



VTrans Riparian Planting Toolkit

FOR CONSTRUCTION IMPACTS ON RIPARIAN AND
WETLAND BUFFERS

Vermont Agency of Transportation | Monday, June 20, 2022

Acknowledgements

This document was developed based on existing riparian buffer guidelines from the Vermont Agency of Natural Resources, Vermont Natural Resources Conservation Service, Virginia Department of Environmental Conservation, among other regional resources. The recommendations in these resources were combined to apply to common transportation-related projects within the Vermont Agency of Transportation.

AUTHORS/CONTRIBUTORS:

- Bonnie Kirn Donahue, VTrans Landscape Architect
- Glenn Gingras, VTrans Senior Environmental Biologist
- Heather Voisin, VTrans Green Infrastructure Engineer

FEEDBACK PROVIDED BY:

- VTrans Environmental staff
- VTrans Highway Division staff

**A special thanks to AOT staff who offered their perspectives on how landscape impacts their work and areas of expertise. These conversations helped craft the approach to planting design in this toolkit.*

QUESTIONS/CONTACT INFORMATION:

Bonnie Kirn Donahue | Landscape Architect

Vermont Agency of Transportation

802-793-1583

bonnie.donahue@vermont.gov

<https://vtrans.vermont.gov/highway/project-delivery-environmental/landscape>

Purpose

This document aims to provide a more consistent, efficient approach to riparian and wetland planting design on projects with construction impacts that often require permits. Revegetating disturbed areas on construction projects will help minimize the environmental impacts from common construction practices, including but not limited to temporary bridges, temporary access roads, work in or adjacent to water bodies. The strategy outlined is intended to be used by VTrans project designers and consultants on transportation-related projects in the State of Vermont.

WHY ARE BUFFERS IMPORTANT?

Riparian and wetland buffers serve important purposes for the health of Vermont's water quality and wildlife, including:

- Preventing erosion on steep embankments
- Provide shade, food sources and woody debris to keep water cool and healthy for fish and other aquatic species to thrive
- Provide wildlife corridors along wetlands and streams.
- Vegetated areas prevent sediment and pollutants like phosphorus from entering water bodies, keeping rivers, ponds and lakes clear from algae.

Using native trees and shrubs in addition to a seed mix speeds up natural succession, establishing an effective riparian buffer more quickly than using seed alone. Selecting plants that have already started to grow will also have a better chance of establishing before invasive plants have a chance to fill in.

Revegetating areas where riparian and wetland buffers are impacted establishes a connection between the newly completed project with the existing conditions. Selecting native plants that complement the character of the area will make projects more visually appealing and merge the transportation asset with its surroundings.

GOALS FOR THE TOOLKIT

- To re-establish a vegetative buffer that supports wildlife, pollinators, and provides ecological benefits.
- Revegetate riparian buffers to have at least 75% cover by woody plants by year 5. Healthy woody coverage should be well-established by year 2.¹
- Use woody plants in addition to seeding on projects to provide greater bank stabilization.
- Specify plants that are native to Vermont.

¹ NRCS VT, (391), Page 5.

- Prioritize plants that are pollinator-friendly, wildlife-friendly, Vermont-provenance, and contribute to species diversity.

Right Plant, Right Place

Successful planting plans for riparian and wetland revegetation match plants to the setting. Using the Wetland Indicator Status rating system can help guide plant selection based on the “probability, or frequency, with which it was thought to occur in wetlands, as opposed to non-wetlands.”² While riparian buffers are not necessarily classified as wetlands, the moisture conditions where the plants grow in each are similar. The Wetland Indicator Status can be used to select plants that are more likely to grow naturally in these areas. Certain plants perform best in constant moisture, while others perform better in occasionally moist or dry conditions. Using this rating in combination with an individual plant’s soil moisture preferences will ensure that the plants specified for projects are appropriate for site conditions.

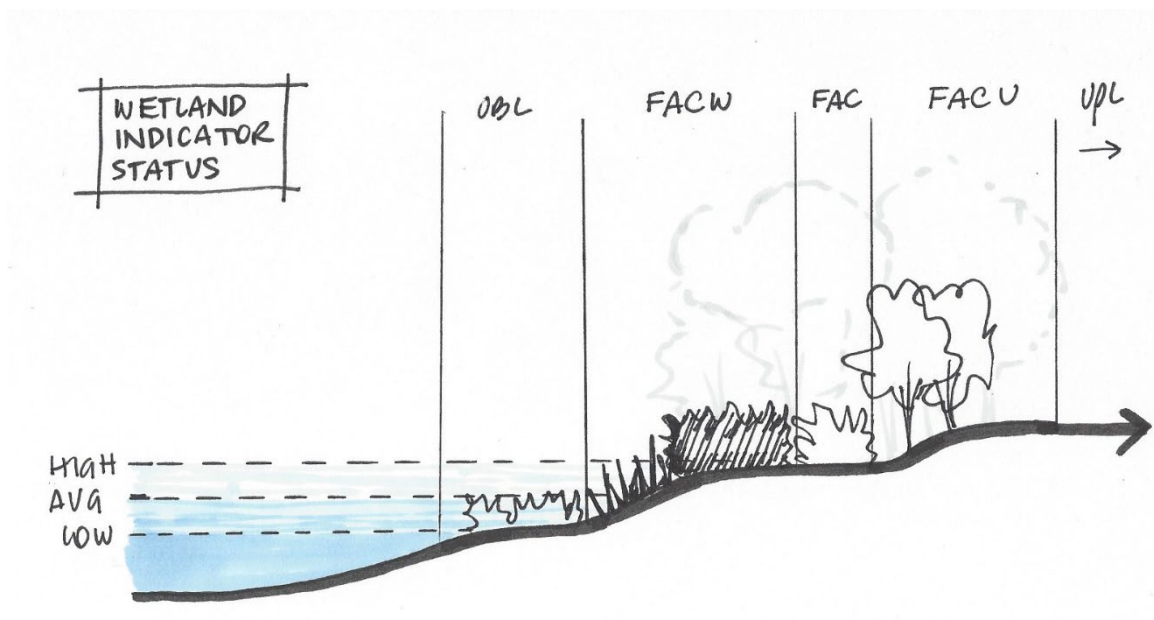


Figure 1: Sketch redrawn by Bonnie Donahue based on image from US Army Corps of Fort Worth, TX³

² Lichvar, Robert W., et al., July 2006, p.1.

³ US Army Core of Engineers, 11/23/2021.

Wetland Indicator Status Definitions (short version):

- **OBL** (Obligate Wetland Plants)—Almost always occur in wetlands.
- **FACW** (Facultative Wetland Plants)—Usually occur in wetlands but may occur in non-wetlands.
- **FAC** (Facultative Plants)—Occur in wetlands and non-wetlands.
- **FACU** (Facultative Upland Plants)—Usually occur in non-wetlands but may occur in wetlands.
- **UPL** (Upland Plants)—Almost never occur in wetlands.⁴

SITE CONSIDERATIONS

Every site is different, and every project has different requirements. Final plant selection and layout should be based upon factors specific to the site and project, including but not limited to:

- Site Features
 - Location and condition of the edge of the body of water
 - Location of the 50' riparian and wetland buffers
 - Post-construction site topography
 - Existing surrounding vegetation
- Roadway Design:
 - Avoid specifying woody plants in the clear zone (CZ).
 - Plants in the clear zone should not grow taller than 2-3' to maintain visibility. Plants in these areas will likely be mowed or treated with herbicide more frequently. Use a seed mix in these areas.
 - Where possible, leave space for ditching by Districts. Use a seed mix in these areas.
 - Be aware of site distance triangles (15°) and avoid planting anything above 2-3' in these areas.
- Utilities:
 - Avoid specifying large trees under overhead utilities. In some cases, small trees (growing lower than 15') may be used. Provide at least 15' clear on each side of the overhead utility line, unless determined otherwise.
 - Review planting plans with VTrans ROW Utility Coordinators.
 - Coordinate plantings near underground utilities to determine safety of roots relative to underground utilities or other structures.
- Maintenance:
 - Low to no maintenance is preferred.
 - If maintenance is required, establish maintenance agreements with AOT Maintenance Districts or preferably municipalities prior to construction (1111 permit, finance & maintenance agreements, etc.).

⁴ Lichvar, Robert W., et al., July 2006, p.3.

- Environmental Resources:
 - o Consider impacts on other environmental resources including, cultural, natural, and stormwater management.
- Invasive Species:
 - o Identify invasive species and balance planting with management.

Planting Strategy

Multiple strategies were considered for planting:

- COOKIE CUTTER:
 - A cookie cutter planting plan & plant list for use on all projects
 - Pros: Efficient use of time and resources for design
 - Cons: Vermont is a large state with a variety of microclimates.
- SITE-SPECIFIC:
 - A site-specific planting plan & plant list for each project
 - Pros: Plantings matched to site character, etc.
 - Cons: Time and resource intensive.
- 1:1 RESTORATION:
 - A 1:1 replacement of existing plants
 - Pros: Restores existing conditions.
 - Cons: Requires a detailed survey of existing plant material across multiple seasons.

SELECTED

- HYBRID:
 - A zone-based planting layout plan with pre-approved plant list.
 - Pros: Accommodates differences in microclimates while making the design process more efficient in terms of time and resources.
 - Cons: Not an exact replica of what exists pre-construction.

SCALE OF PROJECTS THAT REQUIRE PLANTING PLANS

The scale of disturbance on VTrans projects varies from project to project. Projects with more disturbance will require more extensive planting plans, while projects with minimal disturbance may have space for only a small number of plantings. The scale of disturbance, site considerations and available space will determine the scale of the planting plan.

ZONES

Planting plans will be based on zones relative to the water's edge:

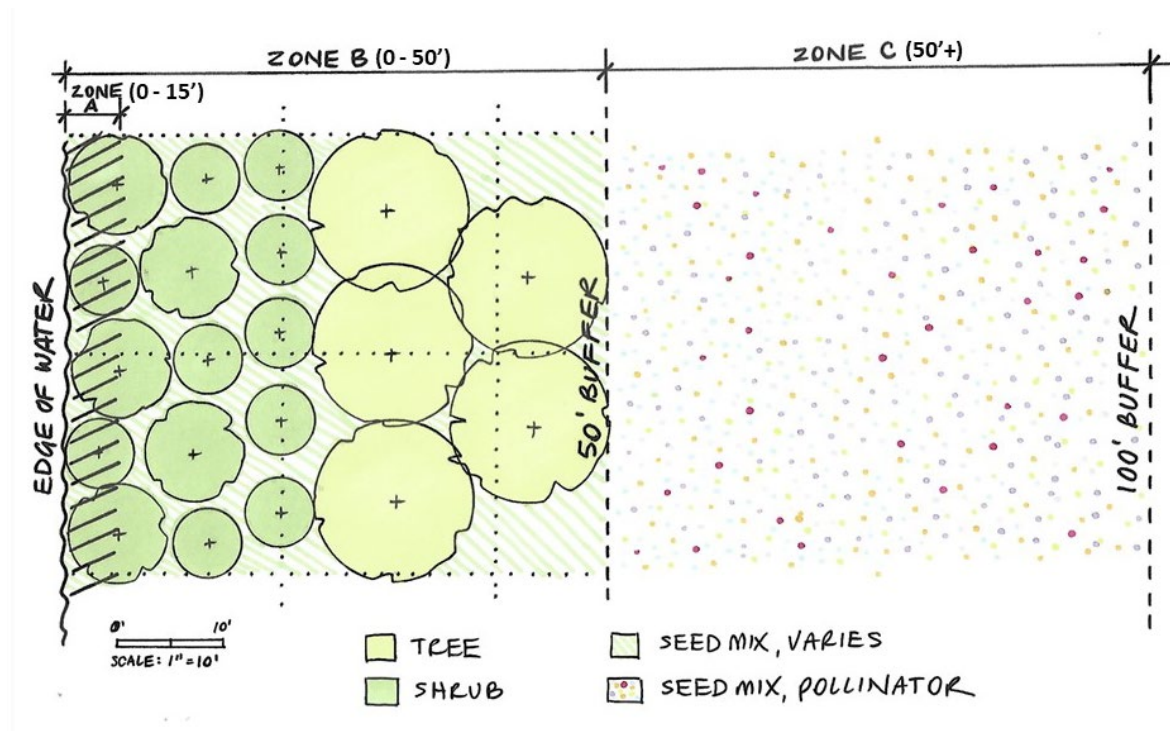


Figure 2: Example planting plan (436 stems per acre). For illustration only. Plant layout may vary as needed.

Planting units (20'x20') are an easy way to determine the number of plants needed on a project. Planting layout may vary.

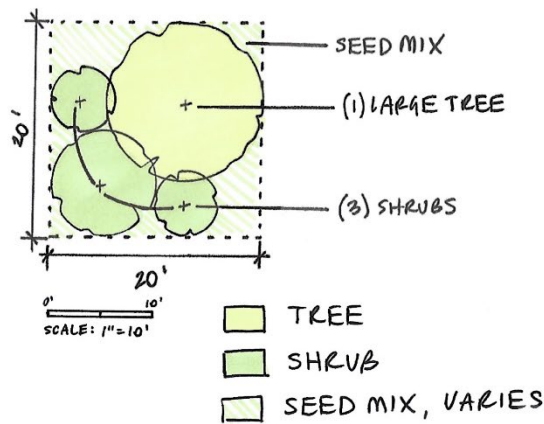


Figure 3: 20'x20' planting unit with (1) large tree and (3) shrubs. (436 stems per acre)

ZONE DESCRIPTIONS

1. GENERAL

- a. Stems per Acre:
 - i. The goal for each project is to plant a minimum of 436 woody stems per acre, which equals approximately:⁵
 1. (1) large tree every 20'x20' = 109 stems/acre
 2. (3) large and small shrubs per 20'x20' unit
 - ii. See Zone B for more information.
- b. Plant Design:
 - i. For species diversity, specify at least (5) (and up to 10-20) different species of trees and shrubs for each planting plan. For pollinator plants, plant 6-8 plants of the same species in proximity to one another.⁶ The feasibility may depend on the size of project.
 - ii. Include (3) flowering species for each season (spring, summer, and fall).⁷
 - iii. Include local provenance, native plants that support pollinators and monarch butterflies.
 - iv. In most cases, specify straight species instead of cultivars. These are the most attractive to native, beneficial insects.
- c. Plan Drafting:
 - i. Dimensions and plant types are rough guidelines and may vary depending on site conditions and project requirements. For more detailed information, see page 4, Site Considerations.
 - ii. Draw plants at 50-75% of their mature size, and base plant spacing on this.
- d. Maintenance:
 - i. Planting plans should be designed to require no additional maintenance other than standard mowing practices. The goal is for the area to naturalize.
 - ii. On culvert projects, at least one, 15-20' access area should remain open (seeding) for maintenance access.

2. ZONE A

- a. Location: For disturbed areas immediately adjacent to the edge of water or wetland.
- b. Area: Within 0-15+' of the edge of water or wetland.
- c. Wetland Indicator Status: OBL/FACW
- d. Plants to include:
 - i. Live Fascines

⁵ NRCS VT, (391), page 5.

⁶ Sorensen, 12/23/2021, page 1.

⁷ Sorensen, 12/23/2021, page 1.

1. Definition: Live fascines are bundles of live, dormant branch cuttings that will root and grow into full-size plants. Cuttings are usually species of *Salix* (willow).
 2. To be used only if there can be sufficient contact with soil at the river's edge.
 3. Placed along entire disturbed perimeter of the body of waters' edge; details to be included in the plans and can be found in the Vermont Standard Specifications and drawings for EPSC.
 - a. Avoid *Salix purpurea*, and other non-native plants.
 4. See VAOT standard EPSC drawing, [Live Fascine](#).
- ii. Live Stakes
1. Definition: Live stakes are individual cuttings of live, dormant branches that when planted, will root and grow into full-size plants. Cuttings are usually species of *Salix* (willow) and *Cornus* (dogwood).
 2. To be used if there is stone fill at the river's edge.
 3. Placed along entire disturbed perimeter of the body of waters' edge; details to be included in the plans and can be found in the Vermont Standard Specifications and drawings for EPSC.
 4. Spacing 1-3' apart; and up to 5' max.
 - a. Avoid *Salix purpurea*, and other non-native plants.
 5. See VAOT standard EPSC drawing, [Live Stake](#).
- iii. Wetland seed mix with pollinators
1. Placed in OBL/FACW areas at or below the ordinary high water (OHW) line.
 - a. Seed mix should not be placed in areas that will be submerged with water.
 2. Use erosion control matting instead of hay or straw for mulch; details to be included in the plans and can be found in the [Vermont Standard Specifications](#), and VAOT standard [EPSC drawings](#).

3. ZONE B

- a. Location: For areas within 0-50' of the edge of water or wetland.
- b. Area: Include the plants below for every 20'x20' area of disturbance⁸ at or above the ordinary high water (OHW) line.
- c. Wetland Indicator Status: FAC/FACU
- d. Plants to include for every 20'x20' in this zone:

⁸ Virginia Department of Conservation and Recreation, 2006, p. 139-140.

- i. (1) Large, canopy tree
- ii. (3) Shrubs (large and small)
- iii. Wildflower (pollinator) seed mix
- iv. Live Stakes
 - 1. Depending on site conditions, live stakes may be used within the first 0-35' in place of shrubs, spaced at 1'-3' on center (up to 5' O.C.).
- v. Pollinator and monarch-friendly perennials
 - 1. To install on projects where possible.
- vi. Concentrate the 436 woody stems/acre within the 50' buffer. Additional woody plants may be placed outside of the 50' buffer depending on the site and project requirements.

4. **ZONE C**

- a. Location: For areas more than 50+' away from the edge of water or wetland.
- b. Wetland Indicator Status: UPL
- c. Plants to include:
 - i. Where possible, apply a wildflower (pollinator) seed mix that matches the site's sun/shade and moisture requirements.
 - ii. Depending on the extent of disturbance, additional trees and shrubs may be planted beyond the 50' wetland or riparian buffer. For pollinator friendly plantings, plant groupings of 6-8 woody plants of the same species together.

Construction/Establishment

- Plantings should be installed in accordance with project plans, details and standard specifications (See [SECTION 656](#) – PLANTING TREES, SHRUBS, AND VINES.)
- Exact layout and placement may be coordinated with the Project Engineer and VTrans Landscape Architect.

Post-Construction

PROJECTS WITH PERMITS

When required by permit, the approved monitoring plan will be used to track success post-construction.

PROJECTS WITHOUT PERMITS

VTrans will revisit and evaluate projects post-construction to make sure the approach is working and adjust when necessary. The Vermont NRCS standards will be used to evaluate success post-construction: “The riparian forest buffer will be considered established when 75% of the planted trees and shrubs are alive after 2 growing seasons.”⁹

⁹ NRCS VT, (391), Page 5.

Resources

- Kirn, Rich. *Planting Guidance for the Revegetation of Riparian Areas in Vermont*. Vermont Fish and Wildlife Department. January 2016. PDF.
<https://dec.vermont.gov/sites/dec/files/wsm/wetlands/docs/Riparian%20Planting%20Guide%20Final%201-8-16.pdf>
- Lichvar, Robert W., Melvin, Norman C., Butterwick, Mary L., and Kirchner William N. *National Wetland Plant List Indicator Rating Definitions*. U.S. Army Corps of Engineers. July 2012. PDF.
<https://www.fws.gov/wetlands/documents/national-wetland-plant-list-indicator-rating-definitions.pdf>
- NRCS VT. *Specification Guide Sheet for Riparian Forest Buffer (391)*. Natural Resources Conservation Service. Accessed 12/7/2021. PDF.
https://efotg.sc.egov.usda.gov/api/CPSFile/22122/391_VT_PS_Riparian_Forest_Buffer_2009
- Sorensen, Jane. *Homestead Pollinator Habitat Enhancement Planning*. Accessed 12/23/2021. PDF.
https://www.uvm.edu/sites/default/files/Extension-Master-Gardener/Homestead_Pollinator_Habitat_Guidelines_and_Options_for_the_HomeScale.pdf
- US Army Corps of Engineers. *Planting for Mitigation*. Fort Worth District Website. Accessed 11/23/2021.
<https://www.swf.usace.army.mil/Missions/Regulatory/Permitting/Planting-for-Mitigation/>
- USDA. *Plant Hardiness Zone Map - Vermont*. Accessed 11/23/2021. PDF.
<https://gpsr.ars.usda.gov/phzm/vm/VT150.jpg>
- Vermont Department of Environmental Conservation. *Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers*. 1994. PDF.
https://anrweb.vt.gov/PubDocs/DEC/WSMD/mapp/docs/mp_native-veg.buffer-manual.1994.pdf
- Virginia Department of Conservation and Recreation, and Chesapeake Bay Local Assistance. *Riparian Buffers Modification & Mitigation Guidance Manual*. September 2003 – Reprinted 2006. PDF.
https://static1.squarespace.com/static/55c211c8e4b06ea5799e6c03/t/56098ce1e4b080746e848fbf/1443466465396/DCR-BufferManual_o6Rev.pdf

Native Plant List for Riparian Buffers on Construction Projects

Plants below were selected for their native-to-Vermont status, tolerance of full to part sun, moisture requirements, stress tolerance, and their overall ability to live in tough post-construction conditions.

EVERGREEN TREES

Larix laricina	Tamarack
Picea glauca	White spruce
Pinus strobus	White pine
Thuja occidentalis	Eastern white cedar (arborvitae)

DECIDUOUS TREES

Acer rubrum	Red maple
Acer saccharinum	Silver Maple
Acer saccharum	Sugar maple
Betula nigra	River birch
Betula populifolia	Grey birch
Carpinus caroliniana	American hornbeam
Celtis occidentalis	Common hackberry
Fagus grandifolia	American beech
Ostrya virginiana	Hop hornbeam
Populus tremuloides	Quaking aspen
Quercus bicolor	Swamp white oak
Quercus rubra	Red oak
Salix nigra	Black willow
Tilia americana	Linden, basswood
Ulmus americana (<i>DED resistant cultivars</i>)	American elm

DECIDUOUS TREES – SMALL

Hamamelis virginiana	Witch hazel
Prunus virginiana	Chokecherry

DECIDUOUS SHRUBS

Alnus rugosa	Speckled alder
Aronia arbutifolia	Red chokeberry
Aronia melanocarpa	Black chokeberry

<i>Cornus amomum</i>	Silky dogwood
<i>Cornus racemosa</i>	Gray dogwood
<i>Cornus sericea</i>	Red twig dogwood
<i>Ilex verticillata</i>	Winterberry
<i>Physocarpus opulifolius</i>	Ninebark
<i>Rhus glabra</i>	Smooth sumac
<i>Rhus typhina</i>	Staghorn sumac
<i>Salix discolor</i>	Common pussy willow
<i>Salix eriocephala</i>	Wooly headed willow
<i>Salix interior</i>	Sandbar willow
<i>Salix lucida</i>	Shining willow
<i>Sambucus canadensis</i>	Elderberry
<i>Sambucus racemosa</i>	Red Elderberry
<i>Spiraea latifolia</i>	Meadowsweet
<i>Spiraea tomentosa</i>	Steeplebush
<i>Vaccinium angustifolium</i>	Lowbush blueberry
<i>Vaccinium corymbosum</i>	Highbush blueberry
<i>Viburnum cassinoides</i>	Witherod
<i>Viburnum lentago</i>	Nannyberry
<i>Viburnum opulus</i> var. <i>americanum</i>	Highbush cranberry

VTrans Specifications, Details, & Pay Items:

1. Trees

- a. Specifications:
 - i. SECTION 656 – PLANTING TREES, SHRUBS, AND VINES
- b. Details:
 - i. VAOT Standard Drawing – E1 TREE PLANTING
 - ii. VAOT Planting Details for Engineered Slopes
- c. Pay items:
 - i. 656.20 Evergreen Tree
 - ii. 656.30 Deciduous Trees

2. Shrubs

- a. Specifications:
 - i. SECTION 656 – PLANTING TREES, SHRUBS, AND VINES
- b. Details:
 - i. VAOT Standard Drawing – E2 SHRUB PLANTING
 - ii. VAOT Planting Details for Engineered Slopes
- c. Pay items:
 - i. 656.25 Evergreen Shrubs
 - ii. 656.35 Deciduous Shrubs

3. Perennials

- a. Specifications:
 - i. SECTION 656 – PLANTING TREES, SHRUBS, AND VINES
- b. Details:
 - i. VAOT Standard Drawing – E3 PERENNIALS GROUNDCOVERS AND VINES
 - ii. VAOT Planting Details for Engineered Slopes
- c. Pay items:
 - i. 656.41 Perennials

4. Live Stakes

- a. Specifications:
 - i. SPECIAL PROVISION – LIVE STAKE
- b. Details:
 - i. VAOT EPSC Detail – LIVE STAKE
- c. Pay items:
 - i. 900.620 SPECIAL PROVISION (LIVE STAKE)

5. Live Fascines

- a. Specifications:
 - i. SPECIAL PROVISION – LIVE FASCINE
- b. Details:

- i. VAOT EPSC Detail – LIVE FASCINE
 - c. Pay items:
 - i. 900.640 SPECIAL PROVISION (LIVE FASINCE)

6. Tubeling

- a. Specifications:
 - i. SPECIAL PROVISION - TUBELING
- b. Details:
 - i. VAOT Standard Details – E3 PERENNIALS GROUNDCOVERS AND VINES
 - ii. VAOT Planting Details for Engineered Slopes
- c. Pay item:
 - i. 900.620 SPECIAL PROVISION (TUBELING)

7. Pollinator, Wildflower and Wetland Seed Mixes:

- a. Specifications:
 - i. SECTION 651 – TURF ESTABLISHMENT
- b. Notes:
 - i. Use erosion matting (preferred) or straw.
 - 1. Hay carries weed seeds and should be avoided.