New stone must be brought onsite for testing at the Contractor's expense.
- C. All stone should have a density greater than 165 lbs/ft³.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Non-woven filter cloth: Per Section 31 32 40 Geotextile for Streamwork and/or as specified on the Construction Documents. If not specified on Construction Drawings, cloth to be Mirafi 160N or approved equal.
- B. Stone size: All stone sizing shall be per the "Rock Sizing Chart" on the Construction Documents. When nominal dimensions are identified (e.g., 16-inch stone) this value refers to the intermediate axis (not smallest nor largest axes).
- C. Stone properties: Stone shall consist of angular rock, similar in color, texture and density to the native rock at the site and obtained from an approved source. Stone shall not be harvested from streams or rivers outside of a commercial quarry operation except as shown on the Construction Documents or directed by the Engineer. All stone shall be free from laminations, weak cleavages and shall not disintegrate from the action of air and water or in handling and placing. Granular sedimentary stone is unacceptable. Concrete shall not be considered as an alternative for stone. White stone is not acceptable. Stone sizes shall be as specified in the Construction Documents as per the 'Rock Sizing Chart' found thereon; stone classification shall be per Table 1 below.

Class	Size in Weight (lbs.) ¹	Approx. Diameter ²	Percent of Total by Weight
Class Al	25-75	0.8	10 max. >75 lbs.
Class I	50-150	1.1	60 >100 lbs.
Class II	150-500	1.6	50 >300 lbs.
Class III	500-1,500	2.2	50 >900 lbs.
Туре І	1,500-4,000	2.8	Av. Wt. 2,000 lbs.
Type II	6,000-20,000	4.5	Av. Wt. 8,000 lbs.

Table 1: Stone Sizing Criteria

¹ In all classes/types of riprap, a maximum 10% of the stone in the mixture may weigh less than the lower end of the range.

² Mean D₅₀ Diameter (ft.)

- D. Imbricated boulders: Imbricated stone shall meet requirements per Paragraph 2.01C, but stones shall be large (boulder size), block-like, flat and stackable.
- E. Gravel: Stone per AASHTO M43 aggregate sizing.
- F. Three to four-inch stone: 3- to 4-inch stone (aka railroad ballast) shall meet the following: D10 = 2 inches, D50 = to 3.5 inches and D100 = 6 inches.

PART 3 – EXECUTION

3.01 ROCK INSTALLATION

A. Dewatering: Unless otherwise specified on the Contract Documents, excavation and/or fill placement required for rock installation shall occur in the dry per Section 01 57 52 – Dewatering and Flow Diversion for Streamwork.

- B. Subgrade preparation excavation for rock placement: Excavation must conform to the lines and grades specified in the Contract Documents. Should bedrock or other unsuitable soil be encountered, over-excavation beyond finished grade lines may be required. If these conditions occur, the Contractor is to immediately contact the Engineer for approval before excavating beyond lines and grades specified in the Contract Documents.
- C. Subgrade preparation: Fill for rock placement: Portions of rock installation may require placement of underlying fill. Unless otherwise specified on the Contract Documents (see 3.01 D), said fill shall be salvaged from onsite grading operations, preferably from the channel, including materials excavated under 3.01 B. Said placed material shall be compacted via machine-tamping (e.g., pressing with excavator bucket).
- D. Subgrade preparation: Approved fill requirements: Should the Contract Documents require the use and placement of "approved" or "select" fill, said fill shall meet the tenets of Section 31 00 01 Earthwork, Paragraph 2.01: "Select Fill" and Paragraph 3.09: "Compaction." Compaction of approved fill shall be treated as "Other Embankments" under Paragraph 3.09A.
- E. Filter cloth: Cloth installation shall meet the tenets of Section 31 32 40 Geotextile for Streamwork. In addition, the subgrade must be smooth and firm, free from protruding objects that would damage the geotextile and constructed in a manner acceptable to the Engineer. Unless specified otherwise by Contract Documents or the Engineer, the geotextile must be placed on the prepared subgrade with the adjacent edges overlapping a minimum of two (2) feet. Geotextile torn or damaged must be replaced or repaired at the Contractor's expense in a manner acceptable to the Engineer. Fabric shall be placed along all upstream faces of revetments unless otherwise specified by the Contract Documents. All fabric shall be cut such that six (6) inches of exposed fabric is visible above existing grade.
- F. Rock stacking: For revetments requiring rock stacking, the Contractor must use a "thumb" attachment to an excavator bucket or equivalent to place rock unless otherwise approved by the Engineer. Unless otherwise specified on the Contract Documents, rocks shall be stacked on each other at a 1:6 angle (vertical: horizontal) back into supporting slope, with at least a six (6) inch rock overlap.
- G. Specific rock installation methods: Several stream rock revetment practices have separate Execution descriptions; please see Table 2. For practices not included in Table 2 that involve rock placement for toe protection or footers, use installation methods specified by the Contract Documents.

Revetment	Specification
Wood Toe	34 42 72
Riffle Grade Control	35 43 63
Rock Cross Vane	35 43 65
Rock Cascade	35 43 69
Log J-Hook	35 43 73

Table 2: Separate Revetment Execution Descriptions

H. Chinking and void-filling: If specified on the Contract Documents, fill voids within newlyplaced stone with chinking stone as described in the "Rock Sizing Chart." Consult the Contract Documents to determine if use of in-situ material and/or stream bed material (see Section 31 23 40 – Stream Bed Material) is required for void filling.

SECTION 32 01 92 WATERING FOR STREAMWORK

PART 1 – GENERAL

1.01 SUMMARY

A. The work specified in this specification relates to watering necessary to ensure the success criteria for the Short- and Long- Term Plant Warrantees required by the Contract Documents for seeded areas, sod, herbaceous plants, shrubs, trees, tubelings and live stakes. It is the Contractor's responsibility to inspect plantings and seeded areas during the short and long-term warrantee periods to determine watering needs.

B. Related Sections:

- 1. Section 01 78 60 Short-Term (30-Day) Planting Warrantee
- 2. Section 01 78 62 Long-Term (1-Year) Planting Warrantee
- 3. Section 31 25 00 Erosion and Sedimentation Control
- 4. Section 32 91 24 Streamwork Plant Installation
- 5. Section 32 92 30 Specialty Seeding
- 6. Section 32 93 50 Live Stakes

1.02 SUBMITTALS – (NOT USED)

1.03 QUALITY ASSURANCE

A. See Section 01 78 60 – Short-Term (30-Day) Planting Warrantee and Section 01 78 62
 – Long-Term (1-Year) Planting Warrantee.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 WATERING METHOD

- A. The work to be performed under this specification consists of the following:
 - 1. Initial Week of Plant Installation: In the absence of adequate rainfall (one or more inches per week), watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of

4 inches. Watering should be conducted in the early morning to minimize loss caused by evaporation to prevent wilting.

- 2. After Initial Week of Plant Installation: The Contractor is required to water plantings on a weekly basis during the period of time between April 1 and October 15 during dry weather weeks. A dry week is defined as 7 or more days without at least one inch of rain.
- 3. All watering must be accomplished using a hose with nozzle end breaker or a sprinkler. Water must be applied in sufficient quantities to maintain moist soil to a depth of at least 4 inches. Water must be applied at low water pressure directly to each plant, allowing water to be absorbed into the planting pit soil until saturated, but without runoff. The Contractor must avoid application of too much water.
- 4. The following may be used as a guideline for water volume requirements for plants installed for streamwork.

Caliper	Gallons of Water
Under 1"	5
1.5"	5 to 10
2"	10 to 15
2.5"	15 to 20
>2.5"	20 to 30

- 5. Acceptable water sources: Contractor to supply a water truck or water plants from a nearby hydrant. If a hydrant is used, the Contractor is responsible for all regulations, permits or expenses necessary to use the public water supply. Based on site conditions and the written pre-approval of the Engineer, the Contractor may use onsite water sources such as irrigation ponds, sediment basins, pools within stream areas, etc. subject to all appropriate environmental regulations and the tenets of the sediment and erosion control plan for the project.
- 6. After written acceptance of the long-term warrantee period, the Contractor is responsible for the removal of all watering lines, sprinklers, etc. used for the project.
- 7. Payment: Unless specifically stated in the Contract Documents, all costs associated with watering are incidental to various planting and seeding requirements and do not warrant additional payment.

SECTION 32 90 22 TOPSOIL FOR STREAMWORK

PART 1 – GENERAL

1.01 SUMMARY

- A. Work includes furnishing and installing topsoil along swales, streams, rivers, ponds, lakes or other waterways for slope protection as specified in the Contract Documents, or as directed by the Engineer. All topsoil used shall be imported; no onsite salvaged topsoil may be used for streamwork. Placed media shall be pure topsoil or topsoil augmented with up to 50% organic composted mulch, by weight. The inclusion of mulch is encouraged.
- B. Related Sections:
 - 1. Section 01 57 52 Dewatering and Flow Diversion for Streamwork
 - 2. Section 31 25 00 Erosion and Sediment Control
 - 3. Section 32 92 30 Specialty Seeding
 - 4. Section 35 42 57 Coir Mat
 - 5. Section 35 42 63 Double Layer Soil Lift

1.02 SUBMITTALS

- A. The Contractor shall submit the following for approval:
 - 1. Soil-testing laboratory qualifications.
 - 2. Manufacturer and source data for all materials including soils, compost mulch and amendments.
 - 3. Certified chemical and mechanical analysis of samples of imported topsoil, soil mixes, soil amendments and organic compost materials.
 - 4. Delivery tickets showing imported topsoil matches approved mixes.

1.03 QUALITY ASSURANCE

A. The contractor shall submit soil-testing laboratory qualifications. Said qualifications shall demonstrate that the facility is an independent laboratory, recognized by the State/Commonwealth Department of Agriculture, with experience to conduct required testing.

1.04 TESTING

- A. Contractor to provide written certification that imported topsoil and compost meet the tenets of these specifications and that the soil is free from exotic and/or invasive plant seeds, rhizomes, or other noxious species. A copy of soil test results from a licensed soil testing entity must be provided for each source of topsoil and compost used. Certifications shall be forwarded to the Owner or Owner's Representative prior to material being brought onsite.
- B. All soil testing shall be conducted at the Contractor's expense.
- C. Topsoil shall meet the following criteria:
 - 1. pH: 5.0 7.0
 - 2. Cation Exchange Capacity: 5 to 25 cmol+ /kg (meq/100g)
 - 3. Organic Matter (OM): 5% minimum by weight, 10% maximum
 - 4. Nutrient Content: normal contents of nitrogen, phosphorus (index 25 to 50), potassium (index 25 to 50), calcium, magnesium, and sulfur (index 25 to 50)
 - 5. Soluble Salts: <= to 3 millimhos per cm at 25-degree C
 - 6. Contaminants: should contain no toxic substances
 - 7. Grading analysis shall be as follows:

Sieve Size	Minimum Percent Passing by Weight
2 inches (50 mm)	100
No. 4 (4.75 mm)	4 - 90
No. 10 (2 mm)	10 - 80

8. Textural analysis shall be as follows:

Soil Particle Size (mm)	Minimum Percent Passing by Weight
Sand (2.0 – 0.05)	30-70
Silt (0.05 – 0.002)	20-50
Clay (less than 0.002)	5-30

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Furnished Topsoil: Furnished topsoil shall be natural, friable surface soil uniform in color, texture and composition. Topsoil shall be free from species present on State/Commonwealth and Federal noxious plant or invasive species lists.
- B. Acceptable Soil Amendments: The following amendments may be used to augment the soil to meet specified requirements. Amendments and rates of application are to be determined based on soil test results. Specific recommendations for the type of amendments can be found in the Landscape Specification Guidelines by the Landscape Contractors Association of the project state/commonwealth (most recent addition); however, amendment requests shall be supplied and certified by vendor and sent to the Engineer for approval; said certification and testing shall be incidental to the contract.
 - 1. Sulfur: Sulfur for adjustment of soil pH shall be an unadulterated flower of sulfur.
 - 2. Lime: Ground or pulverized limestone, which contains a maximum of 50 percent total oxides.
 - 3. Organic Matter: To increase organic matter based on soil test results, the following materials can be used:
 - a. Yard Debris Compost: Compost made from yard trimmings, such as leaves, grass clippings and pruning that have been properly composted, are mature and have been sieved through a ³/₄-inch screen. Compost shall be free of trash, invasive plants and seeds and contain no toxic substances harmful to plant growth.
 - b. Biosolids Compost/ Composted Sludge: Compost made from polymer dewatered biosolids that meets the minimum requirements of EPA 503 and any required state/commonwealth standards. Compost shall be mature and shall have been sieved through a ¾-inch screen. The pH range shall be 6.2 to 7.2.
 - 4. Fertilizer: Fertilizer analysis and rate of application shall be determined based on soil test results; there is a strong preference for non-use of fertilizer and its use must be approved by the Engineer. If used, fertilizer shall be uniform in composition, free flowing and suitable for application with approved equipment. If compost is used to amend soil, fertilizer is usually not required.
 - 5. Sand: Clean, washed, coarse masonry sand, sized up to ¼-inch particles.
 - 6. Diatomaceous Earth: Diatomite, Isolite, or approved equal.
- C. Mulch: Compost mulch used to augment topsoil shall have been formed as the result of the biological degradation and transformation of plant-derived materials under conditions

that promote anaerobic decomposition. The material shall be free of viable weed seeds and stable regarding oxygen consumption and carbon dioxide generation. The compost shall have a moisture content with no visible free water or dust production when handled, and shall meet the following criteria, as reported by the U.S. Composting Council STA Compost Technical Data Sheet:

- 1. 100% of the material must pass through a half inch screen.
- 2. The pH of the material shall be between 5.5 and 8.5.
- 3. The organic matter content shall be >35%.
- 4. Soluble salt content shall be less than 330 ppm.
- 5. Must be mature and stable per the appropriate test(s) as specified by STA.
- 6. Carbon/nitrogen ratio shall be less than 25:1.
- 7. Must meet USEPA part 503 levels for heavy metals.
- 8. The compost should have an optimum dry bulk density ranging from 40 to 50 lbs./ft³.

PART 3 – EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Package materials will be delivered in manufacturer's unopened container or bundles; they will be identified with name, brand, type, weight and analysis. Bulk (loose, non-packaged) materials shall be shipped and stored separately from other materials. Both bulk and packaged materials will be stored in a manner that will prevent damage or intrusion of foreign matter. Any material contaminated will be removed from the job site. Material shall be protected from excess heat and dehydration.
- B. Organic amendments (topsoil, mulch) shall not be delivered if excessively wet (greater than 10% of optimal top range for moisture content) or frozen.
- C. Delivery location, stockpile locations and scheduled deliveries shall be coordinated with and approved by the Erosion and Sediment Control Inspector prior to delivery. Soils shall be protected from eroding while stockpiled on site and stored per the approved Sediment and Erosion Control Plan.

3.02 JOB CONDITIONS

A. Contractor shall determine location of all underground utilities prior to topsoil work. Existing utilities, paving, vegetation, and other facilities shall be protected from damage caused by topsoil installation. Should damage occur through topsoil placement, the Contractor shall repair facilities as directed by the Owner at the Contractor's expense. B. Cooperation will be undertaken with other trades working in and adjacent to work areas. The Contractor shall review drawings detailing the development of the entire project to gain familiarity with the scope of other required work. Before placing topsoil, all construction work in the area shall have been completed, including installation of utilities.

3.03 PLACEMENT

- A. Existing Soil Removal: Prior to removing topsoil and subsoil, the Contractor shall mow or remove all surface vegetation.
- B. Subgrade conditions and preparation: All areas to receive landscape soil shall be free of construction debris, refuse, compressible or decayable materials, stones greater than two inches and standing water. Adjust sub-grade levels as required to ensure that planting areas have adequate drainage. Immediately prior to being covered with topsoil, the prepared surface shall be in a loose condition (e.g., raked). Subsoils shall not be frozen at time of topsoil placement.
- C. Placement: Do not place topsoil if wet, frozen or not at the optimum moisture content. Topsoil or topsoil/compost mix shall be placed to a depth of three (3) inches minimum unless otherwise specified on the Construction Documents.
- D. Tilling: Placed topsoil shall be tilled into the subsoil to a depth of six (6) inches to ensure adequate aeration of the subsoil.
- E. Compaction: Unless otherwise noted on the Construction Documents, topsoil is only to be hand-tamped as necessary to keep in place and is not to be machine-compacted (not rolled, tracked or pneumatically hardened). Installed topsoil shall have compaction values no greater than 65 percent.
- F. Seeding: Topsoil shall be stabilized with both temporary and permanent seed at the time of placement as shown in the Contract Documents or as directed by the Engineer.
- G. Stabilization: Topsoil shall be temporarily stabilized at time of placement as shown in the Contract Documents. Stabilization techniques shall be per Contract Documents and may include, but are not limited to, coir matting, straw and/or hydroseeding. If straw and coir mat are required, straw shall be placed beneath the coir mat.

SECTION 32 91 24 STREAMWORK PLANT INSTALLATION

PART 1 – GENERAL

1.01 SUMMARY

- A. This work shall consist of furnishing and planting trees, shrubs, and herbaceous plants to complete the work for planting zones as specified on the Planting Plan in the Construction Documents or as directed by the Engineer. No substitution of plant materials is permitted without prior written approval from the Engineer.
- B. Related Sections:
 - 1. Section 01 78 60 Short-Term (30-day) Plant Warrantee
 - 2. Section 01 78 62 Long-Term (1-year) Plant Warrantee
 - 3. Section 31 25 00 Erosion and Sedimentation Control
 - 4. Section 32 92 30 Specialty Seeding
 - 5. Section 32 93 50 Live Stakes

1.02 SUBMITTALS

A. Prior to the start of work on this item, the Contractor shall submit a proposed planting schedule, including source of plant material, to the Engineer for review. No work shall be performed until the Engineer approves this schedule.

1.03 QUALITY ASSURANCE

- A. All plant material shall conform to the current issue of the *American Standard for Nursery Stock* published by the American Association of Nurserymen.
- B. Plant materials must be selected from certified nurseries that have been inspected by state/commonwealth and/or federal agencies. Nursery inspection certificates shall be furnished to the Engineer upon request.
- C. The nursery supply source shall certify that the origin of the seeds from which the trees and shrubs were produced is from Hardiness Zone 7, east of the Mississippi River.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Plants: Per Contract Documents Schenks Branch Tributary Stream Restoration Project April 2022

- B. Fertilizer: Plant fertilizer is to be applied only to containerized plants. The Contractor shall use organic fertilizers. Suitable products that are commercially available are marketed and certified as "organic" or "natural" fertilizers. Organic materials shall include such items as: sea grasses/kelp, rock powder, bone meal, whey, bean meal, blood meal, composted manure, etc. Product nutrient content shall be identified in the standard form of Nitrogen (N), Phosphorous (P) and Potassium (K) ratios. Typical organic fertilizer nutrient content ranges from 1-1-1 to 10-2-10. The minimum acceptable nutrient content shall be 4-2-4, unless otherwise directed by the Engineer.
- C. Mycorrhizal Fungi: Mycorrhizal fungi applied to trees and shrubs shall consist of live spores of both endo- and ectomycorrhizal fungi.
- D. Mulch: Mulch applied to trees and shrubs shall consist of composted hardwood bark.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. To perform all site preparation, including removal of pavements, structures, and inclusion of soil amendments, PRIOR to installing plantings. To promptly replace any existing trees designated to remain that are that are damaged or destroyed in the course of development.
- B. All areas disturbed by construction shall be planted in accordance with the composition and planting schedules for each designated planting zone. Areas within designated planting zones not disturbed by construction shall be supplemented with trees and shrubs to meet the acre quantities specified in the composition schedule.
- C. The Contractor shall refer to the Plant Schedules and Details on the Construction Documents for specific spacing requirements. In the Planting Schedule, the Contractor shall use the Overall Spacing figure to determine the spacing between each species of vegetation. The Contractor shall use the Individual Spacing figure to determine the spacing between each plant of the same species.
- D. Immediately after site preparation and approval, trees, saplings and shrubs shall be planted. Planting shall not be conducted between June 1 and September 1, or as directed by the Engineer.
- E. Rootstock of the plant material shall be kept moist during transport from the source to the job site and until planted.
- F. Plant material collected from the "wild" is prohibited values written permission is obtained on a case-by-case basis from the Engineer.
- G. Container grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil. Roots shall visibly extend to the

inside face of the growing container without the presence of circling roots. All container grown plants shall be grouped and watered daily until they are planted.

- H. Plants damaged in handling or transportation may be rejected by the Engineer.
- I. Water: Water used in the establishment or caring of plants and seed shall be free from any substance that is injurious to plant life. See Section 32 01 92 Watering for Streamwork for more detail.
- J. The Owner or Owner's Representative shall stake out each individual planting pit for shrubs and trees and approve plant spacing and planting techniques prior to proceeding.
- K. Walls of planting pits shall be dug so that they are vertical or sloping outward in heavy soils. Scarify the walls of the pit after digging.
- L. Excavate the planting pit to 2 times the width of the root mass. The planting pit shall be deep enough to allow the root flare to be flush with the existing grade or no more than 3 inches higher.
- M. Remove all debris from the pit and tamp loose soil in the bottom of the pit by hand. Remove the plant either by cutting or inverting the container. There is no need to remove the peat pot or cut the root mass of herbaceous plugs. Do not handle the plant by the branches, leaves or stem.
- N. Place the plant straight in the center of the planting pit, carrying the plant by the root mass. Never lift or carry a plant by the trunk or branches.
- O. No fertilizer shall be used for herbaceous planting. Place 4 ounces of fertilizer in each plant pit for up to 1-gallon size containers, 6 ounces for up to 3-gallon container size and place 8 ounces for up to a 5-gallon container size. Place the fertilizer in the planting pit completely surrounding the plant ball prior to backfilling.
- P. Mix a minimum of 500 spores of endomycorrhizal fungi and 30 million spores of ectomycorrhizal fungi to each cubic foot of backfill for trees and shrub planting.
- Q. Backfill planting pit with existing soil and hand tamp as pit is being backfilled to completely fill all voids and air pockets. **Do not over compact soil**. Make sure plant remains straight during backfilling/tamping procedure. If staking is required, trees must be staked. All stakes must be removed after six (12) months.
- R. Do not cover the top of the root mass with soil.
- S. Trees shall be mulched. A minimum of 20-inch diameter area of mulch shall be placed around each plant. Mulch shall be 2-3 inches thick. Mulch shall NOT be placed directly against the stem of the plant.
- T. Water plants thoroughly immediately after planting, unless otherwise directed by the Engineer. The Contractor shall leave no open planting pits at the close of each day.

3.02 MAINTENANCE

- A. During planting, all areas shall be kept neat, clean and free of all trash and debris, and all reasonable precautions shall be taken to avoid damage to existing plants, turf, structures, and private property.
- B. Remove all tags, labels, strings and wire from the plant materials, unless otherwise directed by the Engineer.
- C. Final cleanup shall be the responsibility of the Contractor and consist of removing all trash and materials incidental to the project and disposing of them off-site.
- D. It will be the Contractor's responsibility to supply water if there is none available on the site. Any costs associated with supplying water shall be the responsibility of the Contractor. See Section 32 01 92 Watering for Streamwork for more detail.

3.03 WARRANTY

A. See Section 01 78 60 – Short-Term (30-day) Plant Warrantee and Section 01 78 62 – Long-Term (1-year) Plant Warranty for details.

SECTION 32 92 30 SPECIALTY SEEDING

PART 1 – GENERAL

1.01 SUMMARY

- A. This work shall consist of furnishing and installing all permanent seed for the areas specified to be seeded on the Contract Documents with wetland, riparian, native woodland, right-of-way or other specialty mixes.
- B. Related Sections:
 - 1. Section 01 78 60 Short-Term (30-day) Plant Warranty
 - 2. Section 01 78 62 Long-Term (1-year) Plant Warranty
 - 3. Section 31 25 00 Erosion and Sedimentation Control
 - 4. Section 32 01 92 Watering for Streamwork
 - 5. Section 32 90 22 Topsoil for Streamwork
 - 6. Section 35 42 57 Coir Mat

1.02 SUBMITTALS

- A. Prior to applying lime and fertilizer, test results for existing soil conditions and recommended application rates for lime and fertilizer shall be provided to the Engineer.
- B. Prior to seeding, the Contractor shall submit a proposed seed and seeding schedule, including the source of seed and contents by percent weight, to the Engineer for approval. No seed shall be purchased, nor work shall be performed until the Engineer approves seed mixes and schedule.
- C. Prior to seeding, Contractor shall perform compaction testing and forward results to Engineer for approval.

1.03 QUALITY ASSURANCE

- A. See Section 01 78 60 Short-Term (30-day) Plant Warranty and Section 01 78 62 Long-Term (1-year) Plant Warranty, respectively.
- B. If Section 01 78 60 Short-Term (30-day) Plant Warranty and Section 01 78 62 Long-Term (1-year) Plant Warranty do not apply to this project, the Contractor is responsible for a 100% Warranty period for the first thirty (30) days, followed by a one-year, 90% care and replacement warranty on all specialty seed areas (up to 10% bare area

acceptable but no single area may exceed 50 square feet). The period of care and replacement shall begin after written acceptance by the Engineer of initial seeding.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Seed

- 1. Specialty seed mixes shall consist of seed varieties below or as specified on the Contract Documents:
 - a. Zone 1 (Stream Side Seed Mix) as shown on the construction documents: Piedmont, FACW Mix – ERNMX-855 from Ernst Seeds, or approved equal.
 - Zones 2 through 4 (Riparian Buffer Seed Mix) as shown on the construction documents: Modified Riparian Piedmont Seed Mix – ERNMX-852 from Ernst Seeds, or approved equal.
 - c. As shown on the construction documents: 5311 Conservation Mix, Full Sun (ERNMX-114), or approved equal.
- 2. Seed shall be certified that the Pure Live Seed (PLS) percentage is 80% or greater. If the PLS is less than specified, the Contractor shall increase the seeding rate to compensate for the PLS difference at no cost to the Owner.
- 3. All seed varieties shall be free from State/Commonwealth and Federal prohibited noxious weed seeds, and shall also be free of the following:
 - a. Annual bluegrass
 - b. Corn cockle
 - c. Spurred anode
 - d. Bermuda grass
 - e. Dodder
 - f. Wild garlic
 - g. Bindweed
 - h. Giant foxtail
 - i. Wild onion

- j. Cocklebur
- k. Horse nettle
- B. Erosion Control Blankets
 - Erosion control blankets used in seeding areas shall be per the Contract Documents or as accepted by the Engineer; see Section 35 42 57 – Coir Mat and 31 25 00 – Erosion and Sedimentation Control.
- C. Mulching Straw
 - 1. Bright, small-grain type straw that is free of rot and noxious weed seeds. Apply ½inch to ¾-inch thick layer or 60 to 80 bales per acre by hand or if hydro-mulched, apply wood cellulose at a net dry weight of 750 pounds per acre.
- D. Water
 - 1. Water shall be supplied per Section 32 01 92 Watering for Streamwork.
- E. Lime and Fertilizer
 - 1. Lime and Fertilizer analysis and application rates shall be determined from field soil sampling in appropriate number taken by the Contractor and analyzed by the Cooperative Extension Service Soil Testing Laboratory at VPI & SU or by a reputable commercial laboratory. Contractor shall furnish lime in accordance with the recommendations of the testing laboratory and Section 3.32 of the VESCH. A soil test report shall be provided to the Engineer.
 - 2. The Contractor shall furnish ground agricultural limestone and organic fertilizers. Organic materials shall include such items as sea grasses/kelp, rock powder, bone meal, whey, bean meal, blood meal, and composted manure. Product nutrient content shall be identified in the form of Nitrogen (N), Phosphorous (P) and Potassium (K) ratios. Fertilizer nutrient content shall be in accordance with recommendations in soil test reporting. The Engineer must approve any proposed substitution for organic materials or nutrient content. The use of petroleum-based fertilizers is not allowed.

PART 3 – EXECUTION

3.01 INSTALLATION OF SEEDING

- A. Site Preparation
 - 1. Areas previously prepared for seeding through the placement of topsoil (see Section 32 90 22 Topsoil for Streamwork) shall require no additional site preparation so long as seed is placed immediately after topsoiling.

- 2. Compacted Soils: Soils shall be considered compacted and resistant to root penetration if subjected to mechanical land clearing or access by heavy construction equipment; soil compaction testing by the Contractor will be required prior to seeding. The evaluation shall include at least 10 compaction tests per acre, evenly spaced throughout the site, using a static cone penetrometer or another method approved by the Engineer. Prior to beginning compaction testing, the Contractor shall submit a Compaction Testing Plan indicating testing method and test locations for approval by the Engineer. Soil at any single test location shall be considered compacted if the reading on the static cone penetrometer is greater than 300 PSI at six (6) inches or less. Based on soil compaction testing, the Contractor shall delineate areas of compacted soils for DECOMPACTION in the Soil Testing Plan and submit to the Engineer for approval. Alternatively, Contractor may forego compaction testing if he voluntarily de-compacts all seeding areas per Paragraph 3.01A.4 below.
- 3. Based on soil testing results, and at the direction of the Engineer, the Contractor shall furnish and apply ground agricultural limestone and organic fertilizers at rates recommended in the soil test report.
- 4. DECOMPACTION: Based on the results of compaction testing, de-compaction may be required. **Compacted soils will require disking or tilling**. Compacted areas outside of the Critical Root Zone (CRZ) limits as shown on the planting plans shall be disked/tilled to a minimum depth of (4) four inches. The CRZ is defined as one foot of radius per diameter inch of tree or as shown on the Contract Documents. **Disking/tilling is NOT permitted within the CRZ**. Contact the Engineer immediately if compaction within the CRZ is observed.
- 5. Non-disturbed areas, or areas where the Owner allows permanent retention of wood chip mulch protection, as well as open water and exposed rock, shall not be de-compacted or seeded.
- 6. All seeding areas shall be free of weeds, trash, debris, brush, clods, rocks and other foreign materials larger than three (3) inches in length. All gullies and washes that develop prior to final dressing shall be repaired prior to seeding.
- 7. Do not seed on frozen ground or when the air temperature is 32°F/0°C or lower.
- B. Seed Placement
 - 1. Seed location: All areas disturbed by construction shall be seeded in accordance with the planting plans and schedules per the Contract Documents. If areas beyond those shown on the planting plans are disturbed, they shall be seeded at no cost to the owner and de-compacted at no cost to the owner based on compaction testing results.
 - 2. Timing: Sow seed mixture between the dates of March 1 and May 31 or between the dates of August 15 and October 31, or as listed on the Contract Documents. If planting cannot be accomplished within these dates, apply temporary seeding and

Schenks Branch Tributary Stream Restoration Project 32 92 30-4 April 2022 mulch only, and delay specialty seeding until the designated seeding window. If permanent seeding is delayed and temporary cover or weed cover is present in permanent seeding area, Contractor shall mow existing cover and disk, till or plugaerate soil to provide appropriate soil-seed contact. Temporary seed mix shall be per Section 31 25 00 – Erosion and Sedimentation Control.

- 3. Installation Method:
 - a. Broadcasting: Broadcast by hand, backpack or push seeder. To help proportion the seed, filler can be used such as; sawdust or sand. Broadcast half the seed in one direction (vertically) and the other half in the opposite direction (horizontally). To achieve good seed-to-soil contact, this procedure is to be followed by rolling or tracking seed into top ¼-inch of the soil, or by dragging the surface with chain link fence or equivalent. The Contractor shall maximize the seed/soil contact by firming soil around the seed with a cultipacker or other similar equipment.
 - b. Hydroseeding: In areas too wet or too steep (greater than 1.5 to 1) for broadcasting, seed shall be spread by hydro-seeding methods.
- 4. Mulching: Apply mulch immediately after seeding and anchor by rolling thoroughly in at least two directions with a crimper roller or by applying a starch-based tackifier such as StarTak 600 manufactured by Chemstar or approved equal in accordance with manufacturer's instructions. Asphalt or other petroleum-based tackifiers shall not be used.
- 5. Watering: Immediately after mulching, the site shall be watered lightly but thoroughly so that the top four (4) inches of soil is saturated.
- C. Maintenance, Mowing, Inspections and Warranty
 - 1. Maintenance and Mowing: Inspect all areas and make repairs. Replace and reseed as required to produce an acceptable stabilized area. Do not mow seeded areas at any time after the completion of seeding or re-seeding.
 - 2. Initial Inspection (30 days): See Section 01 78 60 Short-Term (30-day) Plant Warranty.
 - 3. Final Inspection (eleven months): See Section 01 78 62 Long-Term (1 year) Plant Warranty.
 - 4. Warranty: See Sections 01 78 60 Short Term (30-day) Plant Warranty and Section 01 78 62 Long Term (1 year) Plant Warranty "respectively".

SECTION 32 93 50 LIVE STAKES

PART 1 – GENERAL

1.01 SUMMARY

- A. Live staking consists of insertion of dormant woody plant cuttings into streambanks and encouraging their propagation to stabilize and reinforce stream slopes. Live stakes are installed in the winter (at least one month prior to spring leaf-out). This work shall consist of harvesting, transporting, installing, and maintaining live stake materials into the stream bank as specified on the plans or as directed by the Engineer. Live stakes may be purchased at the discretion of the Contractor subject to the review and approval of the Engineer.
- B. Related Sections:
 - 1. Section 01 78 60 Short Term (30 Day) Plant Warranty
 - 2. Section 01 78 62 Long Term (1 Year) Plant Warranty

1.02 SUBMITTALS

A. Prior to the start of work on this item, the Contractor shall submit a proposed harvesting and installation schedule, including source of supply of live cuttings and plant species, to the Engineer for review and approval. No purchasing, harvest or installation work shall be performed until the Engineer approves this schedule.

1.03 QUALITY ASSURANCE

- A. Harvesting live cuttings: The Contractor shall notify the Engineer seventy-two (72) hours prior to harvesting to review and approve all harvesting sites. Upon approval by the Engineer, the Contractor shall be responsible for harvesting and transporting the cuttings to the job site.
- B. Purchase of live stakes: Contractor shall forward copy of invoice from state/commonwealth certified nursery to Engineer.
- C. Site Inspection: The Engineer representative shall make a final inspection with the Contractor to ensure all live stakes have been installed per the specifications, plans, and details. The Contractor shall be responsible for correcting all deficiencies within ten (10) calendar days of the inspection. The Engineer and the Contractor prior to final completion shall perform a final inspection of the corrected actions; See Section 01 78 60 Short Term (30 Day) Plant Warranty.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Live stakes shall be 0.75 inches to 1.5 inches in diameter and two (2) to three (3) feet in length. Side branches shall be removed and the bark left intact prior to installation. Buds on the stakes shall be oriented in an upward position. The basal ends shall be tapered to a point for easy insertion into the soil. The top shall be cut smooth and square.
- B. Unless specifically described on the Construction Documents, live branch cuttings shall consist of a mix of three (3) or more of the following species with no more than one (1) willow (*Salix*) species and no more than one (1) dogwood (*Cornus*) species included; see list below. Each species (*Alnus, Cornus, Itea, Salix, Sambucus, and Viburnum*) shall comprise no more than 25% of the mix. The Contractor must submit a list of species for the Engineer's approval prior to harvesting, purchase, transportation or installation.

Cornus amomum	Silky Dogwood
Salix sericea	Silky Willow
Sambucus canadensis	American Elderberry

PART 3 – EXECUTION

3.01 HARVESTING

- A. Harvest Permission: The Contractor must obtain permission from the land owner and any conservation easement grantees to access the property and harvest live cuttings.
- B. On-site harvesting: The Contractor shall locate and flag all onsite live cutting sites for the Engineer's approval. The Contractor shall notify the Engineer seventy-two (72) hours prior to harvesting to review and approve all harvesting sites.
- C. Off-site harvesting: The source of all live cuttings shall either be from onsite areas or from purchased stock located within one-hundred (100) miles of the project site.
- D. Live Material Preparation (on or off-site): Cuttings from shrubs and young trees shall be taken in a manner that does not kill the source plant; branches and stems larger than 2 inches in diameter shall be left intact. All cuts shall be smooth and the cut surface kept small. The use of large pruning shears, loppers, and hand or power saws may be required. All cuts shall adhere to American National Standards Institute (ANSI) A300 standard for "Pruning." Trees that are more than 2 inches in diameter shall not be used. Off-site live materials shall be transported cold to the construction site within seventy-two (72) hours of harvesting and then cut to size, as specified above and on the details. Onsite harvested materials shall be installed within eight (8) hours.

3.02 TRANSPORTATION AND STORAGE

- A. Transporting: Stakes harvested offsite will require transportation to the project site. During transport, live cuttings should be bundled tightly together at the construction site for easy loading, handling, and protection. Bundles shall be moistened covered with tarpaulin and taken in unheated vehicles to prevent the live stakes from drying.
- B. Storage of off-site sourced stakes: Any storage of live materials must be approved by the Engineer prior to storing. If the live cuttings are not immediately installed upon arrival, then they must be refrigerated at 34-42 degrees F and cared for until installation by storing in controlled conditions, storing in shade, protected from wind, covered with evergreen branches or plastic, placing in moist soil, or spraying with anti-transpirant chemicals approved by the Engineer. Live branch cuttings shall be sprayed or immersed in cold water (less than 15°C or 59°F) if stored for more than 8 hours. Any costs associated with such storage are incidental to the overall unit costs. All stored stakes must be installed within ten (10) days of initial storage.
- C. Storage of on-site harvested stakes: On-site live materials shall be installed the same day that the cuttings are harvested. If same day installation is not possible, then onsite harvested stakes must be stored per the requirements of offsite stakes (Paragraph 3.02B).

3.03 INSTALLATION

- A. Live Stake Installation Time Frame: Live stakes should be installed from December 1-March 1 unless otherwise directed by the Construction Documents. If, due to construction scheduling live stakes cannot be used based on the timeframe set above or in the Construction Documents, then "live tubelings" of the same species shall be installed, with written approval from the Engineer.
- B. Installation Method: Drive live stakes into the ground so that seventy-five percent (75%) of the stake is below the ground surface. For easy insertion into the soil the bottom end of the stake should be cut at an angle of 30 to 45 degrees. To ensure a flat surface for hammering into the slope, the top should be cut at 90-degree angle. For larger branches the use of pruning shears or power saw may be necessary. All buds of the live branch should be faced upwards during staking. As shown on the detailed plans the live stakes should be installed with the flow of water (pointing downstream to provide the least resistance to flow). The contractor shall use a dead blow hammer for driving the stake directly into the ground or drive a pilot hole, smaller in diameter then the live stake, and then driving the live stake into the pilot hole. Contractor to ensure that there is adequate soil contact along the entire length of the live stake buried in the ground. Soil can be filled in and lightly foot compacted around the live stake to fill voids and air pockets.
- C. Spacing: Live stakes shall be installed at baseflow water surface elevation to a height of no more than two (2) feet vertically from baseflow unless otherwise directed by the Construction Documents. Spacing shall be three (3) to four (4) feet on center and

staggered using a triangular grid pattern, unless otherwise specified on the Construction Documents.

- D. Depth: Three fourths of the live stake length should be buried in the ground; at least one leaf scar shall be left exposed.
- E. Splitting and mushrooming: All live stakes split during installation may be left in place and cut flush with the ground and an additional live stake must be installed adjacent to the split stake. Stakes that "mushroom" (suffer dead blow hammer damage on the top surface) may be left in place and the damaged portion shall be cut off. If cutting the damaged portion of the stake causes damage or loss of any buds, an additional stake must be installed adjacent to the split stake.

3.04 PURCHASE

A. Purchasing: If the Contractor is unable to locate sufficient harvesting sites for the live stakes, upon approval from the Engineer, the Contractor may purchase live stake material from a state/commonwealth certified nursery. The material shall meet all the Specifications found in this Section, specifically the off-site harvest, transportation and storage requirements.

3.05 WARRANTY

A. Warranty: The Contractor is responsible for a 100% Warranty period for the first thirty (30) days followed by a one year 85% care and replacement warranty on all live stakes. The period of care and replacement shall begin after inspection and approval of the initial installation of all live stakes and continue for one year, with one potential replacement period. See Section 01 78 60 – Short Term (30 Day) Plant Warranty and Section 01 78 62 – Long Term (1 Year) Plant Warranty for more detail.

SECTION 35 42 57 COIR MAT

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes installation of coir matting on stream banks, benches, and terraces or other waterway features for the purpose of soil stabilization and erosion control. This work includes the stabilization of stream banks using natural coir fiber matting, top soil, straw and seeding. Coir mat blankets are woven from machine-spun bristle coir twines whose dual purpose is to (1) immediately secure slopes during and after construction and (2) provide long term protection for vegetative establishment. These mats are to be 100% biodegradable durable bristle coir woven blankets having an average field life of four to six years. Coir matting areas are first prepared with a base of disked subsoil that is amended with topsoil and/or compost, then temporary and/or permanent seed and straw mulch are applied. The coir matting is then installed and secured in place using wooden stakes. After the coir matting has been fully secured, live stakes and/or other vegetative stabilization shall be installed per the Construction Documents.
- B. Related Sections:
 - 1. Section 31 00 01 Earthwork
 - 2. Section 31 25 00 Erosion and Sedimentation Control
 - 3. Section 31 37 20 Stone for Streamwork
 - 4. Section 32 90 22 Topsoil for Streamwork
 - 5. Section 32 92 30 Specialty Seeding
 - 6. Section 32 93 50 Live Stakes

1.02 SUBMITTALS

A. Product data for each type and/or size of roll indicated.

1.03 QUALITY ASSURANCE

- A. Contractor shall forward one copy of coir mat specifications from the coir mat supplier for all coir mat used on the project.
- B. Sample Contractor to supply Engineer with one sample of coir mat prior to delivery to, or installation at, the project site.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Coir Mat BioD 70 shall consist of a machine produced mat of degradable natural fibers. Matting shall be Rolanka Bio D as is indicated on the Construction Documents or approved equal. See Table 1.

Attribute	Specification	Bio D 40	Bio D 70	Bio D 90
Weight (oz./sq. yd)	ASTM D 3776	13.6	23.0	29.0
Wet tensile strength:				
Machine direction (MD) or lengthwise (lbs/ft)	ASTM D 4595	672	1488	1776
Crosswise direction (CD) or transverse direction (lbs/ft)	ASTM D 4595	648	1032	936
% Open area	Calculated	65	48	38
Thickness (inch)	ASTM D 1777	0.35	0.35	0.35
Recommended slope	Na	up to 1:1	> 1:1	> 1:1
Recommended flow (fps)	Na	8	12	16
Recommended shear stress (#/sf)	Na	3	4.5	5
"C" Factor	Na	0.003	0.002	0.002

Table 1: Coir Mat Requirements Along Stream Toe up to Flood Prone Area

- B. Stakes:
 - Stakes for Coir Mat BioD 70 installed from the stream toe to the edge of grading shall be of sound quality hardwood "two by fours" split diagonally into triangular wedges. Wedges shall be eighteen (18) inches long and nominally two (2) inches by four (4) inches at the top, tapering to a point.
- C. Top soil, per Section 32 90 22 Topsoil for Streamwork.
- D. Temporary seed, per Section 31 25 00 Erosion and Sedimentation Control.
- E. Permanent seed, per Section 32 92 30 Specialty Seeding.
- F. Live stakes, per Section 32 93 50 Live Stakes.
- G. Straw: Clean, exotic/invasive free native straw, in bales.
PART 3 – EXECUTION

3.01 INSTALLATION

- A. Base soil shall be tilled to a six (6) inch depth; rake in three (3) inches of top soil prior to seeding, straw placement and coir mat placement, see Section 32 90 22 – Topsoil for Streamwork.
- B. Seeding shall be per the designated limits of the planting zones and schedules as shown on the Construction Documents. Permanent seed shall be placed if it is the correct time of year for installation; see Section 32 92 30 – Specialty Seeding. Otherwise, temporary seed shall be placed per Section 31 25 00 – Erosion and Sedimentation Control. It is permissible for both temporary and permanent seed to be placed at the same time. Permanent seed mix shall be as described in the Construction Documents.
- C. A loose layer of straw shall be evenly distributed over seeded areas prior to placement of coir matting; with enough straw coverage (60% 80%) to secure seed and help maintain moisture, but not so much as to completely block sunlight and inhibit growth.
- D. The Contractor shall unroll the coir fiber matting along the slope face beginning at the toe of slope and working in a direction from downstream to upstream. The long edge of the first (bottom) row of matting shall be anchored into a twelve (12) inch deep trench, staked, then backfilled and tamped firmly.
- E. Matting shall be placed snugly (but not tightly) and in full contact with the soil with no obvious slack or wrinkles.
- F. Matting shall be "keyed" into trenches twelve (12) inches deep on the top and bottom edge of blanket and at the terminal upstream and downstream limits of coir mat. Along the bottom of the trenches, matting shall be secured with one (1) stake per three (3) L.F.
- G. Matting along the slope face shall be secured with wooden stakes placed at a minimum spacing of two (2) per square yard for slopes flatter than 2:1 and three (3) per square yard for slopes steeper than 2:1. Stakes shall be installed so that no more than two (2) inches of the stake remains above finished grade
- H. Matting blanket edges shall overlap by a minimum of twelve (12) inches; upstream on top of downstream, and upslope on top of downslope. The overlapping areas shall be secured with stakes installed at a maximum spacing of twelve (12) inches on center with stakes staggered between the edges of the top blanket and the underlying blanket.
- I. Stakes placed at the edge of blankets shall be installed no less than four (4) inches from the trenched fabric edges.
- J. After coir matting is secured, live stakes and/or other vegetation can be installed. Care must be taken by vegetation planting crews so that coir mat is not excessively damaged during planting installation. Cuts made in the matting for plant installation shall not exceed six (6) inches in length.

SECTION 35 42 63 DOUBLE LAYER SOIL LIFT

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes installation of one or more double soils lifts (SL) along a swale, stream, river, pond, lake or other waterway for slope protection.
- B. Related Sections:
 - 1. Section 01 57 52 Dewatering and Flow Diversion for Streamwork
 - 2. Section 31 00 01 Earthwork
 - 3. Section 31 23 40 Stream Bed Material for Streamwork
 - 4. Section 31 25 00 Erosion and Sedimentation Control
 - 5. Section 31 32 40 Geotextile for Streamwork
 - 6. Section 31 37 20 Stone for Streamwork
 - 7. Section 32 01 92 Watering for Streamwork
 - 8. Section 32 90 22 Topsoil for Streamwork
 - 9. Section 32 92 30 Specialty Seeding
 - 10. Section 32 93 50 Live Stakes
 - 11. Section 35 42 57 Coir Mat

1.02 SUBMITTALS

- A. Section 31 00 01 Earthwork
- B. Section 31 32 40 Geotextile for Streamwork
- C. Section 31 37 20 Stone for Streamwork
- D. Section 32 90 22 Topsoil for Streamwork
- E. Section 35 42 57 Coir Mat

1.03 QUALITY ASSURANCE

- A. Section 31 32 40 Geotextile for Streamwork
- B. Section 31 37 20 Stone for Streamwork
- C. Section 32 90 22 Topsoil for Streamwork
- D. Section 35 42 57 Coir Mat

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Fill Material: Per Section 31 00 01 Earthwork and Section 31 23 40 Stream Bed Material for Streamwork.
- B. Geotextile: Per Section 31 32 40 Geotextile for Streamwork.
- C. Footer and Terminal Stone: Per Section 31 37 20 Stone for Streamwork. Stone to be sized per the "Rock Sizing Chart" on the Construction Documents
- D. Top Soil: Per Section 32 90 22 Topsoil for Streamwork
- E. Seeding: Per Section 32 92 30 Specialty Seeding and Section 31 25 00 Erosion and Sedimentation Control for Temporary Seeding.
- F. Live Stakes: Per Section 32 93 50 Live Stakes.
- G. Coir Mat & Wooden Stakes: Per Section 35 42 57 Coir Mat.

PART 3 – EXECUTION

3.01 CONSTRUCTION/INSTALLATION

- A. Soil lifts shall be protected by a riprap foundation, rock toe or other footer protection method as indicated on the Construction Documents. The Contractor shall install toe protection/foundation in accordance with the Construction Documents and related specifications.
- B. The Contractor shall grade/excavate the soil above the installed toe protection to provide a smooth and even surface prior to constructing the soil lift structure. The excavation shall extend a minimum of three (3) foot into existing ground, and the tie-in point for the final lift shall be a minimum of two (2) feet landward from the edge of the excavation, unless otherwise described on the Contract Documents.

- C. Satisfactory soil types include ASTM D-2487 soil classification groups GW, GP, GM, SW, SP and SM or a combination of these soil groups. Soil lifts may be filled with in-situ soil if the fill material meets the requirements of this Section and related Specifications. Small grain stream bed material (SBM) described under Section 31 23 40 Stream Bed Material may be used as directed by the Construction Documents. No stones over five (5) inches in diameter may be used. Soil shall be placed in a manner to produce a reasonably homogeneous stable fill that contains no segregated pockets of large or small fragments or large unfilled spaces caused by bridging of the larger fragments. The front, stream-side face of each layer (the portion closest to the stream) shall consist of one (1) square foot of topsoil.
- D. Soil shall be spread into place in approximately horizontal layers not more than twelve (12) inches in thickness. The contractor shall assure adequate compaction (90% Standard Proctor) and a 90° flush stream-side face. The front, stream-side, one square foot of topsoil shall have a reduced (80% Standard Proctor) compaction requirement zone to facilitate vegetative growth and root establishment. Lightly scarify the top 1/4-inch of topsoil using a leaf rake or similar method after compaction; note that all exposed soil facing will have been compacted to the lesser (80%) value. Place straw and seed as described below.
- E. Straw, temporary seed and permanent seed (if SL is installed during appropriate permanent seeding season) shall be installed between the soil and coir matting on the exposed faces of the lifts (both horizontal and vertical) and tie-in slopes.
- F. Soil lifts shall consist of two layers of matting of different materials. The inner mat layer is to consist of a biaxial grid geotextile (Tensar BX1100 or approved equal). The outer mat is to consist of a coconut fiber coir mat (RoLanka Bio-D 70 or approved equal).
- G. Place a minimum length of six (6) feet of coir mat, laying excess over the form limit. Place grid geotextile next over coir mat, laying excess over form limit. Place fill material and twelve (12) inches of topsoil, compact in place and lightly scarify surface. Place seed and straw as previously described. Fold back excess grid geotextile and coir mat over compacted material to secure top of soil lift. Use hardwood stakes to secure matting in place. Move forms for next soil lift and repeat for remaining layers. Slope of streamside face shall be per Construction Documents. Soil lift layers shall overlap layer below by a minimum of three (3) feet. Additional hand forming may be required to ensure proper shape of the finished lift.
- Wooden stakes shall consist of rough sawn hardwood, triangular in shape, approximately two (2) inch by four (4) inches in cross section and eighteen (18) inches in length.
- I. Live stakes/cuttings shall be placed side by side between soil lifts, perpendicular to the flow of water down the entire length of the soil lift structure. Live stakes shall be installed at baseflow water surface elevation to a height of no more than two (2) feet vertically from baseflow unless otherwise directed by the Construction Documents.

- J. Final soil lift shall tie into existing ground at a 2:1 or flatter slope, and coir matting shall be staked into existing ground a minimum of two (2) feet landward from the edge of the excavation.
- K. The Contractor shall thoroughly water the entire soil lift structure upon completion. No areas of settling greater than six (6) inches shall be permitted.
- L. Once placed, soil lifts shall not be driven over with heavy equipment.
- M. Extreme care must be taken by vegetation planting crews so that coir mat and geotextile is not excessively damaged during plant installation. At no time can the mat be cut more than three (3) inches.

SECTION 35 42 72 WOOD TOE

PART 1 – GENERAL

1.01 SUMMARY

- A. Wood Toe structures are usually installed as bank protection along stream bends where stream scour is anticipated or desired. The Contractor shall furnish all labor, material and equipment required to install Wood Toe structures as described in these technical specifications and shown on the Construction Documents. This work shall consist of transporting, installing and maintaining during construction. Note that Wood Toe is to be constructed from trees harvested from on-site, unless otherwise denoted on the Construction Drawings.
- B. Related Sections:
 - 1. Section 01 57 52 Dewatering and Flow Diversion for Streamwork
 - 2. Section 31 00 01 Earthwork
 - 3. Section 31 13 20 Wood for Streamwork
 - 4. Section 31 37 20 Stone for Streamwork
 - 5. Section 32 93 50 Live Stakes
 - 6. Section 35 42 63 Double Layer Soil Lift

1.02 SUBMITTALS

- A. Per Section 31 13 20 Wood for Streamwork
- B. Per Section 31 37 20 Stone for Streamwork
- C. Product data for cabling and/or anchors if required

1.03 QUALITY ASSURANCE

- A. Per Section 31 13 20 Wood for Streamwork
- B. Per Section 31 37 20 Stone for Streamwork

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Logs: Per Section 31 13 20 Wood for Streamwork.
- B. Stone: Source per Section 31 37 20 Stone for Streamwork. Stone to be sized per the "Rock Sizing Chart" on the Construction Documents.
- C. Dead men (if required) Manta Ray MR-1 or approved equal.
- D. Cabling (if required) 1/8-inch diameter stainless steel.

PART 3 – EXECUTION

3.01 CONSTRUCTION

- A. Wood Toe is to be constructed "in the dry" why baseflow is pumped around the installation area. Ends of logs are to be cut flush (no root wads) but packing branches can have smaller sub branches.
- B. Wood Toe shall be constructed by excavating a trench slightly larger than the overall dimensions for the structure. Do not place filter cloth. After excavation, examine subgrade and notify Engineer if conditions (e.g., muck, bedrock outcrops, excessive groundwater) are observed.
- C. Install initial layer of stream bed material mix (SBM) to a minimum depth of 6 inches; size and gradation of SBM shall be per the Rock Sizing Chart on the Construction Documents.
- D. Install the foundation logs at angle alpha with the proposed thalweg. If not otherwise specified on the plans, the gap between footer logs should be no more than 12 inches.
- E. Backfill between the foundation logs with branches from harvested onsite trees (4 to 8 inches in diameter, cut to a variety of lengths not to exceed the length of the foundation logs and be no shorter than 4 feet. Backfill the remaining voids with SBM until the top of the foundation logs is at the same grade.
- F. Install top logs perpendicular to proposed thalweg and backfill with branches and then SBMM.
- G. Install additional revetment above the placed Wood Toe [e.g., double layer soil lift (Section 35 42 63 Double Layer Soil Lift), etc.] per the appropriate Specification.
- H. Remove unsuitable and surplus wood, rebar, fabric, rocks and excavated materials to fill areas or locations outside the limits of the project area per the approved sediment and erosion control plans.

SECTION 35 43 63 RIFFLE GRADE CONTROL (RGC)

PART 1 – GENERAL

1.01 SUMMARY

- A. This work shall consist of procuring, transporting and installing Riffle Grade Control (RGC) structures along the channel as specified in the Contract Documents. Width, length and grade vary as described in the Contract Documents.
- B. Related Sections:
 - 1. Section 31 13 20 Wood for Streamwork
 - 2. Section 31 23 40 Stream Bed Material for Streamwork
 - 3. Section 31 37 20 Stone for Streamwork
 - 4. Section 35 42 57 Coir Mat

1.02 SUBMITTALS

- A. Per Section 31 37 20 Stone for Streamwork
- B. Per Section 35 42 57 Coir Mat

1.03 QUALITY ASSURANCE

- A. Contractor shall forward gradation analyses from the stone supplier for each size of stone media used on the project.
- B. Grading tolerance for upstream and downstream RGC "X" and "Y" inverts are plus or minus 0.1 feet unless otherwise specified on the Contract Documents.
- C. Average riffle stone depth (Ds), stone height (Hs), and design widths (e.g., W1) shall be measured at the midpoint of the RGC (halfway between inverts "X" and "Y") and all measurements shall be plus or minus 0.1 feet vertically and 0.5 foot horizontally.

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PART 2 – PRODUCTS

2.01 MATERIALS

- A. Base Stone: The RGC structures shall be placed on a bed of base stone unless otherwise indicated by the Contract Documents. Base stone shall meet the tenets of Section 31 37 20 – Stone for Streamwork.
- B. Riffle Grade Stone: This layer of stone shall be per the "Rock Sizing Chart" on the Contract Documents. Stone shall meet the tenets of Section 31 37 20 – Stone for Streamwork. If a mix or combination of sizes are required, all stone sizes shall be assembled onsite either for pre-mixing (combining) or staggered placement (alternating bucket placement followed by immediate hand or mechanical mixing).
- C. Wood: Per Section 31 13 20 Wood for Streamwork.
- D. Stream Bed Material (SBM): Per Section 31 23 40 Stream Bed Material.
- E. Coir Mat: Per Section 35 42 57 Coir Mat.

PART 3 – EXECUTION

3.01 CONSTRUCTION

- A. If a utility crossing will occur within the RGC, perform pipe installation, rehabilitation or replacement work and install necessary internal or external pipe protection prior to RGC work.
- B. Construct upstream and downstream grade control for RGC (if required per the Contract Documents) prior to installing the RGC.
- C. RGC's will be constructed by either excavating or filling to establish subgrade elevation to place base stone. *Do not use filter cloth* unless specifically directed in the field by the Engineer. Grade subgrade for RGC placement.
- D. Scarify subgrade using excavator bucket teeth or similar method.
- E. If required by the Contract Documents, place base stone. The thickness of the base stone shall be a minimum of six inches from the top of the subgrade to the bottom of the RGC stone and sized per the "Rock Sizing Chart" on the Contract Documents. The base material shall be laid directly on the subgrade. Place base stone layer per thicknesses, dimensions and depths as described by the Contract Documents.
- F. Lay out coir mat and stake into place on subgrade utilizing riffle grade control stone to secure toe as shown on the Construction Documents. Work/hand-tamp topsoil into the voids of the riffle grade stone that will be protected by coir mat.

- G. Place riffle grade stone per thicknesses, dimensions and depths as described by the Contract Documents. If a mix or combination of sizes are required, all stone sizes shall be assembled onsite either for pre-mixing (combining) or staggered placement (alternating bucket placement followed by immediate hand or mechanical mixing).
- H. If random boulders are required, they shall be installed a minimum of 24 inches away from coir mat interface.
- I. If required, chink placed riffle grade stone with SBM or other material as specified on the Contract Documents. SBM (or other specified material) shall be washed into riffle grade control stone voids. Where insufficient supply exists to reuse stockpiled SBM, contractor shall provide SBM. Lower lifts of riffle shall be backfilled with SBM and upper 6 to 9 inches lift shall be chinked with reused stockpiled SBM to ensure surface flow.

SECTION 35 43 65 ROCK CROSS VANE (CV)

PART 1 – GENERAL

1.01 SUMMARY

- A. The Contractor shall furnish all labor, material and equipment required to install rock cross vanes as described in these technical specifications and as shown on the Contract Documents. This work shall consist of transporting materials and installing and maintaining rock cross vanes within the stream channel for the purpose of grade control and to protect banks from excessive scour.
- B. Related Sections:
 - 1. Section 01 57 52 Dewatering and Flow Diversion for Streamwork
 - 2. Section 31 00 01 Earthwork
 - 3. Section 31 32 40 Geotextile for Streamwork
 - 4. Section 31 37 20 Stone for Streamwork

1.02 SUBMITTALS

- A. Per Section 31 32 40 Geotextile for Streamwork
- B. Per Section 31 37 20 Stone for Streamwork

1.03 QUALITY ASSURANCE

- A. Per Section 31 32 40 Geotextile for Streamwork
- B. Per Section 31 37 20 Stone for Streamwork
- C. Grading tolerance for upstream and downstream thalweg inverts is plus or minus 0.1 feet.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Stone: Source per Section 31 37 20 – Stone for Streamwork. Stone to be sized per the "Rock Sizing Chart" on the Contract Documents. B. Filter Fabric: Per Section 31 32 40 – Geotextile for Streamwork and/or as specified on the Contract Documents. If not specified on Contract Documents, fabric to be Mirafi 160N or approved equal.

PART 3 – EXECUTION

3.01 CONSTRUCTION

- A. Rock cross vanes shall be constructed by over-excavating a trench slightly larger than the overall dimensions for the structure and to depths required to achieve design elevations shown on the Contract Documents. Filter fabric is to be placed on the subgrade surface to wrap underneath as well as the entire upstream face of the structure, including the tie-in sills. Fabric layers shall overlap a minimum of two feet. Torn or damaged geotextile shall be replaced at the Contractor's expense in a manner acceptable to the Engineer. Enough excess filter fabric should be placed so that after complete construction and backfill, approximately six inches of fabric visibly overlaps the top surface of the structure. Exposed filter fabric in excess of six inches shall be trimmed so that only six inches remains.
- B. The placement of footer rocks should immediately follow the fabric placement. Each layer of footer and additional stacked rocks shall be shingled upstream at a 6:1 (horizontal: vertical) angle or as specified on the Contract Documents. Contractor shall place all rocks so that they interlock and abut. Rocks shall be seated firmly and shall not rotate in place. On unstable bed substrates (e.g., silt loam or sand), two or more tiers of footer rocks may be required to prevent the downstream face of the vane from being undermined; consult the Design Engineer for direction.
- C. The top layer of the rocks shall rest upon at least one tier of footer rocks such that each top rock rests upon two halves of each footer rock below it. Care should be taken when placing vane rocks so that the seams between the top rocks are offset from the seams between the footer rocks. In no case shall the overlap (contact) between layers be less than six (6) inches. Top rocks shall be tight fitting with no voids or gaps larger than one inch to establish surface flow and interconnection of rocks; chinking is not an acceptable way to address this issue.
- D. Top rocks along the vane apex shall be flush with the top surface of adjacent stones to create a uniform sill at elevation shown on the Contract Documents. Similarly, the cross vane arm rocks shall be flush at the surface along the length of the arm per the left and right design vane slopes as described on the Contract Documents.
- E. After filter fabric is secured, trench shall be backfilled with riffle grade control stone, streambed material mix or other material as shown on the Contract Documents. Stone sizing shall be per the "Rock Sizing Chart" on the Contract Documents.
- F. When vanes are placed in 'fill' conditions, an additional piece of filter fabric shall be installed on the upstream face of the vane and shall terminate vertically at the original stream grade to prevent tunneling and potential undermining or failure of the structure.

- G. Vane stones shall be boulders with rectangular block shape with a minimum D50 dimension of 18 inches *or* one-half the median axis dimension (whichever is greater) as specified in the Rock Sizing Chart on the Contract Documents or as otherwise noted on the Contract Documents.
- H. Vane Apex: Vanes are constructed such that the apex of the structure points upstream. The vane apex is located within the center section of the stream and is to be approximately 1/3 the width of the top of the channel bank (bankfull width). The apex or upstream limit of the vane shall be installed with a stone or stones larger than that of the arm stones (generally 50% to 100% larger than the D50 of the arm stone). This stone(s) is to be flat on the top surface of the exposed face.
- I. Vane Arms: The vane arms shall be horizontally angled 20 to 30 degrees from the upstream bank or as shown on the Contract Documents so that flows are directed away from the banks and deeper pool areas are maintained directly downstream of the cross vane. The vane arm shall be placed at 2% to 7% vertical slope from the vane apex to the stream bank tie-in or as shown on the Contract Documents. The bank-end of the vane arms shall tie in at the elevation shown on the Contract Documents.

SECTION 35 43 69 ROCK CASCADE

PART 1 – GENERAL

1.01 SUMMARY

- A. The Contractor shall furnish all labor, material and equipment required to install rock cascades as described in these technical specifications and shown on the Construction Documents. This work shall consist of transporting, installing and maintaining vanes/weirs within the stream channel for the purpose of grade protection.
- B. Related Sections:
 - 1. Section 01 57 52 Dewatering and Flow Diversion for Streamwork
 - 2. Section 31 00 01 Earthwork for excavation necessary to install the vanes/weirs.
 - 3. Section 31 32 40 Geotextile for Streamwork
 - 4. Section 31 37 20 Stone for Streamwork

1.02 SUBMITTALS

- A. Per Section 31 32 40 Geotextile for Streamwork.
- B. Per Section 31 37 20 Stone for Streamwork.

1.03 QUALITY ASSURANCE

- A. Per Section 31 32 40 Geotextile for Streamwork.
- B. Per Section 31 37 20 Stone for Streamwork.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Stone: Source per Section 31 37 20 Stone for Streamwork. Stone to be sized per the "Rock Sizing Chart" on the Construction Documents.
- B. Non-woven Filter Cloth: Per Section 31 32 40 Geotextile for Streamwork and/or as specified on the Construction Documents. If not specified on Construction Drawings, cloth to be Mirafi 160N or approved equal.

PART 3 – EXECUTION

3.01 CONSTRUCTION

- A. Have any baseflow temporarily pumped around the cascade installation work area.
- B. Cascade shall be constructed by excavating a trench slightly larger than the overall dimensions for the structure and examine subgrade. If conditions are adverse (e.g., muck, flowing groundwater) immediately contact the Engineer prior to proceeding.
- C. Filter cloth is to be placed on the sub-grade surface and along the streambank parallel to the direction of stream flow. Geotextile torn or damaged shall be replaced or repaired at the Contractor's expense in a manner acceptable to the Engineer.
- D. Place #57 stone to allow for installation of cascade stone on a layer by layer basis.
- E. Install the footer rocks (multiple layers may be required as detailed on the Construction Documents) along the proposed stream bank toe, installing the first and last sections (in plan view) at a 15 to 30-degree angle back into and underneath the proposed bank. If multiple layers of footer stones are required, they are to overlap at a 1:1 slope. All footer and cascade stone to be installed at a 6:1 slope versus the proposed stream bank to ensure stones are secure against overturning. Drop stone may be installed now or at the completion of the cascade.
- F. Install first layer of cascade stone to sit on top of top footer stone overlapping such that 75% of the footer stone is covered. Install subsequent layers working upslope. Either install stones end to end or overlap per the Construction Documents. Drops between stones not to exceed 12 inches.
- G. Install coir mat at cascade/slope boundary so that coir mat is keyed in adjacent to the newly placed stones.
- H. Ensure that the upstream transition between the flood plain and top of cascade is equal vertically and that sloping of the flood plain with coir mat is completed so that side flow across the flood plain is channeled to the cascade.
- I. Chink cascade with #57 stone or larger size if called for on the Construction Documents.
- J. Remove unsuitable and surplus fabric, rocks and excavated materials to fill areas or locations outside the limits of the project area per the approved sediment and erosion control plans.

SECTION 35 43 74 LOG J-HOOK (LJH)

PART 1 – GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish all labor, material and equipment required to install log J-hooks (LJH) as described in these technical specifications and as shown on the Contract Documents. This work shall consist of transporting materials and installing LJHs within the stream channel for the purpose of grade control and to protect banks from excessive scour.
- B. Related Sections:
 - 1. Section 01 57 52 Dewatering and Flow Diversion for Streamwork
 - 2. Section 31 00 01 Earthwork
 - 3. Section 31 13 20 Wood for Streamwork
 - 4. Section 31 23 40 Stream Bed Material
 - 5. Section 31 32 40 Geotextile for Streamwork
 - 6. Section 31 37 20 Stone for Streamwork
 - 7. Section 35 42 57 Coir Mat
 - 8. Section 35 43 63 Riffle Grade Control

1.2 SUBMITTALS

- A. Per Section 31 13 20 Wood for Streamwork
- B. Per Section 31 32 40 Geotextile for Streamwork
- C. Per Section 31 37 20 Stone for Streamwork
- D. Product data for cabling and earth anchors

1.3 QUALITY ASSURANCE

- A. Per Section 31 13 20 Wood for Streamwork
- B. Per Section 31 32 40 Geotextile for Streamwork
- C. Per Section 31 37 20 Stone for Streamwork

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- D. The structure surfaces shall be even and assembled with a generally neat appearance. There shall be no undulating slopes, visible gaps larger than 1 inch, or noticeable protrusions or breaks in the structure's form that could impact the performance or longevity.
- E. Grading tolerance for individual rocks and logs within the finished installations shall be plus or minus 0.5 feet (horizontal) and 0.1 feet (vertical) from the location and grades shown on the plan set.
- F. Grading tolerance for upstream and downstream thalweg inverts is plus or minus 0.1 feet. Where elevations impact specified design slopes, the total difference between the critical elevations that define the slope shall not exceed 0.1 feet.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Logs: Per Section 31 13 20 Wood for Streamwork.
- B. Filter Fabric: Per Section 31 32 40 Geotextile for Streamwork and/or as specified on the Contract Documents. If not specified on Contract Documents, fabric to be non-woven Mirafi 160N or approved equal.
- C. Stone: Source per Section 31 37 20 Stone for Streamwork. Stone to be sized per the "Rock Sizing Chart" on the Contract Documents.
- D. Nails: two inch galvanized ring-shank roofing nails.
- E. Earth Anchor –McLean Power Systems Duckbill earth anchor (or approved equal) shall meet the following criteria: see Construction Documents for Duckbill Anchor model requirements.

Duckbill Anchor	Capacity (Ibs)	Duckbill Anchor Weight	Steel Cable	Wire Rope Breaking Strength
Model 40	0 - 300 lbs	1 oz	1/16-in 7 x7 GAC	480 lbs
Model 68	300 - 1050 lbs	4.5 oz	1/8-in 7 x 7 GAC	1700 lbs
Model 88	1050-3000 lbs	14 oz	1/4-in 7 x 19 GAC	7000 lbs
Model 138	3000-4950 lbs	2.5 lbs	5/16-in 7 x 19 GAC	9800 lbs

Table 1: Minimum Required Anchor and Cable Properties

F. Cabling – 1/8-inch diameter stainless steel with locking bolts.

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PART 3 – EXECUTION

3.1 CONSTRUCTION

- A. Excavate down to lowest elevation of proposed footer placement. Once subgrade and footer base elevation is approved, excavate a trench slightly larger than the overall dimensions for the LJH structure. Should unsuitable subgrade conditions be identified, contact the Engineer immediately; additional footer rock or log layers may be required whose number, size and location will be as directed by the Engineer. The Contractor will be compensated for labor and material costs associated with additional footer rock or log placement beyond what was specified on the Contract Documents per unit pricing identified on the Contract Documents.
 - 1. Filter fabric is to be placed on the sub-grade surface to wrap underneath the LJH footer logs as well as cover the upstream face. Each fabric layer shall overlap a minimum of two (2) feet. Torn or damaged geotextile shall be replaced or repaired at the Contractor's expense in a manner acceptable to the Engineer. Enough excess filter fabric should be placed so that after complete sill construction and backfill, a minimum of six inches still visibly overlaps the top of the structure.
- B. The placement of footer rocks and logs should immediately follow the fabric placement. Rocks are used to form the apex or "hook" and logs are utilized for the LJH arm. Either rock or logs can be used for the tie-in sills as specified on the Contract Documents. Each layer of footer and additional stacked rocks shall be shingled upstream at a 6:1 (horizontal: vertical) angle or as specified on the Contract Documents. Footer logs for the LJH arm shall be horizontally angled 20 to 30 degrees and placed at 2% to 7% vertical slope from apex to the stream bank tie-in or as shown on the Contract Documents. Contractor shall place all rocks so that they interlock and abut with adjacent rocks and logs. Rocks and logs shall be seated firmly and shall not rotate in place. Logs that cross one another at an angle shall utilize a saddle notch (e.g. curved semi-circular cut scribed with a chainsaw) at the end of the log to fit the log it crosses below.
- C. Where rock is placed, the top layer of the rocks shall rest upon at least one tier of footer rocks such that each top rock rests upon two halves of each footer rock below it. Care should be taken when placing top rocks so that the seams between the top rocks are offset from the seams between the footer rocks. In no case shall the overlap (contact) between layers be less than six (6) inches. Top rocks shall be tight fitting with no voids or gaps larger than one inch to establish surface flow and interconnection of rocks; chinking is not an acceptable way to address this issue.
- D. The top logs shall have a flush connection with the footer logs with no gaps between the logs.
- E. Top rocks along the LJH apex and sill shall be flush with the top surface of adjacent stones and logs to create a uniform sill at elevation shown on the Contract Documents. Similarly, the LJH arm log shall be flush at the surface where it meets the rock apex for a smooth transition from the hook to the arm.

- F. Unless shown otherwise on the Contract Documents, duckbill earth anchors and cabling, shall be used to secure logs. Anchors and cabling should be installed at a minimum of 3 locations (upstream end, middle point, and downstream end). Spacing should not exceed more than 10 feet. Anchors shall be installed to depth specified in Contract Documents or per manufacturer's recommendations.
 - 1. Driving Anchor: Insert the drive steel into the anchor body. Use a sledgehammer, fence post driver or a power-driven jackhammer to drive the anchor to the proper depth. Fill hole made by anchor with soil allowing water to seep down to the anchor, causing wedge out or hardening soil.
 - 2. Locking Anchor: Once anchor has been driven to depth, the drive steel is retracted from the anchor. Pull back on the anchor cable to toggle the anchor into the perpendicular (anchorlocked) position. In average soils the length of pull should equate to the length of the anchor. For example: Model 88 anchor body measures 6" inches. A pull of 5-6" will rotate the anchor into a completely perpendicular position. Several methods can be used to anchor lock the anchors including anchor locking by hand, use of jacks, come-alongs, fence stretchers, center hole hydraulic cylinders, and load lockers. No matter what method is used, it is critical that the anchor be properly locked before tying off the object to be anchored.
- G. Buttress rocks shall be placed on the top of the bank-end of vane arms to secure logs. Stone sizing shall be per the "Rock Sizing Chart" on the Contract Documents.
- H. Filter fabric shall be securely fastened to the upstream face of the top log for the entire length of the vane arm using galvanized roofing nails spaced no less than twelve inches apart. Fabric shall also be nailed to the upstream face of sill logs.
- I. When LJHs are placed in 'fill' conditions, an additional piece of filter fabric shall be installed on the upstream face of the vane arm and shall terminate vertically at the original stream grade to prevent tunneling and potential undermining or failure of the structure.
- J. After filter fabric is secured, trench shall be backfilled with riffle grade control stone, streambed material mix or other material as shown on the Contract Documents. Stone sizing shall be per the "Rock Sizing Chart" on the Contract Documents. Coir matting shall be laid out as shown on the Contract Documents and "keyed" in along the toe of the stream side edge of the matting per Section 35 42 57 Coir Mat.
- K. Apex stones: The apex stones shall be block-like with two roughly parallel opposite sides and a minimum D50 dimension of 18 inches or as specified in the Rock Sizing Chart on the Contract Documents or as otherwise noted on the Contract Documents.
- L. Log J-Hook Apex: LJHs are constructed such that the apex of the structure points upstream. The LJH apex is located within the center section of the stream and is to be approximately 1/3 the width of the top of the channel bank (bankfull width).

- M. Log J-Hook Arm: The LJH arm shall be placed on top of the footer and shall be horizontally angled 20 to 30 degrees from the upstream bank or as shown on the Contract Documents so that flows are directed away from the banks and deeper pool areas are maintained directly downstream of the j-hook. The LJH arm log shall be placed at 2-7% vertical slope or as shown on the Contract Documents. The bank-end of the LJH arm shall tie in at the elevation shown on the Contract Documents and the upstream end of the LJH arm shall be buried beneath the streambed to the length and depth specified on Contract Documents.
- N. Rootwad: placement of rootwad to anchor the log j-hook arm in place at stream bank. Rootwad size, species, and placement shall be as described in the construction documents.
- O. Sills: Sills, composed of logs or rocks, shall be embedded into the inside bank at the upstream hook and into the outer bank at the downstream end of the LJH arm at the locations and elevations shown on Contract Documents. Sills shall include footers installed to the same depth as the rest of the structure.
- P. Buttress Rock: The placement of buttress rocks shall be according to the LJH detail or as shown on Contract Documents. Stone sizing shall be per the "Rock Sizing Chart" on the Contract Documents. Buttress rocks shall be placed so that they interlock with logs, and are seated firmly and do not rock or rotate in place.
- Q. Transition Stone: Stone shall be placed on the downstream face of the LJH Apex and Arm to provide a transition from the top surface of the LJH to the downstream pool. Stone shall be sized per the Rock Sizing Chart and chinked adequately to provide stability.
- R. Scour Pool Stone: Stone shall be placed to the extents of the scour pool and at elevations shown on the Contract documents. Stone shall be sized per the Rock Sizing Chart as well as installed to the specified depth and chinked as shown on the Contract Documents.