SECTION FOUR

Animal Waste Management Planning

Planning for animal manure management and animal waste systems can be quite complex. There are a variety of approaches to animal waste management and nutrient utilization planning. Numerous land application (LAS) systems are used through the agriculture industry for manure utilization.

All farms that maintain livestock are considered to be animal feeding operations (AFOs). Nutrient management plans (NMPs), also known as comprehensive nutrient management plans (CNMPs), are required for any AFO that receives a permit from the Georgia Environmental Protection Division (GA EPD). Large animal feeding operations that are regulated by the GA EPD are referred to as concentrated animal feeding operations (CAFOs). The definition of an AFO and a CAFO, as defined by the US EPA, can be found in the Practice Definitions section of this manual. NMPs are plans that address environmentally friendly nutrient utilization, animal mortality and record keeping on the farm. These plans result in a plan for a balance between nutrient inflows and nutrient outflows. Nutrients can be brought onto the farm in a variety of ways including feeds, fertilizers, animal by-products and other off-farm inputs. A nutrient balance can be achieved through the application of a combination of your NMP and BMPs.

The University of Georgia Nutrient Management Taskforce breaks NMPs into six categories: evaluation of nutrient needs, inventory of nutrient supply, determination of nutrient balance, mortality management, preventative maintenance and inspection, and emergency response planning. As a whole, these six components will help you address virtually all of your on and off farm nutrient inputs and outputs and are compatible with the federal requirements for NMPs.

Production by-products such as poultry litter and sludge from lagoons are often used on farmland and pasture land as an inexpensive fertilizer. In order to apply the proper amounts of these organic and inorganic fertilizers, a soil test is necessary. A soil test will provide you with recommended application rates of nitrogen, phosphorus and potassium. Your soil test will also help in determining if your litter should be applied according to a nitrogen-based plan or a phosphorus-based plan.

In addition, it is a good idea to have a litter test performed on your litter or any litter that is brought onto your farm. Animal by-products such as poultry litter can vary in nutrient content from load to load, house to house and can also depend on handling. A litter test will provide you with an accurate measurement of the amount of nutrients in the litter you will be applying. This will help you apply litter at the appropriate rates and reduce the potential for over applying nutrients, which can be detrimental to soil and water quality.

Animal waste systems require careful planning to properly utilize manure and other animal production by-products in an environmentally friendly way. Careful consideration should be given to locate waste system components in safe locations that also maximize the use of the system.

Conservation practices included in the Animal Waste Management Planning section include:

Anaerobic Digester
Ambient Temperature 365
Controlled Temperature 366

Animal Mortality Facility 316

Animal Trail and Walkway 575

Composting Facility 317

Critical Area Planting 342

Fence 382
Access Control 472

Heavy Use Area Protection 501

Land Leveling 464
Land Smoothing 466

Nutrient Management 590

Prescribed Grazing 528

Stream Crossing 578

Vegetated Treatment Area 635

Waste Facility Closure 360

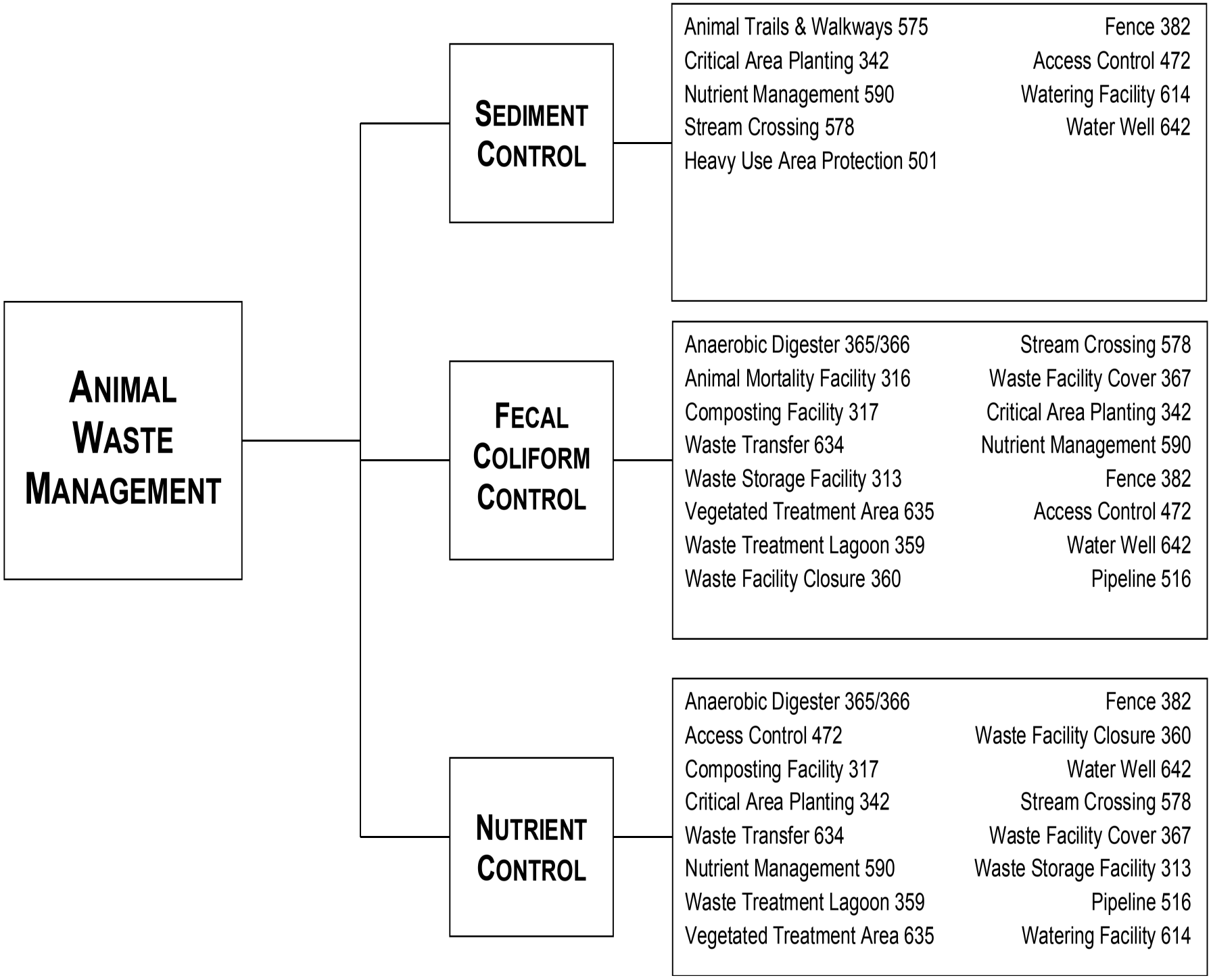
Waste Facility Cover 367

Waste Storage Facility 313

Waste Transfer 634

Waste Treatment Lagoon 359

Watering Facility (614)
Pipeline 516
Spring Development 574
Water Well 642


ANIMAL WASTE MANAGEMENT
SEDIMENT CONTROL
Animal Trails & Walkways 575
Critical Area Planting 342
Nutrient Management 590
Stream Crossing 578
Heavy Use Area Protection 501
Fence 382
Access Control 472
Watering Facility 614
Water Well 642
FECAL COLIFORM CONTROL
Anaerobic Digester 365/366
Animal Mortality Facility 316
Composting Facility 317
Waste Transfer 634
Waste Storage Facility 313
Vegetated Treatment Area 635
Waste Treatment Lagoon 359
Waste Facility Closure 360
Stream Crossing 578
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NUTRIENT CONTROL
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Waste Storage Facility 313
Pipeline 516
Watering Facility 614

MINIMUM REQUIREMENTS FOR CONCENTRATED ANIMAL FEEDING OPERATIONS

ADDRESS PROPER OPERATION AND MAINTENANCE

Ensure adequate storage or manure, litter and process wastewater, including procedures to ensure proper operation and maintenance of the storage facilities

ADDRESS ANIMAL MORTALITY

Ensure proper management of animal mortalities (i.e. dead animals) to ensure that they are not disposed of in any liquid manure, storm water, or process wastewater storage or treatment system that is not specifically designed to treat animal mortalities

DIVERT CLEAN WATER

Ensure that clean water is diverted, as appropriate, from the production area

PREVENT DIRECT CONTACT OF CONFINED ANIMALS WITH U.S. WATERS

ADDRESS CHEMICAL DISPOSAL

Ensure that chemicals and other contaminants handled on-site are not disposed of in any manure, litter, or process wastewater, or stormwater storage or treatment system, unless specifically designed to treat such chemicals and other contaminants

PROVIDE AND MAINTAIN BUFFERS OR EQUIVALENT PRACTICES

Identify appropriate site specific conservation practices to be implemented, including, as appropriate, buffers or equivalent practices to control runoff of pollutants to waters of the United States

MAINTAIN PROPER STORAGE CAPACITY

Identify protocols for appropriate testing of manure, litter, process wastewater, and soil

ADDRESS RATES AND TIMING OF LAND APPLICATION OF MANURE AND WASTEWATER

Establish protocols to land apply manure, litter, or process wastewater in accordance with site specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients in the manure, litter or process wastewater

ADDRESS RECORD KEEPING AND TESTING

Identify specific records that will be maintained to document the implementation and management of the minimum elements listed

(USEPA Minimum Requirements for CAFOs)

ANAEROBIC DIGESTERS (365 & 366) biologically treat animal manure using either an unheated or a managed temperature waste treatment facility.

An operational anaerobic digester

Water Quality Benefits

- Reduces nutrient transport downstream

When to Use

Digesters are used as part of a new or existing waste management system where fresh manure can be collected for use. There are two types of digesters: ambient temperature (unheated) and anaerobic (managed temperature).

How to Establish

All federal, state and local regulations should be followed.

Locate digesters as close as possible to sources of manure, and at least 300 feet from neighboring dwellings and public areas or within 25 feet of an intermittent or perennial streams, unless there are no other feasible locations in order to maintain water quality benefits. Divert rainwater away from these facilities to reduce discharges and maintain capacity.

Treat manure from ruminants by solid separation prior to entering an anaerobic digester. Nutrients processed in a digester are immediately available to plants upon application. Nitrogen is converted to an ionic form that plants can utilize more rapidly.

For more information, see *Additional Resources*.

Considerations and Costs

Consider installing a vegetated screen to reduce negative visual impacts, especially for more visible systems. Improperly installed and maintained digesters increase odors.

Additional potential benefits of controlled temperature digesters may include reduced herbicide usage and lower weed seed germination.

Contact your local conservation agent prior to beginning a digester construction project in order to fully understand maintenance requirements. Anaerobic digesters are moderate to high in cost depending on materials, construction, and size.

Effectiveness

Digesters at mesophilic temperature (35ºC) reduced E.coli by 90% in less than one day during batch digestion compared to bacterial survival in manure slurry of up to 77 days in studies. Controlled temperature digesters reduced pathogenic fecal coliform organisms by 99.9% and M. avium paratuberculosis by 99% in studies.

Additional Resources

NRCS Conservation Practice Standard 365
NRCS Conservation Practice Standard 366

ANIMAL MORTALITY FACILITIES (316) are permanent structures used to dispose of carcasses and include burial pits, mortality composting facilities, incinerators and freezers.

Mortality composting bins

Water Quality Benefits

- Provides an alternative disposal of dead animals and can reduce soil and water contamination resulting from inclement weather

When to Use

Animal mortality facilities are typically part of a waste management plan. All federal, state and local regulations should be followed. Commonly used animal mortality facilities include burial pits, freezers, mortality composters and incinerators.

Poultry operations must obtain written approval or certification from the Georgia Department of Agriculture to dispose of poultry carcasses.

How to Establish

Prior to constructing a pit, the Georgia Department of Agriculture (GDA) must complete a site assessment and approve the site. Locate pits at least 100 feet from any existing or proposed wells and water supply lines, 15 feet from the edge of any embankment, and 100 feet from the normal water level of any body of water.

Burial pits must be at least 4 feet wide and long enough to maintain carcasses. Pits can be a minimum of 3 feet deep and can be no more than 8 feet deep. Pits must be 1 foot above the water table. Carcasses must be covered with 3 feet of soil. Restrict vehicular traffic within 4 feet of pits. If multiple pits are used, separate pits at least 3 feet. Store stockpiled soil that will be used in a burial pit at least 20 feet from the pit.

Freezers are used to store carcasses for off-farm removal or incineration. Chest-type freezers work best and should be located on a suitable base (concrete) near the entrance to the farm in an easily accessible area for emptying equipment.

Incinerators are used to burn carcasses. Permits, approval and registration are the responsibility of the owner. Maintain a minimum distance of 20 feet between incinerators and any other structure, at least 100 feet from any surface watercourse, well or water source, and 900 feet from neighboring residences. It is also recommended that these facilities be kept out of sight of the general public. Runoff should be diverted away from animal mortality facilities.

For more information, see *Additional Resources.*

Considerations and Costs

Costs vary depending on the type of facility selected for an operation. Consider equipment availability, and construction and maintenance costs prior to installation. Producers should choose a facility that meets their needs as economically as possible.

Animal mortality facilities are moderate to high in cost, depending on materials, construction and size.

Effectiveness

Products from composting facilities can be incorporated into the soil and improve agronomic conditions and can also be used a part of a nutrient management plan.

Additional Resources

NRCS Conservation Practice Standard 316

A drum composting system on a poultry farm in southwest Georgia

ANIMAL TRAILS AND WALKWAYS (575) are established and maintained specifically for animal movement, especially in heavy traffic areas.

Dairy cattle travel an established path to barns

Water Quality Benefits

- Reduces erosion
- Reduces sediment entering water sources
- Protects downstream water quality and habitats

When to Use

Establish trails on areas of frequent use where the potential for soil erosion is high.

How to Establish

Consider ecological and environmental impacts when designing trails or walkways. Trail and walkway width should accommodate animal travel at a reasonable pace.

To establish, grade pathways level and cover with surface material. For long and short-term control of erosion, vegetative cover can be established.

For more information, see *Additional Resources*.

Considerations and Costs

In addition to site preparation, producers may opt to seed for vegetative cover. After seeding, provide adequate time for plant establishment.

Fences may be used with this practice to confine animals to trails and walkways.

Maintenance costs associated with this practice include periodic grading, re-shaping, re-surfacing, re-seeding and fence mending.

In areas with heavy animal traffic, a better option is Heavy Use Area Protection (561). See page 2.25 for more information on Heavy Use Area Protection.

Animal trails and walkways are moderate to high in cost, depending on materials, construction and size.

Effectiveness

By providing a stable and protected travel path, animal trails and walkways can significantly reduce the amount of sediment and nutrients entering water.

Additional Resources

NRCS Conservation Practice Standard 575

COMPOSTING FACILITIES (317) utilize animal manure or other waste products (not including animal carcasses) in a sanitary method that results in a product that can be used on farms to improve soil organic matter.

Composted materials can be used to improve soil and increase water-holding capacity

Water Quality Benefits

Composting provides a soil amendment that:

- Physically protects soil from rain and wind and reduces sediment transport in runoff
- Increases plant growth and soil cover
- Improves soil structure, organic content, water infiltration and water holding capacity
- Provides an alternative use for poultry litter and other animal by-products as part of a nutrient management plan

When to Use

Composting facilities provide an alternative use for manure and other waste products from agricultural operations and can improve air quality and odors.

In order to maintain water quality benefits, composting facilities should not be located within 25 feet of an intermittent or perennial stream, unless there are no other feasible locations.

These facilities can be designed to handle animal mortality. Please see Animal Mortality Facilities on page 2.18 for more information.

How to Establish

When possible, composting facilities should be located outside of floodplains and above seasonal high water tables. Permeable soil is ideal to reduce surface water contamination. Be sure to divert runoff away from composting facilities.

Facilities need to be large enough to handle the type and amount of composting materials being used.

pH levels should be neutral or slightly lower to reduce nitrogen losses. Once established, moisture content should remain between 40-60%. The minimum composting period for stability is 21-28 days; for higher quality compost, piles may need up to 60 days.

The GA Department of Agriculture now approves large animal composting on a case-by-case basis. The State Veterinarian must provide final approval for these facilities.

For more information, see *Additional Resources*.

Considerations and Costs

Inspect composting facilities frequently to ensure proper function. This includes temperature, odor, moisture and oxygen. Initially, use a composting mix of 30:1 to reduce odors. Chemical agents and carbonaceous materials may be needed to maintain proper function.

To obtain maximum solar warming, piles should be aligned north to south with moderate side slopes.

Composting facilities can be high in cost depending on materials, size and construction.

Effectiveness

Composting by-products reduced erosion by 86% in studies. On slopes up to 15%, composted materials reduced runoff by 70% in studies.

By using composting by-products sediment transport was reduced up to 99% compared to silt fences and 38% compared to hydroseeding in studies.

Additional Resources

NRCS Conservation Practice Standard 317

A composting system using large equipment to turn materials

Contact the Georgia Department of Agriculture or any conservation agency for more information about installation and use requirements.

CRITICAL AREA PLANTING (342) is establishing permanent vegetation in highly erodible areas to prevent soil erosion and sediment transport in water.

Establishing vegetation in critical areas stabilizes soil and can reduce erosion and protect water quality

Water Quality Benefits

- Reduces erosion
- Reduces sediment transport into water sources
- Filters sediment from runoff
- Protects downstream water quality
- Increases infiltration and water-holding capacity

When to Use

Critical area planting should be used where vegetation cannot be established by ordinary conservation practices.

How to Establish

Site preparation may be necessary to prepare the area for conventional seeding or planting. Areas should be seeded or planted to meet minimum canopy requirements. Native or adapted plant species are ideal for critical areas.

Grading is not necessary when hydroseeding is used.

When planting individual plants, follow proper horticultural practices. Mulching may also be necessary, depending on the site.

For more information, see *Additional Resources*.

Considerations and Costs

Other costs may include fertilizer, compost, mulch, pH adjusting agents, and maintenance.

Diversions may be necessary to divert concentrations of water to safe outlets and reduce erosion.

Depending on the site, liming may be necessary. A soil test will determine if additional fertilizer is needed. Contact your local extension agent for soil testing instructions.

Consider installing irrigation to ensure plant establishment in critical areas.

Critical area planting is high in cost depending on materials, size and construction.

Effectiveness

Sediment runoff models indicate that critical area planting can be 75% effective in reducing soil loss.

Additional Resources

NRCS Conservation Practice Standard 342

FENCING AND ACCESS CONTROL (382 & 472) provide barriers that limit animal, human and wildlife entry into specific areas to protect natural resources.

Fencing animals out of ponds protects water

Water Quality Benefits

- Reduces sediment entering water sources
- Reduces nutrients entering water sources
- Reduces erosion
- Improves water quality
- Protects aquatic habitats

When to Use

Fences should be used to keep animals out of water sources as much as possible. Access control can be used whenever necessary.

How to Establish

Fences need to be of the proper height and material to maintain livestock species being kept on pasture. Be sure that adequate water and shade are available for livestock.

Fences can be constructed of barbed wire, field fence or electric fencing materials. Select materials that will prevent animals from escaping.

For access control, barriers can be constructed from natural or artificial materials. When access control is used to limit access to critical areas, a two-year exclusion period is needed or until vegetation is well established.

For more information, see *Additional Resources*.

Considerations and Costs

Consider impacts on water quality during and after construction. Alternative watering practices are available and should be used whenever possible. When installing fences or access control barriers, reduce impacts on wildlife, animals and surrounding habitats as much as possible.

Costs associated with fencing include site preparation, materials, labor and maintenance costs. Fences need to be periodically inspected to maintain the integrity of the fence.

Fences are moderate in cost depending on material costs and the amount of fencing installed. Access control is low to moderate in cost depending on material costs.

Effectiveness

Fences have been found to reduce nitrogen by 60%, sediment by 75% and suspended solids by 50-90% in studies. Fencing animals out of small, second order streams has reduced fecal coliform colony forming units by 99% in studies.

Additional Resources

NRCS Conservation Practice Standard 382
NRCS Conservation Practice Standard 472

HEAVY USE AREA PROTECTION (561) involves the establishment of vegetation and/or the installation of erosion prevention materials that protect areas where heavy traffic is expected.

Heavy Use Area Protection around a watering trough

Water Quality Benefits

- Reduces soil erosion by limiting animal traffic
- Reduces nutrient and sediment transport in water
- Protects water quality

When to Use

This practice applies to frequently or intensively used areas but does not apply to stream crossings.

How to Establish

Structures should be constructed in accordance with all federal, state and local regulations.

Design heavy use areas to withstand the type and amount of anticipated traffic. A base of coarse gravel, crushed stone, or other suitable material should be provided for load bearing strength, depending on the type and amount of traffic in the area.

Heavy use areas that will be used for livestock need to be clear of any loose, wet, organic or other undesirable materials.

Watering ramps should not extend more than 5 feet into a stream with a slope of 5 to 1 or flatter toward the water source. Install ramps perpendicular to stream flow. Diversions or other means to reduce surface water flow into streams may be needed.

For walkways, an additional 8 to 15 foot treatment area extension is needed. Treatment areas for watering ramps need a bottom width of 10 to 20 feet.

For loafing areas, the maximum recommended treatment area per animal is 200 ft^2 for dairy cattle, 150 ft^2 for beef cattle, 150 ft^2 for horses and 10 ft^2 for sheep and goats according to USDA NRCS standards and specifications.

For more information, see *Additional Resources*.

Considerations and Costs

Locate heavy use areas an appropriate distance from facilities where animals typically congregate (i.e. hay rings, water troughs and mineral blocks) and may cause resource concerns.

To protect water quality, heavy use areas should be located as far as possible from water sources. Watering ramps should be used when no other option is feasible for an operation. Keep heavy use areas as small as possible.

Initial costs may include site preparation, installation, and materials costs.

Maintenance costs may include regenerating vegetative cover and replenishing other heavy use area cover.

Heavy use areas are moderate to high in cost depending on materials, size and construction.

Effectiveness

Heavy Use Area Protection has the potential to reduce erosion from protected areas up to 80%.

Additional Resources

NRCS Conservation Practice Standard 561

A livestock watering area in need of Heavy Use Area Protection and an improved watering facility

Heavy Use Area improvements include a new watering tank and gravel to protect the area

LAND LEVELING AND LAND SMOOTHING (464 & 466) is the reshaping and grading of land to remove soil surface irregularities in order to improve water usage efficiency for irrigation and surface drainage purposes.

Water Quality Benefits

- Protects water quality by decreasing runoff potential
- Reduces sediment in runoff
- Improves water distribution
- Improves surface drainage

When to Use

Land leveling should be used on land that has a detailed engineering survey, design and layout.

Land smoothing is used in areas where irregularities such as depressions, mounds, old terraces, etc. interfere with the implementation of conservation and management practices.

Land leveling and land smoothing are components of other conservation practices and should not be utilized as individual conservation practices.

How to Establish

All federal, state and local regulations should be met.

After leveling, soil should be deep enough to support the root zone. In situations where more than one crop is grown on a field, land should be leveled to meet the requirements of the most restrictive crop.

For more information, see *Additional Resources*.

Considerations and Costs

It may be necessary to border fields with erosion resistant grasses or legumes until good crop stands are established.

In areas where irrigation water will contain more sediment, it may be necessary to raise the height at the point of delivery. Also consider impacts on water flows and aquifers, other users and adjacent wetlands and habitats.

Costs associated with this practice include site preparation, materials and maintenance costs.

Land smoothing may impact the movement of sediment and sediment-attached substances in runoff. Also consider potential impacts on wetland and wildlife habitats.

These practices are low to moderate in cost, depending on the situation.

Effectiveness

Land leveling and smoothing reduces the likelihood of sediment and runoff entering water and promotes proper drainage.

Additional Resources

NRCS Conservation Practice Standard 464
NRCS Conservation Practice Standard 466

NUTRIENT MANAGEMENT (590) involves the development of a plan that will assist producers in improving management and nutrient use by matching needs more efficiently and reducing excess nutrients in runoff.

A litter spreader applies waste to a field as fertilizer

Water Quality Benefits

- Reduces nutrient loadings into surface and groundwater
- Properly utilizes manure
- Improves and/or maintains soil condition

When to Use

A nutrient management plan (NMP) is required for all animal feeding operations receiving permits through GAEPD cost share programs and for any agricultural operation that is receiving federal funding.

How to Establish

All federal, state and local regulations should be followed.

There are 6 parts of a NMP: evaluation of nutrient needs, inventory of nutrient supply, determination of nutrient balance, mortality management, preventative maintenance and inspection, and an emergency response plan.

A detailed farm map will be needed as a basis for a NMP and should include farm property lines, clearly identified fields, roads, off-site dwellings and public gathering areas, the location of all surface waters with direction of flow included, and a soils map if available. Identify critical areas around water sources where nutrient use should be reduced or eliminated.

A soil test is required to identify which nutrient additions are needed. County extension agents can provide you with instructions for soil sampling and can submit soil samples to the UGA Soils Laboratory. Testing costs are minimal. Test results provide producers with an analysis of the soil nutrient content that can be used to determine application rates. Ultimately, nutrient inputs from all sources and outputs should be balanced.

A defined mortality management plan is needed to identify how livestock and poultry mortalities will be managed. This should include normal mortality estimates, methods of disposal or utilization, and plans for dealing with catastrophic mortality events.

Detailed, clear records are part of preventative maintenance and can be used as part of the inspection process. All results from soil, plant and manure tests should be maintained for at least 5 years. Records should include cropping and application schedules, and calibration, maintenance and inspection records.

Emergency response plans include instructions for actions to take in emergency situations, emergency contact information, and any authorizations necessary to obtain essential equipment or neighboring property access.

NMPs can be nitrogen-based or phosphorus-

based, depending on soil test results. Your local conservation agent can help you complete your NMP.

For more information, see *Additional Resources*.

Considerations and Costs

Whenever possible, split nitrogen applications to promote plant uptake and utilization.

Avoid winter applications of nitrogen whenever possible; they are the least efficient.

Always apply nutrients uniformly or according to precision agriculture techniques. Annual reviews are needed to determine if there are any changes to the nutrient balance that need to be addressed in the following year's plan.

NMPs are low to moderate in cost per acre and can often be completed using cost-share money.

Effectiveness

Nutrient management plans result in an average reduction of 35% in total phosphorus loads and 15% reduction in total nitrogen loads.

Additional Resources

NRCS Conservation Practice Standard 590
Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6

Nutrient management plans are required for all LAS permitted AFO and NPDES permitted CAFOS, and are recommended for all liquid manure systems. NMPs are also required for any operation receiving cost share funding through Clean Water Act Section 319(h) funding. Contact any conservation agency for more information or the Georgia Department of Agriculture.

PRESCRIBED GRAZING (528) systems maintain vegetative quality and quantity by managing grazing animals to promote stand longevity.

By planning a grazing system, productivity and yield can be improved

Water Quality Benefits

- Slows runoff and allows time for nutrient absorption
- Promotes thick, well anchored vegetation

When to Use

Prescribed grazing can be used on any land where grazing animals are managed. Prescribed grazing is the intensive management of grazing animals to promote vegetative quality and reduce damage to pastures from over grazing.

How to Establish

Plan prescribed grazing programs based on the type and number of animals, length of grazing periods and growing seasons. Animals should be managed to leave adequate cover and to encourage plant health and vigor. Schedule grazing during the growing season to manage growth.

Adequate ground cover and plant density are necessary for improved filtering capacity, infiltration and soil condition.

For more information, see *Additional Resources*.

Considerations and Costs

In order to maintain minimum adequate cover, it may be necessary to limit animal access for periods of time to allow for plant re-vegetation.

Locate feeding, handling and watering facilities to minimize impacts on vegetation. Other conservation practices that work well with prescribed grazing include fences, pest management, and heavy use areas.

Consider supplying alternative feeds to meet forage intake requirements during low growth winter months and during extreme conditions.

Prescribed grazing is low in cost.

Effectiveness

Sediment runoff models indicate that prescribed grazing can be 75% effective in reducing soil loss.

Additional Resources

NRCS Conservation Practice Standard 528

STREAM CROSSINGS (578) are designed to protect water quality and reduce erosion by designating stable access points and crossings.

A distant view of a stream crossing

Water Quality Benefits

- Reduces nutrient, organic and inorganic loadings in water
- Reduces sedimentation in water
- Reduces erosion by limiting access

When to Use

Stream crossings can be used on any land where there is a need to cross water bodies.

How to Establish

The type of stream crossing installed depends on the amount of traffic through an area. Stream crossing sites should have a stable streambed. Stream crossings should be designed to handle peak runoff and floodwaters.

Multi-use stream crossings should be at least 10 feet wide; livestock crossings should be at least 6 feet wide. Stabilize side slopes. Blend approaches with existing surroundings and have a gradual descent/ascent with a suitable material beneath gravel to reduce erosion. Divert runoff around approaches and away from crossing surfaces.

To limit access, adjacent areas should be permanently fenced. Cross-stream fencing can be used at fords to limit access.

There are several types of stream crossings.

FORDS or drive-throughs are used for low levels of traffic through streams. Design fords to have a minimal impact on streams. Rocks or gravel can be placed within streambeds to provide necessary support.

Concrete fords should only be used where the streambed foundation has adequate strength to support the weight of the concrete.

CULVERTS typically consist of a pipe installed slightly below grade inside a streambed to allow water to pass through, and is covered with backfill to allow for movement across the stream. Culvert length is dependent on the desired width of the road top.

BRIDGES are permanent stream crossings installed over large streams. Bridges are constructed out of concrete, steel or wood. Abutments and wingwalls are recommended to protect stream flows and water quality.

For more information, see *Additional Resources.*

Considerations and Costs

Whenever possible, redirect traffic around water bodies instead of installing stream crossings. If traffic is infrequent, fords have the least impact on overall water quality.

Consider long and short-term impacts on upstream and downstream flows and habitats. Stream crossings can result in increased sedimentation, erosion and flooding, and should be carefully monitored and maintained. All stream crossings should

be evaluated for safety.

Stream crossings are moderate to high in cost depending on materials and construction.

Effectiveness

Stream crossings reduce animal access, provide stable traffic paths and reduce the amount of nutrients and sediment entering water.

Additional Resources

NRCS Conservation Practice Standard 578

A ford installed as a stream crossing

VEGETATED TREATMENT AREAS (635) are strips of herbaceous cover used to reduce sediment and nutrient loadings as part of an agricultural waste management system.

Water Quality Benefits

- Reduces loadings of nutrients, organics, pathogens, and other contaminants in runoff
- Allows time for nutrient absorption

When to Use

Vegetated treatment areas are used as part of a waste management system whenever water quality can be improved through the treatment of wastewater.

Different types of treatment areas exist including rapid infiltration, overland flow and slow rate process treatment strips.

How to Establish

Locate treatment areas outside of floodplains whenever possible. Water entering these areas should be as sheet flow. The minimum width for vegetated treatment areas must be based on the latest US EPA guidelines.

Areas should be located on moderately or highly permeable soils. The appropriate length, width and slope of a treatment area depends on the type and purpose of the area being installed. Permanent vegetation that is tolerant of wet conditions should be established as soon as possible.

Treatment areas should not be located within 25 feet of an intermittent or perennial stream, unless there are no other feasible locations in order to maintain water quality benefits.

For more information, see *Additional Resources*.

Considerations and Costs

Avoid applying wastewater to treatment areas during inclement weather or when soil temperatures are below 39 degrees.

Maintenance includes periodic harvesting to encourage dense upright growth, repairing strips after heavy storms and re-planting as needed. Livestock should not be allowed onto treatment areas.

Costs associated with this practice may include materials, site preparation, installation, and maintenance.

Vegetated treatment areas are low in cost depending on materials and installation costs.

Effectiveness

In studies, treatment areas trapped 80-90% of solids in feedlot runoff with shallow and uniform flow, and removed 60% of total phosphorus and 70% of total nitrogen.

Additional Resources

NRCS Conservation Practice Standard 635
Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6
EPA Technology Transfer Process Design Manual for Land Treatment of Municipal Wastewater
UGA Georgia Cooperative Extension Service

Vegetated treatment areas can be used to address minimum requirements for CAFOs as defined by the U.S. EPA.

WASTE FACILITY CLOSURE (360) refers to the environmentally responsible closure of lagoons and waste storage ponds that are no longer used for their original purpose.

Water Quality Benefits

- Protects surface and groundwater quality by reducing the potential for nutrients entering water

When to Use

Agricultural waste facilities that are no longer utilized as part of a waste management system should be closed.

How to Establish

All federal, state and local regulations should be followed.

Remove any structure previously used for conveyance. Remove all liquid and as much slurry as possible from the impoundment and then backfill with earthen materials.

If sludge is not removed from waste facilities that are being converted to fresh water storage, the impoundment cannot be used for fish production.

Safety precautions and warnings should be utilized to protect both animals and humans from danger.

For more information, see *Additional Resources*.

Considerations and Costs

Additional measures may be necessary to minimize erosion and pollution of downstream water sources.

Plan to pump liquid and remove sludge when odors being carried downwind can be minimized.

Costs associated with this practice include site preparation, disposal of removed equipment, materials for backfilling and safety purposes, and monitoring and maintenance.

Contact your local conservation agent prior to beginning any closure project in order to fully understand maintenance requirements.

Closing unused waste facilities can be high in cost depending on the size of the impoundment and the amount of waste that must be removed.

Effectiveness

Closing unused waste storage facilities protects water quality by reducing the likelihood of residual nutrients entering water.

Additional Resources

NRCS Conservation Practice Standard 360
Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6

WASTE FACILITY COVERS (367) are used to maintain capacity and limit rainfall entering storage facilities in order to improve water and air quality as part of an agricultural waste management system.

Water Quality Benefits

- Reduces unexpected overflow of storage facilities
- Reduces excess nutrients from entering water sources

When to Use

Waste facility covers can be used on any waste collection system to reduce overflow, capture and control the release of emissions, and control the production and emission of biogases from storage facilities.

How to Establish

Covers being incorporated into a waste management system should meet all federal, state and local regulations.

Select covers with a service life of at least 10 years. Covers should allow gaseous emissions to pass through the membrane for release.

All storage facilities should have warning signs and fences to reduce hazards from unauthorized entry.

For more information, see *Additional Resources*.

Considerations and Costs

Covers can be substantial in cost but reduce accidental discharges. They also work well to address odor issues by controlling gaseous emissions.

Waste facility covers are high in cost.

Effectiveness

Waste facility covers protect the integrity and capacity of storage facilities and reduce the potential for overflows.

Additional Resources

NRCS Conservation Practice Standard 367

Waste facility covers can be part of the minimum requirements for CAFOS established by the U.S. EPA to address waste storage capacity.

WASTE STORAGE FACILITIES (313) are used to temporarily store animal manure, wastewater and contaminated runoff as part of an agricultural waste management system.

A stack house allows for litter storage until it can be used for other purposes or can be transported off-farm

Water Quality Benefits

- Reduces nutrient overloads in streams
- Allows time for chemical breakdown

When to Use

Waste storage facilities are typically used as part of a waste management plan and in conjunction with a NMP. Storage facilities should be built on sites that are suitable for construction and use.

Waste storage facilities include stack houses, tanks, and storage ponds.

How to Establish

Waste storage facilities should be planned, designed and constructed to meet all federal, state and local laws and regulations.

Locate manure storage facilities outside of floodplains whenever possible. These facilities should be located where impacts from facility failures such as overflows, accidental releases and liner failure will be minimal.

Permanent inlets should protect against erosion, tampering and accidental releases. Post safety notices to warn against potential danger.

Periodically removing solids will help maintain the capacity of a waste storage facility. This should be incorporated into the final design of a facility.

Runoff from other sources should be diverted away from waste storage facilities.

In order to maintain water quality benefits, waste storage facilities should not be located within 25 feet of an intermittent or perennial stream, unless there are no other feasible locations.

Contact your local conservation agency for more information on additional requirements and permits prior to beginning construction and to fully understand maintenance requirements.

For more information, see *Additional Resources*.

Considerations and Costs

Waste storage facilities should be located as close to sources of manure and polluted runoff as possible. Including side panels on stack houses can reduce exposure to rain and reduce runoff.

Consider incorporating a solid/liquid separation component into a waste management system to reduce the accumulation of solids in the storage facility.

Costs associated with this practice include installation and maintenance. Additional costs may result from updating existing management systems and incorporating new components.

Waste storage facilities are moderate to high in cost depending on the size of the operation, materials and installation costs.

Effectiveness

In studies, the amount of fecal coliform was reduced by 96% in litter that was stored for 2 weeks.

Additional Resources

NRCS Conservation Practice Standard 313
Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6

Waste storage facilities can be used to address manure storage in the minimum requirements for CAFOs established by the US EPA

WASTE TRANSFER (634) utilizes a conveyance system that transports manure to storage facilities, loading areas or agricultural land.

A truck is loaded for on-site manure transfer. Off-site manure transfers are monitored by the GDA

Water Quality Benefits

- Reduces nutrient loadings on operations with large animal populations
- Reduces potential soil and water quality degradation

When to Use

A waste transfer should be used as part of a planned manure management system or a NMP.

How to Establish

All federal, state and local regulations should be followed.

Reception pits should be able to maintain at least one-full day of manure production. When pits will also receive runoff, it is necessary to maintain the volume from a 25-year, 24-hour storm along with additional room for freeboard and emergency storage. Open structures should be covered and protected with gates or fences to minimize safety hazards. Install barriers around push-off ramps to prevent farm equipment from falling into facilities.

There are additional requirements for equipment hauling and land application. Costs for transporting litter depend on distance, type of litter and form of litter (dry or liquid).

For more information, see *Additional Resources*.

Considerations and Costs

Waste transfers are moderate in cost depending on the type of manure and the size of the transfer.

Effectiveness

Manure transfers promote the proper use of manure and reduce nutrient loads in soil. Manure transfers allow for the movement nutrients out of highly concentrated areas.

Additional Resources

NRCS Conservation Practice Standard 634
Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6

A solid separator

Animal manure handlers are regulated by the Georgia Department of Agriculture. Contact the GDA for more information on requirements.

WASTE TREATMENT LAGOONS (359) are used to biologically treat manure, wastewater and contaminated runoff as part of an agricultural waste management system.

Properly constructed and maintained lagoons reduce nutrients and sediment entering nearby sources

Water Quality Benefits

- Decreases nutrient loadings in water sources
- Reduces producer liability
- Improves soil structure and reduces negative water impacts

When to Use

Lagoons are a component of a waste management system and can be built when needed for treatment purposes, and where air and water pollution will not be a problem.

How to Establish

All federal, state and local regulations should be followed. Producers are responsible for obtaining all required permits. Locate lagoons outside of floodplains whenever possible. When not possible, protect lagoons from inundation or damage from a 25-year flood event. Inlets and outlets should be made of permanent, corrosion resistant materials. Erosion protection measures may be needed to ensure lagoon capacity. Post appropriate warning signs and safety protections.

Treatment lagoons are much larger than storage ponds, shallower in depth, and are designed to treat waste and reduce nutrients. In order to protect water quality, waste treatment lagoons should not be located within 25 feet of an intermittent or perennial stream unless there are no other feasible locations.

For more information, see *Additional Resources*.

Considerations and Costs

Locate lagoons as close to the source of waste as possible. Consider using a solid/liquid separation system to preserve lagoon capacity.

Costs associated with this practice include site preparation, materials, installation and maintenance. This may include monitoring and the removal and utilization of waste. An emergency response plan is necessary to address any emergency concerns.

Waste treatment lagoons are moderate to high in cost. Contact your local conservation agent prior to beginning a lagoon construction project in order to fully understand lagoon requirements.

Effectiveness

Lagoons have reduced nitrogen content in dairy manure as much as 80% in some studies.

Additional Resources

NRCS Conservation Practice Standard 359

Waste treatment lagoons can be part of the minimum requirements established by the U.S. EPA.

WATERING FACILITIES allow producers to provide livestock with alternative watering sources away from areas of environmental concern or where water supply is unable to meet demand. This includes watering ramps, spring development, troughs, tanks, pipeline and wells used for livestock watering purposes.

A concrete water trough offers livestock an alternative to drinking directly out of the creek and promotes water quality

Water Quality Benefits

- Conserves vegetative cover and reduces erosion by encouraging uniform grazing
- Protects water sources from contamination from animal manure
- Reduces nutrient and sediment loadings in water sources
- Reduces nutrient transport downstream
- Reduces streambed disturbances

When to Use

Watering facilities such as troughs or tanks can be used on any land where alternative water sources are needed to protect water quality.

Springs should only be developed where there is a dependable source of water for the planned use. Watering ramps can be used for alternative watering when other methods are not applicable.

Wells used as part of an alternative water source can be drilled, dug, bored, or jetted with sufficient available water.

How to Establish

Select a well-drained installation site where trail and flooding erosion are minimized.

Areas that can be potentially damaged by animals should be graveled or paved to reduce erosion and provide stable footing.

Watering facilities should have adequate capacity to meet the demands of livestock. Automatic water level controls and overflow valves can reduce overflow from watering facilities.

Pipelines are limited to 8 inches or less in diameter.

Watering facilities need to accommodate all livestock species and sizes that will be using a facility. Pipes should be protected from traffic, farm operations, freezing temperatures, fire, thermal expansion and contraction.

The capacity of pipeline should allow the watering system to provide a minimum watering capacity for the following species:

- Beef cattle/horses: 20 gallons per head per day
- Dairy cattle: 25 gallons per head per day
- Sheep/goats: 2 gallons per head per day

A watering system should be designed to have an working pressure that is equal to or less than 72% of the pressure rating for pipe and have a maximum velocity of 5ft/sec when flowing at design capacity. Check valves, backflow preventers and vents may be necessary.

For spring development, water collected for use is dependant on the type of spring. Collection trench-

es should be excavated into the impervious layer. Subsurface drains or a perforated pipe 3 inches or larger in diameter are also needed. Spring boxes and outlets should be properly installed to provide sediment traps. To prevent clogging, outlet pipes should be 1-inch in diameter.

Install watering ramps perpendicular to stream flow direction. Ramp width should not exceed 20 linear feet of the stream and should not extend more than 5 feet into a stream or to the stream center, whichever is less. Choose a ramp width that will minimize the amount of time animals spend in the water. The grade of a watering ramp should match the natural grade. Slope should not exceed 5 to 1. Always divert runoff away from ramps.

Fencing will be needed to prevent animal access to water other than by the ramp. This includes fencing around the ramp.

For more information, see *Additional Resources*.

Considerations and Costs

In order to prevent livestock congregating near ramps, locate feeders, salt blocks, and hay away from ramps. When possible, a grazing plan that reduces watering ramp use should be developed. Locating watering ramps outside of shaded areas can prevent animal loitering.

Costs associated with these practices include site preparation, materials, installation and maintenance. Maintenance may include checking for debris, algae, sludge and other materials, repairing leaks, checking automatic water level devices and outlets, removing obstructions, repairing erosive areas and maintaining pipes. Monitoring for erosion is also needed. To reduce erosion, revegetate disturbed areas as soon as possible after construction.

Developing springs may result in a decrease in surface water base flows.

Watering facilities are moderate to high in cost depending on the complexity of the facility, materials and construction costs. Watering ramps are moderate in cost depending on size, materials and construction costs. Spring development is moderate to high in cost.

Effectiveness

Watering facilities reduce the access and/or amount of time livestock spend in water. These facilities significantly reduce the amount of waste and sediment entering water.

Additional Resources

NRCS Conservation Practice Standard 516
NRCS Conservation Practice Standard 574
NRCS Conservation Practice Standard 614
NRCS Conservation Practice Standard 642

A watering ramp with fencing to limit access

Contact your local conservation agency prior to any spring development project for additional guidelines and requirements.