Watershed Stewards Academy
Rainscaping Field Guide

WSA
Watershed Stewards Academy

WSA Rainscaping Field Guide
Conservation Landscapes Quick Guide

What is it?

Conservation Landscapes are installations of native plants – trees, shrubs, grasses and flowers – that provide wildlife habitat, allow greater stormwater infiltration than regular lawns, and offer aesthetic appeal for residential, commercial, or institutional properties. By providing wildlife habitat and reducing stormwater runoff and pollution, they are an important practice in maintaining and improving the health of our waters. Setting up a Rain Barrel to slowly drain into a Conservation Landscape is a great way to get the most benefit out of it.

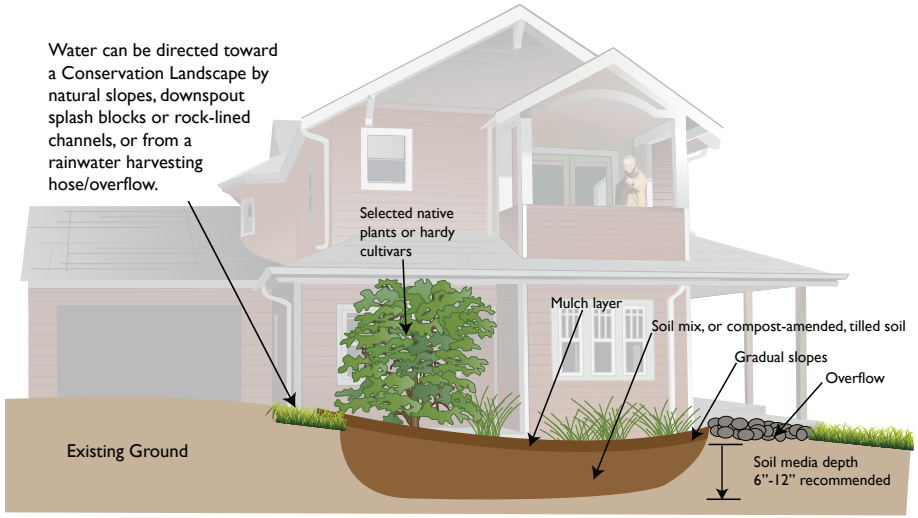
Do:

- Test soil to determine need for soil amendments
- Consider locating Conservation Landscapes in a low spot that will collect stormwater runoff from the surrounding site
- Consider including a Rain Barrel at downspouts that can drain to the Conservation Landscape
- Call Miss Utility before digging
- Remove all turf grass in landscape area
- Water plants during first growing season, especially during dry conditions

Don't:

- Direct runoff toward a building foundation
- Locate Conservation Landscapes where the excavation will damage tree roots
- Compact the soil with heavy equipment during construction
- Add fertilizer if using compost

Overview



Where NOT to Locate a Conservation Landscape

1. Within 10 feet of a building foundation
2. Over utilities
3. Near an existing or reserve septic drainfield or tank
4. Near Wells- Stay back 50 feet from confined wells, or 100 feet from unconfined wells

Recommended Maintenance for Conservation Landscapes

Maintenance Tasks	Frequency
• Water once every three days for the first month and then weekly during the first growing season (April-October), depending on rainfall • Expect up to 10% of the plant stock to fail in the first year, and plan accordingly for replacement plants	Upon establishment
• Check inlets and overflow areas for debris or leaves that are blocking flow • Check and repair erosion areas	After heavy rains in first month Periodically in subsequent years
• Remove weeds by hand	Monthly for first growing season Every 3 months or as needed in subsequent years
• For "meadow" type Conservation Landscapes consisting of grasses, mow in early spring • For other types of landscapes, check for winter damage and add mulch to bare spots as desired (2–3 inches) • Cut back perennials and remove dead growth	March or April
• Add reinforcement planting to maintain the desired vegetation density • Prune trees and shrubs; thin herbaceous plants as desired	Fall
• Remove invasive and non-native plants using recommended control methods • Remove any dead or diseased plants • Dead-head flowers • Stabilize any eroded or bare areas • Remove trash	As needed

WSA Rainscaping Field Guide
Rain Gardens Quick Guide

What is it?

Rain Gardens are shallow landscaped depressions that receive stormwater runoff from surrounding areas, and hold and naturally treat that runoff. They are very similar to Conservation Landscapes, except that they are lower than the surrounding ground – therefore they collect and treat more runoff. The plants used in Rain Gardens need to be able to tolerate occasional inundation as well as dry conditions between rain storms.

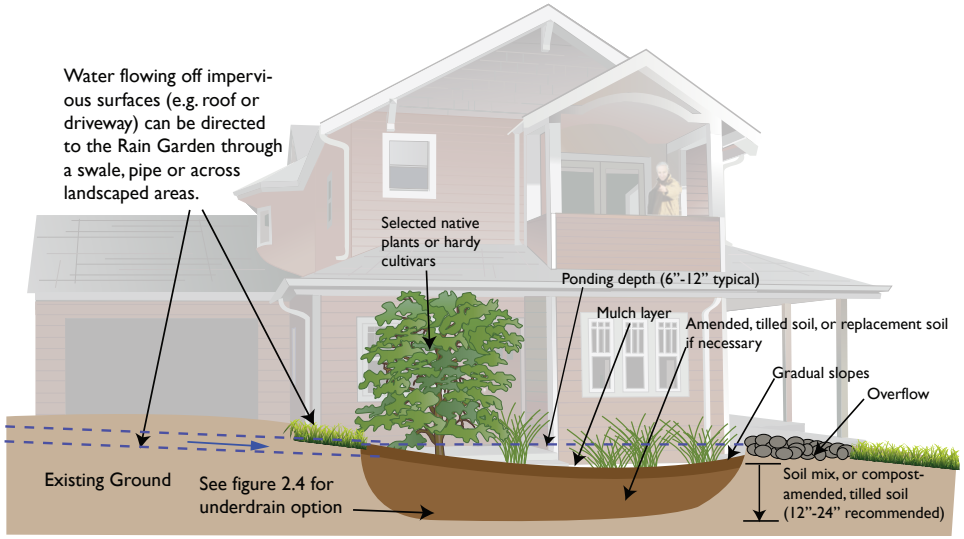
Do:

- Conduct a full site assessment to choose best spot for Rain Garden
- Place Rain Garden in a low spot and direct runoff to Rain Garden
- Consider "treatment train" options, such as catching roof runoff in Rain Barrels and draining those into the Rain Garden
- Call Miss Utility before digging
- Use appropriate soil mix, depending on existing soil characteristics
- Water plants during the first growing season, especially during dry conditions
- Inspect finished Rain Garden after several storms

Don't:

- Place Rain Garden in a soggy area (poorly drained soil) that already stays wet for many days after rain
- Place Rain Garden within 10 feet of building foundation
- Place Rain Garden under tree canopy, above utilities or septic fields, or next to wells
- Compact the soil under the Rain Garden during excavation

Overview



Where NOT to Locate a Rain Garden

1. Within 10 feet of a building foundation
2. Over Utilities
3. Near the edge of steep slopes or bluffs
4. Near an existing or reserve septic drainfield or tank
5. In low spots that do not drain well
6. Within 2 feet of high ground water level
7. Under a tree, or in other areas that would require disturbing healthy native vegetation
8. Where there is high groundwatrer during the winter
9. Near Wells- Stay back 50 feet from confined wells, or 100 feet from unconfined wells

Recommended Maintenance for Rain Gardens

Maintenance Tasks	Frequency
• Water often during the first 2 months, and then as needed during first growing season (April-October), depending on rainfall • Expect up to 10% of the plant stock to fail in the first year, and plan accordingly for replacement plants	Upon establishment Small herbaceous plants will require more watering
• Check and repair eroded areas • Check inlets and overflow areas for debris or leaves that are blocking flow	After heavy rains in first 6 months Periodically in subsequent years
• Remove weeds by hand	Monthly for first growing season Every 3 months in subsequent years
• For meadow type Rain Gardens consisting of grasses, mow the Rain Garden in early spring • For other types of plantings, check for winter damage and add mulch to bare spots as desired (2–3 inches). Do not let mulch touch base of plants. • Cut back perennials and remove dead growth • High winter wildlife value perennials/grasses can be left until they start sprouting in the spring	February or March
• Add reinforcement planting to maintain the desired vegetation density • Prune trees and shrubs • Thin herbaceous plants as desired • Remove excess leaf matter after all leaves have fallen in the fall	Fall
• Remove invasive plants using recommended control methods • Remove any dead or diseased plants • Stabilize bare areas draining to the Rain Garden, especially if there is erosion • Remove trash	As needed
• Remove accumulated sediment at inflow points	Annually

WSA Rainscaping Field Guide
Permeable Hardscapes Quick Guide

What is it?

Permeable Hardscapes use alternatives to traditional paving materials that allow water to seep into the ground rather than become runoff. The surface materials used can be pavers that have spaces between them to allow water to flow through, or in some cases, porous concrete or asphalt. After infiltrating through the surface layer, rainfall seeps into a thick layer of gravel below. This gravel stores and then slowly routes the water into the ground or to a stable outfall. Permeable Hardscapes at the residential and small commercial or institutional scale are typically used for walkways, patios, or parking spots.

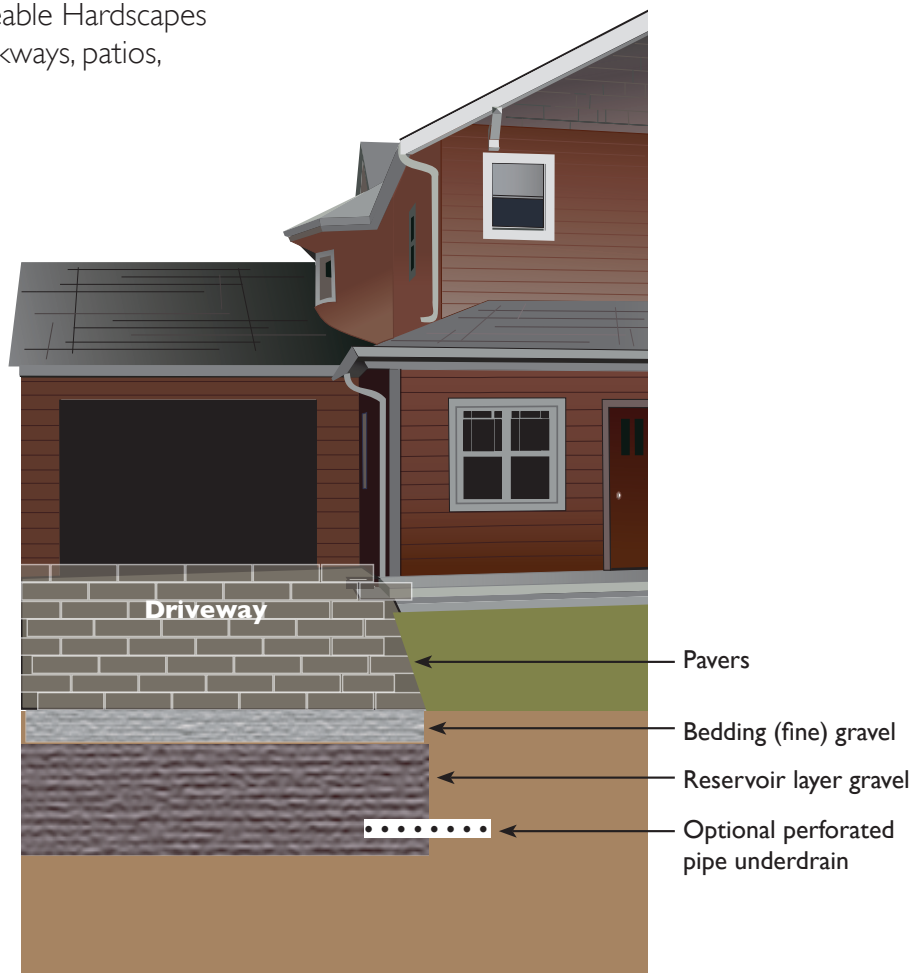
Do:

- Test soil to determine suitability for Permeable Hardscape (needs infiltration rate 1 inch/hour or more)
- Add underdrain if soils infiltrate slowly, or if the drainage area is large
- Add a grass filter strip or other pre-treatment of incoming water to minimize maintenance and chances of failure
- Rake, till, or otherwise scarify the bottom surface of the excavation to improve infiltration
- Check levels and elevations carefully and frequently during installation
- Make sure the edges around the installation are solid. If the surroundings slump or get washed away, so will the hardscape!

Don't:

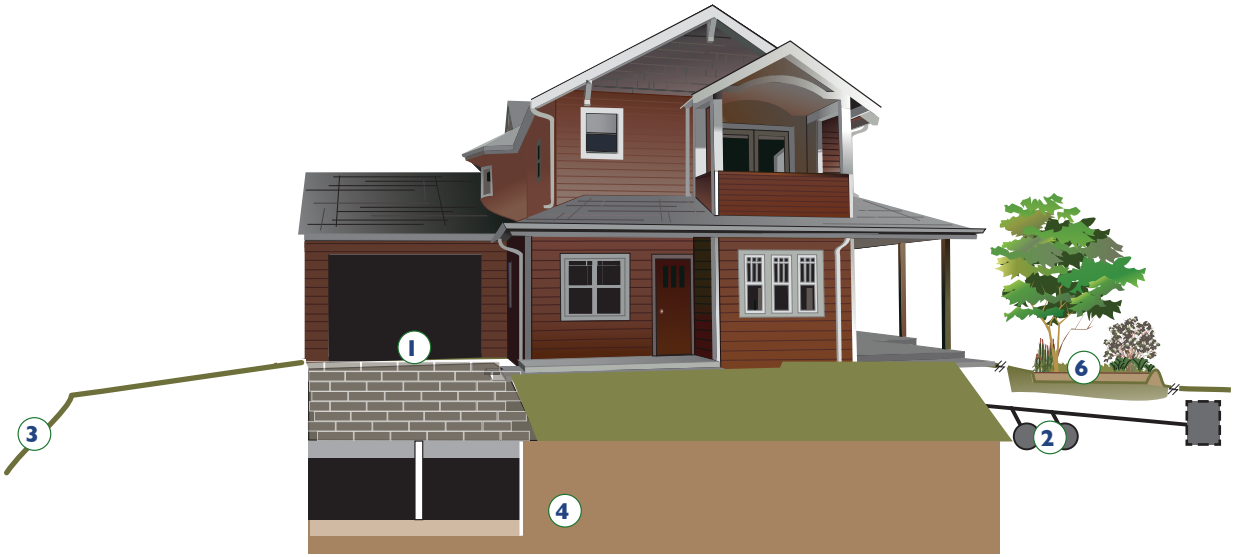
- Locate next to building foundation, water well, septic field
- Direct runoff toward a building foundation
- Send too much water to Permeable Hardscape, especially from *pervious* surfaces. Too much fine sediment = clogging
- Ignore manufacturer specifications and recommendations – each product may have different requirements
- Pressure-wash the spaces between pavers to clean sediment. Instead, use light vacuuming.

Overview



Existing soils that allow infiltration at 1 inch per hour minimum if soils do not have a lot of clay, preferably 2 inches per hour.

Where NOT to Locate a Permeable Hardscape



1. Close to building foundation 5 feet downhill, 25 feet uphill (for projects less than 1,000 square feet)*
2. Over utilities or septic systems
3. Near the edge of loose or steep slopes or bluffs
4. Over impermeable soils
5. Where a lot of water runs onto the Permeable Hardscape from upstream.
6. Under trees or over tree roots

*For projects closer than these setbacks, impermeable liners and/or custom drainage systems may be used, with experienced professional guidance and installation.

Recommended Maintenance for Permeable Hardscapes

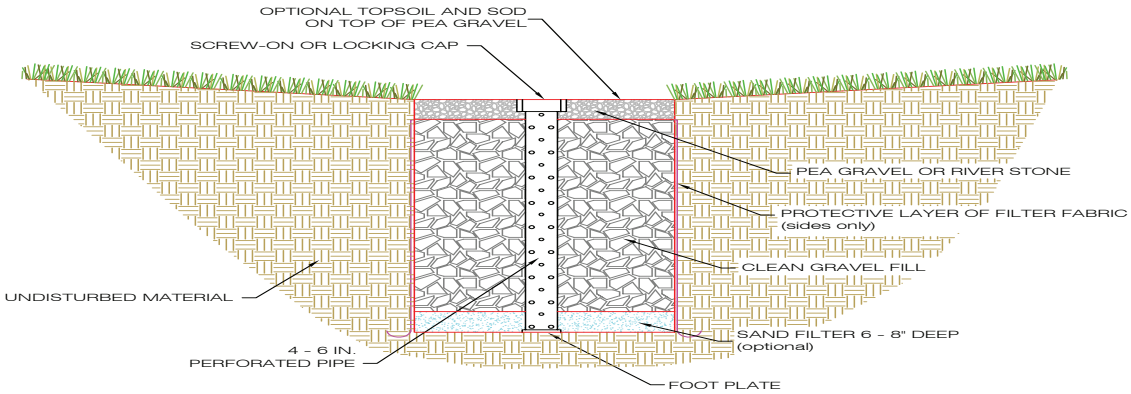
Maintenance Tasks	Schedule
• Sweep the surface if sand or debris accumulates • Leaf blowers can also be used, but make sure debris is removed from the pavement surface • Agitate with a rough brush and vacuum the surface with a wet/dry vac if the joints fill with sand • Remove and replace clogged blocks in segmented pavers • Hire a vacuum sweeper to restore the surface for moderate or larger applications • Repair any structural damage to the paver surface (e.g., cracking, broken pavers, sinkholes)	As needed, particularly at change of seasons when leaves, winter sanding, and other debris may accumulate
• Repair and stabilize any areas that are eroding or washing dirt or debris onto the surface • Check downspouts and channels leading to the Permeable Hardscape and remove any accumulated debris	Quarterly, if other areas drain to the hardscape

WSA Rainscaping Field Guide
Infiltration Practices Quick Guide

What is it?

Infiltration Trenches and Dry Wells are gravel-filled trenches and pits, respectively, that temporarily store stormwater runoff and allow it to seep into the ground. The primary functional structure of an Infiltration Practice is the below-ground gravel reservoir, as the water infiltrates into the soils through the base of the practice. The underlying soils must allow water to percolate through. Infiltration Trenches are typically open-topped, and Dry Wells are typically covered over with a layer of soil and planted with grass to blend in.

Overview



Do:

- Locate any utilities present when planning location of Dry Wells
- Plan for removal, disposal or use of excess soil
- Size the Infiltration Trench or Dry Well properly, and plan carefully for overflows
- Call Miss Utility to locate any utility lines before digging
- Scarify (roughen) the bottom of the trench or basin
- Place gravel in 4-12 inch layers

Don't:

- Install close to building foundation, especially if uphill from building
- Locate near water wells or septic fields
- Use filter fabric on the bottom of the excavation
- Compact the soils in the trench
- Rush if the excavation is near utilities – a little extra time could save a lot

Where NOT to Locate a Infiltration Practice

1. Within 10 feet of a building foundation
2. Over Utilities
3. Near the edge of steep slopes or bluffs
4. Near an existing or reserve septic drainfield or tank
5. In low spots that do not drain well
6. Within 2 feet of high ground water level
7. In areas that would require disturbing healthy native soils and vegetation like under existing tree canopy
8. Where there is high groundwatrer during the winter
9. Near Wells- Stay back 50 feet from confined wells, or 100 feet from unconfined wells

Recommended Maintenance for Infiltration Trenches

Maintenance Tasks	Schedule
• Ensure the contributing drainage area is stabilized, and repair any areas that are eroding • Check downspouts and channels leading to the trenches, and remove any accumulated debris	Quarterly
• Check observation wells (if any) 3 days after a rain event with ½ inch of rainfall or greater. • Treat the practice for clogging if standing water is still present after 3 days • If no observation wells are included, but the practice is very shallow, observe ponding by removing some pea gravel at the surface of the trench	Twice/year
(Clogging troubleshooting) • If the Infiltration Trench starts to drain slowly, remove the top pea gravel or topsoil/turf layer. If filter fabric is present, this may be the source of the clogging. Remove this layer of filter fabric. Check to see if the trench will draw down and replace the overlying material with clean pea gravel or topsoil. • If a Dry Well does not drain properly, dig down to check inflow points for excessive leaves or debris.	Once/year or as needed
(Overhaul) • If the Infiltration Trench or Dry Well is clogged from the bottom, and water stands on the surface, then the practice will need to be reconstructed. If the issue is the underlying soils, the practice should be replaced with a Rain Garden or Conservation Landscape.	Once/year or as needed

WSA Rainscaping Field Guide
Rainwater Harvesting Quick Guide

What is it?

Rainwater Harvesting is simply catching and temporarily storing stormwater runoff in a container for some use. Rain gutters and downspouts direct water to a Rain Barrel or cistern for storage. A great use for stored rainwater is slow release to a Conservation Landscape or Rain Garden to maximize the benefits of those practices.

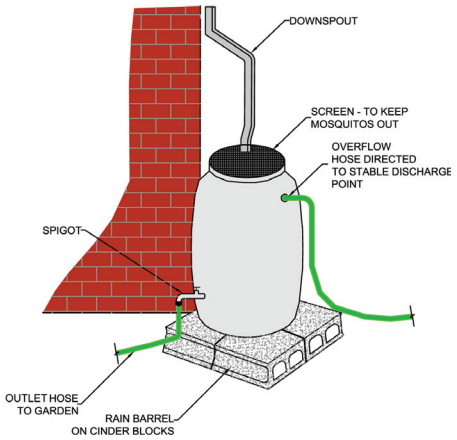
Do:

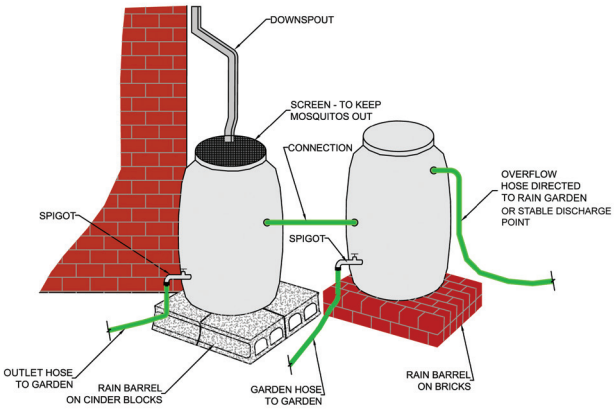
- Have a use or uses of the water in mind before installing the system
- Ensure the surface beneath an above-ground barrel/ cistern is compacted and level
- Make sure that wherever the water is directed is several inches below the spigot
- Ensure any overflow is directed away from the house, and to a stable surface like a splash block or gravel with the ground sloping gently away from the house

Don't:

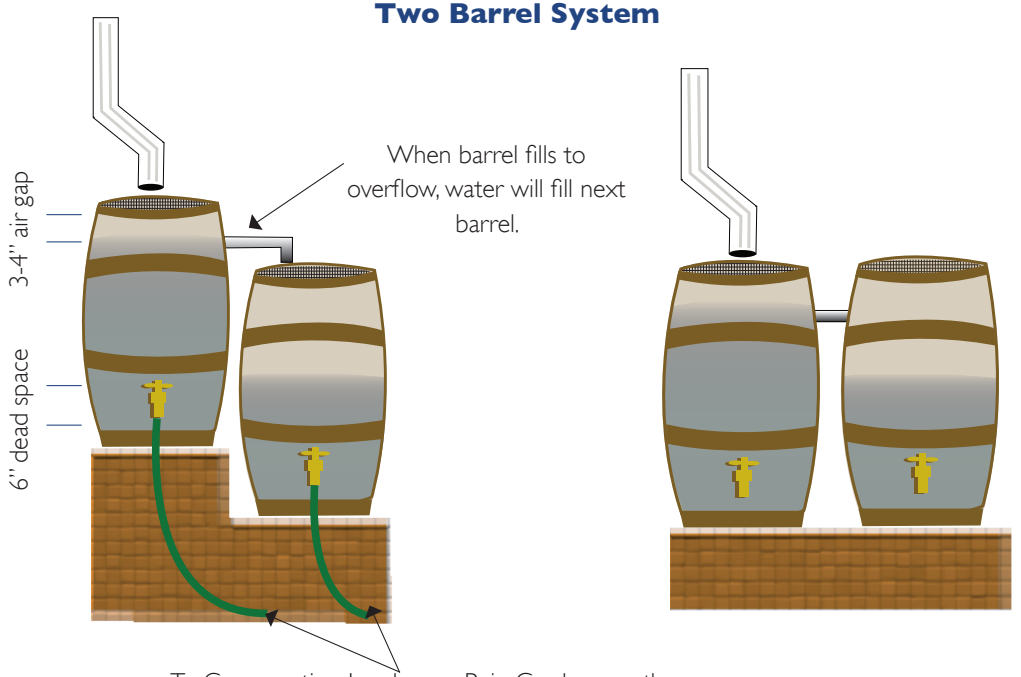
- Underestimate the weight of a barrel or cistern full of water
- Allow water to overflow where it will sit against the house foundation or structure
- Use materials easily damaged by sunlight
- **Leave the Rain Barrel or cistern full after it gets filled – it can only do its job in a storm if it is empty when the rain comes!**

Overview





Two Barrel System



Recommended Maintenance for Rainwater Harvesting Systems

Maintenance Task	Frequency
• Keep gutters and downspouts free of leaves and other debris • Inspect and clean storage tank lids, paying special attention to vents and screens on inflow and outflow spigots	At least once/year
• Inspect and clean pre-screening devices	At least four times/year
• Inspect condition of overflow pipes, overflow filter path and/or secondary runoff reduction practices • Inspect tank for sediment buildup • Inspect structural integrity of tank, pump, pipe and electrical system (as applicable based on the system)	Every third year
• Replace damaged or defective system components • Check mosquito screens and patch holes or gaps immediately	As needed
• Check Rain Barrel or tank regularly to see if mosquito larvae are present • Use mosquito dunks or similar for short-term control and repair any openings allowing mosquitoes to enter	Summer, as needed
• Drain tank after growing season if used for seasonal irrigation use only • Add empty plastic soda bottles (with tops affixed) to the water if some winter use is desired, so that if the tank freezes, it will not crack	Winter, as needed

WSA Rainscaping Field Guide
Green Roof Quick Guide

What is it?

A **Green Roof**, or Vegetated Roof, is a roofing system that contains a storage and drainage system, growing media, and plants. These layers capture, filter, soak up and temporarily store remaining stormwater before it flows into the roof gutter system. Green Roofs require strong roof and building structure, and are best for flat or shallow-sloped roofs.

Do:

- Consult a structural engineer or architect to verify that building can carry the weight of Green Roof
- Plan access to roof for construction and for long-term maintenance
- Look up local building codes and state design specifications for Green Roofs
- Follow specific instructions of Green Roof material manufacturers
- Plan out how to maneuver around roof during installation
- Fertilize and water as needed to get the plants established

Don't:

- Attempt to install Green Roof on slopes steeper than 25%
- Damage waterproofing layer during installation of other layers – it is crucial!

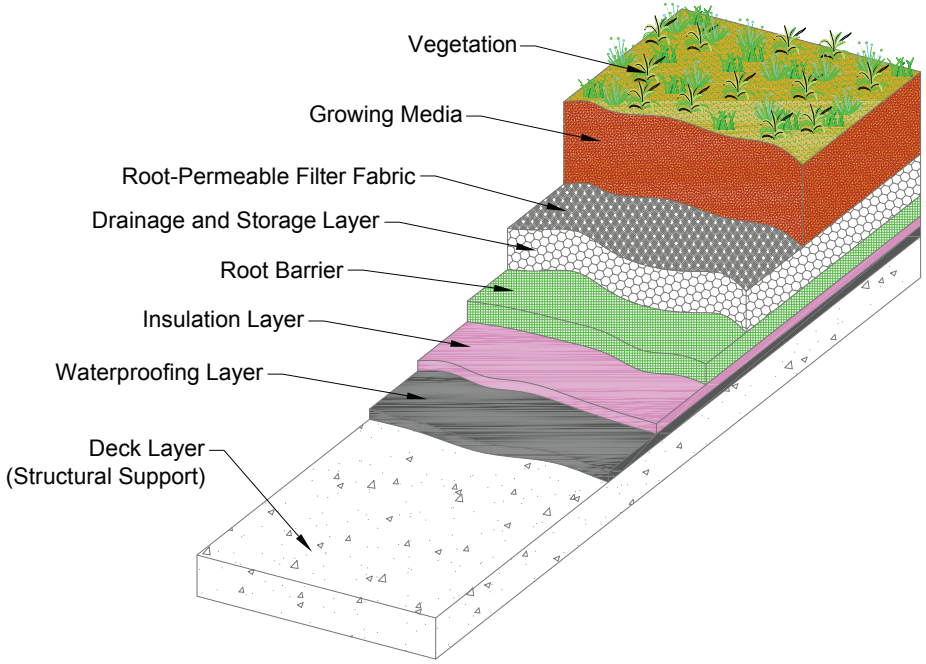
Overview

1. Vegetation
2. Growing medium
3. Drainage layer
4. Moisture and root barrier(s)
5. Roof structure
6. Gutter system
7. Downspout to Rain Barrel, or stabilized outfall

Shallow slope (less than 5%)
Steeper slopes may require baffles or other supports

Roof and wall structure needs to be able to support the heavy loads of saturated Green Roof systems.

Layers of a Green Roof



Recommended Maintenance for Rainwater Harvesting Systems

Activity	Schedule
• Water to promote plant growth and survival • Inspect the roof and replace any dead or dying vegetation	As needed (following construction)
• Inspect the waterproof membrane for leaks or cracks and repair as needed • Weed to remove invasive plants (no digging or using pointed tools) • Inspect roof drains, scuppers, and gutters to ensure they are not overgrown nor have organic matter deposits. Remove any accumulated organic matter or debris • Inspect the roof for dead, dying, or invasive vegetation and plant replacement vegetation as needed	Semi-Annually
• Fertilize (first 5 years)	Annually

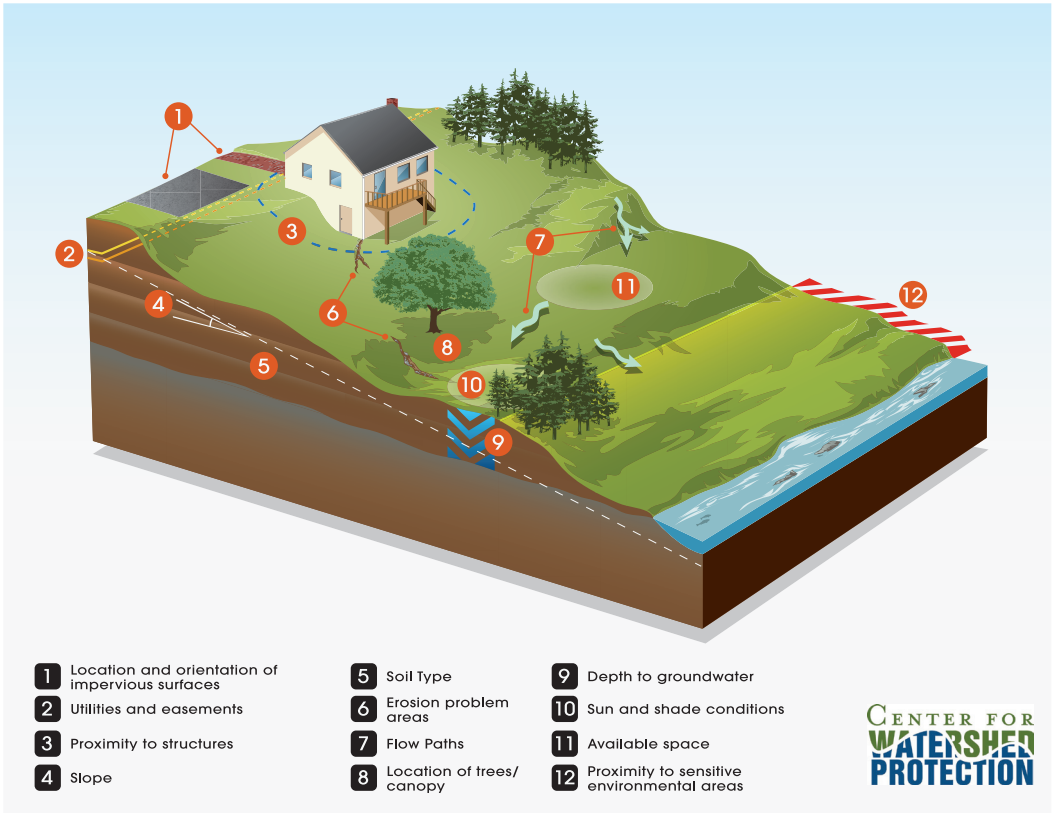
WSA Rainscaping Field Guide
Site Assessment Quick Guide

Site Assessment

It is important to fully assess the opportunities and challenges at a site when selecting the most appropriate stormwater management practices. Some practices may not be feasible, and others may not be practical. Some may even be potentially dangerous or otherwise problematic. Following these steps will help eliminate some guesswork, ensure functional and effective practices are selected, and provide the greatest chance of long-term success. This is intended to be a quick reference tool. **Appendix A** provides more detailed guidance.

Step 1 – Create an Existing Condition or Base Map

Start with an aerial photo from an online mapping tool like Google Maps or My Anne Arundel GIS viewer, or perhaps a plat if one is available. The figure below shows the site constraints that may affect the choice of practice and location. First, map the following on your plat or aerial photo:



- Outline property boundaries
- Highlight the impervious surfaces such as roofs, decks, sheds, pools, driveways, and sidewalks
- Mark locations of trees and landscaped areas
- Measure and calculate the areas of impervious surfaces for use in calculating size of practices

Step 2 – Map Flow Paths

Mark on the map the flow paths of runoff around the site. It is often easier to intercept water where it naturally flows, rather than divert it elsewhere.

Step 3 – Map Utilities and Easements

Resources such as the My Anne Arundel GIS viewer may help identify the location of underground utilities such as electric, gas, sewer, water, cable and telecommunications lines, which must be avoided when digging. Always call Miss Utility (dial 811) before digging!

Step 4 – Map Problem Locations and Areas of Interest

Erosion, poor grass cover, invasive plants, steep slopes, rocky areas, areas planned for some future use, and environmentally sensitive areas such as stream buffers and forest conservation areas are all considerations relating to location and feasibility of stormwater best management practices. **Soils also play a big role in determining which practices are feasible. Be sure to refer to Appendix B on Soil Assessment.**

Step 5 – Create Proposed Conditions Map

Mark the locations available for projects. The available space may partially determine which practices are feasible; undersized practices may not withstand storms or provide any benefit, and oversized practices may not get enough water to sustain the plants that are part of the practice. Use one of the available sizing calculators to determine the ideal size of the practices being considered.

Step 6 – Choose Appropriate Practices

Each practice has sizing and siting constraints. The table below shows which practices are (✓) and are not (×) appropriate for specific locations. It also lists special needs for certain practices to work in those locations.

Location	Conservation Landscape	Rain Garden/ Bioretention	Permeable Hardscape	Infiltration	Rainwater Harvesting	Green Roof	Notes
Next to building	✓[1]	✓[2,3]	×	×	✓[3,4]	✓	1. Refer to chapter for guidelines, section "Location and Feasibility". 2. Stormwater planters or ultra-urban bioretention are also options. 3. Direct overflow at least 5 ft. from foundation. 4. Locate underground tanks at least 10 ft. from foundation.
Next to drinking water well	×	×	×	×	✓[1]	N/A	1. Direct overflow at least 25 ft. from well.
Next to septic drain field	×	×	×	×	✓[1]	N/A	1. Do not site directly on drain field due to potential compression.
Under tree canopy	×	×	×	×	✓	✓[1]	1. Plant selections should match sunlight conditions.
Sandy soils	✓	✓	✓	✓	×	N/A	
Clay soils	✓[1]	✓[1]	✓[1]	×	✓	N/A	1. Soil amendment or localized replacement may be necessary. See Soil Assessment for more detail.
Top of slope	✓	×[1]	✓[2]	×[1]	✓	N/A	1. Locate where they can accept more runoff. 2. Permeable Hardscapes can be at the bottom of a slope, but care should be taken in sizing to not overload the practice.
Bottom of slope	✓[1]	✓	✓[1]	✓	✓	N/A	1. It is important not to send too much water to these practices.
Near/over utility lines	✓[1]	×[2]	×[2]	×[2]	✓[3]	N/A	1. Allowable proximity to utility lines should be confirmed by utility company or municipal government. 2. Under certain special circumstances, it may be possible to locate these over underground utilities, with careful coordination with the utility companies. 3. Underground tanks have the same considerations as below-ground practices. (See note 2)

Soil Assessment and Infiltration Rate Testing

Soils are integral to every type of stormwater management practice, whether the purpose is infiltration or long-term storage. The soil texture, makeup, and infiltration rate are the three most important and telling characteristics, informing most decisions about which practices are feasible.

Soil Texture Identification

Ball Test - Take about 1 tablespoon of the soil sample and knead it together by hand, wetting it gradually. If the soil will not form a cohesive ball it is a sandy soil. If the soil forms a ball, conduct the feel test and ribbon test.

Feel Test – Squeeze and knead the soil in a ball. The sandiest soils will feel gritty, and emit a grinding sound while it is squeezed and kneaded. The least sandy soils will be smooth and silky, with no grinding sound.

Ribbon Test – Finally, placing the soil between the forefinger and thumb, use the thumb to gently push the soil and try to form the soil into a ribbon. Soils with higher clay content will form longer ribbons.

Identifying Soil Texture by Hand. Loose and fluffy, sandy, and gritty are good qualities for soils in BMPs. A smooth ball or long ribbon is not a very good sign.

Infiltration (or Percolation) Testing

Tools Needed:

- Shovel or post hole digger
- Tape measure or measuring stick
- Watch or clock
- Garden hose or other water source
- Pencil and paper for taking notes
- Section of 4-inch diameter PVC or metal pipe, at least as long as the hole is deep
- Digging bar (*optional*)
- Enough gravel to cover the bottom surface of the hole to 2-inch depth (*optional*)

Procedure:

1. Dig a hole to at least the depth of the intended practice and ideally at least 1 foot in diameter.
2. Fill this hole with water and let it sit overnight.
3. Tap a section of vertical PVC pipe securely into the soil at the bottom of the hole so that the water only infiltrates through the bottom of the hole. Add about 2 inches of gravel into the bottom of the pipe so that any clay particles do not form a seal along the bottom of the hole. The pipe will prevent water from infiltrating sideways, which could falsely increase the infiltration rate results.
4. Fill the pipe with water a few inches short of the top and measure the height difference between the water surface and the top of the pipe.
5. Mark the measurement and time. An example is shown in the table below.
6. Approximately once per hour, measure the depth from the top of the pipe to the surface of the water, until the water has completely infiltrated, or the test must be abandoned for other reasons. At each measurement, write down the depth and the time.
7. After completing the test measurement, calculate the infiltration rate for each time period: mark the difference in depth and the amount of time that has passed, and then divide the depth by the amount of time. After calculating the infiltration rate for each time period, divide the total change in depth by the total amount of time taken for the test.

Example of Infiltration Test Record

A	B	C	D	E
Depth (inches)	Time	Difference in depth (inches)	Time elapsed (hours)	Infiltration rate (Column C/D)
3.5	8:30 AM	-	-	-
4.7	9:30 AM	1.2	1	1.2 inches/hour
5.5	10:30 AM	0.8	1	0.8 inches/hour
6.8	11:45 AM	1.3	1.25	1.04 inches/hour
7.6	1:30 PM	0.8	1.75	0.46 inches/hour
8.9	2:30 PM	1.3	1	1.3 inches/hour
9.8	3:30PM	0.9	1	0.9 inches/hour
10.6	4:15 PM	0.8	0.75	1.07 inches/hour
11.8	5:30 PM	1.2	1.25	0.96 inches/hour
			Average rate	**0.92 inches/hour**

The hypothetical test shown in the table above shows an average infiltration rate of approximately 0.92 inches per hour. See calculation below.

11.8 inches – 3.5 inches = 8.3 inches
5:30 PM – 8:30 AM = 9 hours
8.3 inches / 9 hours = 0.92 inches per hour

Design Options Based on Infiltration Rate & Soil Texture

Practice	Infiltration Rate	Design Options
Rain Garden		
	<½ inch per hour	Replace existing soil with a soil mix and use an underdrain
	½ – 1 inch per hour	Replace existing soil with soil mix
	>1 inch per hour	Use existing soil (as long as soil texture is not in a clay category). Compost amendments recommended
Infiltration Trench, Dry Well, and Permeable Hardscape		
	<1 inch per hour	Do not install practice in this location
	1 – 2 inches per hour	Acceptable to install practice here (as long as soil texture is not in a clay category).
	>2 inches per hour	Acceptable to install practice here

Anne Arundel County Watershed Stewards Academy
Arlington Echo Outdoor Education Center
975 Indian Landing Rd. Millersville, MD 21108
410-222-3822 • www.aawsa.org

Sponsored by:
National Fish and Wildlife Foundation

Created in collaboration with the Center for Watershed Protection, Inc.