800
Vegetation

General

Washington State Department of Transportation (WSDOT) practices an ecologically based program of roadside vegetation design and management that seeks to produce low-maintenance, self-sustaining plant communities. The use of native plants planted in the right location is integral to this system. The *Roadside Classification Plan* provides policy on roadside character classifications and appropriate treatment levels for revegetation.

Revegetation plans are an important part of many highway projects and are required when the project disturbs the roadside. The inclusion of a WSDOT Landscape Architect in the design development process can aid the design process and improve the environmental and visual quality of Washington's roadsides.

References

- *Construction Manual* M 41-01
- *Design Manual* M 22-01
- *Highway Runoff Manual* M 31-16
- *Hydraulics Manual* M 23-03
- *Integrated Vegetation Management for Roadsides,* WSDOT
- *Maintenance Manual* M 51-01
- *Roadside Classification Plan* M 25-31. (Includes the "Roadside Classification Log.")
- *Standard Specifications for Road, Bridge and Municipal Construction* M 41-10
- *Utilities Accommodation Policy* M 22-86
- Corridor management plans for Scenic and Recreational Highways
- RCW 17.10 State Noxious Weed List. The site below links to information on noxious weeds: http://www.wsdot.wa.gov/biz/maintenance/htm/weeds.htm
- RCW 47.40 Roadside Improvement and Beautification. Outlines permit process for persons wishing to use highway right of way for improvement and beautification. Establishes penalty for destroying native flora on state lands. Mandates litter removal, and authorizes state and local Adopt-a-Highway programs.

- WAC 173-270-040 *Vegetation Management Program*.
  States that the purposes of vegetation management in highway rights of way are to establish and maintain stable plant communities that resist encroachment by undesirable plants, noxious weeds, and other pests; meet WSDOT operational, health, natural resources and environmental standards; be cost effective; and protect the public investment with minimal negative impacts on the environment. Requires a vegetation management program for all state highways with the Puget Sound basin.
- WAC 468-34-340 Preservation, restoration and cleanup of areas disturbed through utility installation, maintenance and repairs. Outlines criteria for utility use of highway right of way, requires utilities to repair or replace unnecessarily removed or disfigured trees and shrub, and specifies vegetation management practices.

Resources

The region's Landscape Architects

The region's Maintenance Office

HQ Design Office Roadside and Site Development Unit

HQ Horticulturist

HQ Maintenance & Operations Program (M&OP) Landscape Architect

Heritage Corridors Program (when working in a Scenic and Recreational Highway corridor)

Washington State Noxious Weed Control Board:
http://www.wa.gov/agr/weedboard/index.html

Definitions

blend To create a balanced, visually harmonious interface between adjacent elements. A roadside treatment strategy that integrates roadside elements to preserve roadside character continuity.

buffer The zone contiguous with a sensitive area that is required for the continued maintenance, protection, insulation, function, and structural stability of the sensitive area. The critical functions of a riparian buffer (those associated with an aquatic system) include shading, input of organic debris and coarse sediments, uptake of nutrients, stabilization of banks, interception of fine sediments, filtering of pollutants, overflow during high water events, protection from disturbance by humans and domestic animals, maintenance of wildlife habitat, and room for variation of aquatic system boundaries over time due to hydrologic or climatic effects. The critical functions of terrestrial buffers include protection of

slope stability, attenuation of surface water flows from storm water runoff and precipitation, and erosion control.[1]

climax vegetation A stable end-point to plant succession ("steady state") where a group of species predominate and replaces itself.[2]

corridor management plans A written document that specifies the actions, procedures, controls, operational practices, and administrative strategies to maintain the scenic, historic, recreational, cultural, archeological, and natural qualities of a Scenic and Recreational Highway.

cuttings Live plant material without a previously developed root system. Source materials for cuttings should be dormant when the cutting is taken.

ecological succession The natural tendency of plant communities to evolve over time.

enclose A roadside treatment strategy, the aim of which is a more or less permeable buffer between two adjacent elements, typically the roadway and adjoining lands. Roadside treatments, such as berms, structures, or vegetation, are used to provide visual buffers along both sides of the road. In Figure 800.1 vegetation provides a sense of enclosure for the roadway.

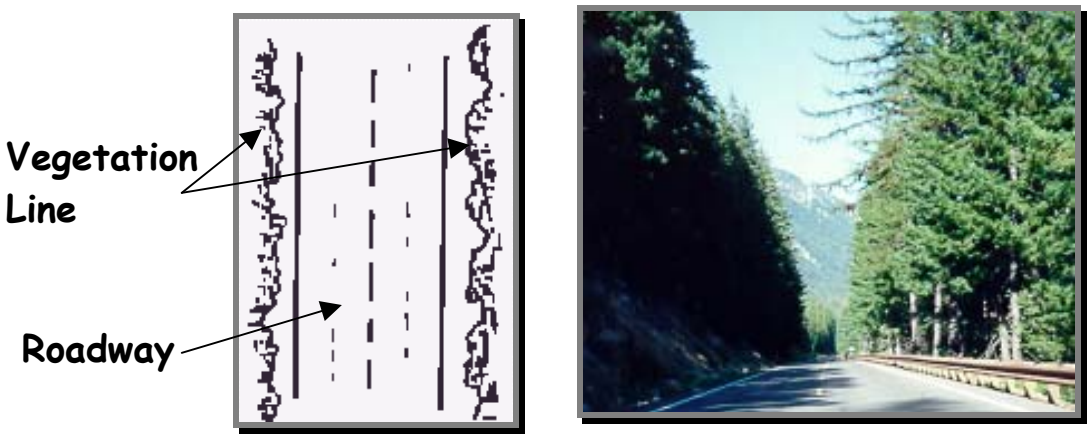

Figure 800.1 Vegetation enclosing the highway

expose A roadside treatment strategy, the aim of which is to preserve or open a visual sight line, or remove vegetation for operational purposes, such as in the Design Clear Zone.

forb An herbaceous plant, such as clover, which is not a grass, sedge, or rush.

groundcover Low-growing plants that form a dense, extensive growth and tend to prevent weeds and soil erosion.

[1] *Highway Runoff Manual* M 31-16. WSDOT, pp Glossary 1-2.
[2] Oliver and Larson, p. 147.

herb Any flowering plant except those developing persistent woody bases and stems above ground.

live poles A form of cutting taken from woody vegetation with a diameter greater than 50 mm (2 inches).

live stakes A form of cutting taken from one to two year old woody vegetation with a diameter of less than 50 mm (2 inches).

native plant A plant occurring naturally in a particular region, ecosystem, or habitat at the time of European settlement.

plant material Trees, shrubs, ground covers, cuttings, live stakes, live poles, rhizomes, tubers, rootstock, and seedlings are referred to collectively as "plants" or "plant material."

reference site An established undisturbed natural site that is used as a comparative design guide to help determine the desired plant composition and species densities for the created, or enhanced project site. It should be located near the project site, preferably within the same watershed, and have similar landscape setting, hydrology and topography.

rhizome A root-like, usually horizontal stem, growing under or along the ground that sends out roots from its lower surface and leaves, or shoots from its upper surface. The primary means by which some plants spread or reproduce.

roadside classification Any of five classifications given to a route or stretch of roadway through a review process conducted by WSDOT, and documented in the WSDOT "Roadside Classification Log." Roadside character classifications fall within two categories: natural and built. *Natural* includes the Open and Forest roadside character classification. *Built* includes the Rural, Semiurban, and Urban roadside character classifications.

roadside restoration The use of planning, design, construction, and maintenance activities to restore roadside plant communities according to designated roadside character and *Roadside Classification Plan* provisions.

roadside treatment strategies Conceptual design strategies used to coordinate implementation of roadside guidelines and fulfill roadside functions. The three basic treatment strategies are enclose/screen, expose, and blend.

Scenic and Recreational Highways A public road having special scenic, historic, recreational, cultural, archeological, and/or natural qualities that have been recognized as such through legislation or some other official declaration. The terms "byway," "road," and "highway" are synonymous. They are not meant to define higher or lower functional classifications or wider or narrower cross-sections. Moreover, the terms State Scenic Byway, National Scenic Byway, or All-American Road

refer not only to the road or highway itself but also to the corridor through which it passes.

screen The use of roadside treatments such as vegetation, berms, or walls to visually block undesirable views, as seen in Figure 800.2. In the picture to the right, below, vegetation is used as a permeable screen for the noise wall.

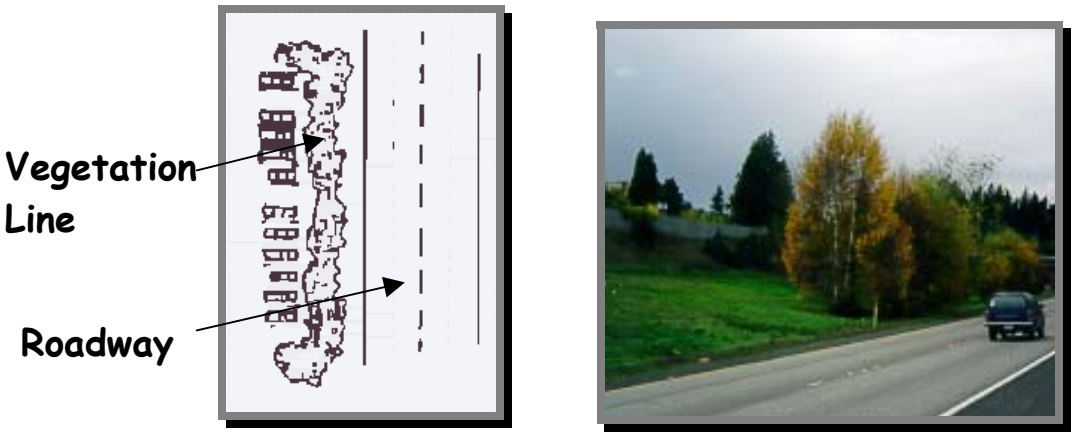

Figure 800.2 Use of vegetation to screen a wall

seedlings Plants grown from cuttings, seeds, or other approved propagation methods. They are generally under 3 years old and under 2 ft in height. Measurement is by height, in 3 inch increments, or by age and number of times transplanted.

shrub A low, woody plant having several stems.

sustainable roadsides Those roadsides that are designed with the intent of integrating successful operational, environmental, and visual functions with low life cycle costs.

tuber A swollen, usually underground stem, such as the potato, bearing buds from which new plant shoots arise.

weed Any plant growing in a location in which it is not desired. A plant growing out of place.

wildflowers Native flowering plants including flowering herbs, shrubs and trees.

xeriscape A landscaping concept based on water conservation through the use of plant materials and techniques appropriate for dry climates or site conditions.

Vegetation

Functions of Vegetation

Vegetation has many functions and adds significant value to our environment. These functions include:

- Traffic calming
- Stress reduction
- Buffer or shade for pedestrian or park and ride facilities
- Stream bank stabilization
- Wetland mitigation
- Water quality improvement
- Water retention and smoother flows
- Air pollution mitigation
- Noise abatement
- Wildlife habitat
- Enclose, screen, expose, or blend
- Visual quality, quality of life
- Corridor continuity
- Roadside Character Classification as noted in the *Roadside Classification Plan*

Roadside Vegetation

Existing vegetation alone often meets roadside function requirements but revegetation projects are initiated after disturbance or for improvement projects. For revegetation of roadside areas disturbed during roadway projects, contact the region's Landscape Architect or the HQ Roadside and Site Development Unit in regions without a landscape architect. They will provide planting designs and seeding specifications. All planting plans require the stamp and signature of a Landscape Architect.

Revegetation activities range from seeding grasses to installing diverse plant communities. Roadside revegetation can include planting trees, shrubs, ground covers, live stakes, live poles, rhizomes, tubers, rootstock, seedlings, and seeds. See the *Standard Specifications* for information on plant specification.

Important additional functions of vegetation include:

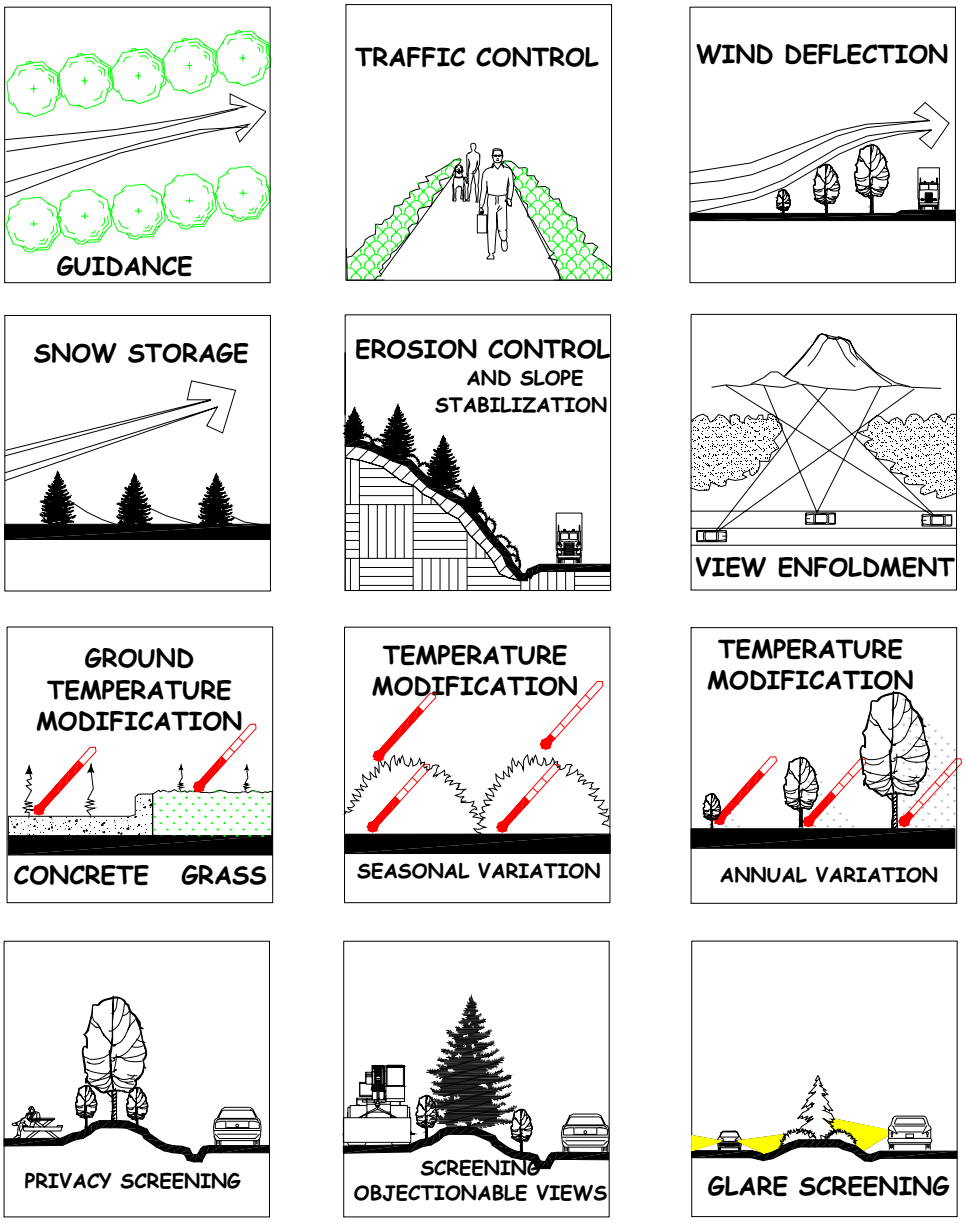

Figure 800.3 Examples of Some Functions of Roadside Vegetation

General Guidelines for Roadside Vegetation

- Protect existing desirable vegetation.
- Maintain Design Clear Zone and sight distance according to the *Design Manual*.
- Maintain, restore, or enhance roadside functions.

- Maintain, restore, or enhance roadside character classifications (Forest, Open, Rural, Semiurban, Urban).
- Implement Treatment Levels in the *Roadside Classification Plan*.
- Implement treatment strategies (enclose/screen, expose, blend).
- Choose the right plant for the right place, for example use shrubs on the outside of curves or within the clear zone.
- Provide complete vegetative cover, where possible.
- Encourage desirable volunteer growth by allowing natural succession to take place.
- Install, protect, and enhance desirable native plant material.
- Discourage invasive species and noxious weeds.
- Use Integrated Vegetation Management techniques.
- Perform soil analyses to determine if soil amendments are necessary.
- Provide topsoil and/or amend existing soils when installing projects where it will improve plant survivability.
- Design for self-sustaining plant communities to minimize long term maintenance.
- Minimize requirements for fertilizer and pesticide use.

Planning

Roadside Classification Plan

The RCP coordinates and guides the management of Washington State highway roadsides, including planning, design, construction, and maintenance activities. The RCP provides extensive roadside vegetation management guidance, including:

- Treatment level guidelines for Forest, Open, Rural, Semiurban, and Urban roadside character classifications.
- Treatment tools (landform, vegetation, and structure) used to restore roadside character.

The *Roadside Classification Plan* advocates the use of native plants, Integrated Vegetation Management, and a long-term management approach to achieve sustainable roadsides.

Integrated Vegetation Management (IVM)

Integrated Vegetation Management is a coordinated decision-making and action process that uses the most appropriate vegetation management

methods and strategy, along with a monitoring and evaluation system, to achieve roadside maintenance program goals and objectives in an environmentally and economically sound manner.

Tactics selected are site specific. Chemical controls are used only when needed. IVM uses plant growth characteristics, principles of succession, and knowledge of natural and human-related factors affecting environmental change to achieve management goals, while minimizing impacts on the environment. For details, refer to *Integrated Vegetation Management for Roadsides*.

Corridor Management Plans

Corridor Management Plans identify the location of a Scenic and Recreational Highway route and its corridor. Revegetation plans can be affected due to the high visibility of these corridors. The maintenance of existing vegetation can also be affected.

Design

It is WSDOT policy to use native plants, including wildflowers to the greatest extent practical. Wildflowers include native woody flowering shrubs and trees.

Species diversity, within the context of native plant associations, is encouraged. A diverse plant mix is less susceptible to disease and homogeneous decline.

Landscape Architects develop PS&E packages that include plant materials lists. Plant material selection is based on site-specific requirements.

Wherever practical, use a separate contract for planting projects. This usually results in better revegetation projects and it allows the roadway project to close out before the plant establishment period ends.

Landscape Plans, and any other plans that specify plants, require the stamp and signature of the Landscape Architect.

Design Criteria

Refer to the maintenance Functional Zone Objectives in Division 1. Select and locate plants with the following criteria in mind to avoid future problems and to avoid increased or difficult maintenance.

- **Sight Distance** Design for and maintain sight distance for motorist, bicycle, and pedestrian traffic. Sight distance is also a security issue for safety rest areas, park and ride lots, pedestrian facilities, and bicycle facilities (see the *Design Manual*).

- **Design Clear Zone** The Design Clear Zone is a function of posted speed, side slope, and traffic volume. Do not locate trees that can grow over four inches in trunk diameter in the Design Clear Zone (see the *Design Manual*). Shrubs are appropriate for this zone.
- **Traffic Barriers** Set shrubs and ground cover plants a minimum of 2 ft and trees a minimum of 6 ft from traffic barriers to reduce maintenance.
- **Vertical Clearance** Provide appropriate setbacks for trees that might overhang the roadway. When trees do overhang the roadway, provide a minimum vertical clearance of 16 ft. Minimum vertical clearance over trails and pedestrian facilities is 10 ft.
- **Medians and Gore Areas** Design medians and gore areas to be a minimum of 10 ft wide. Narrower areas tend to be a problem for maintenance personnel, are expensive to irrigate, and generally are unsatisfactory for revegetation. Consider paving, stone, or other bare surface material in gore areas less than 10 ft wide.
- **Right of Way Line** Place trees and shrubs a minimum of 6 ft inside the right of way line.
- **Curb Lines of City Streets** Comply with local agency standards and WSDOT sight distance criteria for revegetation.
- **Structures** Locate trees as far back from structures as necessary to avoid operational conflicts and the need for excessive pruning.
- **Trails** Set back evergreen trees with branches less than 2 m (6 ft) from the ground a minimum of 6 m (20 ft) from trails. Select species native to the area wherever possible. Set back shrubs higher than 1.5 m (5 ft) a minimum of 2.4 m (8 ft) from trails, for security purposes.
- **Other Roadside Features** Do not locate vegetation that will interfere with signs, signals, or luminaires. Trees and shrubs can provide visual background for signs.
- **Utilities** Refer to the *Utilities Accommodation Policy* for guidance. Avoid impacting utility lines and sewer systems.
- **Corridor Management Plans** Where applicable consult these plans to enhance corridor continuity and to reinforce the character of the Scenic and Recreational Highway.

Plant Material Selection

Plant material selection is based on a site analysis of conditions, maintenance Functional Zone Objectives, plant availability, plant cost, plant success rates in the field, traffic speed, and other horticultural requirements.

Follow these general guidelines for plant material selection for grasses, herbs, shrubs, trees, and groundcovers.

Grasses and Herbs

Consider the following criteria when selecting grass or herb plant material:

- Satisfaction of the functional requirements of the design.
- Ability to provide visual cues that reinforce changes in speed and driving conditions.
- Simplicity of appearance and compatibility with the speed of traffic and the overall landscape.
- Production of extensive root systems.
- Rapidity of establishment.
- Tolerance of site conditions.
- Resistance to insects and diseases.
- Availability from commercial suppliers.
- Ability to self-perpetuate.
- Compatibility with maintenance objectives.

Select species native to the area wherever practical.

Do not use herbs in roadside seed mixes where there are deer.

Do not use lupine adjacent to agricultural or grazing areas.

Do not use seed mixes that include species on the State Noxious Weed List (RCW 17.10). The site below links to information on noxious weeds.
http://www.nwcb.wa.gov/weed_list/weed_listhome.html

Trees, Shrubs, and Groundcovers

Consider the following criteria, in addition to the criteria for grasses and herbs, for shrubs, trees, and groundcover:

- Appropriate characteristics for desirable functions.
- Suitability for space and site conditions.
- Compatibility with natural plant succession.
- Ability to regenerate after damage.
- Longevity.
- Ability to maintain or enhance habitat values for wildlife, where this is desirable. This is determined on a site specific basis in conjunction with the region's environmental office.

- Ability to withstand traffic-generated stresses, such as air pollution and air turbulence.
- Compliance with state and county noxious weed control regulations.
- Select plant species that do not impact endangered or rare species.
- Select species native to the area wherever possible.
- Consider compatibility with the site's natural plant selection process.
- Consider compatibility with roadside maintenance objectives for the area.
- Native flowering shrubs and trees to satisfy the requirement for the use of wildflowers on federally funded projects.

Plant Sizing

Plant size is based on:

- Guidelines of the *Roadside Classification Plan*
- Design requirements
- Commercially available sizes
- Vandal resistance
- Transplant survival
- Available funding
- Functional needs
- Maintenance requirements
- Smaller plants are usually more cost effective and more easily established than larger ones

Establishment of Vegetation: The Right Plant for the Right Place

Plant survivability is improved and maintenance requirements are decreased when plants are matched to site conditions and proposed use.

Successful establishment of vegetation improves with:

- Soil conditions that support the desired plant community or outcome. Restore the soil as closely as possible to the qualities existing in adjacent undisturbed soils. (Create the situation that supports the desired outcome. Refer to adjacent soils and plant communities for an indication of what the area will support in terms of vegetation.)
- Consider the use of mycorrhizal inoculants in areas with no topsoil.
- An understanding of plant succession dynamics and natural processes. For example: physiological characteristics; life history;

responses to competition; role within the plant community and successional pathway; and how the plant responds to management techniques.

- The addition of compost improves plant establishment as well as increasing the water-holding capacity of the soil and mitigating surface erosion. Figure 800.4 shows the difference in grass establishment between the area above with no compost and the area below with compost.

Figure 800. 4 Compost - No Compost

- Mulches conserve soil moisture, reduce soil temperature, and provide a better environment for plant growth.
- Soil amendments can enhance the soil's moisture holding capacity thereby reducing and perhaps eliminating the need for irrigation.
- Soil nutrient availability can be an important determinant of species composition. Refer to the Soils and Soil Amendments chapter (700).
- Consider variations in rooting depths between grasses, shrubs, and trees. Complexity of underground root structure improves erosion control, slope stability, and minimizes the opportunity for invasion of undesirable vegetation. Note how the complexity of root type and depth locks up the soil to the greatest degree. The amount of vegetation above ground is related to the root volume below ground as seen below in Figure 800.5.

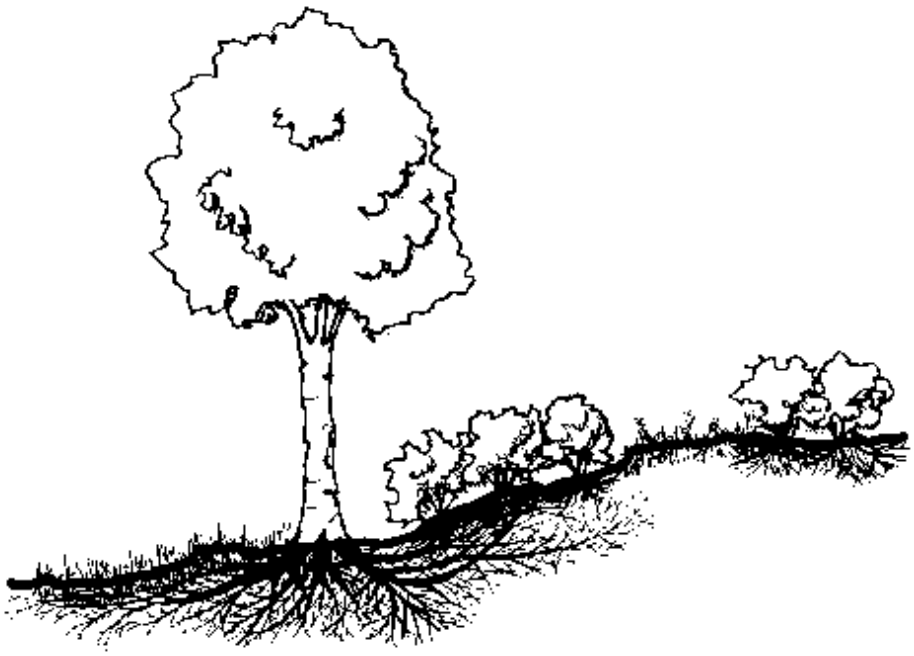

Figure 800.5 Relative root depths and volumes

- Commercial water holding polymers and other similar products can be used during the plant establishment period to provide young plants with moisture.

See the Irrigation chapter (820) for guidance on irrigation of plant material.

Weed barriers can reduce weed competition until desired plants are able to compete for light and nutrients more effectively. They also moderate soil temperature and conserve moisture. Weed mats and bark or wood chip mulch are two examples of weed barriers.

Plant selection composition

Restoration and revegetation projects are most practically planted in mixtures of native plant species. The mixture is composed of various species in balanced proportion to each other.

Factors that determine species percentages within a plant selection are:

- Desired ultimate composition of the plant community, for example forest, scrub-shrub communities.
- Function within the plant community, such as overstory, understory, shrub, groundcover, and herbaceous.
- Dominance in the plant community.
- Growth characteristics.

- Compatibility with other species:

Select fewer numbers of fast growing species, such as elderberry or cottonwood, to reduce conflict with slower growing species.

Slower growing species, such as vine maple, salal, and spruce may require a higher percentage of representation to be successful in the development of the plant association.

Some species may not be appropriate for the initial planting phase. Included are understory plants, such as cedar, salal, or vine maple that demand a microenvironment that can only develop over time.

Spacing

The distance between plants is determined by the following considerations.

- Weed control. Densely spaced vegetation minimizes the establishment of weeds.
- Some plant species need support from surrounding plants in order to compete and develop. These form functional plant associations. Examples are snowberry, rose, salal, mahonia, spiraea, and mock orange. Plant spacing is based on closure of the canopy after approximately 5 to 7 years. The shrubs form a thicket over time that can shade out weeds.
- Consider the developmental needs of individual plants.
- The following species are examples of species that may be considered for clustering: aspen, hazelnut, and oceanspray.
- Space climax vegetation to resemble the spread in the natural plant community as determined by the reference site.
- Space species such as red alder to quickly perform their function in the plant succession scheme without causing undesirable competition to other desirable plants. A management program that includes periodic removal of plants that have outlived their function will be necessary.
- See Appendix D for methods to calculate plant spacing.

Determination of percentages within a plant selection mixture

This section discusses a method for determining the numbers of plants per species to use in a revegetation plant mixture. The percentages of the species within a plant selection mixture are based on the desired spacing and distribution in the planting area.

- Decide on the native plant revegetation concept: Managed Succession or Accelerated Climax Community Development. (Refer to chapter 810 for more information on these concepts.)
- Develop the desired plant palette for the plant selection mixture.

For example, a roadside restoration mixture that follows Accelerated Climax Community Development principles is designed to consist of a shrub layer of snowberry, rose, and Oregon grape. Intermediate or understory species consist of oceanspray, hazelnut, and vine maple. The overstory is Douglas fir, western hemlock, red alder, and big leaf maple. Red alder is intended to function as a temporary cover crop (overstory) with most alders to be removed during the initial five to seven years.

- Establish an area size to base the calculations on. Metric and English examples are shown in the following three charts:

Total planting area	930 m^2	10,000 sq ft
Spacing	1 m	3 ft
Area per plant	0.836 m^2	9 sq ft
Divide total by area per plant	930 m^2 ÷ 0.836 m^2 =	10,000 sq ft ÷ 9 sq ft =
Total number of plants	1112*	1111*

* Round to 1100 plants for this example.

For the overstory species of Douglas fir, western hemlock, red alder, and big leaf maple, determinations are made for the species mixture. Site conditions are less favorable for western hemlock; thus its percentage has been arbitrarily established at 2% of the total of 1100 plants. For the remaining species, the following calculations are made:

Total planting area	930 m^2	10,000 sq ft
Spacing	5 m	15 ft
Area per tree	37 m^2	400 sq ft
Divide total by area per plant	930 m^2÷ 37 m^2 =	10,000 sq ft ÷ 400 sq ft =
Total number of trees	25	25

Twenty-five trees is about 4% of the total number of plants or 1-1/3% for each species.

Because, of the three species listed above, Douglas fir is the least competitive on the chosen site, it is assigned 2%, with red alder and big leaf maple each making up 1% of the total species mix. Overstory species will total 6% (2 +2 +1+1).

For intermediate height, understory species such as oceanspray, hazelnut, and vine maple, spacing is desired as seen below: (In a managed

succession planting program these species would be added in subsequent years as the overstory develops and shade becomes available.)

Total planting area	930 m^2	10,000 sq ft
Spacing	3 m	10 ft
Area per tree	9.3 m^2	100 sq ft
Divide total by area per plant	930 m^2 ÷ 9.3 m^2 =	10,000 sq ft ÷ 100 sq ft =
Total number of trees	100	100

One hundred plants are about 10% of the total. Vine maple is arbitrarily assigned 4% and the oceanspray and hazelnut are assigned 3% each.

The remaining percentage of 84% is shared by the shrub layer of snowberry, rose, and Oregon grape. Observations of the reference site for this project have documented a forest floor dominated by snowberry with rose and Oregon grape interspersed in mostly small clusters. The decision is to assign snowberry with 50%, rose with 20%, and Oregon grape with 14% based upon the ratios at the reference site.

The shrub layer shades out undesirable competitors through early closure. It has been experienced that a 1 m (3 ft) spacing per plant will provide this benefit within the normal plant establishment period of 5 to 7 years.

The final mixture looks as follows:

Plant Selection EXAMPLE					
Botanical name	**Common name**	**%**	**Spacing**	**Quantity** 1100 Total*	**Notes**
Pseudotsuga menziesii	Douglas fir	2	3 m (10 ft) min.	22	-
Tsuga heterophylla,	western hemlock	2	3 m (10 ft) min.	22	-
Alnus rubra	red alder	1	3 m (10 ft) min.	11	-
Acer macrophyllum	big-leaf maple	1	3 m (10 ft) min.	11	-
Holodiscus discolor	oceanspray (creambush)	3	3 m (10 ft) min.	33	Clusters of 3 - 5
Corylus cornuta	beaked hazelnut	3	3 m (10 ft) min.	33	Clusters of 3 - 7
Acer circinatum	vine maple	4	2 m (6 ft)min.	44	-
Symphoricarpos albus	snowberry	50	1 m (3 ft) O C	550	-
Rosa gymnocarpa	wood rose	20	1 m (3 ft) O C	220	Clusters of 15-25
Mahonia aquifolium	Oregon grape	14	1 m (3 ft) O C	154	Clusters of 3 - 7

* Quantities are based on the area in the example above. In a real project situation, the quantities will be calculated for the actual planting area that is designated for the plant selection.

Figure 800. 6 Plant Selection for the Example

Notes: Average plant spacing of the plant mixture just under 1m (3 ft) on center. (930 m^2/1100plants)

Trees are to be randomly distributed throughout the planting area.

OC = on center. Plant spacing measured from center to center of plant.

Construction

Design documents consider construction requirements such as site accessibility and constraints such as contract timing. During construction:

- Do not deviate from plans without approval of the Landscape Architect.

- Protect existing trees from construction impacts.

Ideally, the root zone of vegetation is protected out to 1.5 times the diameter of the drip line. At a minimum, protect the root zone to the outermost reach of its branches (the drip line). If cuts or fills are required in the vicinity of trees to be saved, consider retaining walls, tree wells, gravel, or drainage systems to protect the root systems.

Heavy equipment stored, parked, or driven around the base of a tree can compact the soil and deprive the tree's roots of the water and air they need to survive. Stockpiling building materials or fill can have a similar effect. Refer to the Soils and Soil Amendments chapter for more information on soil compaction and its minimization.

Scraping soil from roots or cutting them too deeply or too close to the tree can cause the tree to die or have a weakened hold and blow down. This damage may not be visible for years.

- Contracts often include a one-year plant establishment guarantee period from the contractor.
- On projects operating under a Corridor Management Plan, the community has had significant input into the plans and deviation could cause problems.

Transplant guidelines have been moved from the Soil Bioengineering chapter to this location. The text remains the same.

Transplant Guidelines

The reason for setting transplant guidelines is to increase the likelihood of plants surviving, growing to maturity, and reproducing. The chance of success is much greater if plants from the same altitude and ecosystem are used because they are adapted to that area's climate and elevation.

Collect plant materials during the dormant season. Keep them protected from wind and heat. Best results are obtained when installation occurs the same day materials are collected. However, some believe greater success can be realized with cuttings if stems are soaked in water 5 days prior to planting. Protecting stems from wind and keeping them cool and moist is essential.

Upland Plant Species

Use local seed (collection) zones to identify the best areas to collect seeds, cuttings, or plants. A seed zone is an area with a defined boundary and altitudinal limits within which landform and climate are sufficiently uniform. The landscape architect or HQ horticulturist will be the source of information.

In 1966, seed zones were developed, based on climatic and physiographic information, to reduce the risk of maladapting commercial tree species and to provide structure for commercial seed trade. Each zone has geographic boundaries and is additionally divided into 500-foot

elevation intervals. Seed lots are coded by both seed zone and elevation band.

- When collecting seeds, cuttings, or plants for smaller projects (perhaps a one-time collection) the elevation band can extend approximately 250 feet above and below the site.
- Salvage and transplant while plants are dormant.
- Collect cuttings from 30 to 50 parent plants in good condition (if available). In general, take no more than 33 percent of the parent plant's material and take no more than 50 percent of cuttings or seed from a given area.
- For plant cuttings, use young shoots (1 to 2 years old). Older and larger stems tend to have higher mortality.
- Protect cuttings from wind by covering them with plastic sheeting or moist cloth.

Shrubs, Herbs, Grasses, and Riparian Species

Use watershed boundaries as seed, cutting, plant collection, and transplant zones. In addition, collect necessary plant material within a 500-foot elevation band of the planting site.

Gene Pool Conservation Guidelines

Making sure the seed lot, cuttings, or plant lots are genetically diverse is just as important as plant movement guidelines. To prevent loss of genes in the population, use a minimum of 30-50 unrelated donor plants. Collecting an equal number of seeds, cuttings, or plants from each donor plant or area will also ensure representation by as many parent plants as possible.

Separate donor plants by sufficient distance to the reduce risk of relatedness.

Planting

- Plant salvaged plants within about 2 hours of lifting. Keep plants moist and free from wind and heat exposure.
- Dig holes 2 times the volume of the root ball. Larger holes will be required in more compacted soils.
- Planting holes must be deep enough so that the downslope side of the rootball is entirely buried.
- Plant the plant so the root collar is at the depth at which it was previously growing.

- Spread roots out so none are kinked or circling. Protect roots, especially fine root hairs on the main root system. Add water, if available, to reduce voids and increase root and soil contact.
- Use on-site soil to backfill the hole. Firmly tamp the soil around the plant. Be careful not to compact the soil.
- Transplanting a microsite: Depending on site conditions and project objectives, it might be preferable to salvage and transplant a small section of ground. This section usually contains several plants with roots, mycorrhizae, seed, soil, soil microorganisms, and duff materials. This technique provides great benefits to the area being revegetated. For transplanting small sections of ground, excavate an area large enough to "plant" the entire piece. Lay it in the excavated area and level with adjoining ground. Use excavated soil to secure edges of transplanted piece. Tap gently into place. Whenever possible, water the transplant.

Seed, Fertilizer, and Mulch

Figure 800. 7 Hand-Distribution of Mulch

Hydroseed or broadcast seed, fertilizer, and mulch. Make sure seed is covered with the correct depth of soil if broadcasting. The depth will depend on the type of seed being used. Check with the HQ Horticulturist for correct planting depths for the seed mix. Composted organic amendments, in place of fertilizer, also work well. Some compost blowers are able to inject seed as the compost is blown onto the site.

Once seeded, it is necessary to protect the site from additional surface water flow, specifically overland flow from roads. Direct the water flow away from the project area with gravel drains, swales, culverts, or drainpipe.

Weed-free straw or wood cellulose fiber mulches can be used as a mulch to minimize rain splash erosion. When using straw as a mulch, use as

thin a layer as possible to cover the soil (¼ inch). Grass seed cannot sprout if the mulch is too thick.

Planting

Correct plant handling and planting techniques play a major part in plant establishment.

- Keep the rootball moist and bare roots covered at all times.
- When planting, the root flare should be 10% of the root ball depth above ground level.
- Dig the planting hole so it is a minimum of 2 times the diameter of the rootball width.
- Plants smaller than 20-gallon container size do not need to be staked.
- Mulch should cover only the edge of the rootball. When planting is completed, there should be no additional soil and little or no mulch over the root ball for container plants.

Additional information on tree planting can be found at the following website: http://hort.ifas.ufl.edu/woody/planting/index.htm

Maintenance

The maintenance supervisor in charge of the contract area reviews and comments on plans during the development of the PS&E. Maintenance review is essential because WSDOT maintenance crews maintain landscape projects after installation.

Before maintenance crews make significant changes in existing roadside landscaping, consult any applicable Corridor Management Plan and the region's Landscape Architect. Communication between all roadside partners is an important part of improving Washington's roadsides.

Partnerships

Some projects have special partnership arrangements, for example, WSDOT might require the project sponsor or partner to maintain plant communities. Corridor Management Plans will describe partnership agreements within the scenic highway corridor. Project sponsors have included cities, counties, tribes, Metro, Intercity Transit, and other agencies. In these cases, the partner, or partners, reviews design documents and plant material selection prior to installation; they can also contribute labor, funding, and materials.

Security and Visibility: Safety Rest Areas and Weigh Stations

WSDOT has a policy of not removing vegetation or limbing trees in the roadside to open views for adjacent property owners.

The following are general recommendations for areas where vegetation is creating security concerns or limiting visibility within Safety Rest Areas, weigh stations, etc. Visibility into a site is often needed or requested by agencies such as the Washington State Patrol.

The following actions have been used successfully in a number of areas to alleviate concerns while minimizing impacts on existing vegetation and the valuable functions it provides. These actions are only applicable to alleviate specific security and site visibility concerns, and are not intended as a standard treatment for every roadside area.

- Analyze the area to determine the source and extent of the concern.
- Evaluate all of the functions that the vegetation provides.
- Tailor all actions to balance any removal or thinning of vegetation with the functional value that the vegetation provides in the specific location.
- Complete removal of all vegetation (clearing) is not an acceptable method of alleviating every security concern. Strive for a win-win treatment that alleviates security and visibility concerns while retaining the functional value of the vegetation.

Where removal or thinning of vegetation is determined to be desirable, consider the following actions:

- Limb branches of large evergreen trees (Western Red Cedar, Douglas fir, etc.) to an approximate 9 ft elevation above the ground surface.
- Prune smaller deciduous trees to encourage an open habit with leaves above a 6 ft elevation (hazelnut, serviceberry, vine maple, etc.). Remove only branches that are within the direct line of vision.
- Trim shrubs and groundcover to a 2 ft height and do not allow to grow higher than 3 ft high before pruning again (salal, snowberry, Nootka rose, etc.).
- Information on correct pruning methods can be found at http://hort.ifas.ufl.edu/woody/pruning/index.htm

Consult with the region's Landscape Architecture Office or HQ Roadside & Site Development Unit for site and species specific pruning methods.

Additional Sources of Information

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