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SECTION 8 – LANDSCAPE REQUIREMENTS FOR STORMWATER FACILITIES

8.1 INTRODUCTION

Successful revegetation is critical to the function of water quality and quantity facilities, and vegetated corridors. Plantings improve water quality and provide habitat and aesthetic benefits. The purpose of this Section is to assist design professionals in successfully planning, designing, and implementing landscape plans for water quality and quantity facilities and vegetated corridors. The information should not be used simply as a boilerplate applied to all sites. Instead, it should be used to guide design decisions to promote successful planting efforts. Each design will be unique and must consider the individual opportunities and constraints offered by each site.

8.2 LANDSCAPE GUIDELINES

The designer must consider four major components while developing landscape plans for water quality and quantity facilities: hydrology, soils, plant materials, and maintenance. Understanding the future hydrologic conditions at the treatment facility is critical to designing a successful planting plan. Identifying and correcting poor soil conditions and selecting and placing appropriate plant materials are also substantially important for planting success. Finally, landscape design and planting plans should not interfere with a facility's engineering function or create maintenance problems. These four components are discussed in detail below.

8.2.1 Hydrology

A. Varying hydrologic conditions complicate landscape design. Water levels change seasonally and also with local storm events. Treatment facilities are often inundated during the wet season and early growing season, but then dry out during the summer. These conditions must be understood and accounted for in the planting plan. Selected plants must be adapted to variable moisture regimes.
B. Landscape design and construction documents shall be prepared by a Landscape Architect registered in the State of Oregon are required. Construction documents detail the design and provide good control to assure the project is installed as designed. Proper installation provides predictable hydrologic conditions and thus increases the chances for successful planting

8.2.2 Soil

A. Plants require appropriate soil conditions to grow. On completion of earthwork, the landscape contractor is commonly left with soils that are high in clay or minerals and devoid of topsoil and organic material, or soils high in noxious weed content.
B. Site preparation is necessary to improve the soil and remove undesirable plant materials and seeds. Before planting, clearing and grubbing (see Chapter 2 Subsection "Clearing and Grubbing") may be required to remove rhizomes and seed banks where noxious weeds are present. Topsoil should be stripped and stockpiled for reuse whenever possible, but noxious weed conditions may require that topsoil is stripped and removed from the site.
C. Where topsoil has been removed, is not adequate, or does not exist, scarify the subgrade and import at least 4 inches of topsoil, unless noted otherwise. Imported topsoil should be tested for the following characteristics to assure it will provide a good growing medium for the selected plants:
    1. Texture – relative proportions of soil separates (sand, silt, and clay).
    2. Fertility – nutrient content and fertility status of the soil.
    3. Microbial – presence of microbial organisms in the soil.

D. Incorporate at least 2 inches of garden compost into imported topsoil. Where topsoil is present and is weed free, incorporate 2 inches of garden compost into the top 4 inches of the native soil. Incorporate other amendments, conditioners, and bio-amendments as needed to provide a soil capable of supporting the specified plants. Traditional fertilization techniques (applying N-P-K) are detrimental to the soil and should be avoided when using native plants.

8.2.3 Plant Materials

A. Plant selection must consider soil types, hydrologic conditions, and shade requirements. Dense planting with small stock is preferred to sparse planting with large stock. Native plant stock is recommended because many species are adapted to hydrologic conditions common in water treatment facilities and generally require minimal maintenance. Ornamental stock can be useful for blending treatment facilities into surrounding landscapes but is discouraged in areas that will not receive additional maintenance.

B. Plantings shall be installed between October 1 and November 15 or between February 1 and May 1. When plantings must be installed outside these times, additional measures may be needed to assure survival. Additional considerations for preparing planting plans include:
   1. Plant Massing: Plantings should be placed in-groups ranging from three to seven of the same species to encourage massing. Groupings may be larger, depending on the size of the facility. Groupings of different species can be placed next to each other, as long as the species are appropriate for the given hydrologic conditions.
   2. Plant quantities shall comply with the following minimum acceptable design standard:
      (a) Evergreen trees: 3 per 1000 square feet, minimum height 6 feet.
      (b) Deciduous trees: 2 per 1000 square feet, minimum caliper 1 to 1-1/2 inch at 2 feet above base.
      (c) Shrubs: 30 per 1000 square feet, minimum container 1 gallon or equivalent.
      (d) Wetland plants: 1 per 2 square feet of pond emergent plant zone.
   3. Planting Restrictions:
      (a) Do not place deep rooting trees and shrubs (e.g., willow) on top of pipe alignments.
      (b) Falling leaves will fill the pond and clog drainage structures. However, it is desirable to place trees, particularly evergreens, next to the south and west perimeter of standing water, to provide shade and thereby reduce water temperatures.
   4. Seeding: Seed mixes and application rates for wet, moist, and dry zones are provided in **Tables 8.4** and **8.5**. Alternative mixes may be approved by the City.
   5. Mulching: Trees, shrubs, and groundcovers shall be adequately mulched with an appropriate material (e.g., compost, bark dust) to retain moisture and discourage weed growth around newly installed plant material

8.2.4 Maintenance

Providing a low maintenance planting design should be a goal for every facility. However, all treatment facilities will require some degree of maintenance to help assure that facilities function as designed. Third parties (e.g., volunteer groups, homeowner associations) can provide additional maintenance if a more refined aesthetic is desired. The following maintenance issues should be addressed during project design and through the maintenance period:

A. Access: Access roads shall be provided as outlined in Chapter 3 Subsection “Access Road Design.”

B. Irrigation: A method for irrigation shall be installed and used during the plant establishment period, unless a natural water source is available and is an approved substitute by the City. Watering shall be provided to assure survival through the dry season.

C. Weed Control: The removal of noxious weeds including Himalayan blackberry (Rubus discolor), reed canary grass (Phalaris arundinacea), teasel (Dipsacus fullonum), Canada thistle (Cirsium arvense), and others will be necessary through the maintenance period, or until a healthy stand of desirable vegetation is established.
D. Plant Replacement: Plants that fail to meet the acceptance criteria must be replaced during the maintenance period (see Chapter 3 Subsection "Landscaping Inspection for Warranty"). Before replacing a plant, the cause for loss shall be determined. On determining the cause, correct the problem (e.g., amend soil, provide wildlife protection, modify species selection) and then replace the plant(s).
E. Erosion Control: Where seeding is used for erosion control, refer to Chapter 1 Subsection "Erosion Prevention and Sediment Control."
F. Wildlife Protection: Appropriate measures shall be taken to discourage wildlife browsing. Biodegradable plastic mesh tubing, or other substitute approved by the City, shall be placed around individual trees and shrubs to prevent browsing by wildlife, including beaver, nutria, deer, mice, and voles

8.3 RECOMMENDED PLANT SPECIES

A. This section outlines commonly available native plants suited for various hydrologic regimes and illustrates typical planting schemes for water quality and quantity facilities, and vegetated corridors. The schemes provide a foundation from which to begin planting design, but they may require modification in response to individual site characteristics. Consulting a professional landscape architect, ecologist, or horticulturist knowledgeable about native plants and water quality and quantity facility design is highly recommended when preparing planting plans.
B. Water quality facilities and vegetated corridors generally feature three types of planting zones with respect to hydrology during the growing season:
    1. Wet (standing or flowing water/nearly constant saturation; anaerobic soils).
    2. Moist (periodically saturated; anaerobic and/or aerobic soils).
    3. Dry (infrequent inundation/saturation, if any; aerobic soils).
    4. Open water, typically 3 feet or deeper, is also common in treatment facilities, particularly in fore bays and extended wet ponds. These areas are rarely vegetated, except by floating aquatics that generally volunteer on their own.
C. Specific plant sizes may be required as part of the development approval process but shall not be less than three to five-gallon container stock for trees; one-gallon container stock for shrubs; and conservation plugs for emergents. Live stakes shall be used for plantings. Live stakes may be used for other species that take readily from cuttings (e.g., Douglas spirea, red-osier dogwood). Conservation plugs are also known as leach tubes and styro-blocks. They typically have soil intact around deeply developed roots systems. They are the preferred alternative for most emergent stock. Rhizomes, tubers, bare root, and potted stock are also acceptable, but they may require additional planting quantities and higher densities to achieve design intent. Plant size and stock may be tailored to meet availability issues and the individual requirements of each site.
D. **Tables 8.1, 8.2,** and **8.3** list commonly available plants for wet, moist, and dry zones, respectively. The zones are used later in the planting schemes to depict different planting zones within the different water treatment facilities. Plants other than those listed in the following tables may be used with City approval.

Table 8.1. PLANTS FOR WET AREAS

Botanical Name	Common Name	Spacing	Preferred Light	Comments
Trees				
Salix sp.	Willow species	3-5’ O.C.	Sun, part shade	
Shrubs				
Cornus sericea	Red-osier dogwood	3-4’ O.C.	Sun, part shade	Highly adaptable
Spirea douglasii	Douglas spirea	2-3’ O.C.	Sun	Tolerates prolonged inundation
Herbaceous				
Alisma plantago-aquatica	Water plantain			
Beckmannia syzigachne	American slough grass			
Bidens cernua	Nodding beggar’s tick	1-2’ O.C.	Sun	
Bromus carinatus	California brome grass			
Carex densa	Dense sedge	12” O.C.	Sun	
Carex comosa	Bearded sedge	12” O.C.	Sun	Tolerates variable water regimes
Carex obnupta	Slough sedge	12” O.C.	Shade or part shade; will tolerate sun	Tolerates variable water regimes
Carex stipata	Sawbeak sedge	12” O.C.	Part shade	
Deschampsia caespitosa	Tufted hairgrass			
Deschampia caespitosa	Tufted hairgrass			
Elecoharis spp.	Spikerushes	12” O.C.	Sun	Tolerate prolonged inundation
Elymus glaucus	Blue wildrye			
Festuca rubra v. rubra	Native red fescue			
Iris tenax	Oregon iris			
Juncus effuses	Soft rush			
Juncus ensifolius	Daggerleaf rush	12” O.C.	Sun	
Juncus acuminatus	Tapertip rush	12” O.C.	Sun	
Juncus oxymeris	Pointed rush	12” O.C.	Sun	
Lysichitum americanum	Skunk cabbage			
Sagittaria laifolia	Wapato	12” O.C.	Sun	Favors prolonged inundation (to 6”)
Scirpus acutus	Hardstem bulrush	18-24” O.C.	Sun	Favors prolonged inundation
Scirpus microcarpus	Small-fruited bulrush	12” O.C.	Sun, part shade	Tolerates prolonged inundation (to 6”)
Scirpus tabernaemontanii	Softstem bulrush	18-24” O.C.	Sun	Favors prolonged inundation
Sparganium emersum	Simplestem bur reed	12-18” O.C.	Sun, part shade	
Aquatics				
Nuphar luteum ssp.	Pond lily	3’ O.C.	Sun	

Table 8.2. PLANTS FOR MOIST AREAS

Botanical Name	Common Name	Spacing	Preferred Light	Comments
Trees				
Alnus rubra	Red alder	6-10' O.C.	Sun	Highly adaptable; nitrogen fixer
Acer macrophyllum	Big leaf maple	12-18' O.C.	Sun	
Cornus stolonifera	Redtwig dogwood			
Crataegus douglasii	Black hawthorn	6-10' O.C.	Sun	
Fraxinus latifolia	Oregon ash	10-15' O.C.	Sun, part shade	
Thuja plicata	Western red cedar	12-18' O.C.	Park shade, shade	
Shrubs				
Acer circinatum	Vine maple	10 O.C.	Part sun, shade	
Lonicera involucrata	Twinberry	5' O.C.	Part shade	
Oemleria ceraisformis	Indian plum	5-8' O.C.	Shade	Tolerates fluctuating water table
Physocarpus capitatus	Pacific ninebark	5-8' O.C.	Part shade	
Rosa nutkana	Nootka rose	5' O.C.	Sun	
Rosa pisocarpa	Swamp rose	5' O.C.	Part shade	
Rubus spectabilis	Salmonberry	5' O.C.	Sun, part shade	Prefers slightly drier soils
Sambucus racemosa	Red elderberry	5-8' O.C.	Part shade	
Symphoricarpos albus	Snowberry	5' O.C.	Sun, shade	Prefers well drained soils
Herbaceous				
Aster chilensis ssp. Hallii	Common California aster	3' O.C.	Sun	
Aster subspicatus	Douglas's aster	3' O.C.	Sun	
Cammasia quamash ssp.	Common camas	12" O.C.	Part shade	Bulb; prefers drier soil
Carex aperta	Columbia sedge	12" O.C.	Sun	
Carex deweyana	Dewey's sedge	12" O.C.	Sun, part shade	
Carex obnupta	Slough sedge	12" O.C.	Part shade	
Carex stipata	Sawbeak sedge	12" O.C.	Part shade	
Gualtheria shallon	Salal	3-4' O.C.	Part shade, shade	Prefers moist, well-drained soils
Juncus tenuis	Slender rush	12" O.C.	Sun	
Juncus patens	Spreading rush	1-2' O.C.	Sun Part shade	
Polystichum munitum	Sword fern	3-4' O.C.	Part sun, shade	Prefers moist, well drained soils
Scirpus microcarpus	Small-fruited bulrush	12" O.C.	Sun, part shade	Prefers moister soils

Table 8.3. PLANTS FOR DRY AREAS

Botanical Name	Common Name	Spacing	Preferred Light	Comments
Trees				
Alnus rubra	Red alder	6-10’ O.C.	Sun	Highly adaptable; nitrogen fixer
Corylus cornuta	Hazelnut	6-10’ O.C.	Sun	
Prunus emarginata	Bitter cherry	6-10’ O.C.	Sun	Shade intolerant
Quercus garryana	Oregon white oak	10-15’ O.C.	Sun	
Pseudotsuga menziesii	Douglas fir	10-15’ O.C.	Sunm, part shade	
Shrubs				
Amelanchier alnifolia	Western serviceberry	5’ O.C.	Sun, part shade	
Holodiscus discolor	Oceanspray	9’ O.C.	Sun, part shade	
Ribes sanguineum	Red flowering currant	6’ O.C.	Sun, part shade	
Rosa gymnocarpa	Baldip rose	6’ O.C.	Sun	
Rubus parviflorus	Thimbleberry	5’ O.C.	Part shade	
Sambucus racemosa	Red elderberry	5’ O.C.	Part shade	
Symphoricarpos albus	Snowberry	5’ O.C.	Sun/shade	
Herbaceous				
Achillea millefolium	Western yarrow		Sun	1 lb/acre
Arctostaphylos uva-ursi	Kinnikinnick	12-18” O.C.	Sun/shade	
Bromus carinatus	Native California brome		Sun	10 lb/acre
Elymus glaucus	Blue wildrye		Sun	9 lb/acre
Festuca rubra v. rubra	Native red fescue			
Fragaria vesca	Wood strawberry	1’ O.C.	Part shade	
Gualtheria shallon	Salal	3-4’ O.C.	Part shade Shade	Prefers moist, well-drained soils
Lupinus bicolor	Two-color lupine		Sun	8 lb/acre
Lupinus latifolius	Broadleaf lupine		Sun	8 lb/acre
Lupinus polyphylus	Large-leafed lupine		Sun	8 lb/acre
Mahonia aquifolium	Tall Oregon grape	4-6’ O.C.	Sun, part shade	
Mahonia nervosa	Cascade Oregon grape	3-4’ O.C.		
Mahonia repens	Creeping Oregon grape	2-3’ O.C.		
Solidago canadensis	Canada goldenrod		Sun	2 lb/acre

8.4 SEED MIXES

The seed mixes indicated in **Tables 8.4** and **8.5** shall be used to overseed in water quality and quantity facilities, and vegetated corridors. One seed mix is prescribed for use in wet and moist zones, and one for dry zones. Alternative mixes may be approved by the City. Broadcast application is discouraged to prevent wind drift of the smaller, native seeds. Lower rates may be used in areas where seeding is intended to augment other plantings (e.g., the bottom of water quality swales).

Table 8.4. WET/MOIST AREA SEED MIX

Scientific Name	Common Name	% Mixture
Elymus glaucus	Blue Wildrye	47
Hordeum brachyantherum	Meadow Barley	40
Deschampsia caespitosa	Tufted Hairgrass	10
Glyceria occidentalis	Western Mannagrass	2
Beckmannia syzigachne	American Sloughgrass	1

*Pro Time 840 Native Wetland Mix. Application rate: 87 lbs./acre (minimum)

Table 8.5. DRY AREA SEED MIX

Scientific Name	Common Name	% Mixture
Elymus glaucus	Blue Wildrye	60
Hordeum brachyantherum	Meadow Barley	30
Bromus carinatus	Native California Brome	10

*Pro Time 400 Native Grass Mix. Application rate: 30 lbs./acre (minimum)

8.5 PLANTING SCHEMES

The following schemes provide general recommendations for plant placement in water quality facilities and buffers. These are guidelines only; planting plans must be individually tailored to unique conditions at each site.

8.5.1 Water Quality Swale

Water quality swales should generally be vegetated with emergents in the swale bottom, with emergents, groundcovers, and shrubs on the side slopes, and with groundcovers, shrubs, and trees on the adjacent dry areas. Typically, the swale bottom is wet, the lower 8 to 12 inches of the side slopes are moist, and areas 12 inches above the bottom of the swale are dry.

8.5.2 Extended Dry/Wet Pond

Extended dry ponds and extended wet ponds should be vegetated similarly to water quality swales. Emergents should be placed in the pond bottom, emergents, groundcovers, and shrubs on the side slopes, and groundcovers, shrubs, and trees on the adjacent dry areas. The hydrologic planting zones will vary in the facilities, but typically, wet areas occur at or below the permanent pool elevation, moist areas occur between the permanent pool elevation and maximum pool elevation, and dry areas occur above the maximum pool elevation.

8.5.2 Constructed Wetland

Constructed wetlands should feature dense emergent plantings in the wet zones, which are typically composed of deep and shallow emergent areas. Floating aquatics and emergents capable of surviving extended or permanent inundation may also be placed in the permanent pool areas. The moist zones should be planted with emergents, groundcovers, shrubs, and trees, and the dry zones with groundcovers, shrubs, and trees.

8.5.3 Vegetated Corridors

Three types of vegetated corridors are described below: headwater forests, riparian forests, and forested wetlands. Upland and wetland habitats are present in all three types; local topography and drainage patterns dictate where the habitats occur.

A. Headwater Forest: Headwater forests are densely wooded and wet throughout most of the year. Steep valley slopes prone to landslides drain the top of the watershed to the stream below. Perennial to intermittent flows may occur, depending on local conditions. Channels range from shallow to deeply entrenched, with rock and large woody debris common throughout. A mixture of wetland and upland species may occur in this community, depending on local drainage and topography. The headwater forest should be planted with 200 trees per acre (three species min.), 300 shrubs per acre (four species min.), and 1,000 emergents per acre (two species min.).
B. Riparian Forest: Riparian forests are moderately to densely wooded floodplains beside a stream. Landscape character ranges from flat with open floodplain to moderately steep with U-shaped valleys and upland terraces. They are frequently inundated during the rainy season and moist to dry during the summer. Hydrologic conditions vary. Channels with large woody debris are typically moderately to deeply incise with flat floodplains. Wetland species are the norm, but upland species do occur where microtopography allows. The riparian forest should be planted with 170 trees per acre (two species min.), 300 shrubs per acre (four species min.), and 2,000 emergents per acre (three species min.).
C. Forested Wetland: Forested wetlands are densely wooded, wet in the winter, and frequently dry out in the summer. The landscape is flat to gently rolling and may be perched above the stream in some areas. Frequently flooded with low-velocity overbank flows or rainwater results in shallow groundwater interaction or surface water influence into June in normal rainfall years. Stream channels range from shallow to deeply entrenched, depending on local conditions. A natural levee is common along the stream. The forested wetland should be planted with 200 trees per acre (two species min.), 300 shrubs per acre (three species min.), and 4,000 emergents per acre (three species min.).