Snyder County Agricultural BMP Guide

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Snyder County Conservation District

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USDA-Natural Resources Conservation Service-Middleburg Field Office

Snyder County Conservation District

Conserving Natural Resources for Our Future

Dear Reader,

As you read this fifth edition of the "Snyder County Agricultural BMP Guide," you will see a variety of agricultural best management practices (BMPs) installed on various farms within Snyder County. This edition was first printed as part of the Conservation District's "Ag. BMP-CREP-Buffer Tour" held on June 28, 2023. (Just like this edition, the first edition was printed as part of a county agricultural BMP Tour held in June 2005.) We hope this guide is useful in giving farmers ideas of BMPs they can install on their farms ranging from riparian stream buffers, cover cropping, to manure storages. Properly operated and managed BMPs prevent sediment and nutrient pollution from entering our local streams and groundwaters as well as the Chesapeake Bay. Many farmers may have worked with the Snyder County Conservation District (SCCD), USDA—Natural Resources Conservation Service (NRCS) or others agencies, organizations, and consultants to plan, design, construct, inspect and fund the BMPs similar to or shown in this guide.

While farmers earn a living with their land and animals, they must take care of the soil and water resources in order to produce the agricultural products we need now and in the future. Farmers also work in an atmosphere of increased scrutiny from the general public.

Pennsylvanians that produce or utilize animal manure must have a manure management plan (MMP) or nutrient management plan (NMP). Cropland needs to follow practices within an agricultural erosion & sedimentation plan (Ag. E&S Plan) or an NRCS developed conservation plan that meets PA regulations. Air emissions, odor management and tougher permitting procedures are also becoming a reality.

Each farm has unique challenges to prevent sediment and nutrient pollution of surface and groundwaters. There are no "one size fits all" solutions regarding agricultural BMPs. It is the hope of the Conservation District that this guide will encourage farmers to seek assistance to prevent sediment and nutrient pollution on their farms. The Conservation District also hopes that any other people who read this guide may come away with an appreciation of what farmers can do, and will do, to protect our local surface and ground waters.

Sincerely,

Directors and Staff,
Snyder County Conservation District **June 2023**

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Snyder County Agricultural BMP Guide

5th Edition

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Manure & Composting Facilities

Manure storages are designed to help farmers manage their manure in a way that allows them to apply nutrients at a more opportune time. When designing a manure storage, items such as where the storage is located, type and number of animals, type of manure being stored, type of bedding used and type of manure spreading equipment used on the farm are considered.

Manure storages allow farmers to spread when conditions are most favorable. Winter spreading of manure could result in nutrient runoff. However, a manure storage cannot control how the manure nutrients are spread on the field. A manure storage is only as good at the farmer's management ability.

Liquid & Semi-Solid Manure Storages

Liquid manure storage concrete tank constructed to store not only manure but also milkhouse wastewater from a pipe (top left, see red arrow) or collected barnyard water from a pipe (center right, see yellow arrow).

Liquid manure storages may be designed and built to allow the farmer to scrape manure from barnyards into them through tractor push-off ramps (with tractor guards) (bottom left and bottom right).

Safety signs are required to warn people about the dangers of falling and manure gases and other hazards related to handling liquid manure.

Typically, liquid manure storages have pads where portable manure pumps can be placed (top left). Farmers have also installed liquid manure storages made of metal (top right).

Liquid manure storage tank (poured in place with slatted floors) for a heifer raising facility (center left). Similar structures have been built for swine and certain poultry facilities.

Roofed manure storage stacking structures with concrete walls constructed to store dry stackable manure (bottom two photos).

Manure can enter roofed manure stacking structures either by gutter cleaner from the stanchion barn (bottom right) or through a tractor push-off ramp (with tractor guard) from the barnyard (bottom left).

All structures to store liquid and semi-liquid manure need to be designed by a professional engineer. All structures built since January 2000 also have to be approved by a professional engineer. If a manure storage built before January 2000 needs repairs, a professional engineer must certify the proposed and finished repair.

Roofed manure storages with concrete walls for various management situations. Top left photo: Dairy stackable manure from a gutter cleaner and a nearby barnyard. Top right photo: Liquid dairy manure scraped from alleyways regularly into a roofed storage to limit additional rainwater. Second from bottom: Roof installed over existing concrete manure stacking area for a beef herd barnyard.

An unroofed manure stacking area with concrete walls serving a concrete cattle barnyard and lot. (bottom)

Solid Manure Storages

All structures shown on the next four pages have a poured concrete floor.

The primary goal of keeping precipitation and snow melt away from poultry manure is so that farmers can apply this highly concentrated nutrient source at a low rate per acre for crop growth.

Roofed poultry manure stacking structures have been built with treated wood and concrete curbing (three photos above and center right), poured concrete walls (center right) and precast concrete wall sections (bottom two pictures).

Roofed poultry manure storages can vary from farm to farm*. For instance, a storage can have an access pad and loading dock attached (above left), a ceiling that prevents starlings from roosting in the building (right), and accommodate gutter cleaners (above right).

*Depending on the program, these examples may not be eligible for financial assistance.

Notice that most of these roofed poultry manure storages have a concrete slab at the entrance to allow manure spills from loading and unloading to be cleaned up.

Mortality Composting Structures

State regulations limit farmers on what they can do with dead animals. Although proper burial, incineration, or hiring a rendering service to take dead animals are viable options, composting dead animals into a nutrient crop source is also a possibility.

Farmers can compost dead animals outside in piles or trenches at locations where leaching cannot take place. In this way additional stormwater flows into the compost and compost leachate does not reach wells, waterbodies and concentrated flow areas. However, a facility designed for this purpose is more superior alternative. All leachate is contained, the compost is easier to manage and is less likely mortalities will attract scavengers..

Having the right ratio of manure and dead animals (nitrogen source) with straw or sawdust (carbon source) and moisture are key requirements for operating a functional mortality composter.

Stand alone poultry mortality composter structures constructed with treated lumber (left) concrete walls (center right).

Mortality composting facility for a swine finishing operation (bottom right).

Some farmers can compost their mortalities within their roofed manure storages if managed correctly. (center left).

Four examples of mortality composting bins as part of roofed poultry manure stacking structures on different farms. One has walls of treated lumber within the manure storage (above left), one has walls of treated lumber as an extension of the manure storage (above right), one has poured concrete walls (center right) and one has bins separated by precast concrete walls (below left).

Whenever a Conservation District or cooperating agency (NRCS or PA Department of Environmental Protection [DEP]) staff person visits a farm, we follow biosecurity protocols and do not enter any animal housing facility unless invited by the farmer.

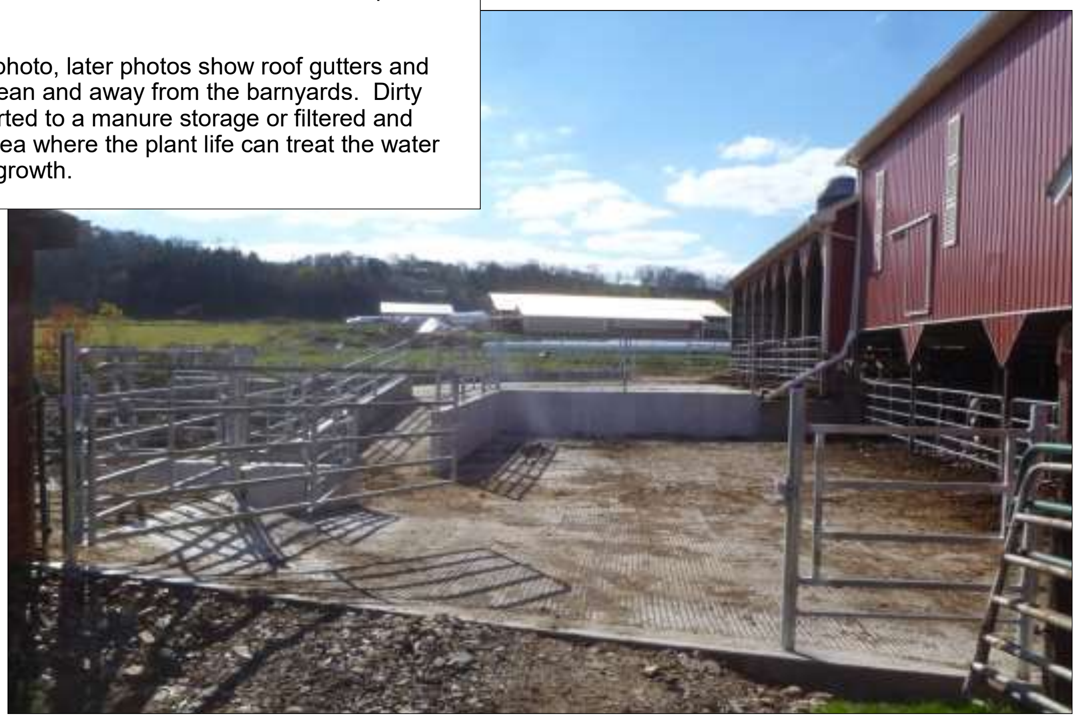
Barnyard/Concentrated/Heavy Use Area Improvements

A major source of where nutrients could leach or run off are barnyards. These are places where livestock gather to eat, rest, drink and eventually deposit manure. (Barnyards fall into a group of farm BMPs or water quality concerns referred to as animal heavy use areas (AHUAs), heavy use areas (HUAs), heavy use area protections (HUAPs) or animal concentrated areas (ACAs). [ACAs can also be formed in pastures. See pages 26 — 29 for more information.]

Improved and properly functioning barnyards and concentrated areas are designed so farmers can utilize the manure by collecting and applying it immediately or taking it to a storage. When improving a barnyard, considerations must be given to items such as location in relation to streams and manure storages, type and number of animals and the treatment of nutrient laden barnyard water due to precipitation. Other supporting BMPs, such as roof gutters and vegetative filter areas may be needed. Many improved barnyards and ACAs work hand in hand with manure storages.

A newly installed and improved barnyard (top right) for a dairy operation allowing the farmer to feed and move the cattle while giving space for them to move around. Notice that the concrete floor allows the farmer to scrape the manure on a regular basis.

Although not easily visible in this photo, later photos show roof gutters and downspouts keeping that water clean and away from the barnyards. Dirty barnyard water can either be diverted to a manure storage or filtered and transferred to a vegetative filter area where the plant life can treat the water and use the manure nutrients for growth.



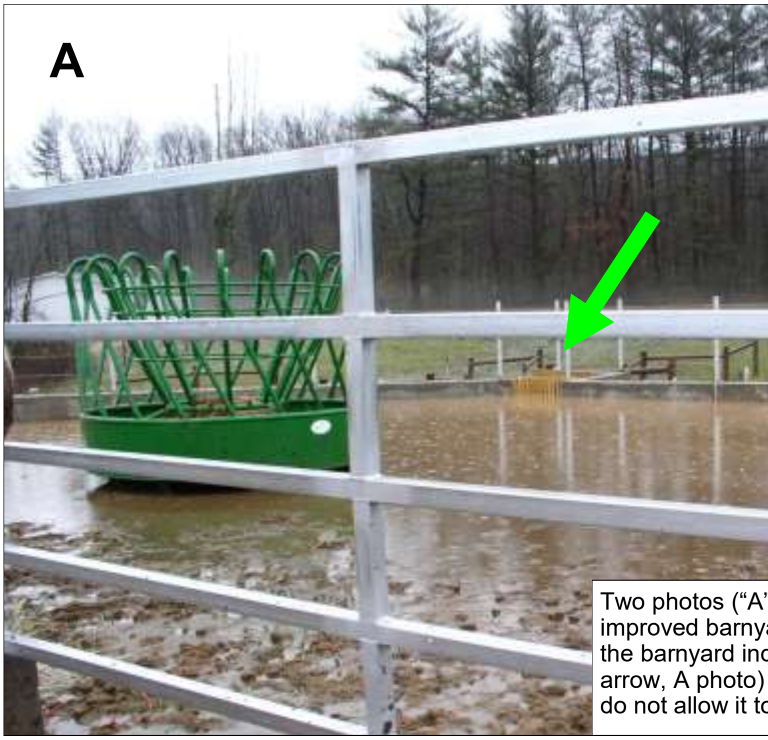
An improved concrete barnyard under construction on a dairy farm (bottom left). Notice the roof gutters and downspouts that keep roof water from reaching the barnyard. The farmer can push the manure away from the barnyard and into the roofed and poured concrete walled manure storage stacking structure on the left. Hidden from view is the screen box that filters manure solids and allows barnyard water to flow into an underground concrete septic tank where it will be later pumped to a vegetative filter area.

The dairy farmer (left) had improved his existing barnyard. This allows him to feed his cattle and transfer manure directly into a manure spreader with an existing gutter cleaner or a newly installed push off ramp (green arrow). The farmer below connected a newly improved barnyard with a liquid manure storage via push off ramp (yellow arrow).

A farmer can utilize a manure storage stacking area connected to an improved barnyard. This beef farmer has a manure storage stacking area with 4 ft. concrete walls and floor (left).

Barnyard improvements can be designed with how the farmer feeds and waters the livestock as shown in the center left, center right, and bottom right photos on this page.

The barnyard shown on the bottom left photo utilizes a concrete settling basin (outlined in red) to filter manure laden water before it is screened and pumped to a filter area in one of the nearby pastures (not shown)



Two photos ("A" and "B" on this page) show how a properly designed improved barnyard should work during a rainstorm. The water laying within the barnyard indicates that the floor is sloped towards the screen box (green arrow, A photo) and the concrete curbs contain and hold the stormwater and do not allow it to leave the site (photos A and B).

A screen box (center left and center right, different operations) filters manure solids that flow from an improved barnyard during a rain event. The first screen (center left) prevents heavy solids from entering the screen box. The second and third screens have smaller spaces that filter smaller solids. Notice the water flowing from the final screen marked with a red arrow (center right). This water flows into a concrete septic tank where the water settles, then is siphoned or pumped to a vegetative filter area. **Regular cleanout maintenance is needed for this BMP to work to its fullest capacity.**

An open concrete curbed and floor barnyard alongside a roofed ACA and a scrape alley (behind cow) connected to a liquid circular manure storage. Notice the roof runoff controls along the roofed ACA.

Farmers seeing these roofed barnyards/(ACAs) in this guide should note that the goal of these structures is to limit stormwater to the areas while allowing farmers to feed their livestock and collect and store a limited amount of manure. As a rule of thumb, conservation agencies and non-government organizations do not financially assist farmers in designing and installing new barns and animal production facilities.

Top two photos show different attempts to improve barnyards for horses. The first owner (second from top) installed a reinforced gravel pad to collect manure in his barnyard. The other owner (top) reduced the size of his gravel barnyard and seeded and mulched a grass filter area to catch manure runoff from entering a nearby road ditch. Both owners installed roof runoff controls (not shown in either photo) to limit roof water from entering their barnyards.

A roofed ACA (second from bottom) and a combination of an open and roofed barnyard/ ACA (bottom). Notice the roof runoff controls for both.

Another reason for constructing an ACA or improving an existing barnyard is to keep grazing animals off of pastures when there is no or little vegetation on pastures, conditions are too wet or snow covered. The farmer can then feed the animals in the ACA while not degrading pasture vegetation.

If a pasture is severely degraded, such as vegetation height is lower than 3 inches, PA environmental regulations classify the area as an ACA in which the farmer must divert water above the degraded area and somehow treat dirty water below the area.

The take home message: It is easier to maintain lush vegetation in a pasture by not overgrazing it and keeping animals off it when conditions are poor instead of installing a grassed waterway above the pasture and a non-grazing vegetative filter area below the pasture.

This farmer (bottom left) worked with the private firm to design a fabric roofed ACA with steel framing. Note that not all financial assistance programs allow for this type of flexibility.

Several roofed barnyards/animal concentrated areas (ACAs) either completed or in the process of being built are shown on this page. Although not easily visible in the two top photos, roof runoff controls and underground outlets were installed.

Photos in this guide were taken on Snyder County farms by Snyder County Conservation District and USDA-Natural Resources Conservation Service, Middleburg Field Office staff.

A stand alone roofed barnyards/ACAs structure (top right photo) and a barnyard/ACA with a roof extended from the main barn (center photo).

Although not funded by any public financial assistance grants, this farmer installed netting and a type of monoslope roof that prevents starlings from roosting in his roofed ACA (left and above).

Wastewater Treatment Systems

This section covers two types of wastewater: milkhouse wastewater and barnyard water.

Milkhouse wastewater contains small amounts of milk and detergents used to clean milk handling equipment. This end product, if it enters streams, can cause fish kills and other aquatic habitat damage. Bacteria break down the wastewater using dissolved oxygen in the stream that would normally be used for aquatic life.

Milkhouse wastewater can be taken directly to a liquid manure storage, stored temporarily for later land application, or treated by a vegetative filter area.

Barnyard water contains animal manure. This water must either be diverted to a liquid manure storage or filtered and treated by a vegetative area.

Concrete septic tanks being installed to intercept milkhouse wastewater at a dairy farm (top right). The outlet goes to a vegetative filter area.

On this dairy farm, the milkhouse wastewater is pumped from a concrete septic tank (not shown) and flows into a manure hopper cast in place in a barnyard where it flows into a concrete liquid manure storage concrete tank (center left). Other farms temporarily store their milkhouse wastewater into a concrete tank, where it can later be pumped into a manure spreader for field application.

Milkhouse wastewater can either be pumped (bottom left) or siphoned from the concrete tank. The other bottom pictures (bottom center and bottom right) show a special type of siphon called a flout.

Safety signs are required to warn people about the dangers of wastewater gases and other hazards from buried tanks.

On many dairy farms, both milkhouse wastewater and barnyard water flow into either a manure storage or into a vegetative filter area. For example, both milkhouse wastewater (inlet not shown) and barnyard water (screen box shown above left) flow into concrete septic tanks before it is pumped to a vegetative filter area. At another location, barnyard water is scraped into a concrete settling basin where the solids are filtered before entering a concrete septic tank (above right).

A concrete septic tank being installed to handle barnyard water and/or milkhouse wastewater (right). Typically each septic tank has two compartments.

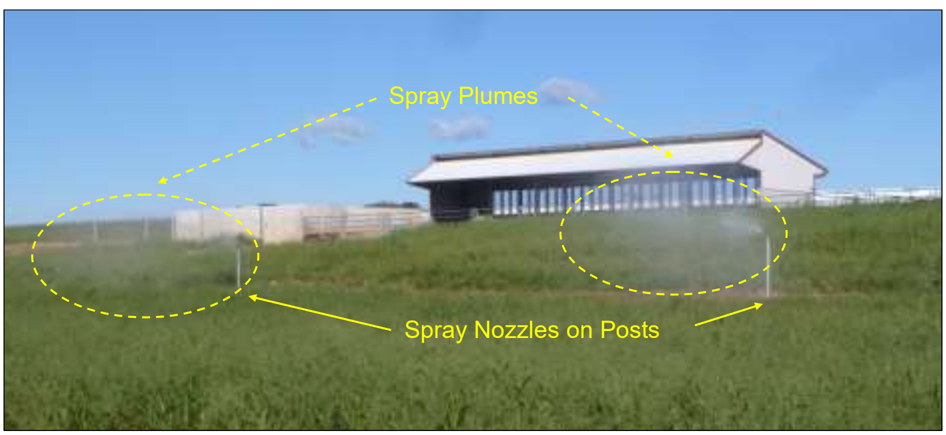
Living vegetation helps with water quality by reducing nutrient, sediment, pathogen and waste flows into surface and ground waters. In regards to treating milkhouse wastewater and barnyard water, these filters are either permanent pastures or hay fields. These vegetative filters work together with the parts of the barnyard water/milkhouse wastewater treatment system.

In a vegetative filter area, the grass uses the wastewater nutrients and traps the sediment from reaching surface waters. The soil binds and filters the other wastes and detergents from entering the ground water.

The picture at the center left shows a manifold distribution system for milkhouse wastewater. The yellow dashes represent the filter area while the yellow arrows represent the gradual downward slope of the land away from the milkhouse wastewater manifold distribution pipe.

Bottom left: A milkhouse wastewater & barnyard water distribution line in action at the top of a vegetative filter area on a dairy farm.

Another method of distributing wastewater in a vegetative area is by irrigation. The wastewater is pumped to the vegetative filter area where it irrigates the site through a spray nozzle. A nozzle is shown at the left. The top center photo shows barnyard water and milkhouse wastewater being sprayed in a permanent pasture. Second from bottom: Barnyard wastewater from a dairy heifer operation irrigates a permeant pasture from two nozzles (see yellow markings).



Just as we read road signs to help us navigate, we hope this guide offers farmers some ideas for their farms.

Riparian Buffers

Riparian buffers, also known as stream buffers, are vegetated areas or strips along a stream which help protect streams from pollutants (such as excess fertilizer and manure nutrients and pesticides) and sediment coming from adjacent lands, including crop fields and pastures.

While buffers can be solely grassed, the most effective buffers in helping water quality are forested. Trees plated along streams have been shown to greatly increase the nutrient runoff filtering and sediment trapping capabilities of buffers compared to solely grass buffers. Forested buffers, once allowed to grow, can stabilize streambanks, improve water infiltration and reduce flooding.

A newly established riparian forested buffer planted between a steam and a newly installed pasture streambank fence (top left and bottom right photos). Many riparian buffer projects are found along pastures that border streams.

To protect newly planted buffer trees from deer, voles and other animals, a tree tube (in this case one made of plastic mesh) is installed with a wooden stake and zip ties. (top right).

While the emphasis has been to establish forested buffers along streams that border pastures and crop fields, they also can improve water quality along farmsteads and homesteads (left photo).

Shade from trees may also cool the stream's water to improve cold water fish habitat. Improved water quality also allows more sensitive invertebrates to thrive and become food for other aquatic life and wildlife.

A well maintained riparian forested buffer after it was established 13 years ago along a headwater stream which flows into a pond and divides a pasture.

Knowing how to maintain something properly for optimal performance is important, whether it is a riparian buffer, another BMP, a tool or a piece of farm machinery.

Many of the buffers shown here were through USDA's Conservation Reserve Enhancement Program (CREP) from the Farm Service Agency (FSA) and Natural Resources Conservation Service (NRCS) or separate programs administered by the Snyder County Conservation District (SCCD). Questions about financing, establishing, and maintaining buffers may be forwarded to these agencies and non-government organizations such as Pheasants Forever.

Any riparian buffer has the capability to go from small trees in tree tubes along a stream (bottom right) to what you see on the bottom left photo.

Research shows that the wider the riparian buffer area the greater the nutrient filtration and sediment trapping ability.

In the above photo, this farmer planted trees near a stream that will allow possible additional income when they grow. Not all buffer programs offer this option.

Examples of newly planted riparian forested buffers bordering pastures.

Stream Crossings & Fencing

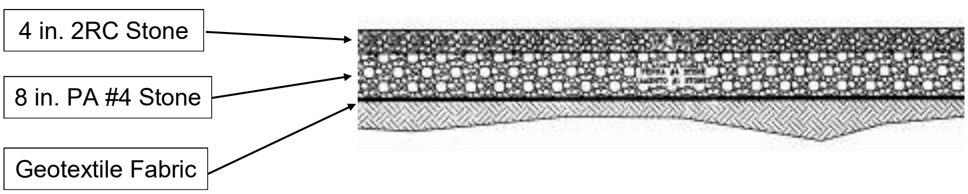
Cattle need water and historically streams supply livestock with that water. However, unlimited access to streams can not only degrade streambanks and stream water quality, but also cause livestock health issues such as hoof problems and mastitis. Streambank crossings and streambank fencing are BMPs that help both water quality and livestock.

Above photos show an excavator, in coordination with NRCS staff, build a cattle walkway and stream crossing for a dairy farm. Notice the different types of stone used. The arrow points to the vibratory roller needed and bulldozer to complete the job.

Currently, there are no PA environmental regulations or laws that prohibit animal access to any waterbody. **However, the animals cannot degrade any waterbody.**

An excavator laying a base layer of rock over geotextile for a cattle stream crossing (center left of this page).

Stream crossings may be designed to handle farm equipment as well as livestock.



Pictures of the different types of stone used on crossings can be found on page 27 of this Guide.

A few cattle stream crossings have been constructed with "seconds" concrete pig slats not used for swine facilities (top left and top right).

In pastures, streambank fencing go hand in hand with cattle stream crossings.

Research shows that the wider the grass and tree buffer area is between the streambank fence and the streambank itself, the greater the nutrient filtration and sediment trapping ability.

Stream crossing projects will require a permit through the PA Department of Environmental Protection (DEP).

Pasture Management Improvements

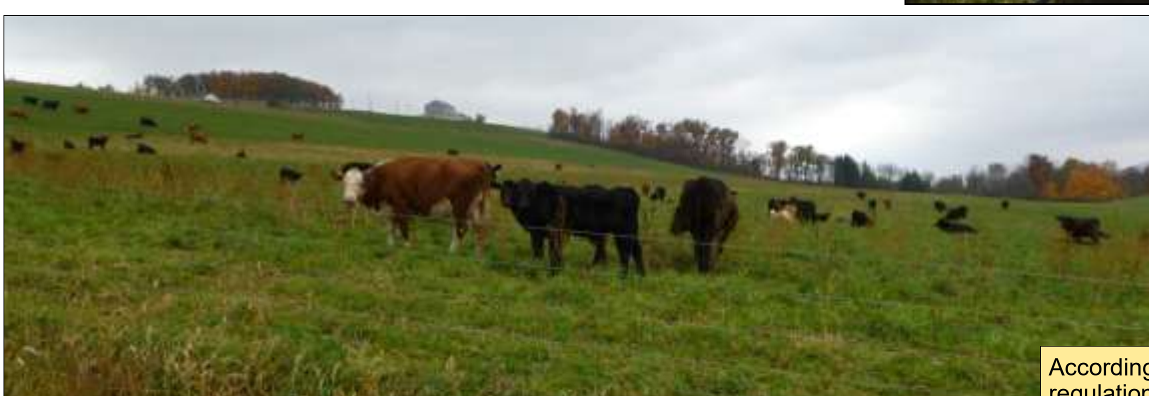
When cattle have access to graze one large area, they selectively choose to eat certain vegetation. Before the more palatable vegetation has a chance to rest (replenish root reserves and grow large amounts of lush leaves) the cattle graze that vegetation again. Over time, the palatable vegetation may die off. Bare spots may be created, thus exposing the soil to erosion and degrading the quality of the pasture.

A properly managed pasture is divided into smaller paddocks. The cattle have access to only a small portion of pasture at one time. After a brief time (depending on the number and species of livestock and paddock size) the cattle are moved to another paddock. The small paddock forces the cattle to be not as selective while grazing. Also, when the cattle leave the paddock, this gives the vegetation time to rest in order to replenish root reserves and grow lush vegetation for the next time. This type of grazing allows the farmer to utilize a valuable resource while keeping the soil covered with vegetation. If managed correctly, a farmer can increase the amount of pasture forage being fed to the livestock. Watering systems, cattle walkways, cattle stream crossings, streambank fencing may complement and improve the management of pastures.

Pasture Fencing

Newly installed pasture fence with interior fencing to sub-divide pasture into smaller paddocks for a beef and sheep farm (left). Interior fence is right above the red dashed line in photo. The interior fencing may be permeant or temporary, depending on the pasture management strategy.

Newly installed pasture fence on a beef operation keeping cattle out of a waterway. This pasture was formally a crop field (right).



According to PA environmental regulations, farmers with pastures must either:

a.) follow a NRCS developed "Prescribed Grazing" plan, or

b.) maintain dense vegetation (average height at least 3 inches) throughout the growing season.

Some equine species such as horses (shown above), naturally graze well below 3 inches. This can be challenging in order to meet DEP manure management rules regarding pastures.

Pastures need to be flexible for operator and livestock. This includes the types of fencing, gates, watering systems, ability to harvest hay in paddocks, and desirable vegetation in the pastures (top 3 pictures in this page).

Pasture Sacrifice Area

A sacrifice area is a place near or in an pasture where animals may be confined when pastures are not suitable for grazing due to low vegetation height, wet conditions, etc. These areas should not be near any waterbodies or locations where water runoff can transport pollution to waterbodies. On some operations, creating a reinforced gravel ACA, barnyard or sacrifice lot is desirable. Above, reinforced gravel is being placed at an equine operation.

Cattle Walkways

Completed cattle walkway made of reinforced gravel (below left photo).

Reinforced gravel ACAs, sacrifice lots, barnyards, stream crossings, cattle walkways and access roads typically consist of a geotextile fabric on the bottom, a coarser rock above the geotextile (center bottom photo) and a finer stone mix to top (bottom right photo). Excavation and compaction are necessary to complete the project. A finer stone mix that is shown in the bottom right photo for the finished top layer may be desired by equine and some livestock owners.

Reinforced gravel cattle walkways and pads around pasture waterers, water troughs and hay feeders will help prevent turning some pasture sections into large bare spots and mud holes. If this happens, it is likely to be classified as an animal concentrated area (ACA) under PA environmental regulations..

Example cattle walkways at two separate farms (above and left). Geotextile may be needed at some places due to soil type and nearness to streams.

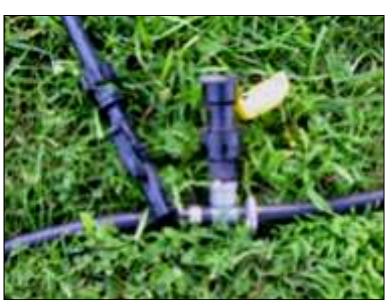
Geotextile fabric laid before stone is placed for cattle walkway (center right). Cattle walkway just completed (center left).

Pasture Watering Systems

Base layer of stone being placed overtop of geotextile fabric around a precast concrete spring development trough on a dairy farm (bottom left).

Reinforced gravel pads placed around newly installed water troughs and waterers at various beef and equine operations (left, right, below and right).

Example of portable water troughs in pastures (two left and right photos). For some operators, flexibility with locating water troughs is suitable for how they manage their pastures.



A frost free hydrant located in a pasture (bottom right). The bottom left photos shows a quick disconnect for a water line where water trough portability is preferred.

Streambank Restoration

While simpler and less costly stream protection BMPs, such as riparian buffers and streambank fencing, are preferred, there are times where more is needed to restore a stream's ability to handle heavy water flow and native fish habitat. These type of BMPs include log deflectors, mudsills and log and stone throats.

It should be noted that this is not stream dredging or solely debris removal. These practices closely mimic a natural stream environment while working with an agricultural setting and other human activity as much as possible.

Single log deflector (top left photo, yellow arrow) installed within a stream.

Any stream project will require a permit through the PA Department of Environmental Protection (DEP).

A mudsill carefully excavated, seeded and mulched along a streambank (bottom photo). Notice the supporting logs and stone installed.

At the top left, a log and stone throat (yellow arrow) with log deflectors to close off the stream and create plunge pools to increase stream aeration and habitat for native fish.

An rehabilitated stream segment less than one year after it was completed (center right).

At bottom left, a stream restoration project just completed. The same stream segment less than one year later (bottom right).

Farmstead Stormwater Controls

When farmers think of agricultural BMPs, they normally do not think about roof gutters and downspouts. These simple practices keep the clean roof water from reaching manure covered barnyards, pastures and manure stacking areas. The less water that reaches a potential nutrient or sediment source, the less contaminated water that has to be treated by a filter area or placed in a storage. Roof runoff controls usually work with underground pipes and outlets and complement other BMPs, such as improved barnyards and roofed manure storages in functioning more efficiently.

Roof runoff being diverted away from a concrete barnyard on two separate dairy farms (top two photos) and a horse pasture on another farm (center photo).

Example of a roof gutter and downspout installed on a mortality composter attached to a poultry manure storage (below)..

Roof gutters, downspouts and underground outlets keep the clean water clean so the farmer does not have to treat the dirty water that would be contaminated by being in contact with manure in barnyards and other areas.

Underground outlets carrying roof runoff water can that outlet its water into a rock lined basin (mid-center) or lined with rock in some manner that is does not cause scouring (center left).

Example of roofs gutters and downspouts installed on a roofed ACA next to an improved barnyard ACA with concrete cubing (top left) and a roofed ACA on a separate operation (top right). Notice the green plastic pipe that will carry the roof water from the roof gutters and metal downspouts and transport it away to pipes underground.

An animal guard at a pipe outlet (center right) prevents curious animals from entering the pipe but allows potential debris from exiting the pipe.

An example of a rock lined inlet diverting water away from poultry facility (bottom left). An outlet pipe taking stormwater to a drop box (bottom right)

Sometimes, diversions and waterways have to be constructed in order to divert water away from farm buildings (barns, sheds, etc.) and BMPs (such as manure storages and improved barnyards). The lower three photos show a diversion alongside a liquid manure storage (top right) or a diversion carry stormwater away from a roofed poultry manure storage (bottom two photos).

To prevent scouring from the rainwater, a concrete splash block is placed underneath the downspout (yellow arrow).

We hope that when a farmer installs and manages BMPs to help improve our soil and water resources, the BMPs also helps the farmer improves his or her overall agricultural operation.

Cropland Conservation Management & Practices

This is a group of BMPs that keep the soil in place. They include planting crop rotations, contour strips, cover crops and no-till planting. The more crop residue or vegetation that exists on the soil surface, the less soil that is exposed to rainfall and other precipitation.

Cover crops keep the soil covered during harsh winter weather. Originally, farmers normally plowed the cover crop as a “green manure” for the future field crop. While the cover crop completed its mission over winter, the soil becomes exposed to spring showers until the new crop establishes a canopy.

However, farmers have additional options now. The cover crop can either be killed by a herbicide, crimped by a roller, or harvested as a forage. In this way, the cover crops continue their soil saving mission even after they die. The dead stems and roots keep the soil intact long enough for the new crop to establish a canopy.

No-till planting works on a similar principal by covering the soil from rains and other precipitation. Research has shown that tillage burns soil organic matter into carbon dioxide (CO_2) that is released into the atmosphere.

Continuous no-tilling combined with cover crops and diverse crop rotation can keep the existing soil organic matter available for future crop. Some farmer have actually seen increases soil organic matter as well as improve soil structure.

No-Till Planting

PA environmental regulations require that any farm tract which plows (even no-till) or has a animal heavy use area [AHUA, animal concentration area (ACA)] 5,000 or more square feet, an agricultural E&S (erosion & sedimentation) plan or NRCS conservation plan meeting tolerable soil loss (“T”) is required.

Corn no-tilled into a field that was in alfalfa/grass the year before on a farm (top right). The farmer sprayed a herbicide to kill the alfalfa and grass the previous year. No-till corn planted in a field that had soybeans the previous year, and corn the year before (top left). Two no-till drills on a harvested wheat field during a Conservation District sponsored no-till field day event (bottom).

A team of four horses pull a no-till row planter (top left) and a no-till drill (top right) on harvested wheat fields during a Conservation District sponsored field day event. At center left, two farmers get ready to demonstrate how a no-till transplanter works during a Conservation District sponsored field day event. The no-till transplanter can plant seedlings such as pumpkin, tomatoes and squash.

Farmers and researchers have been experimenting planting a cover crop between crop rows called interseeding (such as field corn or sweet corn) while the crop is approximately "knee high." One piece of equipment that was tried in Snyder County was an interseeder (above), a no-till drill designed to plant between row crops spaced 30 inches apart. Farmers walk through an unharvested corn field where the interseeder was used during a Conservation District field day event (left). Notice the established cover crop between the corn rows (bottom two photos).

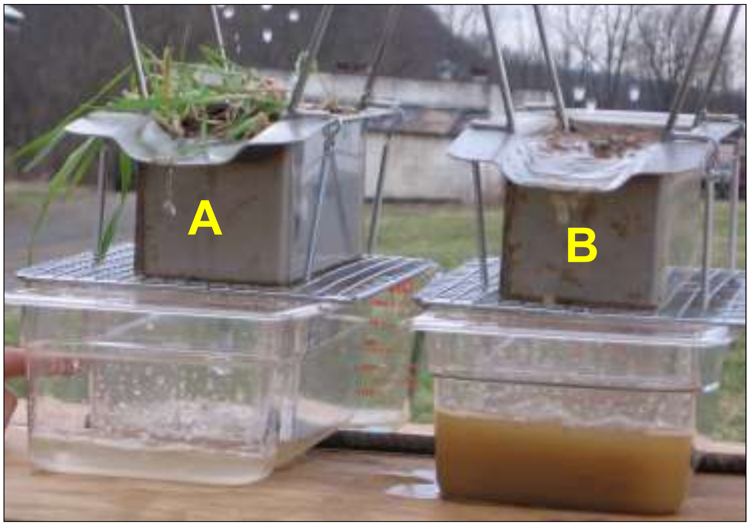
Two farms where a small grain cover crop species was planted after harvested corn silage (left and right). The photo at left was taken in early spring while the right photo was taken in late fall.

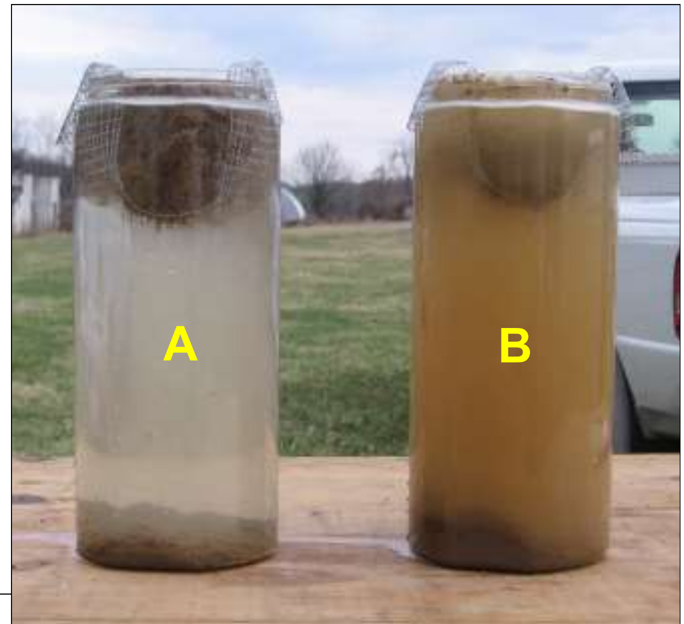
A tillage radish (above) planted in a harvested small grain field to improve water infiltration. Typically, tillage radish is planted with other cover crop species for a more thorough living cover. Photo taken in late fall.

Three different cover crop mix test plots on a farm (above, left and bottom left). Photos taken in late fall.

Some farmers have been experimenting with various cover crop mixes, such as clovers and grasses, while others experimented with newer varieties and species. Some farmers and researches believe the more diverse the cover crop mixture, the better the soil health (e.g., water holding capacity, organic matter). Pest control, nutrient retention for future crops, nitrogen fixing ability are also some potential benefits.

Soil Health: An Extra Benefit





The upper two photos are results from two separate soil health demonstrations, conducted by an NRCS staff person during a field day event sponsored by the Conservation District. It compares no-tilled soil (left, "A") and continuously conventionally tilled soil (right, "B"). In the upper right photo, notice that A's soil clump on the wire mesh on top is still holding together due to the soil organic matter allowed to accumulate over time. In B, the soil clump has lost is shape at the wire mesh on top due to lower organic matter content. Tillage allows the oxygen to burn the organic matter and the lost carbon is released into the air instead of binding the soil and becoming a source of plant nutrients and feedstuff for other soil organisms. The cloudy jar B indicates water easily breaking up the soil clump while the clearer water in A shows that the soil clump is more resistant to degradation by water.

The above left photo show mimics a heavy rainfall event over no-tilled soil with a cover (A) and a continuously conventionally tilled soil without cover (B). This demonstration shows the amount of water runoff the soil surface, its condition and how much is infiltrated. The runoff from soil A is much cleaner than from soil B. Although not readily visible in the left photo, water infiltrates soil A more than soil B.

When soil is not tilled earthworms work the soil, and after consuming it with crop residue, or produces a "glue" that helps keep the soil together. Signs of earthworm activity are their casts (feces) or holes/burrows they make. An example earthworm burrow is marked in yellow (right).

Contour Buffer Strips & Field Borders

Continuous no-till and cover crops are good for soil health. However, these practices work better when in cooperation with contour strips and crop rotation (page 41). When working together, these practices limit sheet erosion on cropland. Other practices that prevent sheet erosion are vegetative field strips, riparian buffers with trees (pages 20 — 22), and permanent grass along streams and field borders.

Vegetative contour field buffer strip (marked by arrow in above left photo) in crop field. This strip will prevent sediment from traveling a longer distance to a road ditch below (not shown) that eventually flows into a stream. At right, a field buffer where permanent grass will be grown instead of rotating in and out with row crops. Edges of fields are places where erosion (sheet, rill and gulley) can take place due to direction of the crop rows and typically lower crop residue from lower production. Once established, field borders reduce erosion and possibly produce a hay crop.

Diversions & Waterways

Even with continuous no-till and cover crops, some other practices are needed to prevent gulley erosion where water can concentrate. Once water moves downhill in a concentrated motion, the velocity can erode large amounts of valuable topsoil from crop fields. Some of these places are created not by the slope of the crop field, but the location of road ditches and culverts. When constructed, diversions (running across the contour) and waterways (running downhill) aid to prevent gully formation, or can repair existing gullies by slowing the flow of flowing water.

In this page, photos of diversions and grassed waterways either being constructed or already established. Over time, some of these practices may need to be reshaped and/or reseeded in order to properly transport crop field stormwater. When diversions and waterways are constructed, a combination of straw, seed and a type of matting are needed to prevent erosion during storm events before the vegetation is firmly established. Notice the jute matting (top left photo) and plastic matting (right) used in the grass waterways.

Rocks are placed at waterway inlets (center right) and in the waterway itself (center left, bottom left, and upper photos) to prevent water scouring due to the water's high velocity either from culvert pipes or to topography.

In the bottom right photo, an above ground inlet (yellow arrow pointing to a perforated pipe) takes water from a grass waterway and outlets the water to another location.

The top three photos show completed grass waterways in use on three separate farms.

Notice in the next to top photo, a diversion (circled in red) intercepts water above it and carries it to the top of the grassed waterway.

Contour Farming, Stripcropping & Crop Rotations

Regardless if a farmer no-tills, plants cover crops or installs other soil saving practices, growing crops into strips following the contour of the hill is effective in preventing soil erosion and increase water infiltration.

Also, raising different crops from year to year, especially different crops alongside strips within the same hillside, aids in soil health, improved soil moisture retention and rainfall infiltration, reduce pest problems and soil erosion.

Nutrient & Manure Management

All of the structural manure BMPs mentioned in this booklet are useless if the farmer spreads the manure improperly. A nutrient management plan (NMP) or manure management plan (MMP) guides a farmer with the amount of manure to apply for a certain crop at a specific time of year. Other things that a farmer needs to do in order to be certain that excess manure nutrients are not applied is to calibrate the manure spreader and take soil and manure tests. Manure is a crop nutrient source, not an animal waste product.

Every farm in Pennsylvania that land applies or produces manure or agricultural wastewater (generated on the farm or received from an importer), regardless of size, is required to have and follow a written manure management plan (MMP). This includes direct application of manure by animals on pastures and in animal concentration areas (ACAs). Some operations due to animal numbers or animal density are required to hire a certified nutrient management specialist to write a nutrient management plan (NMP). Contact the Conservation District for details.

A poultry farmer loading a dry manure spreader (above). Since poultry manure is nutrient rich compared to some other drier manures, farmers have to land apply it at lesser amounts. Some farmers may have to decrease their manure application rates on certain fields due to high phosphorus levels or proximity to streams.

Liquid manure is being pumped out of a circular concrete manure tank and into a liquid manure spreader on a dairy farm. Not more than 9,000 gallons of liquid manure (e.g., dairy, swine, veal) may be applied per acre at one time. In winter, that rate is reduced to 5,000 gallons/acres.

Your MMP or NMP will help you to determine the specific application rates on your farm. It will also guide you on where you cannot spread. For instance, manure cannot be spread by a manure spreader within 100 ft. of any waterbody (stream, pond) unless there is a 35 ft. permanent vegetative buffer. In winter, the no spread zone is 100 ft. regardless of the existence of a buffer. Also, manure cannot be applied within 100 ft. of a private drinking well.

Calibrating your manure spreader is similar to calibrating your sprayer. Knowing the amount of manure you are actually applying will help with records, as well as knowing how much nutrients the crop is receiving. Combining this knowledge with a manure sample and a soil test will enable the farmer to make better use of the operation's resources. Bottom Photos: A manure spreader calibration demonstration is being conducted during a Conservation District field day event.

Farmers land applying manure (top and center left photos in this page). A liquid manure spreader with a low disturbance injection attachment parked on a farm field (center right photo)

Miscellaneous Practices

The BMPs shown from this point forward are practices that fall into three categories: a.) practices that seem minor but help our local water quality and work with other BMPs, b.) stand alone practices that are not the typical BMP that conservation agencies deal with on a normal basis, or c.) practices needed as part of an excavation erosion & sedimentation plan (E&S Plan).

Seed & Mulch Excavated Areas

When the project is almost completed, no matter if it is a grassed waterway (bottom right) or an improved barnyard (bottom left), establishing vegetation to keep the soil in place is critical. Mulching is necessary to protect the seed and maintain soil moisture during early vegetation growth.

Vegetation along manure BMP sites (top three) where earth was disturbed during construction.

A permit and an excavation E&S (erosion & sedimentation) plan is required if an excavation and construction project disturbs, at minimum, 1.0 acre of earth over the life of the project.

Farmstead Access & Farm Roads

Most people on a farm do not usually think of farmstead traffic as a problem. However, if a road turns into a muddy mess, not only can sediment leave the farm, but typically is a nuisance for the farmer. The four photos on the bottom half of this page show reinforced access roads serving farm buildings, barnyards and the farm in general.

Reinforced gravel roads along an improved barnyard (top right photo) and a roofed ACA (top left photo) to aid in livestock feeding.

The bottom three photos show conveyor belt water bars (ready for installation or already installed) for a forest access road to limit road washouts. These water bars can be also used on farm access and farmstead lanes and roads.

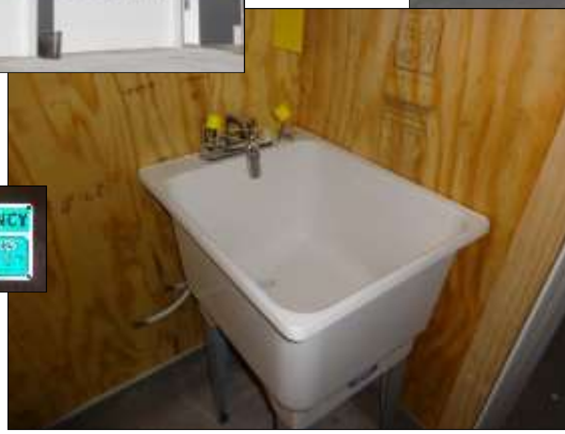
Stormwater Basins

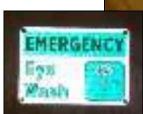
Although constructed at residential and commercial developments, there are certain situations when a farmer will be required to construct a stormwater basin when adding a new building or expanding a current facility. Stormwater basins are designed to temporally hold rain and snowmelt by preventing a high volume of water rushing into a nearby stream or drainageway at once by releasing that water at a slower rate. As the water slows down in the basin, it drops most of its sediment in the basin, while decreasing potential flooding downstream. When not holding water, they appear to be grass covered bowls.

A permit and an excavation E&S (erosion & sedimentation) plan is required if an excavation and construction project disturbs, at minimum, 1.0 acre of earth over the life of the project.

Example stormwater basins on farms that are well established and working as designed.

Chemical Handling Facilities

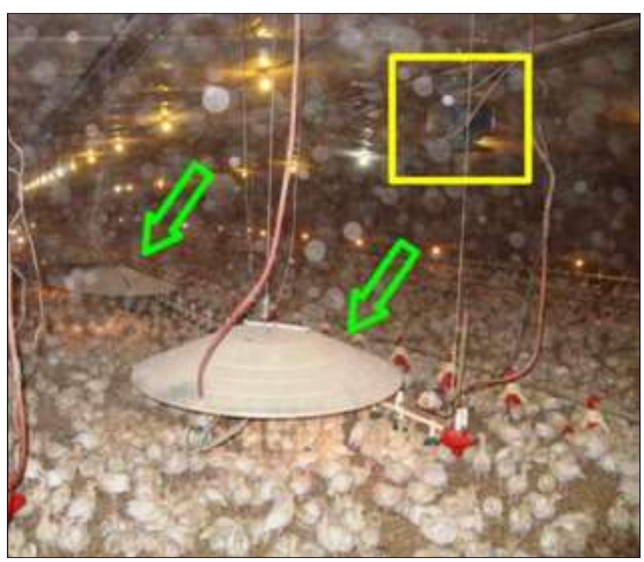




Many farmers handle pesticides and other potentially hazardous liquids. If there is a leak or an accident, containment of the spill and treatment of the victim is important. Pictures on the top half of this page show images from two separate facilities.

Manure to Energy Conversion Facilities

One swine facility installed a manure digester that produces methane gas which runs an electric generator (above and left) to run its operation as well as the option to sell its excess. Some poultry facilities burn their poultry manure and use the heat produced to warm their own poultry houses (below left and below right). At one farm, young turkeys enjoyed heat from traditional brooders (green arrows) and one of the additional ceiling heaters connected to the manure burner (yellow box).



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Cooperating Agency Staff:

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The Snyder County Conservation District engages and leads through partnerships, innovation, and implementation to conserve, promote, and improve Snyder County's natural resources.

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Conserving Natural Resources for Our Future