Construction and Material Specifications

Harpeth River Restoration Project

Prepared for:
Harpeth River Watershed Association

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CHAPTER 1–MOBILIZATION

1.1. DESCRIPTION OF WORK

The CONTRACTOR'S mobilization shall include transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary facilities at the site; submittal of an approved construction schedule; cash flow, equipment flow, man-hour flow, material flow 'S' diagrams, material tracking sheets, and preparatory Work at the site.

If the CONTRACTOR elects to demobilize and remobilize before completion of Work, no additional payments will be made.

1.2. MATERIALS

A. NON-WOVEN GEOTEXTILE FILTER FABRIC

Filter Fabric shall consist of a non-woven geotextile fabric with equivalent properties of US 205NW manufactured by US Fabrics. Minimum weight is 8oz/sy.

B. NO.3 COARSE AGGREGATE (STABILIZED CONSTRUCTION ENTRANCE ONLY)

No. 3 Coarse Aggregate shall conform to the requirements of TDOT Standard Specifications.

1.3. WORKING AREA

The CONTRACTOR shall conduct his operations within the limits of grading/disturbance (LOD), limits of clearing & grubbing or limits of riparian zone as indicated on the drawings. Any temporary access or stockpile areas shall be coordinated with the property owners. The CONTRACTOR shall enter those areas only for the duration of time required to complete his Work. The CONTRACTOR shall cooperate at all times with the property owners, OWNER, ENGINEER, other Contractors, and other Consultants to help resolve any scheduling or other conflicts that may arise.

1.4. FIELD OFFICE AND PARKING AREAS

The CONTRACTOR shall coordinate placement of offices and employee parking with the property owners, OWNER and ENGINEER. No other areas shall be used without permission from the OWNER or ENGINEER. At a minimum, the parking area shall have a stone surface consisting of 4 inches of No. 3 Stone with Geotextile fabric.

1.5. STORAGE AREAS

Materials and equipment delivered to the project site shall be temporarily stored and maintained in areas selected by the CONTRACTOR and approved by the property owners, OWNER and ENGINEER prior to incorporation into the Work. The parking and office areas shall not be used for temporary storage.

1.6. TEMPORARY CONSTRUCTION ENTRANCE

1.6.1. Installation

A. All the dimensions in the drawing are recommended minimums.
B. The contractor shall install four (4) inches of NO.3 Stone with geotextile fabric.
C. The contractor shall make every effort to minimize the amount of soil and mud leaving the construction site. The stone in the entrance should be replaced or cleaned whenever the entrance fails to reduce tracking on pavement by the construction vehicles.
D. There should be at least one construction entrances at the site. The CONTRACTOR is responsible for locating entrances and getting approval from the ENGINEER and property owners.

1.6.2. Maintenance

A. Reshape pad as needed for drainage and runoff control.
B. Top dress with clean stone as needed.
C. Immediately remove mud and sediment tracked or washed onto public roads by brushing or sweeping. Flushing can only be used if the water is conveyed into a sediment basin.
D. Repair any broken road pavement immediately.

CHAPTER 2–CONSTRUCTION STAKING AND LAYOUT

2.1. DESCRIPTION OF WORK

The Work shall consist of furnishing all materials, equipment, incidentals and labor necessary for construction staking and layout with respect to grading operations, in-stream structure layout and permanent survey monuments as determined by the Engineer.

2.2. MATERIALS

Survey monument materials shall be in accordance with the plan details

2.3. QUALITY ASSURANCE

Surveying shall be performed by qualified personnel, employed by or on behalf of the CONTRACTOR

The CONTRACTOR shall ensure that all construction staking is performed under the direct supervision of a Professional Land Surveyor, licensed in the State of Tennessee.

2.4. SUBMITTALS

The CONTRACTOR shall make all submittals in accordance with the applicable specification and far enough in advance of schedule dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and re-submittal, and for placing orders and securing delivery. In scheduling, allow at least five full working days for the ENGINEER'S review following his receipt of the submittal.

2.5. SURVEY MARKERS

The ENGINEER prior to the beginning of construction will provide the CONTRACTOR with information regarding the location of reference points and benchmarks.

The CONTRACTOR shall be responsible for installation of proposed permanent survey monuments at locations shown in the plans.

2.6. CONSTRUCTION STAKING

The CONTRACTOR shall locate the control points established by the ENGINEER and shall establish the necessary bench marks for the proper layout of grading operations and in-stream structures. The CONTRACTOR shall make all calculations involved and shall furnish and place all layout stakes or markers. The CONTRACTOR shall exercise care in the preservation of stakes and bench marks and shall have them reset at the CONTRACTOR'S own cost when they are damaged, lost, displaced or removed.

2.7. CONSTRUCTION LAYOUT

The CONTRACTOR shall be responsible for the proper layout of the Stream Restoration of the Elisha Creek Stream Restoration project. The CONTRACTOR shall be responsible for reporting any discrepancies to the ENGINEER for clarification. Minor adjustments to suit field conditions are anticipated, and it shall be the responsibility of the ENGINEER to make decisions regarding adjustments. Any inspection or

checking of the CONTRACTOR'S layout by the ENGINEER and the acceptance of such shall not relieve the CONTRACTOR of its responsibility to secure the proper dimensions, grades and elevation of the required Work.

At the completion of Work, the CONTRACTOR shall submit a record set of as-built drawings to the ENGINEER for approval. This Work is considered incidental to the CONTRACTOR'S Lump Sum price. These as-built drawings shall show all deviations from the original design. These drawings shall be marked in red-ink on a blackline or blueline set of drawings.

CHAPTER 3 –SITE PREPARATION

3.1. DESCRIPTION OF WORK

This specification covers all items related to clearing, grubbing and stripping of the project area as specified on the plans or as directed by the OWNER'S REPRESENTATIVE.

3.2. CONSTRUCTION METHODS

3.2.1. CLEARING AND GRUBBING

The CONTRACTOR shall only remove trees and shrubs that are absolutely necessary for the execution of the work and shall make all efforts to minimize tree removal unless otherwise shown in the plans. In addition, trees shall be removed in a manner to allow them to be reused on the site for instream structures and floodplain large woody debris. All trees, snags, logs, stumps, shrubs, and rubbish shall be removed from the following areas specified below:

- All areas to receive more than 1 ft of fill
- All areas which will be excavated more than 1 ft.

All areas indicated in items above shall be stripped of all vegetation, topsoil and other organic material to a depth of at least six (6) inches or as directed by the ENGINEER.

Unless otherwise specified, all stumps, roots and root clusters having a diameter of one (1) inch or larger shall be grubbed out to a depth of at least one (1) foot below ground surface in all areas designate above.

All material grubbed or stripped shall be removed from within the limits of excavation or areas to be filled and shall be temporarily stockpiled for use as final dressing of the Site or placed in the Topsoil Stockpile. Within the limits of the existing wetland, the CONTRACTOR shall remove topsoil/hydric soils and place them in the proposed wetland areas.

All areas to be covered by embankment, stone slope protection, or other constructed feature shall be cleared and grubbed. Remove all vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish prior to placement of material. Remove stumps, logs, shrubs, brush, vegetation and other items that interfere with construction operations within the work limits. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

3.2.2. STRIPPING

All areas to be covered by embankment, stone slope protection, or other constructed feature shall be stripped to a minimum depth of 6 inches prior to placement of material. The final depth and extent shall be determined during construction.

Material suitable for use as fill shall be stockpiled. Material unsuitable for use as topsoil or backfill, or In excess of required fill, shall be wasted.

3.2.3. TOPSOIL

All cleared topsoil material shall be stockpiled and used for final dressing. Locate topsoil stockpiles so that the material can be used readily for the finished grading. Protect topsoil and keep in segregated piles until needed. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil.

3.3. SUBMITTALS

3.3.1. Site Usage Plan

The site usage plan shall include a plan view drawing of the project site with designations indicating where the following items will be located within the CONTRACTOR'S work limits at various times during the construction period. These areas shall be coordinated with the appropriate property owners.

- Location and number of temporary field offices and/or office trailers.
- Parking areas for personal vehicles, delivery trucks, etc.
- Potable water supply and sanitary facilities.
- Temporary connections to public utilities.
- Access points and gates for construction traffic entering or exiting the site.
- Storage areas for stone, aggregates, soil and other bulk materials, including excavated demolition material.
- Other stationary construction equipment, if used.
- On-site staging areas.

3.3.2. Off-Site Staging Areas

The CONTRACTOR shall submit a description of plans for the use of off-site locations to support the Work. Include all staging and storage areas for equipment and materials not located within the property boundaries at the project site. Provide the following for each site:

- Address and directions from the project site
- Name and address of current owner
- Evidence of ownership or rights to use the site
- Federal, state, or local permits, if required
- Plans for restoring the site upon completion of the project

CHAPTER 4 – EARTHWORK (EXCAVATION AND FILL)

4.1. DESCRIPTION OF WORK

This specification covers all items related to stream earthwork related to the proposed channel and floodplain, as specified on the plans or as directed by the OWNER'S REPRESENTATIVE. Tasks include earth and rock excavation, dredging of stream sediments, placement of earth, and compaction of soils. The Work covered by this specification consists of furnishing all materials, equipment, and labor for the removal and placement of earth materials at the locations and to the extents indicated on the Drawings.

4.2. CONSTRUCTION METHODS

4.2.1. EXCAVATION

1. The proposed stream channel shall be constructed by excavating the flood prone area adjacent to the channel to the bankfull elevation indicated on the profile and cross-sections. The proposed stream channel shall be excavated to the stream bottom indicated on the profile and cross-sections. This shall be done as excavation and is typically accomplished with a track excavator. Any stockpiling of materials or "double handling" necessary to build the channel shall be considered incidental to construction.
2. Excavate as required where needed to achieve the final contours, elevation, and dimensions indicated. Excavate soil disturbed or weakened by the CONTRACTOR'S operations, and soils softened or made unsuitable for subsequent construction due to exposure to weather. Reuse excavated materials where the material meets the specified requirements for fill at a given location.
3. All Excavation will be considered unclassified.
4. Excavations below Indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill excavations cut below indicated depth with satisfactory material and compact as specified.

4.2.2. FILLING

1. Fill and backfill to contours, elevations, and dimensions indicated. Do not place fill over frozen or excessively wet areas.
2. Place fill in horizontal lifts extending the full width and length of the embankment. Do not dump fill material into the final position; distribute the fill by blading and dozing in a manner that will prevent the development of voids, pockets, and/or poorly mixed material.
3. Apply water or aerate the material to obtain satisfactory moisture content for compaction. Compaction shall be accomplished by sheepsfoot rollers, pad foot rollers, tamping foot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory plates, vibratory rollers, or other approved equipment well suited to the soil being compacted. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Compact each lift before placing overlaying lift. Finish to a smooth surface by blading, rolling with a smooth roller, or both.
4. Compacted lift thicknesses shall not exceed 12 inches, unless noted otherwise.

5. Each lift shall be compacted with no less than 4 passes with approved equipment well suited for the material being compacted.

4.2.3. GRADING

A. LINES AND GRADES

Embankments and excavations shall be constructed to the lines, grades and cross sections indicated on the drawings, unless otherwise directed by the ENGINEER. The ENGINEER reserves the right to increase or decrease the bankfull bench widths or the embankment slopes or make such other changes in the cross sections as may be deemed necessary.

B. FINAL CHANNEL GRADING AND RESTORATION

Following construction of in-stream structures, the channel shall be final graded to provide a smooth transition around the structures and between proposed and existing slopes in preparation of final restoration. The constructed stream channel shall be restored as soon as possible by seeding in accordance with these plans and specifications. The excavated bankfull channel shall be fully restored and vegetated, if possible, before flows are introduced to the new channel.

C. FINISHED GRADE AND TOPSOIL

The CONTRACTOR shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed prior to commencement of the seeding operation. The location of underground utilities and facilities in the area of the planting operation shall be verified, Damage to underground utilities and facilities shall be repaired at the CONTRACTOR'S expense.

D. HANDLING OF FLOWS

If possible, channel relocation work shall be completed and restored prior to allowing flow to enter into the newly constructed stream channel. If the channel relocation work is not completed prior to abandoning the old channel, a temporary dam and pump-around may be installed to facilitate construction of the channel "in the dry." Flows producing riffle depths greater than six inches shall be considered high flow conditions. Dam shall be placed such that it can be overtopped during high flows without resulting in flooding. The use of a temporary dam and pump-around shall be considered incidental to the project. A diversion ditch may also be used if approved by the ENGINEER.

4.2.4. RESTRICTED WORK AREAS

Excavations and filling shall be confined to areas within the Work Limits as indicated on the Drawings. Prior to beginning work, the Work Limits shall be marked in accordance with Construction Staking & Layout.

4.2.5. SURFACE DRAINAGE

The CONTRACTOR shall provide for the collection and disposal of surface water encountered during construction. It is the responsibility of the CONTRACTOR to assess the soil, ground water, and stream level conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

So that construction operations progress successfully, drain the site to keep soil materials sufficiently dry. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

The CONTRACTOR shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction; grade the area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils and prevent erosion. *12*

Erosion and sediment control measures shall be planned and undertaken in accordance with the requirements in EROSION CONTROL.

4.2.6. MATERIAL STOCKPILES

On-site stockpiles of soils (not including stone and coarse aggregates) and/or dredged sediments shall be graded to maintain positive drainage at all times. The side slopes shall have a 4H:1V maximum slope. The top shall have a two (2) percent minimum slope.

4.2.7. DELIVERY, STORAGE AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

4.2.8. UTILITIES

Movement of construction machinery and equipment over pipes, bridges, and utilities during construction shall be at the CONTRACTOR'S risk. Perform work adjacent to utilities in accordance with procedures outlined by utility company. Report damage to utility lines or subsurface construction immediately to the ENGINEER.

4.2.9. BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

4.2.10. DISPOSITION OF DREDGED AND SURPLUS MATERIAL

All surplus or other soil material not required or not suitable for filling, backfilling, or aquatic and riparian habitat, including brush, refuse, stumps, roots, and timber, shall be removed from the site.

The CONTRACTOR is responsible for locating, securing and permitting a suitable off-site disposal area, purchasing or leasing needed property, obtaining all required federal, state, or local permits, complying

with all applicable federal, state, or local regulations, maintaining the disposal site during construction, and closing/restoring the disposal site at the conclusion of this project.

4.2.11. TOLERENCES

The CONTRACTOR shall make every reasonable effort to construct the project uniformly. Tolerances which will be allowed, before any decreases or increases in the quantity to be paid are made or before reworking of the constructed item is required, are as follows:

1. The distance from centerline to the toe of the side slopes in excavations and the top of side slopes in fills shall not deviate more than six inches from the dimension shown on the drawings, and the total width of the bottom of the excavation shall not be deficient by more than six inches at any location.
2. The sloped surfaces between the bottom of slope line or the top of the bankfull bench and the original ground shall not be inside or outside the specified slope limits more than one foot, measured horizontally.
3. No additional payment will be made for any earthwork performed outside the limits specified by the neat lines of the cross-sections on the drawings and no extra material shall be removed or placed more than one foot outside of these limits without permission by the ENGINEER.
4. Finish grades as indicated within one-tenth of one foot. Where construction operations disturb areas where the existing grade is to remain, re-grade the surface to match the existing slopes.
5. Grade areas to drain water away from structures. Maintain areas free of trash and debris.

4.3. SUBMITTALS

4.3.1. Dewatering Work Plan

The CONTRACTOR shall submit a description of procedures to be used in accomplishing dewatering work, where needed.

4.3.2. Soil Disposal Plan

The CONTRACTOR shall submit a plan for the disposal of dredged and surplus earth materials at an on-site location. The plan shall identify the location of the disposal area, demonstrate that the CONTRACTOR has obtained the property owner's approval, and describe the layout, grades, and closure plan for the disposal fill. Topsoil shall be removed from the disposal area and stockpiled prior to the placement of disposal fill. Topsoil shall be replaced following the placement of disposal fill over the entire disposal area. Undesirable fill shall be disposed of in accordance with these specifications.

4.3.3. Preconstruction Submittals

The CONTRACTOR shall submit 15 calendar days prior to starting work:

1. Dewatering Work Plan
2. Soil Disposal Plan

4.3.4. Test Reports

All materials originating from off the project site shall be tested by the CONTRACTOR for conformance with the project Specifications. The CONTRACTOR shall submit copies of all laboratory and field test reports within 24 hours of the completion of the test:

1. Borrow soil testing including material USCS Designation, standard Proctor test (ASTM D 398), and environmental testing for each material type; ENG
2. Fill gradation tests

CHAPTER 5 –SEEDING AND PLANTING

5.1. DESCRIPTION OF WORK

This specification covers all items related to planting and native seeding, the preparation of soil for seeding, planting of trees and shrubs, the placement of erosion control fabric and mulch, harvesting, transporting, installing, and maintaining live stake materials and joint plantings as specified on the plans or as directed by the OWNER'S REPRESENTATIVE.

The Work covered by this specification consists of furnishing all materials, equipment, and labor for the seeding and planting at locations and to the extents indicated on the Drawings.

5.2. MATERIALS

A. SEED CLASSIFICATION

State-approved seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS Seed Act and applicable state seed laws.

B. SEED SPECIES AND MIXTURES

i. Riparian Zone Seed Mix shall consist of seed varieties specified in the Planting details shown on the drawings.
ii. Standard Seed mix shall consist of seed varieties specified in the Planting plan as shown on the drawings.
iii. Seed shall be certified that the Pure Live Seed (PLS) percentage is equal to or greater than that which is specified on the Plant Schedules. If the PLS is less than specified, the CONTRACTOR shall increase the seeding rate to compensate for the PLS difference at his/her own expense. All seed and seed varieties must contain only species specified and shall be free from prohibited noxious weed seed.
iv. Temporary seed species for surface erosion control or over seeding shall be a minimum of 95 percent pure live seed in accordance with the Temporary Cover portion of the Riparian Zone seed mix in the planting plan shown on the drawings.
v. Weed seed shall be a maximum 1 percent by weight of the total mixture.
vi. The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed.
vii. Substitutions will not be allowed without written request and approval from the ENGINEER.

C. PLANT STOCK

Plant stock shall be composed of Tennessee-native trees and shrubs to complete the work for designated planting zones as specified on the planting plans and as directed by the ENGINEER. The CONTRACTOR shall use the planting and seeding schedules provided by the ENGINEER on the plans.

D. PLANT SUPPLIER REQUIREMENTS

i. Any proposed species substitutions or changes in percent composition of species shall require prior written approval by the ENGINEER. Only specified plant species will be accepted. No cultivated varieties (cultivars) are acceptable.
ii. All stock must be healthy and vigorous and free from damage or disease, mishandling or poor pruning. Plants that have evidence of stress, disease, dieback or mishandling will be rejected. Plant materials must be selected from certified nurseries that have been inspected by state and/or federal agencies. Nursery inspection certificates shall be furnished to the ENGINEER upon request. The nursery supply source shall certify that the origin of the seeds from which the trees and shrubs were produced is from Hardiness Zones 5 or 6. Plant material collected from the "wild" is prohibited.
iii. Container grown stock shall have roots that visibly extend to the inside face of the growing container. All container-grown plants shall be grouped and watered daily until they are planted. Plants damaged in handling or transportation may be rejected by the ENGINEER. Each plant or same-species group of plants shipped to the job site must be clearly labeled with its scientific name. The CONTRACTOR is responsible to check to see that the plants are correctly labeled. The ENGINEER will not accept improperly labeled plants. The CONTRACTOR is not allowed to add, alter, or remove labels. The ENGINEER will not pay the CONTRACTOR for stock that is improperly labeled or for stock on which the CONTRACTOR has altered or removed the labels.
iv. All plant substitutions must be approved by the ENGINEER in writing prior to purchase and planting. If a substitute is selected, it must be native to the same region of Tennessee and of the same size, value, and quality as the original specified plant. Substitutes will have to be coordinated with the BA permit.
v. All exposed earth on site is to be covered with weed-free straw to prevent rain damage and foster germination of new plants. The CONTRACTOR must provide the ENGINEER documentation from the supplier that the material is weed-free. Straw obtained from regular farming operations is not weed-free and will not be accepted by the ENGINEER.

E. TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the seed specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1 1/2, inch diameter. Topsoil shall be free from viable plants and plant parts.

Furnished topsoil shall also meet the following criteria:

Characteristic: Criteria: pH: From 6.5 to 7.5

Cation-exchange capacity: From 5 to 25 cmol+ /kg (meq/100g) Nutrient content: Normal contents of nitrogen, phosphorus, potassium, Calcium, magnesium, sulfur: proper micronutrient Levels

Soluable salts: Less than 200 ppm

Contaminants: Should contain no toxic substances

Furnished topsoil shall be obtained from a properly permitted, commercially available site. Furnished topsoil shall be obtained from a local well-drained site with a topsoil depth of at least 4 inches, with a proven ability to support native vegetation growth. Furnished topsoil shall be free of Bermuda Grass, Quackgrass, Johnson Grass, Mugwort, Nutsedge, Poison Ivy, Canada Thistle, Tearthumb, Phragmites, Mustard Seed and other noxious weeds.

F. LIME

Only pelletized lime will be used to adjust soil pH. Rate of application will be determined by CONTRACTOR to obtain soil pH of 6.5 to 7.5. Soil pH testing to determine application rates will be the responsibility of the CONTRACTOR.

G. INORGANIC FERTILIZERS

The CONTRACTOR may use inorganic or organic fertilizers. 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 6-2-4, unless otherwise directed by the ENGINEER.

H. ORGANIC FERTILIZER

The CONTRACTOR may use “organic” or natural fertilizers. Organic materials shall include such items as; sew 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 6-2-4, unless otherwise directed by the ENGINEER.

i. Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

ii. Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

iii. Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen

iv. iv. Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from food, agricultural or industrial residuals; biosolids (treated sewage sludge), yard trimmings, or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation; The compost material shall pass through a 3/8 inch screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35 to 55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic or foreign materials larger than 2 inches in length. Furnished compost shall be free of viable vegetative tissue or seeds from species present on State and Federal noxious plant lists and invasive species. Compost shall be supplied by a Seal of Testing Assurance Program (STA) participant.

v. Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

I. MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure is not recommended to be used as mulch because it would encourage surface rooting of the planted stock and the establishment of volunteer weeds.

J. STRAW

Straw shall be oat, wheat, rye, barley, or rice stalk. Straw stock shall be in air-dry condition and of a suitable consistency to be broadcast by commercial mulch-blowing equipment.

K. WOOD CELLULOSE FIBER

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

L. ORGANIC MULCH

Organic mulch materials shall be native to the project site and consist of recycled mulch, shredded bark, wood chips, or ground bark.

M. WATER

Water shall be the responsibility of the CONTRACTOR, unless otherwise noted. Water shall not contain elements toxic to plant life.

N. LIVE STAKES

Live cuttings for live stakes shall be 1/2", to 2 inches in diameter and 2.5 -3.5 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. The species used will include: Sandbar Willow (Salix interior).

5.3. CONSTRUCTION METHODS

5.3.1. Topsoil and Seed

All areas of exposed soil disturbed during construction shall be restored and reseeded. Final grading, fertilization, seeding, and mulching of all such areas shall be completed as soon as practical after completion of the respective portions of the project. The application of fertilizer, seed, and mulch shall be accomplished between March 15th and June 15th or September 1st and December 1st .

Scarify existing subgrade surface. Provide four inches of topsoil for newly graded finish earth surfaces and other disturbed areas. Additional topsoil will not be required if work is performed in compliance with stripping and stockpiling requirements. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

Apply fertilizer uniformly at 600 pounds per acre. Apply seed mixture uniformly at the rates indicated on the plans. Seeds shall be covered to an average depth of 1/4 inch by brush harrow, spike-tooth harrow, chain harrow, cultipacker, hand rake, or other approved device.

Apply mulch cover to all seeded areas and promote germination and growth; asphalt adhesive and/or other measures shall be applied in sufficient quantities to secure the mulch without inhibiting grass growth. Water as needed until an acceptable stand of grass is established.

Seeded areas shall be maintained until all seeding work or designated portions thereof have been completed and accepted. Any damage shall be repaired, and mulch material that has been removed by wind or other causes shall be replaced and secured.

- Nursery Stock Units -All shrubs and trees to be in accordance with the Tree and Shrub Specifications in the plans.
- Spacing –Trees and shrubs shall be spaced according to the planting details in the plans.
- Spacing Pattern -Tree and shrub species to be distributed in a random order.
- PLS = Minimum Pure Live Seed Percentage.
- All seed to be broadcast and raked into soil.

5.3.2. Prepare Site

A. SITE PREPARATION

All areas to be seeded shall conform to the finished grades as specified on the plans and be free of all weeds, trash, debris, brush, clods, loose stones and other foreign materials larger than three inches (3") in diameter or length that would interfere with seeding. All gullies, washes, or disturbed areas that develop subsequent to final dressing shall be repaired prior to seeding. Apply fertilizer in accordance with these specifications.

B. APPLICATION OF SOIL AMENDMENTS

The soil amendments shall be as recommended by the soil test. The soil amendments shall be spread uniformly over the soil a minimum 1 inch depth and thoroughly incorporated by tillage into the soil to a maximum 4 inch depth.

C. TILLAGE

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum 3 inch depth. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1-vertical, the soil shall be tilled to a maximum 2 inch depth by scarifying with heavy rakes, or other method. Roto-tillers shall be used where soil conditions and length of slope permit. On slopes 1horizontal-to-1-vertical and steeper, no tillage is required. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer, and soil conditioner shall be applied prior to tillage.

D. TILLAGE OF OVER COMPACTED AREAS

Areas within the stream mitigation limits that may have been used for truck access or as haul roads may be over compacted and may not support plant growth. Over compacted areas shall be loosened to a depth of 1-foot by tilling with appropriate equipment.

5.3.3. Prepare Surface

A. PREPARATION

The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris.

B. DEBRIS

Debris and stones over a minimum 3 inch in any dimension shall be removed from the surface.

C. PROTECTION

Areas with the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

5.3.4. Seeding

A. SEEDING TIME

Seeding shall be performed from September 1 to December 1 and March 15 to June 15. No seeding shall be performed on frozen ground or when the temperature is 32 degrees F or lower.

B. SEEDING CONDITIONS

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for ENGINEER approval.

C. SOIL TEST

Delivered topsoil. existing soil in smooth graded areas and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, and organic matter content. Sample collection on site shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant grow1h. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the seed species specified.

D. INSTALLATION

- All areas disturbed during construction of the stream shall be seeded in accordance with the planting plans and schedules. The herbaceous plant seed mix is specified on the composition schedules. Areas not disturbed shall NOT be seeded.
- Seeding shall be accomplished by using a broadcast spreader. Any alternative seeding methods must be approved by the ENGINEER. When seed is installed by a broadcast spreader, it shall be capable of placing seed at the specified rate.
- Seed shall be applied in two different directions and thoroughly covered with ¼” inch of topsoil. The CONTRACTOR shall maximize the seed/soil contact by firming soil around the seed with a cultipacker, other similar equipment, or by dragging the surface with a finish harrow or chain link fence. Immediately after seeding, the site shall be watered lightly but thoroughly so that the top 4 inches of soil is saturated. The CONTRACTOR shall mulch and tack all broadcast-seeded areas within 12 hours after seeding with a weed-free straw at the rate of 2 tons/acre.

E. DELAYS

When directed by the ENGINEER during contract delays affecting the seeding operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded in accordance with Temporary Seed Seeding.

Temporary Seeding shall be performed in the same manner as permanent seeding as directed, with the following exceptions. Temporary seeding areas will not require the addition of topsoil.

5.3.5. Planting

A. INSTALLING PLANT STOCK TIME AND CONDITIONS

i. Plant Stock Time

Plant stock shall be installed from September 1 to December 1 and March 15 to June 15.

ii. Plant Stock Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, frozen ground or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted for ENGINEER approval.

iii. Layout

Planting locations and bed outlines shall be staked on the project site before any excavation is made. Planting locations may be adjusted to meet field conditions.

B. INSTALLATION

i. All restoration sites designated for native plantings shall be planted in accordance with the planting details on the plans.

ii. The CONTRACTOR shall refer to the Planting details for specific spacing requirement. The CONTRACTOR shall use the Overall Spacing dimension and layout as indicated on the planting details to determine the spacing between each plant. The CONTRACTOR shall use the Individual Spacing dimension and detail to determine the spacing between each plant of the same species.*22*

iii. Immediately after site preparation and approval (which includes removal and proper disposal of dead invasive plants), plant stock shall be installed. Planting shall be conducted between September 1 to December 1 and March 15 to June 15, or as directed by the ENGINEER. Rootstock of the plant material shall be kept moist during transport from the source to the project area and until planted.

iv. Installation of Plant Materials

- The CONTRACTOR is not required to stake out each individual planting pit. However, upon planting a typical 1,000 square feet area within each planting zone, the CONTRACTOR shall have the ENGINEER inspect and approve plant spacing and planting techniques prior to proceeding.
- Containerized Trees and Shrubs. All planting pits shall be dug so the walls of the planting pits shall be vertical or sloping outward in heavy soils. Scarify the walls of the pit after digging.
- Excavate the planting pit to at least 1-1/2 times the width of the root mass of the plant to be installed. The planting pit shall be deep enough to allow the top of the soil surface of the containerized plant to be flush with the existing grade after the soil in the bottom of the hole is tamped. Remove all debris from the pit and tamp loose soil in the bottom of the pit by hand. Remove the plant by inverting the container and pushing on the container bottom. If roots are concentrated along the inside surface of the plant pot, the surface of the plant root ball should be scarified to encourage outward growth into the soil of the planting pit. Do not lift or carry the plants by the branches, leaves or stem. Place the plant straight in the center of the planting pit, carrying the plant by the root mass.
- All planting holes shall be dug by hand using a mattock, pick or iron bar and planting holes shall be deep enough to allow the first lateral root of the root mass to be flush with the existing grade.
- Remove all non-organic debris from the hole and tamp loose soil in the bottom of the hole by hand.
- When planting, spread roots in the hole; add a fertilizer tablet and gradually backfill with soil. Firm the soil, being careful to avoid breaking roots, fill hole with water (weather permitting), and backfill with additional soil as necessary. Hand tamp as hole 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.

C. FERTILIZATION

i. Fertilize prior to backfilling according to the following procedures:

- Container Grown Plants. Place 1/2 ounce of fertilizer per each quart of container size for herbaceous plants.
- Trees and Shrubs. Place 4 ounces of fertilizer in each planting pit for up to 1-gallon size containers, 6 ounces for up to 3-gallon container size, and place 8 ounces for up to 5-gallon container size.

ii. Watering

Water plant thoroughly immediately after planting. Watering shall be of a sufficient quantity to saturate the backfill, and shall be applied slowly enough to sink into the soil and avoiding runoff. The need for additional watering, or determination of when watering is not necessary, shall be at the discretion of the CONTRACTOR. This shall include up to 6 separate watering visits executed during the growing season.

D. MAINTENANCE DURING PLANTING OPERATION

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. 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

E. RESTORATION AND CLEAN UP

i. Restoration

Pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the CONTRACTOR's expense.

ii. Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite.

F. PLANT ESTABLISHMENT PERIOD

i. Commencement

Upon completion of the last day of the planting operation, the plant establishment period for maintaining installed plant material in a healthy growing condition shall commence and shall be in effect for a minimum of 12 months. A written calendar time period shall be furnished for the plant establishment period. When there is more than one plant establishment period, the boundaries of the planted area covered for each period shall be described. The plant establishment period shall be modified for inclement weather shut down periods, or for separate completion dates for areas.

ii. Maintenance During Establishment Period

Maintenance of plant material shall include straightening plant material, supplementing mulch; pruning dead or broken branch tips; maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; and removing and replacing unhealthy plants. At the end of the 12-month establishment period, the CONTRACTOR shall remove all stakes and guying material.

- Watering Plant Material
  The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of 1 inch absorbed water per week, delivered in the form of rain or augmented by watering. Run-off puddling and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or existing plant material shall be prevented.
- Weeding
  Grass and weeds in the installed areas shall not be allowed to reach a maximum of 3 inches height before being completely removed, including the root system.

- Plant Pit Settling
  When settling occurs to the backfill soil mixture, additional backfill soil shall be added to the plant pit or plant bed until the backfill level is equal to the surrounding grade. Serious settling that affects the setting of the plant in relation to the maximum depth at which it was grown requires replacement of plants in accordance with paragraph 3.2.6.B.iv.
- Maintenance Record
  A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, and the quantity of replacements made on each site visit.

iii. Unhealthy Plant Stock

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine If there is a green cambium layer below the bark. The CONTRACTOR shall determine the cause for unhealthy plants and shall provide recommendations for replacement. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

iv. Replacement Plant Stock

Unless otherwise directed, plants shall be provided for replacement in accordance with Part 3.2.6. Replacement plant stock shall be installed in accordance with Part 3.2.6. An extended plant establishment period shall not be required for replacement plant stock.

v. Maintenance Instructions

Written instructions shall be furnished containing drawings and other necessary information for year-round care of the installed plant material; including, when and where maintenance should occur, and the procedures for plant material replacement.

G. METAL GUYING MATERIAL

Metal guying material shall be a minimum 12 gauge wire. Multi-strand cable shall be woven wire. Guying material tensile strength shall conform to the size of tree to be held firmly in place. Metal guying material must be covered in a rubber hose sleeve.

H. TURNBUCKLE

Metal turnbuckles shall be galvanized or cadmium-plated steel, and shall be a minimum 3 inches long with closed screw eyes on each end. Screw thread tensile strength shall conform to the size of tree to be held firmly in place.

I. PLASTIC GUYING MATERIAL

Plastic guying material shall be designed specifically for the purpose of firmly holding plant material in high wind velocities.

J. CHAFING GUARD

Plastic chafing guards shall be used to protect tree trunks and branches when metal is used as guying material. The material shall be the same color throughout the project site. Length shall be a minimum 1½ times the circumference of the plant trunk at its base.

K. RUBBER GUYING MATERIAL

Rubber chafing guards, consisting of recycled material, shall be used to protect tree trunks and branches when metal guying material is applied. The material shall be the same color throughout the project. Length shall be a minimum 1 1/2 , times the circumference of the plant trunk at its base

5.3.6. Live Stake Harvesting

The source of all live cuttings shall be from purchased stock or located on-site or within 25 miles of the project site. The CONTRACTOR shall locate, flag, and code the live cutting sites. The CONTRACTOR shall notify the ENGINEER 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.

5.3.7. Live Stake 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 branch material from a State certified nursery. The material shall meet all of the specifications found in this section.

5.3.8. Live Stake Material Preparation

A. CUTTING

Shrubs and young trees used in preparation of live stakes shall be cut directly above the ground. All cuts shall be smooth and the cut surface kept small. The use of large pruning shears or power saws may be required. Trees that are more than 3 inches in diameter shall be topped. The live materials shall be transported to the construction site within 8 hours of harvesting and then cut to size, as specified above and on the details.

B. STORAGE

Live materials must be protected against drying out and overheating before/during transport (e.g., they shall be covered, transported in unheated vehicles, moistened, kept in soak pits) and on-site prior to installation (e.g., by storing in controlled conditions, storing in shade, covering with evergreen branches or plastic, placing in moist soil, or spraying with antitransparent chemicals). Live materials shall receive continuous shade, shall be sheltered from the wind, and shall be continuously protected from drying by being heeled into moist soils. Where water is available, live cuttings shall be sprayed or immersed.

Warm water (60 F) stimulates growth and should be used only upon the approval of the ENGINEER. Any costs associated with such storage are incidental to the overall unit costs. Live materials shall be installed the same day that the cuttings are harvested. If installation of live materials cannot be accomplished on the same day and storage is required, live materials shall be stored for a period no longer than two (2) days. Any storage of live materials must be approved by the ENGINEER prior to storing.

C. LIVE STAKE INSTALLATION

i. Installation

Drive live stakes through the erosion control fabric and into the ground so that 60 percent of the stake is below the ground surface. The CONTRACTOR shall use a dead-pan 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. Stagger the live stakes in a random pattern throughout the specified planting area at a density of 1 live stake per square yard. Live stakes shall be installed according to the plan details.

ii. Placement

Placement of the live stakes shall be indicated on the drawings and details. Live stake buds shall be facing upward.

iii. Replacement of Split Stakes

All live stakes split during installation may be left in place, but must be supplemented with a new live stake that remains un-split after installation.

D. MAINTENANCE

The CONTRACTOR shall maintain a 1 year, 85 percent care and replacement warranty for live stakes. The CONTRACTOR shall perform maintenance as follows: a) Replace all diseased and dead vegetation caused by factors other than stream erosion; b) Keep vegetation cleared of debris after all storm events; and c) Prune all dead wood and vegetation as needed. 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 and shall be included in the unit cost of the live staking installation.

5.3.9. Protection of Surfaces

Protect newly backfilled, graded, top soiled, and seeded areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, slopes, or seeding.

5.4. SOURCE INSPECTION

The nursery or source of plant materials and the source of delivered topsoil shall be subject to inspection by the ENGINEER.

5.4.1. Delivery, Inspection, Storage, and Handling

A. PLANT STOCK IDENTIFICATION

Plant stock shall be identified with attached. durable, waterproof labels and weather-resistant ink, stating the correct botanical plant name and size.

B. PROTECTION DURING DELIVERY

Plant stock shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

C. DELIVERED TOPSOIL

Prior to its delivery, the availability of topsoil meeting the requirements in paragraph 2.5.E. Topsoil shall be verified. A soil test shall be provided to the ENGINEER for topsoil delivered to the site.

D. SOIL AMENDMENTS

Soil Amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

E. INSPECTION

i. Seed

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements

ii. Planting

Plants shall be well shaped, vigorous and healthy with a well branched root system, free from disease, harmful insects and insect eggs, sun-scald Injury, disfigurement or abrasion. Plant stock shall be checked for unauthorized substitution and to establish nursery grown status. Plants showing desiccation, abrasion. sun-scald injury. disfigurement, or unauthorized substitution shall be rejected. The plants shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plants that measure less than specified, or have been poled, topped off or headed back, shall be rejected. Container-grown plant stock shall have new fibrous roots and the root mass shall retain its shape when removed from the container. Plants with broken or cracked balls; or broken containers shall be rejected. Bare-root plant stock that is not dormant or is showing roots were pulled from the ground shall be rejected.

F. STORAGE

i. Seed Storage

Seed shall be stored in designated areas. Seed shall be stored in cool, dry locations away from contaminants and direct sunlight.

ii. Plant Storage

Plants not installed on the day of arrival at the site shall be stored and protected in designated areas. Plants shall not be stored longer than 30 days. Plants shall be protected from direct exposure to wind and sun. Bare-root plant stock shall be heeled-in. All plant stock shall be kept in a moist condition by watering with a fine mist spray until installed.

iii. Other Material Storage

Storage of other materials shall be done in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with plant or seed stock.

G. HANDLING

Plants shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped plant material shall be avoided. Plants shall not be handled by the trunk or stems. Plant stock shall not be dropped or dumped from vehicles.

H. TIME LIMITATION

Except for container-grown plant stock, the time limitation from digging to installing plants shall be a maximum 90 days. The time limitation between installing the plant stock and placing the mulch shall be a maximum of 24 hours.

5.5. WARRANTY

The CONTRACTOR shall maintain a 1 year, 85 percent care and replacement warranty for 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 1 year, with one potential replacement period. The CONTRACTOR will not be responsible for live stakes that have been damaged by vandalism, fire, flooding or other activities beyond the Contractor's control.

5.5.1. Seeding Warranty

The CONTRACTOR shall maintain a 1 year, 85 percent aerial coverage care and replacement warranty on all native seeding per 1,000 square foot area. The period of care and replacement shall begin after final inspection and approval of the initial installation of seed. The CONTRACTOR will not be responsible for seeded areas that have been damaged by vandalism, fire, flooding, animal predation, or other activities beyond the CONTRACTOR'S control. The CONTRACTOR shall be responsible for reseeding all areas

experiencing less than an 85 percent survival rate, prior to the end of the growing season (October) of the year following completion of seeding.

5.5.2. Planting Warranty

The CONTRACTOR shall maintain a 90 percent care and replacement warranty for 1 year for all planted trees, shrubs, and herbaceous plants. Replacement of trees, shrubs, and herbaceous plants shall be conducted in accordance with the material and construction in these specifications. The CONTRACTOR shall not be responsible for damage or plant mortality due to vandalism, wildlife predation, or Act of God beyond the CONTRACTOR'S control and responsibility (e.g., floods). Plant replacements shall be performed in accordance with these specifications.

CHAPTER 6 –WATER CONTROL

6.1.DESCRIPTION OF WORK

Control of water within the Work area is the sole responsibility of the CONTRACTOR. The need for water control measures such as cofferdams, sumps, pumps, pipes, etc., to maintain dry working conditions shall be the CONTRACTOR'S responsibility to determine; and the design, installation and maintenance of said measures shall be the CONTRACTOR'S responsibility. While past water levels may not be indicative of future levels, they do provide an indication of expected high water conditions that the CONTRACTOR should be aware of when preparing its bid. The CONTRACTOR should anticipate such conditions and be prepared to provide water control as required by the Specifications and the ENGINEER. All items related to Water Control are considered incidental to the overall accomplishment of the project and no separate payment will be made.

6.2. MATERIALS

Construction materials used in water control are at the discretion of the CONTRACTOR, provided no environmental or safety regulations are violated. All manufactured materials and products shall be used in accordance with manufacturer's recommendations.

6.3. FLOODING CONSIDERATIONS

The CONTRACTOR shall monitor NOAA weather radio or commercial broadcasts during construction activities for flash flood watches and warnings that might impact the project area in order to withdraw personnel and equipment from Work areas should flooding conditions develop.

6.4. SUBMITTALS

6.4.1. Water Control Plan

The water control plan shall describe the means and methods for implementing water control measures. Any structures to be used for water control shall be described, including design calculations, drawings, details, etc., sealed by a professional engineer licensed in the State of Tennessee. The plan shall be submitted for ENGINEER approval at least seven calendar days prior to its anticipated implementation.

6.5. ENGINEERING APPROVAL

The CONTRACTOR shall submit a plan for water control during the execution of the project. Structures incorporated in water control measures (i.e. cofferdams, sheet piles, braced excavations, pumps, sumps, pipes, etc.) shall be subject to approval by the ENGINEER prior to installation. Design calculations, drawings, details, etc., prepared and sealed by a professional engineer licensed in the State of Tennessee, on behalf of the CONTRACTOR, shall be provided to the ENGINEER

6.6. PERFORMANCE

Water control measures shall allow Work to be performed in such a manner that equipment and personnel do not work in flowing water where possible. Construction of structures and other in-stream work in the Harpeth River channel will require work in flowing water.

6.7 PUMP AROUNDS

If possible, channel relocation work shall be completed and restored prior to allowing flow to enter into the newly constructed stream channel. If the channel relocation work is not completed prior to abandoning the old channel. a temporary dam and pump-around may be installed to facilitate construction of the channel "in the dry." Flows producing riffle depths greater than six inches shall be considered high flow conditions. Dam shall be placed such that it can be overtopped during high flows without resulting in flooding. The use of a temporary dam and pump-around shall be considered incidental to the project. A diversion ditch may also be used if approved by the ENGINEER. Work on this project will require construction in flowing water.

6.8. PUMP DISCHARGES

The CONTRACTOR may employ pumps for dewatering, dredging, or other construction operations. When used, any discharge from a pump shall be routed so as to prevent the release of sediments into the streams.

CHAPTER 7 –IN-STREAM STRUCTURES

7.1. DESCRIPTION OF WORK

This specification covers all items related to in-stream structures as specified on the plans or as directed by the OWNER'S REPRESENTATIVE.

The Work covered by this specification consists of furnishing all materials, equipment, and labor for the construction of in-stream structures at the locations and to the extents indicated on the Drawings.

Tasks such as excavation and backfilling are covered by this specification.

7.2. MATERIALS

Products specified in this Section shall be placed only in the locations indicated on the contract drawings, except where noted.

7.2.1 Boulders

Boulders are solid durable **LIMESTONE** rock quarried locally, which is generally resistant to erosion and to normal stream chemistry. Boulders shall have specific gravity of at least 2.5. Boulders shall have a dry density greater than 163 lb/ft3.

i. Footing boulders

Footing boulders shall have approximate cubic dimensions measuring 12in x 24in x 24in = 4 ft^3. Each footing boulder shall have weight greater than 652 lb. Competent, existing, in-place, limestone bedrock, as determined by the Engineer, may be used in lieu of footing boulders where site conditions permit.

ii. Surface Boulders

Surface boulders shall have approximate cubic dimensions measuring 12in x 24in x 36in = 6 ft^3. Surface boulders shall have dry weight greater than 978 lb.

iii. All boulders

Boulders - Use hard, durable limestone boulders harvested on-site from the existing channel or approved stone quarried locally. All boulders, including surface boulders and footing boulders, shall have average diameter no less than 3 feet. Average diameter is calculated by measuring length x height /3. Do not use boulders less than 12” in length, width or height. All boulders placed in the active channel between bankfull lines must be placed on a footing boulder or foundation log.

Boulders shall be durable **limestone** with minimum diameter as specified in the plans for appropriate structures. Boulders shall demonstrate a minimum Slake Durability Index of 85 percent as determined by KM 64-513-02.

7.2.2 Non-woven geotextile filter fabric

Filter Fabric shall consist of a non-woven geotextile fabric with equivalent properties of US 205NW manufactured by US Fabrics. Minimum weight is 8oz/sy.

7.2.3 Bedding Material

Bed material aggregates shall be gravel or crushed stone. Aggregates shall be composed of clean, hard, durable, mineral particles free from organic matter, clay balls, soft particles, or other substances that would interfere with the free-draining properties of the aggregates. Aggregates may be crushed limestone or other material that has limestone particles included. Aggregates from crushed limestone shall be thoroughly washed and screened to remove limestone dust, limestone fines, and fine soil particles. Do not use rounded stones for bed material. Bed material may be recycled river alluvium or aggregates made from solid durable limestone rock quarried locally, which is generally resistant to erosion and to normal stream chemistry.

Placed bed material shall generally conform to the requirements in TDOT Standard Specifications for Class A-3 Machined Riprap and TDOT Size 57 Coarse Aggregate (903.22) unless otherwise directed. This material shall be placed with typical thickness of less than 24-inches with surface tolerance of 2-inches of finished grade. Bed material shall have specific gravity of at least 2.5 and 20% by weight shall be at least 4-inch equivalent circular diameter. Either use an approved stock-pile of river alluvium or mix equal parts TDOT Class A-3 Machined Riprap, 2-inch to 6-inch diameter (0.5 to 11 lbs.) and TDOT Size 57 Coarse Aggregate, ½-inch to 1-1/2-inch, stones. The surface of placed bedding material shall be thoroughly chinked and filled with the smaller stones by scattering and tamping with approved equipment.

7.2.4 Coir Matting

The coir erosion control fabrics shall consist of 100% natural coir drawn from coconut husks. The yarn shall be wheel spun, well cleaned, evenly spun and uniformly twisted. The fabric shall have an open weave construction. The weight of the fabric shall equal or exceed the fabric(s)specified on the Drawings and be installed with dead stout stakes or approved equivalent.

i. Coir Matting – Use a woven geotextile blanket composed of 100% biodegradable, natural coconut (coir) fiber having approximate weight of 0.143 lbs/ft2 (700 g/m2), ¼" x ¼" mesh size, 50% open area, 222.7 lbs dry breaking load, 194 lbs wet breaking load and 12 ft/sec permissible water flow velocity.

Standard Roll Specifications
Width: 7.5 ft (2.3 m)
Length: 164 ft (50 m)
Weight: 308 lbs (140 kg) approx.
Area: 239 yd2 (200 m2)

ii. Dead stout stakes - shall be constructed using 1-inch x 1-inch (nominal) hardwood lumber, 18 to 24 inches in length, cut diagonally across its length to form two stakes. The length of stakes shall be in

accordance with the specifications of the manufacturer of the erosion control product. Stakes shall be placed as shown in detail on the drawings. Cross stakes consist of two dead stakes as shown in the detail placed on the upstream edge of the fabric. Placement is shown in the detail.

7.2.5 Structure Logs

Use hardwood logs free of disease, rot and insects. Recycle logs from felled trees on-site where possible, leaving rootwads intact. No saw cuts shall be left exposed on any log structure to provide a natural appearance. Logs shall have a minimum diameter of 18-inches as measured at breast height of the original tree. Logs are usually 30-ft long measured with or without rootwads. Use log length specified on the drawings for vane arms and LWD Toe Wood Structures.

7.2.6 Live Stakes for Wood Toe sod mats

Live Stakes shall be 2”-3” diameter and 3’-5’ long.

7.2.7 Live Stakes for bankfull bench (vane arms)

Live cuttings for live stakes shall be 1/2", to 2 inches in diameter and 2.5 -3.5 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. The species used will include: Sandbar Willow (Salix interior).

7.3. CONSTRUCTION METHODS

7.3.1. Excavation Required for Construction of Hydraulic Structures

All excavation required for construction of hydraulic structures will be considered incidental to that structure.

7.3.2. Structures

A. DOUBLE INVERT BOULDER CROSS VANE

Construct cross vane structures by first shaping the bankfull channel to the grades specified, including scour pools and placement of gravel substrate. Next, excavate enough bed material to place the boulders and bed material overlay. Placement of boulders shall start at the center of the stream, or invert, and proceed outward to the banks. First, place footing boulders and surface boulders at the channel invert and then check the elevations of the inverts. Once the inverts have been established the remainder of the footing and surface boulders shall be placed tightly against each other, minimizing voids. The vane arms of the cross vane shall slope up to the bank at the elevations and slopes indicated on the drawings. Fill the voids on the upstream side of surface boulders with gravel such that water will flow over the surface boulders rather than through gaps in the boulders. Hand placement of interstitial mix (bed material) will be necessary to provide adequate filling of all voids between boulders.

B. TOE WOOD

Construct Toe Wood by first excavating below the channel extents at the toe of the bank on the outside of bends. Then place foundation logs at the angles specified in the plans. Place the root wad logs

cantilevered over the foundation logs. Place filler material (small logs, limbs, tree tops, and brush parallel to the root wad logs. Place shallow backfill. Place live cuttings parallel to the root wad logs. Place backfill over the live cuttings. Then stack soil wrapped lifts on top of the backfill as shown in the detail.

C. LOG CROSS VANE

Construct log vane structures by first shaping the bankfull channel to the grades specified, including scour pools. Next, excavate enough bed material to place the logs, filter fabric and gravel overlay. Placement of logs for log vane structures shall start as indicated in the plans from the toe of the bank and proceed outward to the banks. First, place foundation and surface logs and then check the elevations on stream bottom and tie to the bank. These logs shall be placed tightly together to minimize gaps. The vane arms of the log vane shall slope up to the bank at elevations and slopes indicated on the drawings. Place filter fabric at the upstream end of the structure as shown on the drawings and backfill with gravel to seal any gaps. Fill the voids on the upstream side of surface logs with gravel such that water will flow over the surface logs rather than through gaps in the logs. Do not leave exposed filter fabric in the channel.

D. BOULDER CLUSTERS

Excavate the stream bed and place footing boulders arranged as shown in the detail. Place surface boulders on top of two footing boulders as shown. Footing boulders are not required if bedrock is encountered at the bed elevation shown on the profile in the project drawings.

7.3.3. FILLING AND BACKFILLING

A. GENERAL

Fill and backfill to contours, elevations, and dimensions indicated. Do not place fill over frozen or excessively wet areas. Place backfill material adjacent to structures as the structural elements are completed and accepted.

Place fill in horizontal lifts extending the full width and length of the embankment. Do not dump fill material into the final position; distribute the fill in a manner that will prevent the development of voids, pockets, and/or poorly mixed material.

Apply water or aerate the material to obtain satisfactory moisture content for compaction. Compaction shall be accomplished by sheepsfoot rollers, pad foot rollers, tamping foot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory plates, vibratory rollers, or other approved equipment well suited to' the soil being compacted.

Compact areas not accessible to rollers or compactors with mechanical hand tampers. Compact each lift before placing overlaying lift. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

B. LIFT THICKNESS

Compacted lift thicknesses shall not exceed 6 inches, unless noted otherwise.

7.3.4. FINISH OPERATIONS

DISPOSITION OF DREDGED AND SURPLUS MATERIAL

All surplus or other soil material not required or not suitable for filling, backfilling, or aquatic and riparian habitat, including brush, refuse, stumps, roots, and timber, shall be removed from the site.

The CONTRACTOR is responsible for locating, securing and permitting a suitable off-site disposal area, purchasing or leasing needed property, obtaining all required federal, state, or local permits, complying with all applicable federal, state, or local regulations, maintaining the disposal site during construction, and closing/restoring the disposal site at the conclusion of this project.

7.4. TOLERANCES

The surface of In-Stream Structures shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown on the drawings, The degree of finish for vane slopes and invert elevations shall be within 0.1 foot of the grades and elevations indicated. All gaps or voids between surface boulders of cross vanes and log vanes shall be plugged with gravel to form a tight-fitting seal. Maintain areas free of trash and debris.

CHAPTER 8 –EROSION CONTROL

8.1. DESCRIPTION OF WORK

This Work consists of furnishing all labor, equipment and materials for providing erosion control measures for all disturbed areas during construction.

8.2. MATERIALS

8.2.1. SILT FENCE

Temporary silt fence shall conform to the requirements of Tennessee Department of Transportation Standard Specifications.

8.2.2. TEMPORARY SEEDING

Temporary seed species for surface erosion control or over seeding shall be a minimum of 95 percent pure live seed in accordance with the temporary cover crop specification found in the seeding schedule. Weed seed shall be a maximum 1 percent by weight of the total mixture. Seed labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act shall be furnished. The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed. Substitutions will not be allowed without written request and approval from the ENGINEER. Seed that is wet or moldy or that has been otherwise damaged in transit or storage will not be accepted. Acceptable temporary seed species and seeding rates are shown on the plans.

8.2.3. COIR MAT

Coir mat shall be as specified in section 7.2.D. of these specifications. Coir mat will be placed in the areas shown on the plan view, typical cross sections, and details. Coir mat will be placed perpendicular to the flow as shown in the detail. It shall be placed on a flat surface with no voids between the final grade and the coir mat. Both dead stakes and live stakes will be used to secure the mat. The details explain the spacing of the staking. This method goes above and beyond the manufactures recommendations to secure the mat to the soil. The most effective method to secure the mat is to establish grass as quickly as possible. The contractor is responsible for replacing any coir matt that may come loose or wash out for a period of one year after installation.

8.2.4. SURFACE EROSION CONTROL BLANKET

When called for in the plans the blanket shall be consistent thickness with 100% coconut fiber (0.5 lb/yd_2) evenly distributed over the entire area of the mat. The blanket shall be covered on the top and bottom with natural fiber netting having 5/8 inch x 5/8 inch mesh size.

8.2.5. EROSION CONTROL MATERIAL ANCHORS

Erosion control anchors shall consist of 18-inch wooden stakes.

8.2.6. WOOD STAKING MATERIAL

Wood stakes shall be hardwood or fir; rough sawn, free from knots, rot, cross grain, or other defects that would impair their strength

A. BRACING STAKE

Wood bracing stakes shall be a minimum 2 x 2 inch square and a minimum 8 feet long with a point at one end. Stake shall be set without damaging rootball.

B. WOOD GROUND STAKES

Wood ground stakes shall be a minimum of 2 x 2 inch square and a minimum 3 feet long with a point at one end.

C. DEADMEN

Wood deadmen shall be a minimum 4 x 4 x 36 inches long.

8.3. CONSTRUCTION METHODS

8.3.1. TEMPORARY SEEDING

A. APPLICATION

Temporary seeding shall be used on exposed soil surfaces where additional Work will not occur for a period of more than 14 calendar days. Temporary seeding shall be performed at no additional cost to the OWNER.

B. GROUND SURFACE PREPARATION

After the areas required to be seeded have been brought to the grades shown, the soil shall be tilled to a minimum depth of at least four inches by an approved operation until the condition of the soil is acceptable. The Work shall be performed only during periods when, in the ENGINEER'S opinion, beneficial results are likely to be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the Work shall be stopped. Undulations or irregularities in the surface shall be leveled before application of seeding and netting.

C. SEEDING

Seeding Seed and fertilizer shall be broadcast as specified in the planting details.

D. MULCHING AND NETTING

Refer to planting details.

E. PROTECTION, CARE AND MAINTENANCE

Protection of temporary seeded areas shall be the responsibility of the CONTRACTOR. Protection shall be provided against traffic or other use by erecting barricades immediately after treatment is completed, and by placing warning signs, as directed.

Seeded areas shall be maintained until permanent seeding can be placed on the area. Any damage shall be repaired, and mulch material that has been removed by wind or other causes shall be replaced and secured.

The CONTRACTOR shall be responsible for the proper care of temporarily seeded areas. Water and fertilizer shall be applied to seeded areas as necessary to promote seed growth and prevent erosion.

8.3.2. SILT FENCE

A. INSTALLATION

Silt fence shall be installed down-slope of areas to be disturbed prior to clearing and site preparation. The bottom 12 inches of the fabric shall be buried in a 6 inch trench cut into the ground to prevent sediment form escaping under the fence. All earth work shall be on the upstream side of the fence. *38*

B. MAINTENANCE

Silt Fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Damaged, dislodged, or decomposed fences shall be repaired or replaced immediately. Silt fence shall be replaced at least every six months.

Sediment deposits shall be removed after each storm event or when deposits reach approximately one-half of the barrier height.

Silt Fence shall remain in place until permanent soil stabilization has become established.

8.4. PERMIT COMPLIANCE

The OWNER has obtained a Section 404 Permit through the U.S. Army Corps of Engineers for performance of this project. The 404 Permit is related to discharge of dredge or fill material into the waters of the United States. The CONTRACTOR shall comply with the provisions of the permit.

CHAPTER 9 –STORM WATER POLLUTION PREVENTION PLAN

9.1. SUMMARY

The Contractor shall furnish all labor, equipment, materials, and routine maintenance for the construction of temporary erosion and sediment control measures in accordance with the Drawings and Specifications, or as otherwise directed by the Engineer.

The Contractor shall install and maintain any and all erosion and sediment control measures necessitated by project changes or alterations made by the Engineer, or by the Contractor. These changes and alterations must comply with the Drawings and Specifications and any applicable local and state ordinances and laws.

9.2. SUBMITTALS

The Contractor shall submit all required local permits prior to construction.

9.3 COMPLIANCE

A. The Contractor shall comply with the Stormwater Pollution Prevention Plans (SWPPP) as outlined in the Drawings.

B. During the project the Contractor shall keep a copy of the NOI-SWCA and the SWPPP on the jobsite, available for review by the Owner, Agency, and state inspectors and regulatory officers.

C. During the project the Contractor shall keep a Maintenance Log on the jobsite, in a 3-ring binder, and shall record the dates and intensity of significant rain events, how each BMP responded to each rain event, and the method used to maintain, clean out, repair, and/or replace any impacted BMP. A copy of a typical Maintenance Log is included in this Section.

D. BMP's shall be inspected weekly (at a minimum) and after any significant rain event (>0.5"). The Contractor shall take corrective action for proper maintenance of each BMP.

9.4 PRODUCTS

9.4.1. GENERAL

The materials used for sediment and erosion control shall meet the requirements set forth in other parts of the Drawings and Specifications.

9.5 EXECUTION

9.5.1 GENERAL

A. All sediment and erosion control devices shall be installed prior to beginning site clearing and grubbing and/or excavation/construction.

B. The Contractor shall monitor and maintain all sediment and erosion control measures throughout the construction period.
    a. Sediment and erosion control measures shall be inspected weekly and after each storm event exceeding 0.5 inches of precipitation.
    b. Accumulations of silt or other material obstructions that reduce their effectiveness shall be removed.
    c. The Contractor shall promptly make any required repairs to insure all measures continue to function properly for the duration of the project. Maintenance is incidental to the cost of the project.

C. The Contractor shall indemnify and hold harmless the Owner for any penalties imposed against the Owner by any local or state agency for the failure of any erosion and sediment control measures.

D. The Contractor shall promptly correct any erosion and sediment control deficiencies identified by the Engineer or other local or State agency. If the Contractor fails to correct these deficiencies within 24 hours of notification, the Owner may make any required corrections and assess the cost of this work to the Contractor.

E. During the project the Contractor shall undertake intermediate grading measures to insure the site drains properly and in a manner that silt and erosion will be directed to the appropriate BMP's. Repairs to specific areas of the site subject to more severe erosion shall be repaired as directed by the Engineer.

F. If any waste/borrow areas or project access routes not defined on the Drawings and Specifications are used, the Contractor shall be responsible for the installation and maintenance of all erosion and sediment control measures required for those areas and shall coordinate with the appropriate property owners involved. The Contractor shall be responsible for the cost for all work related to erosion control, permitting, and re-grading of these areas.