Semi-Arid Green Infrastructure Toolbox

Rain gardens

What is a Rain garden?

Rain gardens are a variation of bioretention, a family of practices that treat stormwater naturally by filtering runoff through vegetation and soil before it either recharges groundwater through deep infiltration or is discharged to a surface drainage system. They are configured to appear like a shallow, depressed, landscaped garden which collects stormwater runoff immediately after a precipitation event, hence the name rain garden. Rain gardens are most commonly installed to serve a single family home or in some cases a small site and typically do not incorporate an underdrain system making them one of the simplest of low impact development practices to implement.

Benefits

- Rain gardens provide a number of benefits to the homeowner and/or community:
- Reducing downstream flooding
- Recharging groundwater
- Improving water and air quality
- Attractive landscaping feature
- Attracts songbirds, pollinators, and other desirable wildlife

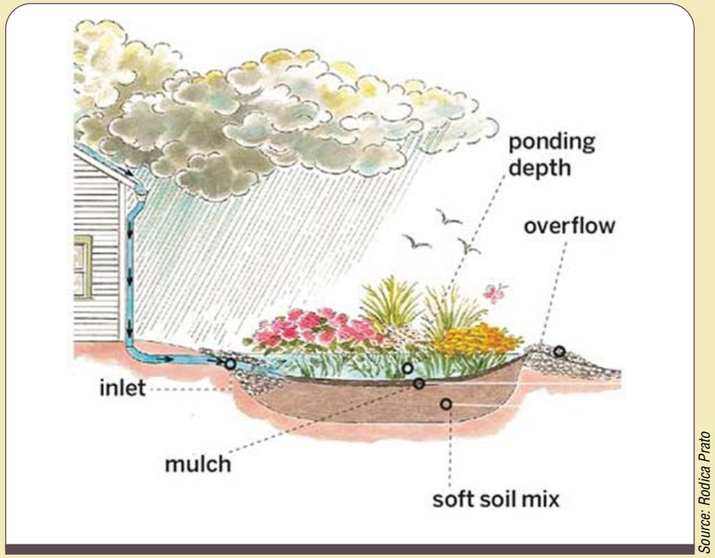
Siting and Design considerations

- Rain gardens should be placed adjacent to and downslope of impervious surfaces. In residential settings rain gardens are often situated downslope of roof leaders so that they treat rooftop runoff. Sometimes they can also treat runoff from driveways, sidewalks or other pavement areas particularly in non-residential settings. Consideration should be made for placement away from utility connections and specifically to avoid potential for water intrusion into basements or crawlspaces. Because rain gardens typically do not incorporate an underdrain system, an evaluation of soil permeability must be conducted to verify that the rain garden can drain dry within 6-12 hours after a rainfall event, generally this requires a soil infiltration rate of 0.5 in/hr or greater.

Maintenance requirements

Like any landscape feature rain gardens require regular maintenance to perform as designed but are somewhat lower maintenance than other bioretention systems which incorporate more structural components such as an underdrain or an overflow structure. Specific maintenance tasks for rain gardens include:

- Regularly clearing out debris and any collected trash
- Inspecting for long term ponding (evidence of clogging or poor design)
- Replacement of wood/rock mulch and dead vegetation



Source: Rodica Prato

This schematic shows the basic elements of a rain garden without an underdrain. Note the use of a soil media to enhance vegetative vigor.

Source: The Bismark Tribune

A rain garden at the North Great Plains Research Laboratory near Bismark ND uses native plants to absorb and filter stormwater and return it to the groundwater system.

Source: Summer Waters, University of Arizona

Rain gardens can be adapted to arid climates through selection of plants and mulch material, in this case gravel or stone.

Plants well-suited to bioretention projects in the northern plains:

Alder-leaved serviceberry
Amelanchier alnifolia 'Regent'

Snowberry
Symphoricarpos albus

Tatarian dogwood
Cornus alba 'Argenteo-marginata'

Prunus virginiana
Choke Cherry

Rocky Mountain juniper
Juniperus scopulorum

Silver buffaloberry
Shepherdia argentea

Sand cherry
Prunus besseyi 'Pawnee Buttes'

Schizachyrium scoparium
Smoke Signal

Calamagrostis acutiflora
Karl Foerster

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How to plan, implement, and maintain rain gardens

Planning and Design: Due to their straightforward function rain gardens are simple to design and construct. Design guidance and criteria varies somewhat from one community to another due to differences in climate, soils, and vegetation. Generally rain gardens are designed to capture and treat the runoff from a specific rainfall depth. There are a variety of design manuals and sizing tools/calculations which may be appropriate for your site. Refer to guidance provided by available municipal design manuals such as those provided by Mile High Flood District for more guidance on bioretention sizing, material selection, and dimensions. Since rain gardens are typically installed in areas where an underdrain is not required it may not be necessary to incorporate an engineered media if the existing soil is suitable to support vegetation health.

In areas in which stakeholders are not well versed in low impact development it may be beneficial to implement a public education program including public meetings or informational signs where practices are installed to provide information on how bioretention functions.

Maintenance: Maintenance of bioretention on commercial and public spaces requires additional consideration related to transportation and roadway maintenance activities. For example where snowplows are used to clear parking areas they may push snow to the roadway edge. Bioretention media is susceptible to compaction from piled snow which can significantly reduce its permeability leading to ponded water and structural failure. Other considerations include: planning for maintenance activities such as removing debris which frequently collects in the shallow bed, ensuring a supply of materials and vegetation stock/seed, and setting up a regular inspection and maintenance schedule. For bioretention systems on private property consideration should be given to public oversight to ensure that maintenance is conducted such as code provisions for inspection and maintenance assurances.

Design Criteria:		
	Maximum contributing area	Generally ~ 1000 square feet*
	Maximum ponding depth	12 inches (but more commonly 6 inches)
	Filter media	Engineered soil media specific to bioretention, see applicable state or local specification
	Media depth	0-2 feet depending on existing soil characteristics and fertility
	Bypass	Surface swale or sheet flow to adjacent slope

**rain gardens generally serve a small area relative to conventional bioretention*

Vegetation selection: Vegetation in rain gardens is the same as that recommended for bioretention family of practices. However the homeowner may choose to select a wider range of species if they are willing to conduct the additional maintenance that may be necessary. Rain gardens often include extensive wildflowers or ornamental shrubs that aren't typically used in more conventional bioretention systems. As a result native species which thrive in similar conditions are often used.

Do		Don't	
Take advantage of existing topography and locate rain garden where runoff flows	☑	Install in areas where temporary ponding could cause negatively impact basements or crawlspaces	☒
Provide irrigation to vegetation during establishment and if necessary for the life of the practice	☑	Install over top of utility connections	☒
Consider vegetation which is applicable to rain garden conditions and is desired by homeowner	☑	Install without evaluating existing soil infiltration/permeability	☒
Trim and remove vegetation to maintain aesthetics	☑	Install in areas with shallow groundwater levels (typically at least 2 feet below bottom of underdrain or soil media)	☒
Replace mulch layer annually	☑	Fail to remove collected sediment which collects on top of mulch layer	☒

Additional examples of rain gardens

Rain gardens can appear as a pleasing landscaping space in this residential rain garden in Maplewood, MN

This rain garden in Denver treats runoff from a small area of pavement at an office facility. Note the incorporation of a tree in the landscaping

Source: US EPA Region 8

This system to divert rooftop runoff to a rain garden creates an interesting feature at this public library in Boise, ID.

Source: US EPA Region 8

This rain garden at the University of Utah exhibits a rock mulch system with a variety of textures to create and interesting aesthetic