

NORTH DAKOTA LIVESTOCK PROGRAM

DESIGN MANUAL

Prepared by

North Dakota Department of Environmental Quality
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SECTION 1. INTRODUCTION

The *North Dakota Livestock Program Design Manual* (design manual) establishes guidelines for use by the North Dakota Department of Environmental Quality (department) in the review and permitting process for concentrated animal feeding operations (CAFOs) and animal feeding operations (AFOs), as defined by North Dakota Administrative Code (NDAC) Section 33.1-16-03.1-03. CAFOs and AFOs must be located, designed, built, maintained and operated to prevent the discharge of wastes into waters of the state as required by North Dakota Century Code (NDCC) Chapter 61-28, NDAC Chapter 33.1-16-01, and NDAC Chapter 33.1-16-03.1, and, to the extent practicable, consistent with the policies and guidelines of this manual, best professional judgment, and best management practices. The department may vary application of this design manual based on site-specific geological, hydrological, or environmental conditions, but only in ways that are consistent with the requirements of law, the policies set forth in this design manual, and best professional judgment.

All CAFOs that discharge to a surface water are required to obtain a North Dakota Pollutant Discharge Elimination System (NDPDES) Permit pursuant to NDAC Chapter 33.1-16-01. Certain AFOs identified in NDAC Chapter 33.1-16-03.1 must obtain coverage under a State Animal Feeding Operation Permit (state permit). This design manual focuses on the requirements in NDAC Chapter 33.1-16-03.1.

The guidelines this design manual sets forth are explanatory in nature, *and do not have the force and effect of law*, NDCC § 28-32-01(12)(k). Statutory and rule requirements for animal feeding operations are set forth elsewhere in the North Dakota Century Code and the North Dakota Administrative Code.

Prior to amending or updating this manual, the department will solicit public comments.

Where the words "shall" or "must" are used the guideline is one where the department believes an enforceable requirement under the relevant environmental statutes or rules will likely occur if this guideline is not implemented. Where the word "should" is used the guideline is a recommendation of the department that is less critical to avoiding violations of relevant environmental statutes and rules.

The department reviews livestock facilities based on the specific site conditions and will follow the standards in this design manual for all applicable facilities. We understand, however, that there may be cases where some of the standards may not apply. If it is appropriate to deviate from these standards, the reasoning shall be explained and documented with the facility information.

Owners/operators are responsible for ensuring their facilities do not pollute waters of the state and do not exceed air quality standards. If a facility is detrimentally impacting waters of the state or air quality, the owner/operator will be required to make corrections to prevent such impacts, regardless of whether

the owner/operator followed the design manual when the facility was designed and constructed.

If appropriate, the department may institute more stringent requirements to protect water quality and air quality.

An owner/operator is responsible for complying with the air pollution law found in NDCC Chapter 23.1-06 Air Pollution Control and the rules promulgated thereunder in NDAC Article 33-15 Air Pollution Control. Specific to CAFOs and AFOs are NDCC Section 23.1-06-15 Regulation of Odors - Rules and NDAC Chapter 33.1-15-16 Restriction of Odorous Air Contaminants.

An owner/operator is responsible for implementing Best Management Practices (BMPs) to ensure compliance with the applicable requirements of NDAC Chapter 33.1-16-01 and NDAC Chapter 33.1-16-03.1, the design manual and the conditions of the permit. The owner/operator shall include the BMPs that will be implemented in Operation and Maintenance (O&M) plans and the Nutrient Management Plan.

SECTION 2. GENERAL APPLICATION AND PERMITTING INFORMATION FOR ANIMAL FEEDING OPERATIONS

2.1. Objective

The objective of this section is to provide a description of the review process for livestock facilities which require state permits under NDAC Chapter 33.1-16-03.1. In addition, it describes the information needed by the department to determine whether a medium or small AFO requires a state permit.

2.2. Operations Requiring a State Permit

NDAC Section 33.1-16-03.1-05 identifies which facilities are required to obtain a state permit. All facilities qualifying as CAFOs must obtain a state permit. Medium and small facilities that do not qualify as CAFOs must obtain a state permit under certain conditions.

Medium AFOs located within 1/4 mile of a stream or surface water that contains water, except for infrequent periods of severe drought, must submit an application for a state permit. Waters completely contained on an owner's property and which do not combine or effect a junction with natural surface or underground waters are not included. This is intended to be measured as a horizontal distance from any portion of the production area of a facility to the nearest point of a stream or surface water of the state. USGS 7½ Minute Quadrangle maps may be used to assist producers in determining if waters are surface waters; however, these are only guides, and the surface water still needs to be assessed to determine its distance from the facility.

Medium and small AFOs must apply for and obtain a permit from the department if it is determined that manure, process wastewater, litter, or runoff is causing or is likely to cause water pollution. To make this determination, the department will inspect the AFO to assess if it is, is likely to, or has discharged pollutants into waters of the state. If there is an impact, a permit will be required. The criteria that will be evaluated to determine if a medium or small AFO is causing or likely to cause water pollution are as follows:

1. The number of livestock and the number of days per year the livestock are on the site;
2. Whether the livestock are confined in or adjacent to surface water where there are no natural or manmade controls to keep runoff out of the surface water;
3. Whether the AFO is impacting or has impacted waters of the state or pollution is discharging to surface water (based on an assessment or testing water samples);
4. Whether the AFO has discharged to surface water from a rainfall event less than

or equal to a 25-year, 24-hour rainfall event (based on an inquiry of the owner or operator); and

5. Whether the AFO is land applying manure in a manner that will keep it out of surface water and is utilizing the nutrients for crop production.

Following are some guidelines to help producers determine whether manure or process wastewater from their operation causes or is likely to cause water pollution. If the facility is located on sandy soil and has a usable well that is less than 30 feet deep, the department recommends that the well water be tested for bacteria and nitrates. If the test indicates high fecal bacteria or nitrates, further assistance may be needed to help determine if the facility is the source.

If a facility is located where manure or runoff from the livestock area reaches an adjacent wash or water way, and if during heavy rains or snow melt, water flows from this water way to a stream or surface water containing water, except for infrequent periods of severe drought, the facility is likely to cause water pollution and needs a state permit.

Also, in addition to a state permit, a facility will need a NDPDES permit if it is located such that pollutants are discharged into waters of the state through a man-made ditch, flushing system, or other similar man-made device; or pollutants are discharged directly into waters of the state which originate outside of and pass over, across, or through the facility or otherwise come into direct contact with the animals confined in the operation.

2.3. Definition of Terms

The following definitions are taken from NDAC Section 33.1-16-03.1-03:

1. "Animal feeding operation" means a lot or facility, other than an aquatic animal production facility, where the following conditions are met:
 - a. Animals, other than aquatic animals, have been, are, or will be stabled or confined and fed or maintained for a total of forty-five days or more in any twelve-month period; and
 - b. Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.
2. "Bedding material" means an absorbent substance applied to dirt or concrete flooring systems, including wood shavings, wood chips, sawdust, shredded paper, cardboard, hay, straw, hulls, sand, and other similar, locally available materials.

3. “Best management practices” means schedules of activities, prohibitions of practices, conservation practices, maintenance procedures, and other management strategies to prevent or reduce the pollution of waters of the state. Best management practices also include treatment requirements, operating procedures, and practices to control production area and land application area runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
4. “Concentrated animal feeding operation” means an animal feeding operation that is defined as a large, medium, or small concentrated animal feeding operation or any animal feeding operation designated as a concentrated animal feeding operation under section 33.1-16-03.1-04. For purposes of determining animal numbers, two or more feeding operations under common ownership are considered to be a single animal feeding operation if they adjoin each other or if they use a common area or system for the disposal of wastes.
5. “Earthen storage pond” or “pond” means a topographic depression either below or above ground level, manmade excavation, or diked area formed primarily of earthen materials, although it may be lined with man-made materials or other seepage control materials, and used to store manure, process wastewater and runoff from the production area of a facility.
6. “Engineer” means a professional engineer registered to practice in the state of North Dakota.
7. “Facility” is an animal feeding operation.
8. “General permit” means a general state animal feeding operation permit. This is a permit issued to cover multiple facilities of the same or similar type, without requiring each facility to be covered under an individual permit.
9. “Large concentrated animal feeding operation” means any animal feeding operation that stables or confines as many as or more than the numbers of animals, not including unweaned young, specified in any of the following categories:
 - a. Seven hundred mature dairy cows, whether milked or dry;
 - b. One thousand veal calves;
 - c. One thousand cattle other than mature dairy cows or veal calves. “Cattle” includes, but is not limited to, heifers, steers, bulls, and cow/calf pairs;
 - d. Two thousand five hundred swine, each weighing 55 pounds or more;

- e. Ten thousand swine, each weighing less than 55 pounds;
 - f. Five hundred horses;
 - g. Ten thousand sheep or lambs;
 - h. Fifty-five thousand turkeys;
 - i. Thirty thousand laying hens or broilers, if the animal feeding operation uses a liquid manure handling system;
 - j. One hundred twenty-five thousand chickens (other than laying hens), if the animal feeding operation uses other than a liquid manure handling system;
 - k. Eighty-two thousand laying hens, if the animal feeding operation uses other than a liquid manure handling system;
 - l. Thirty thousand ducks, if the animal feeding operation uses other than a liquid manure handling system; or
 - m. Five thousand ducks, if the animal feeding operation uses a liquid manure handling system.
10. "Litter" means a mixture of fecal material, urine, animal bedding material, and sometimes waste feed.
 11. "Manure" means fecal material and urine, animal-housing wash water, bedding material, litter, compost, rainwater, or snow melt that comes in contact with fecal material and urine, and raw or other materials commingled with fecal material and urine or set aside for disposal.
 12. "Manure handling system" means all of the water pollution control structures used at the production area of a facility.
 13. "Manure storage pond" means an earthen storage pond that stores liquid manure and process wastewater from indoor confined animal feeding operations.
 14. "Manure storage structure" means any water pollution control structure used to contain or store manure or process wastewater. It includes earthen manure storage ponds; runoff ponds; concrete, metal, plastic, or other tanks; and stacking facilities.
 15. "Medium animal feeding operation" means any animal feeding operation that stables or confines the numbers of animals, not including unweaned young,

specified within any of the following ranges:

- a. Two hundred to six hundred ninety-nine mature dairy cows, whether milked or dry;
- b. Three hundred to nine hundred ninety-nine veal calves;
- c. Three hundred to nine hundred ninety-nine cattle other than mature dairy cows or veal calves. "Cattle" includes, but is not limited to, heifers, steers, bulls, and cow/calf pairs;
- d. Seven hundred fifty to two thousand four hundred ninety-nine swine, each weighing 55 pounds or more;
- e. Three thousand to nine thousand nine hundred ninety-nine swine, each weighing less than 55 pounds;
- f. One hundred fifty to four hundred ninety-nine horses;
- g. Three thousand to nine thousand nine hundred ninety-nine sheep or lambs;
- h. Sixteen thousand five hundred to fifty-four thousand nine hundred ninety-nine turkeys;
- i. Nine thousand to twenty-nine thousand nine hundred ninety-nine laying hens or broilers, if the animal feeding operation uses a liquid manure handling system;
- j. Thirty-seven thousand five hundred to one hundred twenty-four thousand nine hundred ninety-nine chickens (other than laying hens), if the animal feeding operation uses other than a liquid manure handling system;
- k. Twenty-five thousand to eighty-one thousand nine hundred ninety-nine laying hens, if the animal feeding operation uses other than a liquid manure handling system;
- l. Ten thousand to twenty-nine thousand nine hundred ninety-nine ducks, if the animal feeding operation uses other than a liquid manure handling system; or
- m. One thousand five hundred to four thousand nine hundred ninety-nine ducks, if the animal feeding operation uses a liquid manure handling system.

16. “Medium concentrated animal feeding operation” means a medium animal feeding operation that meets either one of the following conditions:
 - a. Pollutants are discharged into waters of the state through a manmade ditch, flushing system, or other similar manmade device; or
 - b. Pollutants are discharged directly into waters of the state which originate outside of and pass over, across, or through the facility or otherwise come into direct contact with the animals confined in the operation.
17. “North Dakota Livestock Program Design Manual” means the guidelines established for use by the department in the review and permitting process for animal feeding operations.
18. “Nutrient management plan” means a written description of the equipment, methods and schedules by which:
 - a. Manure, litter, and process wastewater is beneficially reused in an environmentally safe manner such as being applied to land at appropriate agronomic rates as nutrients or fertilizers; and
 - b. Water pollution and air pollution, including odors, are controlled sufficiently to protect the environment and public health.
19. “Open lot” means livestock pens, feeding or holding areas at the production area of an animal feeding operation which are outside and not under roof, and where rain can fall directly on the lot area.
20. “Open manure storage structure” means an earthen pond or storage tank for holding liquid manure which is not covered so rainfall can fall directly into the pond or tank.
21. “Operation and maintenance plan” means a written description of the equipment, methods, and schedules for:
 - a. Inspection, monitoring, operation, and maintenance of the animal feeding operation, including manure storage structures, water pollution control structures, and the production area; and
 - b. Controlling water pollution and air pollution, including odors sufficient to protect the environment and public health. It includes emergency response actions for spills, discharges or failure of a collection, storage, treatment, or transfer component.
22. “Operator” means an individual or group of individuals, partnership, corporation,

- joint venture, or any other entity owning or controlling, in whole or in part, one or more animal feeding operations.
23. "Overflow" means the discharge of manure or process wastewater resulting from the filling of wastewater or manure storage structures beyond the point at which no more manure, process wastewater, or storm water can be contained by the structure.
 24. "Pollutant" means "wastes" as defined in North Dakota Century Code section 61-28-02, including dredged spoil, solid waste, incinerator residue, garbage, sewage, sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.
 25. "Process wastewater" means water directly or indirectly used in the operation of the animal feeding operation for any or all of the following: spillage or overflow from animal or poultry watering systems; washing, cleaning, or flushing pens, barns, manure pits, or other animal feeding operation facilities; direct contact swimming, washing, or spray cooling of animals; or dust control. Process wastewater also includes any water which comes into contact with any raw materials, products, or byproducts, including manure, litter, feed, milk, eggs, or bedding material.
 26. "Production area" means those areas of an animal feeding operation used for animal confinement, manure storage, raw materials storage, and waste containment. The animal confinement area includes open lots, housed lots, feedlots, confinement houses, stall barns, free stall barns, milking rooms, milking centers, cattle yards, barnyards, medication pens, walkers, animal walkways, and stables. The manure storage area includes lagoons, runoff ponds, storage sheds, stockpiles, under-house or pit storages, liquid impoundments, static piles, and composting piles. The raw materials storage area includes feed silos, silage bunkers, and bedding materials. The waste containment area includes settling basins, areas within berms, and diversions which separate uncontaminated storm water. Also included in the definition of production area is any egg washing or egg processing facility and any area used in the storage, handling, treatment, or disposal of mortalities.
 27. "Runoff" means rainwater or snow melt that comes in contact with manure at an open lot or open manure storage area and, therefore, is defined as manure.
 28. "Runoff pond" means an earthen storage pond that is used to collect and store runoff from an open lot or from a manure storage area.
 29. "Seepage" means the volume of flow through a manure storage structure.

30. “Sensitive groundwater area” means vulnerable hydrogeologic settings as determined by the department such as glacial outwash deposits or alluvial or aeolian sand deposits that are critical to protecting current or future underground sources of drinking water. Areas designated as sensitive groundwater areas by the department include alluvial or aeolian sand deposits shown on Geologic Map of North Dakota (Clayton, 1980, North Dakota geological survey) and glacial drift aquifers listed in North Dakota Geographic Targeting System for Groundwater Monitoring (Radig, 1997, North Dakota department of health), or most recent editions of these publications, with DRASTIC scores greater than or equal to 100 based on methodology described in DRASTIC: A Standardized System For Evaluating Groundwater Pollution Potential (Aller et al, 1987, United States environmental protection agency).
31. “Small animal feeding operation” means any animal feeding operation that stables or confines less than the numbers of animals specified for a medium animal feeding operation.
32. “Small concentrated animal feeding operation” means a small animal feeding operation designated as a concentrated animal feeding operation under section 33.1-16-03.1-04.
33. “State animal feeding operation permit” means a permit issued by the department under this chapter to an animal feeding operation.
34. “Surface water” means waters of the state that are located on the ground surface, including all streams, lakes, ponds, impounding reservoirs, marshes, watercourses, waterways, and all other bodies or accumulations of water on the surface of the earth, natural or artificial, public or private.
35. “Unconfined glacial drift aquifer” means a glacial drift aquifer that does not have an impervious soil layer which acts to prevent or minimize movement of water into, through, or out of the aquifer.
36. “Water pollution control structure” means a structure built or used for handling, holding, transferring, or treating manure or process wastewater, so as to prevent it from entering the waters of the state. The term also includes berms, ditches, or other structures used to prevent clean water from coming in contact with manure.
37. “Water quality standards” means the water quality standards contained in chapter 33.1-16-02.1.

2.4. True Pasture and Rangeland Operations

(See NDAC Section 33.1-16-03.1-03(1).)

Wintering operations were addressed in the previous North Dakota state livestock rules, by the U.S. Environmental Protection Agency and by local zoning ordinances. EPA chose not to define a winter feeding operation but instead chose to address it through the preamble to the federal livestock rules as follows: "First, EPA is reiterating that true pasture and rangeland operations are not considered AFOs, because operations are not AFOs where the animals are in areas such as pastures, croplands or rangelands that sustain crops or forage growth during the normal growing season. In some pasture-based operations, animals may freely wander in and out of particular areas for food or shelter; this is not considered confinement. However, pasture and grazing-based operations may also have confinement areas (e.g. feedlots, barns, pens) that may qualify as an AFO. Second, incidental vegetation in a clear area of confinement, such as a feedlot or pen, would not exclude an operation from meeting the definition of an AFO. Note that animals must be stabled or confined for at least 45 days out of any 12 month period to qualify the operation as an AFO." The state will follow the same directive to not consider true pasture and rangeland operations as AFOs; however, confinement areas of these operations may qualify as AFOs. These areas may be subject to regulation under NDAC Chapter 33.1-16-03.1 or NDAC Chapter 33.1-16-01 and the owner/operator may need to submit an application for a state animal feeding operation permit.

2.5. When to Submit an Application

Applications must be submitted to the department by owners or operators of facilities that require a state permit under NDAC Chapter 33.1-16-03.1. The owner/operator of the following facilities must submit an application and design plans, and must receive department approval prior to construction:

1. New livestock facilities or
2. Existing livestock facilities that are:
 - a. Increasing the number of livestock above the level allowed in the current permit or above the level where a permit is required,
 - b. Expanding the production area, or
 - c. Are updating or changing the manure handling system.

A preliminary application may be submitted before a facility is designed so the department can assist the owner/operator by evaluating information on the water resources in the area, reviewing siting requirements and identifying potential concerns. The final design plans for the manure handling system, including a Nutrient Management Plan, must then be submitted to the department for review.

If a facility design meets department construction and operation standards to prevent the discharge of pollution to waters of the state and to prevent an exceedance of air quality standards, a permit may be issued. If the department determines the design is not adequate, changes will be required before the design can be approved and a permit issued.

For new or expanding facilities requiring a state permit, the department, in accordance with NDAC 33.1-16-03.1-13, may issue a public notice requesting comment when there is significant degree of public interest. A significant degree of public interest exists when justifiable concerns of environmental impact are expressed. For those facilities that have been previously public noticed a public notice shall also be issued if a facility has any of the following changes to the approved nutrient management plan:

- A greater than 10% reduction in the acres available for land application;
- The addition of surface or subsurface drainage;
- A change in the method of manure application.

When an owner or operator is considering a new site for a facility, the department can provide general comments to assist in evaluating a potential site and understanding the requirements for manure handling systems.

An application for renewal of a permit shall be submitted 180 days prior to the expiration. The department will send out a reminder notice prior to the expiration date indicating the expiration date and informing the owner/operator when a renewal must be submitted.

For facilities requiring NDPDPES permit under NDAC Chapter 33.1-16-01, the public notice process in that chapter must be followed.

SECTION 3. SUBMITTING FINAL DESIGN PLANS

3.1. Objective

The final design plans for facilities that require a permit under NDAC Chapter 33.1-16-03.1 shall show that manure, process wastewater and runoff can be properly contained and managed to prevent detrimental impacts to surface and ground water resources and meet air quality standards. Manure, process wastewater and runoff must be contained and stored as per the design criteria for animal manure systems in Section 5. At a minimum, the following information in Sections 3.2.1 through 3.2.5 shall be included in the design plans for facilities that require a permit.

3.2. Information to be Included in Final Design Plans

3.2.1. Design plans which address:

1. Production areas of a facility
 - a. Include provisions to minimize manure, process wastewater, and runoff from the production area and contain manure, process wastewater, and runoff on site until it can be properly utilized off site.
 - b. Specify dimensions of outside lots or barns for livestock. For outdoor lots, specify percentage slope of lots, total drainage area of livestock lots and any additional drainage area running through the livestock lots.
 - c. Indicate the volume of manure and wash water produced from confined facilities. For outdoor lots, indicate the runoff from a 25-year, 24-hour rainfall event or a 100-year, 24-hour rainfall event, depending on the type of operation, including runoff for the period of storage and any additional manure from the livestock lots.
 - d. Provide an overview of facility operation which relates to manure handling, including the collection, transfer and storage of manure on site, the type of livestock and the number of days per year livestock are on site.
 - e. Location and size of feed storage areas at the production area, the types of feed stored and if it is enclosed storage or stored outside.
2. Earthen Storage Ponds or Runoff Ponds
 - a. Specify dimensions of the structure including top and bottom dimensions of pond, relative elevation, side slopes, depth, volume, dimensions of embankments, etc. A typical cross section of the pond and diversions is required along with a profile of any diversions, dikes and drainages.

- b. Specify provisions that will be used to meet seepage requirements such as the necessity of a liner. If a liner is needed, indicate type, construction specifications and testing used during and after construction to ensure integrity. Also include documentation that will be maintained to verify seepage requirements are met. Include any additional precautions and/or maintenance used to ensure pond and liner integrity around inlet areas, if the pond dries out, during pumping, and if vegetation growth occurs in the pond.
 - c. Provide soil boring location, relative elevation of borings, and boring logs based on the Unified Soil Classification System. In addition, note evidence of any past or present water tables or other soil features. A sample of the borrowed or in-situ material that will be used as a liner shall be verified by laboratory testing.
 - d. Provide designs for any inlet structures, including splash pads and an emergency spillway. Include information or designs for equipment used in the ponds for solids settling or transporting or agitating manure. In addition, include provisions to pump or lower the liquid level of the pond and designs for a marker to indicate the level at which the pond must be pumped so that it can store runoff and rainfall from the required rainfall event.
 - e. Provide an operation and maintenance plan for the pond detailing proper operation and maintenance to ensure it continues to operate as designed and listing specific items that need to be inspected and the frequency of the inspections.
3. Non-earthen Storage (Concrete, Metal, Wood, Composite, Etc.)
- a. Include all dimensions and any other pertinent information such as relative elevation of top and bottom; design of wall, floor and top; footer designs; rebar specifications; joint sealers or other specifications used to prevent seepage; testing during or after construction; etc.
 - b. Provide soil boring location, relative elevation and boring logs based on the Unified Soil Classification System. Note evidence of any past or present water tables or other soil features.
 - c. Provide an operation and maintenance plan for the structure detailing proper operation and maintenance to ensure it continues to operate as designed and listing specific items that need to be inspected and the frequency of inspections.

4. Diversions and Embankments

- a. Specify dimensions of the structure, including top and bottom width, side slopes, depth, typical major cross sections, slope, channel profile elevation compared to ground level and flow velocity in diversion channels.
- b. Provide any site-specific conditions needed to ensure stability.
- c. Specify the maintenance required to ensure continued stability.
- d. Include the calculations used to estimate the peak flow in diversion channels, including watershed drainage area, average slope, soil type, vegetation in drainage area, runoff curve number, and maximum flow length.
- e. Include the calculations to show the stability of diversion channels at peak flow. If the drainage area is small, indicate that minimum diversion design is adequate to handle runoff.
- f. Provide specifications on any type of erosion control methods used in stabilizing channels, diversions, earthen storage ponds, etc. used during construction.
- g. Provide an operation and maintenance plan for the structures detailing proper operation and maintenance to ensure they continue to operate as designed and listing specific items that need to be inspected and the frequency of inspections.

5. Construction Specifications for Water Pollution Control Structures Including Excavation, Earth Fill, Liners, Concrete, and Pipelines

- a. Provide general construction information to ensure a stable structure (e.g., include the type of soil used for construction, compaction, moisture content, etc.).
- b. Specify construction requirements needed to ensure stability and quality construction (e.g., stripping and scarifying, lift thickness and compaction, grass seeding after construction, etc.).
- c. Include any testing done during or after construction to ensure stability of the structure.
- d. Designs, including location for all manure storage and water pollution control structures and site-specific background information as specified in

the *North Dakota Livestock Program Design Manual*. Design plans developed by anyone other than the facility owner must be signed by the engineer who prepared or supervised the preparation of the plans as per NDCC Chapter 43-19.1.

3.2.2. Nutrient Management Plans

1. The following facilities that require a Nutrient Management Plan pursuant to NDAC Chapter 33.1-16-01 or NDAC Chapter 33.1-16-03.1 must submit a copy of their current Nutrient Management Plan to the department along with their application and/or design plans which must include the information listed in Section 7:
 - a. CAFOs,
 - b. Facilities that plan to apply manure on frozen ground;
 - c. Facilities with land that is designated for manure application and which also has soil phosphorous levels that meet or exceed the very high levels for crop production based on NDSU Extension Service information;
 - d. Facilities that daily haul and land apply manure; or
 - e. Facilities which fail to comply with these rules or permit conditions.
2. Facilities that do not meet the conditions in item 1 must have a current Nutrient Management Plan kept on site. However, they only need to submit the following information to the department with their application and/or design plans:
 - a. An indication that the facility has a nutrient management plan;
 - b. The name of the individual who developed the Nutrient Management Plan and the organization with which he/she is affiliated;
 - c. The amount of land available for land application of manure;
 - d. The type of crops or vegetation grown on this land;
 - e. The typical manure application rate for each crop;
 - f. The method and timing of application;
 - g. The precautions used to prevent manure from reaching waters of the state; and

- h. The precautions used to minimize odors to residences or public areas where people are present during transport and land application of manure.

3.2.3. Time Line for Construction and Implementation for Existing Systems

Operators of existing facilities installing or updating the manure handling systems to comply with department requirements shall include a project time line if construction is not scheduled to be completed within one year after the application is submitted to the department. This time line shall indicate various phases of the construction to be completed and include an estimated date of completion for each phase. If construction is not completed in one year or a construction schedule cannot be met, the department shall be notified in writing with a new proposed construction schedule submitted prior to the end of the one year or the scheduled completion date.

3.2.4. Notice of Intent to be Covered Under Storm Water Permit

1. Construction activities at a livestock facility site disturbing 1 acre or more must be covered under a general permit for storm water discharges from construction activities (NDAC Chapter 33.1-16-01).
2. The facility design plans must include a storm water pollution prevention plan detailing measures to control erosion and minimize pollution from construction sites.

3.2.5. Best Management Practices for Conservation

Identify appropriate site specific Best Management Practices for conservation to be implemented to control runoff of pollutants to waters of the state, both at the production area and at the land application areas. Practices identified in the Nutrient Management Plan can be referenced and do not have to be repeated.

SECTION 4. SITE SELECTION AND ASSESSMENT STANDARDS

4.1. Objective

This section describes the information required to evaluate the location of a new or expanding facility. Site location is the single most important factor in protecting water and air quality resources from pollution due to facilities. Adequate surface and subsurface information is necessary to limit the potential of new or expanding facilities to degrade water and air quality resources.

4.2. Site Selection Standards

Geologic and hydrologic conditions that control the movement of manure or waste water to surface water or ground water sources are preferred for new or expanding facilities. Upland sites underlain by low permeability soil and located away from surface water are ideal for minimizing the migration of pollutants to waters of the state. Facilities that are located at more sensitive sites typically require engineered improvements (e.g., above-ground storage tanks, synthetic or constructed clay liners) to meet department requirements to protect waters of the state.

The following site conditions shall be considered when evaluating the location of a livestock facility:

1. Proximity to surface water;
2. Surface and subsurface soil textures (e.g., the presence of sand lenses versus continuous clay layers);
3. Depth to ground water and distance to existing wells;
4. Surface topography; and
5. Distance to nearby residents, particularly in the prevailing downwind direction.

Site conditions shall be evaluated by the department during the permit application review process and shall be considered when developing permit conditions for a facility.

4.2.1. General Requirements

New and expanding facilities and manure storage areas shall be located a minimum horizontal distance of 100 feet from a public water supply well, 50 feet from a private water supply well, and 500 feet from any water supply well not owned by the facility where the topography is in a down-slope or down-gradient direction from the facility.

4.2.2. Additional Considerations

The location of storage structures for an animal manure system should be as close as practicable to the manure source. Open manure storage structures should be located so that the prevailing wind direction will not be toward nearby occupied areas. Consideration should also be given to topography, vegetative screening and building location to minimize visual or air quality impacts from an operation. Water supply wells at existing operations should be protected from animal waste impacts.

4.3. Site Assessment Standards

4.3.1. Scope of Site Assessment

The scope of a site assessment is dependent on the size and location of the proposed facility. Larger facilities or those located in sensitive ground water areas generally require more information to adequately evaluate the site. Smaller facilities located in less sensitive ground water areas generally require less information. Contact the department with any site assessment questions.

The following operations require more detailed subsurface soil information.

1. Open-lot cattle facilities with greater than or equal to 2,000 animals, or where the production area is greater than or equal to 20 acres in size;
2. All other large CAFOs or existing operations expanding to large CAFO status; or
3. New or expanding facilities, which meet any of the following criteria:
 - a. The production area overlies or is located within 1 mile of a defined glacial drift aquifer (see attached Figure 1);
 - b. The production area overlies a sensitive ground water area, as defined by the department (see attached Figure 1);
 - c. Soils at the production area have sandy loam, loamy sand, sand or gravel textural classes as defined by Natural Resources Conservation Service (NRCS) soil survey maps;
 - d. A water supply well at the facility is screened at a depth within 30 feet of the ground surface;
 - e. The production area is within 1/4 mile of a neighboring private water supply well, within 1/2 mile of a non-community public water supply well or within 1 mile of a community public water supply well; or

- f. The production area is located within a delineated wellhead or source water protection area (see attached Figure 2).

4.3.2. Site Assessment Requirements

Data regarding subsurface soil types shall be obtained by advancing soil borings, using a method that retrieves a relatively undisturbed soil sample, or by an alternative soil evaluation method that is approved by the department prior to site assessment. Subsurface soils shall be evaluated and logged to at least 10 feet below the base of the manure storage structure. There shall be a minimum of three soil evaluations in the manure storage structure area or one soil evaluation per acre of structure area, whichever is greater. In outdoor feedlot areas, there should be one additional soil evaluation per 10 acres of feedlot area, to a depth of at least 10 feet below ground surface. Soil evaluations should be spaced throughout the proposed facility to enable an accurate assessment of the subsurface geology. The department can provide assistance in locating appropriate drilling locations.

For facilities that meet any of the conditions in Section 4.3.1, soil borings are required for the evaluations. For other facilities, the assessment may be conducted using soil borings or by an alternative soil evaluation method that is approved by the department prior to site assessment. The subsurface soil shall be continuously logged, and the soil shall be classified using the Unified Soil Classification System (as outlined in ASTM D-2488) or the equivalent. Soil types shall be recorded in a soil boring log, along with soil colors, soil moisture conditions and the depth of any ground water encountered during drilling. The ground surface elevation at each boring or assessment location shall be obtained to evaluate the elevation in relation to the base of the manure storage structure. The elevation data shall either be reported in feet above mean sea level or referenced to an arbitrary site benchmark.

All soil borings that extend into an aquifer shall be completed and abandoned according to the requirements established in NDAC Chapter 33.1-18-02 (Ground Water Monitoring Well Construction Requirements). As defined in NDAC Chapter 33.1-18-01 (Water Well Construction and Water Well Pump Installation), an “aquifer” means a water-bearing formation that transmits water in sufficient quantities to supply a well. Soil borings completed above an aquifer must be abandoned according to the requirements of NDAC Section 33.1-18-02-10 (Borehole and Monitoring Well Abandonment). Excavated or disturbed areas resulting from the use of alternative soil evaluation methods shall be filled with compacted soil to achieve permeability equal to or less than the surrounding geologic formation.

Depending on site geology or facility location, the department may require additional soil borings or deeper borings to adequately characterize soil and ground water. Additional borings may be required at sites with complex subsurface geology, such as sites with rapid transitions from fine to coarse-textured soil.

4.4. Zoning and Odor Setbacks

Counties and Townships have authority to regulate the nature, scope and location of AFO's through their local zoning authority.

NDCC Sections 11-33-02.1 and 58-03-11.1 give townships and counties respectively, the authority to impose setback requirements on animal feeding operations. These setback requirements may not vary by more than fifty percent from those established in NDCC Section 23.1-06-15(7)(a). The local zoning authority is responsible for ensuring compliance with zoning regulations.

Zoning regulations established by counties and townships must be submitted to the department. In accordance with NDCC Section 23.1-06-15, the department has established an electronically accessible central repository where all filed county and township zoning requirements can be viewed at www.deq.nd.gov.

All submitted applications where local zoning has been properly established shall contain documentation of approval from the zoning authority. If such documentation has not been provided, the application process shall be put on hold until the required approval documentation has been received by this department.

If neither the county nor the township regulates zoning of animal feeding operations, the department shall require that any new animal feeding operation permitted under NDCC Chapter 61-28 be set back from any existing residence, church, school, business, public building, park or campground as follows:

1. For operations with fewer than three hundred animal units, there is no minimum setback requirement;
2. For operations with at least three hundred animal units but no more than one thousand animal units, the setback for any operation is one-half mile;
3. For operations with at least one thousand one animal units but no more than two thousand animal units, the setback for a hog operation is three-fourths mile and the setback for any other operation is one-half mile;
4. For operations with at least two thousand one animal units but no more than five thousand animal units, the setback for a hog operation is one mile and the setback for any other operation is three-fourths mile; and,
5. For operations with at least five thousand one animal units, the setback for a hog operation is one and one-half miles and the setback for any other operation is one mile.

In counties and townships that do not regulate setback requirements, the department

determines the number of animal units per each animal type in accordance with NDCC Section 23.1-06-15(7)(c). Animals that have not been weaned from their mother are considered to be part of the mother in terms of animal units. For example, a sow and her piglets would still equal 0.4 animal units. The piglets would be counted as separate animal units once the weaning process is complete.

The setback is measured from the nearest odor source, such as a manure storage structure, pens, animal housing or wet feed storage. The residence does not need to be occupied, but must be habitable. A public park is a park established by the federal government, the state, or a political subdivision of the state in the manner prescribed by law. A campground is a public or private area of land used exclusively for camping and open to the public for a fee on a regular or seasonal basis.

SECTION 5. DESIGN CRITERIA FOR MANURE SYSTEMS

5.1. Objective

The objective is to provide the requirements that must be met for manure handling systems at facilities subject to department review. The manure handling systems should enhance the operation and management of the facility by effectively moving manure and runoff from the production area of the livestock facility to properly designed storage areas, thus protecting water quality and air quality. The volume of manure stored should be minimized as much as possible, and manure should not be allowed to drain on to neighboring land.

5.2. Required Manure Storage

Manure storage structures for animal facilities shall be designed to store all of the following:

1. The volume of manure, process wastewater and runoff produced in 270 days or during the time between dates when the storage structure can reasonably be emptied, whichever is longer. Operators of storage structures that allow evaporation can subtract the evaporation to be expected from the structure using regional and local evaporation rates.
2. Rainfall on any open manure storage structure and runoff from open lots from a 25-year, 24-hour rainfall event. Swine, chicken, turkey and veal calf facilities shall be designed to contain rainfall on the open manure storage structure and runoff from the production area due to a 100-year, 24-hour rainfall event.
3. The volume of liquid or slurry that cannot be removed during pumping.
4. The volume of solids accumulated from an open lot system. It is recommended that a solids separator be designed into these systems to extend pond life and minimize the chance of damage to the liner.

For items 1 and 2, see attached tables in Appendix B, C, & D. The volume of solids in item 4 shall be determined by a suitable method or by the following:

Slope of Lot	Volume of Solids
0 – 3.9 Percent	17 cubic yards per acre of lot
4 – 8 Percent	50 cubic yards per acre of lot
Over 8 percent	70 cubic yards per acre of lot

A marker shall be used to indicate the level at which the storage structure can contain the required storage volume, minus the rainfall and runoff from a 25-year, 24-hour rainfall event or a 100-year, 24-hour rainfall event for swine, chicken, turkey and veal calf facilities. When the liquid is above this marker, the level shall be lowered below this marker within a reasonable time period. Under normal weather conditions, this should occur within two weeks. In an earthen storage pond, a depth marker shall be installed in a manner not to jeopardize the integrity of the liner.

Facilities requiring permits under NDAC Chapter 33.1-16-01 and NDAC Chapter 33.1-16-03.1 shall prevent the direct contact of animals at the production area with waters of the state to the extent applicable.

To comply with state and federal dairy regulations, human sewage waste shall not be mixed in any way with livestock manure on dairy facilities.

5.3. Earthen Storage Ponds

An earthen storage pond holds manure, process wastewater and runoff from the production area of a facility. Narrow or L-shaped earthen storage ponds should be avoided. Square, rectangular or round ponds are most desirable.

Coverage under NDAC Chapter 33.1-16-01 or NDAC Chapter 33.1-16-03.1 and these standards does not preclude an owner or operator of a facility from needing to comply with any other applicable federal, state and local requirements.

5.3.1. Design Requirements

The finished bottom of the earthen storage pond shall be a minimum of 2 feet above the seasonal high water table. In sensitive areas, greater separation distances may be required.

Earthen storage pond designs shall include a minimum of 1 foot of freeboard above the minimum design storage volume level measured to the lowest level of the embankment or overflow structure. Manure storage ponds, which are in excess of 300 feet in length at the top liquid surface area, require a minimum of 2 feet of freeboard unless the manure storage pond is covered.

Provisions shall be included to minimize solids entering the pond or to remove solids without damaging the liner or jeopardizing pond integrity. These can include, but are not limited to, solid separators or other methods to reduce the velocity so solids will settle out.

The earthen storage pond shall meet the conditions for soil formation and liners in Section 5.3.3 to minimize seepage and prevent instability.

The facility shall be maintained to prevent erosion.

5.3.2. Embankments for Ponds and Earthen Fill Material

Embankments refer to the side walls of an earthen storage pond that are constructed using earthen fill material. The applicable construction requirements for earthen fill listed below also apply to other components of the manure handling system, including clay liners, dikes, etc.

1. Construction Requirements for Earth Fill

- a. Earth fill used in embankments, clay liners, dikes, etc. shall be relatively impervious material and sufficiently compacted to form a stable structure and minimize seepage.
- b. Frozen soil shall not be used in the construction of embankments, and such structures shall not be constructed on frozen soil.
- c. Final design height of embankments shall be increased by the amount needed to ensure the design top elevation will be maintained after settling. Designs shall use a minimum of 5 percent settlement at the center line of the embankment.
- d. Vegetation and organic material shall be removed from areas where the embankment or earth fill will be placed. The embankment shall be tied into the mineral soil to prevent seepage between the interface. This may include, but is not limited to, scarification of the mineral soil prior to construction and/or the use of a core trench.
- e. Organic material shall not be used in the embankment core construction; however, suitable topsoil that is free of debris may be used as cover material on the outer slopes of the embankment.
- f. The side slopes on the inside embankment of an earthen storage pond shall not be steeper than 2 horizontal:1 vertical. On the outside, the slope shall not be steeper than 3 horizontal:1 vertical.
- g. Top width of embankments shall be wide enough to be stable and permit access of maintenance vehicles. The top width of embankments shall be a minimum of 10 feet.
- h. Embankments shall be seeded from the outside toe to the high water line. Perennial type, low growing, spreading grasses that are erosion resistant and can be mowed are desirable. Alfalfa and other deep-rooted plants are not acceptable since the roots can impair the water-holding capacity of

the structure.

5.3.3. Soil Formation and Liners

The bottom and side slopes of earthen storage ponds shall be properly sealed to prevent excess seepage. This can be done by using a properly constructed clay liner, bentonite, a geosynthetic liner or other equivalent liner material. If a facility can meet the conditions specified in Sections 5.3.7 and 5.3.8, the in-situ soil may be acceptable for pond construction without an additional liner.

Lined earthen storage ponds shall be designed to prevent impacts to waters of the state and designed such that seepage shall not exceed 1/16 inch per day at maximum operating depth over the life of the pond. In sensitive ground water areas, wellhead or source water protection areas, above glacial drift aquifers or in areas where manure from a pond is determined to be impacting waters, the department may require additional protective measures.

Provisions shall be used to prevent or minimize drying and cracking of constructed clay liners. Protective measures, such as placing top soil or sandy soil over the clay liner or keeping a minimum liquid level in the pond, can be used. If a soil cover layer is used, precautions must be taken to prevent weed growth that could damage the liner (e.g., spraying for weeds or by maintaining a shallow-rooted grass on the soil cover). Removal of manure or process wastewater from an earthen storage pond shall be accomplished in a manner that does not jeopardize the integrity of the liner.

5.3.4. Constructed Clay Liners

Constructed clay liners shall meet the conditions in item 1 and the construction specifications listed in item 2. Laboratory tests of the soils used for the liner must be completed to determine the Atterberg limits and sieve analyses showing the grain sizing and proctor density of the soils. An additional sample shall be analyzed for every 5,000 cubic yards and for every major soil change. These tests shall be provided to the department along with information on the locations where the soil samples were collected, including the depths at which the samples were collected. Management provisions must be specified to prevent the liner from drying and cracking.

1. Required conditions for constructed clay liners are liquid limit of 30 percent or greater, a plasticity index greater than 10 (a range from 15 to 30 is preferable) and 30 percent or more (preferably 50 percent or more) of the liner material shall pass through a # 200 mesh screen, as tested by ASTM D-2487.
2. Construction specifications for constructed clay liners:
 - a. The liner shall be a minimum of 2 feet thick after compaction;

- b. To achieve the desired thickness, the liner shall be placed in equal layers or lifts that are approximately 6 inches thick after compaction;
- c. Parallel lifts shall be used for side slopes. However, in the event that side slopes are steeper than 3 horizontal : 1 vertical, horizontal lifts shall be used;
- d. In some sensitive areas, the department may require a thicker liner material or additional construction;
- e. In situations that do not meet any of the conditions listed in Section 4.3.1, the minimum thickness of liner after compaction shall be 18 inches;
- f. Rocks greater than 3 inches in diameter shall be removed from the liner material prior to compaction; and
- g. The moisture content shall be in the range of 1 percent dry of optimum to 3 percent wet of optimum.

5.3.5. Testing of Constructed Clay Liners

Constructed clay liners shall be tested to verify seepage. This can be done in one of three ways:

1. Completing a remolded permeability test, indicating the material can meet the seepage limits. The liner construction must meet or exceed the proctor density used in the remolded permeability test, and the liner must undergo moisture and density testing during construction to ensure the construction specifications are met;
2. Laboratory testing thin-walled tube samples of the liner; or
3. Conducting an on-site seepage test of the liner.

When the testing is done for permeability, Darcy's law can be used to determine the seepage rate at the maximum operating depth for a 24 or 18 inch liner, as appropriate.

If a remolded permeability test is used, testing for compaction and moisture must be completed during construction of the liner on the pond bottom and side slopes using ASTM standard testing methods. Testing shall be done by the project engineer or a professional soil testing firm. Holes or punctures created in the liner due to testing, such as those from nuclear density testing, shall be filled with clay or bentonite after testing to prevent seepage. A minimum of four tests for the first acre of pond surface area must be completed on each lift for density and moisture. For each additional acre of liner, two additional tests must be completed on each lift for density and moisture. A

maximum of two lifts can be tested at one time. Tests shall be randomly distributed over the entire liner area. Ponds that are less than 1.5 acres at the full level shall include testing on at least two sidewalls, while ponds that are more than or equal to 1.5 acres at the full level shall have testing on all four sidewalls.

The department will evaluate the proposed liner testing specified in the design plan and, based on site conditions, may require additional testing as deemed appropriate.

If permeability testing is performed on the constructed liner, it shall be conducted using either of the following methods:

1. An on-site permeability test using standard ASTM methods; or
2. Laboratory testing of thin-walled tube samples, provided proper ASTM methods of collection and testing are used.

If thin-walled tube samples are collected, they must be taken at a rate of one tube per acre of pond surface area or a minimum of two tubes per pond, whichever is greater. Each sample shall be laboratory tested for permeability using an ASTM D5084 or equivalent ASTM testing method. Holes left in the liner from the thin-walled tube samples shall be filled with clay or bentonite and compacted to prevent seepage. If on-site testing of the liner is proposed, the testing method and number of tests must be included in the design plans for departmental review.

Depending on site-specific conditions, the department may require additional testing of a pond liner to ensure seepage limits are being met.

5.3.6. In-situ Soils

If the conditions at the site meet criteria listed in Sections 5.3.7 and 5.3.8, a liner may not be required. Laboratory tests of the in-situ soils must be completed to determine the Atterberg limits and sieve analyses showing the grain sizing. These tests must be provided to the department and include the location and depth of the soil samples. The department understands that soil borings of in-situ soils are typically field classified. The department will require this soil boring information; however, the laboratory tests are used to verify the classification of the soils. Depending on soil and site characteristics, the department may also require a permeability test.

When required by the department, permeability testing shall be completed on the in-situ soils by:

1. An on-site permeability test using standard ASTM methods; or
2. Laboratory testing of thin-walled tube samples, provided proper ASTM methods of collection and testing are used.

If thin-walled tube samples are collected, they must be taken at a rate of two tubes per acre of pond surface area or a minimum of three tubes per pond, whichever is greater.

Each sample shall be laboratory tested for permeability using ASTM D-5084 or the equivalent. If on-site permeability tests are used, they shall be evenly distributed over the area of the liner. The type and number of tests must be specified in the design plans for review by the department. Holes left in the liner from the thin-walled tube samples shall be filled with compacted clay or bentonite.

5.3.7. Manure Storage Ponds

Manure storage pond refers to an earthen storage pond that stores liquid manure and process wastewater from indoor or roofed confined facilities, not to a pond that stores only runoff from open lot livestock areas.

A liner is required for manure storage ponds unless the in-situ soil material is adequate to prevent excess seepage. If a facility with a manure storage pond can meet all of the following conditions, a liner may not be required:

1. There is a continuous layer of soil classified as lean clay (CL) or fat clay (CH) (based on the Unified Soil Classification System), verified by laboratory testing using ASTM D-2487, below the manure storage pond bottom and side slopes. The soil layer must be at least 4 feet thick for ponds that hold up to 8 feet of manure, 6 feet thick for ponds that hold up to 10 feet of manure or 8 feet thick for ponds that hold up to 12 feet of manure;
2. The site is not located in a sensitive groundwater area as defined by the department or in a delineated wellhead or source water protection area (see attached Figures 1 and 2);
3. The volume of liquid manure to be stored at the production area, not including freeboard, is less than 2 million gallons (6 acre feet);
4. The pond is inspected for coarse textured soil after excavation and before earth fill is put in place; and

Any vegetation and organic material shall be removed from manure storage pond floors and side slopes up to the high water line, and the soil in the floor and side slopes must be scarified to a minimum depth of 6 inches and re-compacted to break up any fractures in the soil.

If coarse textured soils are discovered during construction, they shall be removed and a 2-foot clay liner installed in the area where coarse textured soil was encountered.

5.3.8. Runoff Ponds

Runoff ponds are earthen storage ponds that collect rain and runoff from open lot facilities such as cattle feedlots.

The bottom and side slopes of runoff ponds shall be properly sealed to prevent seepage. In general, facilities that meet all of the following criteria may be allowed to use in-situ soil material to prevent excess seepage without an additional liner:

1. The site is not located in a sensitive groundwater area as defined by the department or in a delineated wellhead or source water protection area (see attached Figures 1 and 2);
2. There is a continuous layer of soil classified as CL or CH based on the Unified Soil Classification System, verified by laboratory testing using ASTM D-2487, below the pond bottom and side slopes. The soil layer must be at least 4 feet thick for ponds that hold up to 8 feet of water, 6 feet thick for ponds that hold up to 10 feet of water and 8 feet thick for ponds that hold up to 12 feet of water.

If coarse textured soils are discovered during construction, they shall be removed and a 2-foot clay liner installed in the area where the coarse textured soil was encountered.

5.3.9. Synthetic, Geosynthetic or Other Liners

Synthetic, geosynthetic or other liners shall be installed according to manufacturer specifications. Synthetic liners shall not be used alone, but must be used in conjunction with a self-sealing liner material or a leak detection system to protect against seepage in the event of a tear or puncture.

Minimum thickness for synthetic liner material:

Type	Minimum requirements
HDPE	40 mill thickness
LLDPE	40 mill thickness
PVC	30 mill thickness
GCL	0.75 pounds per square foot
EPDM	45 mill thickness

* HDPE – High Density Polyethylene; LLDPE – Linear Low-Density Polyethylene; PVC – Polyvinyl Chloride; GCL – Geosynthetic Clay Liner; EPDM – Ethylene Propylene Diene Terpolymer

5.4. Other Manure Storage Structures

Non-earthen structures used to store liquid or slurry manure are usually constructed of reinforced concrete or fabricated steel with fused glass or plastic lining.

The storage structures shall be designed to contain manure and accommodate equipment for loading, agitating and emptying.

All seams or joints shall be properly sealed to prevent leaking.

The storage structures shall be properly designed and constructed to:

1. Withstand all anticipated structural loads applied;
2. Prevent damage from livestock or maintenance equipment; and
3. Safely prevent humans and livestock from entering.

Steel and other corrodible material exposed to the manure shall be covered with an adequate protective coating to prevent rust or corrosion.

A minimum of 6 inches shall be provided for freeboard at the top of the tank structure. For larger structures, more freeboard may be required.

Above-ground storage tanks shall have adequate footings extending below the anticipated frost depth.

Above-ground storage tanks shall have a leak detection system installed below the structure.

Tanks temporarily storing manure until it is transferred to a larger storage structure should be designed for a minimum holding time of three days.

5.4.1. Concrete Storage Tanks

Concrete structures shall be properly designed and constructed to ensure adequate strength and stability, minimize cracking and prevent any leaks. Designs shall conform to accepted standards such as:

1. Midwest Plan Service (MWPS-36) Concrete Manure Storage Handbook (1994 edition);
2. American Concrete Institute Standards 318-89 (Rev. 1992) Building Code Requirements for Reinforced Concrete; or

3. American Concrete Institute Standards 350R-89 and 350IR-93/AWWA (1994) Environmental Engineered Concrete Structures.

Storage tanks shall be designed to withstand all anticipated structural loads, including internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, seasonal high water table pressure and frost or ice pressure.

Covers, top slabs and slats shall be designed to support the maximum load which can be applied by the size and type of equipment to be used at the site. In no case shall the live loading be less than 150 pounds per square foot.

Designs for concrete manure storage tanks shall document the loadings the tanks were designed to withstand (e.g., lateral loads, surcharge loads and, if applicable, tank cover loads). If a publicly available design standard was used, such as a MWPS standard, indicate the specific standard used in the design, and the site conditions that were considered in the design.

5.4.2. Manure Stacking Facilities

Manure stacking facilities refer to surfaces that are relatively impervious where solid or semisolid manure is stacked or stored.

Handling manure in different phases may require a variety of designs to ensure all manure is stored. All runoff from the stacking facility shall be contained, and the structure shall be designed to prevent excess seepage.

Manure stacking facilities shall be constructed of durable material and designed to withstand internal or external pressures including hydrostatic uplift loads and imposed surface loads. The structure shall be designed to accommodate equipment for loading and emptying. Floors shall be moderately sloped away from the entrance.

5.4.3. Manure Stockpiles

Stockpiles can be located at animal feeding operations or at cropland application sites. Manure stockpiles may not be located:

1. In gravel pits, or any other excavations;
2. Along streams or lakes;
3. Within a flood plain; or,
4. Within 50 feet of a private water supply well or 100 feet of a public water supply well.

Stockpiles are classified as either short-term or permanent, depending on how long the manure is stored. Manure may not be stockpiled for more than nine months at short-term stockpile locations. In general, short-term manure stockpiles must be located such that runoff from the location does not discharge to surface water or ground water. The size of the short-term stockpile is limited to what the crop in the land application area will require for nutrients.

Short term stockpiles

The same short-term stockpile location cannot be used from year to year. All of the accumulated manure must be removed from the location within nine months of being stockpiled and spread on cropland at agronomic rates. A vegetative cover must be established on the stockpile location for one full growing season before the location can be used to stockpile manure again.

Short-term manure stockpiles may not be located:

1. Within 100 feet of any down-gradient surface water, or conduits to surface water;
2. On land with slopes greater than six-percent;
3. On land with slopes between two and six percent unless cleanwater diversions and erosion control practices are installed;
4. In areas of soil map units where the soil texture to a depth of five feet is coarser than sandy loam, as defined by Natural Resource Conservation Service (NRCS) soil survey maps;
5. In areas of soil map units where there is less than two feet of separation between the base of the stockpile and the depth to the seasonal high water table, as defined by NRCS soil survey maps.

Permanent Stockpiles

Manure stockpiled for more than nine months must be stored at a permanent stockpile location. Manure stockpiled at permanent locations must be stored in a containment area to prevent waterborne pollutants in manure from running off into surface water, or from leaching into ground water.

The subsurface containment to protect ground water is achieved by in situ soils, constructed earthen pads, or other types of manufactured liners, depending on the results of the soil investigation.

The runoff containment to protect surface water is achieved by clean water diversions and containment dikes. They are designed for a 25-year, 24-hour rainfall event.

The scope of the soil investigation for the subsurface containment of a permanent manure stockpile is dependent on the size and location of the containment area. A minimum of three soil borings shall be completed within the boundaries of the containment area, or one soil boring per acre, whichever is greater. The borings need to be at least ten feet below the bottom of pad.

The department can provide assistance in choosing the boring locations. Permanent manure stockpiles located in the following areas may require additional soil boring information:

1. Overlying or located within 1 mile of a defined glacial drift aquifer;
2. Overlying a sensitive ground water area, as defined by the department;
3. Where soil map units have sandy loam, loamy sand, or sand or gravel textural classes, as defined by NRCS soil survey maps;
4. Where a water supply well is screened at a depth within 30 feet of the ground surface;
5. Within $\frac{1}{4}$ mile of a neighboring private water supply well, within $\frac{1}{2}$ mile of a non-community public water supply well, or within 1 mile of a community public water supply well;
6. Within a delineated wellhead or source water protection area.

In situ (in place) soils may provide adequate subsurface containment for permanent manure stockpiles if the following conditions exist at the location:

1. There is a continuous layer of soil classified as CL or CH material (based on the Unified Soil Classification System) verified by laboratory testing using ASTM D-2487. The soil layer must be at least 4 feet thick;
2. The location does not overlie a sensitive groundwater area, as defined by the department, or in a delineated wellhead or source water protection area; and,
3. There is at least two feet of separation between the base of the stockpile and the depth to the seasonal high water table.

Laboratory tests of the in situ soils must be completed to determine the Atterberg limits and sieve analyses showing the grain sizing. These tests must be provided to the department and include the location and depth of the soil samples. When required by the department, permeability testing shall be completed on the in situ soils by either:

1. An on-site permeability test using standard ASTM methods; or,

2. Laboratory testing of thin-walled tube samples, provided proper ASTM methods of collection are testing are used.

Earthen pads can be used for subsurface containment at locations where in situ soils are not adequate to protect ground water. Earthen pads are to be constructed as follows:

1. With a minimum of twelve inches of compacted cohesive soil;
2. With soils that have a liquid limit of 30 percent or greater, a plasticity index greater than 10 (a range from 15 to 30 is preferable) and 30 percent or more (preferably 50 percent or more) of the material shall pass through a # 200 mess screen, as tested by ASTM D-2487;
3. Be compacted with the moisture content in the range of 1% dry of optimum to 3% wet of optimum;
4. Be placed in minimum of two lifts that are approximately 6 inches thick after compaction with sheep-footed rollers to achieve the desired thickness;
5. Remove frozen soils or rocks greater than 3 inches in diameter from the material prior to compaction;
6. Achieve 90 percent of standard proctor density. The density must be verified to ASTM D-2922, at a frequency of one sample per 5,000 square feet; and,
7. Maintain a minimum of two feet of separation between the finished bottom of the pad to the seasonal high water table. Greater separation distances may be required in sensitive ground water areas.

Other impervious materials may be used for subsurface containment, as approved by the department. Synthetic, geosynthetic or other liners shall be installed according to manufacturer specifications. Synthetic liners shall not be used alone, but must be used in conjunction with a self-sealing liner material, or a leak detection system to protect against seepage in the event of a tear or puncture.

5.4.4. Confinement Barns with Earthen Floors

This section addresses such confinement facilities as hoop barns, poultry barns, monoslope barns, bedded pack barns and open housing sheep and swine confinement barns. Depending on the results of the soil investigation, it may be necessary to construct an impermeable floor of compacted soil, or other materials, to protect ground water quality.

The impact on ground water quality from the nitrogen pollutants in litter or bedding that infiltrate the barn floor depends on the underlying soil type. Sandy soils have rapid permeability that allows nitrate to move quickly through the soil to ground water (leaching), while loamy or clay soils have slower permeability that helps retain nitrate in the soil profile.

The depth to the seasonal water table is also important for ground water quality protection. The saturated soil below the water table does not treat or retain manure pollutants as well as unsaturated soil above the water table. The impermeable floor needed in barns to protect ground water can be achieved by in situ soil, compacted soil, or alternative materials, depending on the results of the soil investigation.

The scope of the soil investigation for the impermeable floor of a poultry or hoop barn is dependent on the size and location of the proposed building site. Larger facilities, or those located in vulnerable hydrogeologic settings, generally require more information to adequately evaluate the site. Smaller facilities, or those located in less vulnerable hydrogeologic settings, generally require less information. A minimum of three soil borings shall be completed within the boundaries of the proposed building site, or one soil boring per acre, whichever is greater.

The department can provide assistance in choosing the boring locations. Proposed building sites located in the following areas may require additional soil boring information:

1. Overlying or located within 1 mile of a defined glacial drift aquifer;
2. Overlying a sensitive ground water area, as defined by the department;
3. Where soil map units have sandy loam, loamy sand, or sand or gravel textural classes, as defined by NRCS soil survey maps;
4. Where a water supply well is screened at a depth within 30 feet of the ground surface;
5. Within $\frac{1}{4}$ mile of a neighboring private water supply well, within $\frac{1}{2}$ mile of a non-community public water supply well, or within 1 mile of a community public water supply well; or,
6. Within a delineated wellhead or source water protection area.

In situ (in place) soils may provide an impermeable floor for poultry or hoop barns if the following conditions exist at the proposed building site:

1. There is a continuous layer of soil classified as CL or CH material (based on the Unified Soil Classification System) verified by laboratory testing using ASTM D-2487. The soil layer must be at least 4 feet thick;
2. The location does not overlie a sensitive groundwater area, as defined by the department, or in a delineated wellhead or source water protection area; and,
3. There is at least two feet of separation between the CL or CH layer and the depth to the seasonal high water table.

Laboratory tests of the in situ soils must be completed to determine the Atterberg limits and sieve analyses showing the grain sizing. These tests must be provided to the department and include the location and depth of the soil samples. When required by the department, permeability testing shall be completed on the in situ soils by either:

1. An on-site permeability test using standard ASTM methods; or,
2. Laboratory testing of thin-walled tube samples, provided proper ASTM methods of collection are testing are used.

Compacted soil can be used for an impermeable floor at proposed building sites where in situ soils are not adequate to protect ground water. Compacted soil floors are to be constructed as follows:

1. With a minimum of twelve inches of compacted cohesive soil;
2. With soils that have a liquid limit of 30 percent or greater, a plasticity index greater than 10 and 30 percent or more of the material shall pass through a # 200 mess screen, as tested by ASTM D-2487;
3. Be compacted with the moisture content in the range of 1% dry of optimum to 3% wet of optimum;
4. Be placed in minimum of two lifts that are approximately 6 inches thick after compaction with sheep-footed rollers to achieve the desired thickness;
5. Remove frozen soils or rocks greater than 3 inches in diameter from the material prior to compaction;
6. Achieve 90 percent of standard proctor density. The density must be verified to ASTM D-2922, at a frequency of one sample per 5,000 square feet; and,
7. Maintain a minimum of two feet of separation between the finished bottom of the pad to the seasonal high water table. Greater separation distances may be required in sensitive ground water areas.

8. Six inches of native soil should be placed over the compacted soil floor for protection; and,
9. The compacted soil floor must not become saturated at any time during the service life of the barn.

Other materials may be used for impermeable floors, as approved by the department. Synthetic, geosynthetic, or other materials shall be installed according to manufacturer specifications. Synthetic liners shall not be used alone, but must be used in conjunction with a self-sealing material, or a leak detection system, to protect against leakage in the event of a tear or puncture.

The condition of barn floors must be inspected after each cleaning to ensure that the integrity of the impermeable floor is maintained. Any cracks or joints in alternative impermeable floors must be sealed prior to use, and after each cleaning.

5.5. Inlet, Outlet and Transfer Facilities

Inlet, outlet and transfer facilities refer to piping, valving, pumps, mobile tanks or any other equipment used to move manure from one location to another.

Equipment used for the transfer of manure shall be corrosion resistant and designed to protect against freezing and puncture from ice during winter conditions.

Splash pads or aprons made of concrete or riprap shall be used to prevent erosion of pond liners at inlet structures. Splash pads shall have a surface area of no less than 6 square feet.

Transfer pipes shall be sloped to allow for good drainage without plugging and have clean-out ports every 200 feet and at all junctions, or other provisions to clear blockages.

Provisions shall be made for backflow prevention, such as top loading into storage structures or installing an air valve to prevent a siphon. Check valves used solely to prevent backflow shall not be used; however, they can be used in conjunction with other backflow prevention methods.

Manure storage structures shall have provisions which allow for emptying the manure from the structure. This may include access ramps or ports and may also require platforms for equipment such as pumps or agitation equipment. Only piping that allows for transfer to manure storage, hauling or spreading equipment shall be allowed. Earthen storage ponds shall have provisions for emptying that will prevent damage to the liner. Driving of pumps and equipment directly on the liner is not acceptable.

There shall be no outlet that can automatically release manure from the storage structure. Valves that are under pressure from manure storage structures shall be locked to prevent accidental discharge.

5.6. Diversions

Clean water diversions shall be used to ensure that clean water is diverted, as appropriate, from the production area (away from concentrated livestock areas and manure storage areas).

Dirty water diversions are used to route manure laden water and runoff to containment structures and shall be designed and constructed to prevent an exceedance of applicable water quality standards.

Diversions shall be constructed of relatively impervious material and be adequately designed to form a stable structure. The diversion shall be designed to carry runoff from a 25-year, 24-hour rainfall event for the watershed that it drains and have, at a minimum, an additional 0.3 feet of freeboard. The ridge height of the diversion shall have a minimum settlement factor of 10 percent. The ridge shall have a minimum top width of 4 feet.

Side slopes should not be steeper than 3 horizontal : 1 vertical, and slopes of 6 horizontal:1 vertical are recommended where diversions must be crossed with equipment.

The channel grade shall be designed such that the velocity will not cause excess erosion for the type of soil and planned vegetation or lining. The maximum acceptable channel velocity shall range from 2 feet per second for sandy soils with no vegetation to 3.5 feet per second for channels with high clay soils and vegetation.

Proper maintenance shall be used to maintain the diversion's ridge height, capacity, designed cross section, stabilizing vegetation and, if applicable, storage capacity.

5.7. Water Spreading

Water spreading systems are a method of containing and utilizing runoff from open lot facilities.

The water spreading system shall, at a minimum, be able to contain the anticipated runoff volume from a 25-year, 24-hour rainfall event. Nutrients in the runoff shall be utilized by the crops grown within the water spreading area.

The nutrients in the runoff shall be evaluated based on sampling of the livestock lot runoff or on published values of nutrient concentration in runoff. These values can be found in sources such as the USDA NRCS Agricultural Waste Management Field

Handbook, Table 4 -9 “Nitrogen Content of Cattle Feedlot Runoff” or other sources approved by the department.

Annual Rainfall	Below-average Conditions	Average Conditions	Above-average Conditions
	lb N/acre-in		
< 25 in	360	110	60
25 to 35 in	60	30	15
> 35 in	15	10	5

The soils within the water spreading area shall be sampled for nitrogen and phosphorous prior to installation of the system. Soils shall be sampled at a minimum of once every three years of operation to determine if there is an excess buildup of nutrients in the soil, and the records shall be maintained on file.

If soils show a trend of high nutrient concentrations, or if ground water within the vicinity shows impacts attributable to the system, alternative measures to control the manure and runoff shall be implemented.

Sites located in a sensitive ground water area (see attached Figure 1) will be considered on a case-by-case basis for water spreading systems.

The system shall be designed to ensure: (1) the runoff is distributed over the water spreading area, and (2) nutrients are properly utilized. If the soils and topography are inadequate to ensure proper distribution of runoff and utilization of nutrients, the site is not acceptable.

5.8. Other Methods of Manure Treatment or Manure Handling Systems

Other methods of manure treatment or manure handling systems such as anaerobic lagoons, aerobic lagoons, anaerobic digesters, etc. will be reviewed on a case-by-case basis and based on industry standard specifications. The department shall be consulted on these systems prior to final design completion.

SECTION 6. OPERATION AND MAINTENANCE

6.1. Objective

Facilities requiring a permit pursuant to NDAC Chapter 33.1-16-01 or NDAC Chapter 33.1-16-03.1 shall be operated and maintained so they continue to operate as designed. Particular attention shall be paid to: (1) the handling and storage of manure and process wastewater, (2) measures to prevent the unplanned release of manure, and (3) dead animal disposal. Chemicals and other contaminants handled on site shall not be disposed of in any manure storage or treatment system, unless it is designed for that purpose. In addition, specific records shall be maintained to document the implementation and management of the minimum elements needed for operation.

6.2. Required Operation, Maintenance and Inspections

1. CAFOs shall conduct the following routine visual inspections of the production area:
 - a. Weekly inspections of all storm water diversion devices, runoff diversion structures and devices channeling runoff to the manure storage structure;
 - b. Daily inspection of water lines, including drinking water or cooling water lines; and
 - c. Weekly inspections of the manure storage structures noting the level of liquid in the structure as indicated by the depth marker.
2. All open manure storage structures shall: (1) maintain a depth marker which clearly indicates the minimum capacity necessary to contain the runoff and direct precipitation from a 25-year, 24-hour rainfall event, or (2) a depth marker which clearly indicates the minimum capacity necessary to contain the runoff and direct precipitation from a 100-year, 24-hour rainfall event for swine, chicken, turkey and veal calf operations constructed after the effective date of December 1, 2004;
3. Any deficiencies discovered during the inspections listed in item 1 above shall be corrected as soon as possible;
4. Chemicals or other contaminants handled on site shall not be disposed of in a structure used for storage or treatment of manure, process wastewater or storm water unless it is specifically designed for that purpose; and
5. The operator of a facility requiring a permit under this chapter or under NDAC 33.1-16-01 should maintain a rain gauge at the production area and record measurable rainfall events.

6.3. Utilization of Manure Other Than Land Application

1. If manure, litter or process wastewater is not land applied, it shall be either beneficially reused (e.g., as fuel for energy production, compost, etc.) or properly disposed of in a landfill.
2. CAFOs shall keep records of how the manure, litter, or process wastewater was reused or disposed. The records shall include the date, location, volume of manure and the method of reuse or disposal.
3. Manure is generally prohibited from being disposed of in a landfill; however, in certain circumstances, the department can allow for such disposal if the landfill owner agrees.

6.4. Livestock Mortality Disposal

Livestock mortality shall be disposed of in a manner acceptable to the Board of Animal Health and in accordance with NDCC Section 36-14-19. Livestock mortality shall be disposed of in areas that will not discharge into waters of the state and where they will not detrimentally impact air quality. Livestock mortality shall not be disposed of in any structure used to store or treat liquid manure, process wastewater, or storm water unless the department-approved system is designed for such a purpose.

6.5. Records Required to be Maintained

Each CAFO shall maintain on site complete copies of the information listed below and a copy of the most current nutrient management plan. These documents shall be made available to department personnel upon request. This information shall be maintained for a period of five years from the date created. The CAFO must make the following records available to the department for review upon request:

1. Records documenting the visual inspections (Section 6.2.1);
2. Weekly records of the depth of the manure and process wastewater in the liquid manure storage structure as indicated by the depth gauge in the storage structure;
3. Records documenting any actions taken to correct deficiencies (Section 6.2.3). Deficiencies not corrected within 30 days must be accompanied by an explanation of the factors preventing immediate correction;
4. Records of mortalities management and practices used (Section 6.4);
5. Records documenting the current design of any manure storage structures,

including solids accumulation volume, design treatment volume, total design volume and the approximate number of days of storage capacity;

6. Records of the date, time and estimated volume of any overflow; and
7. Records documenting the land application of manure (Section 7.7).

6.6. Operation and Maintenance (O&M) Plans and Standard Operating Procedures (SOPs)

Operation and maintenance plans mean a written description of the equipment, methods and schedules for: (1) inspection, monitoring, operation and maintenance of the animal feeding operation (manure storage structures, water pollution control structures and the production area); and (2) controlling water pollution and air pollution including odors sufficient to protect the environment and public health. Standard operating procedures are instructions indicating the proper manner to complete a specific task.

1. CAFOs shall have written O&M plans for routine maintenance and inspections of the manure handling system. These shall include, but are not limited to, manure storage structures, diversions, water pollution control structures, and transfer and land application equipment.

General site inspections should note any areas where seepage, erosion, rodent infestation or degradation may be occurring at all manure handling system structures, diversions, and transfer and land application equipment.

The plans shall describe how manure will be sampled and tested.

2. The department may specify that a facility have written SOPs for other situations related to the proper operation of the manure handling system. The department may require SOPs for activities where a specific protocol is needed to ensure good quality or timely results, such as sampling or testing; or for situations where a facility has had problems or compliance issues due to lack of maintenance or improper operation. If required by the department, these SOPs may include, but are not limited to:
 - a. The sampling and testing of any water wells or monitoring wells;
 - b. Any testing necessary to determine if manure may be impacting waters of the state; and
 - c. Any emergency procedures for an unplanned release of manure including an overflow or breach of a manure storage structure.

3. When required to be completed, SOPs shall include the following information:
 - a. A description of the planned action;
 - b. The equipment needed for each action and its availability;
 - c. The frequency each action will be performed;
 - d. Scheduled downtime for the facility, if any; and
 - e. Any necessary prior arrangements with contractors.

6.7. Odor Control

For facilities that are experience excessive odors, BMPs should be used to reduce the extent of odors. Examples of effective BMPs are the following:

1. Straw covers for manure storage ponds;
2. Synthetic covers for manure storage ponds;
3. Windbreaks, either natural or manmade or;
4. biofilters for ventilated animal housing

Proper manure management is an important factor in odor reduction. Properly maintained pens will result in fewer odor concerns. Pens should be scraped periodically and stockpiled correctly in order to reduce odors. When applying manure to fields, follow the application rates set forth in the facility's NMP. Immediate incorporation may reduce odors from manure application.

When an odor complaint is received by the department, an odor reading may be taken at the site of the complaint by certified department inspectors who have successfully completed a department odor certification course. The odor measurement may be taken only with a properly maintained scentometer in the manner described in NDCC 23.1-06-15(3). If a violation is measured by a certified department inspector, the department will require the establishment of an odor management plan.

An odor management plan should identify potential odor sources, determine control strategies to reduce these odors, and establish criteria for implementing these strategies. The odor management plan must include methods and practices that will be used to minimize air emissions resulting from the facility or manure storage areas, measures to be used to mitigate air emissions, and a complaint response protocol describing the procedures the owner will use to respond to complaints filed against the facility.

After implementing the odor management plan, if another odor violation is recorded by two inspectors taking two readings each, at least 15 minutes apart but no more than two hours apart, enforcement action may be taken.

According to NDCC Section 23.1-06-15(4), a person is exempt from any odor violations while spreading or applying animal manure to land in accordance with a NMP approved by the department.

Once application is completed, if odors persist, a violation may be recorded.

SECTION 7. NUTRIENT MANAGEMENT PLANS

7.1. Objective

The objective of the Nutrient Management Plan is to ensure manure, including bedding, litter, waste feed and process wastewater, and runoff from animal areas is land applied to crop or grass land at a rate the nutrients will be utilized by the vegetation grown. The manure shall be handled in a manner so as not to impact waters of the state, exceed air quality standards while it is stored on site, and minimize odors to residences or public areas during land application.

The department understands the Nutrient Management Plan is based on estimated realistic yield goals which can vary depending on weather conditions. Manure and soil sampling as well as record keeping, are necessary to verify proper land application of manure.

7.2. General Conditions

1. Manure, process wastewater and runoff shall be collected and stored in such a manner that it will not:
 - a. Drain into surface waters, including lakes, streams, ditches, channels or other waterways that convey concentrated water flow;
 - b. Detrimentially impact groundwater; or
 - c. Cause air quality violations.

Manure collection and storage shall comply with the design requirements of Section 5.

2. Manure shall be transported in a manner where it will not leak or spill on to public roads or into areas where it could enter surface or ground water.
3. Manure shall be land applied at rates where the nutrients will be used by the crop grown. These rates shall be expressed in tons or gallons of manure, litter, and process wastewater to be land applied. Land application shall not impact waters of the state and precautions shall be used to minimize odors to residences or public areas where people may be present.

7.3. Nutrient Management Plan Information

Facilities requiring a Nutrient Management Plan pursuant to NDAC Chapter 33.1-16-01 or NDAC Chapter 33.1-16-03.1 shall include the following information in their current Nutrient Management Plan:

1. The type of livestock, number of days per year they are on site, an estimate of the volume of manure generated, and the information on which the estimate was based;
2. A description of the manure handling at the facility, including how often manure is cleaned from the livestock areas and how and where manure may be temporarily stored;
3. An aerial photograph/map and a soil map of the site where manure is to be applied;
4. Fields where manure will be applied during frozen conditions shall be identified;
5. Current and/or planned plant production sequence or crop rotation. Also include alternative crops that may be planted;
6. Complete nutrient budget for nitrogen and phosphorous for the rotation or crop sequence that considers all potential sources of these nutrients;
7. Results of field specific soil, plant, water, manure or organic by-product sample analysis. Nutrient planning shall be based on current field specific soil and manure test results and developed in accordance with NDSU Extension Service guidance. Soil and manure tests are considered current if they are no older than three years for livestock facilities that require a Nutrient Management Plan or one year for CAFOs;
8. Quantify all nitrogen and phosphorus sources;
9. Recommended nitrogen and phosphorous rates, timing, method of application and incorporation;
10. The form of manure (liquid or solid) and the expected frequency of land application. Maximum application rates of manure, litter, and process wastewater for each year, for each crop identified in the NMP with rates expressed in chemical form and pounds per acre for each field used for land application. For example, the application of manure can vary from once-a-year, every other year, or twice a year depending on the nutrient utilization of the crop and the amount of nutrients already present in the soil;
11. Location of sensitive areas or resources such as water ways, drainage ways, wellhead or source water protection areas, high water table areas, residences or public areas and the associated manure-handling or nutrient management restrictions;

12. Guidance for implementation, operation, maintenance and record keeping;
13. A field-specific assessment of the potential for nitrogen and phosphorous transport from the field to surface waters. The assessment shall address the form, source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing nitrogen and phosphorous movement to surface waters;
14. Precautions that will be used to prevent manure from impacting surface water, exceeding air quality standards while it is stored on site, and causing excess odors to nearby residences or public areas when manure is land applied;
15. A description of the land application manure records that will be maintained to document the minimum Nutrient Management Plan requirements are met;
16. Realistic yield goals for the crops in the rotation. These goals shall be established based on soil productivity information and historic yield data from the farm land or county wide average. If the yield goal exceeds NDSU Extension Service or NRCS recommendations or is 20 percent higher than county record or historical crop yield data, the reasons for the increased yield goal shall be documented. For new crops or varieties, industry yield recommendations may be used until documented yield information is available in the area of the facility;
17. BMPs implemented to manage nutrients as efficiently and effectively as possible; and
18. The name of the individual who developed the Nutrient Management Plan and the organization with which he/she is affiliated.

7.4. Sampling and Testing of Manure and Soil

1. Soil samples shall be collected and prepared according to NDSU Extension Service guidance. Laboratories shall use testing procedures accepted by NDSU to perform soil sample analyses.
2. Soil testing shall include analyses for soil organic matter, nitrogen, and phosphorous. If there is concern about heavy metals or salts, the department may require testing of the soil for these materials.
3. Manure samples shall be collected and prepared according to NDSU Extension Service guidance or industry standard methods, as approved by the department. Manure testing shall include analyses for nitrogen, ammonia, and phosphorous.
4. If the operator uses feed or feed additives with high concentrations of salts or heavy metals, the department may require the manure be tested for these

materials. The same is true if there is a reasonable expectation that the manure might contain elevated salts, metals or other potentially harmful materials.

5. Manure to be land applied shall be sampled from each manure storage structure that holds manure from separate types of livestock or from similar types of livestock in different phases of growth.
6. Facilities identified by the department as needing nutrient management plans shall have their manure and the soil where manure is being applied tested in accordance with items 1-5 once every three years. CAFOs shall have their manure and the soil where manure is being applied tested in accordance with items 1-5 each year.

7.5. Application Rates to Meet Nutrient Requirements

1. The manure application rate, expressed in pounds of nitrogen or phosphorus, shall not exceed the recommendations for nitrogen and phosphorous based on either the North Dakota Phosphorous Index (PI), as developed by the NRCS, or NDSU Extension Service recommendations based on soil testing.
2. The PI allows manure and other sources of nutrients to be applied at rates to meet the nitrogen needs of a crop if the PI rating is low or medium. If the PI is high, it allows manure and other sources of nutrients to be applied at rates to meet the phosphorous removal in the crop biomass. If the PI is very high, it requires that no manure be applied to that field. Manure shall not be applied to fields where the soil test phosphorous exceeds 125 parts per million (ppm) (250 lbs per acre).
3. Manure and other sources of nitrogen must not be applied at rates that exceed:
 - a. The recommended nitrogen application rate during the year of application;
or
 - b. The estimated nitrogen removal in harvested plant biomass for legumes during the year of application.
4. Nutrient Management Plans shall contain a field-specific assessment of the potential for nitrogen and phosphorous transport from the field. The assessment for phosphorous can be done using the phosphorous screening tool and soil tests, or the PI assessment.

7.6. Precautions to Prevent Surface Water and Air Quality Impacts

1. When land applying manure, the operator shall use reasonable judgment and take adequate precautions to prevent surface water impacts and minimize odors

to nearby residences and public areas. Land application shall not occur during rainfall events, except to prevent the catastrophic failure of a storage structure.

2. On land controlled by the operator, manure shall not be applied closer than 100 feet to any down-gradient surface waters, open tile line intake structures, sinkholes, agricultural well heads or other conduits to surface waters, unless:
 - a. A 35-foot wide vegetated buffer on which there are no applications of manure is used;
 - b. The facility's owner/operator demonstrates that a setback or buffer is not necessary because implementation of alternative conservation practices or field-specific conditions will provide pollutant reductions equal to or greater than the reductions achieved by the 100-foot setback.
3. When irrigating with manure or runoff water the application rate shall not exceed the estimated soil infiltration rate, or the nutrient requirements of the crop. Irrigation application rates shall be adjusted to avoid significant ponding of manure or process waste water in surface depressions or seasonal drainage ways.
4. Manure shall be injected or incorporated within eight hours if applied within 1/2 mile of an occupied residence (other than the owner's residence), building or public area where people may be present. The operator shall be required to inject or incorporate the manure into the soil if manure is applied in a manner such that it causes an odor reading, for two or more days within a 10-day period, (as measured with a scentometer) of 7 or greater within 100 feet of an occupied residence, building or public area. A plan to minimize excess odors will be required before future application of manure in this area.
5. Manure shall not be applied to frozen, snow covered or saturated soils if there is a likelihood of runoff. However, manure can be land applied during frozen conditions provided it is applied on land where runoff is contained and does not drain off during spring runoff. The department recommends operators consider land with slopes of less than 6 percent, where there is stubble or vegetative cover and less than 8 inches of snow on the ground surface. Conservation measures such as terraces, contour strips and reduced tillage effective at reducing runoff.

Other factors to consider are permit requirements, contract agreements, or other legally binding requirements that do not allow the application of manure to frozen ground.

6. When manure is being land applied, the equipment operator shall periodically inspect equipment for leaks. This shall be done daily for trucks or tanks used to

handle solid or liquid manure. For an umbilical cord system or irrigation system, a measurement device shall be used to continuously check pressure so leaks can be found and pumps shut down immediately.

7.7. Record Retention

1. Owners/operators of facilities requiring a permit pursuant to NDAC Chapter 33.1-16-01 or NDAC Chapter 33.1-16-03.1 shall maintain on site a copy of the Nutrient Management Plan, the facility design plan for the manure handling system and any other required information listed in items 2, 3 and 4 below. The plan and information shall be available to the department for review upon request.
2. CAFOs shall maintain complete copies of the following information on site for a minimum of five years from the date they are created:
 - a. The crops grown and expected realistic crop yields;
 - b. The date(s) manure, litter or process waste water is applied to each field;
 - c. Weather conditions at time of application and for 24 hours prior to and following application;
 - d. Test methods used to sample and analyze manure, litter, process wastewater and soil;
 - e. Results from the annual testing of the manure, litter, and process wastewater, and annual soil sample results for land where manure was applied that year;
 - f. An explanation of how the manure application rates were determined in accordance with the standards established by the department;
 - g. Calculations showing the total nitrogen and phosphorus to be applied to each field, including sources other than manure, litter or process wastewater;
 - h. Total amount of nitrogen and phosphorus actually applied to each field, including documentation of calculations for the total amount applied;
 - i. The method used to apply the manure, litter or process wastewater;
 - j. Inspection of manure application equipment including method, frequency, dates and repairs made if leaks were found; and

- k. Setbacks, vegetated buffers or other alternative practices used when land applying manure near surface water or potential conduits to surface water.
3. If manure is transferred from a CAFO to other persons or entities not associated with the facility, the following conditions shall apply, and records shall be maintained:
- a. Owners/operators shall provide the recipient of the manure, litter or process wastewater with the most current nutrient analysis prior to transfer;
 - b. The analysis provided shall be consistent with the requirements of Section 7.4; and
 - c. The owners/operators of the CAFO shall retain records for five years after the transfer date documenting the recipient's name and address, the approximate amount of manure transferred, and the date the manure was transferred.
4. A facility which is not a CAFO and requires department review under NDAC Chapter 33.1-16-03.1, shall maintain complete copies of the following information on site for a minimum of three years from the date created:
- a. The crops grown and realistic crop yields;
 - b. The date(s) and rates manure, litter or process wastewater is applied to each field;
 - c. Test results of manure, litter, and process wastewater, that are not more than three years old, and test results of the soil where manure was applied that are not more than three years old;
 - d. Setbacks, vegetated buffers or other alternative practices used when land applying manure near surface water or potential conduits to surface water.

7.8. Back-flow Prevention

Irrigation equipment used to apply manure shall have back-flow prevention to stop manure from siphoning back into the irrigation source water.

SECTION 8. GROUND WATER MONITORING

8.1. Objective

The department may require ground water monitoring at livestock facilities to:

1. Define the hydrogeologic characteristics of the site (e.g., ground water elevation, ground water flow direction, ground water quality); and
2. Evaluate potential impacts to ground water quality resulting from the facility's operations.

Questions regarding ground water sampling can be directed to the department. Additional information regarding well installation and ground water sampling is presented in the department's *Guidelines for Installing Ground Water Monitoring Wells at Confined Livestock Facilities* (North Dakota Department of Health, July 2001).

8.2. Ground Water Monitoring Program for Livestock Facilities

The department may require a ground water monitoring program be implemented for facilities that meet any of the conditions listed in Section 4.3.1 and at sites where alternative manure-handling systems are used in lieu of containment ponds or structures (e.g., water spreading systems).

8.3. Ground Water Monitoring Plan

Facilities requiring ground water monitoring shall submit a Ground Water Monitoring Plan (GWMP) to the department for review and approval prior to commencement of animal feeding operations. The GWMP shall describe the proposed well locations, the SOPs that will be followed during well installation and sampling and the proposed analytical program.

8.4. Well Location and Installation

A ground water monitoring network for a facility consists of wells on or near the site from which water samples can be collected to determine ground water elevation, flow direction and quality. The ground water monitoring network shall consist of a minimum of three wells. Generally, one well shall be located up gradient, and two wells shall be located down gradient of the facility's livestock and manure storage structures. Additional monitoring points may be required by the department to detect any changes in water quality resulting from a facility's operations.

All ground water monitoring wells shall be installed by a state-certified monitoring well or water well contractor and shall be constructed in accordance with NDAC Chapter 33.1-18-02 (Ground Water Monitoring Well Construction Requirements). All monitoring

wells shall be surveyed at:

1. The elevation of the ground surface at the well locations;
2. The elevations of the top of the well casing; and
3. The well locations in relation to each other and any manure storage areas.

The elevation data shall either be reported in feet above mean sea level or referenced to an arbitrary site benchmark.

With prior department approval, ground water monitoring can be conducted by using existing on-site wells that supply water to the facility, provided information is available to evaluate whether or not the wells were constructed in a manner that will accomplish the objectives of this section.

8.5. Ground Water Monitoring Frequency and Sampling Parameters

8.5.1. Sample Frequency

To evaluate the background water quality for new facilities, a minimum of two sampling events shall be conducted prior to commencement of facility operations and on-site storage of manure. A sampling event consists of one sample collected from each ground water monitoring well. The sampling events should be conducted at least two weeks apart, if feasible.

The ground water monitoring wells shall be sampled a minimum of two times per year while the facility is operating. The department may require more frequent sampling if necessary. For example, additional sampling may be required at sites located within a sensitive ground water area, when the wells are initially installed at a site (to determine background water quality) or when sample results indicate the facility may be impacting ground water. The department may specify the months during which sampling shall be done.

Following two years of monitoring, the department may consider reducing the sampling frequency if requested by the owner. The department will evaluate all ground water monitoring data prior to making such a determination.

8.5.2. Ground Water Sample Collection Procedures

Ground water samples shall be collected following department-approved SOPs, which include implementation of appropriate quality assurance and quality control (QA/QC) practices. The SOPs will be implemented to minimize the potential for cross-contamination of monitoring wells, ensure the collection of a representative ground water sample, and establish a chain of custody to maintain sample integrity during

transportation to a laboratory.

8.5.3. Required Analysis

Ground water samples shall be analyzed by a laboratory certified by the department's Division of Chemistry. At a minimum, all samples shall be analyzed for:

1. Nitrate plus nitrite as nitrogen;
2. Ammonia;
3. Total kjeldahl nitrogen;
4. Chloride;
5. Sulfate; and
6. Laboratory specific conductance.

Additional parameters may be required by the department, based on site characteristics, facility operations and the locations of potential ground water receptors.

8.6. Data Reporting Requirements

Data that is required by the department shall be submitted and addressed to the department at: Division of Water Quality, 918 E. Divide Ave, 4th Floor, Bismarck, ND 58501-1947.

8.6.1. Well Completion Report

Well logs and completion data shall be submitted to the department on monitoring well report forms provided by the State of North Dakota Board of Water Well Contractors. A map indicating the surveyed locations of the wells shall also be included. Well elevation data can be included on the map or submitted in tabular format.

8.6.2. Ground Water Sample Data

All ground water sampling data shall be reported to the department by the last day of the month following the month the samples were collected. For example, if the samples were collected in March, the results shall be submitted to the department by April 30. The ground water sampling data submitted to the department shall include, but is not limited to:

1. A map showing well locations;

2. Depth to ground water data;
3. Well sampling forms;
4. A discussion of any deviation from the approved GWMP; and
5. Laboratory analytical reports (including laboratory QA/QC documentation).

8.7. Action Limits

The department has established two types of action limits for potential impacts to groundwater. They are “increased monitoring action limit” and “maximum level action limit.”

8.7.1. Definition of Established Action Limits

The “increased monitoring action limit” is 5 milligrams per liter above the average of the background samples for any of the following parameters: ammonia, total kjeldahl nitrogen and nitrate plus nitrite as nitrogen. The “increased monitoring action limit” for chloride or sulfate is 50 percent above the average of the background samples for either parameter.

The “maximum level action limit” is reached when three consecutive sample results are 10 milligrams per liter above the average of the background samples for ammonia and total kjeldahl nitrogen, or when three consecutive sample results are 10 milligrams per liter, or greater, for nitrate plus nitrite as nitrogen.

8.7.2. Exceedance of Established Action Limits

If a sample result from the monitoring wells exceeds any action limit, the department shall be notified by telephone within 48 hours. A written response shall be sent to the department within five working days. At a minimum, the information provided to the department shall include:

1. Completed well data sampling form;
2. Analytical results;
3. Description of monitoring well condition;
4. Date and time of sample collection; and
5. The name of the laboratory completing the analysis.

If one sample result of a groundwater monitoring well exceeds the increased monitoring

action limit, an additional sample from that well shall be taken within 30 days. The department may also require samples from other wells. If three consecutive sample results exceed the increased monitoring action limit, the facility shall, within 30 days of the last sample date, submit for department approval a plan to locate the source and determine the extent of contamination. This plan shall include a proposed time schedule from start to finish. The assessment shall be conducted by a person or consulting firm experienced in comprehensive environmental impact assessments.

If the contamination source is determined to be at the facility site, a plan shall be developed to stop or reduce the contamination from impacting ground water. The plan shall also include a time schedule for implementation. This plan must be approved by the department and be submitted within 60 days of determining the source of contamination.

If the maximum level action limit is reached, the department may require the facility to remove all manure from the area which has been determined to be the source of contamination. The department may also require that no additional manure be placed in this area until steps have been taken to upgrade the facility and mitigate the source of contamination. This upgrade must be approved by the department.

8.8. Treatment of Contamination and Closure of Site

If a facility is causing contamination to ground water, the department may require remediation.

If a facility will be closed, the owner/operator shall submit to the department a plan outlining the steps to close the facility in an environmentally safe manner.

8.9. Record Retention

All records pertaining to ground water monitoring shall be kept on file for five years.

SECTION 9. CORRECTIVE ACTIONS FOR AN UNPLANNED RELEASE OF MANURE

9.1. Objective

The objective of this section is to identify the corrective actions that should be initiated to protect waters of the state in the event of an unplanned release of manure. An unplanned release is manure that is released to the environment in a manner which is not identified in the Nutrient Management Plan for proper handling of manure and which exceeds the rate of nutrient uptake by plants. This shall include manure that is spilled from manure storage areas or transfer equipment on or off the production area or land application area. Also included will be any release of manure impacting ground water and resulting in an exceedance of established action levels.

9.2. Unplanned Release of Manure to Ground Surface

If there is an unplanned release of manure on to the ground surface, the following priorities shall be followed in addressing and cleaning up the release:

1. Protect individuals from the loss of life or health;
2. Prevent manure from reaching waters of the state;
3. Contain manure until it can be properly utilized or disposed of;
4. Properly utilize or dispose of the manure; and
5. Clean and restore the release area as needed.

9.3. Emergency Action Plan

If directed by the department, a facility shall develop an emergency action plan to address the unplanned release of waste. The plan shall include the SOPs for actions to take in the event of an unplanned release of manure from the storage area or transport equipment. The SOPs shall follow the priorities listed in Section 9.2 and include the following information:

1. The general locations where an unplanned release of manure is most likely to occur;
2. A description of the action to be taken;
3. The equipment needed for each action and its availability;
4. The names and addresses of contractors or individuals who may have equipment

needed;

5. Any necessary prior arrangements that have been made or need to be made with contractors or equipment owners; and
6. The names and addresses of people who may need to be notified such as downstream land owners, contacts for downstream communities or public areas, local law enforcement agency, fire department, ambulance, emergency management and the department.

9.4. Department Notification of Unplanned Release of Manure

If manure is released where it could directly reach surface or ground water and exceed established action levels, or if the release could endanger human health or the environment, the department shall be notified as soon as possible but within 24 hours. Notification shall be made by calling 701-328-5210 during normal working hours or by calling the Division of Emergency Services at 1-800-773-3259 during non-working hours (including weekends and holidays).

Notification to the department shall include: date, time, location, volume of manure released and actions taken to contain, utilize or properly dispose of the manure. A written report with the above information shall also be submitted to the department within five days of the release, along with a description of the actions taken to prevent a similar release in the future.

An unplanned release of manure may require an assessment to determine if the release could endanger human health or the environment. Contact the department, the local health unit or the county emergency manager for assistance.

If the volume of manure released will not directly impact waters of the state and does not pose an immediate danger to human health or the environment, the department does not need to be notified; however, records must be kept of the release.

9.5. Record Retention

If there is an unplanned release of manure from a facility which requires a permit under NDAC Chapter 33.1-16-01 or NDAC Chapter 33.1-16-03.1, records shall be kept which document the date, time, location, volume of manure released, and the action taken to contain the release, properly utilize or dispose of the manure and clean the site. The records shall be kept on site for a minimum of 3 years for AFOs and 5 years for CAFOs.

APPENDIX A - NDCC CHAPTER 36-14 CONTAGIOUS AND INFECTIOUS DISEASES GENERALLY

36-14-19. Disposition of carcass of animal dying from contagious or infectious disease.

Any animal which is found dead must be presumed to have died from a contagious or infectious disease until the contrary is shown unless another cause of death is apparent. The owner or person in charge of any domestic animal or nontraditional livestock which dies within this state from or on account of any contagious or infectious disease shall dispose of the carcass of such animal as follows:

1. If the animal died of anthrax, as determined by a licensed veterinarian, the carcass must be completely burned at the place where it died if possible. If the carcass must be moved, it may not be dragged over the ground but must be moved only on a suitable conveyor and all body openings in the carcass must be plugged with cotton saturated with a strong antiseptic solution.
2. If the carcass is of a hog which died from hog cholera or swine erysipelas, the same, with hide intact, must be burned within thirty-six hours or given to a licensed rendering plant within such time.
3. If the carcass is of an animal which has died of a disease other than is specified in subsections 1 and 2, or from any other cause, it must be burned, buried, composted, or given to a licensed rendering plant within thirty-six hours, or must be disposed of by a method approved by the state veterinarian. If the carcass is buried, it must be buried not less than four feet [1.22 meters] below the surface of the ground and covered with dirt to that depth. No carcass may be disposed of along any public highway or along any stream, lake, or river nor buried near or adjoining any such place.

The State Veterinarian and the Board of Animal Health can be contacted at:

701-328-2655

APPENDIX B – RAINFALL AND RUNOFF FOR 25-YEAR, 24-HOUR EVENT

ND Supplement to NEH, Part 651 - AWMFH

TABLE 1

Rainfall and Runoff for 25-Year, 24-Hour Storm in North Dakota

Rainfall County (Inches)	Runoff in Inches		Rainfall County (Inches)	Runoff in Inches	
	Unpaved Lot	Paved Lot		Unpaved Lot	Paved Lot
Adams (3.6)	2.5	3.0	Mercer (3.6)	2.5	3.0
Barnes (4.0)	2.9	3.4	Morton (3.7)	2.6	3.1
Benson (3.8)	2.7	3.2	Mountrail (3.6)	2.5	3.0
Billings (3.5)	2.5	2.9	Nelson (3.9)	2.8	3.3
Bottineau (3.7)	2.6	3.1	Oliver (3.7)	2.6	3.1
Bowman (3.5)	2.5	2.9	Pembina (3.9)	2.8	3.3
Burke (3.5)	2.5	2.9	Pierce (3.7)	2.6	3.1
Burleigh (3.8)	2.7	3.2	Ramsey (3.8)	2.7	3.2
Cass (4.1)	3.0	3.5	Ransom (4.1)	3.0	3.5
Cavalier (3.8)	2.7	3.2	Renville (3.6)	2.5	3.0
Dickey (4.1)	3.0	3.5	Richland (4.2)	3.1	3.6
Divide (3.5)	2.5	2.9	Rolette (3.7)	2.6	3.1
Dunn (3.6)	2.5	3.0	Sargent (4.2)	3.1	3.6
Eddy (3.8)	2.7	3.2	Sheridan (3.7)	2.6	3.1
Emmons (3.9)	2.8	3.3	Sioux (3.8)	2.7	3.2
Foster (3.9)	2.8	3.3	Slope (3.5)	2.5	2.9
Golden Valley (3.5)	2.5	2.9	Stark (3.6)	2.5	3.0
Grand Forks (3.9)	2.8	3.3	Steele (4.0)	2.9	3.4
Grant (3.7)	2.6	3.1	Stutsman (3.9)	2.8	3.3
Griggs (3.9)	2.8	3.3	Towner (3.8)	2.7	3.2
Hettinger (3.6)	2.5	3.0	Traill (4.0)	2.9	3.4
Kidder (3.8)	2.7	3.2	Walsh (3.9)	2.8	3.3
LaMoure (4.0)	2.9	3.4	Ward (3.6)	2.5	3.0
Logan (3.9)	2.8	3.3	Wells (3.8)	2.7	3.2
McHenry (3.7)	2.6	3.1	Williams (3.5)	2.5	2.9
McIntosh (4.0)	2.9	3.4			
McKenzie (3.5)	2.5	2.9			
McLean (3.7)	2.6	3.1			

ND651.10(5)

(210-vi-AWMFH, ND Supplement 651.10, July 2003)

APPENDIX C – RAINFALL AND RUNOFF FOR 100-YEAR, 24-HOUR EVENT

Table 1 – North Dakota Counties

County	<u>Rainfall</u> in Inches	<u>Runoff in Inches</u>		County	<u>Rainfall</u> in Inches	<u>Runoff in Inches</u>	
		Unpaved Lot	Paved Lot			Unpaved Lot	Paved Lot
Adams	4.6	3.5	4.0	McLean	4.7	3.6	4.1
Barnes	5.1	4.0	4.5	Mercer	4.7	3.5	4.1
Benson	4.8	3.7	4.2	Morton	4.7	3.6	4.1
Billings	4.5	3.4	3.9	Mountrail	4.6	3.5	4.0
Bottineau	4.7	3.6	4.1	Nelson	4.9	3.8	4.4
Bowman	4.5	3.4	3.9	Oliver	4.7	3.6	4.1
Burke	4.6	3.4	4.0	Pembina	4.9	3.8	4.3
Burleigh	4.8	3.7	4.2	Pierce	4.8	3.6	4.2
Cass	5.2	4.1	4.6	Ramsey	4.9	3.7	4.3
Cavalier	4.8	3.7	4.3	Ransom	5.2	4.1	4.6
Dickey	5.2	4.0	4.6	Renville	4.6	3.5	4.0
Divide	4.5	3.4	3.9	Richland	5.4	4.3	4.8
Dunn	4.6	3.5	4.0	Rolette	4.7	3.6	4.2
Eddy	4.9	3.8	4.3	Sargent	5.3	4.2	4.7
Emmons	4.9	3.8	4.3	Sheridan	4.8	3.7	4.2
Foster	4.9	3.8	4.4	Sioux	4.8	3.7	4.2
Golden Valley	4.4	3.3	3.9	Slope	4.5	3.4	3.9
Grand Forks	5.0	3.9	4.4	Stark	4.6	3.5	4.0
Grant	4.7	3.6	4.1	Steele	5.3	4.2	4.7

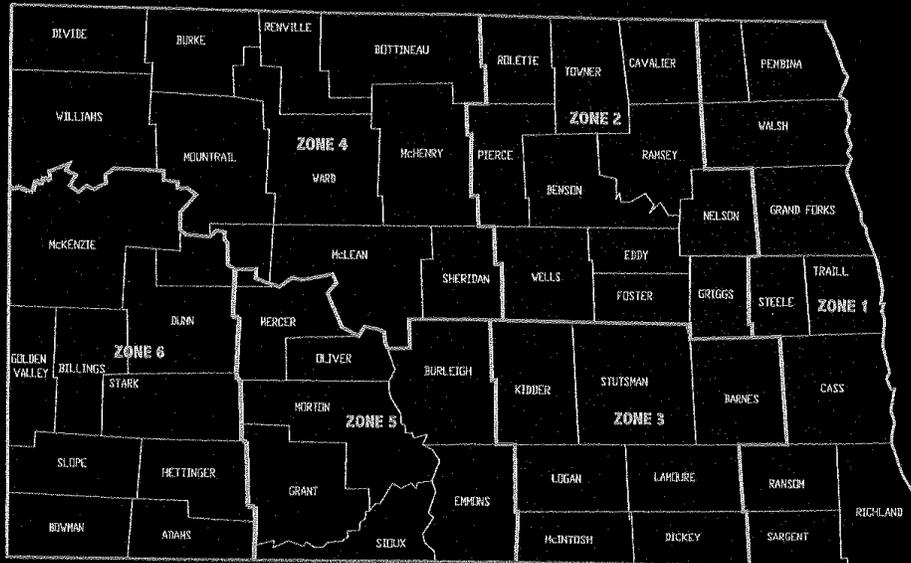
Table 1 – North Dakota Counties

Griggs	5.0	3.9	4.4	Stutsman	5.0	3.9	4.4
Hettinger	4.6	3.5	4.0	Towner	4.8	3.7	4.2
Kidder	4.9	3.7	4.3	Traill	5.1	4.0	4.5
LaMoure	5.1	4.0	4.5	Walsh	4.9	3.8	4.3
Logan	5.0	3.9	4.4	Ward	4.7	3.5	4.1
McHenry	4.7	3.6	4.1	Wells	4.8	3.7	4.2
McIntosh	5.0	3.9	4.4	Williams	4.5	3.4	3.9
McKenzie	4.5	3.4	3.9				

APPENDIX D – DESIGN RUNOFF ZONES

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TABLE 2
Design Runoff Zones



RUNOFF (Inches)

Zone	Oct 15 - April 30	May	Jun	Jul	Aug	Sep	Oct	Yearly
1	0.7	0.5	0.8	0.9*	0.8	0.7	0.2	4.6
2	0.6	0.5	0.8*	0.7	0.6	0.6	0.2	4.0
3	0.6	0.5	0.7	0.8*	0.6	0.5	0.2	3.9
4	0.6	0.5	0.7*	0.7	0.5	0.5	0.1	3.6
5	0.4	0.5	0.7*	0.4	0.4	0.2	0.1	2.7
6	0.4	0.5	0.9*	0.5	0.4	0.3	0.1	3.1

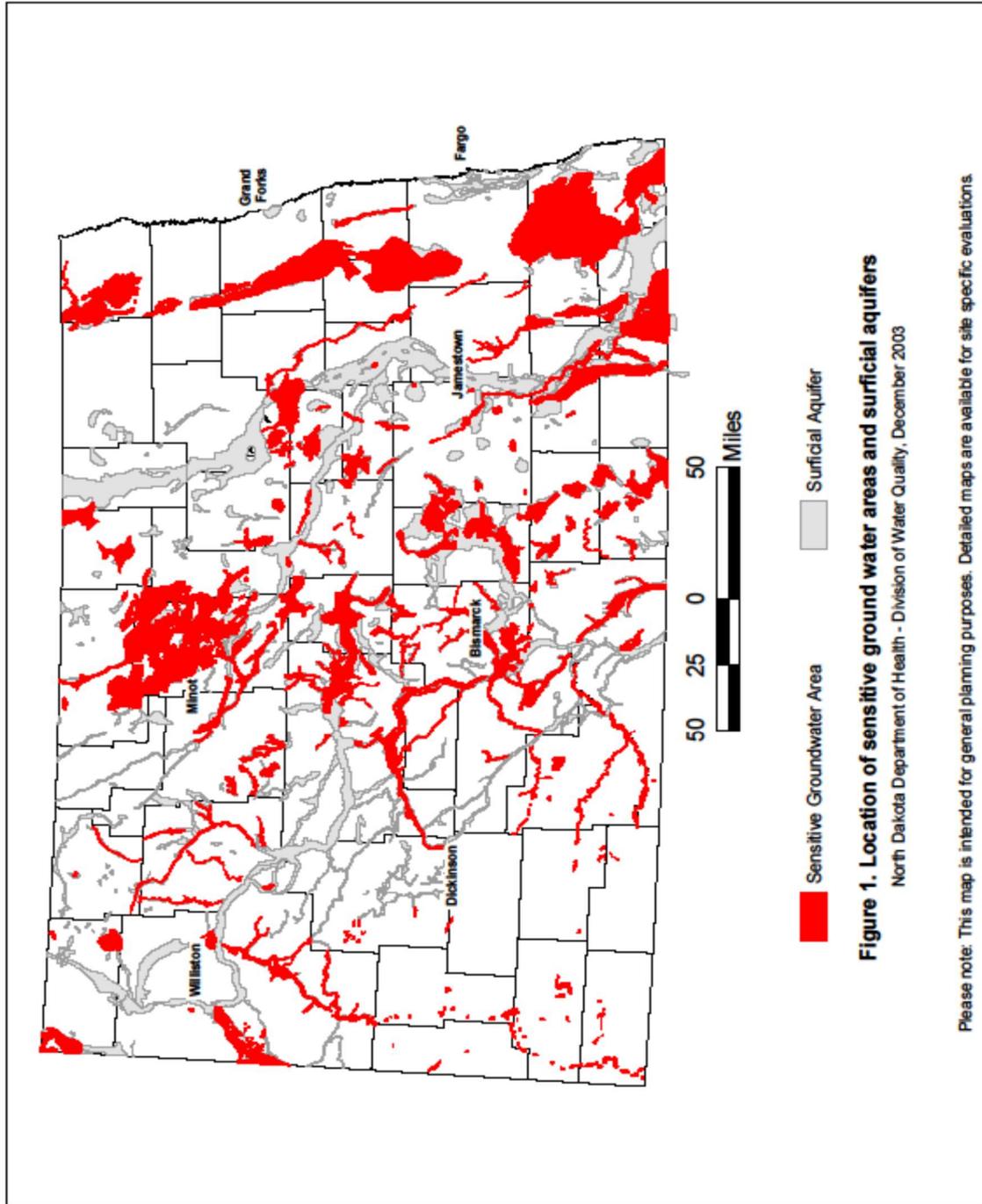
*Note that for each zone, the October 15 to April 30 runoff value is less than that shown for either June or July. In Zone 6, the June runoff is more than twice that for October 15 to April 30. Therefore, if the October 15 to April 30 value is used, pumping will be required more often to have available capacity for the 25-year, 24-hour storm runoff.

ND651.10(6)

(210-vi-AWMFH, ND Supplement 651.10, July 2003)

APPENDIX E – MAPS

1. Location of sensitive ground water areas and glacial drift aquifers.



2. Location of wellhead and source water protection areas for public water systems.

