



RAIN GARDEN MAINTENANCE MANUAL



Hackettstown Middle School Rain Garden Implementation Project

JUNE 2023

Table of Contents

WHAT IS GREEN INFRASTRUCTURE?..... 1

GREEN INFRASTRUCTURE PRACTICES 1

 BIORETENTION & RAIN GARDEN SYSTEMS 1

Design Parameters 2

Construction Details..... 3

BIORETENTION (RAIN GARDEN) MAINTENANCE GUIDELINES 4

 Shrub and Herbaceous Plant Material General Maintenance, Weeding, Mulching.....5

 Riverstone/Stone Gutter Maintenance 8

 Rain Garden Watering..... 9

 Shrub and Herbaceous Groundcover Pruning, Division, Cut Back, Removal of Dead
 Vegetation 11

 Shrub and Herbaceous Plant Material Plant Replacement 14

 Invasive Species Inspection and Control Measures..... 17

List of Appendices

Appendix A — Green Infrastructure Maintenance Report Form.....A1

Appendix B — Plant Fact Sheets.....B1

This document has been prepared by the Rutgers Cooperative Extension Water Resources Program with support by a grant from the National Fish and Wildlife Foundation.

The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions of the National Fish and Wildlife Foundation or its funding sources. Mention of trade names or commercial products does not constitute their endorsement by the National Fish and Wildlife Foundation or its funding sources.

NFWF GRANT ID: 0403.19.065576



WHAT IS GREEN INFRASTRUCTURE?

Green infrastructure is an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure practices capture, filter, absorb, and/or reuse stormwater to help restore the natural water cycle. When used as components of a stormwater management system, green infrastructure practices such as bioretention, green roofs, pervious pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating runoff, these practices can help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits.

GREEN INFRASTRUCTURE PRACTICES

When managing stormwater with green infrastructure practices, the overall goal is to disconnect impervious surfaces that are connected (i.e., drain directly to sewer systems or local waterways). Green infrastructure practices can be designed to capture and infiltrate stormwater. These practices tend to filter water using soil, as in the case of bioretention, or using stone, as in the case of porous asphalt. In areas where infiltration is not possible, these green infrastructure practices also can be used as a detention system to store runoff and slowly release it after the storm event. Some green infrastructure practices are used to harvest stormwater runoff for non-potable water usage such as watering gardens. Other green infrastructure practices, like bioswales, are designed to move water from one location to another while filtering pollutants.

BIORETENTION & RAIN GARDEN SYSTEMS

A rain garden, or bioretention system, is a landscaped, shallow depression that captures, filters, and infiltrates stormwater runoff. The rain garden removes nonpoint source pollutants from stormwater runoff while recharging groundwater. A rain garden serves as a functional system to capture, filter, and infiltrate stormwater runoff at the source, while being aesthetically pleasing. Rain gardens are an important tool for communities and neighborhoods to create diverse, attractive landscapes while protecting the health of the natural environment. Rain gardens can also be installed in areas that do not infiltrate by incorporating an underdrain system.

Design Parameters

- System is located close to the source of runoff
- Flat bottom with stable inflow and overflow
- Captures, treats, and infiltrates at least the runoff volume from the water quality storm (1.25 inches over two hours)
- Can be designed to capture the runoff volume for the two-year design storm (3.3 inches of rain over 24 hours)
- Minimum infiltration rate of 0.5 inches per hour and maximum infiltration rate of 10 inches per hour
- If infiltration rate is unknown or less than 0.5 inches per hour, system can be designed with underdrain
- No standing water may remain at the surface 72 hours after a rain event
- Amend soil with coarse sand and/or compost if necessary¹

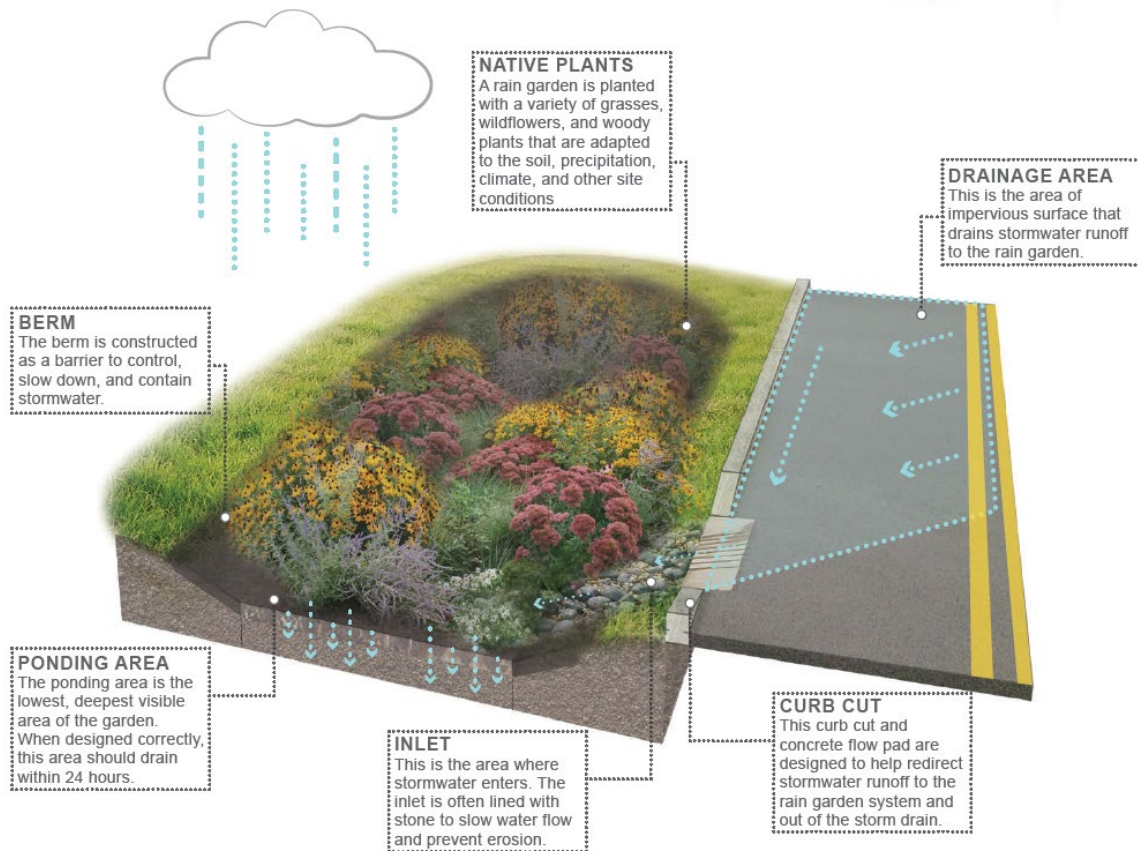


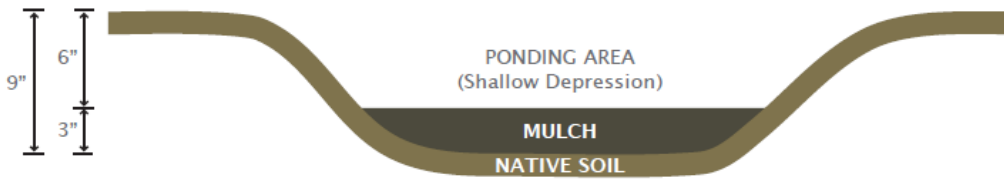
Figure 1: Bioretention system/rain garden

¹ The soil bed material must consist of the following mix, by weight: 85 to 95% sand, with no more than 25% of the sand as fine or very fine sands; no more than 15% silt and clay with 2% to 5% clay content. The entire mix must then be amended with 3 to 7% organics, by weight. The New Jersey Department of Environmental Protection recommends a soil layer of 18 to 24 inches but in many situations where bioretention systems are being used to retrofit existing development, a 12-inch layer may be all that is necessary and in some cases, the native soil may be suitable.

Construction Details

It may be helpful for maintenance staff to understand better how bioretention systems or rain gardens are built. The standard cross-section for a rain garden is shown below. They are typically designed to have three or six inches of ponding. A three-inch ponding depth is typically contained in the design for areas that have soils with low infiltration rates or a higher groundwater table. If a rain garden is designed to manage the same volume of stormwater runoff, a three-inch deep rain garden would have to have a footprint (i.e., the size of the rain garden) that is twice as big as a six-inch deep rain garden. For example, a rain garden that is designed to capture stormwater runoff from a 1,000 square foot impervious surface would have to be 400 square feet in size and three inches deep or 200 square feet in size and six inches deep.

6" DEEP RAIN GARDEN - NO SOIL AMENDMENTS



3" DEEP RAIN GARDEN - SOIL AMENDMENTS

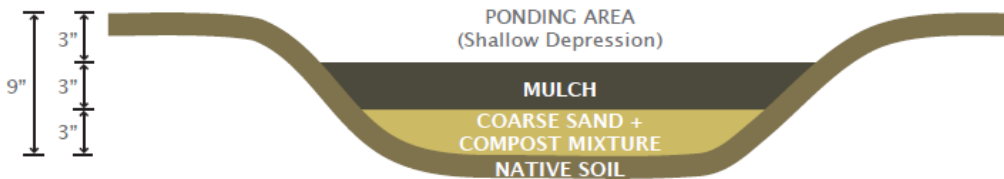
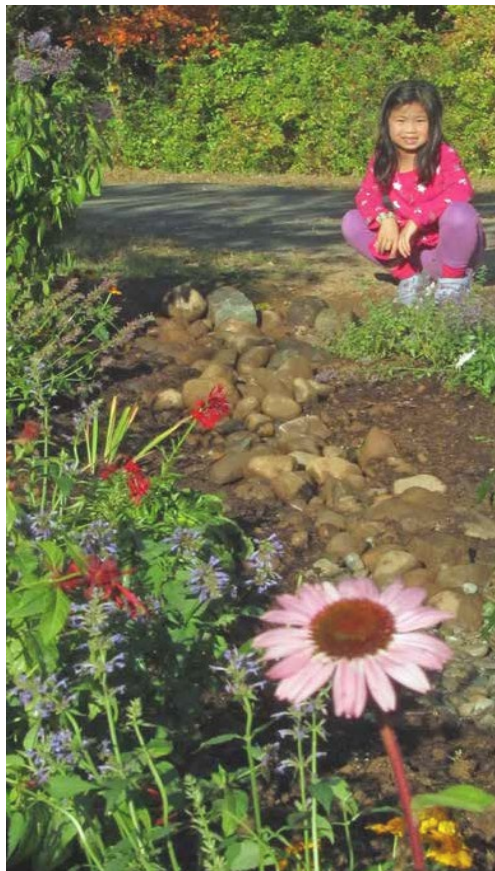


Figure 2: Standard cross-sections of rain gardens

BIORETENTION (RAIN GARDEN) MAINTENANCE GUIDELINES



WATER

Water is essential for the survival of your new rain garden. Please water the garden during the first three months post-planting and as needed throughout the future in times of drought. Plants should be watered every day for the first week they are in the ground and then once a week after that unless there is substantial rainfall. In hot weather or times of drought, the rain garden will need water one to two times a week to prevent the loss of plants, even if the garden is already established.

WEEDS

Please remove unwanted weeds from the garden by hand. Pull them from the base of the weed to remove the roots. As your garden becomes established, the rain garden plants will spread and out-compete unwanted weeds.

MULCH

Mulch is used to prevent weeds and retain moisture in the rain garden. During the first year the garden is growing, please maintain a 3" layer of mulch between plants. As your rain garden plants spread and become denser, you may find mulching the garden more difficult. Mulching beyond the first year is optional. Please be careful not to mulch the garden excessively and keep mulch away from drains.

INLETS/OUTLETS

Please inspect the rain garden's inlets monthly, and be sure to remove any leaves, trash, or debris that may prevent water from passing through. Observe the inlet during rainstorms to make sure stormwater is flowing into the rain garden. After rainstorms, please check the garden to be sure drainage outlet paths are clear and that water is not ponding for more than 72 hours.

NO MOWING

Please DO NOT mow or use a line-trimmer inside of the rain garden. This damages the plants and can destroy the rain garden.

SUPPLEMENTAL PLANTING

Please remove and replace any dead plants in the garden as needed.



PRUNING

We recommend pruning overgrown material in the garden annually when the plants are dormant.

PHOTOGRAPH AND DOCUMENT (See Appendix for Green Infrastructure Maintenance Report Form)

Please photograph your green infrastructure practice and share pictures with the Rutgers Cooperative Extension (RCE) Water Resources Program! In addition, document the maintenance of the practice, and be sure to contact the RCE Water Resources Program at water@envsci.rutgers.edu if you need assistance or have any questions.

**For more information, please visit
www.water.rutgers.edu.**



Shrub and Herbaceous Plant Material General Maintenance, Weeding, Mulching

Rain gardens are shallow surface depressions planted with specially selected native vegetation (trees, shrubs, grasses, and perennials) to treat and capture stormwater runoff. They are often designed to be planted on top of a layer of sand or gravel storage.

Plant beds, or planters, are typically a combination of trees, shrubs, and herbaceous perennials (flowering plants) in a contained planting bed, with a covering of mulch. Planters can be contained within concrete curbs or seatwalls or are often at ground level.

Healthy plants and lawns should be able to withstand minor disease and insect damage without controls. Routine application of pesticides shall not be practiced, as this destroys natural predator-prey relationships in the environment. Where unusually high infestations or infections occur, an accurate identification of the disease or insect shall be made and the control selected with care, prior to application. All chemical controls must be applied under the supervision of a licensed and qualified pest control applicator, following the procedures set forth in the labeling of the product, as required by law.

Type of Maintenance: Preventative

Tools and Supplies:

- Hand pruners
- Mulch (as specified)
- Mulch fork
- Rake
- Spade shovel
- Pitchfork or spade
- Weeding fork
- Plant and weed photo identification sheet
- Trash bag, gloves

Frequency:

- Inspection: 1x/year minimum (Late May to early July, and/or late August to early September)
- Weeding: 3x/year minimum (spring cleanup, summer maintenance, fall put to bed)
- Mulching: Minimum 1x/year (spring)

Labor Hours: 2 people for approximately 4-6 hours depending on site size

Maintenance Procedure:

- A. Safety: Set up a safety perimeter. Protect existing plants from damage due to landscape operations and maintenance and operations of other contractors and trades.
- B. Inspection: Visually inspect for any bare areas of vegetation or for specimen vegetation that has died and needs to be removed and/or replaced. Inspect for signs of frost heave and note any plants that may need to be replaced. Inspect plants for signs of excessive drought, disease, nutrient deficiency, and/or pest problems. Inspect planting areas for signs of soil

compaction, soil subsidence, excessive salt deposits, or ponding of water. Inspect any areas of standing water for mosquito larvae. Also inspect areas (e.g., stabilized outfalls) that may experience erosion or increased sediment deposits which would inhibit infiltration.

- i. Record observations in the Green Infrastructure Maintenance Report Form and report as necessary. If possible, take photographs to document site conditions.
 - ii. Based on the above observations, determine if it is necessary for a skilled horticulture professional to conduct a follow up visit to assess any potential plant health issues. Note this in the Green Infrastructure Maintenance Report Form.
 - C. Remove trash/debris: Remove any leaves, debris, and trash that may have accumulated in or around the plant beds/planters and legally dispose trash/debris off of the owner's property.
 - i. All refuse resulting from the maintenance operation of properties shall be disposed of at locations designated by the manager/owner.
 - D. Weed: Weeding shall occur 3x/year at minimum (spring, summer, and fall).
 - i. Weeding is easiest if done when soil is moist. It is also recommended to pay attention to specific sites and keep track of weed presence on the Green Infrastructure Maintenance Report Form for each site. Weeding is easier and more effective if done consistently throughout the growing season and done BEFORE weeds go to seed.
 - ii. Refer to the project's plant identification sheet for photographs of plants to be able to identify what plants should remain and what plants are weeds and should be removed.
 - iii. All planting areas shall be kept free of weeds, using either mechanical or chemical methods defined below.
 - a. Carefully hand pull or dig out weeds and invasive plants taking care not to damage surrounding plants.
 - b. For control of invasive species, spot spraying with herbicide may be employed by a Certified Pesticide Applicator only after notifying the proper authorities and getting approval to apply herbicides. Spraying is allowed only after receiving approval. Before applying herbicides, the type of weed shall be identified, and the control shall be selected accordingly, using the most effective control for the species, the location, and the season.
 - iv. Weeds shall not be allowed to grow in paved areas such as driveways, walks, curbs, gutters, etc. Dead weeds shall be removed from the paved areas.
 - E. Mulch: After weeding, apply specified mulch across surface of planter and/or planting bed in uniform manner; do not apply more than 3-4 inches thick. Mulching is only once/year in the spring, unless additional applications are needed after heavy rain events.
 - i. Type: organic shredded hardwood mulch (or mulch specified for specific site)

- ii. Shall be free of ceramics, man-made trash or debris of any kind, or other objectionable materials.
 - iii. Application rate: 3 inches applied to a settled thickness of 2 inches.
 - iv. Do not place mulch within 2 inches (150 mm) of plants
 - v. Do not shape mulch like a “volcano;” spread mulch evenly to a uniform level height near shrub trunks or perennial/plant stems to prevent rot from occurring
- F. Cleanup: Remove surplus mulch and waste material including trash and debris, and legally dispose of surplus and waste material off of the owner's property
- G. Record: Make note of any additional observations in the Green Infrastructure Maintenance Report Form.
- H. Safety completion: Remove safety perimeter.

Riverstone/Stone Gutter Maintenance

The riverstone/stone gutter is a 2- to 4-foot wide stone channel serving to slow water down, prevent erosion, and direct runoff into the rain garden, bioswale, or planter.

Type of Maintenance: Preventative

Tools and Supplies:

- Rake
- Clean, washed riverstone per project specifications
- Trash bag, gloves

Frequency: Annually in spring

Labor Hours: 2 people for approximately 1-2 hours depending on site size

Maintenance Procedure:

- A. Safety: Set up a safety perimeter.
- B. Inspection: Visually inspect the riverstone/stone gutter for any areas of riverstone that are bare and/or need to be replenished or replaced. Inspect for signs of weed growth, dumping of debris, or snow plow damage. Record observations in the Green Infrastructure Maintenance Report Form and report as necessary. If possible, take photographs to document site conditions.
- C. Remove trash/debris: Remove any large debris and trash that has accumulated in the riverstone/stone gutter area.
- D. Weed: Remove any obvious weed growth that has established itself within the limits of the riverstone/stone gutter. The riverstone should be free of vegetative growth.
- E. Rake: Gently rake riverstone/stone gutter to re-establish an even surface and even out any irregular depressions or high points (stones may have moved or shifted during the year).
- F. Replenish: Add new riverstone only if shallow and/or bare areas exist after raking has been completed. Add only enough riverstone to bring entire riverstone/stone gutter to a consistent and level grade, approximately even with the elevation of the adjacent edge of pavement.
- G. Record: Make note of any unrecorded observations on the Green Infrastructure Maintenance Report Form.
- H. Safety completion: Remove safety perimeter.

Rain Garden Watering

Watering for the first year after installation should be covered by a one-year maintenance agreement as outlined in project specifications and contract/warranty provisions.

This watering procedure takes effect once the contractor warranty period expires.

Type of Maintenance: Preventative

Tools and Supplies:

- Hose
- Sprinkler
- Hydrant
- Water backpack (for small areas)
- Water truck (if no access to water hydrant)

Frequency:

- Initial establishment (1st year after plant installation): Water in absence of rainfall to maintain a rate of 1" of water per week.
- Year 2, Year 3: Water as needed (generally up to ½" of water per week) during the first 4-6 weeks of the growing season and then only during extended periods of drought and only when ground is not frozen.
- Year 4 and beyond: Water to supplement rainfall only during extended periods of drought and only when ground is not frozen.

Labor Hours: 2 people for approximately 1-5 hours per site depending on site size

Maintenance Procedure:

- A. Safety: Set up a safety perimeter.
- B. Water:
 - i. During the first year after plant installation, water to supplement rainfall throughout the growing season (April through November) if soil conditions are dry. Do not water if ground is frozen. The amount of water recommended (combination of rainfall and/or supplemental watering) is 1" of water per week. If resources permit, 2" of water per week is recommended during extreme drought conditions for ideal plant growth and peak performance.
 - ii. During the second and third year after plant installation, water to supplement rainfall in the first 4-6 weeks of each growing season (April through May) if soil conditions are dry and there is not adequate spring snow melt to provide soil moisture. Do not water if ground is frozen. Also water throughout the growing season if there is extreme drought. The amount of water recommended (combination of rainfall and/or supplemental watering) is 1" of water per week. If resources permit, 2" of water per week is recommended during extreme drought conditions for ideal plant growth and peak performance.

- iii. There is no need to water plants if rainfall has fulfilled the 1" of water per week requirement.
 - iv. Discontinue watering activities once temperatures create frozen soil conditions. Start again in spring when tree buds swell and sprout new leaves.
 - v. Water as necessary so planting soil remains moist 2-3 inches below the finished grade. Use a trickling hose if possible to ensure steady, slow water flow. Water plant roots and avoid watering plant leaves (foliage). Water deeply to promote deeper root growth, which will ultimately enable plants to be more tolerant of drought in the long term.
- C. Record: Make note of any additional observations in the Green Infrastructure Maintenance Report Form.
- D. Safety completion: Remove safety perimeter.

Shrub and Herbaceous Groundcover Pruning, Division, Cut Back, Removal of Dead Vegetation

Plants are chosen for their natural shape and growth habit. Maintenance should encourage vegetation health and enhance the natural form of plant material. Activities such as trimming and pruning should not alter plant form considerably.

Type of Maintenance: Preventative

Tools and Supplies:

- Hand pruners
- Trowel
- Spade shovel
- Pitchfork
- Bow saw (if necessary)
- Trash bag, gloves

Frequency: 1x/year, see below:

- Shrubs: 1x/year in March/April or September/October depending on species
- Perennials: 1x/year cut back in March/April or September/October (March/April recommended)
- Grasses: 1x/year cut back as needed in March/April

Labor Hours: 2 people for approximately 1-8 hours per site depending on site size

Maintenance Procedure:

- A. Safety: Set up a safety perimeter. During pruning, keep adjacent paving and construction area clean and work area in an orderly condition. Protect plants from damage due to landscape maintenance operations and operations of other contractors and trades.
- B. Inspection: Visually inspect for any bare areas of vegetation or for specimen vegetation that has died and needs to be removed and/or replaced. Inspect plants for signs of excessive drought, disease, and/or pest problems. Inspect any areas of standing water for mosquito larvae. Record observations in the Green Infrastructure Maintenance Report Form, and report as necessary. If possible, take photographs to document site conditions.
- C. Remove trash/debris: Remove any large debris and trash that has accumulated in and around planters/plant beds, and legally dispose of large debris and trash off of the owner's property.
- D. Prune:

Shrubs

Prune, thin, and shape shrubs according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by an arborist, remove only injured, dying, or dead branches from shrubs and prune to retain natural character/form. Do not prune for shape.

Shrubs shall be pruned to maintain growth within space limitations, to maintain or enhance the natural growth habit, or to eliminate diseased or damaged growth. Some species shall be trimmed appropriately to influence flowering and fruiting or to improve vigor.

Shrubs must be trimmed as needed to permit unobstructed passage to residents or vehicles. Trimming shrubs within site clearance restricted areas at intersections is appropriate and shall have a maximum height of 2.5 feet from vehicular surface. Any curbs or raised planting areas shall be factored into the maximum 2.5-foot height. Shrubs must be trimmed 4" from the edges of sidewalks and curbs.

Shrubs shall be pruned to conform to the design concept of the landscape. Individual shrubs shall not be clipped into balled or boxed forms except where specifically instructed.

Perennials and Herbaceous Plants

Established plants bordering sidewalks or curbs shall be edged as often as necessary to prevent encroachment. Plants shall not be allowed to cover the crowns of shrubs or trees.

Refer to a plant identification sheet to identify weeds from intended plants.

Perennial cut back/cleanup/removal of dead vegetation: Removing dead vegetation (on perennials) shall occur a minimum of 1x/year during the spring or fall, with a recommendation towards mid-spring before new vegetated growth has emerged or when plant is dormant. Use hand shears to remove dead vegetation and cut back perennials to 6-8" above root crown.

If dried seed pods or dried flowers are considered desirable by the property owner, then the dead vegetation may be allowed to remain through the winter and should be cut back in the spring.

Some species have seed pods that act as food for birds/wildlife and/or decorative dried features; however, other species may spread seed or look unkempt when dried, and this may not be desired.

Perennial division and thinning: Depending on the species, perennials may need dividing every 3-5 years. This is because as certain plants get older, they die back starting from the center.

Division is also done to prevent crowding as a plant grows and becomes larger in size. To divide perennials, dig up the old plant, remove the dead vegetation entirely, and replant the healthier sections. To thin perennials, selectively remove individual plant stems (either healthy or dead) if overcrowding is occurring. Thinning of perennials is done to prevent overcrowding and mildew by encouraging air circulation between individual plants.

Grasses

Refer to a plant identification sheet to identify weeds from intended plants.

Grass cut back: Cut back foliage to 6-10" above root crown in mid-spring before warm season grasses emerge but when cool season weeds are actively growing. Leave a minimum 4-6" of previous growing season's growth depending on the ornamental grass

species. Shorter species such as Blue Fescue will be 4" while taller species such as Switchgrass will be 6".

Grass division: Ornamental and/or clumping grasses shall also be divided every 3 to 5 years to increase vigor. Groundcover grasses and meadow grasses do not need dividing.

List of example grasses that require division:

Sedges (*Carex* spp.)

Pennisetum (Fountain Grass)

Andropogon gerardii (Big Bluestem)

Schizachyrium scoparium (Little Bluestem)

Panicum virgatum (Switchgrass)

Calamagrostis x acutiflora (Feather Reed Grass)

- E. Record: Make note of any additional observations in the Green Infrastructure Maintenance Report Form.
- F. Safety completion: Remove safety perimeter

Shrub and Herbaceous Plant Material Plant Replacement

Plant (shrub and herbaceous plant material) replacement involves replacing missing, dead, or diseased shrubs and herbaceous plant material (perennials, forbs, grasses) in planter beds, planters, rain gardens, and/or bioswales if replacement has been deemed necessary.

NOTE: Tree replacement is not part of this procedure and will occur separately.

Type of Maintenance: Replacement

Tools and Supplies:

- Safety cones
- Safety gear (clothing, gloves, etc.)
- Planting and mulching equipment – shovels, pitchfork, rake, etc.
- Shrubs, plants, and seeds (to be planted)
- Mulch (as specified)
- Trash bags for debris, weeds, etc.

Frequency: Spring and fall, replacement as necessary

Labor Hours: 2 people for approximately 2-6 hours per site depending on scope of replacement

Maintenance Procedure:

- A. Safety: Set up a safety perimeter. Protect existing plants from damage due to landscape operations and maintenance.
- B. Inspection: Visually inspect for any bare areas of vegetation or specimen vegetation that has died and needs to be removed and/or replaced. Inspect areas where plants will be planted (replaced), and note signs of soil subsidence, soil compaction, standing water, evidence of disease/fungus, and animal burrowing.
 - a. Record observations in the Green Infrastructure Maintenance Report Form, and report as necessary. If possible, take photographs to document site conditions.
- C. Remove trash/debris: Remove any leaves, debris, and trash that have accumulated in or around the plant beds/planters.
 - a. All refuse resulting from the maintenance operation of properties shall be disposed of at locations designated by the manager/owner.
- D. Replacement: Follow the below instructions if shrub and herbaceous groundcover replacement has been deemed necessary. Tree replacement will occur separately.
 - a. Replacement requirements for shrubs and groundcover:
 - Shrubs: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

- Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required.
 - Set balled and potted and container-grown stock plumb and in center of planting pit or trench with the root flare at 1 inch (25 mm)
 - Pit should be twice as wide as it is deep above adjacent finish grades.
 - Use planting soil for backfill for types specified and scheduled.
 - Carefully remove root ball from container without damaging root ball or plant.
 - Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - If amending soil, place amendment tablets or incorporate amendments in each planting pit when pit is approximately half filled in amounts recommended in soil reports from soil testing laboratory. If using amendment tablets, place tablets beside the root ball about 1 inch (25 mm).
 - Continue backfilling process. Water again after placing and tamping final layer of soil.
 - Groundcover and Perennial Plugs: For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
 - Set out and space ground cover and plants in swaths to fill in vegetated gaps in plant bed.
 - Dig holes large enough to allow spreading of roots.
 - Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
 - Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
 - Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.
 - Planting Restrictions: Plant during one of the following periods listed below. Coordinate planting periods with maintenance periods to provide required maintenance from date of substantial completion.
 - Shrubs:
 - spring planting: March 1 to May 1

- fall planting: September 1 to November 1

Grass & Perennial Plugs:

- spring planting: April 1 to June 15
- fall planting: August 1 to September 15

Bulbs:

- fall planting: September 15 to October 30

- E. Cleanup: Stones, debris, tools, equipment, rope, pruned branches, tree debris, etc. shall be removed from the site upon completion of work. Excess soil outside of the saucer areas shall be removed and the area raked smooth. Paved areas shall be broom cleaned.
- F. Record: Make note of any additional observations in the Green Infrastructure Maintenance Report Form.
- G. Safety completion: Remove safety perimeter.

Invasive Species Inspection and Control Measures

Invasive species inspection consists of a visual inspection, trash/debris removal, and invasive species management.

Healthy plants and lawns should be able to withstand minor disease and insect damage without controls. Routine application of pesticides shall not be practiced, as this destroys natural predator-prey relationships in the environment. Where usually high infestations or infections occur, an accurate identification of the disease or insect shall be made and the control selected with care prior to application. All chemical controls must be applied under the supervision of a licensed and qualified pest control applicator following the procedures set forth in the labeling of the product as required by law.

Type of Maintenance: Preventative

Tools and Supplies:

- Hand pruners
- Trowel
- Spade
- Pitchfork and weed fork
- Plant and weed photo identification sheet
- Trash bag, gloves

Frequency:

- Inspection: Minimum 3x/year (spring, summer, fall)
- Monitor monthly during growing season for invasive species during the first 2 to 3 years

Labor Hours: 2 people for approximately 4-8 hours depending on site size

Maintenance Procedure:

- A. Safety: Set up a safety perimeter. Protect existing plants from damage due to landscape operations and maintenance.
- B. Inspection: Visually inspect for any bare areas of vegetation or specimen vegetation that has died and needs to be removed and/or replaced. Inspect plants for signs of excessive drought, disease, nutrient deficiency, and/or pest problems.
 - i. Inspect any areas of standing water for mosquito larvae. Inspect meadow area for evidence of invasive species and woody plant establishment. Monitor meadow monthly during growing season for invasive species during the first 2 to 3 years. Examples of invasive species include thistle, knapweed, *Phragmites*, and general weeds such as dandelions.
 - ii. Record observations in the Green Infrastructure Maintenance Report Form and report as necessary. If possible, take photographs to document site conditions.
 - iii. Based on the above observations, determine if it is necessary for a skilled horticulture professional to conduct a follow up visit to assess any potential plant health issues.

Note this in the Green Infrastructure Maintenance Report Form.

C. Control of Invasive Species:

- i. Managing invasive species in meadows is primarily done through mowing. Mowing helps prevent/control woody plant and weed establishment, and helps to disperse seeds of desirable species.
- ii. Refer to the project's plant identification sheet for photographs of plants to be able to identify what plants should remain and what plants are weeds and should be removed.
- iii. For the control of certain types of invasive species not able to be managed by mowing, such as crown vetch, spot spraying and hand pulling should be conducted as directed below:

D. Carefully hand pull or dig out invasive plant species taking care not to damage surrounding plants.

E. For control of invasive species, spot spraying with an herbicide may be employed only by a certified pesticide applicator after notifying the proper authorities and getting approval to apply herbicides. Spraying is allowed only after receiving approval. Before applying herbicides, the type of weed shall be identified and the control selected accordingly, using the most effective control for the species, the location, and the season. Suggested herbicides for control of invasive plants include:

i. **Glyphosate**

Glyphosate herbicide may be used for total vegetation control and is safe to use immediately prior to planting and up to four days after seeding. Glyphosate may also be used to target individual weeds as a careful spot spraying after planting, but some non-target plants are likely to be damaged and killed as well. A specific formulation can be used for total vegetation control prior to planting in the grassland and mow strip areas. A formulation approved for wetland use can be used in stormwater infiltration basins and swales.

ii. **Plateau** (best application for areas near rain gardens)

Plateau herbicide is a very good herbicide for pre- and post-emergent weed control for establishing warm-season grasses. Pre-emergent application prior to planting is best. Plateau's utility is limited when wildflowers or cool season grasses are incorporated into the seeding mix. Native forbs, depending on the species, may or may not be tolerant of Plateau. Cool season grasses are not very tolerant of Plateau. Switch grass is not as tolerant to Plateau as other warm season grasses.

iii. **Transline**

Transline is a selective herbicide for the control of composites, polygonums, and legumes such as crown vetch. If carefully used as directed, it is an effective post-planting spot spray, because it will not kill all the desired vegetation that is touched by over-spray. Transline can be sprayed over the top of grass plantings where crown vetch

is abundant and where there are no desired composite wildflowers or legumes. Control of crown vetch will likely require at least 2 to 3 years of scouting and retreating with spot spray applications. Legumes and composites should be planted sparingly in the successional grassland in treated crown vetch areas.

Note: All products mentioned here are for information only and are not an endorsement of a particular brand.

- F. Remove trash/debris: Remove any leaves, debris, and trash that have accumulated. All refuse resulting from the maintenance operation of properties shall be disposed of at locations designated by the manager/owner.
- G. Record: Make note of any additional observations in the Green Infrastructure Maintenance Report Form.
- H. Safety completion: Remove safety perimeter.

APPENDIX A
Green Infrastructure Maintenance Report Form



Green Infrastructure Maintenance Report Form

GENERAL INFORMATION

Name(s) of person/people inspecting the green infrastructure:

Date:

Location address and cross street/site location name:

Property owner/tax parcel block & lot:

Contact information:

Name of the practice:

STRUCTURAL COMPONENTS

Description of the current conditions:

GENERAL OBSERVATIONS	YES	NO	COMMENTS
1) Are there reports of the infrastructure malfunctioning?			
2) Are there any unauthorized or malfunctioning structures located in the infrastructure?			
3) Is the infrastructure overgrown with vegetation?			
4) Is there standing water or evidence of standing water?			
5) Are there signs of breakage, damage, corrosion, or rusting of structure?			
6) Is there debris or sediment accumulation in or around the inlet clogging the inlet opening/pipe?			
7) Are there signs of erosion, scour, or gullies; rock or vegetation above or around the inlet structure?			
8) Are there tree roots, woody vegetation growing close to or through the inlet structure, or a situation impacting the structure's integrity?			
9) If the inlet has a pretreatment structure (trash rack, forebay, etc.), is it filled with debris or sediment?			

ADDITIONAL OBSERVATIONS



Green Infrastructure Maintenance Report Form

RECOMMENDATIONS FOR WATER QUALITY IMPROVEMENTS	
1) Reduce mowing 2) Plant buffers 3) Establish meadows 4) Retrofit with infiltration structures or other strategies 5) Other	
PERFORMED MAINTENANCE	
1) Was weeding needed? Were they invasive plants (if known)?	
2) Was replacement of materials needed? (plants, mulch, or riverstone)	
3) Were you able to water the plants?	
4) Did you winterize the structure? If so, what did you do? (Where did you put the parts for the cisterns?)	
SUMMARY AND NOTES: Identify unique characteristics and/or opportunities	

APPENDIX B
Plant Fact Sheets

Asclepias tuberosa
Butterfly Milkweed



Characteristics: Persistent, herbaceous perennial

Appearance:

Height – 1-2 ft.

Flower Color – Orange

Flowering Period – July to August

Habitat (Community): Milkweeds grow in clumps beside roadways, on abandoned farmlands, and in other open areas throughout the United States. Butterfly milkweed grows on sandy, loamy, or rocky limestone soils of prairies, open woodlands, roadsides, and disturbed areas similar to other milkweed species.

Hydrology:

Indicator Status – Upland

Shade Tolerance – Intolerant

Wildlife Benefits: Cover and food (seeds or rhizomes) Milkweed species are attractive to many insect species, including the large milkweed bug, common milkweed bug, red milkweed beetle, blue milkweed beetle, and bees. Accordingly, this is a wonderful horticultural plant for landscaping to attract butterflies (particularly monarchs), whose numbers are declining and migratory routes changing due to lack of appropriate habitat.

Distribution: Northeast west to California and South Dakota

Baptisia australis Blue Wild Indigo



Spring/Summer Flower and Foliage ^{a,b}

Characteristics: Herbaceous, Perennial, Deer resistant

Appearance:

Height - 3 to 5 ft.

Flower Color - Blue

Flowering Period – April through August

Habitat (Community): can be found along tree lines, bordering forested riparian areas and in open prairies or native hay meadows. It does not grow well in shaded habitats. It prefers gravelly, sandy or well-drained loamy soils. It withstands prolonged droughts.

Hydrology:

Indicator status – No indicator, drought tolerant

Wildlife Benefits: (Nectar) food for bees and butterflies

Distribution: Nebraska to Texas on the west to the eastern seaboard states. It reaches into Canada in its middle range and New Hampshire is the extreme northeast area.

^a <http://plants.usda.gov>

^b <http://davesgarden.com>

Carex vulpinoidea
Fox sedge



Foliage and Flower^{ab}

Characteristics: Herbaceous, Perennial, Nonpersistent

Appearance:

Height - up to 3.5 ft.

Flowering Period - June through August

Habitat (Community): Fresh water marshes, wet meadows

Hydrology:

Indicator status - Obligate wetland

Salinity - Freshwater

Non-Tidal Regime - Seasonally to regularly inundated

Wildlife Benefits: Food for sora rail; swamp, tree sparrows; grouse, snipe, seed eating songbirds, larkspurs, redpoll, ruffed grouse chicks, ducks.

Distribution: Newfoundland to southern British Columbia, Washington, Oregon, south to Florida, west to Rocky Mountains

^a http://plants.usda.gov/java/largeImage?imageID=cavu2_002_avp.tif

^b <http://www.pinelandsnursery.com/2015/02/carex-vulpinoidea-fox-sedge.html>

Coreopsis lanceolata
Lanceleaf tickseed



Summer Flower & Foliage

Characteristics: herbaceous perennial, self-seeds

Appearance:

Height - 1 to 2 ft.

Flower Color - yellow

Flowering Period - June through August

Habitat (Community): roadsides, native wildflower gardens, meadows or prairies with well drained soils, drought tolerant

Hydrology:

Indicator Status - facultative upland

Salinity Tolerance - none

Wildlife Benefits: attracts butterflies and is a source of nectar for honey bees and wasps

Distribution: North America from Eastern Canada through Eastern and Midwestern United States

Physostegia virginiana
Obedient Plant/False Dragonhead



Summer Foliage



Summer Flowers

Characteristics: Perennial herb

Appearance:

Height – 1-4 ft.

Spread – 2-3 ft.

Flower Color – Pink, pale purple, white

Flowering Period – June-August

Habitat (Community): Swamps, damp thickets, wet woods, and moist prairies

Hydrology:

Indicator Status – Facultative +, Obligate Wetland

Non-Tidal Regime – Best grown in moist to wet soils in full sun.

Wildlife Benefits: Attracts hummingbirds

Distribution: Maine and Quebec to Manitoba and North Dakota, south to Florida and northern Mexico

BEARBERRY

Arctostaphylos uva-ursi (L.)

Spreng

Plant Symbol = ARUV

Contributed by: USDA NRCS Plant Materials
Program



Charles Webber
© California Academy of Sciences
@ CalFlora

Alternate Names

kinnikinnick

Uses

Bearberry serves a dual role on sandy soils, as both a beautification plant as well as a critical area stabilizer. The thick, prostrate, vegetative mat and evergreen character are what make bearberry a very popular ground cover. It is often planted around home sites, sand dunes, sandy banks, and commercial sites. The fruit it produces is eaten by a few species of songbirds and game animals. Deer will sometimes browse the foliage lightly.

Status

Please consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status (e.g. threatened or endangered species, state noxious status, and wetland indicator values).

Description

Pure stands of bearberry can be extremely dense, with heights rarely taller than 6 inches. Erect branching twigs emerge from long flexible prostrate stems, which are produced by single roots. The

trailing stems will layer, sending out small roots periodically. The finely textured velvety branches are initially white to pale green, becoming smooth and red-brown with maturity. The small solitary three scaled buds are dark brown.

The simple leaves of this broadleaf evergreen are alternately arranged on branches. Each leaf is held by a twisted leaf stalk, vertically. The leathery dark green leaves are an inch long and have rounded tips tapering back to the base. In fall, the leaves begin changing from a dark green to a reddish-green to purple.

Terminal clusters of small urn-shaped flowers bloom from May to June. The perfect flowers are white to pink, and bear round, fleshy or mealy, bright red to pink fruits called drupes. This smooth, glossy skinned fruit will range from 1/4 to 1/2 inch in diameter. The fruit will persist on the plant into early winter. Each drupe contains 1 to 5 hard seeds, which need to be scarified and stratified prior to germination to reduce the seed coat and break embryo dormancy. There is an average of 40,900 cleaned seeds per pound.

Adaptation and Distribution

Bearberry's native range is from Labrador to Alaska, south to Virginia, Illinois, Nebraska, and in the mountains from New Mexico north through California to Alaska. This long-lived, low growing shrub is very cold tolerant. This plant prefers coarse well to excessively drained soils of forests, sand dunes, bald or barren areas. It does not tolerate moist or off-drained sites. Although bearberry is often found growing in the open on sand dunes, it grows well under partial shade of forest canopies.

For a current distribution map, please consult the Plant Profile page for this species on the PLANTS Website.

Establishment

Bearberry can be propagated from seeds, softwood cuttings or pre-rooted stem cuttings. It is difficult to root this plant from bare cuttings in the greenhouse. Scarified seed sown in early summer will improve germination the following spring, but this technique is not as reliable as cuttings. Softwood cuttings should be harvested in late summer, and rooted stem cuttings are most successful when harvested during the dormant season. Successfully grown seedlings or

cuttings should be handled carefully in containers;
bare root plantings are rarely effective.

Management

This shrub species requires very little maintenance once it has been established. Annual spring applications of 10-10-10 will increase the growth rate of bearberry, but will also increase weed growth. Weed growth must be controlled to sustain healthy stands of bearberry.

Cultivars, Improved, and Selected Materials (and area of origin)

There are no known varieties of bearberry available; local or regional selections are available from commercial nurseries.

Prepared By & Species Coordinator:

USDA NRCS Northeast Plant Materials Program

Edited: 31Jan2002 JLK; 31may06jsp

For more information about this and other plants, please contact your local NRCS field office or Conservation District, and visit the PLANTS Web site <<http://plants.usda.gov>> or the Plant Materials Program Web site <<http://Plant-Materials.nrcs.usda.gov>>

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's [TARGET Center](#) at 202-720-2600 (voice and TDD).

To file a complaint of discrimination write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call 202-720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.

Read about [Civil Rights at the Natural Resources Conservation Service](#).

Aronia melanocarpa Black chokeberry



Green Summer Foliage



Winter Stalks



Fall Fruit



Spring Flower

Characteristics: Broad-leaved, deciduous shrub

Appearance:

Height - 3 to 6 ft.

Aerial Spread - 3 to 6 ft

Flower Color - White

Flowering Period - Early through mid May

Fruit Color - Black

Fruiting Period - Early September through late November

Habitat (Community): Swamp and bog edges, clearings, moist soils especially along streams

Hydrology:

Indicator status - Facultative wetland

Salinity - Resistant, tolerates infrequent flooding by water containing some salt

Non-Tidal Regime - Irregularly to seasonally inundated or saturated

Wildlife Benefits: (Fruit) is food for black-capped chickadee, bobwhite, gray catbird brown thrasher, cedar waxwing, eastern meadowlark, ruffed grouse, large and small mammals.

Distribution: Newfoundland to northwestern Ontario and Minnesota, south to Nova Scotia, New England South Carolina, and Tennessee

Ilex glabra
Inkberry



Foliage and Fall Fruit



June Foliage and Flower

Characteristics: Broad-leaved, evergreen shrub

Appearance:

Height - 6 to 8 ft.

Aerial Spread - 6 to 12 ft.

Flower Color - Greenish to white

Flowering Period - Early May through late June

Fruit Color - Black

Fruiting Period - Late September to late March

Habitat: Forested seasonal wetlands, shrub swamp and sandy woods

Hydrology:

Indicator status - Facultative wetland

Salinity - Resistant, tolerates infrequent flooding by water containing some salt

Non-Tidal Regime - Seasonally inundated or saturated

Wildlife Benefits: (Fruit) is food for wild turkey, bobwhite, common flicker, hermit thrush, eastern bluebird, cedar waxwing, rufous-sided towhee, waterfowl; (Food, Cover, and Nesting) for mockingbird and American robin.

Distribution: Nova Scotia to Florida and Louisiana along coastal plain

Rhus aromatica Fragrant Sumac



Fruit



Flower



Summer Foliage



Fall Foliage^a

Characteristics: herbaceous; perennial; rabbit resistant; prefers full sun to partial shade

Appearance:

Height – 2 to 6'

Spread - up to 10'

Flowering Period - March through May

Flower Color - gold/yellow

Fruiting Period - June through August

Fruit Color - red/burgundy

Habitat (Community): open rocky woodlands, valley bottoms, lower rocky slopes, and roadsides^b

Hydrology:

Indicator status - upland

Wildlife Benefits: fruit is an important winter food for birds, including turkey, ruffed grouse, robins, and flickers, and for various small mammals (e.g., raccoon, opossum, chipmunk); thickets of fragrant sumac provide cover for many species of birds and small mammals; attracts bees, butterflies, moths, small mammals, and songbirds

Distribution: USDA hardiness zones 3-9

^a <https://plants.ces.ncsu.edu/plants/rhus-aromatica/>

^b <https://plants.usda.gov/core/profile?symbol=rhar4>

Cornus florida
Flowering dogwood



Foliage



Spring Flowers



Fall Fruit

Characteristics: Broad-leaved, deciduous tree

Appearance:

Height - Up to 30 ft.

Aerial Spread - Up to 15 ft.

Flower Color - White

Flowering Period - April to June

Fruit Color - Red

Fruiting Period - September to October

Habitat (Community): Both moist and dry soils of valleys and uplands in understory of hardwood forests; also in old fields and along roadsides

Hydrology:

Indicator status - Facultative wetland

Salinity - Freshwater

Non-Tidal Regime - Dry to moist soils

Wildlife Benefits: (**Fruit, Twigs, and Leaves**) food for wild turkey, ruffed grouse, bobwhite, ring-necked pheasant, common flicker; red-headed and pileated woodpeckers, eastern king bird, brown thrasher, American robin, wood thrush, eastern blue bird, cedar waxwing, and purple finch; (**Cover and Food**) for wood duck, American woodcock, and song sparrow; (**Preferred Nesting, Cover, and Food**) for gray catbird; (**Nesting and Cover**) for American goldfinch.

Distribution: Southern Ontario to Southeast Maine, south to Florida and west to Texas