



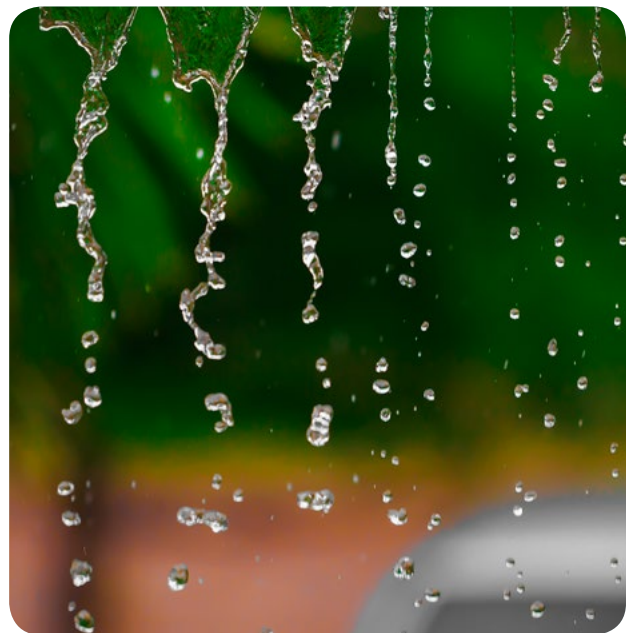
SECTION SIX

STORMWATER RUNOFF SITE MANAGEMENT

Protecting water resources from stormwater runoff is often a multi-step process for hobby farmers, where avoiding and minimizing potential problems is generally the first step. Proper planning can save time and money as opposed to dealing with a larger problem later on.

Previous sections have stressed the importance of selecting the right location for your hobby farm activities; developing a stormwater management strategy; and planning out your nutrient, crop and animal management activities. In those sections, planning strategies were introduced to help the hobby farmer develop successful farming activities while minimizing impacts to water quality.

However, even after careful planning some environmental impacts might remain, which can readily be addressed through further actions. This section focuses on site management measures after following the tips and recommendations in previous sections. Each management technique has been developed so that most hobby farmers can undertake the project in a relatively short amount of time, with commonly found and easily available materials, and in most cases without the need for professional assistance or expensive equipment.





Section 6 offers a “tool box” of Best Management Practices (BMPs) geared towards addressing remaining impacts from your hobby farm through the management and treatment of stormwater runoff. These BMPs include a mix of techniques that focus on:

- Stormwater disconnection/reduction - stormwater is returned to the ground so less water needs to be managed
- Rerouting water - precipitation is kept away from potential pollutants
- Stormwater treatment and natural filtration - help clean polluted runoff before it reaches nearby surface water.

The following Stormwater Runoff Site Management Fact Sheets are included in Section 6:

- FACT SHEET 6-1 Vegetated Buffers
- FACT SHEET 6-2 Grassed Filter Strips
- FACT SHEET 6-3 Vegetated Swales
- FACT SHEET 6-4 Infiltration Trenches and Dry Wells
- FACT SHEET 6-5 Rain Gardens
- FACT SHEET 6-6 Rain Barrels and Cisterns
- FACT SHEET 6-7 Tree Planting for Water Quality
- CHECKLIST 6A Stormwater Runoff Site Management

IMPORTANT STORMWATER TERMS

- **Berm or Check Dam** – Small barrier often used in constructed stormwater BMPs and made out of natural material to slow stormwater flow.
- **Groundwater Recharge** – Occurs when water moves downward through the ground and replenishes groundwater.
- **Infiltration** – Occurs when water on the land surface moves downward through the soil.
- **Level Spreader** – Used in constructed stormwater BMPs to slow and spread out the flow of water as sheet flow.
- **Sheet Flow** – A slow moving, shallow flow of water over land that is not concentrated into channels.
- **Stormwater Best Management Practice or BMP** – A method or action used to prevent, treat or manage stormwater quality and quantity to help protect surface water. BMPs can include structural methods that are constructed to help control, filter, infiltrate and store stormwater. BMPs can also be non-structural methods that rely on education, good housekeeping and maintenance.
- **Stormwater Runoff** - Water from precipitation or snow-melt that runs off impervious surfaces such as rooftops, paved streets and parking lots. Stormwater can also come from hard grassy surfaces like lawns and fields and from compacted surfaces such as unpaved driveways, parking lots and roads. Stormwater runoff can pick-up pollutants along these surfaces and carry contaminants to nearby surface waters.



FACT SHEET 6.1

VEGETATED BUFFERS

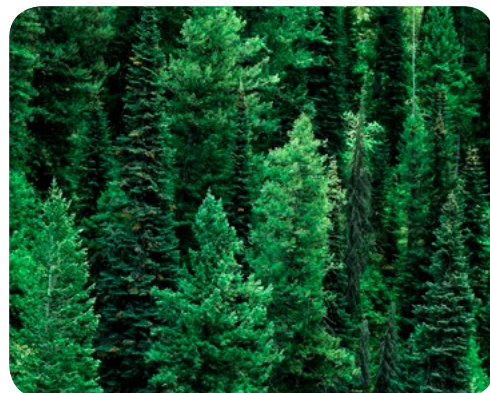
A vegetated buffer is a planted or naturally vegetated area of land that can slow down, spread out and infiltrate stormwater flow to help filter out pollutants such as sediment, nutrients and bacteria before reaching a waterbody. They should be located between your hobby farm and a surface water or wetland, generally running the length of the waterbody.

WHAT IS INFILTRATION?

Infiltration is when water or stormwater soaks into the ground.

WITH MOST VEGETATED BUFFERS, WIDER IS OFTEN BETTER, BUT EVEN A NARROW STRIP OF VEGETATION BETWEEN YOUR HOBBY FARM AND SURFACE WATER CAN OFFER WATER QUALITY BENEFITS.

The size of your buffer will be largely dependent on the area of land you have to work with and the area you are able to dedicate as a buffer. Farm activities should always be placed as far away from wetlands and surface water as possible.



BENEFITS

- ✓ Interception, infiltration and absorption of precipitation and stormwater runoff
- ✓ Filtration of suspended and water soluble pollutants like sediment, fertilizers and pesticides
- ✓ Bank stabilization and erosion control for slopes and disturbed areas
- ✓ Flood control during heavy rain and high-water levels
- ✓ Trees and shrubs provide shade and shelter for aquatic organisms
- ✓ Enhanced habitat for wildlife and pollinators
- ✓ Helps contain animals and prevent direct contact with surface water
- ✓ May help reduce nuisance complaints from adjacent neighbors from odor, dust and noise
- ✓ Can act as a fence line to keep unwanted wildlife such as Canada geese off of your property

DID YOU KNOW?

Although vegetated buffers are typically used along waterways, they can also be used to buffer your hobby farm activities from other areas such as adjacent properties, road shoulders and stormwater drainage systems.

DESIGN CONSIDERATIONS

Consider the following when planning your vegetated buffer:

Length

Your vegetated buffer should extend the length of the waterbody or shoreline on your property. If you need access to the water, consider meandering paths rather than straight paths through the buffer. Winding routes can help slow polluted runoff and reduce erosion. Remember that farm animals should never have a direct route or access to waterways. Fencing, protected waterway crossings and alternative water sources should be used so that animals are kept out of waterways.

Width

Wider is better, preferably 50-feet or more. Recognizing this is not always possible, particularly in more urban settings, any size buffer can be beneficial. Even a narrow buffer with healthy vegetation can provide benefits and is a worthwhile endeavor. Generally, steeper slopes warrant wider buffers to provide enough time to slow the flow of water and remove pollutants.

Slope

Slope is how flat or steep your land is. Since water flows faster going downhill, steep slopes are more susceptible to erosion and cannot filter as effectively as flat lands. If possible, make vegetated buffers wider in sloped areas.

Vegetation

All types of native plants can create an effective buffer. Keep in mind that different types of plants provide different benefits. Ideally, the most effective buffers will include a mix of trees, shrubs and plants that are native to the area. Buffer trees, shrubs, grasses and even the leaf litter or the ground layer each provide a unique function.

Trees

A tree leaf canopy can intercept thousands of gallons of precipitation per year; trap airborne pollutants; provide noise and odor control; protect against damaging winds; and provide temperature control. Fallen limbs can help create topographic features that can slow and detain runoff, filtering pollutants. Tree roots improve soil porosity encouraging infiltration of runoff; aid in flood management; provide streambank stabilization and erosion control; and help filter pollutants.

Shrubs

Shrubs intercept water that passes through the tree canopy. They provide streambank stability and erosion control. Shrub roots and leaf litter can slow runoff and improve soil infiltration, help filter sediment and attached pollutants; and be a physical barrier to some larger animals preventing access to waterways (no farm animals should have direct access to waterways due to water quality impacts).

Grasses

The high stem density of herbaceous plants can slow water and disperse runoff helping to remove sediment and water soluble pollutants like fertilizers and pesticides.

Ground Layer

The ground or leaf layer made up of accumulated plant material like leaves, pine needles and seeds such as acorns help protect the soil against erosion and keep it in place. It also helps slow down runoff, encouraging infiltration into the ground and the filtration of pollutants.



REGULATORY CHECK

In most communities, any activity within 100' of a surface water (or within 200' of a perennial stream) may require approval - see your local Conservation Commission for assistance.

STRATEGIES

Buffers can be created naturally or through the planting and seeding of new areas. The most effective buffers are not only wide but contain a mix of different species of trees, shrubs and grasses. You can establish your buffer using one of three basic approaches: 1) stop maintaining an area to allow for natural revegetation; 2) create a landscaped buffer through planting; 3) enhancing the natural growth process through planting select vegetation (a combination of 1 and 2).

NATURAL REVEGETATION	Natural revegetation allows the existing plants and seeds in the area to grow naturally. This is ideal for areas that have been mowed or disturbed. Simply leave the area alone and it will progress through its natural succession of plant growth. Monitor the area periodically to remove any invasive or non-native plant species. Any bare areas that appear can always be seeded or planted. This approach is the easiest and least costly but will take some time for everything to grow in and mature.
ACTIVE REVEGETATION	Active revegetation is ideal if you don't want to wait for your buffer to grow in naturally or if you would like to select the specific types of vegetation to grow. This approach involves: 1) staking out your proposed buffer area and measuring the space – maybe sketch out a simple plan; 2) selecting your plant species and determining how many you need based on the total area and how much space each plant will require; 3) preparing your planting area; and 4) planting, mulching and watering your plants. Remember that you may need temporary sediment controls until the area has been stabilized by plant growth. This approach is more labor intensive and costly, but the advantage is that your buffer will fill in quicker and with native species you personally selected. Proper species selection, coupled with an early maintenance effort, can also help prevent invasive species growth.
BUFFER ENHANCEMENT	Can't decide if you should do natural or active revegetation? Do a little of both! This approach will allow you to select and plant species in certain areas while letting other spaces revegetate naturally. This method gives you flexibility when it comes to labor, budget, plant type and growing time.

MAINTENANCE AND MANAGEMENT

Some of the best buffer management strategies are to simply leave them alone. Undisturbed buffers generally work the best; however, periodic inspections should take place to identify any problems or corrective actions. The following is a simple inspection checklist and a few reminders to help you get the most out of your vegetated buffer.

- ✓ Seed or plant any bare spots and ensure new plantings are growing and existing plants are healthy
- ✓ Remove invasive species and any hazard trees that pose a safety risk
- ✓ Do not use fertilizer or pesticides within your buffer
- ✓ Keep farm animals out of your buffer
- ✓ Do not store heavy equipment or anything else in your buffer
- ✓ Avoid tracking through your buffer with your vehicles and equipment



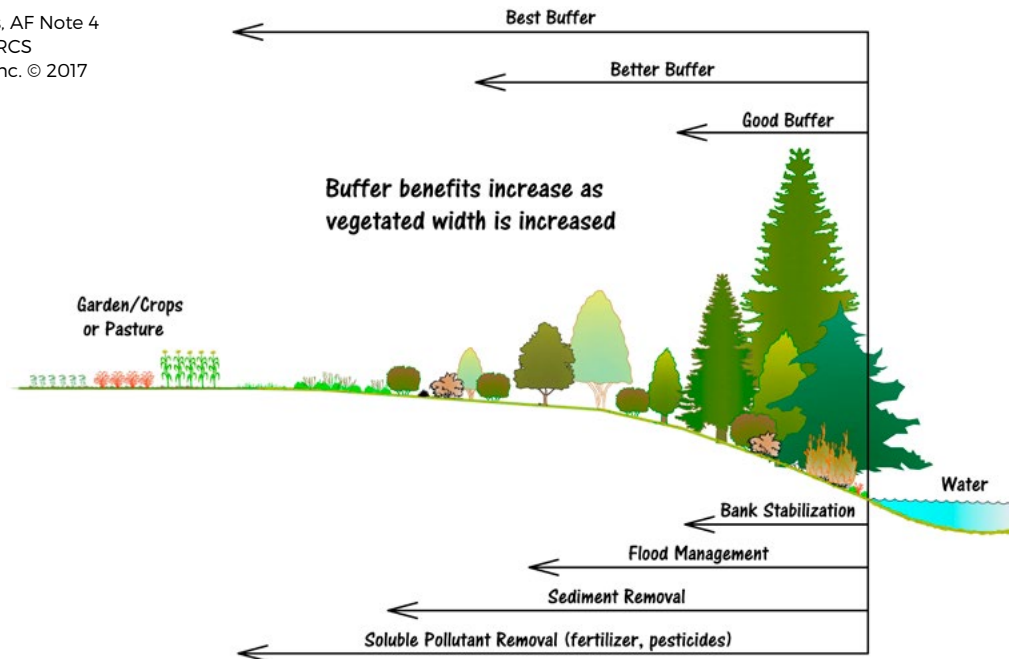
DID YOU KNOW?

Massachusetts has a Prohibited Plant List. Never purchase, plant or propagate any plants on the prohibited plant list: www.mass.gov/eea/agencies/agr/farm-products/plants/massachusetts-prohibited-plant-list.html

CAUTION!

if you plan on purchasing or transplanting your plants to create your vegetated buffer, make sure you are planting species that are non-invasive and native to your area.

Adapted from Agroforestry Notes, AF Note 4
Jan 1997, USDA Forest Service/ NRCS
Comprehensive Environmental, Inc. © 2017



Vegetated Buffers

VEGETATED BUFFER BENEFITS	VEGETATION TYPE		
	Grass	Shrubs	Trees
STREAMBANK STABILIZATION AND EROSION CONTROL	●	●●●	●●●
FILTER SEDIMENT CONTAINING NUTRIENTS, PESTICIDES AND PATHOGENS	●●●	●●	●●●
FILTER WATER SOLUBLE FERTILIZER AND PESTICIDES	●●	●	●●
IMPROVE AQUATIC HABITAT	●	●●	●●●
IMPROVE WILDLIFE HABITAT FOR FOREST ANIMALS	●	●●	●●●
FLOOD PROTECTION	●	●●	●●●

NOTES: Good Benefit ● Better Benefit ●● Best Benefit ●●●

HELPFUL LINKS

www.soaknh.org/wp-content/uploads/2016/06/Vegetated-Buffer.pdf
www.mass.gov/eea/docs/dep/water/bufman.pdf



FACT SHEET 6.2

VEGETATED FILTER STRIPS

A vegetated or grass filter strip (sometimes referred to as a grass strip) is an area used to help slow down, filter and infiltrate stormwater runoff.

Unlike a vegetated buffer, which is used to provide an undisturbed natural protective area between your hobby farm and waterbody, filter strips are installed in specific locations around your hobby farm to help treat stormwater runoff.

Filter strips are more effective in treating sheet flow (a more even, slow moving, shallow flow that can occur on relatively flat, gently sloping land) compared to channelized flows (fast moving, narrow flow that can occur with natural swales, man-made ditches, or eroded gullies) and can be used in combination with other treatment techniques or as a stand-alone practice.

BENEFITS

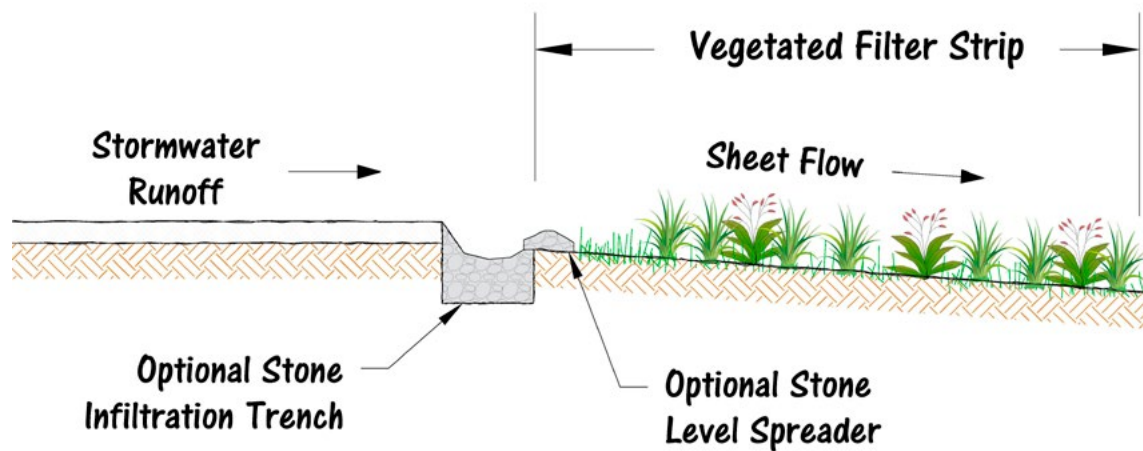
- Trap and filter out sediment and attached pollutants
- Slow down stormwater runoff helping to control erosion
- Promote infiltration of runoff into the soil
- Do not require a lot of space

Where Can Filter Strips be Used on Hobby Farms?

Filter strips can be used wherever precipitation, snow melt or stormwater runoff occur to help intercept and treat it. They are ideally used in areas that receive sheet flow, or water that is spread out (i.e., runoff from a small area of land). Vegetated filter strips are extremely useful on hobby farms where they can be constructed between a wetland or waterway and the following areas:

- Fields used to grow crops
- Pastures used for grazing
- Animal yards
- Barns and other structures
- Manure storage
- Compost areas
- Upland side of vegetated buffers
- Driveways and roadways
- Storm drainage systems





Comprehensive Environmental, Inc. © 2017

DESIGN CONSIDERATIONS

LOCATION IS KEY WITH VEGETATED OR GRASS FILTER STRIPS AND SIMILAR TO VEGETATED BUFFERS, BIGGER IS OFTEN BETTER, BUT ANY SIZE FILTER STRIP CAN MAKE A WATER QUALITY IMPROVEMENT.

Length

The filter strip should extend the crop length of the area where stormwater runoff occurs. For example – if you are looking to filter stormwater runoff from crop fields, then the length of the filter strip should follow adjacent to as much of the field's downslope perimeter as possible.

Width

The width of your filter strip is largely going to depend on the amount of area you can dedicate to it. Filter strips 25-feet in width and more have been proven to provide substantial water quality benefits, however in many situations this is not always possible. It is recommended that hobby farmers assess the areas they would like to protect, determine the amount of area they are able to use and focus on maintaining a healthy, vegetated strip for maximum potential. Something is better than nothing, therefore any amount should be considered a worthwhile endeavor.

Vegetation

Grasses that can withstand periodic mowing and thrive in both wet and dry conditions should be used for vegetated filter strips. If seeding the area, be sure to protect it from any significant flow until the seed has germinated and grown to a point where it has filled in the strip and the risk of erosion has passed.

Slopes

Vegetated filter strips are more effective on gentle slopes where stormwater runoff can flow across the strip as sheet flow. At steeper slopes, stormwater runoff starts to concentrate, creating small rivulets or channels, and may either erode the filter strip or simply bypass it entirely. One way to help eliminate channelized flow and promote a slower, more continuous sheet flow across the filter strip is to install a level spreader. A level spreader can be anything (stone, gravel) that will slow and fan out the water before it reaches the filter strip.

INSTALLATION

The following are basic installation steps for vegetated filter strips:

Step 1

Mark your filter strip boundary with stakes, flags or paint.

Step 2

Clear any existing weeds, invasive species or other unwanted vegetation or obstructions.

Step 3

Ensure the existing soil is level, stable and suitable to plant or seed your selected plant species.

Step 4

The inlet or area where runoff enters your filter strip should be stabilized with plants or stone to both help avoid erosion from incoming water and ensure the flow is spread out to produce sheet flow as opposed to a channel of water.

Step 5

Plant your selected vegetation and be sure to water during the early weeks.

MANAGEMENT AND MAINTENANCE

- ✓ Inspect seasonally and after heavy rains to remove sediment and debris and to stabilize any eroded areas
- ✓ Ensure new plantings are growing and existing plants are healthy
- ✓ Seed or plant any bare spots
- ✓ Remove invasive species
- ✓ Mow at your highest height setting several times per year
- ✓ Do not use fertilizer or pesticides
- ✓ Keep farm animals and heavy equipment out

CAUTION!

Never use or store heavy equipment on vegetated filter strips or swales to avoid soil compaction. Compacted or tightly packed soil can severely limit runoff infiltration (your soil's ability to soak up water), eliminating one of the main functions of vegetated runoff practices.

HELPFUL LINKS

www.mapc.org/resources/low-impact-dev-toolkit/grass-filter-strips

www.mda.state.mn.us/protecting/conservation/practices/buffergrass.aspx

www.elibrary.dep.state.pa.us/dsweb/Get/Document-67997/6.4.9%20BMP%20Vegetated%20Filter%20Strip.pdf



FACT SHEET 6.3

VEGETATED SWALES

A vegetated swale is an open, shallow, vegetated channel or ditch that collects and moves stormwater runoff, preferably to an area better suited for treatment and infiltration, like a rain garden or dry well. The swale itself can also slow down, filter and infiltrate stormwater.



DID YOU KNOW?

Volume vs. Velocity – Stormwater volume refers to the overall amount of water while stormwater velocity is the speed of the water as it moves or flows. Many stormwater Best Management Practices (BMPs) aim to reduce the overall amount of stormwater AND slow it down. Achieving both of these goals helps to control erosion, increase infiltration and reduce pollutants entering nearby surface water.

BENEFITS

- Directs runoff away from areas where pollutants may be more concentrated like animal yards
- Carries stormwater to an area where it can be better managed
- Traps and filters out sediment and attached pollutants
- Slows down stormwater runoff helping to control erosion
- Promotes infiltration of stormwater into the soil

Where can vegetated swales be used on Hobby Farms?

Vegetated swales can generally be used anywhere stormwater runoff collects including water from the roofs of houses, barns, and storage areas; covered compost areas; driveways and roadways; animal yards; the bottom of steep slopes; and near any other areas that generate stormwater runoff.



CAUTION!

Do not use vegetated swales to direct water off of your property, into the street or catch basin, or directly into surface water. Vegetated swales should be used to move stormwater to another, more suitable location on your property where it can further soak or infiltrate into the ground.

CAUTION!

Always call Dig Safe (811) before any type of digging or excavation to help ensure you do not come into contact with utilities, pipes or wires. This must be done at least 72-hours prior to the start of work. See www.digsafe.com for more information.



CI

DESIGN CONSIDERATIONS

Location

A vegetated swale should be located downhill from areas that produce stormwater runoff or at a location to intercept and redirect runoff away from higher pollutant areas. Remember to always check with your local Conservation Commission if you are working within 100' of a wetland or water resource area, or within 200' of a perennial stream.

Size

The length of your vegetated swale will be based on the distance between the source of your stormwater runoff (roof, driveway, roadway etc.) and the discharge location (raingarden, dry well, etc.). The width and depth of a vegetated swale can vary and is often determined by available space and the volume of water you are moving. A rule of thumb is to make the width of each of the sides of the swale three times the depth of the swale.

Slopes

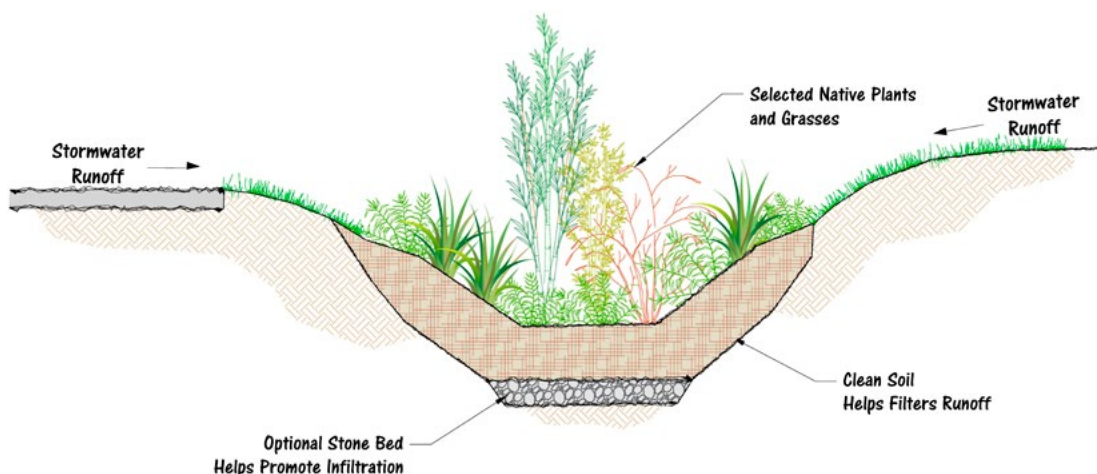
Swales are typically constructed in naturally sloping areas to move water from one location to another through gravity. Consider constructing periodic check dams or berms across the width of the swale. Check dams or berms can be easily constructed out of rocks, silt socks or even haybales and act as a speed bump to slow down stormwater. You can also slow flow by creating a meandering or winding swale (as opposed to straight) to create more time for sediment to settle out. Vegetated swales should not be constructed on steep slopes.

Discharge

Swales should preferably discharge to a vegetated area to allow the runoff to soak into the ground. If a vegetated area does not exist, consider constructing a dry well or raingarden for the swale to flow into.

Plants

Small shrubs and grasses that can tolerate both dry and wet conditions will do well in most swales. Stagger larger plants to either side of the deepest part of the swale, while grasses can be planted full width.



Comprehensive Environmental, Inc. © 2017

Vegetated Swale



INSTALLATION

STEP 1

Mark your swale boundary with stakes, flags or paint and contact Dig Safe (811) at least 72-hours prior to digging. If Dig Safe identifies obstructions in or around your marked area you will need to relocate your swale.

STEP 2

Dig the swale, creating your channel and gently sloping sides along the entire length of the swale.

STEP 3

Install your check dams or berms along the bottom of the swale if needed.

STEP 4

The inlet to your swale where stormwater runoff enters may need to be stabilized with either plants or stone to help avoid erosion from incoming water.

STEP 5

Plant your selected vegetation and be sure to water during the early weeks.

MAINTENANCE AND MANAGEMENT

- ✓ Inspect seasonally and after heavy rains to remove sediment and debris
- ✓ Ensure new plantings are growing and existing plants are healthy
- ✓ Seed or plant any bare spots
- ✓ Remove invasive species
- ✓ Remove any hazard trees that pose a safety risk
- ✓ Do not use fertilizer or pesticides
- ✓ Keep farm animals out
- ✓ Keep heavy equipment out and avoid crossing or traveling through the swale to access your farming activities

HELPFUL LINKS

www.soaknh.org/wp-content/uploads/2016/06/Vegetated-Swale.pdf

http://www.maine.gov/dep/land/stormwater/stormwaterbmps/vol3/chapter8_1.pdf



FACT SHEET 6.4

INFILTRATION TRENCHES AND DRY WELLS

It is common for hobby farms to have one or more covered structures such as a storage shed, barn, compost area or animal shelter in addition to the main residence. Paved driveways, roads or compacted travel ways may also be present on a hobby farm.

Roofs and roadways can significantly contribute stormwater runoff to the overall volume of water that requires management on your hobby farm. If this water can be captured and infiltrated near its source, then the overall amount of stormwater runoff that has to be managed elsewhere can be significantly reduced. One way to do this is to install infiltration trenches or dry wells adjacent to these areas.

An infiltration trench is a shallow, horizontal excavation filled with crushed stone, which stores stormwater runoff in the spaces between the stone and allows for a gradual infiltration of runoff into the ground. Similarly, a dry well is a deeper vertical excavation that serves the same purpose. Both of these techniques are used to treat runoff that has had minimal contact with contaminants such as bacteria and nutrients that are less likely to be found in roof runoff or runoff generated from driveways and private roadways.



WATER QUALITY BENEFIT

Stormwater practices that promote infiltration return stormwater runoff to the ground. This not only benefits groundwater resources, but reduces the amount of runoff that can potentially pick up pollutants from the hobby farm and flow into nearby surface water.



BENEFITS

- Promotes infiltration of stormwater runoff
- Reduces overall stormwater runoff volume
- Helps remove sediment
- Supports groundwater recharge

ARE YOUR SOILS SUITABLE?

The primary function of infiltration trenches and dry wells is to return water to the ground. To achieve this, the soils have to be porous enough to accept the water at the rate it is received. Different soils do this at different rates. A simple percolation 'Perc' test can help determine if your soil can do this at a rate sufficient to support an infiltration trench or dry well. A rule of thumb is that the soils should infiltrate water you've collected within 24-hours. Soils that take longer are not suitable for these types of techniques and often result in flooding and erosion.

How to do a Perc Test:

Note: The following method is for a small system. Large non-residential systems serving extensive impervious areas will require a more in-depth soil investigation and engineering design.

Step 1

Dig a 12" x 12" x 12" hole where you want to install your dry well or infiltration trench.

Step 2

Fill it with water.

Step 3

If it drains within 24-hours, your soils will likely support an infiltration trench or dry well. If it doesn't drain completely or fills with water, then a new location is needed.

CAUTION!

Always call Dig Safe (811) before any type of digging or excavation to help ensure you do not come into contact with utilities, pipes or wires. This must be done at least 72-hours prior to the start of work. See www.digsafe.com for more information.

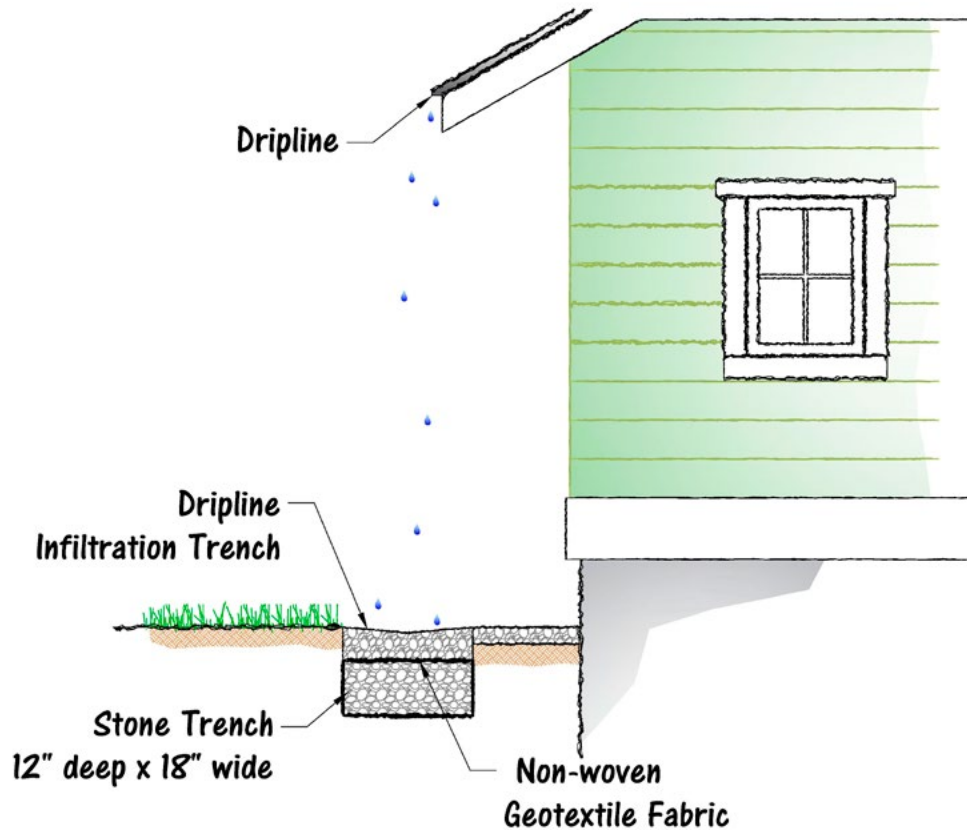


CI



REGULATORY CHECK

Contact your local Conservation Commission before doing any work within 100' of a wetland or water resource or within 200' of a perennial stream



Comprehensive Environmental, Inc. © 2017

Dripline Infiltration Trench

SIZING AND INFILTRATION

Once you have determined where to construct your infiltration trench or dry well and confirmed that your soils are suitable to infiltrate runoff, you are ready to size and construct your stormwater element. Below are links to detailed instructions on how to both size and construct your project.

BEFORE CONSTRUCTING YOUR INFILTRATION TRENCH OR DRY WELL, BE SURE TO REFER TO THE FOLLOWING ONLINE RESOURCES:

- **Infiltration Trench for Driveway Runoff:**
<http://soaknh.org/wp-content/uploads/2016/06/Driveway-Infiltration-Trench.pdf>
- **Infiltration Trench for Roof Runoff:**
<http://soaknh.org/wp-content/uploads/2016/06/Dripline-Infiltration-Trench.pdf>
- **Dry Well:**
<http://soaknh.org/wp-content/uploads/2017/01/Dry-Well.pdf>



INNOVATIVE IDEAS

Pervious Walkways and Patios

Pavers used to promote stormwater infiltration along walkways and sitting areas.

<http://soaknh.org/wp-content/uploads/2016/06/Pervious-Walkways-and-Patios.pdf>

Water Bars

Used to intercept stormwater along sloping walkways, paths or gravel driveways, water bars divert runoff into vegetated areas for treatment and infiltration, reducing erosion.

<http://soaknh.org/wp-content/uploads/2016/06/Water-Bar.pdf>

Infiltration Steps

Steps along a sloped walking path to slow down and infiltrate runoff and reduce erosion.

<http://soaknh.org/wp-content/uploads/2016/06/Infiltration-Steps.pdf>

MAINTENANCE AND MANAGEMENT

- ✓ Inspect seasonally and after heavy rains to remove visible sediment and debris.
- ✓ Check often for ponding and slow draining water as this can be an indicator of clogging. If this occurs, the stone and landscape fabric should be removed, washed free of accumulated sediment causing the clog and replaced.
- ✓ Protect the area from compaction by foot traffic, vehicles and equipment.



REGULATORY CHECK

Some dry wells may be regulated as a Class V well (UIC or Underground Injection Control). Visit the following link to determine if your dry well will require state registration: www.mass.gov/eea/agencies/massdep/water/drinking/underground-injection-control.html. Dry wells draining higher pollutant areas may not be allowed so always check first.

HELPFUL LINKS

www.maine.gov/dep/land/stormwater/stormwaterbmps/vol3/chapter6.pdf
www.dec.vermont.gov/sites/dec/files/wsm/lakes/docs/Shoreland/Infiltration%20Trenches_04162015.pdf
www.extension.unh.edu/resources/files/resource001799_Rep2518.pdf





FACT SHEET 6.5

RAIN GARDENS

A rain garden is a garden that is planted in a shallow depression with soil and plants that help capture, treat and infiltrate stormwater runoff.

Now being used in all types of settings including urban, commercial and residential locations, rain gardens have recently become a popular landscape feature because of their ease of installation, low cost, significant stormwater management benefits and aesthetic qualities.

Sometimes used interchangeably with the term 'bioretention', rain gardens are used to collect and infiltrate stormwater runoff from impervious surfaces such as rooftops, driveways and roads. Hobby farms can often benefit from one or more strategically placed rain gardens. Rain gardens can be constructed alone or at the end of filter strips and vegetated swales to treat and infiltrate overflow from these stormwater management techniques.

BENEFITS

- Promotes groundwater recharge
- Infiltrates stormwater runoff
- Traps and filters sediment associated pollutants
- Plants provide nutrient removal
- Helps reduce overall runoff
- Attractive landscape feature

Rain gardens can be constructed wherever stormwater runoff can be collected including along:

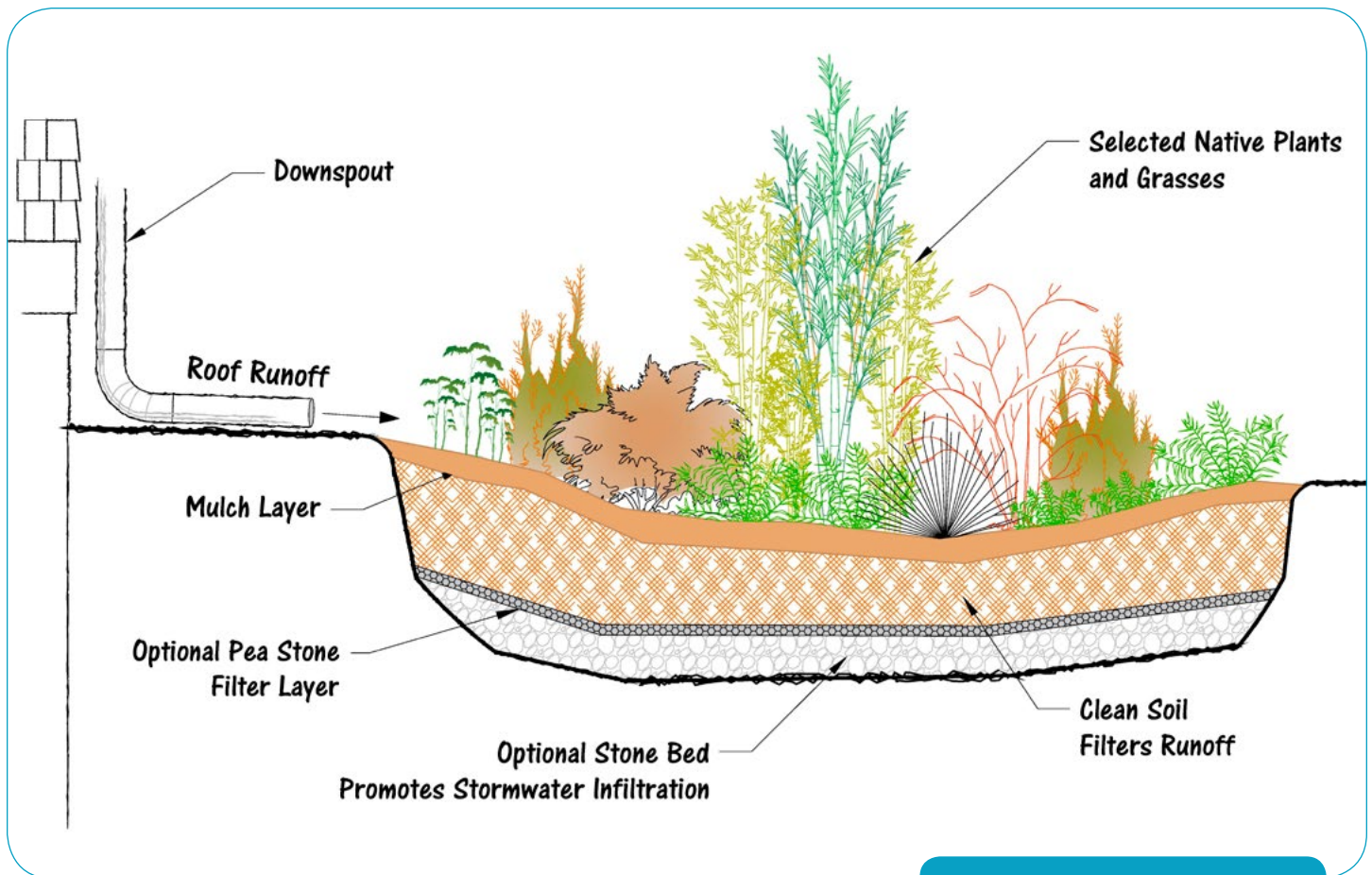
- Driveways/roadways
- Roof gutter and downspouts
- Animal shelter overhangs
- Sidewalks and other impervious or compacted travel ways



DID YOU KNOW?

Massachusetts has a list of prohibited plants and invasive plant species. Never plant or cultivate species on either of these lists:

www.mass.gov/eea/agencies/agr/farm-products/plants/massachusetts-prohibited-plant-list.html
www.massnrc.org/mipag/invasive.htm



Comprehensive Environmental, Inc. © 2017

DESIGN AND INSTALLATION

- Make yourself aware of underground service lines or utilities before you dig. Always call Dig Safe (811) for information about underground utilities.
- Do not construct a rain garden in areas where water already ponds or drains poorly. Consider doing a percolation (or 'Perc') test to determine soil suitability. See link for instructions on how to complete a simple perc test: https://extension.unh.edu/resources/files/Resource005890_Rep8255.pdf.
- Rain gardens should be a minimum of 10 feet from building foundations to avoid water damage.
- Never construct a rain garden over or near the drainage field for a septic system, near drinking water wells or around large trees.
- Beneath your garden bed, include a layer of crushed stone or small rocks collected from around your hobby farm to provide additional water storage capacity.
- Look for native plant species to put in your rain garden. Never plant invasive or prohibited plant species in your rain garden (or anywhere else!).
- Select plant species that are perennial (come back every year). The plants selected for the bottom of the rain garden should be able to tolerate water. Select plants for drier sites as you move up in elevation along the sides. Be sure to include salt tolerant plants if you plan on collecting runoff from travel ways where salt is used during the winter months.

SEE THE FOLLOWING LINKS FOR SPECIFIC RAIN GARDEN SIZING, DESIGN AND INSTALLATION GUIDANCE:

- <http://soaknh.org/wp-content/uploads/2016/06/Rain-Garden.pdf>
- www.ag.umass.edu/landscape/fact-sheets/rain-gardens-way-to-improve-water-quality



BE SURE TO SELECT NATIVE PLANTS FOR YOUR RAIN GARDEN!

Native plants generally offer longevity, diversity, and hardiness. The following link provides a list of native New England plants suitable for rain gardens with information on sun exposure, USDA hardiness zone, soil moisture preference, bloom time, color, suggested rain garden location (base, slope or berm), size and growth pattern: www.extension.unh.edu/resources/files/Resource005899_Rep8265.pdf.

RAIN GARDENS TYPES – THE POSSIBILITIES ARE ENDLESS!

Rain gardens can be designed to accommodate almost any type of garden preference including:

- Formal landscape rain garden
- Daylily rain garden
- Wildflower rain garden
- Shrub rain garden
- Shade rain garden
- Sunny rain garden
- Butterfly rain garden
- Wildlife habitat rain garden
- And many more!

USE THE FOLLOWING ONLINE TOOL TO HELP SELECT PLANTS FOR YOUR NEXT RAIN GARDEN:

- www.nemo.uconn.edu/raingardens/plants.php

MAINTAINING AND MANAGING YOUR RAIN GARDEN

Rain gardens are maintained similar to regular gardens.

- ✓ Weed your garden and remove any invasive species on a regular basis.
- ✓ Replace dead, unhealthy or diseased plants as needed.
- ✓ Clean out any sediment or debris that may accumulate, this includes spring and fall cleanup.
- ✓ Avoid crossing your raingarden with equipment used on your hobby farm.

HELPFUL LINKS

www.epa.gov/soakuptherain/soak-rain-rain-gardens#ma

www.uvm.edu/seagrant/sites/default/files/uploads/publication/VTRainGardenManual_Full.pdf



FACT SHEET 6.6

RAIN BARRELS AND CISTERNS

Structures on hobby farms can generate a large amount of stormwater runoff that if not managed can cause erosion and collect and carry pollutants into nearby waters. Management efforts should first focus on minimizing the runoff from these sources.

One way is to infiltrate runoff back into the ground by directing it into a dry well, infiltration trench or raingarden. If infiltration is not an option or if you prefer to store and reuse water, then rain barrels and cisterns, simple devices that collect and store roof runoff through gutters and downspouts, could be your answer.

Water stored in rain barrels and cisterns can be used for:

- Irrigation of flower gardens, lawns and indoor plants
- Wash water for vehicles and farm equipment
- Moisten compost piles

RAIN BARRELS VS. CISTERNS

A rain barrel is a large barrel typically ranging from 60-100 gallons in capacity that captures rainwater from your roof to reduce stormwater runoff and store water for future use.

Cisterns serve the same purpose but are typically larger, permanently installed tanks that range in size from 100-10,000 gallons in capacity. Unlike rain barrels that sit aboveground, cisterns can be installed partially or fully underground if desired.



DID YOU KNOW?

The roof of a small shed could generate 15 gallons of water during a small rain event (1/4" of rain) and up to 60 gallons during a larger 1" rain event. A larger barn or garage could generate 2-4 times that amount – 30-60 gallons of water for a smaller storm and 120-240 gallons of water for a larger storm. That's a lot of water!



HOW LARGE SHOULD MY RAIN BARREL OR CISTERN BE?

Even small roof areas can generate an amazing amount of stormwater runoff and you'll find that unless you empty your collection system often, you'll need multiple rain barrels or a large cistern to collect everything. The following calculations (using a 10'x10' roof example) can be used to determine how large a system you would need to collect a 1" storm.

Determine Area of Roof

Roof Length (ft) x Roof Width (ft) = Drainage Area (ft²)

Example: 10 ft x 10 ft = 100 ft² Drainage Area

Determine Volume of Stormwater Generated by Roof

Drainage Area (ft²) determined above x 1 inch storm ÷ 12 inches per foot = Stormwater Volume (ft³)

Example: 100 ft² x 1 in ÷ 12 in/ft = 8.33 ft³ stormwater volume

Convert to Gallons (Measurement for Most Rain Barrels/Cisterns)

Stormwater Volume (ft³) determined above x 7.48 gallons = Stormwater Volume (gallons)

Example: 8.33 ft³ x 7.48 gal. = 62.3 gal. stormwater volume

In this example, one 60-gallon rain barrel can almost hold the runoff volume of a one-inch rain event.

AS YOU CAN SEE IT ADDS UP FAST! ALTHOUGH IT WOULD BE NICE TO COLLECT AND REUSE ALL OF YOUR ROOF AREA RUNOFF, YOU DON'T HAVE TO. ANY AMOUNT OF RUNOFF REUSED WILL HELP REDUCE THE CHANCES OF STORMWATER RUNOFF IMPACTING NEARBY SURFACE WATER QUALITY. START SMALL AND STAY SMALL OR START SMALL AND ADD TO YOUR COLLECTION SYSTEM LATER ON. EITHER WAY, YOUR EFFORTS ARE HELPING TO PROTECT NEARBY SURFACE WATER QUALITY AND REDUCING YOUR WATER COSTS.

RECYCLE

Even though most rain barrels do not provide the pressurized flow of a regular hose, if slightly elevated they can produce enough pressure to work a soaker hose irrigation system.



CAUTION!

Roof runoff collected by rain barrels and cisterns is non-potable (not safe for consumption) and can contain pollutants. Humans and animals should not consume it, nor should it be applied to edible crops.

RAIN BARREL INSTALLATION TIPS:

- Install your rain barrel on level ground. Consider raising it slightly on blocks to allow space for a watering can beneath the spigot if needed.
- Make sure your gutter downspout is aligned with the rain barrel intake. Flow diverters can be used to accomplish this.
- Be sure your rain barrel intake area is covered with a screen to catch leaves, twigs and any other debris that might collect in your gutters. This screen will also help prevent mosquitoes from breeding in your collected water.
- Direct any overflow away from the building foundation and into another rain barrel or a vegetated area where it can infiltrate into the ground.

MAINTAINING AND MANAGING YOUR RAIN BARREL

- ✓ Use it often! Emptying your rain barrel creates storage space for the next storm and keeps your rain barrel water supply fresh.
- ✓ Check the structure periodically for leaks.
- ✓ Make sure your gutter downspout is aligned with the inlet and screen.
- ✓ Clean the screen of leaves and other debris to avoid clogging.
- ✓ Inspect your overflow area for erosion and stabilize if necessary.
- ✓ Empty your rain barrel and store it inside during the winter months so water doesn't freeze inside it. If stored outside be sure it's empty and stored upside down to keep it clean and free of ice, snow, water and animals! Be sure to return your gutter downspout to its regular position.

CONSIDER LINKING YOUR RAIN BARRELS TOGETHER. A 1" RAIN EVENT WILL FILL A TYPICAL 60-GALLON RAIN BARREL COLLECTING WATER FROM A SMALL 10'X10' SHED. CONSIDER LINKING SEVERAL RAIN BARRELS TOGETHER TO FORM A CHAIN OR USE SEVERAL RAIN BARRELS AT DIFFERENT DOWNSPOUTS TO STORE MORE WATER FOR FUTURE USE.

CISTERNS

Similar but generally larger than rain barrels, cisterns can be installed above or below ground. Some models even contain a water pump. It is recommended that the manufacturers' instructions for installation be carefully followed for your specific cistern design. The following is a link listing various water cistern manufacturers: www.rainharvest.com/by-manufacturer.asp.

HELPFUL LINKS

www.mass.gov/eea/agencies/massdep/water/watersheds/rain-barrels-and-other-water-conservation-tools.html#Whatarerainbarrels
<http://soaknh.org/wp-content/uploads/2016/06/Rain-Barrel.pdf>





FACT SHEET 6.7

TREE PLANTING FOR WATER QUALITY

There are many runoff site management measures that can be used to help control stormwater runoff on hobby farms. These include vegetated buffers, treatment swales, filter strips and rain gardens to help both reduce stormwater volume and filter out potential pollutants such as excess fertilizer, sediment and manure.

Many of these techniques utilize natural materials and processes where vegetation is used to help in the retention and infiltration (or absorption) of precipitation and snowmelt into the soil or be taken up by plant roots. Trees are a large part of many of these stormwater management measures.

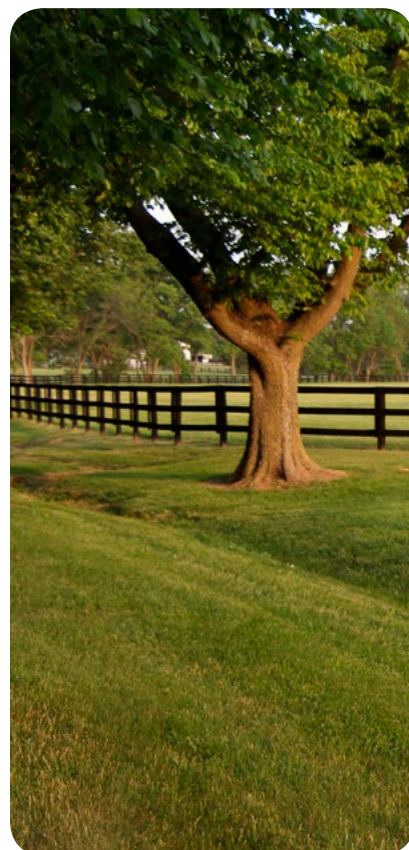
BUT WHAT IF THERE WAS A WAY TO SAFELY REDUCE WATER VOLUME EVEN BEFORE IT REACHES THE GROUND?

Recent studies have shown that tree roots are not the only part of the tree that assists with runoff reduction efforts. A leafy tree canopy itself can help intercept and retain precipitation, thereby reducing the overall volume of stormwater. Tree canopies located in Massachusetts have been shown to intercept on average about 15% of the precipitation that falls on them. When hobby farmers plant trees, they are directly reducing the amount of runoff they need to manage on their farms.

MATURE TREE BENEFITS:

- Erosion control
- Reduce heating and air conditioning costs
- Absorption of carbon dioxide
- Oxygen production
- Stormwater management
- Increased property values
- Source of nutritious food (fruit trees)

While the benefits of trees are clear, and programs nationwide are being implemented to encourage tree planting, even in the most urban of areas, the addition of trees to hobby farms can have far greater long-lasting impacts.



DID YOU KNOW?

One large tree can reduce erosion and help manage stormwater by capturing, using or filtering up to 36,500 gallons of water per year.



In addition to the above benefits, trees planted on hobby farms can:

- **Shade livestock** – keeping them cool in the summer
- **Create windbreaks** – protecting both animals and crops from damaging winds
- **Humidify the air** – helping to maintain moisture for crops during dry periods
- **Improve air quality** – in addition to producing oxygen, trees can trap airborne particulates and other pollutants
- **Provide habitat for pollinators** – trees provide the shelter and thoroughfare for pollinating insects to move about
- **Odor control** – help dissipate and control odor that may reach your neighbors

Consider planting trees throughout your hobby farm to take advantage of one or more of the above tree benefits by following these easy steps:

Step 1

Consider how trees can work for you – which of the above benefits would you like to achieve and how can trees help? Need help with erosion control and shading your farm animals? Plant trees in and around your pasture to improve your buffer and increase animal shelter areas. Are your crops too exposed during inclement weather? Plant trees next to fields where they can provide protection from wind and serve as habitat for pollinators. Barn too hot during the summer? Plant trees around it to provide shade that helps lower summer temperatures, provides a windbreak to reduce heating needs in the winter, and to enhance the infiltration of roof runoff.

Step 2

Evaluate your site and location – trees come in all shapes, sizes, colors and hardiness. Make sure you consider the following to help in your tree selection process:

- Space constraints
- Climate/hardiness zone
- Proximity to structures and overhead utilities
- Maintenance and care needs
- Insect/disease susceptibility

Step 3

Utilize available resources for tree selection, installation and care

- Visit www.itreetools.org to customize your search and find the tree that's just right for you, AND see the benefits existing trees provide.
- Visit www.treesaregood.org for in depth information on tree benefits and values, selecting and purchasing a tree, how to plant a tree, and tree maintenance/care.
- Visit www.treecanopybmp.org for helpful resources on tree canopy use and stormwater management along with resources for tree selection, installation and care.

CHECK WITH YOUR LOCAL LANDSCAPE AND GARDEN CENTER FOR HELPFUL INFORMATION ON TREES AVAILABLE IN YOUR AREA, AS WELL AS TIPS FOR INSTALLATION AND ROUTINE TREE CARE.



STORMWATER RUNOFF SITE MANAGEMENT

Use the following questions to help guide your hobby farm stormwater runoff site management decisions:

CHECKLIST TIPS

- Keep in mind that some of the BMP's listed in Section 6 can be used to achieve more than one of the site management goals listed below.
- When considering potential BMP locations, it is often helpful to walk your hobby farm during or immediately following rain to observe stormwater runoff patterns.

Which Best Management Practices (BMPs) are either currently used or could be applied to your hobby farm to achieve the following (list specific BMPs and potential locations):

- ☐ DISCONNECT stormwater flows, allowing precipitation to soak into the ground closer to where it lands

DISCONNECTION PRACTICE	EXISTING LOCATION	OTHER POTENTIAL LOCATIONS

- ☐ REROUTE stormwater flows, to prevent or minimize stormwater contact with potential pollutants (e.g., manure storage areas)

REROUTING PRACTICE	EXISTING LOCATION	OTHER POTENTIAL LOCATIONS

- ☐ PROVIDE TREATMENT AND NATURAL FILTRATION of stormwater before it can reach nearby wetlands and surface waters

TREATMENT/FILTRATION PRACTICE	EXISTING LOCATION	OTHER POTENTIAL LOCATIONS