## SPSRW-XX: STEP POOL STRUCTURE

Version Date: 05/22/2015 Revision Date: XX/XX/XXXX by XXX

### Description

The work covered by this section consists of furnishing, stockpiling, placing, and maintaining approved stone and boulders, and filter fabric to be utilized to construct the step pool structure, as specified in the Contract Document or as directed by the Engineer. Step-pool structures extend between the proposed toes of stream bank slopes. The step pool structure is a combination of staggered pools, created using boulders and smaller rock, placed in a ring typically extending to 1/2 the bankfull channel width, to form a small pool with a controlled outlet or “structure step”. The “structure step”, directs water during low or base flow into the next adjacent downstream pool. The number of steps is based on the stream bed slope and the end step pool control point is tied to the downstream bed at the run-pool transition. During flow events larger than base flow the water flows across the entire stream bed cross section.

The step-pool structure is used in stream sections with relatively steep grades to prevent channel incision and associated bank erosion, provide stream bed diversity, and to assist with wildlife movement across the structure/grade.

The quantity of structures to be constructed will be affected by actual conditions that occur during the construction of the project. The type and quantity of this structure may be increased or decreased at the direction of the Engineer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

### Materials

ENGINEER TO UPDATE IF THEY FEEL THAT THIS SPECIFICATION IS INADEQUATE FOR SITE CONDITIONS.

Tree species for the wood material shall be either hardwoods or conifers, or a combination of both, the percentage shall vary based on site availability, and/or direction from the Engineer. Wood material shall include limbs, small logs, tree tops, brush and woody shrubs. Limbs may be a variety of sizes with or without leaves/needles depending on the season. Leaves and/or needles not attached to a tree limb (i.e. bundles, piles, etc.) are not allowed. Sources for logs/woody debris shall include on-site fallen trees, standing dead trees, and trees removed due to construction activities as well as off-site timber. All logs shall be relatively solid (hard) and free of visible rot.

Boulders shall consist of flat-sided, durable field or quarry stone that is sound, hard, dense, angular, and resistant to the action of air and water, and free of seams, cracks, or other structural defects. The Contractor shall use stone pieces with a “shape factor” greater than two (length and width more than twice the thickness). The Contractor cannot use limestone or concrete waste for stone. Stone shall be approved by the Engineer.

The size (length, width and depth (thickness)) of the boulder material shall as specified by the Engineer. Stone shall be approved by the Engineer.

Boulders for in-stream structures shall conform to the specifications for boulders shall conform to their respective specifications as shown on the plans.

Coarse backfill material shall consist of durable field or quarry stone that is sound, hard, dense, slightly rounded, resistant to the action of air and water, and free of seams, cracks, or other structural defects. The Contractor shall use stone pieces with a “shape factor” less than two (length and width less than twice the thickness). The Contractor cannot use limestone or concrete waste for stone. Stone shall be approved by the Engineer.

The type, size and gradation of the Coarse Backfill Material shall be specified by the Engineer to be mobile or non-mobile as the conditions in the channel warrant, and in accordance with the construction documents.

Coarse backfill material shall meet the material requirements of NCDOT section 1042 Rip Rap Materials.

Filter fabric for sealing structures shall meet the material requirements of NCDOT Section 1056 Geosynthetics.

### Methods

ENGINEER TO UPDATE IF THEY FEEL THAT THIS SPECIFICATION IS INADEQUATE FOR SITE CONDITIONS.

Structure installation and channel grading sequences may vary based on structure function and design. Grade control structures such as step-pool structures shall be installed as grading operations progress downstream.

Stake the elevation control points shown on the plans, including the beginning, “structure steps”, and end of the proposed step-pool structure. The Contractor may install additional survey control, as needed, to complete the work in accordance with the Contract Documents. The step-pool structure stakeout shall be reviewed by the Engineer prior to proceeding with the work.

* 1. Begin construction of the step-pool structure from the proposed downstream end of the structure and progress upstream with the increase in elevation until the structure is completed and tied into the specified upstream elevation.
	2. Place backfill at the elevation and/or depth specified on the plans. The backfill placement shall be reviewed by the Engineer prior to proceeding with the work.
	3. Place the control point “structure step” and construct the ring of boulders within the channel width as shown on the plans. Place boulders such that adjacent boulders have surface contact with minimal gaps.
	4. Bucket, rake and/or otherwise adjust placed step pool material, as needed, to create pools within the ring of boulders. Step pool material shall be placed and graded in a manner that fills any gaps between the boulders and creates bed variability including, small pools, turbulent areas, and “high spots”. In areas where the required fill depth is minimal, including the pools and/or at the toe of stream bank “full” depth step pool material may be specified in lieu of backfill material.
	5. Repeat steps c) through e) for each step pool until the Step-Pool Structure is completed as specified by the Engineer.
	6. The Contractor may randomly place logs/woody debris and/or sod mats, based on site availability and pending field review from the Engineer.
	7. Finish grade the adjacent streambed, channel banks, and/or floodplain to provide a smooth even grade transition between project structure components (arms, sills, inverts, floodplain sills, etc.) and the existing and/or proposed ground surface.

In locations where exposed bedrock and/or other existing feature extends to and/or within the limits of the proposed work, the step pool structure installation shall be field adjusted to incorporate the bedrock/existing feature, into the finished work. The Engineer shall be contacted as soon as the presence of bedrock and/or other existing feature is field identified, to determine the appropriate method of incorporation. Site conditions may require slight deviation from the plan and shall be approved by the Engineer.

### Measurement

The quantity of step-pool structure to be paid for shall be the actual number of square feet of “Step-Pool Structure” completed and accepted into the final work, as measured along the surface of the structure (control points, pools, and boulder rings). The payment will be considered as full compensation for all work covered in this special provision, including, but not limited to grading, installation, excavating, adjusting, 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, or as directed by the Engineer.

No separate measurement of materials shall be made under this item for backfill, boulders, step pool material, logs/woody debris and/or other incidental items.

### Payment

The work covered by this section shall be paid for at the contract per square foot price for “Step Pool Structures”. Payment will be full compensation for all work covered in this special provision, including, but not limited to grading, installation, excavating, adjusting, 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, or as directed by the Engineer.

Payment shall be made under:

STEP-POOL STRUCTURE SF