4.0 BMP Siting

4.1 Avoid Concentrated Flow

Stormwater collects and concentrates very easily into depressions, swales, and natural runoff conveyances. Concentrated flow can also occur as water overflows from a backyard rain garden or wetland, or as water passes from a cistern that is filled to capacity. This can lead to erosion of berms, riparian buffers, lawns, or other ground cover.

If possible, backyard BMPs should be sited near or in the path of the current drainage way leading from the watershed being treated (Figure 4.1). The existing drainage path can also be utilized as a way to convey water away from the BMP when a storm produces overflow. If the drainage path is eroding, see section 8.0 for information on swale protection.

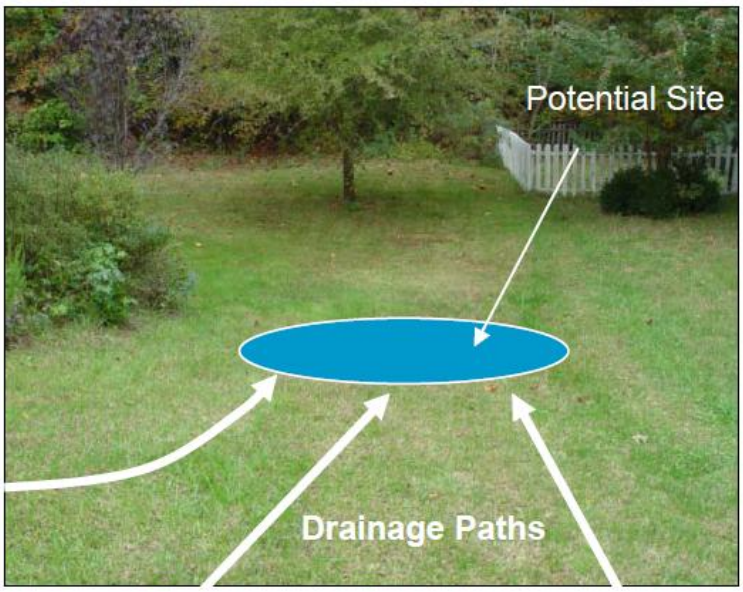

Figure 4.1 A low area in the drainage path provides a suitable location for a backyard BMP.

4.2 Multiple Property Owners

Before a site is chosen for a backyard BMP, the property boundaries should be clearly defined by a SWCD staff member. This is to ensure that no part of the stormwater practice is sited on property belonging to an individual not participating in the program. If an BMP is to be sited in such a way that multiple property owners will be impacted, all property owners should be contacted and should agree upon the project. Also, BMPs are designed to slow and capture stormwater as it leaves a property; thus a pool of water can form as water slows and enters the BMP. This pool of water should not extend to a neighbor's property without consent. Typically, the downstream property owner usually benefits from their upslope neighbor's installation of backyard BMPs, which bring about a potential reduction in flooding and erosion on the downstream owner's property.

4.3 Considerations for Backyard BMP Siting

4.3.1 Topography and Drainage

The preliminary step in any backyard stormwater practice design is to determine the flow paths of stormwater on the property. There are a number of ways that this could be achieved: (1) observe the site during a rainfall event to determine surface flow patterns, (2) use a GIS contour map to determine flow paths, or (3) survey the topography of the site with a site level, laser level, or total station. Flow paths are especially important for impervious surfaces such as rooftops and driveways. Flow direction on a rooftop will be easy to observe on most houses and businesses, where the eaves of the roof will determine which direction water flows. This can be determined from an aerial map or from a site visit. A GIS contour map can be useful for initial investigation, but should not be trusted without some site investigation to corroborate its contours. The best methods to determine site topography are to observe flow paths during a rain event or to use survey equipment to create a topographic map of the site. Installation of backyard stormwater practices should always utilize existing topography and drainage patterns; this will require less grading or digging, reducing cost.

4.3.2 Downspouts

The location of downspouts is extremely important when locating a stormwater practice. Downspouts form small catchments on rooftops. During site reconnaissance, locations of downspouts should be marked on a site map, so that separate rooftop catchment sizes can later be determined. Based on site topography, flow paths for each downspout can be determined. An attempt should be made to capture the largest number of downspouts in a backyard stormwater practice. It may be possible to use corrugated plastic pipe extensions to direct water from a downspout directly to a stormwater practice, either above or below ground (Figure 4.2). In order for this to be possible, the installer must make sure that there is a slope from the downspout to the stormwater BMP, so that the corrugated plastic pipe drains between storm events. This is important for mosquito prevention. It may also be possible to re-route existing yard inlets to a stormwater practice. Typically, this will be completed by using a “pop-up” in the BMP, where water trickles out into the BMP. Again, there must be a slope from the bottom of the pipe to the top of the “pop-up,” to allow for the pipe to drain (Figure 4.3).

Figure 4.2 Using corrugated plastic pipe to deliver stormwater to a backyard rain garden.

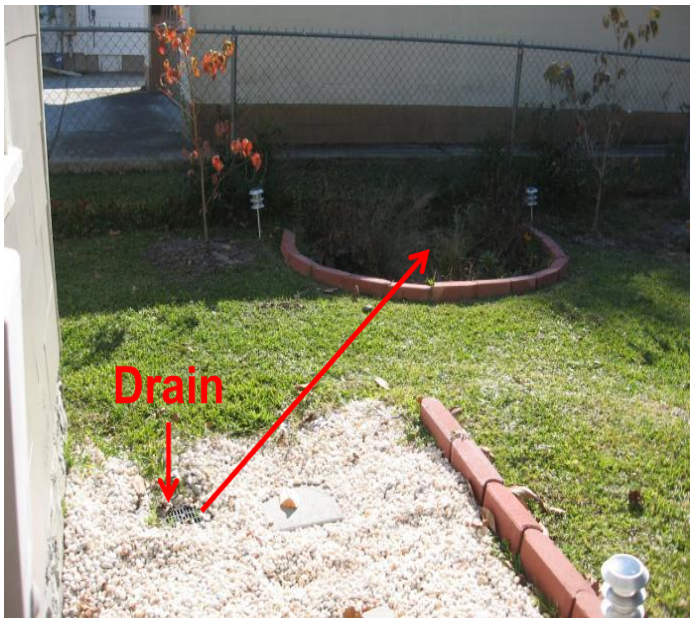

Figure 4.3 Using an existing yard inlet to deliver stormwater to a backyard rain garden.

4.3.3 Surface Ponding

Observe the site for surface ponding or points of collection after a rain event. If surface ponding occurs in an area for more than 3 days after a rain event, it may be a good location for a pocket wetland. Locations of surface ponding are destinations of surface runoff. Potentially, a rain garden could be placed between the runoff source (a rooftop or other impervious area) and this ponded area (the destination).

4.3.4 Existing Landscape

Working with the existing landscape is extremely important when constructing a backyard BMP. Specifically, this will help to reduce the time and effort that construction requires. It will result in less digging (either by hand or with an excavator), which can be a substantial time saver. Working with the existing landscape, as opposed to attempting to change it, will also result in substantial cost savings.

4.4 Constraints for Backyard BMP Siting

4.4.1 Utilities

It is important to consider utilities any time a stormwater practice is installed. Before a design has been created, the utilities on site need to be marked. The North Carolina one-call center can be reached by calling 811. Stormwater practices that infiltrate water (permeable pavement and rain gardens) should be located more than 10 feet from a wellhead and not uphill of the wellhead.

4.4.2 Basements, Crawl Spaces, and Septic Systems

For practices designed to infiltrate stormwater, it is important to consider what this near-surface groundwater may impact. For instance, a homeowner should not install a rain garden near their home's foundation, basement or crawl space. This precaution is to avoid flooding these spaces. Also, septic drain fields are designed to treat a certain volume of water per day; infiltrating water into the drain field has the potential to overtax these systems. For these reasons, it is recommended that an infiltrating stormwater practice be located at least 10 feet from a home's foundation, basement or crawl space and at least 25 feet from a septic drain field. These practices should never be located upslope from these areas.

4.4.3 Soil Type

Best management practices are impacted significantly by the soil in which they are constructed; therefore, it is important to know which soil types are present at a given location before designing or constructing a stormwater practice. Soils underneath backyard practices that rely heavily on infiltration (rain gardens and permeable pavement) must drain within 48 hours of a rain event; further details are provided specifically in the rain garden, backyard wetland, and permeable pavement sections of this document. In North Carolina, the presence of a substantial clay fraction precludes using soils from many parts of the state as the underlying soil for permeable pavement (As discussed in section 10.2, the need for infiltration in the underlying soils of permeable pavement prohibits its use in locations other than the Coastal Plain and Sandhills). Conversely, BMPs that require saturated soils to maintain function and plant vitality, such as backyard wetlands, require that water be easily accessible to plant roots via the water table or that poorly drained soils at the site will hold the captured stormwater long after a rain event (Section 6.0). When a site is evaluated for BMP implementation, determining the soil type can be performed by collecting information from soil surveys and, most importantly, from field inspection.

Generally, the soil types that are present from the soil surface to 36 inches below the soil surface are the most crucial for backyard BMP siting. If the soils in this range (0 – 36 inches deep) mostly consist of sand or loam, they may be suitable for backyard rain gardens. If the

soils in this range consist primarily of sandy soils, they may also be suitable for permeable pavement (only install in Coastal Plain or Sandhills). Lastly, if the soils in this range consist primarily of clay, they are potentially suitable for backyard wetlands.

4.4.4 Water Table

The location of the seasonal high water table is an important factor in determining which BMP would be best for a particular location. This is an evaluation of the highest consistent level that the water table reaches with respect to the ground surface during the year. When soils are observed that have a grey matrix and contain brown or orange mottles (spots of color), this soil is likely in contact with the water table for extended periods of time. If the seasonal high water table is found within 2 feet of the ground surface, the site is likely not a good candidate for certain best management practices (rain gardens and permeable pavement). If such conditions exist at a site, a backyard wetland may be a more appropriate BMP choice.

4.4.5 Watershed Stability

A stormwater feature, such as a pocket wetland, a rain garden, or permeable pavement, needs a stable upslope watershed in order to maintain long-term functionality. If not, the systems will clog and will require arduous maintenance, including removal of all silt and sediment. Observe the areas that are upslope of your chosen location for a BMP. Are there areas of bare soil? Is construction ongoing (Figure 4.4)? If so, construction of the stormwater practice should be postponed until the upslope watershed is stabilized. This is especially important for permeable pavement and rain gardens, where infiltration is needed in order for the system to function.

Figure 4.4 Example of an unstable watershed contributing sediment.

4.5 Determining Outlet Location

Close attention should be paid to where the water from an BMP exits a property. During small rain events, depending on soil conditions, all the stormwater produced in a small catchment may be retained in the BMP. However, the BMP will also experience larger rain events that overload it with stormwater. During these events, the stormwater practice will fill to capacity

and overflow into the adjoining area. Special care should be taken to ensure that the area to which the excess stormwater spills is able to convey the stormwater safely to a nearby drainageway (such as a culvert or swale).

The easiest way to allow excess stormwater to leave a property is to direct it into the existing drainage pathways. For instance, if a roof drain leads to a swale which routes the water off the property, an BMP could be placed in the path of the swale, whereby small amounts of runoff are retained and treated and stormwater from larger storms flows out of the BMP and continues through the swale.

Other drainage conveyances can be used to safely allow large stormwater volumes to leave a property, such as yard inlets, swales, and ditches. In some cases a swale must be constructed between the BMP and the closest natural drainageway to allow proper drainage of the system. More information on swales is available in section 8.0.

When berms are used to retain stormwater (a common practice in rain garden and backyard wetland design), there is opportunity for the berm to erode if the BMP fills to capacity and spills over the berm. In these cases, it is good practice to design and protect a spillway from the additional stormwater.

An opening in the berm (a weir) should be constructed where the stormwater will be conveyed out of the system. A piece of hardwood with a rectangular notch cut in it can be installed in the berm in this opening so the stormwater passes over a stable edge. This lumber acts as a weir to spread the flow, thus reducing velocities.

Additionally, a compacted soil weir reinforced with erosion control matting and vegetated with grass may be used for smaller, backyard practices. More information on BMP outlet design and construction is given in Section 3.5.

4.6 Riparian Buffer Considerations

Many regulations have been implemented to improve the quality of surface waters in North Carolina, including the riparian buffer rules detailed by the North Carolina Division of Water Quality in the “Redbook” of surface waters and wetlands standards (Administrative Code 15A NCAC 02B .0100, .0200 & .0300).

These rules state that a 50 foot riparian buffer should be maintained around surface waters in the Tar-Pamlico Basin, Neuse River Basin, the main stem of the Catawba River, and in the Randleman Lake watershed, among others; all these water bodies being nutrient sensitive. The purpose of these rules is to make use of the inherent ability of riparian buffers to remove nutrients and other pollutants from stormwater runoff. These riparian buffer rules can impact the function and siting of a backyard stormwater BMPs.

When siting a backyard BMP in one of the nutrient sensitive watersheds described in the NCDWQ Redbook, a measurement should be made perpendicular to the stream from the stream bank towards the area being considered for the BMP. No part of the BMP should be

located within this 50 foot boundary. Additionally, backyard swales cannot be constructed in the riparian buffer. Only existing swales can be utilized to route water through the riparian buffer.

The riparian buffer rules not only include a requirement to maintain a 50 foot buffer along the stream bank, they also require that stormwater released into the buffer be diffuse in nature. This means that in systems where water will be collected and dispersed through an outlet (wetlands, rain gardens, etc.) the outlet should be designed to spread the water out as it enters the riparian buffer. No newly constructed channel should be used to convey the water into the buffer, instead, a large weir or berm can be used. The North Carolina Division of Water Quality – 401/404 Wetlands Unit should be contacted for additional information should a newly constructed drainage way be necessary. General level spreader guidance is found in Hathaway and Hunt,
2006 and Winston et al. 2010 (Appendix C), and online via the North Carolina Division of Water Quality – Wetlands and Stormwater Branch (http://h2o.enr.state.nc.us/ncwetlands). Avoiding the installation of CCAP projects in areas adjacent to riparian buffers is generally recommended. If a project is located in a watershed with protected riparian buffers, the BMP discharge should be routed into any existing drainage ways if at all possible.