K-STATE Research and Extension

Stormwater Best Management Practice Maintenance

Water Quality

Kansas stream and lake monitoring indicates that the goals are often not met for water uses — drinking, recreation, industry, agriculture, and other uses. Improving water quality requires the cooperation of everyone affecting runoff quality from surfaces, which includes all of us. Increased emphasis on runoff quality from land areas requires the efforts of landowners, managers, service providers, and regulators. This publication focuses on practice maintenance for residential and commercial lots up to 3 acres. For more information, please refer to the references listed at the end of this publication.

Importance of Permeable Areas

When an area is developed and houses are built, the extent of existing vegetation (such as grasses, trees, and shrubs) is reduced. This replacement of permeable, vegetated land cover with impermeable structures and surfaces such as buildings, roads, walks, and drives causes an increase in stormwater runoff because less water infiltrates.

For example:

A house on 1/5th of an acre (8,750 square feet) receives 1 inch of rain:

Before the impermeable surfaces are added, there could be about 380 gallons of water leaving the site. For visualization purposes, this would be about seven oil drums (55 gallons each).

After adding an average 3-bedroom house, driveway, walkway, and garage (2,900 square feet), the amount of water leaving could be around 1,880 gallons (about 34 drums).

This is an increase of 1,500 gallons (about 27 drums) of stormwater.

This example shows how about five times as much runoff can be expected when a site is converted to residential development. For a development with 100 houses, this increase would be about 150,000 gallons of runoff, which could have a definite impact on water volume and velocity entering streams and lakes. Increased volume and velocity leads to reduced water quality due to increased soil erosion. Additional urban pollutants, such as car fluids, pet waste, and lawn fertilizer (which are dissolved and carried off driveways, roads, and yards) are delivered into drainage channels. The dramatic change in runoff versus time for pre-development and post-development conditions is shown on Figure 1.

Definitions

BMP – stormwater control practices that are effective, economical, practical, and acceptable to users.

Infiltration – the entry of water into the soil's surface; some may eventually move to groundwater.

Stormwater – water from precipitation that does not infiltrate, accumulates on the surface, produces runoff, increases stream flow, and may cause flooding.

Permeable – soil or other material that allows water to infiltrate and move through it.

Impermeable – hard surfaces, even some soil, that do not allow water to infiltrate or to move through it.

Macropore – a large crack or hole (pore) that easily allows water to flow into it under gravity.

Source: MF2730, *Glossary of Water Terms*; *www.bookstore.ksre.ksu.edu/pubs/MF2730.pdf*

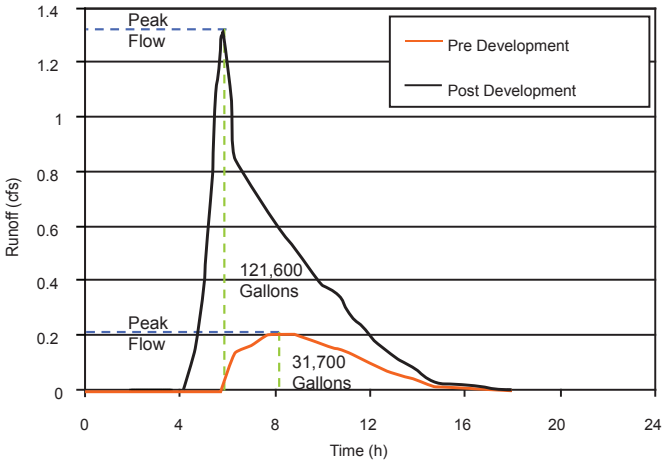

Figure 1. *Runoff from a 100-house development (20 acres) before and after development*

Native Vegetation: Warm Season Grass in the Plains

The following ideas apply to all BMPs with native vegetation: When establishing native vegetation, planning and management during the first three years is critical

for establishing a healthy stand of warm season grasses (Figure 2). Also, many cities have ordinances against long grass, which may be an issue. A number of cities have ordinances posted on an online library for reference. Maintenance practices will likely include:

1. Thinning or removing weeds, and reseeding as needed. After three years, the native vegetation should be able to out-compete weeds.
2. Burning is the "healthiest" option to control weeds after the first three years. Before burning, however, be sure to check local laws and regulations to ensure compliance (you will likely need a fire permit). Frequent burning has been shown to increase above ground plant growth because of more available light favoring warm season grasses, warmer soil temperatures, and earlier emergence.
3. When burning is NOT an option, mowing will also work. Natives can be mowed once or twice a year to a height of 6 to 8 inches with the exception of buffalo grass. Buffalo grass can be mowed as needed for weed control and personal preference (3 to 6 inches). The first, and most critical, time would be in late March or early April just before warm season grasses begin to emerge. Mowing during the fall about a week after the first freeze would be the second time, but is primarily for aesthetic purposes. For planning purposes, average first freeze dates for Kansas have been published (*http://mesonet.k-state.edu/freeze/*).

In the first couple of years (during establishment), mowing may be necessary to remove the seed heads from weeds, limiting weed re-growth and problems in following years. In small areas or when/where soils are very wet a lawn-mower (especially a riding lawn mower) is not appropriate, mowing methods include the use of hand clippers/shears, a weed whacker, or similar devices. In large areas, a riding lawnmower or a brush cutter can be used. Hand weeding to remove winter annuals and summer annual grasses and broadleaf weeds may be helpful. Removing heavy thatch loads by raking will also facilitate native plant establishment and growth where burning is not an option.

Erosion, Trash Removal, and Fertilizer and Pesticide Use

If there is a large sediment source (such as a large area of bare soil or poorly established vegetation) in the contributing area, BMPs may quickly lose functionality. This would require removal of sediment to restore volume capacity; however, sedimentation will continue to occur unless the upstream erosion source is "fixed" or removed.

Figure 2. *Native grass bioswale on Jackson Street near the state capitol building in Topeka.*

Figure 3. *Sediment deposits on the edge of a developing site.*

Figure 4. *Debris in a bioswale at a curb inlet.*

Make sure there are no major unprotected soil areas in the contributing watershed (see example in Figure 3).

Whenever possible, seed bare soils to establish vegetative cover prior to implementing BMPs and quickly re-vegetate areas that may be disturbed above a BMP once it is in place.

The first step in maintaining all stormwater control BMPs is to keep the facility clean of trash and debris.

Due to the vegetation density and difference in plant height, trash often accumulates (Figure 4). In addition to aesthetic considerations, trash can plug outlet pipes and clog a stream, which interferes with flow and can reduce function. Trash accumulation can also lead to mosquito growth because of water being trapped in the debris.

Since most BMP systems are small, debris is generally visible and removal should only take a few minutes.

Fertilizers and pesticides should not generally be used in association with native plants. In areas that are adjacent to rain gardens, bio-swales, and other BMPs, the use of fertilizers and pesticides should be limited or strictly controlled so that elevated levels of nitrogen, phosphorus, and potential toxins do not contaminate these systems.

Rain Gardens and Bioswales

To provide continuously stable infiltration, limiting traffic (mowing, walking, etc.) is essential. The most critical time to avoid traffic is when the system is wet, because wet soil is much easier to compact. High traffic also leads to vegetation damage or loss, which can increase erosion. A dense stand of deep-rooted vegetation helps establish and maintain high infiltration. Vegetation will also help reduce surface sealing with continuous growth above ground. New growth of plant roots and death of old ones forms new macropores (large pores) and creates a micro-ecosystem with soil biota (living organisms) actively "turning" the soil. These macropores also help keep the soil porous, water permeable, uncompacted, and aerated.

If performance of a system decreases (for example, if water is not infiltrated within two days), it may be due to soil sealing, meaning that the surface pores have become plugged with smaller particles. The system can be improved by removing surface deposits of fine materials and reseeding bare areas. The build-up of fine sediment should be periodically removed, typically in late March or early April when the site is mowed or burned. If the native grasses fail to grow after sediment removal, replant the area. If there has been compaction or general poor performance, the soil surface may have to be loosened by tilling, incorporation of more permeable material such as sand, compost, or other organic material, and then reseeded. Aeration is also an option. Another approach, which would be less invasive but would reduce the pollution removal efficiency and water retention capacity, would be to lower the overflow pipe or berm and thus reduce water levels.

Frequently Asked Questions

Q. Should I remove the plant material when I mow?

A. It would be a good idea to periodically (say about every 3 years) remove the material, as thatch can limit new growth, but it is not an essential annual practice. However, we recommend removal of "hay" for the first three years. Remember, burning every third year would also remove the plant material.

Q. I just seeded a section of my yard with native prairie plants but the stuff that is growing looks more like weeds. Is this what's supposed to happen?

A. The stand will likely need some heavy weeding, some of it by hand, during the first three years to help establish the warm season grasses. Until then, the stand may look a bit like weeds. You should also remember that native prairie vegetation will not look anything like a typical lawn or garden. Information on what you can expect in Kansas has been published.

Q. I have a rain garden in my front yard and my neighbor has been concerned about it being a mosquito breeding site. What should I tell them?

A. You can tell them that the rain garden is designed to have standing water in it no longer than 48 hours. This short time does not allow mosquito eggs to hatch and mature.

Q. I have thought about planting some native tall grasses in the ditch in front of my house, but I am not sure if it's a good idea. If so, what should I plant?

A. It could be a very good idea. Native prairie grasses, especially the tallgrass species, have a very deep, extensive, and complex root system, which allows more water to infiltrate. Just make sure to keep the cool season grasses intact to limit erosion while you are establishing the native plants. Some good native species to plant would be big bluestem, little bluestem, and indian grass in areas that don't get too wet, and switch grass in the wetter spots. Also, understand that some communities have ordinances that prohibit allowing grasses to grow taller than a few inches; this is inconsistent with most native grasses.

Q. I'm sick of mowing my lawn, is there anything I can do?

A. Yes, but there are a couple ways to do it, and it isn't as simple as just not mowing any more. You could plant your entire lawn to buffalo grass and, with proper maintenance, mowing would be reduced but maintenance may be an issue until a stand is well established. How to do this is explained in the K-State Research and Extension publication Buffalograss Lawns (MF658).

Reducing fertilization will slow grass growth, reducing the need to mow as frequently and lowering the contribution of nutrients from the lawn into surface water.

You could also do some landscaping with native plants including tall grasses (big bluestem, little bluestem, Indian grass, switch grass, and native forbs).

This could reduce the amount of grass you would have to mow. The problems with this method are that it can be a bit expensive and the landscaped area could look a little wild. Be careful about replacing vegetation with rock cover because that will cause a decrease in infiltration and increases problems associated with runoff.

References and Additional Information

Aerating Your Lawn – MF2130: *www.bookstore.ksre.ksu.edu/pubs/MF2130.pdf*

An online library of municipal ordinances – *www.municode.com*

Average freeze dates in Kansas – *http://mesonet.k-state.edu/freeze/*

Buffalograss Lawns, how to – *http://www.bookstore.ksre.ksu.edu/pubs/MF658.pdf*

Glossary of Water Terms – MF2730: *www.bookstore.ksre.ksu.edu/pubs/MF2730.pdf*

Urban Water Quality BMPs– MF2732: *www.bookstore.ksre.ksu.edu/pubs/MF2732.pdf*

Native prairie plants – MF3233: *www.bookstore.ksre.ksu.edu/pubs/MF3233.pdf*

Knapp, A. K., J. M. Briggs, D. C. Hartnett, and S. L. Collins, eds. 1998. Grassland Dynamics: Long-term Ecological Research in Tallgrass Prairie. New York: Oxford University Press.

Mosquito life cycle – *www.mosquito.org/life-cycle*

What to expect with respect to native vegetation in Kansas - *kansasnativeplants.com/gardenprairie.php*

Authors:

Aleksey Y. Sheshukov, Water Quality Specialist, Biological and Agricultural Engineering

Stacy L. Hutchinson, Professor, Biological and Agricultural Engineering;

Trisha Moore, Assistant Professor, Biological and Agricultural Engineering;

DeAnn Presley, Associate Professor and Extension Specialist, Agronomy

The authors acknowledge the work of the co-authors of the 2008 version of this publication, Reid D. Christianson and Morgan Powell.

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