

# WATER QUALITY FOR SMALL SCALE LIVESTOCK OPERATIONS



Many small-scale livestock operations are located in environmentally sensitive areas or close to residential developments. When it rains, water that does not evaporate or soak into the soil runs downhill, eventually draining into a stream, lake or other body of water. When the water travels across a poorly managed area it is likely to pick up nutrients and sediment from exposed soil and manure.

Pennsylvania's Clean Streams Law is designed to preserve and improve the purity of the waters of the Commonwealth for the protection of public health, animal and aquatic life, industrial consumption, and recreation. This law defines "Waters of the Commonwealth" as any and all rivers, streams, creeks, rivulets, impoundment's, ponds, springs, and all other bodies or channels of conveyance of surface and underground water, or parts thereof, whether natural or artificial, within the or on the boundaries of this Commonwealth.

Implementing general water quality management guidelines can help reduce the negative impact on local waters, watersheds, and groundwater. By developing a water quality management plan you can greatly reduce the amount of contaminated runoff leaving your operation and protect groundwater.

The first step to implementing a management plan is to map your watershed. A watershed is the land area that drains to a given body of water. Everyone lives in a watershed.

The goal of a water quality plan is to reduce polluted runoff and to protect groundwater. Before you begin your water quality plan look around your operation and make note of the following:

- ❖ Where are the property boundaries?
- ❖ How are the pastures, paddocks, and fields laid out?
- ❖ Where are buildings located?
- ❖ Where are the wells located?
- ❖ Where is the septic system and drain field located?
- ❖ Where are streams, wetlands, ponds, and other water conveyance structures located and where do these bodies of water flow?
- ❖ Are there any bare or denuded areas?
- ❖ What is the soil type and slope?
- ❖ Are there any odd areas on the property? (Example: old fence row, old barn or house foundations, old woods) These areas may require different management than the rest of the operation.
- ❖ What crops are grown?
- ❖ What is the acreage break down for each area?
- ❖ What is the neighboring land use?

❖ What are your goals for your operation?

Runoff from manure application areas, storage areas, and barns has the potential to carry pollution that can harm the plants and animals that live in surface water. This type of contamination is classified as non-point source pollution, which means it does not flow from a pipe.

Runoff can also affect groundwater quality through infiltration and could impact the drinking water on your land and your neighbors. Other common sources of ground water contamination are improperly constructed wells; pesticide, fertilizer, and fuel spills; leaking storage tanks; septic tanks; and hazardous waste dumping. Below are a few examples of guidelines to help preserve water quality. Avoid mixing chemicals near a well or waterway. Wells should be elevated above the surrounding area, properly cased, sealed and at least 100 feet (check with local regulations) from livestock areas. Septic tanks should be tested and pumped every 3-5 years and repaired if not functioning properly (check with local regulations, they may require more often).

*Waste Management*

Proper removal, storage, and disposal of manure can help prevent nutrients from impairing water quality.

Unmanaged manure can cause numerous problems for you and your neighbors.

- ❖ Creates an unhealthy environment for livestock potentially resulting in more vet bills and increased feed bills.
- ❖ Manure + Water = Mud
- ❖ Manure laden mud is a breeding ground for insects. These insects can carry disease and cause allergic reactions in both humans and livestock.
- ❖ Unkept areas can harbor internal parasites and cause reinfestation as soon as 24 hours after worming.

❖ Manure problems are inconvenient for the operator and for your neighbors.

❖ Nutrient runoff from manure has a negative impact on the environment.

There is no question that the nutrients in manure are great for plants. The same nutrients that help plants grow on land can also encourage the growth of algae, bacteria, and other aquatic weeds in water. Undesirable plant life grows, shading out and killing other aquatic vegetation beneath the water surface. When the plants and algae decompose they create unpleasant odor, surface scum and use up oxygen in the water that fish and other aquatic life need.

Other primary concerns of waste management include fecal coliform bacteria, nitrates, organic material, phosphates and salts.

Fecal coliform counts in water are used as a standard in measuring water contamination from pathogens in human and animal waste. The coliform bacteria may not necessarily produce disease, but can indicate the presence of other bacteria, protozoa, and viruses that can cause infections and illnesses.

**Table 1: Concentration of Fecal Coliforms in Animal Waste**

*From the Horse Industry Handbook*

Species	Coliform Production Per Day
Sheep	18 Billion
Dogs	7.8 Billion
Cattle	5.4 Billion
Livestock	297 Billion

Nitrates from the nitrogen in manure can be harmful to humans when consumed at high levels. When the nitrates infiltrate through the soil, and end up contaminate groundwater, the source of drinking water for many people may become polluted. High nitrate levels can cause health problems in humans and livestock.

Manure storage structures should be located 100 feet (check with local regulations) from waterways and at least 100 feet (check with local regulations) from drinking water wells. Manure should be stored in a dry area where there is little to no upslope water that will be flowing through this area. The storage area can be roofed or covered to decrease the chance of runoff. The size of the storage structure will depend greatly upon the number of animals, the amount of manure collected, and the amount of bedding used on the operation.

#### *Pasture Management*

A goal of every livestock operation should be to maintain pastures with good vegetative cover to provide quality nutrition to the animals they raise. A field of healthy grass is more than visually appealing. A healthy pasture can also provide livestock with high quality, nutritious feed at a low cost. Pastured livestock are less likely to develop destructive habits. A lush green pasture, instead of mud, can help reduce the chances livestock have of developing digestive and respiratory problems. It also reduces the potential for insects and disease. Weeds that are poisonous to livestock are less likely to crowd their way in where grass is plentiful, and when healthy forage is available livestock are less tempted to eat weeds.

When pastures are thick and well vegetated they anchor valuable topsoil in place, filter out pollutants, and make use of the nutrients deposited by the livestock. As a result you can keep valuable nutrients and soil on your property and out of the stream.

#### *Erosion and Sedimentation Control*

Your management plan; should reveal areas of potential soil erosion and runoff. Erosion is affected by soil type, slope of the land, amount of rain or snowfall, and vegetative cover.

One of the goals of Pennsylvania's Clean Stream Law is to prevent erosion and control sediment loss. Sediment can turn streams and lake water cloudy, making it less suitable for fish and other aquatic life as well as for recreation.

Erosion occurs when water is allowed to travel through a denuded or unvegetated area picking up particles of soil with it. This runoff water can be from upslope areas or from roof water that is not directed away from a sensitive area. There are three types of erosion usually seen in Pennsylvania – sheet, rill and gully erosion.

Sheet erosion involves the removal of a uniform thin layer of soil by raindrop splash or water run-off. This thin layer of topsoil often disappears gradually, making it difficult to monitor because the damage is not immediately perceptible. Sheet erosion is often overlooked until the subsoil is exposed.

Raindrop action on bare soil disrupts aggregates, dislodges soil particles and compacts the erodible soil surface. If rainfall exceeds infiltration, a surface film of water forms. Continuing rainfall causes turbulence within the flow that may increase the water's erosive effect up to 200 times.

Loss of the finest soil particles, to which the bulk of plant-available nutrients and organic matter adhere, affects the productivity of the land. Erosion may also result in removal of seeds or seedlings and reduce the soil's ability to store water for plants to draw upon between rainfall events. Soil deposited off-site through this type of erosion causes crop and pasture damage, water-quality deterioration and stream, dam, lake and reservoir sedimentation.

Generally, repeatedly cultivated soils, fallow soils or soils that are bare from overgrazing are particularly vulnerable to sheet erosion.

Look for areas where removal of topsoil has revealed subsoils or stony soils, clumps of grass where the root system can be seen and areas of uniformly exposed tree roots. Similarly, where darker topsoil is eroded a change in soil color may occur and lighter or bleached subsoils may become visible at a break in slope. Soil deposits on the high side of obstructions such as bits of wood or fences may also indicate active sheet erosion.

Aim at retaining vegetative cover to avoid leaving soil bare, especially when there is a risk of high-intensity rainfall. Keep vegetation levels high during summer (perennials are best - they grow under summer rainfall). Control grazing pressures. Improve vegetation and soil management to maximize rainfall infiltration and use by vegetation.

Rill erosion often occurs with sheet erosion and is commonly seen in paddocks or recently cultivated soils following high-intensity rainfall. It is easily identified as a series of little channels or rills up to 30 cm deep.

Rill erosion results from a concentration of this surface water into deeper, faster-flowing channels, which follow depressions or low points through paddocks. The shearing power of the water can detach, pick up and remove soil particles making these channels the preferred routes for sediment transport. Rill erosion is often described as the intermediate stage between sheet and gully erosion.

The loss of topsoil and nutrients reduces productivity greatly, as the remaining subsoil's are often much less fertile. Also related soil deposition off-site causes sedimentation of streams, dams and reservoirs, resulting in water-quality deterioration and damage to aquatic habitats.

Muddy run-off may indicate high sediment loads. Look for evidence of off-site soil deposition. In some cropping situations, jolting of harvest machinery may indicate the presence of rills.

Revise land use on potential problem areas and avoid extensive summer fallow. Modify cultivation and rotation of croplands. Control grazing pressures, improve vegetation and soil management to increase organic matter and promote water infiltration and evapotranspiration by plants.

Gully erosion is the most severe form of erosion. It occurs when major concentrations of high-velocity run-off water in these larger rills remove vast amounts of soil. This results in deeply incised gullies occurring along

depressions and drainage lines.

Gully erosion means the loss of large volumes of soil. Deep wide gullies, sometimes reaching 30 meters deep, severely limit the use of the land, while off-site deposition of soil causes water-quality decline in streams or rivers and sedimentation of dams and reservoirs. Large gullies disrupt normal farm operations, creating access problems for vehicles and livestock.

Gully erosion often occurs on lower slopes, but can form quite high in the landscape in particularly susceptible areas.

Review the suitability of current land use and management techniques to determine cause of the problems. Attempt to reduce the amount of water reaching the gully by increasing plant water use where the rain falls or installing Best Management Practices (BMP's) to reduce run-off. Control options depend on the size and scope of the problem. In addition to earthwork, replacement vegetation to stabilize banks and the exclusion of livestock may also be necessary.

#### *Stream and Wet Land Management*

Protect stream and riverbanks from trampling, destruction of vegetation, and contamination. Stream bank fencing is a simple, effective way to improve water quality in streams flowing through your operation.

Stream bank fencing stabilizes stream banks and reduces erosion. In Pennsylvania, sediment is the largest cause of stream impairment. After the stream is fenced, new vegetation binds the soil particles to create a stable structure that resists erosion and collapse. During heavy flow times the vegetation also absorbs some of the water's force, helping to slow the current and reduce its erosive power.

The benefits of streambank fencing are many. Below are a few key benefits:

- ❖ Improves water quality – Vegetation along streams trap sediment, pesticides, and absorbs excess nutrients before they enter the water.

- ❖ Protects animal health – By limiting livestock access to streams and other wet areas you are reducing contact with waterborne bacteria, which can cause leptospirosis and other problems from drinking contaminated water. Hoof and leg injuries may also occur from livestock entering and exiting the stream.
- ❖ Promotes pasture management – Stream bank fencing gives the operator more control over grazing.
- ❖ Provides habitat for birds and small animals – Stream side vegetation provides food, cover, and nesting sites for birds and small mammals. The quantity and variety of wildlife is greatest where there are diverse grasses, shrubs, and trees present.
- ❖ Improves fish habitat – Vegetation improves fish habitat by enhancing water quality, providing protective cover, and increasing food for fish. Streamside vegetation also helps to keep the water cool during the summer.
- ❖ Enhances the landscape – Wildflowers and shrubs add a variety of shapes and colors to the farm landscape. Not to mention the birds and mammals these plants attract.
- ❖ Supports good neighbor policy – Remember water is a shared resource. By improving the conditions on your operation, you are setting a good example for those both upstream and downstream.

It is also a good idea to fence livestock out of wetlands. These are areas that tend to stay soggy or have standing water during the driest months of the year – but not always. A good way to identify a wetland is to look at the plants that are growing in this area. Certain plants tend to like wetter areas; examples are cattails and sedges.

The environmental golden rule is “keep clean water clean and treat dirty water”. By following this rule you will be protecting

Pennsylvania’s water quality by reducing runoff and contamination through waste management, pasture management, erosion and sediment control, and stream bank and wetland management. Everyone lives down stream and needs to do their part in preserving our natural resources including water quality.

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*Prepared by members of Pennsylvania’s Small Scale Livestock Committee.*

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