5.2. Facility Specific Landscaping Guidance

The planting recommendations shown under this section are based on research, local experience and/or standard landscape industry methods for design and construction. It is critical that selected plant materials are appropriate for soil, hydrologic, and other site conditions. Storm Water Management plans should use appropriate native and recommended non-invasive species from the Recommended Plant Lists in Table 5.3.2. The design for planting shall minimize the need for herbicides, fertilizers, pesticides, or soil amendments at any time before, during, and after construction and on a long-term basis. Plantings should be designed to minimize the need for mowing, pruning, and irrigation. Grass or wildflower seed shall be applied at the rates specified by the suppliers. If plant establishment cannot be achieved with seeding by the time of substantial completion of the storm water management practice portion of the project, the contractor shall plant the area with wildflower sod, plugs, container plants, or some other means to complete the specified plantings and protect against erosion.

Green Roof Landscaping Requirements

Plantings used on green roofs shall be self-sustaining, with little to no need for fertilizers or pesticides. Shrubs, herbs, succulents, and/or grasses shall be used to cover most of the green roof. See **Chapter 4.1**: Green Roofs for more specific information on green roof recommendations.

Planter Box Landscaping Requirements

The following quantities per 100 square feet of planter box area are suggested:

- 4 - Large shrubs/small trees 3-gallon containers or equivalent.
- 6 - Shrubs/large grass-like plants 1-gallon containers or equivalent.
- Ground cover plants: 1 per 12 inches on center, triangular spacing. Minimum container: 4-inch pot. Spacing may vary according to plant type.

Note: Container planting requires that plants be supplied with nutrients that they would otherwise receive from being part of an ecosystem. Since they are cut off from these processes they must be cared for accordingly.

Infiltration and Filter System Recommendations

Infiltration and filter systems either take advantage of existing permeable soils or create a permeable medium such as sand for water quality and groundwater recharge. The most common systems include infiltration trenches, infiltration basins, sand filters, and organic filters. When properly planted, vegetation will thrive and enhance the functioning of these systems. For example, pre-treatment buffers will trap sediment that is often bound with phosphorous and metals. Vegetation planted in the Storm Water Management Practice will aid in nutrient uptake and water storage. Additionally, plant roots will create macropores for storm water to permeate soil for groundwater recharge. Finally, successful plantings provide aesthetic value and wildlife habitat, making these facilities more desirable to the public.

Design Constraints:
Along with the guidelines listed at the start of this section, the following should be adhered to:

- Determine areas that will be saturated with water and water table depth so that appropriate plants may be selected (hydrology will be similar to bioretention facilities, see Figure 5.2.1 and associated tables for planting material guidance).
- Plants shall be located so that access is possible for structure maintenance.

Vegetated Swale Landscaping Requirements

The following quantities per 200 square feet of swale area are suggested:

- 1 Evergreen or Deciduous tree:
  - Evergreen trees: Minimum height: 6 feet.
  - Deciduous trees: Minimum caliper: 1 ½ inches at 6 inches above base.
  - Multi-sterm trees: Minimum root ball diameter: 20 inches and 6’ tall
- Grass: Seed or sod is required to completely cover the swale bottom and side slopes.
- (Shrubs are optional)

Vegetation or ground cover within the swale should be suitable for expected velocities. For the swale flow path, approved native grass mixes are preferable. The applicant shall have plants established at the time of storm water management plan completion (at least 3 months after seeding). No runoff should be allowed to flow in the swale until grass is established. Native wildflowers, grasses, and ground covers are preferred to turf and lawn areas. These type of landscape can be designed to require mowing only once or twice annually.

Vegetated Infiltration Basin and Dry Detention Pond Landscaping Requirements

Vegetation increases evapotranspiration, helps improve infiltration functions, protects from rain and wind erosion and enhances aesthetic conditions. The following quantities per 300 square feet of basin area are suggested.

- 1 Evergreen or Deciduous tree:
  - Evergreen trees: Minimum height: 6 feet.
  - Deciduous trees: Minimum caliper: 1 ½ inches at 6 inches above base.
  - Multi-sterm trees: Minimum root ball diameter: 20 inches and 6' tall
- 4 Large shrubs/small trees 3-gallon containers or equivalent
- 6 Shrubs/large grass-like plants 1-gallon containers or equivalent
- Ground cover plants: 1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the storm water management area shall be planted with grasses or grass-like plants.

Native wildflowers, grasses, and ground covers are preferred to turf and lawn areas. These type of landscape can be designed to require mowing only once or twice annually.

Appropriate plants should be selected based on ponding depth and drain-down time in the basin. Infiltration systems will be dry much of the time and should be vegetated with drought tolerant species especially if they will not be irrigated.

Bioretention Landscaping Requirements

Planting Soil Bed Characteristics

The characteristics of the soil for the bioretention system are perhaps as important as the facility location, size, and treatment volume. The soil must be permeable enough to allow runoff to filter through the media, while having characteristics suitable to promote and sustain a robust vegetative cover crop. In addition, much of the nutrient pollutant uptake (nitrogen and phosphorus) is accomplished through adsorption and microbial activity within the soil profile. Therefore, the soils must balance soil chemistry and physical properties to support biotic communities above and below ground. Planting soil should meet the following specifications:

- Clay content: less that 5%
- Sand content: 50-60%
- Leaf compost or aged leaf mulch: 20-30%
- High quality topsoil: 20-30%
- Bioretention soil can be created by amending existing soil. Depending on the quality of the soil, combine 20-30% native soil with 20-30% compost and 50% sand.
- Have a permeability of at least 1.0 feet per day (0.5 inches per hour).
- Be free of stones, stumps, roots, or other woody material over 1 inch diameter. It should also be free of brush or seeds from noxious weeds. Placement of the planting soil should be in lifts of 12-18 inches, loosely compacted (tampered lightly with a dozer or backhoe bucket).

Planting Plan Guidance

- Trees and shrubs shall be freshly dug and grown in accordance with good nursery practice.
- Perennials, grass-like plants, and ground-cover plants shall be healthy, well-rooted specimens.
- Plantings shall be designed to minimize the need for mowing, pruning, and irrigation.

The following quantities per 100 square feet of bioretention area are suggested:

- 1 large tree per 100 square feet of bioretention area
- 2-4 small trees or shrubs per 100 square feet of bioretention area
- 6 ferns or grass-like plants per 100 square feet of bioretention area (1-gallon containers)
- Groundcover plantings and wildflower plugs on 12 inch centers with triangular spacing.
- A native grass/wildflower seed mix can be used as an alternative to groundcover planting. Seed mix shall be free of weed seeds.

Plant material selection should be based on the goal of simulating a terrestrial forested community of native species. Bioretention simulates an ecosystem consisting of an upland-oriented community dominated by trees, but having a distinct community, or sub-canopy, of understory trees, shrubs and herbaceous materials. The intent is to establish a diverse, dense plant cover to treat storm water runoff and withstand urban stresses from insect and disease infestations, drought, temperature, wind, and exposure.

The proper selection and installation of plant materials is key to a successful system. There are essentially three zones within a bioretention system (Figure 5.2.1). The lowest elevation supports plant species adapted to standing and fluctuating water levels. The middle elevation supports a slightly drier group of plants, but still tolerates fluctuating water levels. The outer edge is the highest elevation and generally supports plants adapted to dryer conditions. However, plants in all the zones should be drought tolerant. Plants should also have high salt tolerance if bioretention area receives runoff from ground level impervious surfaces.

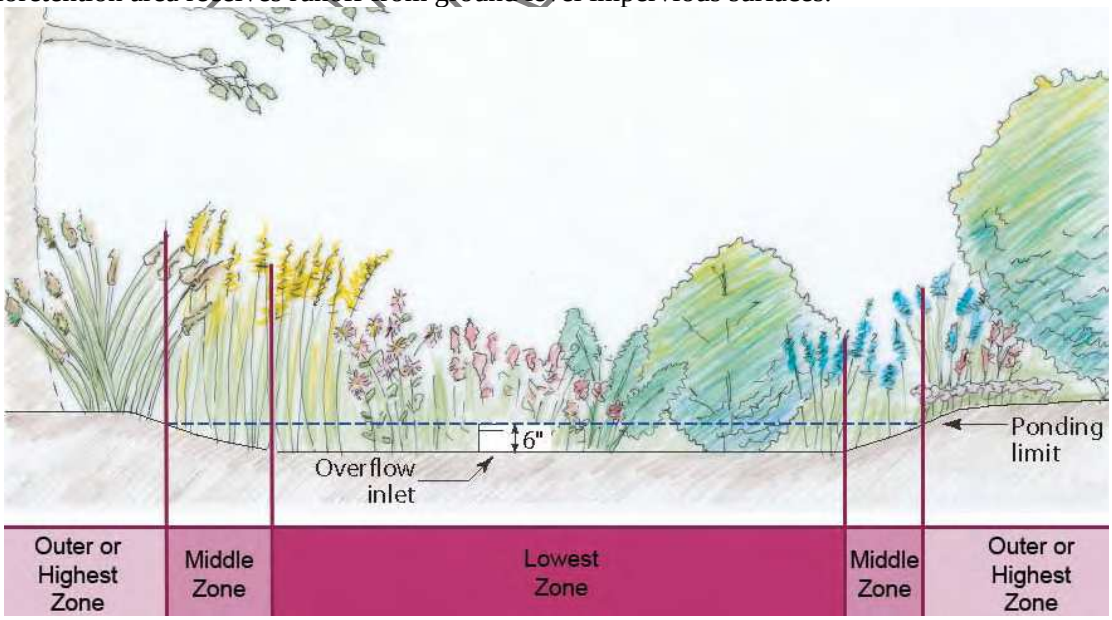

Figure 5.2.1: Zone of a Bioretention System

Lowest Zone (Hydrologic zones 2-4):
Plant species adapted to standing and fluctuating water levels. Frequently used native plants include*:

Table 5.2.1: Lowest Zone (Hydrologic zones 2-4) Suggested Plants

asters (Aster spp.)	winterberry (llex verticillata)
goldenrods (Solidago spp.)	arrowwood (Viburnum dentatum)
bergamot (Monarda fistulosa)	sweet pepperbush (Clethra alnifolia)
blue-flag iris (Iris versicolor)	bayberry (Myrica pensylvanica)
sedges (Carex spp.)	buttonbush (Cephalanthus occidentalis)
ironweed (Vernonia spp)	white oak (Quercus bicolor)
blue vervain (Verbena hastate)	elderberry (Sambucus Canadensis)
joe-pye weed (Eupatorium spp.)	bald cypress (Taxodium distichum)
swamp milkweed (Asclepias incarnata)	river birch (Betula nigra)
switchgrass (Panicum virgatum)	sweetgum (Liquidambar styraciflua)
shrub dogwoods (Cornus spp.)	northern white cedar (Juniperus virginiana)
swamp rose (Rosa palustris)	red maple (Acer rubrum)

* Refer to the plant list for a complete listing

Middle Zone (Hydrologic zones 4-5):
This zone is slightly drier than the lowest zone, but plants should still tolerate fluctuating water levels. Some commonly planted native species include*:

Table 5.2.2: Middle Zone (Hydrologic zones 4-5)

black snakeroot (Cimicifuga racemosa)	spicebush (Lindera benzoin)
switchgrass (Panicum virgatum)	hackberry (Celtis occidentalis)
spotted joe-pye weed (Eupatorium maculatum)	willow oak (Quercus phellos)
cutleaf coneflower (Rudbeckia lacinata)	winterberry (llex verticillata)
frosted hawthorn (Crataegus pruinosa)	slippery elm (Ulmus rubra)
ostrich fern (matteuccia struthiopteris)	blackhaw viburnum (Viburnum prunifolium)
sensitive fern (onoclea sensibilis)	Nannyberry (Viburnum)
ironwood (Carpinus caroliniana)	witch-hazel (Hamamelis virgniana)
obedient plant (Physostegia virginiana)	steeplebush (Spiraea tomentosa)

*Refer to the plant list for a complete listing

Outer Zone (Hydrologic zones 5-6):
Generally supports plants adapted to drier conditions. Examples of commonly planted native species include*:

Table 5.2.3: Outer Zone (Hydrologic zones 5-6)

many grasses & wildflowers	juniper (Juniperus communis)
basswood (Tilia americana)	sweet-fern (Comptonia peregrina)
white oak (Quercus alba)	eastern red cedar (Juniperus virginiana)
scarlet oak (Quercus coccinea)	smooth serviceberry (Amelanchier laevis)
black oak (Quercus velutina)	american holly (llex opaca)
american beech (Fagus grandifolia)	sassafras (Sassafras albidum)
burr oak (Quercus macrocarpa)**	shummard oak (Quercus shumardii)**
mapleleaf viburnum (viburnum acerifolium)	wild hydrangea (Hydrangea arborescens)
black chokecherry (Aronia melanocarpa)	white pine (Pinus strobus)

*Refer to the plant list for a complete listing

**Can be used in both the middle zone and outer zone-most adaptable oaks to constructed sites and variable hydrology.

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Filter Strip Landscaping Requirements

It is critical that plant materials are appropriate for soil, hydrologic, light, and other site conditions. Select vegetation from the list of native species found in this section (Table 5.2). Take soil infiltration capacities, sunlight, pollution tolerances, root structure, and other considerations into account when selecting plants from this list.

Filter strips should be planted with meadow grasses, shrubs, and native vegetation (including trees) from the list provided in **Section 5.3**: Native and Recommended Non-invasive Plants.

For the filter strip, approved native grass mixes are preferable. Seed shall be applied at the rates specified by the supplier. The applicant shall have plants established at the time of storm water management area completion (at least 3 months after seeding). No runoff shall be allowed to flow across the filter strip until the vegetation is established. Trees and shrubs may be allowed in the flow path if the filter strip exceeds the minimum length and widths specified.

Filter strips often make a convenient area for snow storage. Therefore, filter strip vegetation should be salt-tolerant, and the maintenance schedule should involve removal of sand build-up at the toes of the slope. If the filter strip cannot provide pretreatment in the winter due to snow storage or vegetation choice, other pretreatment should be provided.

Vegetation cover should be maintained at 85 percent. If vegetation is damaged, the damaged areas should be reestablished in accordance with the original specifications. In all design cases where vegetation is to be established, the planting regime should be as dense as the soil conditions can sustain. This is especially true at the top portions of the filter strip where the highest sheet flow velocities are found. Soils that can sustain higher quantities and qualities of vegetation may need to be added to insure thick vegetative densities needed for sustainable filter strip performance. All vegetation deficiencies should be addressed without the use of fertilizers and pesticides if possible.