SECTION 321 – STREAM RESTORATION

321.01 DESCRIPTION

Work includes all labor, material, and equipment to construct stream restoration (e.g., in-stream revetments, streambank treatments, etc.), the purpose of which is to create stable, environmentally acceptable constructed stream conditions. The stream restoration work shall include, but not be limited to, streambank stabilization, grade control, vegetative establishment, and aquatic habitat enhancement. This specification further describes work indicated on plans and details. Other restrictions and requirements indicated in project permits shall also apply. All work is to be field adjusted based on channel conditions at the time of construction to meet design intent and ensure long term channel stability.

321.02 REFERENCE STANDARDS

The most restrictive requirements of the latest publications of the following specifications will be complied with for this project:

ASTM	Standard – C33, C136, D2487, D4355, D4491, D4533, D4571, D4632, D6241
MDE	Maryland's Waterway Construction Guidelines, latest revision Best Management Practices for Working in Nontidal Wetlands, Wetland Buffers, Waterways, and 100-Year Floodplains
MDSHA	Standard Specifications for Construction and Materials, July 2019 or latest edition – 901, 919
M-NCPPC	Section 111 – As Built Drawings (Record Drawings) Section 330 – Fish Relocation (by M-NCPPC) Section 721 – Tree Preservation Section 723 – Landscape Soil

321.03 DEFINITIONS

Not applicable.

321.04 MATERIALS

A. Compacted Fill: Satisfactory soil types for compacted fill include ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP and SM or a combination of these soil groups. Soil shall be free of debris, waste, frozen materials, and other deleterious matter.

B. Topsoil/Compost: Topsoil and Compost shall meet M-NCPPC Section 723 – Landscape Soil.

C. Wood and Woody Organic Matter: Unless specifically shown on plans, all trees and woody growth slated for removal shall either be reused within the stream channel or riparian enhancement areas, removed offsite or chipped and spread onsite as directed by the M-NCPPC Construction Manager (CM).

Root wads shall consist of a non-decaying, unused 8-foot (minimum) log, 12 to 36 inches in diameter, with a root ball attached (minimum 48 inches in diameter). All root wad material shall be approved by the M-NCPPC CM prior to installation.

D. Stabilization Matting: Unless specified otherwise on the plans or details, all erosion control matting (ECM) shall be Rolanka BioD-Mat 70 (https://rolanka.com/product/biod-mat-70-woven-bristle-coir-mat/), or approved equal.

Any and all matting containing monofilament and/or plastics of any kind is not permitted for use on Parkland.

All matting, sod, and other materials are to be secured using biodegradable stakes. Metal sod staples are not permitted for use on Parkland.

E. Imbricated Stone: Imbricated stone shall conform to MDSHA rock sizes (Section 920). Rocks must have a density of greater than 160 lbs / cu. ft. and be comprised of angular stones. Concrete or white rock will not be accepted. Imbricated stone deliveries shall be approved by the M-NCPPC CM prior to installation to ensure conformance with intermediate axis measurements defined on the plans.

Stone of serpentine origin is not permitted for use on Parkland.

F. Aggregate: Bed Stability Mix (BSM) consists of a graded rock mixture and boulders to support surface flow of the stream. BSM composition is defined on the plans and all stone material sizes shall conform with MDSHA Section 901.

In addition to conformance with MDSHA Section 901 (Tables 901 A and B), aggregate must conform to the following ASTM/AASHTO gradation table (M 43). Washed aggregate and river rock/gravel must also conform to ASTM C-33.

G. Geotextile Filter Fabric (Non-Woven): In addition to conformance with MDSHA Subsection 919, non-woven geotextile filter fabric must conform to 919.01, Application E, in the MDE "2018 Maryland Standards and Specifications for Soil Erosion and Sediment Control." The fabric must have minimum grab strength of 200 pounds and minimum puncture strength of 450 pounds.

H. Riparian Seed Mix: Riparian seed mix shall be applied at a rate of 20 lbs/acre of pure live seed native species. M-NCPPC Riparian Seed Mix consists of:

25% Creeping red fescue (Festuca rubra)
20% Virginia wild rye (Elymus virginicus)
15% Purple top (Tridens flavus)

30% Riverbank wild rye (Elymus riparius)
10% Deer tongue grass (Diachanthelium clandestinum)

In addition, native riparian seed mix should be supplemented with a minimum of 30 lbs/acre annual rye OR cereal oats OR cereal barley (Lolium multiflorum) as an erosion control/quick stabilizer.

All straw mulch applied on top of seed shall be weed-free.

321.05 SUBMITTALS

A. Contractor must submit to M-NCPPC a list with reference of three (3) projects of similar magnitude, where this type of work has been completed within the last five (5) years.

B. Provide submittals for source of supply of all materials used for stream restoration as shown on the plans.

C. Contractor must submit redline as-builts (signed and sealed by an Engineer in the State of Maryland) to the M-NCPPC CM for review and approval. See M-NCPPC Specification 111 – As Built Drawings (Record Drawings).

321.06 QUALITY ASSURANCE

A. Finished surfaces must be held to tolerances of 0.5 feet laterally or 0.1 foot in elevation unless otherwise specified.

B. The contractor must be familiar with and shall implement best practices as outlined in MDE's Guidelines to Waterway Construction.

C. The contractor shall always have at least one representative on-site with authority over work who has successfully completed the MDE Responsible Personnel Certification (RPC) training course and can provide upon request their RPC number and date completed.

321.07 CONSTRUCTION

A. All construction shall take place "in the dry" using Maryland Department of Environment approved stream diversion techniques to dewater the construction area and minimize downstream sediment. Contractor is responsible for control of water throughout construction, including stream flows and runoff through disturbed areas. Contractor shall comply with M-NCPPC Section 330 – Fish Relocation (by M-NCPPC).

In-stream areas where pump-around is removed at the end of the workday must be completed and stabilized daily. Disturbed areas above baseflow shall receive native riparian seed mix and weed-free straw mulch at the end of each workday. Once stream flow is re-established at the end of the workday, the contactor shall allow sufficient time to inspect the new flow pattern and make appropriate adjustments to ensure non-erosive conditions before vacating the site.

B. Contractor shall implement MDE Waterway Construction Guidelines and MDE Best Management Practices for Working in Nontidal Wetlands, Wetland Buffers, Waterways, and 100-Year Floodplains.

C. Contractor shall lay out critical points of structure (centerline stations, offsets, elevations etc.) to review with the M-NCPPC CM prior to structure installation. All dimensions, orientations, and elevations shall be field adjusted prior to installation in coordination with the M-NCPPC CM to ensure proper orientation, stable installation, fish passage, and smooth tie-in to adjacent features, as well as to minimize disturbance to trees/tree roots an ensure functionality of completed construction. Contractor shall maintain proper equipment on-site to check grades as construction progresses. Contractor shall be responsible for maintaining stakeout during construction until final acceptance by the M-NCPPC CM.

D. Footer rocks shall utilize material from the largest 50^{th} percentile of material class specified on the plans. Footer rocks shall be placed so top surface angles towards the upstream/outmost edges of structure in order to better allow for secure placement of top rocks.

E. Construction of in-stream revetments, including grade control, bank stabilization and aquatic habitat structures, shall be inspected by the M-NCPPC CM under baseflow (not pump-around) conditions to determine any modifications required prior to acceptance. Additional inspections following storm events may result in additional minor modifications. Contractor is encouraged to utilize construction equipment for compaction of completed structures to ensure stability, as well as small pumps to wash in material after the completion of each structure.

F. Completed grade control structures shall have surface flow over the apex during baseflow conditions with consistent arm slopes up from the apex to a stable sill tie-in at bankfull location into existing ground. Riffles shall have surface flow along the thalweg throughout the entire riffle length and stable tie-ins to bankfull locations and upstream and downstream channel. Contractor is responsible for ensuring smooth transitions at upstream and downstream ends of work areas and between the streambed and its banks.

G. All exposed stone (including stone toe, imbricated rock walls, rock packs, etc.) above bankfull depth shall be backfilled with topsoil/compost to within 2-inches of rock surface and vegetated with native riparian seed and mulched with weed-free straw.

H. Voids should not be left in any completed in-stream structures. Continuous filter fabric

shall be placed under and along upstream face of all imbricated rock structures. Imbricated rocks shall tightly abut each other, and structures should be backfilled with BSM and/or streambed mix to fill all voids, including hand placement of stone.

I. Completed streambed profile shall not have revetment drops greater than 0.5' and constructed riffles shall not be steeper than 3% to ensure fish passage, unless otherwise indicated on the plans or approved by the M-NCPPC CM. Contractor will be required to modify/augment constructed revetments that create fish passage restrictions at baseflow, as directed by M-NCPPC CM.

J. Any disturbed banks shall be seeded with Native Riparian Seed and stabilized with weed-free straw mulch. Erosion control matting shall be installed as directed by the M-NCPPC CM.

K. Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, and/or skinning and bruising of bark or excavated materials. Contractor shall coordinate all tree protection measures and tree removals with the M-NCPPC CM prior to construction. Protection measures, such as hardwood mats, tree planking, root aeration matting, equipment restrictions, mulch roads, tree protection fencing, root pruning, etc. must be installed before equipment enters work areas. Additional tree protection measures not indicated on the plan set may be required at the direction of the M-NCPPC CM. All requirements of Section 721 Tree Preservation must be observed.

L. Access routes and staging areas shall be field adjusted with Parks to minimize impacts to natural resources. Equipment restrictions (e.g., < 8 PSI loaded ground pressure) may be required by M-NCPPC in sensitive areas. Access routes will be limited to 12' width, unless otherwise shown on the plans. Access routes shall be removed and restored as directed by the M-NCPPC CM upon construction completion.

M. Riffle Grade Control (RGC):
    1. Where existing channel grades are below thickness of RGC, salvage top 1' of native streambed material. Backfill with common borrow and compact up to RGC subgrade. Use BSM to construct RGC and integrate approved salvaged material for the top lift of RGC.
    2. Set largest material first in a checkerboard pattern. Final top elevations of larger boulders shall be 0.5' +/- above finished thalweg in order to provide flow variety throughout the riffle. Boulders to be at least 2/3 buried. Set largest (generally Class II/III) material concentrated near the riffle crest and tail to hold grade.
    3. Use next smallest material (generally Class 0/I) to backfill voids between largest stones.
    4. Install and compact BSM lifts not to exceed 1.5'.
    5. Wash streambed material and/or bank-run gravel into each lift to fill rock voids and ensure surface flow. Reserve salvaged native streambed material to be used in upper-most lift.

N. Restore any improvements damaged by this work to their original condition, as acceptable to the M-NCPPC CM or other parties or authorities having jurisdiction.

321.08 MEASUREMENT AND PAYMENT

Payment will be full compensation for all material, labor, equipment, tools and incidental items necessary to complete the work. Payment shall be made as shown in the bid proposal. ECM shall be paid based on the quantity of matting installed, with stakes incidental to the installation of the matting. Live Stakes shall be paid by actual number of stakes installed. Rock Sills, Cross Vanes, J-Hooks, Small Cross Vanes, Stone Toes, Riffle Grade Controls, Soil Lifts, Root Wads and other streamwork shall be paid for based on the quantity of material utilized for construction or as shown on the bid proposal. Excavation, backfill, labor, coordination of structure layout, bedding stone, drainage/scour stone, geotextile filter fabric, stakes, and other materials and labor required for complete installation or any structure shall be considered incidental to the costs of the revetments. Fish Relocation (by M-NCPPC) and Maintenance of Stream Flow are separate pay items as shown in the bid proposal.