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# Chapter 28

Landscape Architecture and Community Design for Transportation

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28.1 INTRODUCTION

Transportation facilities encompass one of the largest areas of publicly owned land in New York State and therefore have a significant influence on both the natural and built environments.

The purpose of this chapter is to provide guidance on how:
- To determine the visual, physical and cultural resources particular to a community
- Those resources will influence and be integrated into the department’s projects and operational procedure(s).

The use of the terms Regional Landscape Architect, Landscape Architect, Designer and Engineer are deliberate. Some design activities may be addressed by multiple professionals while others may be specific to a licensed landscape architect.

It is the Department’s responsibility to customers and stakeholders that our projects and operations incorporate expertise in landscape architecture, site design and aesthetics; mitigate the impacts of our actions; and enhance the user’s experience and the public’s perception of the transportation corridors. The practice of Landscape Architecture strives for sustainable and maintainable outcomes that meet transportation service and safety needs, as well as environmental, scenic, aesthetic, cultural, natural resource, and community needs.

Chapter 28 is intended for use with the *NYSDOT Standard Specifications*. The chapter functions as a guide for the specifications, discussing each item in detail and allowing Landscape Architects and/or Designers to fully comprehend and best utilize each item.

Phrases in the *NYSDOT Standard Specifications*, such as “as specified” or “as shown in the contract documents” necessitate action on the part of the Landscape Architect and/or Designer. It is essential that, whenever these terms are encountered in the Standard Specifications, the Designer/Landscape Architect/Environmental Specialist provide detailed information for the item in the contract documents.

28.2 VACANT

28.3 COMMUNITY PLANNING & TRANSPORTATION SITE DESIGN

(Under development)

28.4 AESTHETICS

(Under development)
28.5 LANDSCAPE STEWARDSHIP

28.5.1 Introduction
Landscape stewardship by the NYSDOT entails making informed decisions about when and where to preserve, add, remove or modify vegetation in the state rights-of-way (ROW). Landscape stewardship strives to achieve an optimal balance between transportation needs, landscape ecology and community context. These decisions are related to soil management, grading, drainage, and erosion control.

Throughout this chapter is guidance on addressing sustainability by planning, as appropriate, at the landscape level, using native vegetation and designing to control invasives.

The Department has a significant investment in the landscape design and management of its roadsides. The benefits of landscape stewardship can be measured, and include:
- Pollutant removal,
- Carbon sequestration,
- Storm water management and erosion control,
- Contained or reduced maintenance costs,
- Increased ecological stability,
- Benefits to wildlife through the preservation of landscape corridors,
- Visual and spatial interest,
- Better integration of facilities into their surroundings, and
- Enhancement of local economies and better public relations.

28.5.2 Policy
It is the Department of Transportation’s policy to have an integrated landscape stewardship approach to the design, construction and operation of its facilities.

28.5.3 Landscape Stewardship Policy Guiding Principles
- To increase the extent and integrity of our existing tree canopies where it is safe to do so and promote healthy, self-sustaining plant communities.
- To preserve and enhance safely-sited, healthy trees and natural plant communities.
- To remove hazardous trees whenever practicable.
- To give priority to natural, successional re-vegetation when restoring and managing sites.
- To plant contextually, recognizing the cultural, ecological, aesthetic and community setting.
To plant in areas where it will have the greatest relative benefit based on the availability of funds and the need to balance priorities.

The goal is for the Landscape Architecture Bureau to coordinate the Department’s landscape stewardship efforts with the programs of other agencies and local communities.

28.5.3.1 Corridor Landscape Plans

These are regionally developed programmatic analyses of corridor landscape needs and goals, consistent with landscape stewardship principles. Corridor landscape plans should also be consistent with statewide corridor plans and consider roadside planning, design and maintenance activities.

28.5.4 Project Development Guidance

This section provides Department Landscape Architects with an outline of the required steps for incorporating landscape design and decision-making in the Department’s project development process. Other sections of this chapter will detail the “how to” for these steps.

28.5.4.1 General Considerations

- Ideally separate landscape contracts and contracts with a major landscape component should be let in the State fiscal year’s third quarter (October through December). This enables the contractor to schedule seasonal work and order supplies.
- Are the plants and the quantities needed likely to be available at the time of planting?
- Are there soils in areas designated for planting that may be compacted and need restoration?
- Does vegetation need to be removed or can it be preserved?

28.5.4.2 Project Initiation and Scoping

The development of a project’s landscape plan will be predicated on an analysis of the site’s opportunities and constraints. Landscape plans will not be developed or imposed as a requirement based on the type or scale of project being progressed. It is the responsibility of the Regional Landscape Architect to perform or delegate the following procedural steps:
1. Determine if the proposed project impacts existing vegetation and further, determine which impacts should be mitigated. Identify the presence of invasive species and determine control measures and estimated costs. (Refer to TEM 4.4.9.4)

2. Determine what planting opportunities exist.

3. Determine planting objectives for the proposed project. Planting objectives should identify functional planting needs, planting costs and proposed maintenance responsibilities.

4. Seek input from other project stakeholders (design, maintenance, other agencies, community, etc.) regarding planting needs and objectives.

28.5.4.3 Preliminary Design (Phases I-IV)

It is the responsibility of the Regional Landscape Architect to perform or delegate the following procedural steps in coordination with the project design supervisor and the Project Manager:

1. Coordinate a site inventory to evaluate and document the project’s existing vegetation.

2. Assess the project’s opportunities and constraints (including fiscal considerations); consider how plantings can integrate the project contextually. Document this assessment in the project’s design approval document.

3. Identify and seek input from affected property owners that may have specific landscape concerns that could influence the project’s design.

4. Identify any anticipated special specifications that may be needed and begin coordination with Main Office.

5. Identify potential maintenance entities and support the development of maintenance agreements. Do not assume the Department forces are available to maintain the vegetation.

6. Develop conceptual/draft landscape plan. The plan should reflect stakeholder input, permit requirements, etc. Refer to PDM Appendix 2.

28.5.4.4 Final Design: Plans & Specs. (Phases V & VI)

It is the responsibility of the Regional Landscape Architect to perform or delegate the following procedural steps in coordination with the project design supervisor and project manager:
1. Develop a final planting plan which meets the planting objectives developed during project scoping. Coordinate with the Designer, and team members from construction and maintenance. Various Chapters of the Highway Design Manual should be referenced.

2. Ensure that planting designs are consistent with the Department’s vegetation management policies, refer to:
   - HDM Chapter 10 Roadside Design, Guiderails and Appurtenances
   - NYSDOT Handbook - Plant Materials for Vegetation Management along New York State Roadsides
   - Any applicable corridor management plan developed by the Department, municipality, non-government organization (NGO) or community organization.

3. Identify and document landscape maintenance considerations. Coordinate with the maintaining entity(s) and make adjustments to the final design to ensure that future maintenance needs and capabilities are accommodated. See section 28.5.5 Maintenance Considerations. Begin outlining the Maintenance Plan described in 28.5.5.3. Provide input for maintenance agreements.

4. Prepare or provide information for the final contract documents. The Landscape Architect should consult with the Regional Quality Assurance Engineer for guidance. Below are some options for including the information in contract documents.
   a) **Tables**
      - Re-use of Topsoil Table
      - Tree Removal Table
      - Plant Table
      - Seeding Location Table
      - Sodding Table
      - Invasive Species – locations, removal, treatment, etc.
   b) **General Notes**
      - Improvement of Vegetated Areas limits shown on plans or in notes
      - Clearing and Grubbing limits shown on plans or in notes
   c) **Typical Section**
      - Topsoil
      - Seeding
      - Erosion control
   d) **Contract Drawings**
      - Improvement of Vegetated Areas limits shown on plans or in notes
      - Clearing and Grubbing limits shown on plans or in notes
5. Coordinate special notes or special specifications with the Standard Sheet 611-01. Information should not be contradictory or duplicative.

6. As needed, develop landscape special specifications per HDM Chapter 21.

7. Provide the Project Job Manager with a cost estimate for all landscape items per HDM Chapter 21. Refer to NYSDOT estimating software (TRNSPORT Estimator).

8. Coordinate final planting with design, construction and maintenance personnel. Prepare “Notes to the EIC” when appropriate.

28.5.4.5 Landscape Design Services During Construction

- Pre-landscaping meeting
- Attendance at the project’s pre-construction meeting
- Support during construction including clearing and grubbing, plant layout, inspection, substitutions, etc.
- Tree removal consultation
- Invasive species identification and control options

28.5.5 Maintenance Considerations

28.5.5.1 Introduction

It is important to consider a project’s future maintenance requirements. Maintenance concerns should be addressed and appropriately documented at all project phases.

In addition to considering sustainability, designers shall coordinate with Maintenance Environmental Coordinators and Residencies early in the planning and design process, to ensure enough staff and staff with the correct skills are likely to be available to maintain proposed landscape designs.

28.5.5.2 General Guidance

Although not all projects require long term maintenance, some installed plant materials will require maintenance to guarantee their long term success. This maintenance can be completed using Department forces or other entities. To ensure that maintenance issues are adequately addressed:
• The Landscape Architect should consult with the Designer, Maintenance Environmental Contact (MEC) and regional maintenance staff throughout the project development process.

• Landscape designs should consider available maintenance equipment, personnel and budgets. For example:
  o Fixed object spacing should be wide enough for large mowers,
  o Grades should be manageable (and mowable) to the maximum extent practicable,
  o If slopes are not mowable, then appropriate erosion protection should be included.
  o Plants should be placed in beds or in a “no mow” zone when mowing between them is not feasible.
  o Snow and ice needs should also be addressed (i.e. Snow storage, salt spray, drifting, icing, snow removal).

• Landscape design practices, including plant selection, should strive to minimize the need for long term maintenance and pesticides.

• Vegetation placed on other public property off state rights-of-way (ROW) should only be included in contracts when a formal agreement is secured with the municipality, agency or other party responsible for maintaining the plant material.

28.5.5.3 Maintenance Plan for Landscape Development

The Landscape Architect should develop a maintenance plan in consultation with the landscape’s future caretaker (state forces or others). This ensures that the landscape’s post-contract needs are fulfilled. The maintenance plan should be project specific and may consist of (but not be limited to):

• Maps that graphically depict the location of individual plantings, planting beds, turf, wildflowers and wetland planting locations.

• A maintenance jurisdiction table.

• Recommended mowing schedules.

• Follow up plan for regulatory commitments. Coordinate with Construction Environmental Contact (CEC)

• Maintenance Agreements (Refer to HDM Chapter 14, Resolutions and Agreements).

The format for the maintenance plan may range from a memorandum to a formal plan depending on the project’s complexity and needs.

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28.6 LANDSCAPE PRESERVATION AND DEVELOPMENT

28.6.1 Site Protection and Preservation

The contract documents should clearly indicate the requirements for and extent of site preservation and protection. This will allow the Contractor to easily identify, estimate and schedule their work. Clear and comprehensible documentation facilitates the enforcement of regulations and ultimately provides a better product.

28.6.1.1 General Guidance

- Look for opportunities to save and protect existing natural areas, including canopy and understory vegetation and native soils. Where possible, protect vegetation as clumps of trees and shrubs rather than individual plants. This will preserve shared soil volumes and rooting zones.¹

- Include tree/vegetation protection measures (i.e. Temporary plastic barrier fencing).

- When establishing protection and preservation zones, consider the site requirements for equipment access and maneuverability. Obstacles may include buildings, utility trenches, rock outcroppings, stairs, walls, and other new or existing site features. Understand construction equipment and construction needs.

- Grade changes such as "cuts and fills" can alter site hydrology. This, in turn, affects water and nutrient availability to trees, impacting root system vitality. The Landscape Architect should be mindful of these impacts when recommending tree protection and/or preservation.

- Consider likely locations for construction staging areas.

¹ High Performance Landscape Guidelines | Part III: Best Practices IN SITE PROCESS, New York City Department of Parks & Recreation, 2010
Figure 28-1 Examples of Protection Measures for Trees in Construction Areas

Best practices to ensure that site protection and preservation are addressed during construction

- Build flexibility into designs, (recognize the fall/spring – seasonal implications)

- Communicate intent clearly – there may be more than one way to achieve desired end results

- Coordinate and communicate with construction - Along with constructability reviews discussions with construction staff should at a minimum occur at major project milestones.

- Attend the project’s pre-construction meeting

- Clarify or emphasize important project processes and design intent (notes to the EIC).

- Understand construction schedules and limitations

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28.6.1.2 Scheduling Landscape Operations

The construction sequence for landscape operations varies and can be affected by weather and an assortment of site conditions. Landscape operations need to be coordinated with the general construction schedule.

28.6.2 Soil Disturbance and Grading

28.6.2.1 Soil Erosion Sediment Control

Soil Erosion and Sediment Control is an integral component in the protection of water quality during construction and is required by law (Refer to Highway Design Manual Chapter 8.8 – Erosion and Sediment Control and Stormwater Management and TEM Section 4.4.8 Erosion and Sediment Control and Stormwater Management). When, soil is exposed during construction it is essential that the exposure be minimized and cover established promptly.

28.6.2.2 Topsoil Conservation

“The loss of topsoil either by actual removal with heavy equipment or erosion by wind and water, accounts for the worst on-site damage. This layer of soil has the highest biological activity, organic matter, and plant nutrients—all key components of healthy soil. The on site loss of this upper layer of soil nearly eliminates the soil’s natural ability to provide nutrients, regulate water flow, and combat pests and disease.”

The Designer/Landscape Architect should seek to minimize all forms of topsoil removal or disturbance. This can be accomplished through:

- Minimizing soil erosion and impacts to existing vegetation,
- Minimizing the project footprint, and
- Using operational practices designed to minimize soil loss, compaction or disturbance
- Communicating with construction to ensure that vehicular and equipment access through, in, and around the site is limited where feasible.

Removing and re-using existing topsoil is another means to conserve topsoil.

Among the benefits of re-using on site soils are:

- Existing soils contain native seed banks and native microbial communities.
- Existing soils are more likely to support the restoration of native vegetation.
- Soil retention reduces transportation cost.
- significant cost savings

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2 “Soil Quality – Urban Technical Note No. 1”, United States Department of Agriculture, Natural Resources Conservation Service
Some considerations when specifying the re-use of on site materials or topsoil include:

- Plan ahead to include the pay item in the contract.
- Look for soils free of invasive species.
- Plan on weed management. Additional cost items may need to be included in the contract to accomplish this goal.
- Plan on compensating for 20% loss of soil volume when calculating reuse soil quantities.

A. Native Soils

When designing restoration landscapes, it is critical to know the soil types found within the project limits. Consultation with the Landscape Architect is recommended. At a minimum, the Landscape Architect should reference local soil resources, such as the County Soil Survey, prior to selecting plant materials. Conserving native soils is desirable; they are difficult to replicate.

B. Strategies for "Conserving Native Soils"

- Develop and effectively implement during construction a tree / plant preservation plan with no-disturbance zones clearly delineated on project drawings. No disturbance zones should consider the tree drip lines.

- Reduce soil compaction from construction equipment by laying thick (greater than 6 inches) beds of local mulch, chipped wood, etc.

- Make sure the Stormwater Pollution Prevention Plan (SWPP) is implemented and monitored for effectiveness

- Include contract provisions for the Contractors to follow regarding reducing/minimizing site disturbance. Provide training on implementing these practices.

- Consider delineating storage, recycling, and disposal areas. Use areas to be paved as staging areas. Delineate parking for cars, trucks and equipment on plans.

- Avoid mixing of topsoil with subsoil during savage operations or by deep rutting of construction equipment.

- Add organic matter to the soil to improve the speed with which water soaks into the ground, the ability of the soil to hold water, and soil drainage. Leave grass clippings along the roadside.

- Mulch around trees and shrubs to reduce runoff. Mulch protects soil from being hit directly by rain, reducing soil crusting and increasing the speed with which water soaks into the ground.
28.6.2.3 Grading and Drainage.

A project’s grading and drainage design should be harmonious with the site’s natural landforms, responding to existing slopes, drainage patterns and the surrounding topography while considering operational needs and capabilities.

A sustainably designed drainage plan finds ways to capture stormwater runoff for irrigation and ground water recharge. When appropriate, the design solution for stormwater features should also contribute to the site’s overall aesthetics. Refer to Chapter 8 of the Highway Design Manual (HDM) and TEM Section 4.4.8 Erosion and Sediment Control and Stormwater Management for additional guidance on drainage design.

28.6.2.4 Soil Bioengineering

This section uses special specifications.

A. Introduction

Soil bioengineering/biotechnical erosion control methods are technologies which combine the use of plant materials and structural elements to achieve soil stabilization. They are applied on disturbed sites, including slopes and streambanks. Soil bioengineering techniques are frequently used by Designers/Landscape Architects who are under increasing pressure to satisfy permit requirements issued by regulatory agencies.

Soil bioengineering/biotechnical engineering erosion control methods are typically cost effective, nonintrusive and utilize living plant material as an integral component of the erosion control system. Native, sometimes indigenous, plant material are most frequently utilized as they generally have better survival rates. Soil bioengineering/biotechnical erosion control methods can limit site disturbance and avoid severe access requirements. Therefore, they are suitable for sites that are steep, inaccessible or sensitive to the use of machinery. All of these characteristics make the bioengineering/ biotechnical erosion control approach especially attractive for scenic corridors and selected environmentally sensitive areas.

The benefits of soil bioengineering/biotechnical systems include:

- Integrated natural appearance
- Cost effectiveness
- Preserved and improved water quality
- Increased vegetative diversity.
Enhanced riparian habitats through the provision of shade, cover, fodder and the addition of organic matter for aquatic species.

These benefits are realized through the rapid reestablishment of a natural vegetative cover. The plant materials used in these systems can anchor and stabilize the soil in areas where traditional structural stabilization methods are impractical or unwarranted or where rapid re-vegetation of woody plantings is desired.

B. Policy

Soil bioengineering/biotechnical engineering should be considered when a natural approach to bank stabilization is desired.

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<th>Associated Items Which May Be Needed</th>
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<td>Live Fascines</td>
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<td>Branchpacking</td>
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<td>Vegetated Gabion</td>
<td>Unclassified Excavation and Disposal</td>
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<td>Vegetated Crib Wall</td>
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<td>Vegetated Crib Wall</td>
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<td>Branchpacking</td>
<td>Live Fascines</td>
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C. General Guidance

Soil bioengineering/biotechnical control systems offer resistance to erosion through the placement and configuration of the system’s elements. As root systems develop, they bind the soil, increasing the soil’s resistance to erosion, sliding and shear stresses.

When specifying soil bioengineering/biotechnical systems, the Designer/Landscape Architect should be mindful that the contract may need to include additional pay items to complete the work indicated. These extra items should be taken into consideration when developing the cost estimate. Table 1 below shows these relationships.

D. Design Considerations

The decision to use soil bioengineering methods should be based on a thorough site analysis.

The project Designer/Landscape Architect is encouraged to consider adaptations to a technique, or to combine techniques to fit site specific conditions. The use of pay items such as Planting, Transplanting, Turf Establishment, Sodding, Mycorrhizal Fungi and Mulch for Planting can be incorporated into the soil bioengineering design. Similarly, collected or salvaged plant materials may also be considered for use. By combining methods, the Designer/Landscape Architect can account for each method’s strengths and weaknesses and create an optimally functioning slope-stabilization system.

Sediment control devices such as turbidity curtains and/or cofferdams should be used with soil bioengineering methods around streams, rivers, ponds etc. Consult the Regional Landscape Architect (RLA) and the Regional Geotechnical Engineer to determine the site’s soil profile, analysis of slope stability, and retaining wall designs. The Regional Hydraulics Engineer should be consulted when the proposed project is adjacent to any bridge or highway structure, or subject to stream or flood flows. Soil bio-engineering/bio-technical methods should not be used for stream bank stabilization in situations where their failure under conditions of the 100-year flood event could result in failure of a bridge or highway structure.

Bioengineering/biotechnical CADD details are available in a cell library. Refer to Chapters 20, 21 and 22 of the Highway Design Manual (HDM) for additional information on NYSDOT’s standard cell libraries.
E. Technical Information

Application: Soil bioengineering/biotechnical erosion control techniques are used on projects with soil erosion and bank stabilization concerns. Typical project examples include cut/fill slope stabilization, earth embankment protection, shallow mass movement, small gully repair and stream bank stabilization.

Soil bioengineering/biotechnical erosion control techniques should only be considered after conducting a site assessment. This site assessment should be multi-disciplinary and include:

- slope geometry, and aspect
- climate and micro-climate
- hydrology
- moisture availability
- soil types and characteristics
- existing vegetation

Consult the Regional Geotechnical Engineer, Regional Hydraulics Engineer and the Regional Landscape Architect about site characteristics that suggest the need for hard armor or a combination of hard armor and soil bioengineering erosion control. The Regional Landscape Architect can also assist by providing plant material recommendations.

It is important for the Designer/Landscape Architect to understand the limitations of soil bioengineering/ biotechnical methods. The vegetative cuttings used in these systems are living materials. They must be handled properly to avoid environmental stressors, such as lack of proper moisture or excessive heat. The plants must be installed in moist soil and at the proper depth.

Successful implementation of bioengineering/biotechnical methods also depends upon the existing soil. Rocky soils and gravelly slopes lacking sufficient fines and/or moisture will not provide an adequate growing environment for most plant species used. Soil-restrictive layers, such as hardpans and overly compacted soils, are also challenging, as they tend to prevent or inhibit root growth.

Bioengineering/biotechnical techniques are most successful when installed in the late fall or early spring, when the plant materials used are dormant. Anticipated project construction schedules should be carefully considered. Installation should never be attempted when the ground is frozen. Fall installations should be sure to include adequate temporary soil erosion and sediment control methods. Summer installations are not recommended (environmental stressors including heat and low soil moisture).
F. Characteristics

Soil bioengineering/biotechnical erosion control systems maximize the unique characteristics of the system’s structural and vegetative components to control erosion. These characteristics are functionally specific and, their application is best suited to specific site conditions. As a result, these characteristics need to be understood and carefully considered prior to selection for use.

F.1 Herbaceous Vegetation. Well established herbaceous vegetation, especially grasses and forbs, provide long term protection from surface erosion. This is accomplished by binding the soil with their extensive and fibrous roots. Herbaceous vegetation protect the soil from surface erosion and, as a result, are considered a critical component of soil bioengineering.

F.2 Woody Vegetation. Woody vegetation types are more densely and deeply rooted than other vegetation types. This characteristic means that woody plants offer extensive protection from shallow mass movement. Woody vegetation is frequently installed to impede erosion and offer immediate soil protection and reinforcement. See figure 2 for an example.

F.3 Retaining Structures. The installation of a retaining structure may be necessary to protect and stabilize steep slopes. Low retaining structures such as revetments (see figure 3), situated at the toe of the slope, enable grading at a more stable angle. This type of slope tends to be most successful for re-vegetating and prevents soil loss at the slope crest.
Figure 28-2  Root Wad ready for use

Figure 28- 3 Small tree revetment at toe of slope
F.4 Grade Stabilization Structures. Grade stabilization structures (GSS) are used to control and prevent gully erosion. When GSS are installed, the grade above the structure can be lowered. This reduces the flow velocity through and around the structure. To further stabilize the soil, vegetation can be established around the GSS. GSS may be required temporarily to stabilize critical locations. Under these circumstances, the ultimate goal is to establish and maintain a vegetative cover that prevents erosion and eliminates the need for a permanent GSS.

G. Other Considerations

G.1 Monitoring and Maintenance. Soil bioengineering/biotechnical erosion control methods should only be considered and implemented where there is a reasonable expectation that the system will succeed, and do so with minimal maintenance. When appropriate, the system should be designed on projects that contain soils with sufficient soil moisture throughout the growing season. This ensures that the plant material used in the system is healthy and growing.

G.2 Hydraulic Analysis. In areas subject to a 1% annual probability of flooding, the Designer/Landscape Architect consults with the Regional Hydraulics Engineer prior to designing a soil bioengineering/biotechnical erosion control system that will increase the site’s vegetative cover. This consultation should be used to determine the effect of the additional vegetation on the floodplain’s hydraulic roughness. A hydraulic analysis may be required to assure that the increased resistance to flow will not raise floodwater levels upstream in violation of Federal Emergency Management (FEMA) Flood Insurance requirements.

28.6.2.5 Invasive Plant Species Control

This section uses special specifications.

Presidential Executive Order 13112 and NYS Environmental Conservation Law Article 9, Title 17 require the Department to prevent the introduction and spread of invasive species, and, where practicable, provide for their control. Proposed management measures should be contextually appropriate and consistent with landscape-scale, long-term strategic planning efforts. To ensure compliance, management measures should follow the Department’s policy guidance, found in the Environmental Manual (TEM) Section 4.4.9.4.

Factors to consider when determining contextually appropriate management measures include:
• Is the species in question a national, statewide PRISM (Partnerships for Regional Invasive Species Management) priority species?
• What is the character of the infestation?:
  1) Does the Department control the entire infestation?
  2) Is the infestation isolated?
  3) Is this the leading edge of an invasion?
  4) Is the species located at a critical environmental nexus (e.g. stream crossing, critical habitat, etc.)?
• Cost of Eradication/Treatment

Although the eradication methods outlined in the Department’s specifications are important, it is more important to implement best management practices (BMPs) to minimize the spread of invasive species. BMPs, such as proper disposal of contaminated material and equipment cleaning methods, limit the potential for invasive species to establish in new locations within and beyond a project’s limits or the state ROW.

The Department has determined that it is not practicable to control small portions of large, contiguous invasive plant species infestations occurring inside and outside of the rights-of-way. Exceptions will occur when the Department partners with others (state agencies, municipalities, non-government organizations (NGOs), utilities, etc.) as part of a combined effort to eradicate or control the entire infestation.

Landscape Architects should consider partnerships with operations, outside agencies, stakeholders and adjoining property owners when considering invasive species control efforts.

The length of time a capital project spends in the construction phase has implications for invasive species control efforts. A capital project’s construction phase may not be adequate to effectively control targeted species, which often require multiple, consecutive treatments that span several years. Opportunities for partnering with maintenance should be explored to determine if control practices begun during construction can be continued with the Department’s maintenance forces.

28.6.3 Clearing and Grubbing

This section includes the following pay items:

Item
Clearing and Grubbing

Contract Documents must include:
• Location of areas to be cleared and grubbed
• Location of areas to be cleared and not grubbed
• Location of areas not to be disturbed

§28 2/20/13
Contract Documents may include:
- Temporary Plastic Barrier Fencing pay item

Special Notes for Clearing and Grubbing Items must include:
- Any special requirements relative to the disposal of trees, stumps, or other debris
- Special requirements relative to the protection and restoration of area(s) within or outside the clearing and grubbing limits

If the Landscape Architect requires the use of different materials or methods beyond those provided in the standard specification, a special specification must be used.

28.6.3.1 General Guidance

The work involved during the execution of the clearing and grubbing pay item includes the removal of trees, brush, stumps, and other undesirable vegetation and objects (fences, structures, debris) where the removal of those features is not specified under other pay items.

Trees less than or equal to 4” diameter must be addressed under Clearing and Grubbing.

When specifying clearing and grubbing the Landscape Architect should keep in mind:

- The clear recovery area of the project and deflection area behind the existing and new guiderail.
- It is usually unnecessary and undesirable to clear the full width of the rights-of-way.
- If clearing beyond the rights-of-way is required, it should be anticipated in the design stage, coordinated with real estate.
- It is important that every effort be made to preserve desirable existing vegetation. This means that desirable vegetation needs to be identified during the design phase, and the plant locations need to be clearly communicated. A GPS unit may be one method of accomplishing this.
- Clearing for construction access should be anticipated. It may be necessary to clear 10’ beyond the grading limits to allow for equipment access.
- Permit conditions may place additional constraints on work limits, such as in wetlands or parks.
- Clearing and grubbing limits should not include construction areas such as borrow pits, haul roads, staging areas, stockpile locations or spoil sites needed by the Contractor to complete their operations.
- Area(s) of work should be clearly defined and work procedures clearly specified.

Clearing and grubbing is not appropriate:
- With trees that need multiple cuts, rigging, or specialized skills during their removal,
- When nearby obstacles, such as sidewalks & homes need to be avoided, and
- Where trees are adjacent to or under utility wires.
- Where trees to be removed are widely scattered necessitating multiple work zones

Avoid removing vegetation in even width bands for long stretches of roadway. This creates a monotonous appearance and degrades wildlife habitat. Trees and shrubs should be retained on uphill slopes, along stream corridors, at rock outcroppings, outside the deflection area of guide rail and in areas with no history of accidents. By following these guidelines and consulting with the Regional Landscape Architect, the Designer will create a varying width corridor that is safe and more aesthetically pleasing.

Greater consideration should be given to retaining existing vegetation along:
- Wooded areas of the Adirondack & Catskill Parks (they have special conditions for tree removal),
- Parkways,
- Pine Barrens,
- Scenic byways,
- Signed bike routes,
- River/stream corridors,
- Designated scenic touring routes,
- Adjacent to public parks, and
- Wildlife management areas.

When specifying clearing, using the Standard Specifications a choice must be made whether to use the “lump sum” pay item or the “acre” pay item. Most projects specify clearing and grubbing using the “lump sum” pay item which eliminates the need for field measurements. However, this makes no provision for paying for unanticipated work. Payment by the acre provides for unanticipated work, but is not practicable for vegetation which is separated into clumps and individual trees.

When clearing and grubbing is not appropriate, the Landscape Architect should consider using the tree removal pay item to remove unwanted plant material such as those under or adjacent to utility wires.

The Landscape Architect may want to include some tree removal items as a contingency for trees that are unanticipated or difficult to remove.
28.6.3.2 Salvage of Marketable Forest Products

A. Introduction

The Department of Environmental Conservation (DEC) encourages the Department to utilize surplus forest products that are by-products of the Department’s construction activities. Reuse of surplus construction debris is preferable to the material being disposed of in a landfill.

B. Policy

The Department of Transportation promotes the salvage of marketable forest products that are the by-products of our construction contracts and active highway rights-of-way management.

C. General Guidance

The Department will notify DEC when a project involves the clearing of two or more acres of forest cover containing potentially marketable forest products (saw logs, pulpwood, firewood, other biomass, etc.). The Department will also notify DEC if forest products of significant value, type or quantity (e.g. a stand of Black Walnut trees) will be affected by our projects, regardless of the number of acres involved.

It is the Regional Landscape Architect’s (RLA) responsibility to determine if a proposed project will affect potentially marketable forest products. The RLA is encouraged to consult with the appropriate DEC Regional Forester and/or the Office of Environment during this decision process. The RLA should also consult with other appropriate federal, state, local and non-governmental agencies to determine if invasive species are present and if quarantines exist that preclude the use of the proposed salvage material.

D. Project Development and Construction Guidance

See Appendix 28-F for detailed steps and notification process.

E. Additional Considerations

Unique circumstances, such as a storm event, may necessitate collaboration between the NYSDOT Regional Maintenance Coordinator (MEC), the RLA and the DEC Regional Forester to determine the salvagability of marketable forest products produced during extreme and unusual situations.
28.6.3.3 Vegetation Removal Permits

Department Landscape Architects routinely provide assistance to the Permit Engineer when applications for vegetation removal permits are submitted. The following provides detailed guidance to the Landscape Architect on their role in the review process.

A. Introduction

The benefits of vegetation in the highway rights-of-way are numerous. The removal of vegetation can significantly affect soil erosion, water quality, rare/endangered species habitat, wildlife and visual quality. The removal of trees or other vegetation from the State Highway Rights-of-Way is prohibited when it is undertaken in a response to a request by an adjacent property owner for the purpose of visibility for a business or advertising sign. Exceptions are when:

- The tree removal is performed by a utility company or by a contractor for the utility company in conjunction with the [Utility’s Annual Work Permit](#).
- It is undertaken under [State Regulations (17 NYCRR Part 134)](#), See Appendix 28-A which allows any person, institution, corporation or other entity desiring access to the state rights-of-way to obtain a “vegetation control permit” to increase the visibility of Department permitted advertising devices viewable from state highways.

The “vegetation control permit” is actually a specific operation permitted through the [Highway Work Permit Application for Non-Utility Work (PERM 33)](#). Review and issuance of vegetation control permits follows a similar process as other highway work permits in that the Permit Engineer will perform the administrative and processing tasks and coordinate the review by the appropriate program area(s). The permit is only applicable to legally registered advertising devices that meet specific requirements that are described in the regulations.

Refer to the permit application for details on the submission requirements. Permit applications are reviewed by a regionally designated “Vegetation Control Reviewer” which must be a licensed landscape architect, typically the Regional Landscape Architect. Only vegetation located within the “viewing zone” of the advertising device is allowed to be removed.
B. General Guidance

To ensure compliance with the regulations contained in 17 NYCRR Part 134, the Permit Engineer should coordinate with the Regional Right of Way Officer as the permit is only applicable to legally registered advertising devices. If the sign is located along a State designated Scenic Byway, there are additional stipulations described in Part 134.4(j) that affect permit issuance. If the device is not legally registered by the Department, no work permits are issued.

Part 134.6(a) requires the applicant to submit site plans detailing the vegetation control for department review and approval.

The Vegetation Control Reviewer is responsible for the following activities:

- Reviews the environmental, vegetative and visual aspects of the site plan and details of the vegetation control.
- Identifies any local impact related issues from the vegetation control and if applicable, recommends that the Permit Engineer notify the locality.
- Recommends in writing, approval or disapproval of the permit.
- Assists the Resident Engineer with inspection of vegetation control activities as necessary.
- A Checklist of items that should be reviewed is included in this document's Appendix.

Related Topics:
- Removal of Trees
- Improvement of Vegetated Areas

28.6.4 Improvement of Vegetated Areas

This section includes the following pay items:

Item
Improvement of Vegetated Areas (Previously referred to as Selective Thinning)

Contract Documents must include:
- Location of work,
- Description of work required.

Special Notes for Improvement of Vegetated Areas may include:
- Information for bidders including, but not limited to, how the areas are marked, specific plant species, sizes, or the location of marked sample area(s).
- Any special requirements relative to the disposal of trees, stumps, or other debris not included in the standard specifications. (Items not covered in Section 107).
- Stump treatment when the treatment specified differs from the default treatment provided in standard specifications.
- When stumps are not to be treated with herbicide.
- If backfill other than topsoil is desired, specify the backfill type.
- If surface treatment other than grass is desired, specify the surface treatment.

If different materials or methods than those provided in the standard specification are required, the Landscape Architect must use a special specification.

28.6.4.1 Introduction

This item is intended for use in areas where there is a need to improve the appearance and ecological function, and/or eliminate hazards associated with vegetation in the highway rights-of-way. This item may also be used to reduce future maintenance requirements by removing weed trees and by thinning out dense, second growth, wooded areas.
28.6.4.2 General Guidance

As indicated in Section 614-1.02 and 3.02 of the Standard Specifications, vegetation to be removed should be clearly identified in the contract documents and field designated or marked. If stand improvement goals vary throughout the proposed work location, distinct management areas should be identified and clearly indicated in contract documents and field designated or marked.

**Improvement of Vegetated Areas is not to be used to accomplish the work normally included in Clearing and Grubbing or Tree Removal, such as the removal of dead trees.**

The Landscape Architect should have a clear understanding why Improvement of Vegetated Areas is required. By securing a firm understanding of the work goals, the LA is better positioned to direct the implementation of those goals, including what tasks are needed and where the effort will be most effective.

The goals of Improvement of Vegetated Areas should be clearly described in the contract documents. For example:

"The Improvement of Vegetated Areas shall include the removal of all invasive trees and brush species as listed…".

Work descriptions should also indicate the methods used to measure the treatment area. Work Limits can be described several ways:

- Using the stems or trunks of the existing vegetation as reference points for measurement. This minimizes potential conflicts during construction over what areas to treat and what areas were treated for payment. Also, remember that if stump removal is not specified for this item, the remaining stumps and stubble will be visible after the tree tops and drip edges are removed. Example descriptions include:

  "The treatment area shall be measured from the vegetation stems at the face of woods to the rearmost vegetation stems at the back of the woods."

  "The treatment area shall be measured from the drip lines of the vegetative stand at its face to the drip lines of the vegetative stand at its back."

- The entire limits of work clearly indicated in the contract documents by stationing (station to and from and side) and by depth. Descriptions such as "From Sta. X+00 to Y+00 (LT or RT) for a depth of 20 feet from the face of the vegetation" should be included.

- If marked sample area(s) are used, the contract documents should also include a special note that gives Contractors the location(s) of marked sample area(s).
Section 614-3.02 calls for all trees and shrubs specified for removal to be designated by "separate marking", "marking sample areas" or otherwise. The RLA shall ensure that all marking is done prior to advertisement so potential bidders have the opportunity to view proposed treatment areas. This will also provide the EIC with a basis for comparison during construction.

- Indicate if there will be different types of vegetation stands e.g. medium brush/light woods, heavy woods, etc.

- Designate where selective improvement of vegetated areas will be done, each type should be represented by a sample.

- If the areas will be few and relatively small, the Landscape Architect should consider marking everything they want the contractor to remove at every location.

The Standard Specifications require stumps to be cut to a height of 6 inches above ground unless otherwise specified or approved. If a stump height other than 6 inches is required, it should be noted in the contract documents.

The treatment of all stumps and stubble is recommended to prevent re-sprouting. It is further recommended that the material used for this treatment includes a dye for easy identification of the treated areas. The type, rate and certification requirements for materials being used to treat stumps and stubble are as specified in the standard specifications. If an herbicide is not desired, the Landscape Architect must indicate that in a special note.

The Landscape Architect should consult with the MEC for any special conditions in areas being treated with herbicides.

Related Topics:
- Clearing and Grubbing
- Removal of Trees
- Topsoil
- Turf Establishment

28.6.5 Removal of Trees

This section includes the following pay items:

Pay Items
Tree Removal
Stump Removal
Contract Plans must include:
  - Table for Location of work

Contract Plans may also include:
  - Graphic location of trees to be removed

Special Notes for Tree and Stump Removal Items must include:
  - Material to backfill stump holes

Special Notes for Tree and Stump Removal Items may include:
  - Treatment of stumps if other than standard specifications default

If different materials or methods than those provided in the standard specification are required, the Landscape Architect must use a special specification.

28.6.5.1 Introduction

Trees up to 4” diameter should only be addressed under Clearing and Grubbing

It is extremely important to adequately evaluate the health of trees within the project limits while the project is still in the design phase. There is a critical safety concern relating to the public’s health, safety and welfare (HSW). In addition, tree removals can be a substantial financial obligation and need to be considered in the project’s estimated cost.

It is often difficult for the general public, municipalities and other federal and state agencies to understand why the trees along their streets or properties are being removed; tree decay may not be evident. The Designer and the Landscape Architect should be prepared to discuss tree removals.

28.6.5.2 General Guidance

Tree removals must consider potential SEQR and/or Sec 106 (historic properties) impacts, as well as the presence of threatened and endangered species, such as Indiana Bat,

Reasons for Tree Removal from the State Rights of Ways:

1. Unsound or Hazard Trees:
   The timely removal of unsound trees (that would not otherwise have been removed as a result of project work) is necessary and important, even if the public does not understand or accept the urgency of our actions. Safety comes first with tree removal, regardless of the aesthetic, cultural or other considerations that may be involved.
In conjunction with New York State Department of Environmental Conservation (DEC) the Department provides training on how to identify and manage hazard trees. The Landscape Architect should consult with the Regional Maintenance Environmental Coordinator to obtain the appropriate expertise or services needed.

2. **Construction Impacts:**
   There are many construction activities, such as cutting and filling during grading or excessive root removal, that have the potential to impact existing trees. The Regional Landscape Architect (RLA) should be consulted when the project grading calls for either a fill over or a cut within a tree’s critical root zone. If tree damage is unavoidable and the tree cannot be protected, the tree should be removed rather than preserved. A damaged tree will slowly decline, become hazardous and more costly to remove and replace after project completion.

3. **Adjacent Property Owners request:**
   The Department considers requests for tree removals from property owners adjacent to the state rights-of-way. However, trees within the rights-of-way are beneficial to all, not just adjacent property owners. Unless trees will be removed for reasons stated in Number 1 and 2 above, the request should be denied. The removal of trees or other vegetation from the State Right-of-way is prohibited when it is undertaken solely to provide visual access to adjacent properties.

4. **Maintenance Considerations**
   Refer to the current Environmental Handbook for Transportation Operations for a thorough discussion of maintenance consideration for roadside trees.

5. **Clear Zone**
   Every project goes through a process of clear zone determination which may evolve throughout the project development process. The Landscape Architect should have input into the clear zone determination and to design decisions affecting tree removals at several points during the process. During project scoping, the Landscape Architect should identify the presence of significant or valuable trees within the project limits that may have the potential to affect clear zone determination. Continuing into Preliminary Design, the Landscape Architect should be prepared to supply more specific information on:
   - Location of trees or groups of trees;
   - The trees, species, condition, size;
   - Significance and rationale for preservation.

   This information will be used by the designer in making decisions whether to
   - Refine the target clear zone,
   - Shield the tree(s),
   - Document the decision to leave the tree exposed as an exception within the clear zone, or
6. **Ecological management**

In keeping with the Department’s commitment to landscape stewardship, it is recommended that invasive tree species be removed. Many invasive trees re-sprout from the cut stumps. If such trees are removed, the Landscape Architect should consider grubbing the stumps or treating the stumps with targeted herbicide application to prevent re-growth of the undesirable species.

Trees that are infested by or are hosts to invasive insects or pathogens may also be removed. Dead trees safely situated within the highway rights-of-way can provide habitat for a variety of insects, animals and other species. And while this may be desirable, in certain situations it can also be undesirable. The scheduling of tree removals should take into consideration the presence of invasive, threatened, and endangered species. Refer to Section 28.6.2.6 for additional information on the control of invasive species.

7. **Aesthetics**

Unkempt, scraggly and distressed vegetation may negatively affect views to and from adjacent properties. Highways designed with scenic overlooks and sweeping views have been filled in with vegetation that, over time, has naturalized. When fully grown, this vegetation can block desired views.

Under some circumstances, it may be advisable to engage a municipality’s urban forester or another independent professional to collaborate on tree health assessments. This is especially beneficial when tree removals are likely to become contentious and impact the project approval process (which has scheduling implications).

28.6.5.3 *Contract Specifications*

The Tree Removal pay items described in Section 614-1.03 should be used:

- In urban, commercial and residential areas,
- Where the presence of nearby obstacles, such as utility lines, residences, lawns, and sidewalks, etc. require special removal methods, such as topping,
- In protected areas where wholesale clearing and grubbing is not desired, and
- When the tree’s limbs overhang the roadway.
As a contingency item used with clearing and grubbing as trees as trees over 4'' diameter may present some logistical challenges that warrant removing them with a tree removal pay item.

The major advantage of the tree removal items is the payment method. The Contractor is paid for the number of trees actually removed. If field conditions warrant, the final quantity can be adjusted up, to accommodate unanticipated tree removals, or down, to account for trees that the Contractor is able to remove through clearing and grubbing.

The Regional Landscape Architect is responsible for determining the most appropriate method (and pay item) for removing trees. This is true for all capital projects with no anticipated rights-of-way acquisitions. Quite possibly a combination of pay items for both Clearing and Grubbing and Tree Removal will be desirable. When both are included in the same contract, the contract documents should clearly specify the work and location of work to be completed under each item.

The list of pay items for Tree Removal includes an item exclusively used to remove pre-existing stumps. However, vegetative stumps that are created during the work completed for Clearing and Grubbing and/or Tree Removal should be removed as part of those pay items.

When stumps to be removed are not within required excavation areas, it is necessary to specify the backfill material. When the stump removal is in the highway shoulder, gravel may be required and should be specified. More typically, topsoil will be used to backfill the stump holes.

The Landscape Architect must specify the restoration of stump hole areas, typically using 610 pay items to establish grass. When 610 pay items are already included in the contract for other areas use the same materials for the stump restorations.

For minor contracts, with no seeding items, the work will be covered by Section 107-08 of the Standard Specifications.

28.6.5.4 Treatment of Stumps

In general, all stumps within the proposed road section (per definition in Section 100 of the Standard Specifications) must be removed. This includes pre-existing stumps and those associated with tree removals or clearing and grubbing. Tree stumps that will interfere with roadside maintenance operations should also be removed.

When stump removal is necessary, it must be specified. If only select stumps require removal, they must be shown and/or listed in the contract documents. An approximate percentage of trees requiring stump removal can be specified when the exact number of stumps to be removed cannot be determined during design.
The treatment of stumps (either existing or to be created) within the project limits should be specified in the contract documents. Note that the coding system for the tree removal item numbers includes language that specifies the treatment of stumps.

Complete stump removal is not always necessary or desirable. When the stump is located in the future roadway cross section or shoulder, the entire stump should be removed. As an alternate to complete stump removal, chipping to a depth of not less than 6 inches below finished grade could be considered where appropriate.

The terminology “Stumps cut to above grade” is usually applied to trees in wooded areas. Stumps are typically cut to six inches above grade. However the landscape architect may specify a specific height or leave the stump “as is” for use as wildlife trees.

Cut flush is an approximation and can be difficult to achieve on large trees. The intent should be to leave nothing hazardous in the rights-of-way that could be struck or caught by a vehicle. Preferably, a “flush” cut stump should be no taller than 2” above the surrounding soil. If this is not practical with any tree over 24” DBH, consider specifying “stumps grubbed”.

“Cut to below grade” applies to stump grinding and should be the minimum removal specified in a clear zone or where visible stumps will detract from the landscape aesthetic.

Many invasive trees re-sprout from the cut stumps. If such trees are removed the Landscape Architect should consider grubbing the stumps or treating the stumps with targeted herbicide application to prevent re-growth of the undesirable species.

“Grubbed” applies to project areas where heavy equipment can be used to do the tree removal and all tree parts are excavated. This type of removal is recommended when the site’s proposed use is roadway pavement, when grading is required and when it’s cheaper to grub than to grind.

Ultimately, the decision on which stump treatment to use depends on the type of project, the location of the trees within the rights-of-way and input from the project’s Design Manager, Landscape Architect and team members from other functional units.

Related Topics:
- Clearing and Grubbing
- Improvement of Vegetated Areas
- Salvage of Marketable Forest Products

Return to table of contents
28.6.6 **Tree Pruning and Root Treatment**

This section includes the following pay items:

**Item**
- Care of Trees up to 12 inches Diam. at Breast Height - Pruning
- Care of Trees Over 12” to 24” at Breast Height - Pruning
- Care of Trees Over 24” to 36” at Breast Height - Pruning
- Care of Trees Over 36” to 48” at Breast Height – Pruning
- Care of Trees Over 48” to 60” at Breast Height – Pruning
- Care of Trees Over 60” at Breast Height – Pruning
- Tree Root Zone Treatment (Vertical Mulching/Aeration)
- Tree Root Pruning

**Contract Documents for the above pay items must include:**
- Location, quantity and species for pay items

**Special Notes for Care of Trees-Pruning must include:**
- No other notes are appropriate

**Special Notes for Tree Root Zone Treatment:**
- Method of application

**Special Notes for Tree Root Pruning must include:**
- Backfill material around tree roots

**Special Notes for Tree Root Pruning may include:**
- Soil amendments and mulch per 614-2.06 as needed

Care of Tree work other than pruning, tree root zone treatment and tree root pruning must be paid for as part of a special specification. Such work should be discussed with the Regional Landscape Architect before inclusion in a contract.

28.6.6.1 Tree Pruning

**A. Introduction**

The principal use of the Care Of Trees - Pruning items is to prune trees in special situations. These situations include, but are not limited to, urban areas, park and ride lots, rest areas and other locations where it is particularly important to retain and care for existing trees. Generally, the care of tree pay items should not be used to care for trees in rural locations.
The Regional Landscape Architect should be consulted when considering the use of the Care Of Trees - Pruning items.

B. General Guidance

No tree should be pruned without first establishing clear objectives. The Department considers the following to be valid objectives for pruning:

- To provide clearance,
- To provide line of sight,
- To open highways to sunlight, so that snow and ice build-up is less likely
- To remove structurally unsound plant elements,
- To remove nuisance branches from trails and walkways,
- To improve a view, and
- To improve the health of the plant.

Pruning practices shall follow established arboricultural standards per ANSI A300, The American National Standard for Tree Care Operations.

C. Construction Details

When the Care of Trees-Pruning item is used on a general construction contract in conjunction with Section 201, Clearing and Grubbing, the removal of branches interfering with the roadway clearance or sight distance and the removal of branches broken or injured during construction should be included in the Section 201, Clearing and Grubbing pay item, and not paid for as a part of the work required under Item 614.01, Care of Trees.

Related Topics
- Clearing and Grubbing

28.6.6.2 Vertical Mulching/Aeration

A common root zone soil aeration technique involves drilling holes in the ground. This process is called vertical mulching. This activity is undertaken primarily to mitigate construction impacts.

Most plants thrive in loose soil. Loose, friable soil allows plants to grow deep and vigorous roots, absorb water easily and access the air and nutrients plants need. Soil aeration, or the process of mixing air with the soil, increases the amount of oxygen in the soil. Oxygen supports all of the vital processes required for plant survival. Aeration also increases the soil’s moisture holding capacity. This has the potential to increase the amount and type of nutrients available to plant roots, thereby promoting plant growth, health and vigor.
Leaf wilt is a classic indication of plant stress that may be related to poorly oxygenated soils. It is important to determine the cause of the wilting before treating the soil.

The NYSDOT standard specification for vertical mulching calls for holes approximately 2 inches in diameter on a 2 foot by 2 foot grid. The depth of the holes should be at least 12 inches but may need to be deeper if the soil grade has been raised. The NYSDOT standard specification calls for soil holes to be filled with either mortar sand, mortar sand combined with mycorrhizal fungi, compost, or compost combined with mycorrhizal fungi to maintain aeration and support root growth.

The standard specifications include four methods for vertical mulching, aeration.
- Methods 1 and 2 are appropriate for soil types other than clay.
- Methods 3 and 4 should be specified when the soil’s particle composition is predominately clay, to avoid additional compaction.

Related Topics
- Mycorrhizal Fungi
- Compost

28.6.6.3 Tree Root Pruning

Root pruning is the horticultural practice of making clean cuts on a woody plant’s roots to control its size or root extent, prepare it for transplanting or to repair roots damaged by construction. The latter is the focus of NYSDOT’s standard Tree Root Pruning item.

A. General Guidance

The majority of a tree’s roots are located within the top 6” to 24” of soil. When excavation occurs for grading, utilities installation or foundations where trees or other large woody plants are present, roots are typically torn and mangled by digging equipment. Since plant tissue does not “heal” but rather only calluses, clean cuts allow for the fastest callusing of necessary wounds and healthy re-growth of lost root systems. The Tree Root Pruning item ensures that damaged roots are properly cut prior to backfilling to increase their chance of recovery. The general depth to which roots should be pruned is 12 to 18 inches.

The designer should consult with the landscape architect regarding the vegetation protection goals of the site, and should consider specifying the item for the length of excavation and trenching which will fall within the “Critical Root Zone” (CRZ) of protected trees – roughly the projection on the ground of the tree’s canopy (also called the “dripline”). Since the dripline is very irregular, the trunk diameter is a more reliable basis for calculating CRZ.
B. Determining the CRZ

There is no precise formula for the CRZ – all are approximate.

Typically: measure the tree diameter in inches at 4.5 feet above grade, multiply by 12 and convert the result into feet. This will be the radius of a circle around the tree trunk that needs protection.

Below is a generalized “rule of thumb” alternative.

![Figure 28-5 Critical root Zone Radius](image)

<table>
<thead>
<tr>
<th>Diameter at Breast Height (in)</th>
<th>CRZ (radius in ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 in DBH or less</td>
<td>5 ft CRZ</td>
</tr>
<tr>
<td>4 – 11 in DBH</td>
<td>8 ft CRZ</td>
</tr>
<tr>
<td>12 in or greater DBH</td>
<td>15 ft CRZ</td>
</tr>
</tbody>
</table>

Landmark and Heritage trees may be subject to special requirements.

Case-by-case adjustments to the extent of the CRZ may be needed since root systems vary in depth and spread based on size of tree, soil quality, water table, species, and other related factors. Use a higher multiplier for more sensitive species. For example: a 20" d.b.h. Maple would need a CRZ radius of 20' while for a 10" d.b.h. Oak, a CRZ radius of 15' might be sufficient.

The trees’ critical root zone should be protected by temporary plastic barrier fencing or other suitable means on all construction sites. Temporary plastic barrier fencing is a special specification.

In advising on whether to specify root pruning, the Landscape Architect will take many factors into account, such as tree species, age, size, health, vigor, site conditions, and the extent of the pruning. For example:
- Mature trees are less tolerant of root pruning than young trees.
- Trees on sites exposed to high winds are less tolerant of root pruning than sheltered trees.
- Defective trees or trees in poor health are also bad candidates for root pruning.
• The closer the roots being pruned are to the tree’s trunk, the greater the impact on the tree\(^3\). (In general, roots should not be cut within 3’ of the tree base; a preferred distance is seven feet.)

Whenever trees are root pruned, there is always some risk of tree failure, so the RLA may advise that it is preferable to remove the tree rather than root prune – or to consider alternatives such as pneumatic excavation, which is described below.

28.6.6.4 Pneumatic Excavation

This section uses a special specification work item.

Pneumatic excavation is an alternative to traditional methods of excavation, and is best suited for use in critical tree root zones. These techniques are used when significant (or historic) trees might otherwise require removal. It allows for soils to be pneumatically removed (or blown away) from the tree roots without inflicting damage to the roots. After the soil is removed, project elements, including conduit or other utilities, can be threaded through, under or around the tree roots.

28.6.6.5 Root Control or Protection

Special specifications are required for this work item

A. Root path, tunnel or bridge

Root paths, tunnels and/or bridges are constructed paths that use aeration or drainage strips to give roots a way to grow out of the tree’s existing soil volume and under pavements (including sidewalks) or other obstructions. These systems give the tree roots access to better planting soils. Root paths, tunnels or bridges can connect tree planting pits to adjacent green spaces.

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\(^3\) Sidewalks and Trees, Horticulture & Home Pest News, Sherry Rindels, Department of Horticulture, by Iowa State University Extension

§28  2/20/13
B. Root Protection / Aeration Matting

Root protection and/or root aeration matting (RP/RA) is a commercial product that reduces the impact of construction traffic, storage and other activities on or around a tree’s root system. From soil compaction to physical damage and even pollution, (RP/RA) matting provides a heightened level of protection in most situations. The main objective of (RP/RA) matting is to allow designated construction activities within the trees protected critical root zone with minimal compaction or rutting to surface soils and root systems. The methods and procedures for the removal of the (RP/RA) matting are just as critical as the proper installation methods.

C. Modular root protection / barriers

Modular root protection systems or barriers are placed between a tree’s roots and the area to be protected, such as a sidewalk, road, building, golf course green or anywhere that roots can cause damage. These systems inhibit or redirect root growth so that they don’t cause structural damage to adjacent surfaces.

Related Topics
- Tree Root Pruning
28.6.7 Soil

28.6.7.1 Topsoil

This section includes the following pay items:
Item
Topsoil – Reuse On-Site Materials
Topsoil – Roadside
Topsoil - Lawns
Topsoil – Special Planting Mix
Topsoil - Acidic
Topsoil – On-Site Wetland Materials
Topsoil – Wetland

This section also includes special specification work item: Urban Planting Mix

Contract Documents must include:
- Topsoil locations, types, lines, grades and depth. (Typical Sections are one appropriate method of conveying this information to the Contractor.)
- Pay items for removing invasive species, if present, where on-site materials are to be reused as topsoil.
- For Reuse On-Site Materials and Reuse On-Site Wetland Materials, the Landscape Architect must provide locations of soil to be reused and the depth to excavate. This can be shown on the standard excavation tables.

Special Notes for Topsoil Items may include:
- 4 inches of topsoil for turf and 3 inches of topsoil for sod are the default minimum depths in the standard specification. If the Landscape Architect wishes to provide a different depth it must be specified in the contract documents and the estimate adjusted accordingly.
- Section 610-3.01 D Topsoil – On–Site Wetland and Wetland Off-Site or Manufactured call for subsoil to be tilled or scarified 6 inches prior to placing the wetland topsoil. If the Landscape Architect wishes to till to a different depth that information must be included in the contract documents.
- Stockpile locations
- §617 Pay items for removing invasive plant species should be included as contingency items for treatment of topsoil after placement in areas with known infestations of invasive plant species.
- Protection methods for wetland areas not to be disturbed

Section 713-01 Topsoil Material may not be changed or adjusted by special notes. If different materials are required, the Landscape Architect must use a special specification.
A. Standard Specifications

A.1 Topsoil-Reuse On Site. The Office of Technical Services allows the reuse or reclamation of topsoil from designated sites. Regional Landscape Architects designate approved sites within the project limits for topsoil harvesting in the contract documents. Topsoil from such sites shall be stored on site. The specification directs the contractor to take reasonable care that the topsoil is not contaminated with subsoil during stripping and other handling operations.

The Topsoil-Reuse on Site pay item has a gradation requirement that may require the contractor to screen the material prior to placing the soil. No other testing is necessary or to be specified for Topsoil-Reuse On-Site Material.

Topsoil stripped from sites designated in the contract documents is not subject to further requirements for stockpiles, including sampling or testing. Therefore the Regional Landscape Architect should not designate locations of topsoil for reuse on-site, if the quality and quantity of topsoil can not be verified during design. Quality can be verified either through standard soil testing or by visual observation of the existing vegetation. When estimating, the Landscape Architect should assume a 20% loss of soil volume for soil stripped and re-used within the project limits.

The Contractor may propose to use on-site material from sites not designated in the contract documents. Topsoil acquired in this manner would still be required to follow the Department’s existing guidance on topsoil stockpiling for sampling and testing.

A.2 Topsoil-Roadside. This item may be considered for locations where naturally occurring topsoil with at least 3% but less that 8% organic matter is suitable for infrequently managed turf. This includes areas where seeding on existing sub-soils is not a viable alternative.

A.3 Topsoil- Lawns. Topsoil- Lawns is intended for use in situations where regularly managed turf will be established. The requirements for this type of topsoil are based on university research that clearly establishes the importance of using topsoil containing at least 6% and up to 12 % organic matter. This level of organic content assures sufficient nutrient and moisture availability for successful germination, satisfactory establishment, and long-term sustainability of turf.

A.4 Topsoil-Special Planting Mix. This topsoil mix is intended for use where a higher organic content topsoil is required. Example applications for Topsoil Type 3 include specialized planting beds and planters.
A.5 **Topsoil- On-Site Wetland Materials.** The standard topsoil specification allows wetland topsoil to be reused or reclaimed from sites designated in the contract documents. The intent is to re-use wetland soil from wetlands impacted by project construction activities.

The Designer/Landscape Architect/Environmental Specialist should coordinate with the involved regulatory agencies prior to specifying the re-use of on-site wetland soils. The contract documents should clearly indicate the boundaries of the wetland soil to be removed.

The Landscape Architect/Environmental Specialist should field verify that the wetland soils do not contain invasive species and/or noxious weeds prior to specifying the wetland soil for re-use.

Preserved wetland areas should be protected by fencing or some other method. If the project Landscape Architect wants to include protective fencing, a separate pay item for the fencing must be included in the contract documents.

A.6 **Topsoil- Manufactured or Offsite Wetland Materials.** This item is also intended for wetland mitigation sites.

B. **Requests for Amending Topsoil**

The Regional Landscape Architect may be asked to assist construction staff in interpreting topsoil test results for projects in construction. Where samples do not meet topsoil material specifications the Contractor is required to submit a plan for amending pH and/or organic. There is no method for changing topsoil’s gradation.

B.1 **Initial Testing for Materials.**

- Gradation – no amendments available
- pH
- Organic

B.2 **Retesting.** In the case of pH correction, soil amendments can take six months, or more, to chemically react with the soil sufficiently to change the laboratory test results and accurately reflect pH changes. Therefore, the Department has determined that the risks of failure and/or substantial departure from the specified (nutrient, organic content, pH, etc.) requirements for the amended topsoil are not significant enough to warrant re-sampling and
retesting. This assumes that an appropriate and acceptable plan for amending the topsoil has been approved by the Engineer in Charge.

B.3 Organic Material Requirements for Topsoil. Standard specification section 713-01 MATERIALS REQUIREMENTS for Topsoil specifies that the organic materials used to amend topsoil shall meet the requirements of Section 713-15 Organic Materials. Landscape Architects may not modify the specification requirement by substituting an alternative composted organic material specification. The Department must be consistent with the requirements and commitments made by the NYSDEC regarding the adaptive reuse of a wide variety of composted organic materials. These requirements and commitments are consistent with State and Federal regulations. Consequently, Designers/Landscape Architects are not free to exclude composted bio-solids from use on a project (unless the use of composted bio-solids is prohibited by a law, rule, or regulation in a project area) or to specify that compost must be manufactured from lawn or leaf litter, yard waste or other suitable materials.

Related Topics
- Soil Amendments
- Soil and Erosion Control
- Invasive Species

28.6.7.2 Topsoil – Structural Soil Mix

This section covers a special specification work item.

The specification is:
- PIN approved only.
- HDM Ch. 21 should be followed for approval.

The Structural Soil Mix (previously “Topsoil: Urban Planting Mix”) is different from other topsoil mixes. This mix produces a load bearing soil suitable for use under sidewalks.

Structural soil mixes are two-phased systems comprised of a stone matrix for strength and soil for horticultural needs. Structural soil mixes depend on a load-bearing stone lattice to support sidewalks.4

Topsoil is mixed with crushed stone in a hydrogel slurry. The resultant mix allows the appropriate compaction of subgrade prior to pouring the sidewalk while maintaining adequate

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air pockets within the soil for fibrous tree roots to grow, without damaging the sidewalk as the tree matures.

The special specification “Structural Soil Mix”, calls for a proprietary product called “C-U Soil” patented by Cornell University. It is best used to help assure survival of trees in limited urban places (for example when space is limited between sidewalk and roadway).

Plants selected for structural soils should be alkaline-tolerant and drought tolerant species. The pH of the system will be immediately dominated by the soil chosen. Planting a tree into structural soil is fairly simple. The tree is simply planted into the structural soil as it would be in a normal, albeit very stony, field situation. The roots would be expected to immediately contact the structural soil and grow into the material.5

28.6.7.3 Soil Amendments and Compost

This section includes the following pay items:

Item
- Fertilizer
- Limestone
- Mycorrhizal Fungi
- Moisture Retention Additive
- Sulfur
- Compost

Contract Documents must include:
- Specific amendments to be included in the contract
- Location(s) and/or plants to be treated.
- Location(s) where compost is to be used

Special Notes for Soil Amendment Items may include:
- If not using the manufacturer’s recommended rates, the Landscape Architect must specify the rates of application for all pay items except mycorrhizal fungi.
- Fertilizer type

No other notes are appropriate

If different materials or methods other than those provided in the standard specification are required the Landscape Architect must use a special specification.

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A. Introduction

Soil amendment products are placed on, applied to or incorporated into existing soils to improve the soils structure, cation exchange capability (CEC) and nutrient content. Several types of soil amendments have been shown to be beneficial for vegetation establishment and long term plant health and growth. Improving the soil’s structure and chemistry has the potential to:
- Increase soil drainage (percolation rate),
- Improve aeration,
- Loosen tight soils,
- Assist in pH manipulation, and
- Increase the soil’s nutrient holding capacity (and CEC).

B. Policy:

Soil amendments should not be specified unless a soil test has been done and there is a demonstrated and documented need for the amendments.

C. General Guidance

Soil amendments provide limited value when used for backfill in tree and plant pits. Optimally, plant roots will eventually grow beyond the plant pit. Chemical soil treatments are temporary and may have to be continuously repeated. The best approach is to choose plants suited to the existing soil conditions. (i.e. USDA NRCS Soil Survey)

Consult with the Regional Landscape Architect before specifying soil conditioners including, lime, fertilizer, sulfur or other soil amendments. Soil amendments are to be used with discretion. Soils tests are an important tool in determining the appropriate soil amendment.

The location where soil amendments (including limestone and fertilizer) are to be placed, along with any limitations on the treatment areas, must be specified in the contract documents. Fertilizer should be discouraged in areas of critical aquifer recharge areas, “TMDL (Total Maximum Daily Load) watersheds”, and well head influence zones, such as Long Island and the NYC reservoir watershed.

When using soil amendments in an existing area, consider including notes that limit tilling in order to preserve the existing soil structure.

Soil tests for nutrients and organic must be done by outside laboratories. NYSDOT Materials Lab cannot test for these components.
D. Fertilizers

D.1 Policy

Fertilizers shall not be specified unless a soil test has been taken and there is a demonstrated need for them.

D.2 General Information

Plants need **macronutrients**, nitrogen, phosphorus and potassium (aka “NPK”) to grow. These essential plant nutrients are required by the plants in relatively large quantities, hence the term “macro”nutrient. The micronutrients (iron, manganese, copper, zinc, boron, molybdenum and chlorine) are equally important for plant growth, but the quantities necessary are smaller, hence the term “micronutrients”. The addition of fertilizer to the soil increases the quantity of macro- and/or micro-nutrients that are currently not found (or not available) in the soil. Fertilizers that also alter soil pH can change the availability of targeted macro- and micro-nutrients.

- **Organic Fertilizers.** Organic fertilizers consist of nutrient elements derived from living matter or synthesized carbon compounds. Organic fertilizers generally are insoluble in water and release elements slowly. Examples include animal manure, bonemeal, sewage sludge and plant refuse. Exceptions to the slow release of organic fertilizers are natural and synthetic urea products. Technically, organic urea has the quick release properties of inorganic fertilizers.

- **Inorganic Fertilizers.** Inorganic fertilizers are nutrient elements derived from non-organic sources. Ammonium nitrate, ammonium phosphate, potassium nitrate and potassium chloride are all examples of inorganic fertilizers. Inorganic compounds are water soluble and release elements very quickly when mixed with soil and water.

Note that suppliers may use coatings on inorganic fertilizers that will mimic the natural slow release of organic fertilizers. These compounds may be proprietary and the Landscape Architect should follow Department procedures when specifying such products.

When labeled “complete” a fertilizer contains quantities of all macronutrients, including nitrogen, phosphorus and potassium. An “incomplete” fertilizer will contain one or two macronutrient, but not all three. Other trace elements may also be present.⁶

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D.3 Preferred Fertilizer Traits

- Organic
- Greater than 50% of the nitrogen is water insoluble/slow release
- Pesticide-free

Ironically, over-application of fertilizers may contribute to the depletion of soil micronutrients or render them inaccessible to plants. Excessive fertilizing can also result in more mowing and turf diseases and can be harmful to wildlife and waterways. Over-fertilization may encourage pests such as spider mites, aphids, scale, whiteflies, lacebug and adelgid.

D.4 When the Landscape Architect is specifying fertilizer, consider the following:

- If existing soils are staying in place or being re-used, what nutrients are missing from the soil? Take a soil test. Before specifying a fertilizer, it is important to know the soil’s nutrient availability or cation exchange capacity (CEC), pH and organic content. It is equally important to understand the type and chemical composition of the fertilizer being considered for use and the way the fertilizer interacts with the soil to achieve the desired results.

- Will the fertilizer impact water quality? With efforts for phosphorus reduction, especially in areas such as Lake George and Onondaga lake watershed, consider excluding phosphorus from fertilizer recommendations. See Section E below for additional information.

- What are the nutrient requirements of the existing or proposed plant material?

- Is a slow release or a quick release fertilizer best suited for the site? For Establishing Turf and Sod a quick release fertilizer is often used. For 611 items, this may depend on whether the fertilizer is applied at the time of planting (typically slow release to prevent fertilizer “burn”) or to supplement existing plant materials that have an urgent need (quick release).

- What is the optimal rate of fertilizer based on soil, slope and plant characteristics? For example a lower rate of quick release fertilizers may be best on steep slopes so that the fertilizer is used immediately and not subject to runoff.

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7 Suffolk County Department of Health Services, in cooperation with U.S. Environmental Protection Agency, Peconic Partner for Clean Water
8 Suffolk County Department of Health Services, in cooperation with U.S. Environmental Protection Agency, Peconic Partner for Clean Water
D.5. Standard Specifications. The materials shall meet the requirements of Section 713 Landscape Development Materials for Fertilizer and Limestone.

The choice of the fertilizer used depends on several factors. These factors are discussed below according to fertilizer type:

D.5.a Type A. Ratio 2-1-1 or 3-1-1 (approximate analysis). Minimum 50% insoluble nitrogen and with a salt index less than 50. These fertilizers are typically used for establishing turf and in other instances where high nitrogen is required.

D.5.b Type B. Ratio 1-2-1 (approximate analysis) 50% Organic/IBDU/or coated for slow release with a water insoluble nitrogen (WIN). This fertilizer is typically used for specialized plantings such as flower beds or flowering shrubs.

D.5.c Type C. Either Nitrate of Soda containing a minimum of 16% nitrogen or Ammonium of Sulfate containing a minimum of 20.5% nitrogen as appropriate to soil conditions. The product used is based on soil pH needs.

- Nitrate of Soda contains nitrogen which is important to the growth of stems and leaves. It is short-lived in the soil, so it is best applied just before planting time.
- Ammonium of Sulfate is used to lower the pH of the soil, while contributing essential nitrogen for plant growth.

D.5.d Type D. Bone meal shall be commercially steamed bonemeal, finely ground with a minimum of 1.0% nitrogen and a minimum of 20% phosphoric acid. Bone meal is primarily used as a source of phosphorus which supports strong root growth. Bone meal is long lasting and most effective when well-mixed with the soil so it's close to plant roots. Bone meal is also slow releasing, which means that it is a source of phosphorous that is unlikely to enter watersheds.

D.6. Rate of Application

Different plants have different nutritional needs. Soil pH influences nutrient availability and subsequent plant absorption of soil nutrients.
The rate of fertilizer application must be specified as the number of pounds of fertilizer per square yard of the particular fertilizer type used or as the number of pounds of nitrogen per square yard required.

Plant materials experience fertilizer burn when they are exposed to excess fertilizer salts. Fertilizer burn can occur through direct contact with plant materials (plant parts such as leaves, roots and stems) or when fertilizers are applied to the soil without adequate watering.

Contact fertilizer burn is similar to the “burn” roadside plants exhibit when exposed to aerial sprays of highway de-icing salts. When fertilizers are applied without adequate watering, the fertilizer forms a hypertonic solution in the soil. This solution elicits an osmotic response from the plant roots; water leaves the roots through osmotic pressure and the plant dehydrates.

Both organic and inorganic fertilizers can “burn” a plant if improperly applied. Generally, organic fertilizers release nutrients more slowly than synthetic fertilizers and are less likely to burn plants. If fertilizer burn is a concern, specify a slow-release fertilizer. Slow-release fertilizers are coated so that the fertilizer is released over time or as additional water becomes available (reducing the chance of fertilizer burn).

D.7 Fertilizer for Existing Trees

D.7.a General Guidance. No tree should be fertilized without first establishing and documenting clear needs and objectives. Fertilizing trees to address known nutrient deficiencies and unique nutritional needs is considered an acceptable objective by the Department.

D.7.b Construction Details. The type of fertilizer chosen (Section 713-03), the method of fertilizer application (Section 610-3.05) and the fertilizer application rate must be specified in the contract documents. If the Landscape Architect wishes to specify a fertilizer other than those described in the standard specifications, a special specification must be submitted.

D.8. Fertilizer for Turf:

The 2010 NYS Dishwasher Detergent and Nutrient Runoff Law prohibits the use of fertilizers that contain phosphorus on lawns or non-agricultural turf except when a new lawn is being established or a soil test has indicated a need for additional phosphorus.9

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The Dishwasher Detergent and Nutrient Runoff Law (Chapter 205 of the laws of 2010)
- Prohibits the use of phosphorus-containing lawn fertilizer unless establishing a new lawn or a soil test shows that the lawn does not have enough phosphorus.
- Prohibits the application of lawn fertilizer on impervious surfaces and requires pick up of fertilizer applied or spilled onto impervious surfaces.
- Prohibits the application of lawn fertilizer within 20 feet of any surface water except: where there is a vegetative buffer of at least 10 feet; or where the fertilizer is applied by a device with a spreader guard, deflector shield or drop spreader at least three feet from surface water.
- Prohibits the application of lawn fertilizer between December 1 and April 1.

D.8.a Initial Seeding. Type A and Type B are complete commercial fertilizers containing NPK in their stated ratios. These formulations may be recommended in the initial seeding operation based on soil conditions. The rate will be determined by the soil test results.

D.8.b Established Turf. Generally, it is not recommended that the Department fertilize established turf. Specifying fertilization for established turf should only be considered after consultation with the Regional Landscape Architect.

E Lime

E.1. General Guidance. Lime may be desired on soils with pH below 5.5. The application of lime is for frequently managed turf areas. Other applications should be approved by the Regional Landscape Architect.

Soils with a low pH (highly acidic) that contain large quantities of aluminum and manganese may have these nutrients readily available for plant uptake. In large quantities, aluminum and manganese are toxic to plants. Acidic soils also bind calcium, phosphorus and magnesium, making these nutrients less available to plants. To decrease soil acidity, a common practice is to apply a material that contains some form of lime. Finer limestone particles are more rapidly effective than coarser limestone materials.

How Purity, Fineness, and Calcium Carbonate Equivalent (CCE) affect the neutralizing ability of liming materials:

E.2. Fineness. The rate of reaction of a liming material is determined by the particle sizes of the material; 100% of lime particles passing a 100-mesh screen will react within the 1st year.
while only 60% of the liming materials passing a 20-mesh sieve (but held on 100 mesh sieve) will react within a year of application. Material that does not pass the 20 mesh sieve is not expected to react within a 1 year following application. So, to be of practical use, limestone CCE equivalents need to be adjusted for the fineness of the material.

To determine the fineness of a limestone the following calculations need to be done:

- Subtract the % passing a 100 mesh sieve from the % passing a 20 mesh sieve and multiply this difference with 0.60.
- Add the % passing the 100 mesh sieve and divide the sum by 100.

Thus, the fineness of a material of which 70% passes a 100 mesh sieve and 97% passes a 20 mesh sieve is \(((97-70)\times0.60 + 70)/100 = 0.86\).

- **Calcium Carbonate Equivalent (CCE)** is the neutralizing value of a liming material compared to pure calcium carbonate. A CCE of 100% indicates that a material will neutralize the same amount of acidity per pound as pure calcium carbonate.

- **Effective Neutralizing Value (ENV)** is the fraction of the material’s CCE that will react with soil acidity in the first year of application. The ENV is calculated by multiplying a liming material’s CCE and its fineness. As an example: a liming material with CCE of 90% and a fineness of 0.86 has an ENV of 90*0.86= 77.4.

### Table 28-2 Calcium Carbonate Equivalent (CCE) Of A Few Common Liming Materials

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Chemical Formula</th>
<th>CCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcitic Limestone</td>
<td>CaCO₃</td>
<td>100</td>
</tr>
<tr>
<td>Dolomitic Limestone</td>
<td>CaMg(CO₃)₂</td>
<td>109</td>
</tr>
<tr>
<td>Burned lime, Quick Lime</td>
<td>CaO</td>
<td>179</td>
</tr>
<tr>
<td>Hydrated or Slaked Lime</td>
<td>Ca(OH)₂</td>
<td>136</td>
</tr>
</tbody>
</table>

Assuming 100% pure material.


E.3 **Application.** Limestone is relatively slow acting. Lime is most effective when applied between April 1 and November 1. It is not recommended to place lime on frozen soil or snow. The limestone is likely to be lost or washed away when applied under these conditions.

Most liming materials are only slightly soluble in water, so incorporating lime into the soil is critical. Even when properly mixed, lime will have little effect on soil pH if the soil is dry;
moisture is essential for the lime-soil reaction to occur. Water is included in the pay item for all soil amendments.

Dry limestone should be mixed into the top 3 to 5 inches of soil and gently watered in so that the limestone will be available to the plants. Unless otherwise directed, limestone should be applied before seeding.

E.4 Rate. Lime application rates should be determined based on the results of a soil test.

Lime application rates are partially determined by soil texture. To produce an equivalent change in pH, more lime will be needed on a loam or clay soil than on sandy soil. When the soil test also indicates a magnesium deficiency, the Landscape Architect should consider specifying dolomitic limestone to raise the soil’s pH. Dolomitic limestone with not less than 20% to 30% magnesium is recommended.

<table>
<thead>
<tr>
<th>Table 28-3 Method for Calculation of Lime Application Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lime recommendations are given in 100% ENV (effective neutralizing value). To convert to lime recommendation for a particular liming material, some calculations must be done.</td>
</tr>
<tr>
<td>• Lime rate (tons/acre) = 100 x lime rate for 100% ENV (tons/acre) / ENV of material</td>
</tr>
<tr>
<td>Actual lime required = ( \frac{\text{Recommendation}}{\text{ENV of limestone}} \times 100 )</td>
</tr>
<tr>
<td>• For example: soil test recommendation is 1.5 tons/acre of 100% ENV; limestone material has ENV = 70.3. Thus:</td>
</tr>
<tr>
<td>o Lime rate (tons/acre) = 100 x 1.5 / 70.3 = 2.1 tons limestone/acre</td>
</tr>
</tbody>
</table>

From: [http://courses2.cit.cornell.edu/cca/soilFertilityCA/CA5/CA513.html#PO42](http://courses2.cit.cornell.edu/cca/soilFertilityCA/CA5/CA513.html#PO42)
Table 28- 4 Pounds of Calcitic or Dolomitic Lime Needed to Raise Soil pH to 6.5 (lbs. Per 1,000 square feet)

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Soil pH</th>
<th>Sand</th>
<th>Loam</th>
<th>Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.0</td>
<td>20 lbs.</td>
<td>35 lbs.</td>
<td>50 lbs.</td>
</tr>
<tr>
<td></td>
<td>5.5</td>
<td>45 lbs.</td>
<td>75 lbs.</td>
<td>100 lbs.</td>
</tr>
<tr>
<td></td>
<td>5.0</td>
<td>65 lbs.</td>
<td>100 lbs.</td>
<td>150 lbs.</td>
</tr>
<tr>
<td></td>
<td>4.5</td>
<td>80 lbs.</td>
<td>150 lbs.</td>
<td>200 lbs.</td>
</tr>
<tr>
<td></td>
<td>4.0</td>
<td>100 lbs.</td>
<td>175 lbs.</td>
<td>230 lbs.</td>
</tr>
</tbody>
</table>

Table From: [http://www.sustland.umn.edu/implement/soil_ph.html](http://www.sustland.umn.edu/implement/soil_ph.html)

F. Sulfate

F.1 General Guidance. High soil alkalinity (where the pH is above 8.0) also interferes with a plant’s ability to uptake key nutrients. Turf grasses are especially sensitive to higher pH soils because their roots are shallow. In general, clay soils are more likely to have high pH than loamy, silty or sandy soils. Urban soils tend to be highly alkaline, a consequence of leaching from concrete surfaces.

Construction materials that are high in alkaline, including limestone gravel, concrete, diamond grindings and high pH irrigation water may also contribute to a soil's alkalinity. The Landscape Architect may wish to consider applying sulfur to soils exposed to slurry from diamond grinding, especially if these areas are to be planted (The slurry hardens up like cement and makes turf very difficult to establish).

If the soil is excessively alkaline, consider building raised beds using topsoil from an approved source.

F.2 Application. Ammonia sulfate, iron sulfate, elemental sulfur, sulfuric acid or aluminum sulfate may all be used to lower soil alkalinity.

To be most effective, sulfur materials should be worked into the soil. Sulfur materials that come into contact with plant leaves should be washed off immediately after application to prevent damaging leaf burn.

F.3 Rate. After determining the soil’s pH, consider the following measures (listed in order of effectiveness) to lower the pH of highly alkaline soils:
1. To reduce the soil pH by 1.0 point, mix in 1.2 oz of ground rock sulfur per square yard if the soil is sandy, or 3.6 oz per square yard for all other soils. The sulfur should be thoroughly mixed into the soil before planting.

2. Add elemental sulfur (90 or 99% sulfur material) annually at a rate of 6 to 10 pounds per 1000 square feet of area. Elemental sulfur slowly oxidizes in the soil to form sulfuric acid. Test the soil occasionally and stop adding sulfur when the pH has reached desirable levels.

3. Use acidifying fertilizers such as ammonium sulfate and other products with label designations indicating an acidic reaction in the soil. With repeated use, these materials may reduce soil pH.

4. Amend the soil with organic matter. On average, soils with higher organic matter contents have lower pH. Sawdust, composted leaves, wood chips, cottonseed meal, and leaf mold, will lower the soil pH.

The table below shows the pounds of elemental sulfur needed per 10 square feet to lower the pH of a loam or silt-loam soil to the desired pH indicated in the table. Reduce the rate by one-third for sandy soils and increase the rate by one-half for clays.\(^\text{10}\)

<table>
<thead>
<tr>
<th>Present pH</th>
<th>Desired pH</th>
<th>6.5</th>
<th>6.0</th>
<th>5.5</th>
<th>5.0</th>
<th>4.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.0</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td>-</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>-</td>
<td>-</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td></td>
</tr>
</tbody>
</table>

\(^{10}\) How To Change Your Soil’s pH, by Eldon Everhart, Department of Horticulture, Iowa State University of Science and Technology, 1994
G. Mycorrhizal Fungi

Adding mycorrhizal fungi to a planting medium is beneficial for trees, shrubs, herbaceous plants and turf grasses. Adding mycorrhizal fungi to planting soils has been shown to increase root growth. Increased root growth results in improved phosphorous and calcium uptake, quicker root growth establishment, and higher plant and turf survival rates. Extensive and healthy root systems enable plants and turf to better withstand drought and other environmental stressors. It also helps existing trees to recover from excavation and construction stressors.

When mycorrhizal fungi are specified, they shall be applied in accordance with the manufacturer’s recommendations.

If specifying both fertilizer and mycorrhizal fungi products, the Landscape Architect should specify lower quantities of fertilizer. As stated previously, mycorrhizal fungi improves plant’s feeder-root production. Plants use fertilizer more effectively, so less fertilizer is needed. If fertilizer is to be used with mycorrhizal fungi, it must be low or no phosphorous fertilizer.

Mycorrhizal fungi products may come as a concentrated powder form. This particular formulation blends well with other powder formulated products and seeds and may be added to hydromulching applications. Generally, the application of mycorrhizal fungi requires no special equipment.

The type of application depends upon site conditions and method of application. Mycorrhizal fungi can be broadcast, worked into seed beds, placed under cuttings, blended into planting soil, applied as a root dip gel, probed into the root zone of existing plants, or sprinkled near roots at transplant time. The goal is to place the mycorrhizal fungi in contact with the plant’s roots.

Mycorrhizal fungi products may be mixed with water for general use on trees, shrubs.

For Lawns/Turf mycorrhizal fungi products can be applied dry in a lawn spreader or mixed with water for spray applications. Be sure to water thoroughly after dry applications.

H. Moisture Retention Additives

The Department’s experience is that moisture retention additives are best used with new plants to aid in establishment.

Moisture retention additives are not permanent fixes. After five years virtually all hydrogels are depolymerized through natural decomposition processes. The rate of
degradation increases in the presence of fertilizer salts (and no, it doesn't make any difference if these are synthetic or organic fertilizers). One is then left with the original soil conditions; in a permanent landscape, this can be problematic unless other water-conserving steps are subsequently implemented.\textsuperscript{11}

The Regional Landscape Architect should be consulted before Hydrogels are specified. During times of drought or in cases where plant establishment is critical, hydrogels may be warranted. In general, selecting a more drought tolerant plant is the preferred solution.

H.1 Hydrogels. Hydrogels (hydrophilic polymers) are hard, crystal-like polymers that absorb water. Theoretically, this absorbed water is then slowly released into the soil solution and made available to plant roots to prevent or delay water stress. Individual particles will absorb between 60 and 400 times their dry weight in water, depending on the specific type.

The use of the first generation of synthetic hydrogels is not recommended. There have been indications that these materials hold the water, making the water unavailable for plant material. Careful consideration should be given before specifying any hydrogels.

Caution is advised if you are incorporating hydrogels. Hydrogels are known to break down in the presence of fertilizer salts. When using both hydrogels and fertilizers on a project, specify only slow-release fertilizers and irrigation water low in soluble salts. This will increase the usefulness of the material. Also, do not use more than the manufacturer's recommended rate per container or planting area; plants have actually popped out of the soil and containers in wet seasons or under heavy irrigation because there was too much hydrogel in the mix.\textsuperscript{12}

It has also been suggested that there are health issues associated with the acrylamide units. However, all hydrogels eventually break down over time\textsuperscript{13}.

H.1.a Potassium Based Granular Polyacrylamide Polymer or Co-polymer of Acrylamide Hydrogel. This product slowly releases moisture into the root zone. The Polymer should be potassium based, such as Terra Sorb, Hydrosorb, Gelscape, AquaGel C or Horta-Sorb or other approved equal material subject to the review and approval of the Regional Landscape Architect. Sodium based products should not be used with plant material. The

\textsuperscript{11} The Myth of Polyacrylamide Hydrogels, Linda Chalker-Scott, Ph.D., Extension Horticulturist and Associate Professor, Puyallup Research and Extension Center, Washington State University

\textsuperscript{12} Ohio State University Extension Factsheet, Horticulture and Crop Science, 2021 Coffey Rd., Columbus, Ohio 43210-1086

\textsuperscript{13} The Myth of Polyacrylamide Hydrogels, Linda Chalker-Scott, Ph.D., Extension Horticulturist and Associate Professor, Puyallup Research and Extension Center, Washington State University
additive is applied at the time of planting. This product is typically used when planting bare root materials.

H.2 Wetting Agents/Surfactants. Wetting agents/surfactants are chemicals that lower the surface tension of water facilitating the rapid and even penetration of water into the soil or planting medium. The intent is to minimize runoff and provide better aeration and drainage to improve growing conditions.

Wetting Agents/Surfactants are generally not recommended for use as a moisture retention agent. Determining an appropriate application rate for these products is difficult. When wetting agents are over applied, plant injury may result. The Landscape Architect should consider an application rate in accordance with the manufacturer's recommendations and/or a rate of less than 25 lbs per 1,000 SF. Under some circumstances, the Department may allow their use when it is specifically requested by a Contractor.

I. Organic Soil Amendments

Organic soil amendments can have an effect on final site grades and the additional volume must be appropriately considered. Design team members need to coordinate their efforts when establishing final site grading for the contract documents.

I.1 Compost

I.1.a General Information. The standard specification allows the Contractor flexibility in choice of compost types. The Designer/Landscape Architect shall not restrict the choices with a note in the contract documents.

Compost is an organic substance produced by the biological and biochemical decomposition of organic material. The end product of the composting process differs substantially from the raw materials. It is generally odor free, dark, crumbly humus that contains both macro- and micro- nutrients. Compost is considered a beneficial soil amendment because it builds soil structure, increases the soil’s microbial community, is a source of slowly released nutrients, moderates soil pH and acts as a buffering agent.

The New York State Department of Environmental Conservation (DEC) provides the following definition of composting:

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14 Tree Planting Guidelines, City of New York Parks & Recreation, February 2003
“Composting involves the aerobic, thermophilic decomposition of organic material, such as biosolids, using controlled temperature, moisture, and oxygen levels. Composting results in a humus-like material that is typically used in landscaping to enhance topsoil. All composting methods are aimed at optimizing conditions for microorganisms to efficiently degrade the material.”

The United State Environmental Protection Agency (EPA) defines compost as:

“Compost is organic material that can be used as a soil amendment or as a medium to grow plants. Mature compost is a stable material with a content called humus that is dark brown or black and has a soil-like, earthy smell. It is created by: combining organic wastes (e.g., yard trimmings, food wastes, manures) in proper ratios into piles, rows, or vessels; adding bulking agents (e.g., wood chips) as necessary to accelerate the breakdown of organic materials; and allowing the finished material to fully stabilize and mature through a curing process.”

Composts used on Department property, in both capital projects and maintenance activities fall into one of five categories. These categories include:
- Biosolids, Mixed Solid Waste, Septage and Other Sludges (aka biosolids),
- Source-Separated Organic Waste (aka SSOW),
- Yard Waste Composting Facilities (aka Yard Waste),
- Leaf Compost, and
- Agricultural Compost.

These composts differ in the raw material or “feed stocks” used to create the compost and, to a limited extent, the method of composting used to produce the material. Three of the five compost types originate from facilities that are regulated by the New York State Department of Environmental Conservation (DEC).

I.1.b DEC Regulated Composting Facilities. Composting facilities regulated by the DEC include Biosolid, Mixed Solid Waste, Septage and other Sludges, Source-Separated Organic Waste and Yard Waste. The EPA also regulates the use of biosolids.

The New York State rule (6 NYCRR Part 360) regulates the use of biosolids and other compost “ingredients” in general as well as their use in the production of composting products. Subpart 360-5: Composting Facilities of 6 NYCRR Part 360 specifically “regulates the construction and operation of composting and other organic waste processing (OWP) facilities for mixed solid waste, source separated organic waste, biosolids, septage, yard waste and other solid waste (6 NYCRR Part 360-5).” This subpart defines three distinct types of composting facilities that are relevant to this section. The regulations also describe three distinct methods for composting; the windrow composting method, the aerated static pile and the with-in vessel composting method.

Refer to Reference Section for additional information.
I.1.b. (1) Composted Biosolids/Composted Sewage Sludge. Composted biosolids/sewage sludge may be used to amend or manufacture topsoil provided the material complies with 6 NYCRR Subpart 360-5.5 and 40 CFR Part 503. Using composted biosolids/sewage sludge helps divert thousands of tons of waste from landfills and incinerators. Composted biosolids/sludge add organic matter to existing soils and topsoil.

Regulated material includes any composted biosolids, topsoil containing composted sewage sludge or other proposed soil amendment materials containing regulated biosolids. Refer to Standard Specification 713-15 for additional information on material requirements for this product when its use is specified on a capital project.

The federal regulations, 40 CFR Part 503, provide guidance on biosolids, including their use, allowable pollutant limits, management practices, operational standards and monitoring requirements. The federal operational standards discuss the guidelines for achieving differing levels of pathogen removal from processed biosolids: Class A (all pathogens removed) and Class B (pathogens reduced not necessarily removed). Composting is considered a Class A pathogen reduction method.

The state regulations contain the parameters for pathogen and vector attraction reduction as well as the allowable composting methods. The raw materials used in the composting process, such as bulking agents are also regulated. The end product of the composting process must meet strict criteria for pollutant concentration limits, particle size, on-site storage, labeling and intended use (6 NYCRR Subpart 360-5.5).

Topsoil amended or manufactured using biosolids/sewage sludge must have a certificate from a laboratory approved by NYS Department of Health verifying compliance with all applicable laws, rules and regulations. Only facilities permitted to compost biosolids under 6 NYCRR Subpart 360-5.5 will be allowed to furnish finished biosolid compost.

The Contractor must provide the EIC with the laboratory approved certificate before the biosolid compost is delivered to the project site. An information label must be attached to a product bag, or, when using bulk material, an information sheet or brochure must be provided to the user.

I.1.b. (2) Source Separated. Source separated organic waste (SSOW) means any readily degradable organic material that has been separated from non-compostable
material at the point of generation. Organic materials collected in SSOW programs typically get delivered to composting facilities where the waste is separated and turned into compost.

6 NYCRR Subpart 360-5.6 outlines the state regulations that pertain to the operation of SSOW. The regulations contain the parameters for pathogen and vector attraction reduction as well as the allowable composting methods. The raw materials used in the composting process, including bulking agents, are also regulated. Raw materials include food waste, soiled or unrecyclable paper and yard waste (in combination with any of the former materials). It does not include biosolids, sludge or septage.

As with biosolids, the end product of the composting process for SSOW must meet strict criteria for pollutant concentration limits, particle size, on-site storage, labeling and intended use. The labeling information must be attached to the product bag, or, if used in bulk, an information sheet or brochure must be provided by the Contractor to the EIC.

I.1.b. (3) Yard Waste Composting Facilities. Yard Waste Composting Facilities are regulated for their location (relative to other land uses), design (facility construction requires certification), soil conditions, drainage, composting methods, odor control and product use. According to the rule, yard waste compost must be used in a legitimate manner as a soil amendment (6 NYCRR Subpart 360-5.7).

Yard waste composting facilities are permitted by the DEC. Permit requirements include the submission of an annual report. This report contains, at a minimum:

- The type and quantity of waste received and processed,
- The turning frequency,
- The timing and amount of water added,
- The quantity (weight and volume) of product produced,
- Quantity (weight or volume) of compost removed,
- Description of the end-product distribution (6 NYCRR 360-5.7 (c)(5) (i-vi)).

The typical DEC regulated yard waste composting facilities are municipally owned and operated.

I.2 Other Compost Types

I.2.a Leaf Compost. Leaf Compost is a material option under Section 713-15 Compost. Leaf compost is an end product resulting from the composting of deciduous leaves. Leaf Compost should be free from odor and should contain no substances that are toxic to plants. The final product of the composting process shall not resemble the raw material from which it was derived.
I.2.b  **Agricultural Compost.** Agricultural Compost is allowed for Type A, B and C under Section 713-15 Compost. Agricultural Compost is not aged manure. Agricultural compost uses manure, feedstocks and other bulking agents and combines them in specific proportions. This mixture is then composted using the windrow method. Regulations ensure, among other things, that proper methods were used to reduce pathogenic organism content and vector attraction. The final compost is stable, with a uniform texture and an earthy, inoffensive odor.

J. Other Soil Amendments

The use of these materials will require a special specification.

J.1 **Pozzolans.** The term “pozzolan” describes a broad category of natural or manmade materials which are silica-based and chemically react with lime (calcium hydroxide) to form cementitious products. Some, typically of volcanic origin (such as finely-ground pumice) have been used for millennia, primarily as cements. The Department’s concrete specifications allow the use of two others, fly-ash or blast furnace slag, for partial replacement for Portland cement.

Certain naturally-occurring pozzolans, chiefly **diatomaceous earth** and **lassenite pozzolan** formed from the skeletons of microscopic diatoms, have also proven useful as soil amendments. They have in common:

- Lightweight
- Low bulk density
- High porosity
- High water-holding capacity

Research is increasingly showing that, when they are used as a top-dressing, mixed with soils, or in vertical aeration these characteristics can improve the soil’s aeration, facilitate recovery of soils compacted by construction, improve water retention and availability to plant roots and allow any fertilizers added to the soil to be used more completely and efficiently.

J.1.a **Diatomaceous Earth.** Diatomaceous Earth is a talc-like mineral powder, from a naturally-occurring soft, sedimentary rock (diatomite) found in multiple locations from Europe to the deserts of the United States. It is often at the surface in former lake beds. In the landscape industry, it has been used in sports fields and golf courses for its ability to support turf growth and prevent compaction. It may have applicability in areas such as grass shoulders.
It is better known for its industrial uses— as a filtering medium, a mild abrasive, a thermal insulator, an absorber in cat litter and for oil spill cleanup. It is becoming increasingly popular as a natural “mechanical” insecticide (it is ingested and kills insects). It may be calcined (super-heated to fuse particles together) or uncalcined, depending on the particular use.

Care in handling is needed—typically gloves and dust masks are required.

J.1.b Lassenite Pozzolan. Lassenite Pozzolan is unique in origin among pozzolans as it is only found and mined in one region in Nevada and California. Though occurring in only one location, it is not proprietary as it is mined and sold under several brand names. The deposits were formed 26 million years ago, when hot volcanic ash from the explosion of Mount Lassen fell in two former lakes, killing their populations of diatoms which precipitated to the lake bottom. It is amorphous silica, mined as a fine powder and, being from fresh water has virtually no salts and no heavy metals. Lassenite Pozzolan is primarily marketed as a soil additive for aeration and improved drainage. In areas subject to high wear and tear Lassenite pozzolan provides some structural benefits to prevent further compaction.

J.2 Gypsum. Gypsum, also known as calcium sulfate, is a soil amendment used to condition the soil and aid plant growth by loosening dense and water-impervious soils. **Prior to specifying gypsum a soil test is REQUIRED during the design phase.** If the Regional Landscape Architect determines that planting conditions necessitate the use of gypsum, a special specification must be used.

The chemical components of gypsum, calcium and sulfate, are highly soluble and when mixed into the soil (and well watered) replace the sodium ions that adsorb to soil particles. This released sodium can then be leached from the soil with sufficient watering. In certain soil conditions, the application of gypsum can also result in the leaching of aluminum, iron and manganese. This may have water quality implications if there are significant amounts of aluminum in the existing soil. Studies have found plants to exhibit nutrient deficiencies in iron, manganese and magnesium when gypsum has been applied to the soil.

Gypsum works well in heavy clay soils and in soils that are high in sodium. Gypsum should not be used with sandy soil and may negatively affect mycorrhizal inoculation of roots. Gypsum also should not be used to alter soil pH.

Gypsum is best applied when core aerating or tilling. Surface applications are not effective.

The calcium in gypsum has the potential to create a more porous soil that is easier to work with and permits deeper circulation of air, water and other nutrients when the amendment is properly applied. This promotes strong, vigorous root systems. However, gypsum products do not work well in soils that are already high in calcium. If your soil is not calcium deficient, gypsum can act as a soil hardener.
J.3 Peat Moss. Peat Moss is not a sustainable material and Landscape Architects should carefully consider whether another material is equally suitable. Peat moss is used as a soil amendment to lower soil pH and/or to “lighten” or “loosen” heavy soil, potentially increasing soil oxygen. It should be noted that peat moss is a partially decomposed material that will compete with the plants for available soil nitrogen. Other, more sustainable materials, that may serve the same purpose as peat moss include; bio-solids, sewage sludge and leaf compost.

If the Regional Landscape Architect determines that planting conditions necessitate the use of peat moss, a special specification must be used. The RLA should also consider whether more suitable plant choices could be made to avoid the need for amendments.

Related Topics
- Topsoil
- Turf Establishment
- Planting

28.6.8 Turf, Wildflower and Sod

This section includes the following pay items:

**Item**
- Turf Establishment
- Wildflower Seeding
- Sodding

28.6.8.1 Turf

The Department’s standard specification for turf establishment is a performance specification. This means that the specification does not include unnecessary “how to” information or details. Rather, they are descriptive of the **results required** to fulfill the specification. The specifications give the Contractor the latitude to determine the best means to meet the Department’s result criteria. The Landscape Architect should not include special notes in the contract documents directing the Contractor “how to” or requiring specific methods to achieve a satisfactory stand of grass.

**Contract Documents must include:**
- Pay Items for water, mowing and fertilizer as appropriate
- Seed Mix Type(s) and Location(s) of turf establishment on the project
Special Notes for Turf:
- No other notes are appropriate

Contract Documents may include:
- Mulch type if other than straw

If materials or methods other than those provided in the standard specification are required, the Landscape Architect must use a special specification.

Turf Establishment Type A: is used for typical roadside applications where low maintenance is expected.

Turf Establishment Type B: is used in residential lawn areas or other areas that will receive a high level of maintenance such as rest areas, municipal parks, buildings or complexes, universities, hospitals, commercial businesses, and public schools.

A. Introduction

Turf is the single most effective erosion control method used to reduce sediment runoff. It is important to establish a vegetative cover over areas disturbed by construction. State regulations require the establishment of temporary or permanent cover over exposed, bare earth within seven (7) days if soil disturbance activities have ceased. These regulations prevent the erosion of unprotected earth surfaces and to present an attractive, finished appearance to the completed or ongoing highway construction project. A healthy turf cover is also a means of combating invasive species or other undesirable plant material.

The Department uses turf in the following applications:
- Soil erosion and sediment control
- Maintenance of refuge (safety recovery) areas
- Re-establishment of residential lawn areas
- Water quality treatment area
- Maintenance of site distance
- Integrative vegetative management.

Most New York State soils can support a satisfactory stand of appropriately selected grass and legume species. When existing soil conditions preclude the establishment and subsequent maintenance of a turf cover consult with the Regional Landscape Architect. In most cases the addition of compost is sufficient. Before specifying other soil amendments consider using a topsoil item.
B. General Guidance

It is customary to sow a mixture of seeds. The seed mixes include grasses that germinate and grow quickly to provide a temporary cover, as well as grasses intended to form permanent turf.

Hydroseeded areas may begin to germinate in as little as 5-7 days. The first seeds to germinate are the temporary “nursery” or cover grasses. The permanent grasses take another 7 to 14 days to germinate. The bluegrasses can take up to 30 days to germinate. Adequate water is crucial to seed establishment success. The contract documents should include language that ensures watering of newly seeded areas throughout the germination process. If, after 45 days, permanent grasses have not germinated, the area will likely require re-seeding.

As a general rule:
- Kentucky bluegrass germinates in 14 to 28 days. It grows well in full sun to part shade, but does not do well in hot exposures. Kentucky bluegrass is more commonly used in upstate NY lawn seed mixtures.
- Perennial rye grasses germinate in 5 to 7 days. They grow well in full sun to part shade and do not do well in hot exposures.
- Fine-leaved fescues germinate in 14 to 21 days. They grow well in full sun to light shade and are slower growing and more water efficient than tall fescue.

Once germinated, most grass types will take between 3-4 weeks to fill in. Depending on how often the area is watered and the type of grass seed used, it can take as long as 8 weeks to see vigorous growth.

Site conditions, including soils, slopes, drainage, exposure, climate and proposed maintenance should be considered when choosing which seed mix to include in the project.

B.1 Standard Seed Mixes. The Department's standard seed mixes provide a sufficient range of grass types capable of adapting to local soil variations. The mixes found in Section 713-04 Seeds should meet the needs for the majority of the Department's typical uses. The names are descriptive of general applications; however the mixes may be specified as needed.
- General Roadside Seed Mix
- Restoration/High Traffic Seed Mix
- Lawn Seed Mix
- Salt Tolerant Seed Mix

B.2 Other Seed Mixes. A special specification is required to use a seed mix other than those provided in §713-04 Seeds of the Standard Specification.
Recent research in environmental stewardship has focused on re-vegetating roadways with native grass species and grass/forb seed mixes. While large scale seeding with these mixes is not yet recommended, unique instances may warrant their use and experimentation. When they are used, Regions are encouraged to share the results. Such use would require a special specification. The publication Vegetating with Native Grasses in Northeastern North America (USDA NRCS in association with Ducks Unlimited Canada) is a good resource for design and implementation of these concepts.

C. Acceptable Established Turf

Refer to 610-3.03 for the detailed performance standards.

The timing of the one mowing cycle can vary based on the turf grass mixes. In general, this requirement provides sufficient time for permanent turf grasses to germinate and establish.

D. Restoration under Section 107-08

Section 107-08 of the Standard Specifications is used to restore incidental areas disturbed during construction.

Maintenance contracts, such as lighting, traffic signals, signs, bridge painting or repair, etc., have disturbed earth areas so small and scattered that measuring each area is impractical. For these project types, it is not necessary to include the pay item for seeding in the contract if a rough estimate suggests that the Project’s total seeding area will be less than 500 square yards. The requirement to reestablish vegetation (through seeding) in disturbed areas within the work limits will be provided for under §107, Legal Relations and Responsibility to Public, §107-08 Protection and Restoration of Property and Landscape. The cost for the seeding will be distributed under various contract items. However, if the rough estimate suggests that more than 500 square yards of seeding will be necessary, the pay item for seeding should be included in the contract. If locations are in sensitive areas you may wish to include a seeding pay item even if less than 500 square yards.

Site restoration work not identified in the contract documents will use the seed mixes specified in the contract’s 610 seeding items. When the 610 seeding items are not specified in the contract documents, the standard seed mixes identified in §107-08 shall be used. In either case, the materials used to complete the restoration will NOT be compensated for using the 610 pay item.

If a project’s turf restoration involves more than very small, isolated locations, the contract should include the standard turf establishment pay item.
E. Mulch for Turf Establishment

The following information is provided to assist the landscape architect in choosing a material and in estimating the quantities needed. The Standard Specification’s default is straw. The Landscape Architect is provided additional mulch types which can be specified by note in the contract documents.

E.1 Straw. When straw is specified, the application rate should ensure sufficient ground coverage; 2-3 bales per 1000 square feet are recommended.

Straw should be used whenever temporary or permanent seeding is done after October 1st in order to properly protect the site during winter months.

E.2 Wood Fiber. Wood fiber mulch is used for general seeding and for erosion control. When used alone, wood fiber mulch may be used on slopes up to 1:2.5 or less. When used with tacking agents or with RECPs, wood fiber mulch can be used with slopes up to 1:2, as per manufacturer’s recommendations.

Wood fiber mulch is typically composed of 100% recycled long strand, thermally refined (within a pressure vessel) wood fibers. It is phytosanitized and free from plastic netting.

Application rates vary based on site conditions.

E.3 Cellulose. Cellulose mulch is used for general seeding when slopes are flatter than 1:4. Cellulose mulch is not recommended for channels or areas with concentrated water flow.

Cellulose fiber mulch is generally made from clean recycled news print. No debris, plastic or netting should be present in the mulch.

Application rates vary based on site conditions.

E.4 Cellulose and Wood Fiber Blend. Cellulose/wood fiber blends are used for general seeding when slopes are 1:3 or flatter. This material is not recommended for channels or in areas with concentrated water flow.

NYSDOT standard specifications call for a combination of 70% wood fiber and 30% cellulose fiber. It should be phytosanitized and free from plastic netting.

Application rates vary based on site conditions.
E.5  **Cotton Hydro**. Cotton hydro-mulch is a blend of mechanically processed straw fibers and reclaimed cotton plant materials. It may be used for general seeding where slopes are 1:3 or flatter.

Application rates vary based on site conditions.

E.6  **Pelletized Hydro Mulch**. Pelletized mulches such as “Jet Spray” are a combination of paper and wood fiber. This material may be poured into hydromulch machines, which reduces loading time.

Application rates vary based on site conditions.

E.7  **Hay**. The Department does not allow the use of hay. Hay directly contributes to the introduction and spread of invasive plant seeds or other propagules.

F.  **Mowing**

F.1  **Mowing newly established seeding or sodded areas**. This section includes the following pay items:

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<th>Item</th>
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<td>Mowing</td>
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<td>Mowing Limits Markers</td>
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**Contract Documents must include:**
- Mowing Type(s) and Location(s)

**Special Notes:**
- No other notes are appropriate

**Contract Documents may include:**
- No other notes are appropriate

F.2  **Mowing Limits Markers**. The decision to install mowing limits markers along a state highway should be determined by the Maintenance Residency, Regional MEC and/or other entity responsible for the highway’s maintenance. Please refer to Transportation Maintenance’s Mowing Guidance Package – D. Establishing Mowing Limits.
28.6.8.2 Wildflowers

The Department’s standard specification for wildflower seeding is a performance specification. This means that the specification does not include necessary “how to” information or details. Rather, the specifications give the Contractor the latitude to determine the best means to meet the Department’s result criteria. The Landscape Architect should not include special notes in the contract documents directing the Contractor “how to” or requiring specific methods for seeding wildflowers.

**Contract Documents must include:**
- Location of wildflower seeding areas
- Wildflower seed mix
- Pay Items for water, weed removal and mowing

**Special Notes:**
- Planting season
- No other notes are appropriate

**Contract Documents may include:**
- Pay items for topsoil or compost
- Special specification for wildflower signing as appropriate,
- Mulch type if other than straw
- Elimination of Mulch Anchorage if desired

A. General Information.

FHWA’s regulations (23 CFR Part 752) require the Department to plant wildflowers on all federal-aid landscape projects unless it is determined that wildflowers cannot be grown satisfactorily on a particular project or that a project has a scarcity of available planting areas.

FHWA requires a total of one fourth of 1 percent of the total cost of landscape improvements to be used on wildflowers. The value of donated plant material may not be considered when calculating the minimum expenditure required for wildflowers.

23 CFR Part 752 defines landscape projects as any action taken as a part of a highway construction project or as a separate action to enhance the aesthetics of a highway through...
the placement of plant materials consistent with a landscape design plan. Seeding for erosion control and planting vegetation for screening are not considered a landscape project under these regulations.

Separate itemized summaries identifying the cost of wildflowers and the collective cost of other plantings in the project, exclusive of the plants used for erosion control and screening purposes, should be completed as soon as the successful low bidder’s prices become available.

The Regional Landscape Architect should maintain a record of federal-aid projects that include wildflower plantings. The records should include the project’s funding source, amount and cost of the wildflower plantings in each project, along with the total cost of plantings provided for highway aesthetics. These record keeping activities facilitate compliance confirmation.

B. Wildflower Design Considerations

Only wildflowers native to New York State should be planted. Landscape Architects should be familiar with wildflower species that are native to their geographical area and that are commercially available. Wildflowers that are identified as invasive must not be planted. According the FHWA’s Annual Wildflower Survey Report of 1994, it is advisable to include a non-competitive bunch-type grass, or other appropriate nurse crop in the wildflower seed mix as an aid to wildflower establishment.

Wildflower planting designs should be incorporated into project planting plans.

Areas considered for wildflower planting should be investigated to assure suitability for wildflower growth. Wildflowers should not be planted in the following areas:
- Slopes steeper than 1:3,
- Areas where erosion control is an especially important consideration,
- Drainage paths,
- Within 15 feet of a curb or shoulder,
- Areas that are inaccessible for maintenance,
- Areas that would be difficult to mow based upon the Department’s current mowing practices, and
- Areas where new turf grass areas are to be established.

“Wildflower Area” signs may be installed to identify locations intended to be perpetually managed as “wildflower areas”. Areas earmarked, after five years, to become natural regeneration areas may also be signed as such. There is no Department standard for these types of signs. A special specification will be required for these to be included in a contract.
C. Wildflower Planting Practices

The following information is quoted from FHWA guidance.  

C.1 Site Preparation for Wildflower Seeding. A primary objective of site preparation is to facilitate good seed/soil contact. In general, minimal soil disturbance and no additional soil amendments are recommended.

NYSDOT standard specifications for wildflowers do not included specific ground preparation instructions. The ground preparation is at the discretion of the Contractor unless the topsoil pay item is included for the wildflower planting location.

In general, the pay item for Preparation of Subsoil for Turf Establishment is not recommended for wildflower locations. Subsoil tilled too deeply could cause dormant broadleaf weeds and undesirable grass seeds to germinate and grow. These seedlings can out-compete the wildflower seeds for soil resources, preventing their germination. Wildflower seeds sown on newly established, un-vegetated slopes may be exposed to high concentrations of weed seeds.

If site conditions are unique and require specific ground preparation or other parameters, a special specification is required.

C.2 Seed Quality. Several factors affect wildflower seed quality. Examples include length of storage, seed hygiene and where and when the seeds were harvested.

Wildflower seeds are particularly susceptible to damage during storage. Wildflower seeds should not be stored for prolonged periods and should be planted soon after harvesting. Seeds collected during the most recent growing season have significantly higher germination rates than seeds collected in earlier seasons.

Wildflower seeds also need to be properly cleaned and free from germination inhibiting residue. This applies to purchased seed as well as to seeds that are collected or donated.

Wherever possible, specify local ecotype mixes for wildflower seeds. Seeds that are sourced from other eco-regions of the US may not be successful here.

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15 Causes of Unsuccessful Wildflower Plantings, FHWA, Office of Environmental Policy, Environmental Division, 1989
C.3 **Planting Procedures.** Commonly used techniques for planting wildflowers include drill seeding, **hydroseeding** or broadcasting seeding for small areas. All three techniques can result in a successful wildflower planting.

Additional consideration should be given to the germination characteristics specific to the wildflower species used. For example, different wildflower species have different soil depth requirements for successful germination. Some species should not be planted too deeply. Others prefer a heavy soil cover. Seasonal differences in seeding depth requirements may also exist.

Hydroseeded wildflower seeds may become suspended in the mulch fibers above the soil. Absent sufficient precipitation or moisture in the mulch, the seeds or seedlings can dry out. Adjustments to hydroseeding application methods must be made to ensure that the wildflower seeds achieve good soil contact.

C.4 **Soil Preparation.** Wildflower species are not adaptive to all soil types. Highly alkaline or highly acidic soils can deter successful wildflower establishment. A mixture of wildflower seeds identified as appropriate to a geographic area may not, in fact, be suitable for all soil conditions. The Landscape Architect should ensure that the mix’s dominant species is compatible with local soil and climatic conditions.

Soil additives such as fertilizer are not required and may be harmful to wildflowers growth. Fertilizer encourages the growth of weeds and unwanted grasses.

C.5 **Moisture Requirements.** Adequate moisture is required for the establishment of wildflowers. Even species classified as drought tolerant must receive sufficient water in order to germinate and establish. Once established, the wildflower plant will exhibit drought tolerant characteristics. The Landscape Architect should specify watering when seeds are expected to germinate and periodically thereafter until the wildflowers are established.

D. **Wildflower Maintenance**

Untended wildflower areas in the Northeastern U.S. will, with rare exceptions, revert to woodland conditions. This process is known as natural succession. Regional Landscape Architects should determine whether a planting area will be perpetually maintained with wildflowers. This decision should be coordinated with the MEC and Resident Engineer.

Planting areas not intended to be perpetually managed for wildflowers may be considered for designation as “natural regeneration areas”. Before making this decision, coordinate with the MEC and Resident Engineer. A site originally sown with wildflowers can be reverted to a natural regeneration area within five years from the last time wildflower seeds were sown by adjusting the maintenance schedule. Refer to the Department’s Mowing Guidance for additional information.
If, however, it has been determined that a location will be indefinitely managed as wildflower areas, the appropriate maintenance strategy should be applied. Refer to the applicable sections of the Department’s Mowing Guidance for additional information. Subsequent maintenance should include periodic, supplemental seed sowing. These sowings can be incorporated into landscape specific contracts, maintenance contracts or other capital projects.

The project Landscape Architect should document any project specific establishment methods developed for wildflower areas. Maintenance criteria and practices considered critical for the satisfactory growth of wildflowers should also be documented. The information can then be shared with the maintaining entity (state forces or others). Whenever feasible, regional offices are encouraged to share wildflower maintenance tasks. This includes entering into agreements with local governments, non-government organizations (NGOs) or citizen groups.

E. Wildflower Waivers

A wildflower waiver is required for federal-aid projects that include landscaping but do not include wildflower planting. Exceptions to the federal rule occur after it has been determined that wildflowers cannot be satisfactorily grown or that a project has no suitable wildflower planting areas. The wildflower waiver should be completed prior to project letting. The waiver must include adequate justification to support the findings and conclusions and should be processed as follows:

- Waiver requests for federal-aid Interstate NHS projects with an estimated construction cost of one million dollars or more are completed by the Regional Landscape Architect and forwarded to the Landscape Architecture Bureau (LAB) for submission to the FHWA. Approved waivers will be returned to the region.

- On all other federal-aid projects, the Regional Landscape Architect approves waivers.

- Approved waivers should be placed in the project files.

A template for wildflower waivers may be found in Appendix 28-B.

Related Topics
- Mulch for Turf Establishment
- Watering

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28.6.8.3 Sodding

The Department’s Standard Specification for sodding is a performance specification. The specification does not include unnecessary “how to” information or details. This gives the Contractor the latitude to determine best means to meet the Department’s result criteria. The Landscape Architect should not include special notes in the contract documents directing the Contractor “how to” install sod or requiring specific sodding methods.

**Contract Documents must include:**
- Location of areas to be sodded
- Pay Items for topsoil, compost, water, weed removal, mowing and fertilizer as appropriate

**Special Notes for sodding:**
- No other notes are appropriate

If different materials or methods other than those provided in the standard specification are required, a special specification must be used.

The desired characteristics of a high quality sod include uniformity; high shoot density; adequate strength for harvesting and handling; lack of weeds, insects, diseases and nematodes; acceptable color; sufficient maturity in terms of carbohydrate reserves to ensure effective rooting and a minimum thatch layer.\(^{16}\)

The primary requisite for successful sod establishment is rooting into the underlying soil. Three inches of topsoil is recommended for areas to be sodded.

Sod is cut fresh to order. It is a live, perishable product and should be installed and watered immediately upon delivery. Sod turf has a high nitrogen content. Because of this, sod will heat up and ferment if left rolled up. Covering a pallet and/or watering the sod while rolled up, especially in hot weather, worsens the problem. The length of time that sod can be stacked before damage occurs varies from 10 to 48 hours. Factors that influence this include sod condition, soil temperature and atmosphere.

After installation, it is essential to begin watering new sod within a half hour. Apply at least 1 inch of water so that the soil beneath the sod is very wet. Avoid standing water, but the ground should be very soft when walked upon.\(^{17}\)

Sod should be selectively used. The Landscape Architect should carefully consider the need for sod before including the pay item in the contract. Locations suitable for sod include;
- Areas where there is already a high quality, frequently maintained turf,

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\(^{17}\) Saratoga Sod Farm, info@saratogasod.com
Where requested by adjacent property owners, such as businesses, churches, schools, universities, municipal complexes, parks, etc.,
Locations adjacent to sidewalks,
Locations that receive regular watering, and
Residential areas.

Although sod may give an immediate ground cover, most of the commercially available sod contains bluegrass. Bluegrasses are susceptible to damage from shade, nutrient deficiencies, salt and other roadside pollutants. The cost for sod is also significantly higher than turf establishment.

Related Topics
- Mulch for Turf Establishment
- Watering

28.6.9 Planting

This section includes the following pay items:

Item
- Planting - Major Deciduous Trees
- Planting - Minor Deciduous Trees
- Planting - Coniferous Trees
- Planting - Deciduous Shrubs
- Planting - Evergreen Shrubs
- Planting - Vines & Groundcovers
- Planting – Herbaceous Plants

Contract Documents must include:
- Locations where materials are to be planted
- Scientific and common names of plants specified

Contract Documents may include:
- Watering pay item
- Post Planting Care pay item

Special Notes for Planting.
- Topsoil type if anything other than un-amended existing soil is desired.
- Soil amendments when necessary
- Materials for the Protection of Planting (e.g. staking, anti-desiccants)
- Compost type
Mulch type
If calling out street trees, specify the height to which the tree should be free of branching.

If different materials or methods than those provided in the standard specification are required the Landscape Architect must use a special specification.

28.6.9.1 Policy

It is the policy of the Department of Transportation to provide for the appropriate preservation, restoration and planting of vegetation.

28.6.9.2 Introduction

Roadside plantings are essential for integrating transportation systems into their existing environment or for improving on the existing setting.

The provision of plantings can help:
- Minimize or mitigate the negative impacts of projects (i.e., erosion and sediment control, visual screening, etc.),
- Accentuate the positive (i.e., framing views, emphasizing gateways, etc.)
- Improve the natural environment (re-establishing previously disturbed ecological systems),
- Promote genetic diversity,
- Habitat connectivity (i.e. connecting individual woodland patches, etc.).
- Reinforce or re-direct user behavior (i.e., traffic calming).
- Promote livability (i.e. personal security, human scale, residential/stakeholder comfort),
- Influence energy usage (i.e. summer cooling, reduce mowing, reduce urban heat island effect), and
- Address safety goals (i.e. indicate change in direction, reduce glare).

28.6.9.3 Objectives for Planting

The AASHTO Green Book mentions three general objectives of landscape design:
- To provide vegetation that will be an aid to aesthetics and safety,
- To provide vegetation that will aid in lowering construction and maintenance costs, and
- To provide vegetation that creates interest, usefulness, and beauty for the pleasure and satisfaction of the traveling public.
AASHTO’s Guidelines for Vegetation Management provide the Landscape Architect with practical information on roadside vegetation management to assist with the project’s planting design.

Plantings should be provided in the Department’s projects to accomplish one or more of the following objectives:

- Address the aesthetic considerations associated with transportation facilities and the relationship between those facilities and their surroundings.
- Mitigate impacts or effects identified in environmental or project development documents, such as permit requirements.
- Improve or maintain the existing site’s ecology and habitats to promote genetic diversity and local eco-types.
- Hide or distract from industrial blight
- Serve other specific functions. (i.e. preventing erosion; reducing headlight glare; providing snowdrift control; indicating highway alignment changes; visual buffer; traffic calming; gateway enhancement, reducing roadside maintenance, etc.)
- Support community visioning, such as those established during the corridor planning processes or articulated in a master plan (i.e. NYS Scenic Byway Corridor Management Plans, NYSDOS Local Waterfront Revitalization Program, etc.)

28.6.9.4 General Guidance for Planting Design

A. Site Inventory and Analysis

The Department has a significant investment in our green infrastructure. The following points should be considered before planting:

- Know your site! Understand:
  - The environmental conditions – soils, hydrology, solar aspect, erosion prone locations, wind, topography and microclimates;
  - Existing vegetation and plant communities;
  - The social context – Is there a community vision? Has the Department engaged in outreach? What are the user’s expectations? Creating a design theme and articulating the design intent assists with public engagement and acceptance.
  - The engineering constraints, such as clear zone, sight distances, speed limit, overhead or underground utilities, etc. (refer to HDM Chapter 10);
  - The visual and aesthetic context; and
  - Where the rights-of-way boundaries are.
Outdoor advertising is part of the landscape. The Department cannot plant in front of legally-registered outdoor advertising devices. If there is a question about a given device, contact the Regional Right-of-Way Group.

Know the project!
- Understand the goals of the project and its potential landscape footprint.
- The project Landscape Architect should have a dialog with the Designer in the early project stages (scoping, preliminary design) to understand mutual concerns. Can adjustments/compromises be made which will accomplish mutual goals? For example, can a curb be reconfigured to provide sufficient room for planting; can a wall be extended to preserve a slope, etc.

Is it appropriate to plant? A project does not have to include trees and shrubs simply because site conditions or spaces allow for plantings.

Is it appropriate to protect or preserve the existing plant material? It may not be if:
- Restoration is more appropriate than protection. (e.g.: Preservation of plant material would compromise the intended long-term function of the improvements).
- Plant health is poor.
- Long-term survival is unlikely due to degree of construction impact.
- Changed drainage patterns are likely to alter soil moisture significantly.
- Changes to sun exposure and other growing conditions will alter species composition.
- The project includes plans to excavate on two or more sides of an existing plant or place soil within the dripline of an existing plant (varies with species typically more than 4 to 6 inches can affect the health of the plant).

Consider the maintenance implications:
- Have you coordinated with Operations/Maintenance? Do they have a maintenance plan? Do you understand their access and equipment needs?
- What are the typical requirements for the classification of roadway?
- How could planting choices support sustainable, safe maintenance practices? (e.g.: vegetative alternatives to reduce mowing, vines to deter graffiti)
- Do you understand the needs of the local maintenance practices, access and equipment needs?
- Do you have a commitment from the local community or homeowner for future maintenance needs? (If you can not get a maintenance agreement for the planting scheme you may need to adjust designs to the maintenance realities.)
- How much maintenance will the design require?
- Does the maintenance organization have staff, equipment and other resources to maintain the design?
o How complex or extensive will the final maintenance be? For example, can the design be easily mowed after planting or will frequent watering be required for plant survival after the post planting care or contract duration?

- Consider the future use and/or ecological function of unpaved areas:
  o Are there existing or proposed wetlands and/or streams?
  o Is there an opportunity for wildlife habitat, foraging or movement corridors?
  o Have you identified permit requirements?
  o Are there opportunities to connect isolated ecological communities?

B. Planting Design Principles

The planting design should reflect the planting objectives of the project, as discussed under Section 28.6.9.3. Additionally, it is recommended that:

- **Existing vegetation of good quality that is well established should be preserved and protected to the greatest extent possible.** The benefits of saving existing vegetation:
  o Wildlife connections
  o Soil stabilization
  o Shade
  o Wind protection
  o Minimize mowing requirements
  o Blowing and drifting snow control

Planting designs should not compromise the safety of Department personnel or the public. Plant material should not be located in areas where it will unnecessarily expose maintenance personnel or require lane closures during pruning or other maintenance operations.

Planting intended to enhance established plant communities should be visually and ecologically compatible with the existing vegetation.

- **The scope and location of planting should be contextually relevant to the project area and the user’s experience of the transportation system.** Vegetation that is removed in front of homes, parks, or other sensitive viewsheds should be mitigated by preparing a comparable planting plan, when appropriate.

- **Select plants with the highest likelihood of survival and the least demand on future maintenance.**

- **Consider sustainability:**
  - Select and locate plants to minimize water consumption.
Planting designs should be prepared with a goal of little or no use of pesticides and fertilizers.
Create conditions for natural regeneration of plant communities (for example, de-compacting soil post-construction).

- **Consider "Green Street" areas where possible**
  - Apply "Green Street" principles in remnant sites where pavements are not necessary. These can increase vegetation, capture stormwater, reduce urban heat island effect, and provide a more aesthetically pleasing pedestrian experience.

- **Planting Hierarchy** - Where practical, the Landscape Architect should include vertical layering of plants, i.e.,
  - Plants that remain close to the ground,
  - Plants that provide a shrub layer,
  - Larger shrubs and small trees that create an understory and
  - Canopy trees that will grow to heights that cover and shade plants underneath.

The spacing between plants is variable and the species are randomly mixed. This more closely mimics the arrangement of plants found in nature.

**Figure 28-8 Avoid planting on 1:2 slopes. Trees will suffer from lack of natural water and will need to be limbed up as the canopy develops.**
Figure 28-9 Planting Hierarchy

- **Root Space Requirements**: Rooting space should be a primary consideration in tree selection. The mature size, growth rate and longevity of a tree are directly related to the available rooting space.

C. Plant Selection

Plant selection at the NYSDOT requires consideration of federal, state and local guidance(s) while simultaneously acknowledging each site’s limitations. Environmental sensitivity at all scales (site, local, regional) and environments (wild, rural, urban) is equally important. Designers are encouraged to identify broad ecological trends, local microclimates and contemplate the implications of scale. The plant materials selected should be diverse, readily available and detailed at the appropriate level of taxonomic specificity.

C.1 Federal, State and Local Guidelines. Federal and state guidelines for plant selection include the Department’s landscape stewardship principles (refer to §28.5 Landscape Stewardship, of this document) and the 1994 Presidential Memorandum on Environmentally and Economically Beneficial Landscaping Practices on Federal Landscaped Grounds. The 1994 memorandum recommends the use of regionally native plant species on federal-aid projects that include plant material. All Department projects and actions that include the use of plant material shall use regionally native plant species when their use is cost effective and practicable. The use of non-natives may be appropriate when local site conditions warrant their use, the area is subject to significant salt spray, or there is a lack of native plant
availability. The use of invasive plant species is never appropriate (see Section 28.6.9.4.5 Invasive Species Planting Considerations).

Municipalities, towns, villages, hamlets and other non-governmental community organizations may have local codes, ordinances, tree planting programs or other guidance(s) that need to be considered. All relevant laws and planning documents, including (but not limited to) city, county and regional master plans should also be reviewed for design guidance prior to finalizing a planting design. If a community employs a municipal forester, his/her input should be solicited.

C.2. Site Characteristics that Assist in Plant Selection. Making the right observations and choices before planting can enhance plant survival. These fall into three general categories:

- Site Assessment - Will the site give the plant what it needs to survive? These “abiotic” factors, or “cultural requirements”, include light, water, nutrients, oxygen, carbon dioxide & temperature.
- Site Modification - Will the site receive drainage enhancements, pH modification, soil amendments or other treatments that modify the existing site conditions sufficiently to justify broadening or changing the plant palette?
- Plant Selection - Is the plant being considered for selection a good match to the site?18

Abiotic factors are the non-living, chemical and physical site factors and include wind, temperature, sun exposure, soil quality, air quality, available water, and salt spray. The plant material used on the Department’s projects should be tolerant of roadside conditions. Roadside conditions can be harsh (wind) and unnatural (salt levels); this may limit the potential plant palette.

The Landscape Architect should look for site microclimates that may exist or result from a project’s impacts. Microclimates are localized climatic conditions that differ from the climate of the surrounding area. The Buffalo metropolitan area is an excellent example of a regional microclimate that exists due to the city’s proximity to Lake Erie. At the site level, changes in forest edges due to clearing and grubbing may leave the remaining trees’ root systems and trunks vulnerable to sun scald and/or frost cracking.

When selecting plant combinations, the Landscape Architect should consider the compatibility of different plants based on their cultural requirements. It would not be appropriate to plant a moisture loving plant in the same planting bed with a plant that prefers dry or xeric conditions. Regionally, the Landscape Architect should be familiar with local, natural plant associations and understand how these associations fit into the landscape. For example, it is not advisable to plant a birch, beech, hemlock upland forest in a river bottom.

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18 Green Survival, Revisited by Dr. Nina Bassuk, American Nurseryman, February 1, 1991
Plant species currently thriving in the vicinity of the project area or in areas similar to the proposed environment are excellent references for a proposed plant palette. Plant species or cultivars known to be structurally weak or prone to excessive fruit or leaf drop should be avoided. These “messy” plants, along with thorny and toxic plants, should never be placed proximate to vehicular or pedestrian travel ways.

C.3 Plant Pathogen Primary and Alternate Hosts. Careful consideration must also be given to the unintended consequences of combining species known to transmit pathogens (insect and disease) when they are proximate to one another. For example:

- Juniper and Apple: Cedar/Apple Rust - Cedar-apple rust is caused by the fungus known as Gymnosporangium juniperi-virginianae. Two other common juniper-rosaceous rusts are hawthorn rust and quince rust; there are many more. Examples of juniper hosts include eastern red cedar, southern red cedar, Rocky Mountain juniper, some prostrate junipers, and Chinese juniper. Examples of rosaceous hosts are apple, crabapple, hawthorn, quince, serviceberry, and pear.

- Hosts that could affect adjacent agricultural crops. The Plum Pox Virus (PPV) is a disease that attacks stone fruit. The virus, which was identified in New York in 2006, also infects the wild and ornamental species of the genus Prunus. The virus is spread locally (secondary or short distance) by aphids and regionally (primary or long distance) by the movement of infected nursery stock or propagative material. Currently, there are no chemical control methods for PPV. Infected plans are removed and destroyed as soon as the disease is detected. New York State Agriculture and Markets (working with APHIS) has identified quarantine and regulated areas where the handling and movement of Prunus nursery stock is strictly prohibited. Affected areas are found in Niagara, Orleans and Wayne Counties. Planting Prunus species in the state rights-of-way that are adjacent to peach, apricot or plum orchards is not recommended.

C.4 Use of Varieties and Cultivated Varieties. Most plant material installed by the Department are “ordinary roadside plantings” and do not warrant precision in plant varieties or cultivars, especially new introductions. This level of taxonomic specificity is rarely justified for use, unless the intent is to promote plant genetic diversity or to select for specific plant characteristics, such as frost tolerance or plant morphology. Under these circumstances, cultivars of native species may be planted in limited quantities. Cultivated varieties plants should be selected with a reasonable expectation of availability and survival in the given location, and subsequently evaluated for success or failure. If the use of subspecies, varieties, and cultivars is justified, then the contract documents should also include a list of acceptable substitutions.

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C.5 Monoculture Plantings. A monoculture is the cultivation of a single genus, species and variety of tree or other vegetation type. These types of plantings run the risk of mass devastation from pests and/or disease pathogens, and, as a result, are strongly discouraged.

The most notable example of a monoculture planting is a homogenous row of street trees. Uniform street tree plantings are aesthetically pleasing and cohesive. Of the six urban landscape typologies described in the Landscape Architectural Graphics Standards (2007) three (residential street, commercial street and boulevard) contain design guidance that recommends “plant a single species of tree in steady alignment.” Single-species plantings have the ability to visually connect the roadside, create a neighborhood atmosphere, provide a means to lessen “jarring transitions” between land uses and have the ability to affect a sense of order and tranquility\(^\text{19}\). For some communities, a single tree species, such as a sugar maple, cherry, apple or peach tree, may provide a strong identifying and unifying element (i.e. peach, cherry or sugar maple festival). Single species plantings draw attention to design features such a monuments and emphasize special areas within the landscape such as municipal complexes.

Despite these advantages, Bassuk et al (undated)\(^\text{19}\) noted that the need for species diversity outweighs the “appeal” of homogenous street tree plantings. The paper\(^\text{19}\) cites several well known unsuccessful single species plantings, including the American elm (Dutch elm disease), American chestnut (chestnut blight), honey locust (honey locust plant bug), Norway maple (giant tar spot and verticillium wilt) and London planetree (anthracnose).

Instead, Bassuk et al (undated)\(^\text{19}\) promotes the use of visually compatible trees that, when placed in groupings or communities can create the desired uniformity. The researchers grouped and listed common street trees according to two primary (size and shape) and two secondary (branching density and foliage texture) criteria. From these lists, the researchers identified several tree planting strategies (Bassuk et al, undated\(^\text{19}\)), including a recommendation that at least three species or cultivars from each group be used in any one area. Further, the paper advised that designer consider the biological diversity of the “forest” (urban, suburban, rural, or actual) at all scales. The general rule of thumb offered by the team is that “…any one species should not make up more than 5 – 10 percent of the total tree population for a neighborhood or district.” This strategy avoids overplanting, promotes diversification and can be easily implemented on state projects. Designers can specify lists of acceptable plants and include allowable percentages for each genus or species within the list. For example, the contract could specify that several different kinds of similarly characterized trees – sugar maples, freemanii maples, tilias, etc. may be used to satisfy the design intent. The contract could then stipulate that no more than X% of any one species is used.

\(^{19}\) Visual Similarity And Biological Diversity: Street Tree Selection And Design, Bassuk, Nina, Trowbridge, Peter, Grohs, Carol, undated

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Tree characteristics (and groups) can also vary within one transportation corridor. Again, Bassuk et al (undated) observed that the artful placement of tree groupings can represent subtle changes in site conditions or emphasize one area over others. These changes can be functional, such as changes in setbacks and signage, or natural, such as changes in soil types and available moisture.

There may be unique circumstances for which the Department will accept the limited planting of monocultures. However, monoculture plantings are discouraged and ultimately, the design team, including the Department, municipal authorities, members of the community and other involved entities, need to work together to simultaneously satisfy the need to achieve aesthetic goals while providing a healthy diversity of species.

C.6 Plant Availability. Complex projects often have extended preliminary and final design stages. For these projects, the lag time between design and planting could be several years. This can leave the Contractor searching for the specified plant materials which, at the time of design, were available but now are not. When specified plant materials are not available, the E.I.C. should contact the project Landscape Architect or Regional Landscape Architect to determine, or approve, suitable alternatives.

D. Utilities Considerations When Planting

When underground or overhead utilities exist or are proposed, the Landscape Architect should refer to Chapter 13 of the Highway Design Manual when developing the planting plan.

Utility facilities and landscape plantings often occupy the same narrow strip of rights-of-way. In fact, utility facilities are often limited to a specific location. Landscape plantings should be coordinated with, and sited relative to, utility facility relocations in a manner that utilizes the available area to its best advantage.

When utilities are a concern on a project, the utility company(s) should be contacted during the project’s design phase. Many times, the utilities can assist in the selection of tree species that are compatible with the overhead electric lines. This may eliminate the need for extensive trimming.

Where overhead utilities exist or are proposed, the plant material should be carefully selected and located. The Project Landscape Architect should ensure that, at their mature height, the plant material will not interfere with utility lines. Access for utility line maintenance must also be considered.

Note: NYS Public Service Commission guidelines for tree heights near utility rights-of-way:

- Trees planted 30-60 feet away should not exceed 15 feet
- Trees planted 60-90 feet away should not exceed 25 feet
- Trees planted 90-120 feet away should not exceed 60 feet

Figure 28-10 Check for overhead and underground utilities before selecting a plant location.

E. Invasive Species Planting Considerations

The Department should never plant species considered invasive or those that support the spread of invasive fauna. Project planting plans should always prevent the introduction and spread of future invasive species infestations and strive to control (where possible) existing invasive species infestations (Reference Executive Order #13112).
Department Policy: The following species shall not be used.

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer platanoides</td>
<td>Norway maple</td>
</tr>
<tr>
<td>Ailanthus altissima</td>
<td>Tree of heaven</td>
</tr>
<tr>
<td>Berberis thunbergii</td>
<td>Japanese barberry</td>
</tr>
<tr>
<td>Berberis vulgaris</td>
<td>Common barberry; European barberry</td>
</tr>
<tr>
<td>Celastrus orbiculatus</td>
<td>Oriental bittersweet; Asian or Asiatic bittersweet</td>
</tr>
<tr>
<td>Elaeagnus umbellate</td>
<td>Autumn Olive</td>
</tr>
<tr>
<td>Euonymus alatus</td>
<td>Winged euonymus, burning bush</td>
</tr>
<tr>
<td>Frangula alnus</td>
<td>European buckthorn, glossy buckthorn</td>
</tr>
<tr>
<td>Hesperis matronalis</td>
<td>Dame’s rocket</td>
</tr>
<tr>
<td>Iris psuedacorus</td>
<td>Yellow Flag Iris</td>
</tr>
<tr>
<td>Ligustrum obtusifolium</td>
<td>Border privet</td>
</tr>
<tr>
<td>Lonicera japonica</td>
<td>Japanese honeysuckle</td>
</tr>
<tr>
<td>Lonicera maackii</td>
<td>Amur honeysuckle</td>
</tr>
<tr>
<td>Lonicera morrowii</td>
<td>Morrow’s honeysuckle</td>
</tr>
<tr>
<td>Lonicera tatarica</td>
<td>Tatarian honeysuckle</td>
</tr>
<tr>
<td>Lonicera x bella</td>
<td>Bell’s honeysuckle</td>
</tr>
<tr>
<td>Lythrum salicaria</td>
<td>Purple loosestrife</td>
</tr>
<tr>
<td>Miscanthus sacchariflorus</td>
<td>Plume grass; Amur silvergrass</td>
</tr>
<tr>
<td>Phalaris arundinacea</td>
<td>Reed canary-grass</td>
</tr>
<tr>
<td>Phragmites australis</td>
<td>Common reed</td>
</tr>
<tr>
<td>Rhamnus cathartica</td>
<td>Common buckthorn</td>
</tr>
<tr>
<td>Rosa multiflora</td>
<td>Multiflora rose</td>
</tr>
</tbody>
</table>

In addition some native plants such as Robinia pseudoacacia (Black locust), have invasive characteristics and generally should not be planted. The Landscape Architect should evaluate their use as appropriate to the natural and cultural context.

The Landscape Architect should be aware that the specific statewide species list can evolve as species are evaluated by NYSDEC and NYS Agriculture & Markets. A resource for this information is the Regional PRISM (Partnership for Regional Invasive Species Management)
28.6.9.5 Planting Guidance for Urban Conditions

Urban planting conditions present many unique challenges to the long term survival of plant materials. Examples include; climate extremes, highly disturbed soils, inadequate planting soil volumes, low water, and roadside salt (aerosol and in solution). Plants selected for urban environments must be able to survive these harsh conditions.

A. General Guidance

A.1. Street Trees. It is preferred to place street trees behind the sidewalk, rather than in between the sidewalk and curb. This configuration is more conducive to ample root growth. For some projects, this will necessitate planting off the state rights-of-way and in private property. Remember that planting release forms must be used when planting on private property.

- The “snow storage” area, also referred to as the “tree lawn”, is the area between the back of curb and the sidewalk. If this area is less than 4 feet wide, street trees should not be planted. Look for other planting locations, such as the area behind the sidewalk.

- If the “tree lawn” is wider than 4’, street trees located between the curb and the sidewalk should be planted in a continuous planting trench, if possible. This increase the soil volume available to each tree. Avoid individual planting pits.

- When placing street trees adjacent to new sidewalks, consider using an urban planting mix (e.g. a structural soil mix intended for planting) both in the planting trench and underneath the sidewalk.

A.2. Cultural Considerations for Plants

- Salt Tolerance
- Drought Tolerance
- Air and soil pollutants in urban situations are intensified.
- Runoff from concrete and limestone surfaces in urban areas boosts soil alkalinity. Successful urban plants are generally calciphytes: species that can tolerate alkaline soils.20
- Applying soil amendments to urban planting media should be carefully considered. Typically, newly planted material does not benefit from fertilizer at the time of planting. Providing for good soil drainage and aeration is more critical to plant survival.

20 The Right Plant for the Right Place by Dr. George Ware, American Nurseryman, August 1, 1994

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For a variety of reasons, urban sites often have compacted soil. Compaction leads to poor drainage and deprives plant roots of oxygen. Inadequate drainage kills urban trees more quickly than any other hazard.\textsuperscript{21} Excess water moves both on the surface and within the permeable surface layers until it finds the lowest point. If the subsoil is compacted and poorly drained, planting holes will fill with water and suffocate the roots. Coordinate with the EIC to ensure that the standard detail for planting in heavy clay soils is used.

The urban landscape predisposes trees to a short life span and limited growth potential. This can be directly related to poor soil conditions and limited rooting space.

Figure 28-12 shows the relationship between root space and ultimate tree size. According to the chart, a tree with a 16 inch diameter trunk requires 1000 cubic feet of soil. In a compacted clay soil, a tree's rooting depth may be restricted to 1 foot or less. To achieve the desired 1000 cubic feet of soil required for adequate growth, the tree's root spread would have to be 36 feet in diameter. Anything less will reduce tree size, growth rates, vigor, and longevity.\textsuperscript{22}

\begin{flushleft}
\textsuperscript{21} Green Survival, Revisited by Dr. Nina Bassuk, American Nurseryman, February 1, 1991
\textsuperscript{22} Colorado Cooperative Extension
\end{flushleft}
## Table 28-7 Soil Volume Calculations

<table>
<thead>
<tr>
<th>Caliper, DBH (inches)</th>
<th>Volume Requirement (cf)</th>
<th>Surface Area (sf)</th>
<th>Size (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>200</td>
<td>100</td>
<td>10 x 10</td>
</tr>
<tr>
<td>8</td>
<td>450</td>
<td>225</td>
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</tr>
<tr>
<td>12</td>
<td>700</td>
<td>350</td>
<td>18.5 x 18.5</td>
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<tr>
<td>16</td>
<td>1000</td>
<td>500</td>
<td>22.5 x 22.5</td>
</tr>
<tr>
<td>20</td>
<td>1250</td>
<td>625</td>
<td>25 x 25</td>
</tr>
</tbody>
</table>

Assume 2 foot Depth

*Figure 28-12 Soil Volume Ratio*

*Return to table of contents*
B. High Density Urban Settings

Landscape Architects should study pedestrian traffic patterns when selecting locations for plants and planting pits. This type of study can reveal opportunities to provide shade, ornamental plantings, small sitting areas, street furnishings and extended tree pits.

The urban landscape is highly visible and accessible. Materials placed in public areas should be attractive and able to withstand a high volume of use.

- Plant placement should consider and complement storefronts, existing signage, and other street elements.
- Interconnected tree pits should be used whenever possible. Larger soil volumes and shared rooting space support better plant growth. Groups of plants create a mutually beneficial micro-climate by partially shading and cooling each other and the soil.
- Plantings in urban areas are likely to viewed by pedestrians, bicyclists and vehicles moving at 30 mph or less.
- Preserving existing plants in densely urban areas may necessitate additional (and extraordinary) measures. The Landscape Architect will often be required to conduct tree surveys and make individual plant assessments.
- Proposed tree planting locations should be mindful of adjacent parking lanes, including where car doors are likely to open and where formal or informal pathways are likely to occur.
- When selecting a location for plants, the Landscape Architect must consider the presence of above and below ground obstacles such as utilities.
- Plants in highly urban areas have greater maintenance needs related to vandalism.
- The maintenance jurisdiction table needs to be clear. Where the local government retains maintenance responsibility, a resolution is needed.

C. Commercial / Suburban Corridors

Characteristics of Corridors that influence planting design:
- Multi–lane,
- “Strip” development patterns,
- Can be controlled access,
- Mixed land uses,
Lots of breaks in access or access control issues, such as driveways,
Limited green spaces,
High need for sight distance and visibility to business,
Disjointed landscapes,
Lower visual quality,
Numerous utilities,
May be a mix of open and closed drainage systems,
High volume,
High speeds,
Open intersections,
Unfriendly to pedestrians/bicyclists,
Inconsistent sidewalks, and
Transit facilities usually present.

C.1 Planting Considerations.

Is there an opportunity for a planted median?

What are the challenges to a planting design?
- Consider existing utilities,
- Parking lots,
- Minimal rights-of-way,
- Sight distance needs,
- Multiple municipalities and their maintenance needs,
- Access needs,
- Snow storage requirements,
- Variation in land uses,
- Opposition to planting,
- Future maintenance requirements,
- Coordination with proposed highway signs and lighting,
- Clear zone needs,
- Micro-climate, and
- Heat sink effect.

Is the Corridor the Community’s Main Street?
- Desires for a community identity balanced with safety requirements
- Conflicting visions for corridors and corridor needs (for example: through movement vs. local uses).

Is there an opportunity for traffic calming with corridor planting?

Are maintenance requirements of planting design feasible?

How can the landscape planting influence the corridor’s visitor’s experience?
Are there planting opportunities behind the sidewalk or off the rights-of-way?

Is there an opportunity for the plantings to humanize the scale and improve the visual context of the highway corridor? (Boulevard effect)

How can the planting assist the visitor in locating facilities or destinations?

C.2 Cultural Considerations for Plants.

- Challenging planting medium is usually present.
- When closed drainage is present water may not be present for the plants

For commonly used plant material, refer to Cornell Urban Tree List Matrix, or for Olmsted Planting Lists for Specific Locations.

28.6.9.6 Villages

Many forces can influence the selection of plants for village settings. Generally, plants chosen for village settings are not subject to the severe environmental conditions found in highly dense urban settings. However, there may be pockets of high density urban conditions within a village. “Fit” or appropriateness of the specific plant should be carefully considered. Where feasible, selection should respect community identity, wishes and events (for example – Rochester’s lilacs, Albany’s tulips).

Planting Considerations:

Is there an opportunity for the plantings to humanize the scale and improve the visual context of the village setting? (i.e. contextual spacing, setbacks, speed limits, plantings will be co-dominant with architecture, or can be a focus)

Is the Corridor the Community’s Main Street?

- Desires for a community identity balanced with safety requirements
- Design provides a sense of place - theme, visual landmarks

What are the challenges to a planting design?

- Transition – zones, quick, variety, concentration, compact, continuity of plant material
- Viewshed – may be able to see entire viewshed from one location, focal points, framing of identifiable elements, use of foreground, middle ground, screening
Hardscape vs. vegetation
Tree Canopy – Arching, denser, continuous
Consider existing utilities,
Parking lots, on-street parking
Rights-of-way available,
Sight distance needs,
Access needs,
Pedestrian and non-motorized vehicle needs
  • Snow storage requirements,
  • Variation in land uses,
  • Opposition to planting,
  • Future maintenance requirements,
  • Coordination with proposed highway signs and lighting,

Is there an opportunity for traffic calming with corridor planting?
  • Narrow or screen the view of roadway,
  • Provide a sense of enclosure,

Are maintenance requirements of planting design feasible?

Is there an opportunity to engage the public in the planting design?
  • Volunteer community groups,
  • Part-time officials
  • Business organizations
  • Homeowners

How can the planting assist the visitor in locating facilities or destinations? Can the landscape planting influence the visitor’s corridor experience?

28.6.9.7 Interstates

A. General Considerations for Interstates

Plantings along interstates are often seen from a distance or while the viewer is traveling at 55 mph or greater. The Landscape Architect should use plant masses and major tree groupings. Single trees or small planting beds do not benefit the viewer or provide ecological habitat.

Special attention should be given to the landscape design within the interchange gores. The gore areas, or the graded area between the ramp and main roadway, should be planted with
grasses and ground covers only. Using these vegetation types will help maintain sight distances and safety recovery zones.

Interstate corridors, because of limited access, uninterrupted length and connectivity of the system, lend themselves to a corridor treatment for wildlife. Wildlife will naturally move in the corridor and judicious design and maintenance can support safe movement. Interstate rights–of–way also provide edge habitat for wildlife.

Maintenance along interstates is likely the Department’s responsibility. Approved planting plans should also have approved maintenance plans. Planting schemes that require less labor-intensive maintenance (i.e. one or two mowing cycles) are recommended.

B. Characteristics of Corridors that influence planting design

B.1 Rural/Suburban Interstates

- Open vistas
- Long sweeping edges – herbaceous alternatives, grassland birds, pollinators
- Wildlife passages
- Need for snow fences or living snow fences
- Mowing Limits Guidelines TMI 10-03
- Natural Regeneration Disturbed highway sites may provide locations for invasive species to take hold. Consider the use of successional type plants (even in seed form) to outcompete invasives.
- Planting design respond to existing or proposed landforms (natural or otherwise).

B.2 Urban Interstates

- Noise Barriers are typically present
- Shorter focal points
- More likely to have highway lighting
- Mowing Limits Guidelines TMI 10-03
- Typically more structures/architectural features present

28.6.9.8 Rural Planting Considerations

Any objectionable views of the transportation facility from its surrounding viewshed may be screened through the use of plantings. Conversely, any objectionable views offsite from the transportation facility may also be screened through plantings.
These types of areas lend themselves to ecological model described in Section 28.6.9.12. Establishing mowing limits and encouraging the natural regeneration of disturbed areas are two examples of considered planting objectives. See the Department's Mowing Manual for further information. The rate of succession from grasses to native woody vegetation depends on a variety of factors. These include; the soil type, the density of the grass cover, the distance to (woody plant) seed sources, the site's location relative to seed sources, and various dispersal methods for seeds. The Landscape Architect should be confident that enough natural factors exist for a reasonable expectation for natural regeneration. Under these conditions, extensive planting may not be required. Generally speaking, the relatively thin turf cover on roadside slopes facilitates early, natural re-vegetation by woody plants. “Nature will make the plant selection and take care of plant establishment, more accurately and much less expensively than man.”

When developing the planting plan, consideration should be given to connecting individual woodland patches, creating corridors for plant or animal movement, providing habitats, and supporting biodiversity.

Figure 28-13 Quick cross section sketches can be used to help the Designer/Landscape Architect understand grade relationships.

Plants of minor trees in Area A is not effective for the mainline and the shade which may be cast in certain situations may result in poor growth.

Plants in Area B will depend on adjacent property, etc. -- generally speaking, only major trees should be used.

23 John J. Ryan, former Director of Landscape Architecture Bureau, 1972
28.6.9.9 Parkway Planting Considerations

A. Introduction

The Department’s planting policy is as applicable to parkways as it is to all other Department projects. However it is important for Designers and Landscape Architects to recognize that parkways have essential identifying characteristics that are immediately recognizable and clearly different from other highways. The parkway identity is partially embedded in the planting design.

Parkways are characterized by their significant natural features and the quality of the surrounding landscape. Plant materials, existing and introduced, constitute a large percentage of the parkway landscape. They help create a “green” corridor and enhance the motorist’s experience. Mass plantings soften the effects of the roadway infrastructure and help integrate the roadway into the landscape.

Many of New York’s parkways are individually or as a district eligible for or listed on the National Register of Historic Places (NR). Therefore, if the project involves an historic parkway, review of the specific National Register eligibility statement or nomination is needed to determine the contributing landscape features to the parkway that will need to be considered in the planning process. This should be in coordination with the Regional Cultural Resource Coordinator (RCRC) as part of the Section 106 of the National Historic Preservation Act/Section 14.09 of the Office of Parks, Recreation and Historic Preservation Law (Section 106/14.09) consultation process. (See HDM Chapter 28.7 Guidance for Landscape Treatment At Historic Properties for additional information).

B. Parkway Development:

The philosophy of early parkway design was derived from the English school of naturalistic estate design that became popular during the 17th and 18th centuries. This style was subsequently adopted and refined in North America by Fredrick Law Olmstead, the father of Landscape Architecture. His designs for parks often included integrated circulation systems that were the precursors to later parkway designs.
The influence of landscape architects and garden designers can be seen in most of the parks built in North American cities between 1860 and the early 1900's. Coincidentally, this is the same time period that the earliest parkways were being constructed. The planting designs for those early parkways rapidly traditionalized and are successfully implemented today. It is therefore, very appropriate for the Department’s parkway landscape development to continue to replicate the landscape planting concepts used on the early parkways. These designs used ample amounts of native and specimen plantings to create naturalistic undulating edges to the parkway lawn areas and vistas.

C. Objectives for Parkway Planting

1. Maintain and enhance existing vegetation. The dominant role played by vegetation within the parkway corridor differentiates a parkway from any other roadway. Parkway vegetation creates a unique and memorable experience.

2. Introduce new vegetation with care so that it integrates seamlessly with the unique characteristics of the parkway corridor.

3. Screen views of man-made elements, such as commercial developments, by using groups of lush, naturalistic plantings, not formal rows of manicured trees. A parkway’s scenic integrity is compromised by such intrusions that contrast with the system’s rustic aesthetic.

4. Balance parkway functions as modern transportation corridors and linear parks. This is challenging and requires coordination with the project team.

D. General Guidance For Parkway Planting Design

Landscape design is an important element in the design of all parkways and should be considered early in the process. This will ensure that the character or theme of the parkway and its environment are retained. Here are some design characteristics of parkway plantings:

- Undulating planting bays and lawn areas,
- Buffer areas to screen views,
- Openings that create views,
- Complimentary paths and trails,
- Mass plantings,
- Integration with adjacent woodlands and forests,
- Use of wildflowers, flowering shrubs and trees as accents and for seasonal color,
- Highlight and complement natural features, geological formations, water bodies, and topography.
The general planting principles presented in HDM section 28.6.9.4 also apply to parkway plantings. Below are some additional and basic guidelines to consider when designing parkway plantings:

- Research the history of the parkway landscape corridor. Focus on the particular location, species composition and character of the parkway vegetation.
  - Inventory and document the existing vegetation’s condition.
  - Include specimen trees, forests, fields, meadows, tidal marshes, dunes, planting beds, shrubs and groundcovers. Document any existing or potential threats to the vegetation.

- Coordinate with the RCRC when working on a historic parkway. (See HDM Chapter 28.7 Guidance for Landscape Treatment At Historic Properties for additional information).

- Retain both vegetation and adjacent resources (structures, fences, guide rails, site furnishings, etc.) by developing maintenance measures that preserve all character-defining features and their historic relationships.

- Where feasible, preserve signature landscape plantings.
  - Replace plant material “in-kind” when surviving prototypes remain.
  - Retain appropriate forms, arrangements, species and design character through a program of cyclical replacement or maintenance.

- When the replacement of an entire landscape area is necessary, first consideration should be given to replicating the features of the original design if the overall form and intent are still evident and relevant. This includes design concepts and physical spatial layouts that determine the organization of views, open vistas and intimate spaces created through plantings. The replacement planting may also be used to adapt to the changed context surrounding the parkway. For example, a once desirable view may now need to be screened.

E. Flexibility in Design

For federal guidance on parkway planting design, in particular setback recommendations refer to the following:

- U.S. Department of Transportation, Federal Highway Administration, Flexibility in Highway Design Chapter 6, Cross Section Elements.
- Chapter IV of the AASHTO Green Book,
F. Additional Guidance on Historic Parkways


28.6.9.10 Planting for Roundabouts

The Landscape Architect must consider maintenance, sight distance and the context of the roundabout when determining the type and quantity of planting incorporated into a roundabout design.


28.6.9.11 Planting Design Considerations for Adirondack Park Preserve

Projects within the Adirondack Park must be designed, constructed and maintained to achieve a harmonious fit with the Park’s natural surroundings. These projects should also minimally impact the Park’s ecology and environment. The Landscape Architect should refer to the *Guidelines for the Adirondack Park* (Green Book).

28.6.9.12 Ecological Approach to Planting

A. Introduction

An “Ecological Approach” to planting uses plant materials to supplement, expand or replicate natural communities. Our highway rights-of-ways provide hundreds of miles of opportunities to develop wildlife passages, improve plant communities and drainage ways, and construct wildlife underpasses at the edge of bridges.

With slight design modifications, it is often possible to re-establish or maintain existing wildlife connections and enhance existing plant communities.

B. Benefits:
- Increases probability of plant success.
- Helps preserve and increase genetic diversity.
- Helps preserve local pollinators, insects, birds, and mammals.
C. General Information:

The ecological approach to planting is not appropriate for every project. Before applying these concepts, Landscape Architects must research the roadside ecology, understand the existing plant communities and maintenance considerations. For example, sites that have invasive species prior to construction will not revert to a more desirable native plant community.

D. Natural Re-vegetation:

Natural re-vegetation results from a design decision to let roadside areas go fallow with the intent for these areas to regenerate plant communities through dispersion and succession. During this process, plants compete with one another and form mutually beneficial (symbiotic) relationships. These relationships determine which plants survive and which are ephemeral. Supplementary planting of natural re-vegetation areas can accelerate both dispersion and natural selection. Select plants that are found in the mid-successional stage (neither pioneering nor climax dominant species). Consider the means by which these plants spread, including seed dispersal methods. Through the careful selection of plant materials, try to encourage natural dispersal agents to the site to assist.

When natural re-vegetation is desired, educate the adjacent community or individual landowners about the process. Explain that the landscape is neither ecologically nor aesthetically finished nor complete.

Regulatory agencies may require alternative methods to achieve natural re-vegetation. Existing plantings may need supplementation to address the naturalized area’s aesthetic or other concerns.

E. Ecological Setting

The Department’s highway rights-of-ways may provide ephemeral habitat for wildlife species. Ephemeral habitat types include grassland, shrub/scrub, meadows, wet meadows and wetlands. Restoring ephemeral habitats is consistent with the Department’s existing
policy; however, the regional MEC should be consulted before the design is finalized. Specifically, mowing cycles should be discussed with Operations.

When a forested ecological community is the design prototype, the following criteria should be used to determine plant material types, quantity and composition:

- Place in Canopy:
  - 40% Dominant (canopy and overstory) plants
  - 60% Understory plants (including understory trees, shrubs, vines and groundcovers)
- Successional Stage:
  - 33% Pioneer species
  - 67% mid- to late successional stage

These ratios mimic the composition and proportion of plant types found in most natural forested areas. The environmental benefits of multi-tiered plantings are well documented. This method of planting reduces long-term operational costs by decreasing mowing, pesticide use and invasive species treatment.

At locations where a shrub/scrub community design prototype is appropriate, the approximate plant composition should be as follows:

- 60% shrub species,
- 10% tree species, and
- 30% grassland species.

At locations where a grassland or meadow design prototype is appropriate, the approximate plant composition should be as follows:

- 70% grasses to 30% forbs for grasslands
- 2/3 forbs to 1/3 grasses for meadows

The industry standards for grassland and meadow mixes include numerous species. It is common that only one-half to two-thirds of the species will become established.

F. Self-Sustaining Plant Communities

A self-sustaining plant community for NYSDOT means one that has a continuous cover of desirable native plants that are regenerating and thriving with minimal external resources. Self-sustaining communities are formed over time through complex, symbiotic relationships that include the co-evolution of species and soil building. Recognize that landscapes are based on growth and change over time. Roadside conditions make it challenging to replicate a naturally sustainable plant community. The Landscape Architect should consider factors such as salt, lack of or too much water (due to highway drainage), carbon loading due to exhaust and disturbances such as maintenance and construction. The Landscape Architect should provide a planting plan which moves the roadside towards greater ecological stability. The planting plan, for instance, might reflect a pioneer/successional...
community rather than the end state. The selection of the species planted should consider the natural characteristics and constraints of the site and the man-made environment of the specific location.

G. Additional Considerations for Ecological Planting

- Finding suppliers for native species or local sources of species can be difficult and may increase costs.
- Public expectation of planting area appearance may not be congruent with certain plant communities; public outreach may be necessary.

H. Construction Considerations

Avoid backfilling with a rich soil mixture in the plant pit only. This can create a dramatic difference in soil textures which can inhibit the spread of roots beyond the amended backfill. Generally backfilling with existing soil is preferred.

I. Maintenance Considerations

Introduced species may have a competitive advantage over native species; one specific species may dominate a given area; opportunistic species may naturally colonize an unsuitable area (weak wooded species too close to the highway); etc. These conditions may require selective removal and/or planting to correct this imbalance.

28.6.9.13 Native Plant Salvage

This work item may be accomplished using the transplanting standard specifications.

Native plant salvage is the removal of native plants from within a project’s limits and replanting the same plants elsewhere within the project limits. Native plant salvage from project areas not slated for disturbance is not appropriate. The Regional Landscape Architect should be consulted before specifying plant salvage.

Re-cycling valuable locally-adapted plant materials can increase plant establishment success, provide a reliable source of low cost materials for bio-engineering and restoration projects, reduce the amount of “debris” from site clearing activities and reduce the need to transport plants across the state/country.

24 Creative Site Preparation, Larry J. Kuhns, Paul W. Meyer & James Patterson, AGORA/Fall 1985
Native plant collections or “rescues” can be undertaken by volunteer forces, such as local garden clubs, conservation groups and the general public. One key benefit is the opportunity for public involvement on Department projects. Native plant rescues create beneficial partnerships between the Department and local organizations and allow the community to make a difference.

28.6.9.14 Transplanting of Trees

This section includes the following pay items:

**Item**
- Transplanting, 0 to 48 inch in height
- Transplanting, over 48 inch to 72 inches in height
- Transplanting, over ¾ inch to 3 inches Diameter at Breast Height (DBH)
- Transplanting, over 3 inches to 6 inches DBH
- Transplanting over 6 inches to 12 inches DBH
- Transplanting, Vines, Groundcovers
- Transplanting, Herbaceous Plants

**Contract Documents must include:**
- Locations of materials that are to be transplanted
- Scientific and common names of plants
- Watering pay item
- Pay items appropriate for post planting care

**Special Notes for Transplanting may include:**
- Fertilizer type
- Soil Amendments
- **Mulch** type
- Materials for protection of plants per Section 713-08
- Topsoil type
- Compost type

If the Landscape Architect requires materials or methods other than those specified in the standard specification a special specification must be used.

**A. Introduction**

When deciding whether to transplant a tree or shrub, or to start over with a new plant, the Landscape Architect should consider the species transplant tolerance, the condition of the
plant, the season the plant will be transplanted, the new planting site conditions, equipment needs, and follow-up care.

Transplanting stresses trees and shrubs. Excessive stress may cause re-located plants to die or to become unattractive. Plants already in the advanced stages of decline are especially likely to succumb to transplantation stress. In general, shrubs have better transplant tolerance than trees, deciduous plants better than evergreens, shallow rooted species better than deep rooted species, and younger plants better than older plants. Some species tend to withstand transplanting better than others.

B. General Guidance

Transplanting involves the careful extraction of a tree or shrub, re-locating the plant to a new location, and replanting. The most difficult and critical step in this process, and the step that requires the most experience, is the extraction.

For most trees and shrubs, late winter or early spring are the best times to transplant. Fall is also acceptable, but not optimal. Transplanting in the summer is not advisable; it is too hot and dry to transplant most trees and shrubs.

Trees and shrubs that have been dug for transplanting should be planted as soon as possible. The Department's material specification for transplanting is based on the guidance for “Collected Plants” detailed in ANSI Z60.1. Once a plant has been extracted from the ground, it should receive the same treatment and care as a nursery-supplied plant.

A special specification should be used to transplant material greater than 12 inches DBH.

Related Topics

- Tree root pruning
- Post-Planting Care

25 Transplanting Trees and Shrubs, County Commissions, North Dakota State University and U.S. Department of Agriculture cooperating
28.6.9.15 Wetland Planting Design

A. Wetland Vegetation

Wetland vegetations are essential to achieving full wetland functionality. Consequently, the planting component of the wetland design must be given sufficient attention. Allowing a created wetland to become naturally vegetated is economical and an acceptable means of establishing wetland cover. However, this method provides little control over what plant species ultimately occupy the wetland. Those that do may be undesirable or ineffective in achieving the requisite (or regulated) functions. Planting a wetland with select hydrophytes (plants adapted to life in wetlands) is more commonly practiced. Before determining what plants to include in a wetland design, it is important to understand how each particular species reacts to a wetland’s unique substrate and hydrological conditions.

B. Use of Native Plants for Wetlands

Non-native and/or naturalized plant species are present in many wetlands. However, it is widely understood that the spread of non-native plant species has contributed to natural ecosystems loss and/or modification. Federal, state and local agencies, such as the Adirondack Park Agency, the NYS Department of Environmental Conservation and the US Army Corps of Engineers, support the use of only native plant species. Furthermore, Presidential Executive Order 13112 requires that federally-funded projects do not contribute to the spread of invasive species. Since native species have successfully established diverse and functional wetlands, the use of non-native plants should be avoided.

For further information about wetland plants native to New York State, refer to the publication entitled Revised Checklist of New York State Plants, New York State Museum, Mitchell, R. S. and Tucker G.C.1997.

C. Wetland Plant Patterns

The planting design for a created wetland should be patterned after species associations found in similarly classified, functioning and local natural wetlands. When creating a wetland, study local wetlands that are analogous. The characteristics of the wetland that should be noted include:

- Genus and species of plants in the wetland,
- Composition of plants, including percent dominance and coverage,
- Plant’s position relative to the water and the wetland hydrology,
- Soil composition and pH
- Site elevation.
This information should be used as a template for the wetland planting plan. Generally, a broad variety of plant species should be used, even if diversity is not a stated goal. A diversified planting scheme is more resistant to pests, invasive species, disturbance, and promotes wildlife diversity.

D. Plant Selection for Wetlands

Determining the proper species to plant in a wetland is critical. It is important to match plants with the correct water depth. Water depths of 300mm (12 inches) or less support emergents plants. Depths of 300 to 600mm (12 to 24 inches) support select emergents and floating aquatic plants. Water depths of 600 to 900mm (24 to 36 inches) support submergent vegetation. Finally, depths greater than 900mm (36 inches) provide an open water environment and do not support vegetation. Remember, the species selected and the plant community composition must be appropriate to achieve the intended functions. The following should be considered when selecting plants:

- **Hydrologic Regime.** Are the plants compatible with the depth, duration of inundation and the timing of hydrology? Are the plants adaptable to the broadest water range?

- **Availability and Quantity.** Are the plants commercially available and in the quantity needed? There may be time constraints for large orders of certain plants.

- **Success.** Have the plants been used successfully in the past to achieve the desired functions? Significant areas of the site should not be committed to species that have questionable potential for successful establishment. Plant selection should be based on desired functions and survivability, not aesthetics.

- **Timing.** Are the plants going to be available when needed? Some plants can only be harvested and/or transplanted during certain times of the year and may not be available when needed.

- **Handling and Storage.** Do the wetland plants need special handling or storage, such as refrigeration? Will these special requirements be available on site during planting?

- **Cost.** Are the plants available for a reasonable price? Plants in short supply or with special harvesting, handling, or planting requirements can be very expensive. Plants with similar characteristics may be available for a more economical price.

- **Wildlife Value.** Do the plants have wildlife value? Unless designing the wetland for a specific wildlife type, avoid specifying only those plant species that are foraged by wildlife populations expected to occupy the site.
Perennials. Have perennial plant species been selected to increase the chances of long-term establishment?

Maintenance/Monitoring for Selected Species

E. Wetland Plant Types

Wetlands are generally vegetated with whole herbaceous plants, parts of herbaceous plants (tubers, bulbs, rhizomes), whole woody plants (trees and shrubs), parts of woody plants (cuttings), or seed. Establishment by seed alone may be less successful than using plants because of the wetland seed stratification requirements and seed loss due to water action.

Herbaceous plants generally come from two sources: donor wetland sites or nursery-grown stock. Using donor wetlands to obtain plants will eventually affect the health and vigor of the donor stand. Finding a suitable and accessible donor wetland can also be difficult. Harvesting plants from donor wetlands is not recommended unless commercial sources are not available and the collection can be done without undue harm to the donor wetland. Nursery-grown herbaceous plants include; stock in peat-pots that were developed from seed; bare root plants or sprigs (dormant or growing plants with soil removed from roots); tubers, bulbs and rhizomes (below-ground parts of perennial plants); or plugs (excavated clumps of plants with roots and associated soil). Vegetating a wetland with nursery-grown herbaceous plants can be more expensive, but it is a reliable source.

Another possible source of wetland plants is the propagules from existing wetland soils impacted by a Department project. The impacted wetland soil should be stripped and reused within 24 hours or stored at a height not to exceed 9 feet for no more than one growing season. The Department’s standard specification for Topsoil On-Site Wetland Materials allows this, but the designer should advise the Engineer as to the intent, desired storage height and duration.

Woody plants generally come from four sources: seeds, cuttings, bare root plants and container stock. Seeds from woody plants should be collected in the fall and stored in a cool, dry place until spring planting. Seeds should be either broadcast onto a prepared substrate or inserted into shallow holes. Cuttings taken from dormant live trees should be planted immediately or temporarily stored in moist sand. Dormant cuttings are appropriate to be taken from willows, cottonwoods, elderberry and buttonbush. Cuttings from many other woody species (such as viburnum, alder, dogwood, and ash) have low survivability. Bare root plants do not store well and should be planted immediately after being dug. It is best to plant bare root seedlings in locations with consistent access to available water. Container/balled and burlapped stock is expensive, but a reliable way to vegetate a wetland. When containerized/balled and burlapped trees are transplanted, the entire root/soil volume remains intact. This reduces plant stress.
Large and specimen plants should generally not be used in created wetlands. They can be expensive and their size and weight makes them difficult to handle.

F. Wetland Seed Mixes

There are no standards for testing pure live seed, germination percentages and seed purity for wild collected wetland seed. Therefore, rates should not be specified for these items.

Seeding is an inexpensive way to establish wetland vegetation. However, the success of wetland seeding can be unpredictable. If water levels rise above the seeded area before germination, the seed and seedlings may float and wash away. Also, many commercial seed mixes contain non-native species, invasive species or species with limited hydrologic tolerances. Species which should not be included in wetland seed mixes include:

- Reed canary grass - *Phalaris arundinacea* (low wildlife value and now considered more of a problem than a benefit).
- Giant fescue - *Schedonorus giganteus* (does not allow naturalized species to occupy the draw down zone).
- Redtop - *Agrostis gigantea* (only marginally flood-tolerant. Bentgrass is preferred).
- Barnyard Grass - *Echinochloa crus-galli* (very tall plant which chokes out and shades new plants. Annual rye grass is preferred).

Avoid seed mixes containing non-native species.

Wetland seeding is best accomplished during the beginning of the growing season and can be performed using drill or broadcast methods. Seeding in the fall, winter or early spring risks the loss of seed before or after germination due to water action or frost/freezes. To improve dispersal, the seed should be mixed with sand (1 part seed to three parts sand). Hand broadcasting is recommended on sites less than 0.4 hectare (1 acre) in size. Seed should be spread in two different directions to ensure adequate coverage, and the site should be lightly dragged, raked or rolled to increase soil contact. Seed mixes can be used alone or to supplement wetland plantings.

G. Wetland Plant Mortality Rates

Plant mortality in created wetlands is inevitable and should be taken into account when specifying the quantity of plants for each species. The desired number of live plants and the expected mortality rate should be established. The final plant quantities should be adjusted accordingly. For example, if 495 live trees per hectare (200 live trees per acre) is an
established goal, and the expected mortality rate is 50 percent; 990 live trees per hectare (400 trees per acre) should be planted. Plant mortality rates may differ between species of trees, shrubs and herbaceous plants.

H. Wetland Plant Densities

Planting densities should be based on the plant’s intended functions, potential for animal depredation, desired number of live plants, expected mortality rates, and cost. The following are common planting densities for an initial wetlands planting; vegetation can be placed closer if plant clusters are desired.

- Herbaceous plants should be spaced about 0.6 meters (2 feet) apart.
- Shrubs spaced about 1.8 meters (6 feet) apart.
- Trees spaced about 3 meters (10 feet) apart.

The planting bed width is variable and depends on the wetland’s side slope. Trees and shrubs should be planted as far upslope as possible. This increases plant survivability; most wetland species will survive upland conditions.

I. Source of Wetland Plants

Wetland plants can be purchased from nurseries, collected in the wild, or grown for a specific project. Each method has advantages and disadvantages. Each method also differs in the quality, availability, and costs of material acquisition and installation.

An increasing number of commercial nurseries are now growing wetland plants. While it has been noted that nursery-grown plants are reliable, they tend to be genetically and physiologically adapted to their growing site. This may cause them to be difficult to establish at locations with different climatic characteristics. Therefore, plants should be obtained from a nursery within two hardiness zones of the project site. Large latitudinal distances between the source and project location should be avoided; longitudinal variation is more acceptable. Occasionally plants are grown by a commercial nursery for a specific project that has a lengthy construction schedule. One or two years of lead time is usually required so the plants are a viable size when they are transplanted. However, the Department’s standard specifications do not allow this level of control.

Plants collected from the wild are more closely adapted to local environmental conditions than nursery-acquired plants. However, collecting plants from the wild can be very demanding. Several donor sites may need to be located and the collected species must be accurately field identified. If plants from the wild are used, the collection and planting process must be coordinated so plants are harvested and planted within 36 hours. The transplanting pay item does not provide a specific time period for re-planting (after harvesting). If specifying a “re-planting” time frame is desired, a special specification is required.
J. Wetland Planting Season

The successful establishment of wetland plants is influenced not only by plant selection and location, but also by proper planting time. The planting period for herbaceous vegetation is broader than for woody plants. In general, early spring planting is the most successful. Herbaceous plants, sprigs, rhizomes, tubers, bulbs and rootstock have the greatest chance of survival if they are dug and immediately planted - during the spring or late fall before the ground is frozen or snow covered. Bare root seedlings are best planted when dormant. Container-grown plants and plugs may be planted while growing or dormant. Table 611-1, Planting Seasons, in the Standard Specifications provides the appropriate planting seasons for each region across the state.

Once the created wetland is planted and hydrology has been introduced, vegetation should be monitored closely. If dead or unhealthy groupings of plants are found, the remaining live plants should be relocated or the water level adjusted.

K. Handling and Storage of Wetland Plants

Wetland plants must be carefully collected, handled and stored. These handling precautions are critical if the plants are not dormant. To lessen plant stress, vegetation should be transported in a covered vehicle that provides protection from the wind. Before planting, wetland vegetation should always be kept cool and wet. Emergent species are best stored and transported in opaque plastic bags or wash tubs. These containers should be used to keep the plant’s root systems in water or in contact with saturated mulch. Floating and submerged aquatic plants must be kept continuously wet during storage and transport. All plants should be rinsed and stored in fresh cool water after arriving at the site. If not scheduled for immediate planting, emergent vegetation can be “heeled in” at the site for up to two days. “Heeling in” involves the arrangement of plant bundles in a shallow water trench and carefully placing wet soil over the root system. Submerged and floating aquatic plants should not be stored on site for more than two days; some species may require water changes several times per day. Tidal plants can be placed in wash tubs and positioned so that water or waves lightly wash over the tubs, continuously refreshing the plants. It is best not to store any plants longer than necessary, and delivery should be scheduled to correspond to the Contractor’s schedule for planting.

L. Rate of Planting for Wetlands

Planting vegetation in water is more difficult and time consuming than planting in a dry environment. A person experienced in handling wetland vegetation can place about 500 herbaceous plants per day within water compared to 1400 herbaceous plants per day in a
dry environment (using a planting bar or tile spade). Approximately 300 bare root seedlings can be planted per day using the tile spade method.

M. Wetland Planting Techniques

It is very important that plants be properly set within planting holes. Bare root seedlings and containerized plants should be set with their root collars 50mm (2 inches) below the ground surface. This effectively “mulches” the plant and prevents the root collar from wicking away moisture. It is also important that bare root seedlings be placed so their roots do not bend upward. Upward bending roots may not reach the water table and result in a plant susceptible to wind throws. Planting holes must also be properly backfilled to prevent air pockets. Air pockets left around the root system may cause the roots to dry out.

N. Water Level Management for Wetlands

For the Department, water level management in newly created wetlands is accomplished by designing passive water control measures, such as grading, equalization pipe, capture of stormwater and other non-mechanical means to manage the drainage patterns and water volumes to support wetland plants. Active measures, such as dams, dikes, levees, water control structures, to control water levels on Department rights of way are not typically feasible.

O. Wildlife Management during Plant Establishment in Wetlands

The created wetland may need protection to prevent wildlife from damaging newly planted vegetation. Canadian geese, ducks and deer can cause significant damage by grazing on young shoots and seedlings. Muskrats uproot plants and feed on rhizomes and tubers.

Waterfowl feeding can be discouraged by creating a 4.5 meter (15 ft) by 4.5 meter (15 ft) grid of stakes into open water and weaving multiple layers of string between each stakes. The string should be kept low to prevent ducks and geese from swimming under the lines. Although temporarily unsightly, the string and stakes can be removed once a dense vegetative cover is established (usually after two growing seasons). To discourage muskrat feeding, areas planted with tubers and rhizomes can be covered with chicken wire or an appropriate fencing. This too is a temporary measure and will require removal as the plants establish themselves. Deer browsing can be minimized by applying liquid or powered repellents (such as Ro-pel or Deer-Away) to vegetation. This requires frequent re-application and often repels other animals. Finally, attaching bars of Irish Spring® soap to newly planted trees can also deter deer browsing.
P. Invasive Plant Species in Wetlands

When invasive species occupy 5 percent more of the land area in the created wetland than the same plants occupy in the surrounding natural area, regulatory agencies typically require that the invasive species in the created wetland be controlled. For example, if the natural wetlands surrounding the created wetland contain 10 percent purple loosestrife, the created wetland should not contain more than 15 percent purple loosestrife. This method of determining when to control invasive species may be used and accepted by regulatory agencies. The degree of invasion should influence the type of remedial action to be performed. Refer to TEM Section 4.4.9.4 for additional guidance.

Related Topics
- Topsoil
- Invasive Species

28.6.9.16 Gateway Planting

See HDM Chapter 11, APPENDIX 11B: DECORATIVE COMMUNITY GATEWAY SIGNING AND/OR LANDSCAPING ON STATE HIGHWAY RIGHT OF WAY for the policy and guidance.
8.6.9.17 Planting and Personal Security Concerns

A. Introduction

Security can be influenced by a single factor or a combination of factors. Factors that influence security include:

- Location,
- Time of day,
- Proximity to other activities and/or people,
- Potential hiding places,
- Lighting, etc.

The following are of particular concern in transportation design:

- Safety Parking Areas
- Rest Areas
- Transit Facilities
- Park and Ride Areas
- Bike /Shared use paths
- Streetscape and Community spaces

B. General Information

Planting design and plant selection influence security. The goal should be to provide spaces that are open, visible and easily perceived as safe from within the space and outside the space. If improperly designed, spaces are created that become potential hiding places for illegal or illicit activities.

The Landscape Architect should consider the following guidelines:

- Plantings that create hiding spaces should not be placed close to paths, sidewalks, parking areas and other facilities that pedestrians use.
Dense shrub groupings or evergreen plants over three feet in height should be distanced from the pedestrian facilities. Adequate spacing provides time for people to react to threatening situations. Deciduous trees, shrubs under three feet in height, perennials (except some species of tall grasses and wildflowers), and groundcovers do not grow to sizes or have growth habits that create security hazards.

- Berms, walls, grading contours, fences and other visual obstructions that are not used as screening should be designed to maintain visibility.
- Roadside planting designs should not result in a personal safety concerns.
- Incorporate escape avenues into the overall design.
- Look at all pedestrian travel routes, including informal pedestrian paths.
- Consult with public safety officers to determine if the proposed site design contains any security challenges.
- Plant selection should be contextual. (i.e. no thorns next to pedestrian paths)

28.6.9.18 Planting Season

A. Trees, Shrubs and Vines

The recommended planting seasons for all geographic regions in the state are presented in Section 611-3.01 General, Table 611-1 Planting Seasons.

Plantings completed in the early spring and the early fall planting seasons have the best plant establishment rates. However, construction schedules will dictate when planting can occur. Section 611-3.01 includes contract language that allows the Contractor to propose, for approval, planting season adjustments. The Regional Landscape Architect should support planting season extensions of two weeks. Consideration should be given to the prevailing temperatures and soil conditions... are these conditions still suitable for successful plant survival? The weather should be the determining factor; no planting is to occur after ground has frozen.

Well established, container-grown plant materials are acceptable for summer planting. The Contractor should be aware that, when planting during the summer months, plants may require additional watering and care. Because container-growing medium is typically well-drained and regularly irrigated in the nursery, container-grown trees will require frequent watering after leaving the nursery. If the root ball of a container-grown plant dries out, the soil may repel water (the soil shrinks when dried, allowing the water to run down the inside edges of the container without penetrating the soil/root mass). If this occurs, be sure the root ball is thoroughly wetted before planting. Some plant materials have a better survival rates when planted during the spring planting season. These plants are known in the horticulture industry as "Fall Transplant Hazard", or "Fall Digging Hazard" plants. Plant

transplant failure rates are most frequently seen when the plants originate as balled and burlapped or bare root material. Many believe that the process of balling and burlapping and extraction as bare-root material during the plant’s active growing season harms the plants. Plant survival rates increase when the plants are “dug” during dormancy, or in the early spring.

As written, the standard specifications for the planting items allow for both a spring and a fall planting season. The Landscape Architect should consult with the project Designer and the project’s Construction team member to determine if it is reasonable to expect that the project will have a spring planting season. This consultation should occur before the project’s Landscape Architect develops the project’s planting specification. If the project cannot be planted in the spring, bare root plant material or balled and burlapped plant material considered to be “Fall Planting Hazard” should be avoided. Please be aware that the plants identified as “Fall Transplant Hazards” can be specified as “container grown” material for use when planting in the fall season. When specifying spring-only planting, the Landscape Architect must put this note in the planting tables as part of the contract documents.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abies concolor</td>
<td>Concolor Fir</td>
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<tr>
<td>Acer rubrum</td>
<td>Red Maple</td>
</tr>
<tr>
<td>Acer freemanii</td>
<td>Freeman Maple</td>
</tr>
<tr>
<td>Betula (all)</td>
<td>Birch</td>
</tr>
<tr>
<td>Carpinus (all)</td>
<td>American Hornbeam, Ironwood</td>
</tr>
<tr>
<td>Celtis (all)</td>
<td>Hackberry</td>
</tr>
<tr>
<td>Cercis</td>
<td>Redbud</td>
</tr>
<tr>
<td>Cornus</td>
<td>Dogwood</td>
</tr>
<tr>
<td>Crataegus (all)</td>
<td>Hawthorn</td>
</tr>
<tr>
<td>Cupressocyparis leylandii</td>
<td>Leyland Cypress</td>
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<tr>
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<td>Beech</td>
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<tr>
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<td>American Holly</td>
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<td>Juniper virginiana</td>
<td>Easter Red Cedar</td>
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<tr>
<td>Liquidambar</td>
<td>Sweetgum</td>
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<td>Tulip Tree</td>
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<tr>
<td>Malus</td>
<td>Crabapple</td>
</tr>
<tr>
<td>Nyssa sylatica</td>
<td>Tupelo, Black Gum, Sour Gum</td>
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<td>Oystrya virginiana</td>
<td>Ironwood, Hophornbeam</td>
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<td>Planetree</td>
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<td>Zelkova</td>
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<td>Broadleaf evergreens in general</td>
<td></td>
</tr>
<tr>
<td>Bare root material in general</td>
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</tr>
</tbody>
</table>
LANDSCAPE & COMMUNITY DESIGN

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B. Sod

The sodding seasons for each state geographic location are presented in Section 610-3.04 Sod, Table 610-1 Sodding Seasons. No sod shall be installed on frozen ground.

C. Turf Establishment

The Department’s standard specifications do not provide a planting season for turf establishment. Neither may a planting season be added by special note. This flexibility accommodates the need to install erosion and sediment control during all seasons. As a result, seeding, both temporary and permanent, may be done at any time during contract administration.

D. Wildflowers

The Department’s standard specifications do not provide a planting season for wildflower seeding. Neither may a planting season be added by special note. This gives the Contractor the flexibility to accommodate the need to install erosion and sediment control during all seasons.

28.6.9.19 Planting Details

A. General Guidance

The Landscape Architect should specify container-grown plants if it is more cost effective in that region and a large size tree is not required.

Un-amended existing soil is the standard specification’s default for planting soil for planting and transplanting.

If the Landscape Architect prefers to use one of the topsoil types detailed in Section 713-01 the basis of payment for the planting specifications allow this addition at no additional cost. The use of topsoil must be included in the contract plans by note. As an alternative the basis of payment for the item also allows the addition of compost to the existing soil. Rate and other information for the compost are found under 610-3.07. It is not the intent of the standard specifications to provide special mixes beyond what is described above. If the planting location requires a non-standard planting mix a special specification is required.
The standard specifications provide a default of no automatic staking for plant material. If staking is desired the Landscape Architect must specifically state this by means of a note. No separate pay item is required. Staking materials are included in “Materials for Protection of Plants” (713-08).

When desired fertilizer, mycorrhizal fungi and other amendments are to be specified and paid for separately for both planting and transplanting.

B. Specimen Plants and Street Trees

B.1 Specimen and Quality Grade Designation. A special specification must be used when including specimen plants in a contract.

Landscape Architects may specify the use of specimen plants on a project. However, the need for these plants must be clearly established and documented in the project files. Specimen plants are only effective in refined urban or suburban situations. Expensive, high quality plants are not as effective and add little value along rural roadides, controlled access facilities and other similar locations where plantings are massed for visual effect.

The language in the special specification must include appropriate definitions for the specimen plants. Allowable deviations from standard minimums for caliper, height, root ball diameter, container or box size, etc., must also be included in the special specification. Other descriptive factors to consider include plant symmetry, crown width, fullness of branching, single or single dominant leader, age, specialized pruning techniques, and plant uniqueness. Contract administrators will accept the material based upon its compliance with the language provided in the special specification.

For example, if the landscape architect wants uniform street trees or trees with oversized root balls this must be described in the special specification.

B.2 Street Tree. When there is an established need for street-trees, a Landscape Architect may specify them by including a note in the planting tables stating the height to which the tree should be free of branching. The clearance height for the tree’s branches shall be proportionate to the tree species and the tree’s existing size and will ensure that the tree’s crown and trunk are balanced. Specifications for street trees are not intended to deviate from the standard minimums as per ANSI Z60.1 Section1.1.2.4.

C. Balled and Burlapped Stock (B&B)

C.1 General Information. Burlap may be natural, treated, plastic or of other material. In all cases, the burlap should be removed from as much of the tree ball as possible. NYSDOT’s standard specifications do not allow treated, plastic, synthetic burlap materials as they do
not bio-degrade and will prevent the roots of the plant from growing. Natural burlap will degrade over time, but may act as a wick and remove moisture for the plant’s development from the root ball.

C.2 Wire Baskets. Wire baskets were designed to support a root ball on the top and sides. The top and side wires support the root ball during loading, shipping, and transplanting, ensuring the root ball arrives at its planting site intact. The wire basket also provides a means for lifting the tree by the root ball so that the tree is not lifted by strapping on the trunk.

Wire baskets left on the upper portion of the root ball after planting may girdle the tree roots.

NYSDOT’s specifications require the wire basket, along with burlap, twine, ropes, etc to be removed completely from the upper one half and the top of the root ball. Refer to the Department’s Standard Sheet 611- 01 for additional guidance.

C.3 Container-Grown Plant Material. Container-grown plant material is generally acceptable in lieu of B&B material. The advantages of container-grown material include the possibility of extending the planting season and the possible cost savings through using smaller and lighter balls.
D. Tree Stem Protection

D.1 General Information. Tree guard products have short term benefits but can lead to permanent damage if left unattended. Tree wraps and tree paint are not recommended under any circumstances. Don’t apply tree guards unless their care, including maintenance, monitoring and removal is specified in the contract documents.

No single method for rodent and deer control is completely effective. An incompletely-girdled tree may live; however, it will become structurally weak as the years pass. The side of a tree stripped of bark will eventually rot and weaken.

D.2 Tree Shelters and Rodent Guards. Tree rodent guards may be considered on newly planted trees when there is a likelihood of rodent damage. Rodent guards are paid for separately and must be specified in the contract documents.

Tree shelters and guards can protect hardwood trees from damage by voles and other rodents. Tree shelters are plastic tubes that are placed around seedlings when they are planted. Like small greenhouses, the tubes allow light to reach the seedling and trap heat and moisture. A tree shelter will protect a tree from rodent girdling for about five years. There are two common types of tree guards — tubes and those made of spiraling plastic. Both keep pests away from young trees. Tree shelters and rodent guards should be monitored and removed if insects infest or disease occurs. The heat and moisture desirable for the seedling can become a problem if the shelters and guards are left in place too long.

D.3 Tree Wraps. Tree wrap use is neither necessary nor desirable. They may harm the plant if the wraps are left on too long or improperly applied.

D.4 Tree Paints. It is never necessary or desirable to put paint or tar on tree wounds. It is a great misconception that trees need bandages. Tree wrap, paint and pruning tar can trap moisture against the wound, delaying healing. It is better for the wound to have contact with the air.

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E. Mulch for Plants or Plant Beds

This section includes the following pay items:

Item
Mulch

Contract Documents must include:
- Location(s) of work
- Type of mulch

Special Notes for Mulch may include:
- No other notes are appropriate

If different materials or methods than those provided in the standard specification are required the Landscape Architect must use a special specification.

E.1 Organic Mulch. The benefits of organic mulch are well established. Mulch improves soil properties by conserving moisture, improving soil structure, moderating temperature, increasing fertility and by providing protection from mower damage.

E.1.a General Information. Mulch should normally smell like freshly cut wood. However, mulch sometimes develops a toxicity that causes it to smell like vinegar, ammonia, sulfur or silage (sour mulch). This happens when material with ample nitrogen content is not sufficiently rotated and forms pockets of increased decomposition. When this occurs, the process becomes anaerobic and produces small quantities of phytotoxic materials. Once exposed to the air, the production of phytotoxic material stops. Nonetheless, the toxic materials that were created may persist. If the mulch is placed around plants before the toxicity has had a chance to leach from the pile, these plants may sustain damage or be killed (depending on the hardiness of the plant materials and the quantity of the phytotoxic material in the mulch). Marginal leaf chlorosis, scorch and defoliation are other possible effects. Damage usually occurs within 24 hours after application. Plants with procumbent growth habits or freshly planted plants are the most susceptible to damage from sour mulch. In addition, the phytotoxic material present in the mulch may prevent some seeds from germinating.

27 Beware of Sour Mulch, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University, 2009
29 Beware of Sour Mulch, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University, 2009
If sour mulch is applied and plants are killed, water the mulch heavily to prevent further damage. Water lessens the concentration of the toxins and leaches them out of the root zone. Removing the offending mulch may have little effect; by the time the dead plants are noticed, most of the toxicity has already dissipated.

For individual plants, the mulched area should include as much of the root zone as possible. The mulched area should extend at least 3 feet out from the base of a tree. It is advisable to pull the mulch 1 to 2 inches away from the base of all plants to prevent bark decay. Mulch the entire area if the plants are planted in beds.

Excessive application of mulch can result roots growing in the mulch and not in the soil. Improper mulching such as “mulch volcano” keeps moisture around tree trunk creating an environment for rot; insects; and root growth that can strangle the tree.

The Department does not advise using landscape fabric or plastic with bark mulch and wood chips. Initially, the plastic or fabric may provide additional protection against weeds. But as the mulch breaks down, weeds may start to grow either in the mulch above or through the landscape fabric or plastic. The barrier between the soil and the mulch also prevents the mulch from improving the soil condition. The plastic or fabric also makes planting additional plants more difficult.

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30. Mulching Trees and Shrubs, Prepared by: Erv Evans, Consumer Horticulturist, NC State University
31. Mulching, Backyard Conservation Tip Sheet, NRCS
E.1.b Mulch for Planting Type A Seasoned Wood Chips. This is the most commonly used product on NYSDOT projects and is suitable for most roadside applications. This is also the default mulch for the standard specifications for planting and transplanting.

E.1.c Mulch for Planting Type B Recycled or Green Wood Chips.

E.1.c (1) Recycled Wood Chips. NYS Department of Environmental Conservation allows the reuse of unadulterated waste wood for wood chips. These wood chips are then used as Type B mulch in landscaping and erosion control. The Contractor may choose to use unadulterated wood chip products from any source, providing that source meets the requirements of 6 NYCRR Part 360. It should be noted that this type of wood chip product may consist of sharply shredded wood, lack a “natural bark” quality and not have the typical “chip” shape. Wood chips sourced in this manner are appropriate for use along rural highways or parkways that are not adjacent to residential or commercial properties, pedestrian paths, bikeways or similar active use areas.

E.1.c (2) Green Wood Chips. Commonly expressed concerns about fresh/green woody mulches such as robbing nitrogen, transmitting disease, and acidifying soil are not borne out in research trials. The Landscape Architect may wish to include a thin underlying layer of a more nutrient rich mulch (like compost) when green wood chips, are likely to be used if there are concerns regarding nutrient deficiencies. Green Wood chips are appropriate for use along rural highways or parkways and have the added benefit of reducing construction waste. However, the landscape architect may not wish to use this mulch next to residential or commercial properties, pedestrian paths, bikeways or similar active use areas. Green Wood Chips often have a less uniform look and may have leaves and twigs visually apparent. Homeowners and users of sensitive pedestrian or bicycles areas may object to the product’s aesthetics.

E.1.d Mulch for Planting Type C USDA-APHIS Protocol Wood Chips. USDA-APHIS develops Pest Response Guidelines (NPRG) as a framework for providing methods and tools used for containment, control or eradication for a pest. These are specific to the particular pest and the Landscape Architect will need to know which pest(s) or disease the waste wood may be exposed to or infected by.

For example the New Pest Response Guidelines for both Emerald Ash Borer and Asian LongHorned Beetle call for the host wood to be chipped inside the quarantine zone to a size

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32 “Wood chip mulch: Landscape boon or bane?”, Linda Chalker-Scott, Ph.D., MasterGardener WSU editor Extension Urban Horticulturist and Associate Professor, Puyallup Research and Extension Center, Washington State University, 2007
of less than 1 inch in at least two dimensions. Chips of this size are no longer subject to Federal or State regulations and may be disposed of at the Contractor’s discretion.

There may be multiple APHIS approved disposal method for each individual pest or disease and the standard specification allows the Contractor to choose the most appropriate APHIS approved method for the particular contract. Chipping or mulching the waste wood, including stump, has been the most cost effective and common method of treatment. See TEM 4.4.9.4 for additional information.

The pay item is intended for use in a known quarantine area or when an outbreak of a pest or disease is likely to exist based upon a regulatory agency’s advice.

E.1.e Mulch for Planting Type D Shredded Bark Mulch. Shredded bark mulch may not be appropriate for slopes over 1 on 2.5; areas prone to flooding or high wind. Since shredded bark is the lightest form of mulch, it will blow away. Consider using a heavier or larger material if these conditions exist. Shredded bark mulch decomposes quicker, which although adds nutrients to the soil, may require replacement or maintenance more often than other mulch choices.

E.1.f Mulch for Planting Type E Pine Bark Chunks or Nuggets. Pine Bark Chunks or Nuggets may be a more expensive product so consider the size and style of the area you’re putting the mulch in. Pine bark nuggets may be too large for a bed of annuals but perfect for an area around trees or shrubs. An appropriate use is when matching existing mulch in the immediate area.

E.2 Inorganic mulches. Inorganic mulches, including stone, recycled tires, plastic, etc., tend to stay in place and do not rob the soil of nitrogen or harbor weed seeds. Despite these obvious advantages, inorganic mulches have numerous disadvantages and require careful consideration before using on Department projects. Perhaps the greatest disadvantage is that these mulches do not contribute organic matter to soil.33

As a rule stone mulches are not recommended. Stones tend to work their way out of planting beds where they can be thrown by mowers or vehicles. This has the potential to cause injury. Over time, stone mulches can migrate down into the soil. This makes future digging difficult. Light-colored stones can reflect heat onto plants and scorch sensitive plants.

33 Mulching for a Healthy Landscape, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University, 2009

§28 2/20/13
F. Tree Wells and Tree Walls

This section includes special specification work item.

Filling or excavating around existing trees can cause a tree to decline and/or die. The physical damage caused by filling or excavating around trees may not be readily apparent; several months, a year, or even longer may pass before outward signs of injury are visible. The length of time that passes before the injury begins to show depends upon the tree’s age and species and the depth of grade change.\textsuperscript{34} Two examples of re-grading that will inflict serious or fatal harm to a tree include:

- Filling of soil more than 4 to 6 inches in the tree’s root zone
- More than 30 to 40 percent of the root system is impacted by either fill or excavation.

When the highway grading design includes either of the above described grading scenarios, tree removal is recommended. When tree preservation or retention is an \textit{absolute necessity}, a tree well or wall may provide a solution.

F.1 Tree Wells. The prime considerations in constructing tree wells are:

- Air circulation in the root area,
- Water and plant nutrients, and
- Proper drainage.\textsuperscript{35}

There are several methods of constructing tree wells which (may) provide for air circulation, moisture control, and nutrient availability. When possible, the well should be built before the grade is changed. This makes construction easier, simplifies the installation of the drain tile, and allows the well to provide extra protection for the tree during construction.

A tree well should extend a minimum of 3 feet from the trunk of the tree. However, greater well diameters have a better chance of saving the tree. The recommended (maximum) height for tree wells is 3 feet.\textsuperscript{36}

\textsuperscript{34} \textit{Tree Wells}, Clifford W. Collier, Jr., Cooperative Extension Service West Virginia University

\textsuperscript{35} \textit{Tree Wells}, Clifford W. Collier, Jr., Cooperative Extension Service West Virginia University

\textsuperscript{36} \textit{Tree Wells}, Clifford W. Collier, Jr., Cooperative Extension Service West Virginia University
F.2 Tree Walls. Saving a tree when cutting a slope may be less difficult than when filling a slope. When grades are being lowered, cut the tree roots as far away from the tree trunk as possible (beyond the drip line is desirable). Remove the soil to the proper depth and construct the retaining wall around the tree. The Designer/Landscape Architect should make certain that the wall drains properly. Gravel or stone placed immediately behind the wall aids in drainage. The ensuing tree care is similar to the care the tree would have received if it were growing in a lawn.

G. Anti-desiccants/Anti-transpirants

There is no separate pay item number for anti-desiccants. There is a material specification, contained in 713-08, “Materials for Protection of Plants”. It is intended that anti-desiccants be specified, when desired by notes on the plans and included in the pay items for planting. If there is a need to specify it apart from planting, such as on existing, established plant material that would need to be a special specification, although the same standard material section can be referenced.

Anti-desiccants or anti-transpirants are sold under trade names such as Wilt-Pruf, Nu-Film, VaporGuard, and Stressguard. "Anti-transpirant” and “anti-desiccant" are synonymous in the industry. This is true despite the differing dictionary definitions for "transpiration" and "desiccation."

Anti-desiccants/transpirants create a chemical barrier over the leaf pores (stomates). These pores allow the plant to respire (take in carbon dioxide) and transpire (release water vapor).
Closing these pores reduces the water lost through transpiration (daily leaf sweating) and prevents the plant from desiccating or drying out.

Anti-desiccants are used in the northeast when transplanting trees and shrubs or to reduce winter burn injuries. Winter burn in evergreen plants is needle damage caused by a combination of cold winds, which dry out the needles, and a frozen substrate, which prevents the plant from replacing water lost through transpiration.

A plant’s location in the landscape is an important consideration when deciding whether to apply an anti-desiccant. Plants placed in windy sites are more prone to this type of damage than plants placed in protected locations. Soil moisture is also a factor.

Caution is needed when using anti-desiccants. Because leaves lose water through the same pores that take in carbon dioxide for photosynthesis, anti-desiccants can be toxic to plants. In addition, these products are generally more hazardous to evergreens than to deciduous plants. For example, anti-desiccants should never be applied to blue spruces or other plants that have a bluish waxy coating on their leaves. That waxy coating is the plant’s own natural anti-desiccant; spraying an anti-desiccant washes away that wax and the blueness. You can minimize the toxic effects from anti-desiccants by reading the label carefully and noting the warnings for specific plants and the directions for dilution and timing.

28.6.9.20 Post-Planting Care

This section includes the following pay items:

Item
Post-Planting Care

Contract Documents for Post-Planting Care must include:

- Location(s) of plants or plant beds to be cared for
- Type of mulch

Special Notes for Post-Planting Care may include:

- A note calling attention to the contract finish date or post-planting completion date if it is anticipated that they will differ
- Materials for the protection of planting as appropriate
- No other notes are appropriate

37 Winter Burn, Robert Bishop, Frederick County Master Gardener Program
If different materials or methods than those provided in the standard specification are required the Landscape Architect must use a special specification.

A. Introduction

As per 23 CFR, PART 752 -- LANDSCAPE AND ROADSIDE DEVELOPMENT, the Department’s standard specifications make provisions for the inclusion of post-planting care.  

Adequate provision for planting care can be accomplished with this item or by other means (i.e. stakeholder partnerships).

When using the pay item for post-planting care, the Landscape Architect should consider if:

- Maintaining a low plant mortality rate is critical,
- The project contains regulatory requirements that necessitate plant survival,
- The planting is related to commitments made to the public,
- The planting’s design function would be compromised (i.e. Living snow fence or other critical screening),
- Other mechanisms exist for post-planting care (i.e. Maintenance agreements), and
- The costs to administer the post-planting care would exceed the realized benefits (under this circumstance, no post-planting care is necessary).

The Landscape Architect should document, in the project files, the decision to plant without including the post-planting care item in the contract.

B. General Guidance

Before including the “Post-Planting Care” item in a capital project, the Landscape Architect should consult with the Designer and Construction regarding the size, type, duration and value of the project. Remember, “Watering Vegetation” is a separate pay item (refer to Section 28.6.10).

Replacement plants are not included in the standard pay item for Post-Planting Care and, if necessary, must be accomplished by other means.

C. Post-Planting Care - Integrated vegetation and pest management

Be aware that the specification requires the Contractor to:

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http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=4326b3462801c075d9d260366f1f811e&rgn=div5&view=text&node=23:1.0.1.8.42&idno=23

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Monitor for new infestation of pests or onset of disease in all new planting; Establish action thresholds for when control is needed; Select and undertake control methods; and Evaluate the success and adjust control methods if necessary.

D. Common project types for including a “Post-Planting Care” item

D.1 Highway/Bridge Construction Projects. When planting is a critical element, required by a regulatory agency or necessary for other compelling reasons as determined by the Department, the post-planting care item may be included in the contract. Post-planting care may be specified for all project plants or for plants in a specific location where low plant mortality is critical.

When planting is a minor element and/or less critical Post-Planting Care may not be needed.

D.2 Stand-Alone Landscape Development Projects. A separate landscape development contract may be developed to focus resources on plant establishment. Projects of this type typically include a post-planting care pay item. When included in the contract, the project will not receive final acceptance until the post-planting care is complete.

The completion date for a “stand alone” planting project must be set for the satisfactory completion of the post-planting care item. As a result, the post-planting care item is a major component of the contract work. A note to this effect should be inserted in the contract documents:

SAMPLE SPECIAL NOTE: The completion date for this contract has been selected to allow for the performance of the work required under the Post-Planting Care in Section 611. The contractor’s attention is drawn to the fact that all contract work other than that required for the Post-Planting Care must be complete at least twelve months prior to the contract completion date. Failure to comply may result in an assessment for engineering charges and/or liquidated damages as provided in Section 108-03.”

E. Projects without Post-Planting Care.

The design of these projects should anticipate and compensate for an average plant mortality rate.

- Contingency Planting
- Additional planting – built-in buffer for plant losses
The Landscape Architect should also note that some studies indicate that a newly planted tree may take up to four years to establish. The one year of post planting care provided for in Department contracts is only one tool used to enhance plant survival.

28.6.9.21 Replacing Plants On Capital Projects

There may be many approaches to plan for plant replacements, including and not limited to:
- Not replacing non-critical plants
- Maintenance Agreements
- Contingency Planting
- Additional planting – build buffers into the contract to compensate for plant losses
- Follow-up contracts
- Field change order
- Order on contract (least preferred)

Refer to Section 100 of the Standard Specifications for damages to plants during contract duration.

28.6.10 Watering

This section includes the following pay items:

Item
Watering Vegetation

Contract Documents must include:
Location of vegetation to be watered
Quantity must be on bid sheet

If different materials or methods than those provided in the standard specification are required the Landscape Architect must use a special specification.

28.6.10.1 Introduction

Watering pay items are required when specifying sod, wildflowers, or turf.

The watering vegetation pay item should also be considered for any planting:
- Which is highly visible,
- Which is required to meet mitigation commitments, and
- Which are in sensitive/ critical environmental habitat areas.
28.6.10.2 General Information

When watering vegetation is needed, the appropriate items must be specified in the Contract documents.

Project Designers/Landscape Architects considering the project’s water needs are encouraged to use stormwater as an irrigation resource. This could be accomplished by directing stormwater runoff from impervious areas to plant beds where infiltration, limited ponding and detention, evapotranspiration and pollutant filtering can occur. When this is not feasible the watering pay item should be included in the contract documents.

28.6.10.3 Guidance for Estimating Watering Quantities

Watering Rate per plant or turf area is essential to estimating quantities. Refer to Appendix 28-C Estimating.

Water used with the distribution of seed and fertilizer under the seeding item (hydroseeding) or applying fertilizer item is a part of each item’s cost and cannot be paid for under Item 610.

28.6.11 Weed Removal

This section includes the following pay items:

Item
Weed Removal

Contract Documents must include:
- Location(s)

Special Notes:
- No other notes are appropriate

Contract Documents may include:
- No other notes are appropriate

This item is intended for newly established turf, sod, wildflower area and plant pits. Weed removal for pre-existing turf, sod, wildflower and plant pits would require a special specification. See Section 28.6.2.5 for guidance on invasive plant species control.

When post planting care is specified two weedings are included in that item. If more than two weedings are desired the weed removal item may be specified in addition.
28.6.12 Living Snow Fences/Shelterbelts

(See HDM Chapter 5.7.13.2 Shelterbelts for additional information)
https://www.nysdot.gov/divisions/engineering/design/dqab/hdm/hdm-repository/chapt_05.pdf

28.7 GUIDANCE FOR LANDSCAPE TREATMENTS AT HISTORIC PROPERTIES

28.7.1 Introduction

Section 106/14.09 consultation for historic properties is initiated during scoping, occurs throughout the preliminary design process and is completed prior to design approval. The following provides a recommended approach to landscape treatments that may be incorporated in the Section 106/14.09 consultation process. Such treatments balance historic preservation concerns with safety, accessibility mandates, technical requirements, and transportation needs. Historic properties are those resources that individually or as a district are eligible for or are listed on the National Register of Historic Places (NR).

The Designer/Landscape Architect should be aware that the landscape itself may qualify as the historic property or that landscape elements may contribute to the integrity of historic properties, including historic districts and historic parkways. The historic significance of the landscape or landscape elements is identified as part of the Section 106/14.09 process.

While historic properties are commonly thought of as a building or a collection of buildings (like a farm and its outbuildings), historic properties may include a wide range of significant features. For example, contributing components of a property might be topography (the height, depth or shape of natural or human-made ground features), vegetation (hedges, fields, wooded areas), circulation features (roads, paths, trails, parking areas, navigable waterways), natural and human-made water features, and structures, site furnishings and objects. These features are often encountered in a variety of state or federal undertakings and their extent and condition can vary widely.

Even if the area does not meet the NRE criteria, the Designer/Landscape Architect may follow the guidance in this section and use landscape treatments to enhance the setting or historic character of an area identified as important to a community’s context.

During detailed design, a community and/or property owner may request other aesthetic or landscape treatments beyond those initially agreed upon during the Section 106/14.09 consultation process. The Department will consider these requests, taking into account existing standards, costs, historic context, and other factors. If determined appropriate, the Department will seek State Historic Preservation Office’s (SHPO) concurrence to the proposed change.
The proposed treatments offered in this section were developed based on:

- Americans With Disabilities Act (ADA),
- NYSDOT guidance for Context Sensitive Solutions,
- Highway Design Manual,
- *The Secretary of the Interior’s Guidelines for the Treatment of Cultural Landscapes*, National Park Service

**Guiding Principles:**

- The setting may contribute to the significance of historic properties and every effort should be taken to retain landscape features identified as important in defining the historic character of the setting.
- All work should be consistent with *The Secretary of the Interior’s Standards for Treatment of Historic Properties*.
- New highway/street landscape treatments should enhance and be compatible with the historic setting and the context of the neighborhood/community.
- The restoration or replacement of the existing or original landscape elements at historic properties should be based on appropriate historical documentation, historic character of the property and its period of significance.
- The proposed landscape treatments should be respectful of the characteristics or qualities that contribute to the property’s historic significance.

**28.7.2 Site Protection Considerations**

Designer/Landscape Architects should consider construction sequencing that might affect existing historic properties or identified landscape features. Historic properties, including contributing elements, should be shown on the plans. (For example: hedge rows, light fixtures, stone walls, carriage steps, etc.) This may include limiting access to particularly sensitive areas. Location requiring protection or access restrictions should be included in the plans. Pay items for protection fencing should be included in the contract documents.
28.7.3 **Recommended Treatments**

The treatments recommended at historic properties are summarized below and include historic districts and historic parkways. Each landscape feature is addressed separately with an understanding that all features must be integrated into a unified design.

28.7.3.1 Sidewalks & Curbing

Sidewalks and curbs may contribute to the setting of an historic district. In repairing, replacing or building new sidewalks and curbs, the ADA requirements to make all public facilities accessible to persons with disabilities are to be followed. The ADA establishes the minimum allowable widths, slopes, heights, lengths, etc. of all necessary elements in the pedestrian system, including those associated with historic buildings and facilities.

Where the existing sidewalks and or curbs contribute to the historic setting, the following treatments are recommended:

1. Reset or reuse the existing materials. Where practicable, original materials (granite, bluestone, sandstone, brick, slate etc.) will be retained and reset rather than replaced. Missing or unsalvageable original materials will be replaced in kind.
2. In-kind replacement should match in size, color, texture and material as practicable. (for example: obtain materials from the original quarry)
3. If there is no practicable source for in-kind replacement materials, the Landscape Architect needs to propose alternatives that are in context with the historic setting. The RLA, in coordination with the RCRC, will determine if additional consultation with the SHPO/OPRHP is needed.
4. The tinting/integration of concrete coloring to match historic sidewalk or curb materials is not recommended. Past experience has shown that new concrete weathers to match the existing sidewalks or curbs. In addition, the tinting of concrete may affect the quality and strength of the material.

28.7.3.2 Trees and Other Vegetation

In accordance with [Section 45.5 of the New York State Highway Law](#), DOT is responsible for making the highways safe for the traveling public and has an obligation to remove all dead, dying and dangerous trees that have the potential of injuring persons using the transportation system. Given this requirement, and knowing the value of mature trees to the setting of historic properties, the following apply:

- All vegetation removed will be replaced with a species whose form is consistent with a roadside development plan for the community, consistent with native/ invasive species considerations, and with the character of the historic resource as determined by the RLA in coordination with the RCRC.
Street plantings used in historic streetscapes may not be available or appropriate to plant in today’s environment; however tree selection should be in keeping with the original design intent.

Replacement trees will be placed within ten feet of the existing tree locations, if practicable, in order to preserve the scale of the streetscape and allow for the reestablishment of a tree canopy. Gaps in a hedge row will be filled if they are a contributing element. As always, safety takes priority in locating elements along the roadside.

If removal, alteration or replacement of contributing vegetation becomes necessary and was not previously addressed in Section 106/14.09 consultation, the RLA will coordinate with the RCRC to determine if additional SHPO/OPRHP consultation is needed.

28.7.3.3 Lighting

As part of the Department’s project development process, replacing or adding lighting will be considered during the Section 106/14.09 consultation. The following treatments at historic properties are recommended:

1) When a project proposes replacement of existing non-historic lighting or introduction of new lighting where none previously exists, the design will be simple and unobtrusive.
2) If it can be documented that lighting existed historically, its style will be replicated as closely as practicable, consistent with the historic character.

See HDM Chapter 12 Highway Lighting

28.7.3.4 Signs

New signs will be installed at a historic property only when mandated for safety reasons. All existing signs contributing to a historic property/district will be retained/reinstalled or refurbished as practicable at existing location.

28.7.3.5 Traffic Control Devices (Signal Poles)

The Designer/Landscape Architect should consider the visual impact resulting from the location and design of new or replacement of traffic control devices in historic districts or adjacent to historic properties. Consult early with those designing the traffic control elements to minimize the visual impact on the historic properties. (For example: pole color/style, cabinet location, etc.)
28.7.3.6 Elevation Changes

Elevation changes within historic setting may affect the spatial relationships between the historic properties and contributing landscape elements, including trees, foundation lines, driveways and sidewalks. Proposed elevation changes that may affect a historic setting should be identified as soon as possible. The proposed change should be reviewed by the RLA in coordination with the RCRC to determine if consultation with the SHPO/OPRHP is needed. Elevation changes may require the addition or modification of steps and railings or the introduction of retaining walls.

Consultation with SHPO/OPRHP will be required if retaining walls are introduced at a historic property where none existed previously.

The following treatments where elevation changes are proposed at historic properties are recommended:

1) All existing stairs and steps identified as contributing to historic properties will be retained, reinstalled or refurbished as close to existing location as practicable. If it is determined that stairs or steps can not be reset or do not meet NYSDOT and ADA safety and accessibility standards, replacement shall match existing in size, color, texture and all other qualities using the Secretary of the Interior Guidelines.

2) Where the elevation changes require the installation of new railings, railing designs that meet NYSDOT and ADA safety and accessibility standards must be used. Special specifications contain railing designs used in prior projects and may serve as a library of railing types. SHPO/OPRHP must review and concur that the railing design selected is appropriate for the historic setting.

28.7.3.7 Street Configuration Changes

The actual street configuration may contribute to the historic setting or historic district. During the design process, minor changes in a street configuration may be proposed. Any changes such as, but not limited to, the following may affect historic properties and should be reviewed by the RLA in coordination with the RCRC to determine if additional consultation with the SHPO/OPRHP is needed.

1) Intersection configuration or geometry
2) Curb radii
3) Introduction or relocation of:
   - Bus stop,
   - New curb,
   - New crosswalks and/or curb ramps,
   - Signal locations,
   - Traffic calming measures,
   - Bike or parking lanes, and
   - Traffic islands.
4) Additional loss or introduction of vegetation
28.7.3.8 Guide Rail and Stone-faced and Textured Barriers

In most cases, guide rail does not contribute to historic significance; however the introduction of new guide rail, extension of rail or the replacement of existing guide rail may affect historic properties, such as an historic bridge, parkway or district. Barrier appearance may require research and documentation as to what is appropriate for the specific historic property or setting.

Corten, self weathering rustic highway guide rail and barriers (A588) are no longer used by the Department. (EI-08-016).

Any changes that may affect historic properties should be reviewed by the RLA in coordination with the RCRC to determine if additional consultation with the SHPO/OPRHP is needed.

An amendment to the Programmatic Agreement for the National Register listed Taconic State Parkway identifies the “special areas” where aesthetic guide rail treatments are to be used.

For details regarding guide rail or barrier selection or design, the Designer/Landscape Architect should refer to Highway Design Manual Chapter 10 10.2.3.7 Barrier Options for Aesthetically Sensitive Areas.

28.7.3.9 Retention of Historic Landscape Features

Other historic landscape features such as fences, walls, hitching posts and carriage steps may contribute to the significance of a historic property. Any changes that may affect historic properties should be reviewed by the RLA in coordination with the RCRC to determine if additional consultation with the SHPO/OPRHP is needed. The following treatments of historic structures, objects and features are typically recommended:

1) Retain in existing location whenever possible.
2) If temporarily removed to facilitate construction, reset as close to the existing location as practicable.
3) If safety or the project design requires relocation, retain the association with historic property.
4) Reproduction or replication is not recommended.
5) Salvage and reuse historic material as determined during Section 14.09/106 consultation.
6) If possible, repair contributing features, structures or objects damaged during relocation following the Secretary of the Interior Guidelines.
7) If repair is not possible, restore based on documentation.
28.7.3.10 Walls

Walls are often contributing features that may be associated with individual historic properties or historic districts.

A wall is a solid structure that defines and sometimes protects an area. Landscape element walls include exterior boundary walls and retaining walls.

Any changes that may affect historic properties should be reviewed by the RLA in coordination with the RCRC to determine if additional consultation with the SHPO/OPRHP is needed.

For walls associated with bridges, the Designer/Landscape Architect should consult the Bridge Designer/Landscape Architect and refer to Bridge Design Manual, the NYSDOT Historic Bridge Inventory and the NYSDOT Canal Bridge Inventory.

The following treatments of walls are typically recommended:

1) Retain in existing location whenever possible. If the project includes repair of the existing wall, follow the Secretary of the Interior Guidelines.
2) If a wall needs to be relocated for safety or the project design, reset the wall in a manner that retains the association with historic property.
3) Salvage and reuse historic material as determined during consultation.
4) If repair is not possible, restore based on documentation. Reproduction or replication is not recommended.

28.7.3.11 Introduction of New Landscape Features

Often the Department is requested by a community to add certain amenities to downtown historic districts. These features might include kiosks, benches, drinking fountains, lights, etc. The Department’s position is that the addition of these features adds to the interest and quality of life in these areas, however, they may not always be compatible with historic properties.

Where there never were historic features like lights, signs, fences, etc. but they are required as part of the historic property today, it is appropriate to install a new contemporary feature:

a) Whose material, finish, color, design, general appearance, location and spacing are compatible with the historic property, its setting and its period of significance;
b) Whose presence in the landscape is clearly secondary to the extant historic features; and

c) Whose appearance will not produce a false historic appearance or sense of development.

Installing historic-appearing features where similar features never existed historically is not appropriate.

Therefore, if a community is requesting the additional amenities, the Department will consider the request, provided the SHPO/OPRHP and the community agree on the features.
When new landscape features are added in medium- to high-speed environments, roadside safety should also be considered and potentially hazardous features should not be added within the existing clear area.

### 28.8 PARK AND RIDE LOTS

See [Highway Design Manual Chapter 24.3 Commuter Transfer Facilities](#).

### 28.9 REST AREAS

See [Highway Design Manual Chapter 27, Highway Rest Areas and Roadside Parking Areas](#).

### 28.10 SCENIC BYWAYS

#### 28.10.1 Introduction

The NYS Department of Transportation manages the New York State Scenic Byways Program which was created by the State Legislature in 1992 "to encourage and coordinate state actions and the activities of others which are related to the development, protection, promotion, and management of scenic byways." The state program was established in response to establishment of the Federal Highway Administrations’ National Scenic Byways program.

A scenic byway is a designated and legislated transportation route. The scenic byway and adjacent corridor are of particular scenic, historic, recreational, cultural or archeological intrinsic value. These qualities are managed to protect these characteristics and to encourage economic development through tourism and recreation.

#### 28.10.2 Project Development

For projects that are on a [New York State Scenic Byway](#), designated route or within a scenic byway corridor the following actions are recommended:

- Include the Byway Organization in the Public Involvement Plan – they are a Stakeholder.
- Identify Byway resources that could be affected by the Department’s project.
Consult with the Scenic Byway Management Organization during the project’s early stages. Scenic Byway Managers are usually able to provide useful and significant insights into local issues and concerns. They should also be able to identify the existence of important byway resources that could be affected by the project.

Reference the byway-specific Scenic Byway Corridor Management Plan in the project’s Design Approval Document (DAD). Each Corridor Management Plan identifies significant byway resources and includes a transportation and safety component that identifies byway specific concerns and needs. The Regional Scenic Byway Contact (RSBC) should have a copy of each Department approved Scenic Byway Corridor Management Plan (SBCMP) for designated and proposed scenic byways within their specific region.

Explore partnering efforts, as state and national designated Scenic Byways have access to various federal and state funding sources. Additionally, the Byway Management Organization can be influential in working with local communities.

28.10.3 Scenic Byways Signs

The New York State Scenic Byways Sign Manual (see Highway Design Manual, Appendix 11A) provides guidance on various types of signing for Scenic Byways. Designers should be aware when replacing exiting byway signs that standards for the Byway Identification Sign have been updated, including the sign assembly, spacing and the America’s Byways logo which is used for signing National Scenic Byways. Main Office Scenic Byways program staff should be contacted to obtain Byway specific logos; these are not maintained in the CADD Cell Libraries.

When directional and interpretive signage is proposed within designated Scenic Byway corridors, the Scenic Byway Management Organization should be consulted; the Scenic Byway Corridor Management Plan (SBCMP) should be referenced for consistency with planned Byway efforts.

28.10.4 Background Information

The New York State Scenic Byways Program is administered by the New York State Department of Transportation and managed by staff of the Department’s Landscape Architecture Bureau (LAB) in the Office of Environment (OE). Each of the Department’s regional offices has an identified Regional Scenic Byway Contact (RSBC).

The Scenic Byways program was established by the New York State Legislature and is described in the Highway Law Article 12-C. Article 12-C, Section 349-DD of the Highway Law identifies the components of New York State’s Scenic Byways system of designated routes that were either included in the establishing legislation or have successfully gone through the SBCMP nomination process and achieved designation. When a proposed/nominated byway achieves state designation, the legislation is updated to include the designated route of the new
byway. The legislation remains the most accurate reference for determining a specific byway route.

For additional information on the New York State Scenic Byways Program, the Department maintains an internal and external New York State Scenic Byways website, https://www.dot.ny.gov/display/programs/scenic-byways. Program guidance and a listing (with links and contact information) of National, State and proposed designated byways in the State are referenced here.

The National Scenic Byways Program’s annual Discretionary Grants Program, as funded by the series of federal highway and public transportation bills, provides for competitive and merit-based funding for byway related projects that implement Scenic Byway Corridor Management Plan recommendations. The grant application process is managed by Scenic Byways Program staff at the New York State Department of Transportation. In addition, scenic byway designation has been an eligible category in the similarly funded Transportation Enhancements Program (TEP), which is also administered and managed by the Department.

28.10.5 Links to Additional Information
- New York State Scenic Byways Program https://www.dot.ny.gov/display/programs/scenic-byways
- National Scenic Byways Online
  Site for the Traveling Public: http://www.byways.org/
  Site for Byway Community: http://www.bywaysonline.org/

28.11 LANDSCAPE FEATURES, ELEMENTS AND COMPONENTS
(Under development)

28.12 PARTNERING OPPORTUNITIES
(Under development)
28.13 GLOSSARY OF TERMS

**Aerated Static Pile Composting** - A composting system that uses a series of perforated pipes (or equivalent) as an air distribution system running underneath a compost pile and connected to a blower that either draws or blows air though the compost.

**Agronomic rate** - The rate of nitrogen addition designed to provide the amount of nitrogen needed by the crop or vegetation grown on the land, and to minimize the amount of nitrogen that passes below the root zone of the crop or vegetation grown on the land to the ground water.

**Amendment** - An organic material added to waste prior to composting to reduce bulk weight and increase air voids, and to increase the quantity of degradable organics.

**Basal End** - The base of a branch, stem, or stick, not the growing tips.

**Berm** - A constructed, vegetated or paved embankment used for enclosure, separation or protective purposes.

**Biodiversity** - The tendency in ecosystems, when undisturbed, to have a large number and wide range of species of animals, plants, fungi, and microorganisms. Human population pressure and resource consumption tend to reduce biodiversity.

**Biofiltration** - A technique using living material to capture and biologically degrade/process pollutants. Common uses include capturing harmful chemicals or silt from surface runoff. Examples of biofiltration include Bioswales, Constructed Wetlands and Natural Wetlands.

**Biomass**[^40] - The term "biomass" means any plant-derived organic matter available on a renewable basis, including dedicated energy crops and trees, agricultural food and feed crops, agricultural crop wastes and residues, wood wastes and residues, aquatic plants, animal wastes, municipal wastes, and other waste materials.

**Biopower** - Biopower refers to use of biomass to generate electricity. Technologies include co-firing of biomass in existing coal fired boilers as well as gasification.

**Biofuels** - A variety of fuels can be made from biomass resources, including liquid fuels ethanol, methanol, biodiesel, Fischer-Tropsch diesel, and gaseous fuels such as hydrogen and methane.

**Biosolids** - Biosolids means sewage sludge that can be beneficially used. Biosolids, also referred to as treated sludge, is a term used by the waste water industry to denote the byproduct of domestic and commercial sewage and wastewater treatment. These residuals are further treated to reduce pathogens and vector attraction by any of a number of approved methods.

[^40]: NYSERDA  http://www.powernaturally.org/programs/BiomassResources/default.asp?i=2

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Bollards - A barrier post, used to block vehicular traffic at trail access points.

Burlapped Plant - A shrub or tree that has been dressed for transplanting with a burlap-wrapped clump of soil around its roots.

Calciphytes - Plant species that can tolerate alkaline soils. A plant that thrives in a soil rich in lime or chalk, but cannot tolerate acidic conditions (typically a pH less than 7). Examples include hackberry (Celtis occidentalis), sycamore (Platanus occidentalis), catalpa (Catalpa speciosa), honeylocust (Gleditsia triacanthos), Kentucky coffeetree (Gymnocladus dioica), bur oak (Quercus macrocarpa), chinquapin oak (Q. muehlenbergii), Shumard oak (Q. shumardii), and many hawthorn species.41

Cambium Layer - A thin formative layer beneath the bark of most vascular plants that is responsible for secondary growth.

Clearance - The vertical dimension which must be cleared of all tree branches and other obstructions that would otherwise obstruct movement along the trail.

Context – Specific resource elements make up context -- Aesthetic, Archeological, Community/Economic, Cultural, Environmental (or "Natural"), Historic, Recreational, and Scenic. Aesthetic Context includes the visual qualities of a design element both as a self-contained object and as a part of its surrounding environment. Visible, physical evidence of past human life or activities describes the Archeological Context. Cultural Qualities are not necessarily expressed in the landscape; rather, culture encompasses all aspects of a community’s life. Incorporating historic qualities, elements and features begins with understanding their significance today. The Recreational Context encompasses resources for outdoor recreational activities. Scenic resources are defined as those landscape patterns and features which are visually or aesthetically pleasing and which therefore contribute affirmatively to the definition of a distinct community or region.

Critical Root Zone (CRZ) - A circle or area on the ground that corresponds with the dripline of the tree, sometimes called the tree protection zone. This zone is used in determining allowable disturbance to the area around an existing tree during construction.

Defensible Spaces - Theory of architect and city planner Oscar Newman encompasses ideas about crime prevention and neighborhood safety.

Design Charrette - A focused workshop that takes place in the early phase of the design process. All project team members meet together to exchange ideas, encouraging the generation of integrated design solutions.

41 Constraints To Tree Growth Imposed By Urban Soil Alkalinity, By George Ware
Dibble - Small tool used for planting, or to plant by means of using a small tool (i.e. a dibble.)

Dry Weight Basis - Calculated on the basis of having been dried at 105 degrees Celsius until reaching a constant mass (i.e., essentially 100 percent solids content).

Flashy Stream - Stream characterized by rapidly rising and falling stages.

Feed Crops - Crops produced primarily for consumption by animals.

Fiber Crops - Crops such as flax and cotton.

Food Crops - Crops consumed by humans including, but not limited to, fruits, vegetables, and tobacco.

Forb - An herb other than grass.

Habitat - The natural environment of an organism; place where it is usually found.

Hard Armor - One of the most common ways to protect riverbanks and stream banks is by using what is known as hard armor solutions. These solutions include the use of riprap, gabions and segmental retaining walls. Although each of these methods is different, the science behind them is the same: a durable material, such as rock or concrete, is placed on the face of the riverbank to protect it from eroding and eventually collapsing.

Herbaceous Plant - Vegetation which is non-woody.

Historic Properties – Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

Horizontal composting reactors – Composting vessels that come in a wide range of configurations, including static and agitated, pressure and/or vacuum-induced aeration. Agitated systems usually use the turning process to move material through the system in a continuous mode, while static systems require a loading and unloading mechanism.

Hydrophyte - Aquatic plants that grow in areas of perpetual flooding

Hydroseeding - Hydroseeding is the simple procedure of applying grass seed, fertilizer, hydromulch and water in one liquefied application. Various soil amendments and soil stabilizers may also be used in the mixture depending on the needs of the environment
**Landscape Project (per 23 CFR 752)** – Any action taken as a part of a highway construction project or as a separate action to enhance the aesthetics of a highway through the placement of plant material consistent with a landscape design plan. Seeding undertaken for erosion control and planting vegetation for screening purposes shall not constitute a landscape project.

**Macronutrients:**

- **Nitrogen** – essential nutrient for plants
- **Phosphorus** – important to seedling and root growth
- **Potassium** – important to regulating transpiration and translocation of materials between plant cells. It is thought to influence rooting and increase resistance to heat, cold, drought and disease.

**Mature source-separated organic waste, biosolids, septage, yard waste and other solid waste:** means a soil conditioning material with characteristics which render it harmless to plant growth when used as a topsoil or soil supplement and make it sufficiently stable that it will not generate offensive odors during storage, handling, or ultimate use.

**Micronutrients**\(^{42}\):

- **Boron** is believed to be involved in carbohydrate transport in plants. It also assists in metabolic regulation. Boron deficiency will often result in bud dieback.
- **Chlorine** is necessary for osmosis and ionic balance. It also plays a role in photosynthesis.
- **Cobalt** is essential to plant health. Cobalt is thought to be an important catalyst in nitrogen fixation. It may need to be added to some soils before seeding legumes.
- **Copper** is a component of some enzymes and of vitamin A. Symptoms of copper deficiency include browning of leaf tips and chlorosis.
- **Iron** is essential for chlorophyll synthesis, which is why an iron deficiency results in chlorosis.
- **Manganese** activates some important enzymes involved in chlorophyll formation. Manganese-deficient plants will develop chlorosis between the veins of its leaves. The availability of manganese is partially dependent on soil pH.

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\(^{42}\) http://en.wikipedia.org/wiki/Micronutrient
Molybdenum is essential to plant health. Molybdenum is used by plants to reduce nitrates into usable forms. Some plants use it for nitrogen fixation, thus it may need to be added to some soils before seeding legumes.

Zinc participates in chlorophyll formation, and also activates many enzymes. Symptoms of zinc deficiency include chlorosis and stunted growth.

Mulch - Material placed on an exposed surface to provide more desirable moisture and temperature relationship for plant growth and control the growth of unwanted vegetation. May also prevent sheet erosion.

Native – Those plant species that have historically occurred or currently occur in a particular ecosystem by means other than introduction associated with human activities since the beginning of the colonial era.

Organic waste processing (OWP) facility - A facility involved in the processing of readily biodegradable organic components in solid waste to produce a mature product for beneficial use as a source of nutrients, organic matter, liming value, or other essential constituent for a soil or plant. The processes include, but are not limited to, composting, heat drying, and chemical stabilization.

Osmocote and Magamp – Proprietary slow release fertilizers

Planting Plan - A plan of the project area (e.g. wetland mitigation site) showing how the various planting materials will be placed in relation to one another and to other structures.

Phragmite - A large perennial rhizomatous grass or reed. This plant is regarded as an invasive species.

Phosphorus fertilizer – Fertilizer that has a phosphate content of more than 0.67% phosphorus by weight.

Propagule - Part of a plant capable of vegetative propagation.

Public Places - All spaces, indoors or outdoors, which are generally accessible to the public.

Quick Release Fertilizer - The general properties of quick release fertilizers include; high water solubility (quick release), relative high burn potential at excessive rate applications (high salt index), low cost per unit of fertilizer nutrient and readily available for plant use.

Rhizome - A modified plant stem which grows horizontally under the surface of the soil. New growth will emerge from the nodes of the stem.

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Root Path - A narrow zone of growing medium that permits plant roots to reach a larger surrounding soil mass to draw minerals and water.

Rototiller - Machines designed for seed bed preparation and eradication of weeds.

Scenic Byway Corridor Management Plans (SBCMP) - A SBCMP is a comprehensive document developed with direct community and stakeholder input. The SBCMP serves as the nomination documentation and is required for designation as a New York Scenic Byway. The SBCMP outlines strategies to balance the interests of the byway communities and its resources with the interests of visitors and their experiences. The document should include discussions on byway specific visions, goals and themes; public participation; stewardship; tourism development; marketing and promotion; resource interpretation; financial resources; support and implementation; and transportation safety. The SBCMP’s include Department-reviewed and approved transportation and safety components. The SBCMP recommendations provide a comprehensive framework of community input that has been developed for each scenic byway corridor.

Sheepsfoot Roller - A roller used for compaction of fine-grained or clayey soils.

(Landscape) Site Inventory - Depending upon the project scale and/or planting objective, the inventory may include an identification, location, type, species, size, condition, and approximate age of existing plant material. An indication of the relationship of the material to the project site and to adjoining properties may also be included.

Slow Release Fertilizer - Slow release fertilizers include products in which the nutrients contained within the product are slowly soluble, slowly released, or held in a natural organic form (which require mineralization and nitrification in the soil).

Soil - The loose surface material (gravel, sand, silt, and peat) of the earth in which plants grow. Also, in agriculture, A, B, and C horizons.

Soil Bioengineering - The reliance on plant material for slope protection, rebuilding and stabilization, erosion control, etc. Soil biotechnical engineering combines the use of plant materials and structural elements to achieve the same goal.

Soil pH - Soil pH is the relative acidity (H+) ions or basicity (OH-) ions that the soil contains. Soil pH influences plant growth.

Soil Suitability - The ability of the soil to support the intended use of the land (e.g. establishment of a wetland)
Specimen Plant or quality grade designation - Specimen plants shall include deviations other than branching for street tree from standard minimums for desired characteristics. Refer to ANSI Z60.1 Section 1.1.2.3, 2004. Examples of deviations from standard minimums are caliper, height, root ball diameter, container or box size, etc., as well as other factors such as symmetry, crown width, fullness of branching, single or single dominant leader, age, specialized pruning techniques, or uniqueness of the plant.

Street Tree – Not a specimen tree but a standard tree with a trunk clear of branches up to a specified height on the tree. Per ANSI Z60.1 Section 1.1.2.4, 2004, “The height of branching specification shall bear a relationship to the size and kind of tree, so that the crown of the tree is in good balance with the trunk.”

Submergent - Plants/vegetation that grow under water.

Tackifier - Material sprayed onto a soil surface to bind soil particles and prevent erosion.

Tuber - Underground stem which stores food and plant energy from which the plant propagates.

Unadulterated Wood - Unadulterated wood means wood that is not painted or treated with chemicals such as glues, preservatives or adhesives. Any painted wood or chemically treated wood (e.g., pressure treated wood, treated railroad ties) or wood containing glues or adhesives (e.g., plywood, particle board) is considered adulterated wood.

Utility Annual Work Permit. - "Annual Work Permits" are available on a Region-wide basis for the maintenance of a utility’s facilities. Examples of work which can be performed under this permit include pruning of trees, emergency repairs, routine maintenance and service connections. Examples of work not authorized by this permit, and requiring a Highway Work Permit include replacement of poles, or other utility facilities which are obsolete or near life expectancy.

Vegetated Buffer - Vegetated buffers are areas of natural or established vegetation maintained to protect the water quality of neighboring areas. Buffer zones slow stormwater runoff, provide an area where runoff can permeate the soil, contribute to ground water recharge, and filter sediment.

Vegetation - The total plant communities that are growing on the earth, a piece of land or project site.
Vegetation Control – As per Title 17 NYCRR Parts 134 and 150
“Vegetation Control” means any activity intended to limit or regulate the growth or survival of vegetation, including, but not limited to, cutting, excavating, pruning, removing, trimming or mowing.

Viewing Zone - As per Title 17 NYCRR Parts 134 and 150 -
Viewing Zone means the triangular shaped area bounded by a line perpendicular to the highway center line and starting at the point on an advertising sign furthest from the highway center line and a line continuing along the highway center line for a distance of 500 feet (152.5m) in the direction the sign is facing, to a third point on the highway center line, and then closing by a hypotenuse between the first and third points. A sign structure may have two Viewing Zones if signs on the common structure face in substantially different directions.

Vertical Composting Reactors – Vertical composting reactors are generally over 4 yards high and can be housed in silos or other large structures. Organic material is typically fed into the reactor at the top through a distribution mechanism, and flows by gravity to an unloading mechanism at the bottom.

Wetland - Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wildflowers – Native flowering herbaceous annual, biennial, or perennial plants that are typically associated with a site’s early successional stage of plant occupation.

Windrow Composting – The composting method in which a compost mixture is placed in elongated piles, called windrows. These windrows are aerated naturally by a chimney effect, by mechanically turning the piles with a machine such as a front-end loader or specially designed equipment, and/or by forced aeration.

Within-vessel Composting – These systems are also known as horizontal and vertical reactors. These systems are closed systems.
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Vegetation Control Permits for Advertising Signs

Part 134

(Statutory Authority: Highway Law §52, §88; Transportation Law, §14; Vehicle and Traffic Law, §1220-a)

Vegetation Control Permits Legislation

Vegetation Control Permits Checklist

9/6/2012

§28A
APPENDIX 28A
Vegetation Control Permits for Advertising Signs

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NEW YORK STATE DEPARTMENT OF TRANSPORTATION

WILDFLOWER WAIVER REQUEST

TO: Project File

FROM: __________________________, Regional Environmental Unit Supervisor, Region ___

SUBJECT: PIN #: Project Type:
Route: • Interstate NHS > $ 1 million _________
County: • Other _________

DATE:

I request this waiver from the requirements for planting wildflowers (Section 130 of the Surface Transportation and Uniform Relocation Assistance Act of 1987) on the basis of my investigation of the project location and my certification of the following:

Native wildflowers cannot be grown satisfactorily because:

_____ Planting areas are inaccessible for maintenance
_____ Soils or other environmental conditions are not suitable for sustaining wildflowers

There are no available planting areas because:

_____ Available planting areas are mowed regularly
_____ Available planting areas are in drainage ways
_____ The project is abutted by maintained lawns
_____ The project is located in an urban environment
_____ Available planting areas have slopes steeper than 3:1 and/or erosion control is primary consideration

Additional Comments: ____________________________________________________________

This waiver has been: APPROVED ______ DISAPPROVED: ________

SIGNED: __________________________ DATE: __________________

Reasons for disapproval: _______________________________________________________

____________________________________
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This information is not required for the standard specification. It is provided for the Landscape Architect’s use in developing special specifications. The principal factors influencing seed quality are purity and germination. Purity is not identified by that name on the label. However, it is the percent, by weight, of pure seed of an identified species and cultivar in a lot of seed. For example, 25.3% of the mix (by Weight) in Table 6 is pure Seed A.

Table 28-1: Sample Seed Label

<table>
<thead>
<tr>
<th>Ace Seed Co., Inc.</th>
<th>Lot No. 123</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Textured Species Germ.</td>
<td></td>
</tr>
<tr>
<td>25.3% Seed A</td>
<td>82%</td>
</tr>
<tr>
<td>27.2% Seed B</td>
<td>86%</td>
</tr>
<tr>
<td>41.6% Seed C</td>
<td>95%</td>
</tr>
<tr>
<td>Coarse Textured Species None Claimed</td>
<td></td>
</tr>
<tr>
<td>Other ingredients</td>
<td></td>
</tr>
<tr>
<td>0.5% Weed Seed</td>
<td></td>
</tr>
<tr>
<td>4.2% Inert Matter</td>
<td></td>
</tr>
<tr>
<td>1.2% Crop Seed Test</td>
<td></td>
</tr>
<tr>
<td>9/2009</td>
<td></td>
</tr>
<tr>
<td>200 lbs. Net Wt.</td>
<td></td>
</tr>
</tbody>
</table>

Purity is an important number on the label; however, it is an indication of quantity not quality. The germination listed for each identified species and cultivar represents the percent of pure seed that is alive and will germinate under laboratory conditions. If the seed type has a low germination and/or purity a higher percent by weight will be required.

Pure Live Seed
Pure live seed is the true indication of seed quality. This is determined by multiplying the germination by the purity and dividing by 100 to get the percentage of pure live seed.

\[
\frac{(\text{Germ} \times \text{Purity})}{100} = \text{PLS} \%
\]
This total means that over 83% of the contents of that mix is viable, pure seed that will produce grass seedlings when properly established.

### Table 28-2: Example of how seeding information is used to determine live seed per acre

<table>
<thead>
<tr>
<th>Example</th>
<th>The specifications require 160 lbs PLS/Acre of the following mix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seed A 80% min. Germ.</td>
</tr>
<tr>
<td></td>
<td>Seed B 85% min. Germ.</td>
</tr>
<tr>
<td></td>
<td>Seed C 95% min. Germ.</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>160 lbs PLS/A</strong></td>
</tr>
</tbody>
</table>

The label shown in Table 4 is on the seed bags delivered to the project and is in one acre lots as the specifications require.

The percentage and number of pounds of pure live seed in this mix are calculated as follows:

- Seed A (82% Germ. x 25.3% purity)/100 = 20.75% PLS x 200 lbs = 41.5 lbs PLS
- Seed B (86% Germ. x 27.2% purity)/100 = 23.39% PLS x 200 lbs = 46.78 lbs PLS
- Seed C (95% Germ. x 41.6% purity)/100 = 39.52% PLS x 200 lbs = 79.04 lbs PLS

**Total = 167.32 lbs PLS**
The delivered seeds meet the specification.

Other Ingredients in a Mix
It is difficult, if not impossible to keep seed production fields free of weeds. As a result, weed seeds are harvested along with grass seeds. It is also difficult to clean all of the chaff, stems and leaves out of the seed. Therefore, a certain percentage of the material in virtually every seed container or bag will contain weed seeds. The same is the case with various unintended crop seeds and inert matter.

A crop seed includes plant species grown for profit, such as tall fescue, bromegrass and others. However, there is no requirement to list which species are present in a container or bag unless the total percentage (by Weight) of all the crop seeds exceeds 5 percent. If the crop seed exceeds 5 percent, the species must be listed. This can be important if you are seeding lawns. For example, a Kentucky bluegrass blend contaminated with tall fescue could result in a poor quality lawn.
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Fertilizers are identified with large bold numbers on the fertilizer container. These numbers refer to the percentage of “primary” nutrients in the container. Using the label above the bag contains:

- 10 percent nitrogen
- 6 percent phosphate
- 4 percent potassium.

<table>
<thead>
<tr>
<th>Bag Weight</th>
<th>% of Nutrients</th>
<th>Pounds of Nutrients</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 lbs</td>
<td>x 0.10</td>
<td>= 5 lbs of nitrogen</td>
</tr>
<tr>
<td>50 lbs</td>
<td>x 0.06</td>
<td>= 3 lbs of phosphate</td>
</tr>
<tr>
<td>50 lbs</td>
<td>x 0.04</td>
<td>= 2 lbs of potassium</td>
</tr>
</tbody>
</table>

10 lbs. (total weight of nutrients)

The total weight of the nutrients will never equal the weight of the container. The remainder of the container is comprised of a mixture of one or more “secondary” micronutrients (trace elements) and a filler material.

To calculate the application rate for the fertilizer the Landscape Architect would use the coverage rate listed on the package or the results of a soil test.
An example of using the coverage area listed on the bag

<table>
<thead>
<tr>
<th>Total weight of Nutrients foot</th>
<th>Coverage Area Listed on Bag</th>
<th>Weight of Nutrient per square ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 lbs</td>
<td>10,000 sq. ft</td>
<td>0.0005 lbs of nitrogen/ ft(^2)</td>
</tr>
<tr>
<td>3 lbs</td>
<td>10,000 sq ft</td>
<td>0.00003 lbs of phosphorus/ ft(^2)</td>
</tr>
<tr>
<td>2 lbs</td>
<td>10,000 sq ft</td>
<td>0.00002 lbs of potassium/ ft(^2)</td>
</tr>
</tbody>
</table>

Applying the fertilizer according to the results of a soil test requires converting the total weight of the nutrients in the bag of fertilizer to lbs/ ft\(^2\) because soil test recommendations are expressed in terms of lbs/ square foot or lbs/1,000 square feet.

Area to fertilize
40 ft x 60 ft = 2,400 ft\(^2\)

Soil test recommends 0.5 lbs of nitrogen per 1,000 square feet
(2,400 ft\(^2\) ÷ 1,000 ft\(^2\)) x 0.5 lbs of nitrogen = 1.2 lbs of nitrogen

(1.2 lbs of nitrogen x 50 lb bag) ÷ 5 lbs of nitrogen/bag = 12 lbs

The applicator would need to apply 12 lbs of fertilizer to the area.
Introduction

In recent decades, economic benefits in all corners of New York State have grown because the forests have grown. While New York is currently 61% forested, just 80 years ago the state contained only half this area of forest. The increased forest supports a critically important wood products industry. The Department of Environmental Conservation (DEC) encourages the utilization of forest products resulting from our construction activities rather than the material finding its way into a landfill. In addition there is a growing interest in biomass by New York’s industries. This provides a market for lower grade forest products that may be present on our projects and rights of way. Biomass as defined here is plant matter grown or harvested to generate electricity or produce heat. For example, forest residues (such as dead trees, branches and tree stumps), yard clippings and wood chips may be used as biomass. Examples of such industries in New York State may be found on DEC’s Program Publications and Resources web site. (http://www.dec.ny.gov/lands/4963.html)

Table 28F-1: Annual Revenues from New York Forests \(^1\)

<table>
<thead>
<tr>
<th>Total values and per forested acre basis</th>
<th>Millions of $</th>
<th>$ per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest-based manufacturing value of shipments</td>
<td>$6,911</td>
<td>$374</td>
</tr>
<tr>
<td>Forest-related recreation and tourism</td>
<td>1,877</td>
<td>102</td>
</tr>
<tr>
<td>Christmas trees/maple products</td>
<td>25</td>
<td>1.3</td>
</tr>
<tr>
<td>Totals</td>
<td>$8,813 million</td>
<td>477.3</td>
</tr>
</tbody>
</table>

28F.1 Project Initiation/Scoping Stage:

The NYSDOT Regional Landscape Architect (RLA) is responsible to ensure that any significant stands of forest products or of forest products of significant value that may be potentially affected by the project are identified.

28F.2 Preliminary Design (Design Phases I through IV):

If the forest cover affected involves two or more acres of potentially marketable forest products or contains forest products of significant value the RLA will notify the appropriate DEC Regional

---

\(^1\) "The Economic Importance of New York’s Forests", North East State Foresters Association, Published August, 2007 using 2005 or better data.
Forester in writing. This notification should occur prior to design approval to provide the Regional DEC staff with enough time to consult with our Department on a recommended plan for the marketable forest products.

A copy of the notification to the DEC Regional Forester should also be sent to:

Forest Utilization Program  
Private Land Services Bureau  
Division of Lands and Forests  
NYSDEC  
625 Broadway, Albany, NY 12233-4253

28F.3 Advanced Detailed Plans (Design Phase V):

If marketable forest products or forest products of significant value are present on the proposed project the RLA will continue to coordinate with the DEC Regional Forester as needed.

The contract documents will provide the information needed for the contractor to make a decision as to whether to salvage the marketable forest products. For example, location, type of materials, size or other information as recommended by DEC and the Regional Construction staff.

28F.4 Final Plans, Specs. & Estimate (Design Phase VI):

The PS&E transmittal letter shall contain a brief summary stating whether or not there are marketable forest products on the project. If marketable products are present the summary should also indicate whether DEC intends to promote their salvage. Also note this under “Other Environmental Issues/Notes” on the project’s ECOPAC.

Potential buyers or markets for marketable forest products may be found through the Department of Environmental Conservation (DEC) web site or by consulting with DEC’s Regional Foresters. DEC maintains a list of Cooperating Timber Harvesters and sawmills. Additional buyers can be located by using the services of a consulting forester. A list of Cooperating Foresters is also available through DEC.

28F.5 Construction Stage

When potentially marketable forest products have been identified the RLA will provide the EIC and NYSDOT Regional Construction Environmental Coordinator (CEC) with DEC’s web site and the DEC Regional Forester’s contact information.

Potentially marketable forest products are to be drawn to the Contractor’s attention at the pre-construction meetings. The DEC Regional Forester should be invited to the pre-construction meeting. The project’s EIC will facilitate a discussion with the Contractor, the NYSDOT RLA and CEC and the DEC Regional Forester regarding the disposition of marketable forest products prior to commencing any removal activities. The Contractor shall submit their written plan for all potentially marketable forest products or demonstrate why the salvage of such material is not feasible. There may be economic advantages to salvaging the marketable forest products. The EIC documents the decision and monitors the direction chosen.
Professional forestry assistance should be obtained before undertaking any timber harvest. Information and assistance in using Best Management Practices for forest management activities can be found at many federal, state and local organizations.

Some of these organizations include:

- Catskill Forest Association (845) 586-3054
- Cornell County Cooperative Extension (607) 255-4696
- County Soil and Water Conservation Districts (See telephone book for local number)
- Empire State Forest Products Association (518) 463-1297
- New York City Department of Environmental Protection (718) 337-4357
- New York Forest Owners Association (800) 836-3566
- New York State Department of Environmental Conservation (518) 402-9425
- New York Tree Farm (800) 836-3566
- Society of American Foresters (301) 897-8720
- State University of New York College of Environmental Science and Forestry (315) 470-6500
- USDA Forest Service (603) 868-7616
- USDA Natural Resource Conservation Service (315) 423-5076
- Watershed Agricultural Council - Forestry Program (607) 865-7790

Additional Resources are available on DEC’s web site for Lands and Forests, including a list of area foresters for New York State. [http://www.dec.ny.gov/lands/46800.html](http://www.dec.ny.gov/lands/46800.html)
Sample Corridor Plans:

1. I-87 Northway - Region 1
2.
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APPENDIX 28H
Sample Tables, Typical Sections & Special Notes for Contracts

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<table>
<thead>
<tr>
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<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
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<td>Sample Tables</td>
<td>28H-1</td>
</tr>
<tr>
<td>28H.2</td>
<td>Sample Typical Sections</td>
<td>28H-2</td>
</tr>
<tr>
<td>28H.3</td>
<td>Sample Special Notes</td>
<td>28H-3</td>
</tr>
</tbody>
</table>

28H.1 SAMPLE TABLES

Region 7’s excel table for landscape development items

Region 7’s table for landscape development items (pdf format)

LANDSCAPE DEVELOPMENT GENERAL NOTES AND TABLES

SECTION 610 - GROUND VEGETATION

<table>
<thead>
<tr>
<th>STATION</th>
<th>TYPE</th>
<th>SIDE</th>
<th>m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTRACT LIMITS</td>
<td>C - LAWN SEED MIX</td>
<td>LT &amp; RT</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>200</td>
</tr>
</tbody>
</table>

09/06/2012  §28H
28H.2 SAMPLE TYPICAL SECTIONS

Refer to the Highway Design Manual (HDM) Chapter 3 for typical sections.
28H.3 SAMPLE SPECIAL NOTES

- 610.0701 MYCORRHIZAL FUNGI: THE CONTRACTOR SHALL APPLY MYCORRHIZAL FUNGI TO ALL PLANTING PITS AND PLANTING BEDS.

- 610.1602 TURF ESTABLISHMENT- LAWNS
  SEED MIX: AS PER SECTION 713-04 OF THE SPECIFICATIONS. TYPE C - LAWN SEED MIX AS DESIGNATED ON THE PLANS.

- 611-2.02 - PLANTING MATERIALS
  TOPSOIL: 713-01 TOPSOIL, TYPE B.2. LAWN
  MULCH: 713-05 WOOD CHIPS, TYPE D. SHREDDED BARK MULCH
  COMPOST: 713-15 ORGANIC MATERIAL E: WELL ROTTED MANURE
  MATERIALS FOR THE PROTECTION OF PLANTS: 713-08 TREES SHALL BE STAKED. 713-08 ANTI-DESICCANT

- 3.05H ANTI-DESICCANTS: ALL PLANTS, EXCEPT SEEDLINGS AND ROOTED CUTTINGS, SHALL BE SPRAYED WITH AN ANTI-DESICCANT MEETING THE REQUIREMENTS OF 713-08, MATERIALS FOR PROTECTION OF PLANTS. THE ANTI-DESICCANT SHALL BE APPLIED ACCORDING TO THE MANUFACTURER’S DIRECTIONS TO THOROUGHLY COVER ALL ABOVE GROUND PARTS.

- 713-08 MATERIALS FOR PROTECTION OF PLANTS: THE CONTRACTOR SHALL STAKE ALL TREES INSTALLED ON A SLOPE OF 1 ON 3 OR GREATER

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28I.1 Woody Plants for Soil Bioengineering

Woody plants with fair to good or better rooting ability from unrooted cuttings.

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baccharis halimifolia*</td>
<td>Eastern baccharis</td>
</tr>
<tr>
<td>Cephalanthus occidentalis*</td>
<td>Buttonbush</td>
</tr>
<tr>
<td>Cornus amomum*</td>
<td>Silky dogwood</td>
</tr>
<tr>
<td>Cornus drummondii</td>
<td>Roughleaf dogwood</td>
</tr>
<tr>
<td>Cornus foemina*</td>
<td>Stiff dogwood</td>
</tr>
<tr>
<td>Cornus racemosa</td>
<td>Gray dogwood</td>
</tr>
<tr>
<td>Cornus rugosa</td>
<td>Roundleaf dogwood</td>
</tr>
<tr>
<td>Cornus sericea ssp. sericea</td>
<td>Red-osier dogwood</td>
</tr>
<tr>
<td>Physocarpus opulifolius*</td>
<td>Common ninebark</td>
</tr>
<tr>
<td>Populus balsamifera</td>
<td>Balsam poplar</td>
</tr>
<tr>
<td>Populus deltoides*</td>
<td>Eastern cottonwood</td>
</tr>
<tr>
<td>Rosa palustris</td>
<td>Swamp rose</td>
</tr>
<tr>
<td>Rosa virginiana</td>
<td>Virginia rose</td>
</tr>
<tr>
<td>Rubus allegheniensis</td>
<td>Allegheny blackberry</td>
</tr>
<tr>
<td>Rubus idaeus ssp. strigosus*</td>
<td>Red raspberry</td>
</tr>
<tr>
<td>Salix amygdaloides*</td>
<td>Peachleaf willow</td>
</tr>
<tr>
<td>Salix discolor*</td>
<td>Pussy willow</td>
</tr>
<tr>
<td>Salix exigua</td>
<td>Coyote willow</td>
</tr>
<tr>
<td>Salix humilis</td>
<td>Prairie willow</td>
</tr>
<tr>
<td>Salix interior</td>
<td>Sandbar willow</td>
</tr>
<tr>
<td>Salix lucida</td>
<td>Shining willow</td>
</tr>
<tr>
<td>Salix lutea</td>
<td>Yellow willow</td>
</tr>
<tr>
<td>Salix nigra*</td>
<td>Black willow</td>
</tr>
<tr>
<td>Salix purpurea</td>
<td>Purpleosier willow</td>
</tr>
<tr>
<td>Sambucus canadensis*</td>
<td>American elder</td>
</tr>
<tr>
<td>Sambucus racemosa ssp. pubens*</td>
<td>Red elderberry</td>
</tr>
<tr>
<td>Spiraea alba*</td>
<td>Meadowsweet spirea</td>
</tr>
<tr>
<td>Symphoricarpos albus*</td>
<td>Snowberry</td>
</tr>
<tr>
<td>Viburnum dentatum*</td>
<td>Arrowwood</td>
</tr>
<tr>
<td>Viburnum lantanoides</td>
<td>Hobblebush viburnum</td>
</tr>
<tr>
<td>Viburnum lentago*</td>
<td>Nannyberry</td>
</tr>
</tbody>
</table>

(*) - Denotes native to New York.
### 28I.2 Grasses for Soil Bioengineering

Grasses useful in conjunction with soil bioengineering/biotechnical engineering erosion control.

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrostis alba</td>
<td>Redtop</td>
</tr>
<tr>
<td>Ammophila breviligulata</td>
<td>American beachgrass</td>
</tr>
<tr>
<td>Andropogon gerardii*</td>
<td>Big bluestem</td>
</tr>
<tr>
<td>Arundo donax</td>
<td>Giant reed</td>
</tr>
<tr>
<td>Elymus virginicus</td>
<td>Wildrye</td>
</tr>
<tr>
<td>Eragrostis trichodes</td>
<td>Sand lovegrass</td>
</tr>
<tr>
<td>Festuca rubra</td>
<td>Red fescue</td>
</tr>
<tr>
<td>Hemarthria altissima</td>
<td>Limpograss</td>
</tr>
<tr>
<td>Lolium perenne</td>
<td>Perennial ryegrass</td>
</tr>
<tr>
<td>Panicum amarulum</td>
<td>Coastal panicgrass</td>
</tr>
<tr>
<td>Panicum clandestinum</td>
<td>Deertongue</td>
</tr>
<tr>
<td>Panucum virgatum*</td>
<td>Switchgrass</td>
</tr>
<tr>
<td>Phalaris arundinacea</td>
<td>Reed canarygrass</td>
</tr>
<tr>
<td>Poa pratensis</td>
<td>Kentucky bluegrass</td>
</tr>
<tr>
<td>Schizachyrium scoparium*</td>
<td>Little bluestem</td>
</tr>
<tr>
<td>Sorghastrum nutans*</td>
<td>Indian grass</td>
</tr>
<tr>
<td>Spartina pectinata*</td>
<td>Prairie cordgrass</td>
</tr>
<tr>
<td>Zizaniopsis miliacea</td>
<td>Giant cutgrass</td>
</tr>
</tbody>
</table>

(*) - Denotes native to New York.

### 28I .3 Salvage or collected materials

Cattails
Alnus roots
Swamp grasses/forbs-blueflag, sagittaria, filbert
Hammamelis