

Sequatchie Cave State Natural Area Improvement  
Project

Technical Specifications and Special Provisions

Prepared for the  
Tennessee Department of Environmental and Conservation  
Division of Natural Areas



## Sequence of Construction

The contractor is responsible for following the sequence of construction in accordance with the plans and the following provisions. The following provisions, along with the instructions contained in the plans, constitute the sequence of construction.

General site notes:

- Under no circumstances shall any waste material or temporary stockpiling material be placed in any areas outside of the limits of disturbance.
- All construction work shall be done during periods of dry weather
- The portion of the road to be removed will occur prior to construction.

### A. Construction Phase

1. Initial site preparation.
  - a. Identify project boundary, limits of disturbance, sensitive areas, staging area, and access points with David Adams or designated DNA (Division of Natural Area) personnel.
  - b. Construct the staging area in a manner to support the execution of the project in phases as indicated in the plans as directed by designated DNA ( Division of Natural Area) personnel.
  - c. Install erosion control devices in accordance with the site stabilization plan. The silt fence on the back side of the soil lift will not be installed until after the soil lift has been completed.
2. Complete construction
  - a. Install soil lift as directed in the plans.
  - b. Install the remaining silt fence
  - c. Install the bio retention as directed in the plans.
  - d. Excavate the area for the grassy strip as directed in the plans and then backfill with top soil and plant as indicated in the plans.
  - e. Install pervious concrete as directed in the plans.
  - f. Install fence as directed in the plans.
3. Install walking path as directed in the plans.
4. Planting  
Prepare and install plants during the dormant season in accordance with this bid package designated by DNA (Division of Natural Area) personnel.

### B. Post Construction Phase

- a. Completion of project site

Remove all remaining waste materials and leave the site in a clean park-like condition. Seed and

mulch any remaining disturbed areas utilizing the seed and mulch mixes specified in the plans.

## **Technical Specifications**

### **Section 1.0 Site Preparation**

**General:** Furnish all labor, equipment and materials required to complete all work associated with general access to the site and preparing the site.

All work under this section shall be performed in a manner to minimize soil erosion. The Contractor shall perform such erosion control work, temporary or permanent, in order to satisfactorily minimize erosion resulting from clearing and site preparation. The installation of temporary or permanent erosion control measures shall begin prior to the initiation of clearing or land disturbing activities.

#### **1.1 Mobilization/Demobilization**

***Scope/Description:***

Mobilization/Demobilization consists of preparatory work and operations, including but not limited to the movement of personnel, equipment, supplies, and incidentals, to the project site, for the establishment of facilities necessary of work on the project; the removal and disbandment of those personnel, equipment, supplies, incidentals, or other facilities that were established for the prosecution of work on the project; and for all other work and operations which must be performed for costs incurred prior to beginning work on the various items on the project site.

#### **1.2 Staging Areas**

***Scope/Description:***

To limit disturbance of soils on site, the Contractor shall restrict the storage to the identified staging areas. The staging area will be in the area marked pervious concrete, but can change based on recommendations by the contractor. Prior to construction activities, the Contractor shall identify and mark the boundaries of all staging areas by using silt fencing or another marking strategy as approved by the DNA personnel. Due to the site being an environmentally sensitive area, all fueling of equipment shall take place offsite.

#### **1.3 Clearing and Grubbing**

***Scope/Description:***

Clearing and grubbing operations shall be performed within the Limits of Disturbance as indicated on the Sediment and Erosion Control Plan Sheets or as designated DNA (Division of Natural Area) personnel.

Following site layout and prior to the commencement of any work, the Contractor and designated DNA (Division of Natural Area) personnel shall visit the site to review the boundaries of the Limits of Disturbance, sensitive areas, identify wooded areas to protect within the Limits of Disturbance and discuss site work and site access strategies that will minimize tree removal without significantly interfering with site work.

Specifically, 6" – 8" of soil located at the proposed vegetated area will need to be removed and disposed of properly. That area will be replaced with topsoil to promote the growth of new grass. The existing cable fence will be removed as indicated and disposed of off-site, and the holes exposed by the removal of the

fence will be filled in with topsoil and slightly compacted. Also, the existing boulders that will be removed due to the construction of the Vegetated Soil Lift (Section 2.2) will be placed elsewhere at the site as directed by designated DNA (Division of Natural Area) personnel.

## **2.0 Earthwork**

**General:** Furnish all labor, equipment and materials required to complete all work associated with the removal and addition of the soil.

### **2.1 Furnished Topsoil**

***Scope/Description:***

The work covered by this section consists of furnishing and installing soil for Vegetated Soil Lifts (Section 2.2).

***Materials:***

Furnished soil shall be natural friable soil uniform in texture. The soil may be salvaged from other excavation on site if approved the DNA personnel. Topsoil shall be free from any parts of Johnson grass, thistle or phragmites. The organic material content should be less than 5%.

***Construction Methods:***

The top layer of soil (approximately 0.2') of the existing bank where the Soil Lifts are installed shall be excavated and stockpiled to be mixed into the Furnished Topsoil to make the lifts. The mixed soil shall be placed and compacted in 1-foot lifts as described in Section 2.2 of these Special Provisions.

***Method of Measurement:***

Furnished Topsoil will not be measured under this section.

### **2.2 Vegetated Soil Lift**

***Scope/Description:***

The work covered by this section consists of building a Vegetated Soil Lift; a structure designed to stabilize eroding and scoured banks by installing natural soil material in layers wrapped with Coir Fiber Matting and will readily vegetate with live cuttings.

The quantity and location of structures to be constructed will be in accordance with the plans but may be modified in size or shape to accommodate the actual conditions that occur during the construction of the project. The quantity of structures may be increased or decreased, at the direction of DNA personnel.

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:***

Stone material installed along the right side of the Soil Lift shall meet all of the requirements of Boulders.

Materials utilized to build the Vegetated Soil Lift include Burlap Backed 900 Gram Coir Matting (Section 4.1), 700 Gram Coir Matting (Section 4.2), and Live Whips (Section 5.1) in accordance with these special provisions.

***Construction Methods:***

The Vegetated Soil Lift shall be constructed in accordance with details in the plans, at locations as shown on the construction plan sheets. Boulders, described in Section 3.1, will be embedded into the bank on the right side of the Vegetated Soil Lift as seen in the plans. The boulders will be placed in a step wise pattern down the bank, with the top boulder slightly overlapping the boulder below it.

The limits of the Vegetated Soil Lift shall be determined and staked. All construction of the Vegetated Soil Lift shall avoid contact with the adjacent stream. All soils used in the Vegetated Soil Lift will be approved by DNA (Division of Natural Area) personnel.

Approved topsoil obtained from bank grading and/or "Furnished Topsoil", Section 2.1. Remove existing cherty soil from bank and place a thin layer of soil (0.1'-0.2') where the base of the Vegetated Soil Lifts will be installed. Then place a layer of live whips in the soil and cover with another thin layer of soil. Lay out Burlap backed 900 Gram Coir Matting along the length of the structure and allow for enough fabric to fold back over the soil lift. Secure the top of the matting with 1.5' wooden stakes on a 1' center. Place soil material in lift and seed and straw the part of the lift that will be exposed when the lifts are completed with permanent and temporary seed as specified in these special provisions. Pull back matting tightly, compact the soil with equipment to the necessary slope, and secure with 1.5' wooden grade stakes on 1' centers in two staggered rows, one in the middle of the matting where the top of bank is located and the other at the top of the matting. This first lift shall be 1.0' (+/- 0.2') tall. Place a thin layer of soil (0.1'-0.2') on top of the first lift. Then place a layer of live whips in the soil and cover with another thin layer of soil. Following this same procedure, install four additional levels of the Vegetated Soil Lift for a total of five layers until it is approximately 1' from the top of the bank. Finish the Soil Lift by grading the final portion of the bank at a 2:1 slope until the existing terrace is reached. Seed and straw the slope above the last lift and install 700 gram coir matting as specified in these special provisions.

### **Section 3.0 Structures**

**General:** Furnish all labor, equipment and materials required to complete all work associated with the installation of the structures, including the bio retention and the pervious concrete.

#### **3.1 Stone**

***Scope/Description:***

The work covered in this section consists of furnishing, stockpiling, placing and maintaining approved stone to be used in constructing structures and for use in other locations as directed by DNA (Division of Natural Area) personnel.

***Materials:***

Rock materials for machined rock shall consist of blasted stone or other stone approved DNA personnel.

The stone shall be sound, tough, dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended. The river cobble should be smooth stone that has no sharp edges.

The stone shall meet the state gradation specifications and/or the following requirements regarding the size distribution:

	REQUIRED STONE SIZES – INCHES (MM)
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Type	Minimum	Midrange	Maximum
Class A-1	2 (51)	9 (229)	15 (381)
Boulder	24 (610)	36 (914)	48 (1,219)
River Cobble	6 (152)	10 (254)	14 (356)

CLASS EQUIVALENT	% OF TOTAL BY WEIGHT OF PASSING						
	1 ½"	1"	¾"	½"	3/8"	#4	#8
#57 Stone	100	95-100		25-60		0-10	0-5

**Construction Methods:**

The Contractor shall place the stone in the constructed structures at the locations shown on the plans, to the thickness, widths, and lengths as shown on the plans, or as approved by DNA personnel. All machined rock shall be placed neatly and uniformly with an even surface, in accordance with the details in the plans and shall meet the approval of DNA personnel.

**3.2 Bio retention with Underdrain**

**Scope/Description:**

The work covered in this section consists of the construction of a bio retention with an underdrain. Bio retentions areas are vegetated depressions that capture and treat storm water through the use of plants and filtering media. Storm water is stored and then infiltrates through the soil medium into the groundwater. The size and location of the bio retention to be constructed will be in accordance with the plans, but may be affected by the actual conditions that occur during the construction of the project. Such variations will not be considered as alterations in the details of construction or a change in the character of the work.

**Materials:**

Stone material utilized to build the Bio retention shall meet all of the requirements of #57 Stone.

Other components of the bio retention will include washed sand, triple shredded hardwood mulch, and a fill soil media consisting of 85% washed sand, 10% soil fines, and 5% organic matter mixed together.

The filter fabric shall be Geotextile Fabric (Type III) (Erosion Control) as specified by the Tennessee Department of Transportation.

Shrubs and grasses as described in Sections 4.5 and 5.2 respectively, shall be used in the bio retention.

The underdrain will be a 6" rigid schedule 40 PVC pipe with 3/8" perforations at 6" on the center. The Cleanout pipe will be a 6" rigid schedule 40 PVC pipe without perforations.

Before construction begins, block the existing drainage area from entering the bio retention. This can be achieved using a temporary berm, waddle, or other approved device. During the construction process the equipment used to install the structure should work along the sides of the bio retention area to avoid compacting the soil and decreasing the infiltration rate. Once the appropriate depth has been reached, rip the bottom soils 8" – 12" to increase infiltration. Filter fabric should be placed along the sides with a 6" overlap on the sides. The #57 Stone should be installed first to a depth of 18". Before completely installing the stone to the correct depth, place the underdrain in the center of the bio retention as shown on the plans and cover with at least 3" of #57 stone. Install the underdrain at a slope of 1%. The cleanout pipe should also be installed into the underdrain and extend just above the top layer with a removable PVC cap. A 3" layer of washed sand will be over the #57 Stone, followed by the fill soil media. The fill soil media should be stockpiled on a plastic sheet or impervious surface before being placed into the structure. Care must be taken to keep the fill soil media clean of other soil. Topsoil can be used to add the required 10% soil fines to create the soil fill media. However, care should be used to ensure that fines are limited to 10% of the media. Prepare and plant the recommended shrubs and then install the 3" mulch layer. The mulch layer will be shredded aged hardwood bark. Plant the remaining herbaceous plants in the bio retention.

### **3.3 Pervious Concrete**

#### ***Scope/Description:***

The work covered in this section consists of the construction of pervious concrete and marking the parking area. Pervious concrete reduces the fines in normal concrete mix to allow for drainage between the voids and through the concrete. The size and location of the pervious concrete to be constructed will be in accordance with the plans, but may be affected by the actual conditions that occur during the construction of the project. Such variations will not be considered as alterations in the details of construction or a change in the character of the work.

#### ***Materials:***

Stone material utilized to build the pervious concrete shall meet all of the requirements of #57 Stone to be used in the reservoir layer.

The pervious concrete should be of a mix as specified in the ACI 522 and recommended by the Tennessee Concrete Association.

**Construction Methods:**

Striping Paint should be a latex based mix intended for traffic use. Ensure that the paint will last for at least two years.

**Construction Methods:**

During the construction process the equipment used to install the structure should work along the sides of the area to avoid compacting the soil and decreasing the infiltration rate. Once the appropriate depth has been reached, rip the bottom soils 6" – 10" to increase infiltration and be sure that the bottom has a slope of less than 0.5%. The #57 Stone should be installed first to a depth of 10". This layer should be installed in 5" lifts and then compacted. Be careful to not crush the aggregate while compacting. The pervious concrete should be installed next to a thickness of 4" and should slope slightly to the overflow channel, outlined in Section 3.4. The finished concrete must be cured for 7 days and be covered during that process. During the curing process the contractor shall mark the boundary of the pervious concrete area in such a way to keep the area from being disturbed. Only a contractor certified in installing pervious concrete should complete this work. Do not complete work in the rain, snow, or when the ground is frozen. Keep pervious concrete area free from sediment during the entire construction process.

After the concrete has been allowed to cure for 30 days and the concrete surface has been cleaned, mark the parking lot lines. The lines shall be 4" wide and only installed in dry weather with temperatures above 50° F. Each parking stall will be at a 60° angle with the curb, and be 20' long and 10' wide. Submit striping plan to the Designer for approval before marking the concrete.

This phase of construction will be completed when weather conditions are optimum for pouring pervious concrete and will be completed by April 15, No work shall be performed until DNA personnel approves this schedule.

**3.4 Overflow Channel****Scope/Description:**

The work covered in this section consists of the construction of the overflow channel. The overflow channel will convey excess ponded water from the bio retention to the stream. The size and location of the channel to be constructed will be in accordance with the plans, but may be affected by the actual conditions that occur during the construction of the project. Such variations will not be considered as alterations in the details of construction of a change in the character of the work.

**Materials:**

Stone material utilized to build the overflow channel shall meet all of the requirements of River Cobble, Class A-1 Riprap, and #57 Stone to be used in the base layer.

The underdrain will be a 6" rigid schedule 40 PVC pipe with no perforations.

The filter fabric shall be Geotextile Fabric (Type III) (Erosion Control) as specified by the Tennessee Department of Transportation.

The overflow channel will tie into the side of the bio retention as shown on the plans, with the lowest point of the channel being 6" below the top of the bank of the bio retention. The channel will be excavated to a depth of approximately 4.7'. The #57 Stone should be installed first to a depth of 4.0'. Before completely installing the stone, place the underdrain in the center of the channel and cover with #57 stone up to the recommended depth. The underdrain should connect to the underdrain from the bio retention and kept to a minimum 1% slope. The river cobble will be installed on top of the aggregate layer and have a width of 4' and a thickness of 8". The channel will have a depth of 6", a bottom width of 1', and side slopes of 3:1, as shown on the plans. Ensure that the channel has positive drainage towards the stream. The channel will be laid out by the Designer before construction begins.

At the confluence with the stream, a stabilized stone outlet will be installed as shown on the plans. The stone outlet will dissipate the energy of the water from the overflow channel to prevent erosion. The area of the stone outlet will be excavated to a depth of 1.5' and a layer of filter fabric will be placed as a barrier between the existing soil and the riprap. Class A-1 Riprap will fill in the excavated area to a depth of 1' and tie back into the existing ground at a 2:1 slope. The outlet of the underdrain will also be located here. The location of the stabilized stone outlet will be laid out by DNA personnel before construction begins.

#### **Section 4.0 Erosion Control**

**General:** Furnish all labor, equipment and materials required to complete all work associated with the Installation and maintenance of temporary or permanent erosion control measures. Erosion control measures shall be installed in accordance with the plans and special provisions, the Tennessee Erosion & Sediment Control Handbook, and as directed by DNA personnel

##### **4.1 Heavy Coir Matting (burlap backed)**

***Scope/Description:***

Heavy Coir Matting will be used in the installation of "Vegetated Soil Lift", Section 2.2. Preparation of soil and seeding in conformance with Sections 4.4 and 4.5 will occur prior to the placing of the matting. Straw is not required to be installed under Heavy Coir Matting. This material shall be equivalent to the following product: RoLanka International, Inc. CoirWrap 1100.

***Materials:***

Bottom fabric weight (ASTM D3776) 7 oz. /SY (230 g/sq.m)

Top fabric - CoirMat 900 (Mixed coir fiber)

**Construction Methods:**

Bottom fabric - Tightly woven burlap

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Unit weight (ASTM D3776) 33 oz/sy (1100 g/sq.m)

Thickness (ASTM D1777) 0.35 inch (9 mm)

Top fabric weight (ASTM D3776) 26 ozs /SY (900 g/sq.m)

Bottom fabric weight (ASTM D3776) 7 oz. /SY (230 g/sq.m)

*Stakes:* Provide hardwood stakes 1.5' x 1" x 2" with a 2" nail protruding 1" from the side of the stake, 2" from the top of the stake.

6" wooden stakes (also known as eco stakes)

**Construction Methods:**

In locations where this and other stabilization techniques are jointly utilized, all treatments shall be installed so that they interface smoothly and provide the appropriate protection for the stream banks. Prior to installation prepare soil as specified in Sections 4.4 and 4.5, provide smooth soil surface free from stones, clods, or debris that will prevent the uniform contact of the matting with the soil. Take care to preserve the required line, grade, and cross-section of the area covered and apply the specified seed mix/mulch.

Where one roll of matting ends and a second roll begins, overlap the end of the upstream roll over the top of the beginning of the downstream roll so there is a 1-foot overlap and stake the two pieces. Install the matting as directed in the installation of the "Vegetated Soil Lift", Section 2.2.

Place 1.5' stakes as described in the Vegetated Soil Lift section. Place eco stakes in three staggered rows in the middle approximately 1' apart. The DNA personnel may require adjustments in the trenching or staking requirements to meet individual site conditions (i.e. multiple roll thickness, trenching into undisturbed soils on an extended bank area).

**Method of Measurement:**

The Heavy Coir Matting will not be measured under this section.

**4.2 Coir Matting**

**Scope/Description:**

Furnish, install and maintain coir matting in locations as directed by the Designer. Work includes providing all materials, excavating and backfilling, and placing and securing coir matting. Preparation of soil and seeding in conformance with Sections 4.4, 4.5, and 4.6 will occur prior to the placing of the matting.

**Materials:**

*Matting:* Provide matting to meet the following requirements:

100 % coconut fiber (coir) twine woven into a high strength matrix.

Size: 6.6 ft. x 164 ft. (120 SY)

Weight: 21 oz./SY

Thickness: 0.30 in. minimum

Tensile Strength (Wet): 86/41 lbs. /in  
minimum

Elongation (Wet): 64% x 48%

Permissible Shear (lbs./SF): 4.5

Flow Velocity: 10 ft/sec

“C” Factor: 0.003

Open Area (measured): 50%

*Stakes:* Provide hardwood stakes 1.5' x 1" x 2" with a 2" nail protruding 1" from the side of the stake, 2" from the top of the stake.

6" wooden stakes (also known as eco stakes)

**Construction Methods:**

In locations where this and other stabilization techniques are jointly utilized, all treatments shall be installed so that they interface smoothly and provide the appropriate protection for the stream banks.

Prior to installation prepare soil as specified in Sections 4.4, 4.5, and 4.6, provide smooth soil surface free from stones, clods, or debris that will prevent the uniform contact of the matting with the soil. Take care to preserve the required line, grade, and cross-section of the area covered and apply the specified seed mix/mulch.

Start the installation at the upstream end of the channel by placing the matting immediately upon final graded bank surfaces. Secure the matting at the bottom of the bank with wooden staking. Apply the matting by unrolling from upstream to downstream without stretching such that the matting will lie smoothly but loosely on the ground and in good contact with the soil surface, without air pockets or gaps beneath the matting. Where one roll of matting ends and a second roll begins, overlap the end of the upstream roll over the top of the beginning of the downstream roll so there is a 1-foot overlap and stake the two pieces.

Place a row of 1.5' stakes, with the stakes spaced 3' apart, on the top and bottom of the strip of matting. Place eco stakes in three staggered rows in the middle approximately 1' apart. DNA personnel may require adjustments in the trenching or staking requirements to meet individual site conditions (i.e. multiple roll thickness, trenching into undisturbed soils on an extended bank area).

**Method of Measurement:**

The Coir Matting will not be measured under this section.

### 4.3 Temporary Silt Fence

**Scope/Description:**

Use of temporary silt fence shall be incorporated where specified as it appears in the Tennessee Erosion & Sediment Control Handbook, dated August 2012, and the English Standard Drawings by the Tennessee Department of Transportation Design Division, updated August 2012, which are applicable to this project and by reference are considered a part of these plans. The quantity and location of silt fence may be changed at the discretion of DNA personnel.

**Materials:**

Temporary Silt Fence – EC-STR-3B

### 4.4 Temporary Seeding

**Scope/Description:**

The work covered under this section shall consist of furnishing, applying and maintaining all materials necessary to conduct temporary seeding and mulching activities required to stabilize all disturbed areas as directed by the Designer. Temporary seeding will be required on all final disturbed areas within the project limits.

**Materials:**

The Contractor shall utilize the following seed mix in seeding all disturbed areas within the project limits:

Winter Mix (October 15 – April 15)

Winter Rye ( <i>Secale cereale</i> )	30 lbs./acre
Winter wheat ( <i>Triticum aestivum</i> )	30 lbs./acre

Summer Mix (April 15 – October 14)

Foxtail Bristlegrass ( <i>Setaria italica</i> )	10 lbs./acre
Browntop Millet ( <i>Urochloa ramosa</i> )	10 lbs./acre

**Construction Methods:**

Seed is to be sown with a spreader or a seeding machine. Seed is to be evenly distributed and should not be broadcast or dropped when wind velocity exceeds 5 mph. Seeded areas are to be protected by spreading straw mulch uniformly to form a continuous blanket over seeded areas. The Contractor may propose alternate methods of seeding and mulching (hydro-seeding) if shown to be equivalent to the proposed method.

### 4.5 Permanent Seeding

**Scope/Description:**

The work covered under this section shall consist of furnishing, applying and maintaining all materials necessary to conduct seeding and mulching activities called for in the plans.

**Materials:**

The Contractor shall utilize the following seed mix specification in all areas that result in a finished grade of bare soil:

<u>Species</u>		Application Rate (in Mix)	
		<u>% of Mix</u>	<u>lbs./acre</u>
Switchgrass	<i>Panicum virgatum</i>	29	10.0
Riverbank Wild Rye	<i>Elymus riparius</i>	29	10.0
Eastern gamma grass	<i>Tripsacum dactylides</i>	15	5.0
Deer Tongue	<i>Panicum clandestinum</i>	6	2.0
Showy Tickseed	<i>Bidens aristosa</i>	6	2.0
Fox Sedge	<i>Carex vulpinoidea</i>	6	2.0
Blackeyed Susan	<i>Rudbeckia hirta</i>	3	1.0
Cardinal Flower	<i>Lobelia cardinalis</i>	3	1.0
River Oats	<i>Chasmanthium latifolia</i>	3	1.0
<b>TOTALS</b>		<b>100</b>	<b>34.0</b>

**Construction Methods:**

Seed is to be sown with a spreader. Seed is to be evenly distributed and should not be broadcast or dropped when wind velocity exceeds 5 mph. Seeded areas on the streambanks shall be protected with coir fiber matting in addition to straw mulch as detailed in the plans and these provisions. Other seeded areas are to be protected by spreading straw mulch uniformly to form a continuous blanket over seeded areas. The Contractor may propose alternate methods of seeding and mulching (hydro-seeding) if shown to be equivalent to the proposed method.

The contractor shall combine the permanent seed mix and both temporary seed species into one mix and apply on all areas within the conservation easement.

**4.6 Straw Mulching**

**Scope/Description:**

The work covered under this section shall consist of furnishing, applying and maintaining all materials necessary to conduct mulching activities called for in the plans.

**Materials:**

All straw used for mulching activities should be wheat straw. The contractor may propose alternate methods of mulching upon submission to DNA personnel

**Construction Methods:**

The straw mulch will be uniformly spread to form a continuous blanket over the seeded areas. The straw shall provide 75% coverage (2 tons/acre) over the seeded areas.

**4.7 Filter Fabric**

**Scope/Description:**

Use of filter fabric shall be incorporated where specified in the plans and as measured from the plans and details. The filter fabric to be used is as it appears in the Tennessee Erosion & Sediment Control Handbook, dated August 2012 and the English Standard Drawings by the Tennessee Department of Transportation Design Division, updated October 2016, which are applicable to this project and by reference are considered a part of these plans:

**Materials:**

Filter Fabric – Geotextile Fabric (Type III) (Erosion Control)

## **Section 5.0 Planting**

**General:** The Contractor will be responsible for managing and being on-site during all activities involving permanent planting, including but not limited to the following: site preparation for planting, seedbed preparation, storage, planting operations, and quality control inspections.

### **5.1 Live Whips**

#### ***Scope/Description:***

The work covered by this section consists of furnishing, transporting, installing and maintaining live whips as shown on the plans and as directed by DNA personnel. Work includes providing all materials necessary to install the live whips. The amount of live whips shall be determined from the information provided in the plans and details for this project.

#### ***Materials:***

Live whips shall be composed of freshly cut, dormant branches consisting of a random mix made up of native vegetation to include: black willow (*Salix nigra*), silky willow (*Salix sericea*), silky dogwood (*Cornus amomum*) and elderberry (*Sambucus canadensis*). The species composition shall include a minimum of 10% of each species, except for black willow, which shall be a maximum of 10% of the live whips. Species composition may not be modified without the prior approval of DNA personnel. Live whips shall be ½" - 1" in diameter and 4-6 feet in length. Prior to the start of work on this item, the Contractor shall submit a proposed harvest/procurement and installation schedule, including source of supply of live cuttings, to DNA personnel for review. No work shall be performed until DNA personnel approves this schedule.

#### ***Procurement***

Live whip materials may either be harvested locally by the contractor or procured from a certified nursery specializing in the production of bioengineering plant materials. Live whips obtained from a nursery shall be compatible with the same USGS Physiographic Province and USDA Hardiness Zone (Zones 6a, 6b, 7a, 7b, or 8a) as the area(s) to be planted.

***Handling during harvest and/or transport*** - The Contractor shall be responsible for harvesting and transporting the cuttings to the job site. Live cuttings shall be bundled together securely at the collection site for easy loading, handling and protection during transport. If transport by vehicles is necessary, the bundles shall be covered with a tarpaulin, transported in unheated vehicles, and moistened to prevent drying-out and additional stress. Live cuttings shall be transported to the construction site within 24 hours of harvest and shall be installed within 48 hours of cutting (especially if the ambient temperature is 50°F or above).

***Storage*** - If the cuttings are not installed immediately following harvesting or shipping, they shall be promptly and properly placed in controlled storage conditions and protected until installation is possible. During storage, live cuttings must be protected against drying out and overheating (e.g., by storing in controlled conditions, storing in shade, covering with watered-down burlap, coir fiber matting or straw, placing in moist soil, or spraying with anti-transpirant chemicals). Regardless of the storage method utilized, live cuttings shall receive continuous shade, shall be sheltered from the wind, and shall be continuously protected from drying-out. If storage is required, live branch cuttings shall be stored for a period no longer than three (3) days. DNA personnel must approve any storage of live branch cuttings.

***Whip Preparation*** - Side branches and brushy limbs may be left intact and the bark of the whip must remain intact. Buds on the whips shall be oriented towards the top of the whip. Live whips shall be cut to size as specified above. All cuts shall be smooth and the cut surface shall be kept as small as possible.

***Whip Installation*** - Prior to installation, the Contractor is required to obtain DNA personnel approval of all

plant materials intended for use. Live whips shall be laid approximately two inches apart between the levels of the Vegetated Soil Lift and shall be installed in accordance with the details provided in the plans. A minimum of 2/3 of the length of the live whip shall be installed between soil lifts, with approximately the top 1/3 of the whip extending into the channel.

*Live Stake Alternative* – If necessary live stakes, of the same species distribution, shall be installed in the soil lift as an alternative to live whips. The live stakes shall be spaced approximately one foot on center in one row on each lift. Buds of the stakes shall be oriented upwards during staking. A minimum of 2/3 of the length of the live stake shall be installed into the ground. Following installation, the top one to two inches shall be cut cleanly off. Live stakes shall be 18"-30" in length.

#### *Guarantee*

The Contractor shall be responsible for maintaining a survival rate of fifty (50) percent on all Live Whips for the duration of the first growing season following installation and shall incur the cost of replacement through this period. At least thirty (30) days prior to the end of the first growing season an on-site inspection will be conducted and the Contractor will be directed accordingly on mortality and replacement requirements. If replacement is deemed necessary at that time, an alternative such as live stakes will be used in place of Live Whips.

## **5.2 Bio retention Plantings**

### ***Scope/Description:***

The work covered by this section consists of supplying and installing containerized plants in the bio retention structure. Substitutions of specified plant materials may be made only with the approval of DNA personnel and shall be compatible with the specified planting scheme. The work of planting includes planting bed preparation, initial planting, plant establishment, and replacement plantings, as needed. The Contractor shall perform the operations provided for in these specifications in a careful, workmanlike manner that will promote the continued life and healthy growth of all plants in their final location.

### ***Materials:***

All plant material shall be container-grown as defined hereafter. Container grown nursery stock shall be healthy, vigorous, well rooted, and established in the container in which it is growing. The container grown nursery stock shall have a well-established, fibrous root system reaching the sides of the container to maintain a firm ball when the container is removed, but shall not have excessive root growth encircling the inside of the container. All woody species shall be of 2- or 3-gallon stock and all herbaceous plants shall be of 3 – 6" pots. All plant material shall meet appropriate physiographic ecoregion and plant hardiness zone requirements, and be from an approved source.

### ***Construction Methods:***

Plants shall be planted in the bio retention area as depicted on the plan sheets and in accordance with the details in the plans, as directed by the Designer.

No planting shall be done when the temperature is below 32°F, when soil to be excavated for the plant hole is frozen, when the sides or bottom of the plant hole are frozen, or when the soil to be used for backfilling is frozen or too wet. In digging, loading, transporting, unloading, planting, or otherwise handling plants, the Contractor shall exercise utmost care and use adequate precautions to prevent injury to or drying out of the trunk, branches, or roots as well as prevent freezing of the plant roots. Container vegetation must always be handled by the container and never by the tops of the plants.

Installation of vegetation shall be located in designated areas as described in the plans and as directed by DNA personnel. Soil in the area of planting shall be loosened to a depth no less than the depth of the root.

Vegetation will be planted in holes made by a shovel or other means that meet the approval of the DNA personnel

Care should be taken to ensure seedling root systems are always kept moist and covered from the elements. After planting, the soil shall be tamped firmly to eliminate air pockets.

## **Section 6.0 Miscellaneous**

**General:** The Contractor will be responsible for managing and being on-site during all activities involving the installation of the fence and the walking path.

### **6.1 Fencing**

#### ***Scope/Description:***

The work covered in this section consists of furnishing and installing a fence between the parking lot and the natural area as shown on the plans. The size and location of the fence to be constructed will be in accordance with the plans, but may be affected by the actual conditions that occur during the construction of the project. Such variations will not be considered as alterations in the details of construction or a change in the character of the work.

#### ***Materials:***

A post and chain barrier fence. The fence shall consist of 4x4 wooden pressure-treated posts with a stainless steel chain strung between the posts.

#### ***Construction Methods:***

This is the suggested way to install the fence. If the contractor would like to use a different method it must be approved by DNA personnel. Install the posts 5' apart on center by digging a hole for each post deep enough to have 2' of the post buried into the ground, with concrete securing the bottom 1' of the post. Backfill the remaining voids in each hole with dirt and tamp the holes to provide compaction and to keep the post straight. Each post shall extend 2' above the ground. A metal chain will pass through a hole drilled 6" from the top of each post.

### **6.2 Walking Path**

#### ***Scope/Description:***

The work covered in this section consists of furnishing and installing a walking path as shown on the plans. The size and location of the path to be installed will be in accordance with the plans, but may be affected by the actual conditions that occur during the construction of the project. Such variations will not be considered as alterations in the details of construction of a change in the character of the work.

#### ***Materials:***

Crushed stone – 1/4" to 3/4" to fill in the walking path

#### ***Construction Methods:***

Outline the area of the 3' wide path using string or other methods. Remove 1" of soil between the outline and also any roots or rocks until the ground is flat. Fill the void with crushed stone and compact the stone with a tamper or other device. The proposed walking path should connect to the existing dirt path.

**General Construction Contract:**

<b>Bid Item Number</b>	<b>Technical Specifications Section or (Subsection)</b>	<b>Description</b>	<b>Quantity</b>	<b>Unit</b>	<b>Unit Price</b>	<b>Bid Amount</b>
1	A. Construction Phase	Construction of DNA Ecological Improvement Project, Phase I	1	LO		
2	B. Post Construction Phase	Construction of DNA Ecological Improvement Project, Phase II	1	LO		

**Total Base Bid** \_\_\_\_\_ **\$**

**UNIT PRICES**

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the scope of the work all in accordance with the contract documents.

Payment will be made as "lump sum" for each Phase when project has been approved by David Adams or designated DNA park personnel.