

RESOLUTION 2007-07

RESOLUTION ADOPTING LOCAL PERFORMANCE STANDARDS FOR AGRICULTURE TO IMPROVE AND PROTECT GROUNDWATER QUALITY AND FOR THE HEALTH AND SAFETY OF THE PUBLIC

To the Honorable Chair and Board of Supervisors of Calumet County, Wisconsin:

| | |
|--|-------------------------------------|
| Motion: | Adopted: <input type="checkbox"/> |
| 1 st _____ | Lost: <input type="checkbox"/> |
| 2 nd _____ | Tabled: <input type="checkbox"/> |
| Yes: _____ No: _____ | Absent: _____ |
| Number of votes required: | |
| <input checked="" type="checkbox"/> Majority | <input type="checkbox"/> Two-thirds |
| Reviewed by: _____ | Pamela Captain Corp Counsel |

WHEREAS, Wisconsin State Statute §92.15 allows counties to adopt local performance standards for livestock operations that exceed performance standards, conservation practices, and technical standards found in Wisconsin Administrative Code NR151 by demonstrating that the regulations are necessary to achieve State water quality standards, and

WHEREAS, Wisconsin State Statute §93.90 allows counties to adopt local performance standards for regulating new and expanding livestock operations that exceed the performance standards found in Wisconsin Administrative Code ATCP 51 by basing the local standards on reasonable and scientifically defensible findings of fact that clearly show that they are necessary to protect public health or safety.

WHEREAS, The Calumet County Board of Supervisors has reviewed and considered the Final Report of the Northeast Wisconsin Karst Task Force, dated February 9, 2007, the April 17, 2007 presentation by Eugene McLeod, County Conservationist, pertaining to Groundwater Quality in Calumet County and Local Performance Standards for Agriculture to Improve and Protect Groundwater Quality and other documentation made part of the record herein and has heard and received public input on adopting local performance standards for agriculture necessary to improve and protect groundwater quality and for the health and safety of the public.

NOW, THEREFORE BE IT RESOLVED, That the Calumet County Board of Supervisors finds that a pure and safe groundwater resource is necessary for the health and safety of County residents and visitors and to the economic health of businesses and industries within the County, including the dairy and livestock industries.

BE IT FURTHER RESOLVED, That the Calumet County Board of Supervisors finds testing of water from private wells in the County in the past four (4) years has indicated that 47% of over 1,200 tested wells contained water that exceeded Wisconsin groundwater water quality standards for nitrates and/or bacteria and was considered to be unsafe to drink.

BE IT FURTHER RESOLVED, That the Calumet County Board of Supervisors finds the majority of the wells with unsafe water are located in areas of the County that have been mapped as being more susceptible to groundwater contamination from

| | YES | NO | A |
|--------------|-----|----|---|
| 1 BALLERING | | | |
| 2 BARRIBEAU | | | |
| 3 BROCK | | | |
| 4 CONNORS | | | |
| 5 CRITER | | | |
| 6 DRAHEIM | | | |
| 7 DIETZEN | | | |
| 8 GENTZ | | | |
| 9 KOENIG | | | |
| 10 KRAUSE | | | |
| 11 LAUGHRIN | | | |
| 12 LEHRER | | | |
| 13 LEONHARDT | | | |
| 14 PHIPPS | | | |
| 15 SCHOLZ | | | |
| 16 SCHWOBE | | | |
| 17 SCHUH | | | |
| 18 SOMMERS | | | |
| 19 STANKE | | | |
| 20 STECKER | | | |
| 21 STILLMAN | | | |

land use on the ground surface because of thin soils, bedrock openings, sinkholes and similar land features that are direct conduits to groundwater.

BE IT FURTHER RESOLVED, That the Calumet County Board of Supervisors finds the transport, storage, land application, and runoff of manure, fertilizers, and other wastes from livestock operations in these susceptible areas has contributed significantly to these groundwater quality problems.

BE IT FURTHER RESOLVED, That the Calumet County Board of Supervisors finds that the accompanying Local Performance Standards for Agriculture to Improve and Protect Groundwater Quality are needed in Calumet County to protect public health and safety and to help meet State groundwater quality standards.

BE IT FURTHER RESOLVED, That the Calumet County Board of Supervisors finds that it is necessary in order to protect public health and safety that the local standards apply in areas of the County that are more susceptible to groundwater contamination, as shown on the accompanying map of Groundwater Protection Areas in Calumet County, and

BE IT FURTHER RESOLVED, That adherence to the Local Standards for Groundwater Protection be promoted by Calumet County through education, cost-sharing incentives, and regulations.

Dated this 19th day of June 2007.

**INTRODUCED BY THE LAND &
WATER CONSERVATION COMMITTEE**

Patrick Laughrin, Chair

Bill Barribeau

Jerry Criter

Donald Sommers

Jerry Koenig

**AND
THE BOARD OF HEALTH**

James Stecker, Chair

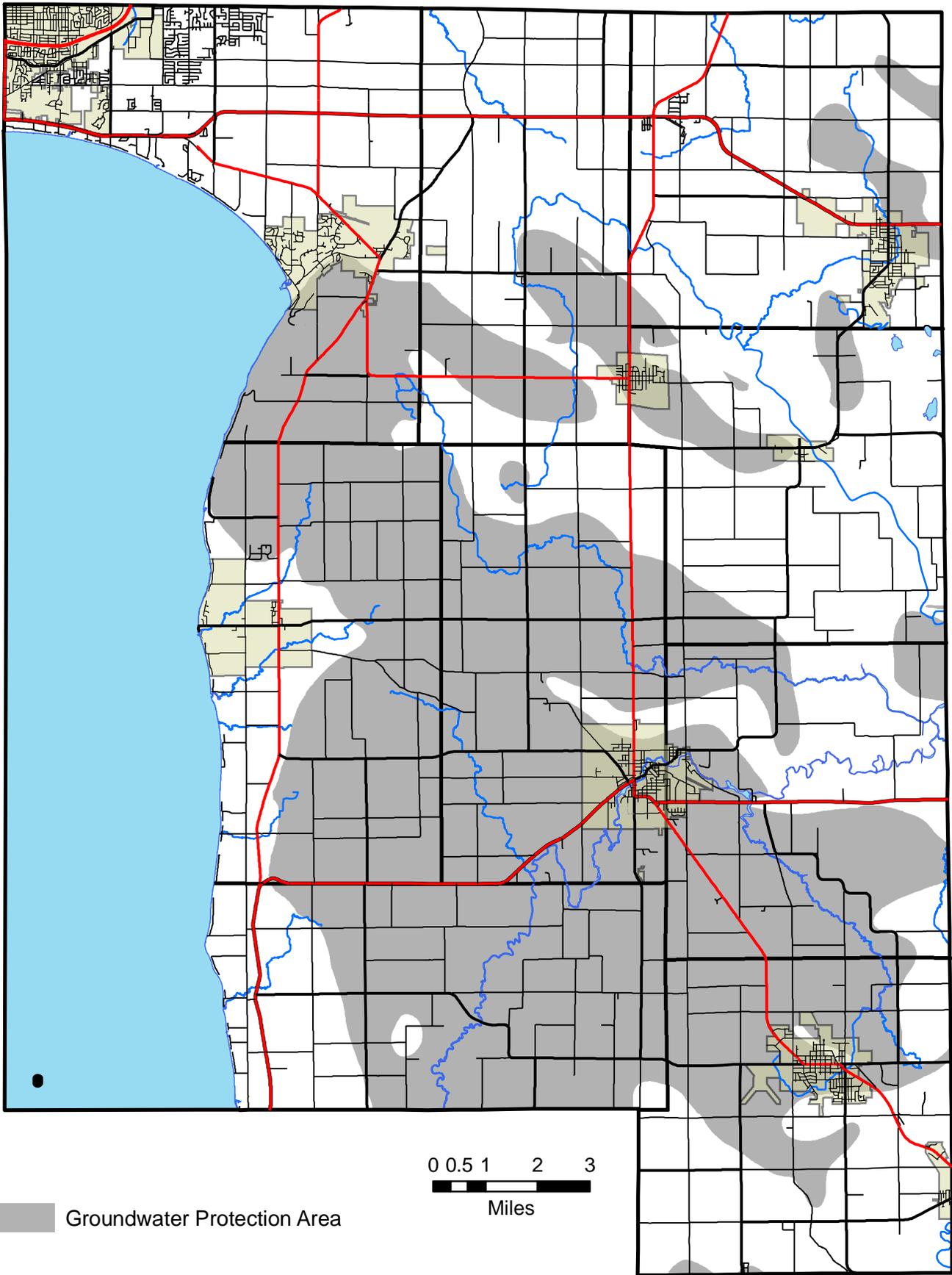
Alice Connors

Patrick Laughrin

Kristopher Krause

COUNTERSIGNED BY

Merlin Gentz, County Board Chair



Calumet County Groundwater Protection Area

Calumet County
Land & Water Conservation Department
Based on WGNHS Susceptibility Data



LOCAL PERFORMANCE STANDARDS FOR AGRICULTURE TO IMPROVE AND PROTECT GROUNDWATER QUALITY

The appropriate performance standards, prohibitions, and best management practices in Wisconsin Administrative Codes NR 151, ATCP 50, and ATCP 51 shall be met and used by agricultural producers throughout the County to prevent delivery of manure and other pollution from manure storage facilities, unconfined manure piles, animal lots, milking centers, and land applications of manure to groundwater and surface land features directly connected to groundwater. The following more stringent local performance standards, prohibitions, and best management practices shall also be met and used by all agricultural producers within specified Groundwater Protection Areas of Calumet County.

Polluted Runoff and Leachate

- There shall be no delivery of polluted surface runoff from manure storage facilities, feed storage facilities, unconfined manure piles, animal lots, milking centers, and land applications of manure to groundwater, wells, or to land features connected to groundwater. The land features include sinkholes, bedrock openings, and areas of focused infiltration within closed depressions. Polluted runoff from these sources observed entering land features connected to groundwater will be presumed to be entering the groundwater.
- There shall be no delivery of polluted leachate from manure storage facilities, feed storage facilities, unconfined manure piles, animal lots, milking centers, and land applications of manure to groundwater.

Sinkholes and Bedrock Openings

- Waste materials shall not be dumped into sinkholes and bedrock openings.
- Drain tiles shall not outlet directly into sinkholes and bedrock openings.
- There shall be no deliberate diversion of surface runoff into sinkholes and bedrock openings.
- There shall be no cropping directly on or within sinkholes and bedrock openings. At least one of the following best management practices shall be used on cropland adjacent to sinkholes and bedrock openings to reduce polluted runoff from entering them.
 - Establish and maintain a minimum width of 100 feet of permanent vegetative cover around sinkholes and bedrock openings
 - Vegetative cover shall be planted and maintained according to NRCS Technical Standard 342, Critical Area Planting.
 - Establish and maintain an alfalfa and/or grass cover on cropland within 100 feet of sinkholes or bedrock openings in at least 4 years out of every 6 consecutive years.
 - Use reduced tillage on upslope cropland areas within 100 feet of sinkholes or bedrock openings, leaving at least 30 % crop residue on the soil surface after crop harvest and planting.
 - Divert surface runoff away from sinkholes and bedrock openings using berms, tiles, ditches, or grass waterways.
 - Properly close sinkholes according to NRCS Technical Standard 725, Sinkhole Treatment.

Animal Lots and Milking Centers

- Clean water runoff from land surfaces and buildings shall be diverted away from contacting animal lots located within a water quality management area.
- There shall be no discharge of untreated animal waste from animal lots and untreated milking waste from milking centers that are located on sites susceptible to groundwater contamination. Discharges include waste infiltrating into the soil or moving horizontally in surface runoff. Best management practices shall be used to treat or contain the wastes. The owner or operator of the lot or center shall choose one or more practices from a site specific list of practices approved by the LWCD, to treat or contain wastes from the site. If a NRCS Technical Standard exists for a practice, the practice shall be designed, constructed, and maintained according to the applicable Technical Standard.
- Design specifications for new or substantially altered animal lots shall include documentation of a site assessment for each lot and potential waste water treatment strip as prescribed by NRCS Technical Standard 561, Heavy Use Area Protection and NRCS Technical Standard 635, Wastewater Treatment Strip. In addition, soil borings for the site assessment shall be made to at least 5 feet below the surface of proposed and existing animal lots.

Unconfined Manure Piles

- The following standards apply to unconfined manure piles located anywhere within the Calumet County Groundwater Protection Area, including piles located within animal lots, pastures, and cropland.
- Unconfined manure piles shall not be located in water quality management areas.
 - This requirement shall be implemented on the effective date of a County ordinance by large livestock operations under a County licensing ordinance or WPDES permit and livestock facilities with existing manure storage facilities
 - This requirement will be phased in as follows by all other livestock operations and facilities:
 - A written stacking plan shall be developed and followed for all unconfined manure piles in water quality management areas within 3 years after the effective date of a County ordinance.
 - The plan shall be developed by a person deemed qualified by the LWCD and must be reviewed and approved by the LWCD.
 - The plan shall describe at a minimum specific sites where the pile will be located, maximum period for the pile, maximum volume of the pile, and best management practices to be implemented to reduce the potential for contamination of groundwater by waste infiltrating into the soil or moving horizontally in surface runoff.
 - There shall be no unconfined manure piles when a manure storage facility becomes available, not to exceed 10 years after the effective date of a County ordinance prohibiting the piles.
- All unconfined manure piles located outside of water quality management areas shall meet the following requirements:
 - Maximum period for a pile at one site is 8 months
 - Maximum volume for a pile is 15,000 cubic feet

- Maximum frequency for a pile at one site is 1 year out of 3 years.
- Soils underneath piles shall be in hydrologic soil group B or C (See USDA-NRCS *Soil Survey of Calumet and Manitowoc Counties* or website <http://websoilsurvey.nrcs.usda.gov/app> to determine).
- Soil surface underneath a pile shall have a vertical separation of at least 3 feet from seasonal high water table
- Land slope down gradient of a pile shall be 3 % or less

Manure Storage Facilities and Feed Storage Facilities

- Design specifications for Waste Storage Facilities and Manure Transfer Systems shall include documentation of a site assessment for each facility and system as prescribed by NRCS Technical Standard 313, Waste Storage Facility and NRCS Technical Standard 634, Manure Transfer.
- All manure storage facilities built prior to the existence of a Calumet County manure storage permitting ordinance (1989) shall be inspected by a registered engineer or certified engineering practitioner for structural integrity and leakage. The inspecting engineer or practitioner shall provide written certification to the LWCD that the facility meets one of the requirements for existing facilities in Wisconsin Administrative Code ATCP51.18(2).
 - If the facility is part of a large livestock operation under a County licensing ordinance and the facility cannot or does not receive such certification, the facility shall be upgraded according to NRCS Technical Standard 313, Waste Storage Facility and NRCS Technical Standard 634, Manure Transfer or closed according to NRCS Technical Standard 360, Closure of Waste Impoundments.
 - If the facility is part of all other livestock operation and the facility cannot or does not receive such certification, the facility shall be upgraded or closed according to the preceding NRCS standards or visually inspected for obvious leaks or structural failure. Such inspections shall take place at least once every 2 years or each time it is emptied, whichever is a shorter period. The inspections shall be conducted by a person deemed qualified by the LWCD and inspecting person shall submit a written report to the LWCD on his or her findings. If the facility is found to be leaking or lacking structural integrity, the facility shall be upgraded according to NRCS Technical Standard 313, Waste Storage Facility and NRCS Technical Standard 634, Manure Transfer or closed according to NRCS Technical Standard 360, Closure of Waste Impoundments.
- A qualified person shall develop a written environmental incident response plan for new and substantially altered manure storage facilities to minimize potential and actual pollution of groundwater from failure, leakage, and overflow of the facilities.
- Closure of a manure storage facility shall occur when an operation where the facility is located ceases operations, or when manure has not been added or removed from the facility for a period of 24 months. Closure of the facility shall be in accordance with the most recent version of NRCS Technical Standard 360, Closure of Waste Impoundments. The owners or operator may retain the facility by meeting conditions in Wisconsin Administrative Code NR 151.05(3).
- Manure storage facilities that pose an imminent threat to public health from groundwater pollution or are causing violation of groundwater standards shall be upgraded, replaced, or abandoned in accordance with the most current version of NRCS Technical Standards.

- New or substantially altered manure storage facilities for livestock operations that require a Wisconsin DNR WPDES permit or require a permit under the Calumet County livestock licensing ordinance shall have a volume capacity of at least 9 months storage of manure, based on the amount of manure generated on an annual basis by the livestock operation.
- New manure storage and feed storage facilities shall be setback a horizontal distance of at least 400 feet from sinkholes, bedrock openings, and areas of focused infiltration within closed depressions. If the most current version of NRCS Technical Standard 313, Manure Storage specifies greater setback distances, they shall be followed instead.
- Clean water runoff from land surfaces and buildings shall be diverted away from contacting manure storage facilities and feed storage facilities located within a water quality management area

Land Applications of Manure and Nutrient Management

- A qualified person shall identify and map observable sinkholes, bedrock openings, closed depressions, areas of focused infiltration within closed depressions, wells, areas with soils with a soil depth of less than 3 feet to bedrock, and areas with soils with a soil depth of at least 3 feet and 5 feet or less to bedrock prior to land applications of manure. Areas shall be determined by the most accurate method available, such as field observations, borings, or from NRCS soils maps.
- A qualified person shall develop a written environmental incident response plan for the transport and land application of manure to minimize potential and actual pollution of groundwater from spills and manure moving off site from where it was applied.
- There shall be no land applications of manure on soils with a soil depth of less than 3 feet to bedrock. Land applications of other nutrient sources that are non-pathogenic to humans are allowed on these soils if they are applied in accordance with a nutrient management plan. The plan must be developed according to NRCS Technical Standard 590, Nutrient Management and Wisconsin Conservation Technical Note WI-1.
- Land applications of manure on soils with a depth of at least 3 feet and 5 feet or less to bedrock shall not exceed 7,000 gallons per acre of liquid manure, 17.5 tons per acre of solid manure, or ½ of the manure volume or weight that supplies the needed nutrients called for in a nutrient management plan. The plan must be developed according to NRCS Technical Standard 590, Nutrient Management and Wisconsin Conservation Technical Note WI-1.
 - A maximum of 2 such applications are allowed on an annual basis on these soils and the applications must be separated by a time period of at least 2 weeks. An alternative rate or method of application that provides equivalent groundwater protection may be used with prior written approval and an approved spreading plan from the LWCD.
- There shall be no land applications of manure on or within 100 feet of sinkholes, bedrock openings, and areas of focused infiltration within closed depression and within 100 feet of delivery systems leading to these features. There shall be no land applications of manure within 100 feet of a private well and 1,000 feet of a municipal well. Land applications of other nutrient sources that are non-pathogenic to humans are allowed on these soils if they are applied in accordance with a nutrient management plan and are not directly on sinkholes, bedrock openings, and wells. The plan must be developed according to NRCS Technical Standard 590, Nutrient Management and Wisconsin Conservation Technical Note WI-1.
- There shall be no land applications of manure to saturated soils

- There shall be no land applications of manure to frozen ground, ice covered ground, or snow covered ground
 - This requirement shall be implemented immediately on the effective date of a County ordinance by large livestock operations under a County licensing ordinance or a WPDES permit and by livestock facilities with existing manure storage facilities that have a volume capacity of at least 5 months storage of manure based on the amount of manure annually generated by livestock at the facility.
 - This requirement shall be phased in as follows by all other livestock operations:
 - A written winter spreading plan shall be developed and followed for all land applications of manure on frozen ground, ice covered ground, or snow covered ground within 3 years after the effective date of an ordinance prohibiting it.
 - The plan shall be developed by a person deemed qualified by the LWCD and must be reviewed and approved by the LWCD.
 - The plan shall describe at a minimum specific areas where applications can occur, ground preparation for applications, and times, rates, and methods of applications.
 - There shall be no land applications of liquid manure to frozen ground, ice covered ground, or snow covered ground 5 years after the effective date of an ordinance prohibiting it.
 - There shall be no land applications of solid manure to frozen ground, ice covered ground, or snow covered ground 10 years after the effective date of an ordinance prohibiting it.
- Land applications of manure shall be incorporated immediately. The depth of incorporation shall not exceed 10 inches on soils with a depth of at least 3 feet and 5 feet or less to bedrock.
 - A variance to this requirement for manure applications to cropland with actively growing crops, to pasture lands, to cropland which is under a long term no-till system and to cropland which is subject to a winter spreading plan may be granted with prior written approval and an approved spreading plan from the LWCD. A long term no-till system is a cropping system in which no-tillage has been used in 3 consecutive years.
- Nutrient management plans required by County ordinance shall be updated annually and a copy of updated portion of the plan shall be submitted to the LWCD by June 1st of each year
- The locations of the following features shall also be clearly marked and labeled on nutrient management plan maps:
 - Observable sinkholes, bedrock openings, closed depressions, areas of focused infiltration within closed depressions and delivery systems leading to these features on or within 100 feet of land where land application of manure may occur
 - Private wells (including old unused wells) on or within 100 feet of land where applications of manure may occur and municipal wells on or within 1,000 feet of land where applications of manure may occur
 - Cropland areas with a soil depth of less than 3 feet to bedrock Areas shall be determined by the most accurate method available, such as field observations, borings, or from NRCS soils maps
 - Cropland areas with a soil depth of at least 3 feet and 5 feet or less to bedrock. Areas shall be determined by the most accurate method available, such as field observations, borings, or from NRCS soils maps

Technical Standards and Site Plans

- The most current version of NRCS technical standards and Wisconsin Conservation Technical Notes shall be used to meet all County ordinance requirements that refer to technical standards and notes.
- The locations of the following features shall also be clearly marked and labeled on site plans for livestock facilities:
 - Observable sinkholes, bedrock openings, closed depressions, areas of focused infiltration within closed depressions and delivery systems leading to these features on or within 100 feet of land where land application of manure may occur
 - Private wells (including old unused wells) on or within 100 feet of land where applications of manure may occur and municipal wells on or within 1,000 feet of land where applications of manure may occur
 - Cropland areas with a soil depth of less than 3 feet to bedrock. Areas may be determined by field observations, borings, or from NRCS soils maps
 - Cropland areas with a soil depth of at least 3 feet and 5 feet or less to bedrock. Areas may be determined by field observations, borings, or from soils maps in the USDA-NRCS *Soil Survey of Calumet and Manitowoc Counties, Wisconsin*.

DEFINITIONS FOR LOCAL PERFORMANCE STANDARDS FOR AGRICULTURE TO IMPROVE AND PROTECT GROUNDWATER QUALITY

Animal Lot – means an outdoor area, feedlot, barnyard, or facility where animals are confined and concentrated for feeding or other purposes.

Animal Waste – means the same as manure.

Animal Waste Storage Facility – means the same as manure storage facility.

Area of Focused Infiltration – means a land area within a closed depression where surface water ponds and infiltrates rapidly and relatively unfiltered downward into fractured bedrock.

Bedrock – means the top of the shallowest layer of a soil profile that consists of consolidated rock material or weathered-in-place material, more than 50% of the volume of which will be retained on a 2 mm soil sieve.

Bedrock Opening – means an area on the land surface where fractured bedrock is exposed.

Closed Depression – means a sunken or low-lying land area that has no surface drainage outlet and drains internally.

Deliberate Diversion – means diversion of surface water runoff via a man-made conveyance such as a ditch, waterway, or tile.

Delivery System – means a defined channel or concentrated flow path.

Environmental Incident Response Plan - means a written plan of action on response and reporting procedures for manure storage facility failures and overflows, manure spills during transportation and land application, and movement of manure during or after land application. It also may be called a spill response plan.

Feed Storage Facility – means a structure, building, silo, bunker, paved area, or land area used to store or handle animal feed.

Frozen Ground – means an area of land where the soil is frozen anywhere within the first 8 inches of soil depth or where the soil is frozen such that manure cannot be incorporated immediately.

Groundwater Protection Area of Calumet County – means a specific area within Calumet County where groundwater is particularly susceptible to contamination from land use activities on the land surface. The boundaries of the Groundwater Protection Area are available in map form from Calumet County LWCD and on the LWCD web site.

Ice Covered Ground - means an area of land where ice is present on the land surface.

Incorporated Immediately – means the mixing of manure with surface soil or subsurface placement of the manure during or within 4 hours of land applications so that at least 80 % of the applied manure is covered with soil and the manure application rate is controlled so that the manure stays in place and does not run off from where it was applied.

Land Application – means mechanical application of manure to the land using manure hauling vehicles or equipment. It does not mean manure deposited by grazing or pasturing animals on land areas dedicated to grazing or pasturing.

Liquid Manure – means manure with a solids content of less than 12% by volume

Livestock Operation – a farming operation that feeds, confines, maintains, or stables animals.

LWCD – means the Calumet County Land and Water Conservation Department

Manure – means livestock excreta and other materials, such as bedding, rain, waste water, soil, hair, feathers and other debris and organic waste normally included in animal waste handling operations.

Manure Storage Facility – has the same meaning as the definition of manure storage facility in Wisconsin Administrative Code NR151, Subchapter II, NR151.015. The area where manure is contained within a composting barn is also a manure storage facility.

Milking Center – a building or area where animals are milked.

Milking Center Waste - means all wastes generated from a milking center including waste milk, detergents, sanitizers manure, bedding materials, foot bath chemicals, and water used for processing and cleaning.

NRCS – means the United States Department of Agriculture Natural Resources Conservation Service

Qualified Person – A person who has attended a Calumet County Land and Water Conservation Department (LWCD) approved training course on the identification and mapping of sinkholes, bedrock openings, closed depression, and areas of focused infiltration within closed depressions and on manure management and environmental incident planning in landscapes with these features or a person who can demonstrate to the LWCD that they possess the equivalent knowledge and/or training from other sources.

Saturated Soils – soils in which all of the pore spaces are occupied by water or where any additional inputs of water or liquids from manure cannot infiltrate into the soil. A field technique to estimate whether the soil is saturated is to grab a handful of surface soil, form it into a ball within the hand, and squeeze it lightly. If water comes out of it, it is saturated. A field technique to estimate maximum rates for liquid manure applications on wet soils to avoid saturation from the applications is contained in Table 1 of NRCS Technical Standard 590, Nutrient Management.

Sinkhole - A depression or opening on the land surface, usually bowl or funnel-shaped, and generally formed by dissolution and collapse of limestone or dolomite bedrock at or just underneath the land surface. Sinkholes may be partially or completely filled with earth and debris. Fractures in bedrock beneath sinkholes often extend to the groundwater table.

Site That is Susceptible to Groundwater Contamination means any one of the following:

1. An area within 250 feet of a private well.
2. An area within 1,000 feet of a municipal well.
3. An area including and within 1,000 feet of a *sinkhole, bedrock opening, or area of focused infiltration* within a *closed depression*.

4. An area including and within 1,000 feet of a delivery system to a sinkhole, bedrock opening, or areas of focused infiltration within a closed depression..
5. An area where soil depth to bedrock or groundwater is 5 feet or less.

Snow Covered Ground – means an area of land where snow is present on the land surface.

Solid Manure – means manure with a solids content of 12% or more by volume

Unconfined Manure Pile – has the same meaning as the definition of unconfined manure pile in Wisconsin Administrative Code NR151, Subchapter II, NR151.015.

Untreated – refers to waste that is not collected or subjected to treatment process or conservation practice to capture or filter out pollutants in it or to reduce or eliminate runoff of waste and pollutants and their infiltration into the soil.

Waste Materials – means manure, milking center waste, and other organic and chemical waste from or generated by a livestock operation

Water Quality Management Area – has the same meaning as the definition in Wisconsin Administrative Code NR 151.002, except that “a site that is susceptible to groundwater contamination” is defined differently as follows:

Site That is Susceptible to Groundwater Contamination means any one of the following:

6. An area within 250 feet of a private well.
7. An area within 1,000 feet of a municipal well.
8. An area including and within 1,000 feet of a sinkhole, bedrock opening, or area of focused infiltration within a closed depression.
9. An area including and within 1,000 feet of a delivery system to a sinkhole, bedrock opening, or areas of focused infiltration within a closed depression..
10. An area where soil depth to bedrock or groundwater is 5 feet or less.

SCIENTIFIC RESEARCH, STUDIES, AND OTHER DOCUMENTS SUPPORTING CALUMET COUNTY LOCAL CONSERVATION STANDARDS TO IMPROVE AND PROTECT GROUNDWATER

Copies of the documents listed below are available for viewing in the Calumet County Clerk's Office on the first floor of the Calumet County Courthouse, 206 Court Street in Chilton during normal office hours.

Wisconsin Department of Health and Family Services, Division of Public Health. 2006. Manure Contamination of Rural Residential Wells. Human Health Hazards fact sheet.

"Common factors that can lead to contamination of residential wells include:"

- "Thin or sandy soils above fractured bedrock,"
- "Groundwater near the surface,"
- "Depressions where runoff water stands (or drains into the ground),"
- "Sink holes,"
- "Winter or early spring spreading of manure nearby (especially liquid manure),"
- "Winter and early spring rains or snow melt causing runoff from nearby fields,"

"When people drink water that is contaminated with manure they can become very sick. Bacteria and other organisms found in manure can cause many diseases. Some of the more familiar organisms include Cryptosporidium, E. coli 157-H7, and Salmonella. Common symptoms include diarrhea, nausea, cramps, or fever. When people bathe or shower in this contaminated water, it is less likely that they become ill. However, they can still get sick with ear and respiratory infections, skin rashes, and infections in open wounds."

"Contamination events make us aware of areas where groundwater quality is particularly at risk. Once we know about sensitive areas, local soil and water conservation and/or DNR staff can ensure that farmers applying manure follow safer land spreading practices, avoid manure applications in areas prone to groundwater contamination, and tightly control or prohibit other activities that can affect groundwater."

Erb, Kevin and Ron Stieglitz (editors). 2007. Final Report of the Northeast Wisconsin Karst Task Force, February 9, 2007.

"Relative vulnerability to contamination"

- "Extreme – Less than 5 feet (soil depth) to carbonate bedrock, and/or closed depressions or any drainage areas that contribute water to sinkholes/bedrock openings. Level of protection 1, requiring most protection"
- "High – 5 – 15 feet (soil depth) to carbonate bedrock. Level of protection 2."
- "Significant - >15 – 50 feet (soil depth) to carbonate bedrock. Level of protection 3."
- "Moderate – greater than 50 feet (soil depth) to carbonate bedrock. Level of protection 4."

"Frozen or snow covered ground and saturated soils. There is a high probability of groundwater contamination when manure is applied to frozen or snow covered ground or saturated soil in criteria 1, 2, and 3 (extreme, high, and significant vulnerability) areas."

Recommendations:

- “No applications of manure in these areas on frozen, snow covered, or saturated soils.”

“Soil depth restrictions. There is a high probability of groundwater contamination when manure is applied to soils in criteria 1 (extreme vulnerability) areas.”

Recommendations:

- “No applications of manure on land with less than 3 feet of soil to bedrock.”
- “Maximum application rates should be 3,000 gal/acre per application (or solid waste ton/ac. equivalent) with a maximum application rate of 6,000 gal/yr.”
- “Shallow incorporation (< 10 inches) of all wastes immediately after application on soils 3 to 5 feet to bedrock. No deep injection of manure.”
- “Incorporation of all wastes immediately after application in areas with >5 to 50 feet of soil to bedrock (high and significant vulnerability areas).”

“Setbacks and land draining to sinkholes, closed depressions, or bedrock. There is a high probability of groundwater contamination when manure is applied to land areas within closed depressions and within drainage areas that contribute runoff to sinkholes or bedrock openings (extreme vulnerability areas). Land areas near channels and concentrated flow paths that deliver runoff to closed depressions, sinkholes, and bedrock openings are the most critical to the quality of runoff water. No runoff or concentrated flow of liquid wastes.”

Recommendations:

- “No applications of wastes within 100 feet of sinkholes, bedrock openings, surface inlets, and areas of focused infiltration within closed depressions.”
- “No applications of wastes within 100 feet of delivery systems (defined channels or concentrated flow paths) to sinkholes, bedrock openings, surface inlets, and areas of focused infiltration within closed depressions.”
- “Incorporation of all wastes immediately after application in closed depressions, regardless of soil depth.”

“Requirements for persons who plan or conduct applications of animal wastes in shallow carbonate bedrock (<50 feet) areas.”

Recommendations:

- “In areas with less than 50 feet of soil to carbonate bedrock (extreme, high, and significant vulnerability areas):”
 - “Require field investigations to identify and map closed depressions, sinkholes, bedrock openings, bedrock outcrops, surface inlets, and areas of focused infiltration within closed depressions and drainage areas to these features during nutrient management planning.”
 - “Require a spill response plan for water storage, transport, and applications.”
 - “Require training on karst topography, spill response planning, and field identification of the above sensitive features.”

“Temporary, unconfined stacks of manure and derivatives. Areas with criteria 1 and 2 (extreme and high) vulnerability rankings have extreme or high susceptibility to groundwater contamination and therefore would meet the definition of Water Quality Management Area (WQMA) under NR 151. NR 151 states “a livestock operation shall have no unconfined manure pile in a WQMA”. Table 9 of USDA-NRCS Technical Standard 313, Animal Waste Storage Facility defines setback distances, waste

consistency, stack size, stacking period and frequency, and conservation BMP's for unconfined manure piles.”

Recommendations:

- “No unconfined manure piles on soil less than 15 feet deep to bedrock (extreme and high vulnerability areas).”
- “No unconfined manure piles within 1,000 feet of sinkholes, bedrock openings, surface inlets, and areas of focused infiltration within closed depressions.”
- “No unconfined manure piles with 1,000 feet of delivery channels to sinkholes, bedrock openings, surface inlets, and areas of focused infiltration within closed depressions.”
- “No delivery of runoff from unconfined manure piles to the hazards/sensitive features above. Unconfined manure piles in areas with >15 – 50 feet of soil (significant vulnerability areas) must meet the most protective criteria set forth in Table 9, NRCS Technical Standard 313 (12/05) for 16 – 32 % solids waste consistency under the categories of size and stacking period, hydrologic soil groups, and surface separation distance.”

“Waste and feed storage facilities. There is a significant risk of soil subsidence in areas with sinkholes, other karst features, and shallow soils over carbonate bedrock that could lead to groundwater contamination from waste or feed storages”

Recommendations:

- “Waste storages built before a certain date (left to local jurisdiction) and located in areas with less than 50 feet of soil to carbonate bedrock (extreme, high, and significant vulnerability areas) are to be inspected and certified by a qualified person. If not certified, they must be properly abandoned, upgraded, or inspected annually or when emptied by a qualified person.”
- “Animal waste storage facilities in the above areas should have a capacity of at least 9 months of waste generated.”
- “No manure or feed storage facilities within 400 feet of sinkholes, bedrock openings, surface inlets, and areas of focused infiltration within closed depressions.”

“Outside animal lots. Direct infiltration and runoff from outside animal lots is a significant contributor to groundwater contamination in areas with sinkholes, other karst features, and shallow soils.”

Recommendations:

- “No discharge of untreated waste from outside animal lots and feedlots or untreated milkhouse wastewater in areas with less than 15 feet of soil over carbonate bedrock (extreme and high vulnerability areas). The required BMP's to adequately treat waste generated from outside animal lots will be dependent on soil depth, number and type of animals, density of animals, etc. Appropriate treatment may range from low density/duration grazing to complete confinement and collection of water and runoff from outside animal lots. Other examples of BMP's include: wastewater treatment strips, diversions, heavy use protection, roof runoff structures, prescribed grazing, etc.”

“Karst features (sinkholes, bedrock openings). Dumping of waste materials or directing polluted runoff and tile discharge water to these features will cause groundwater contamination.”

Recommendations:

- “No dumping of waste materials into sinkholes and bedrock openings at the land surface.”
- “No drain tile outlets in sinkholes and bedrock openings at the land surface.”
- “No diverting or directing of surface runoff to these features.”
- “Presume that waste material or polluted runoff entering these features is reaching groundwater and is a source of groundwater contamination (for regulation purposes).”
- “Establish and maintain a permanent vegetative buffer that is at least 100 feet wide around sinkholes and bedrock openings at the land surface.”

Devito, Janet, Angela Pierce, Nicholas Reckinger, and Tracy Valenta. 2006. Groundwater Quality and Management in Northeast Wisconsin Areas with Shallow Aquifers: A follow up report to the 2006 Northeast Wisconsin Karst Task Force. UW – Green Bay Environmental Science and Policy Graduate Program.

The report contains justifications for the recommendations in the *Final Report of the Northeast Wisconsin Karst Task Force*. It also contains descriptions of groundwater contamination events from manure in northeast Wisconsin.

Gotkowitz, Madeline B. and Stephen J. Gaffield. 2006. Water-Table and Aquifer-Susceptibility Maps of Calumet County, Wisconsin. Wisconsin Geological and Natural History Survey.

This is a report and map on the likelihood that contamination from land uses on the land surface in Calumet County will reach the groundwater system. The map was used to establish the boundaries of the proposed groundwater protection areas with the County. These areas are where the local performance standards would apply.

McLeod, Eugene L. 2006. PowerPoint Presentation to Calumet County Board pertaining to Groundwater Quality in Calumet County and Local Performance Standards for Agriculture to Improve and Protect Groundwater Quality. April 17, 2007.

Presentation on poor groundwater quality within Calumet County. It shows links between areas within Calumet County with unsafe groundwater and Karst topography and the storage, handling, and land application of animal manure.

UW-Stevens Point Center for Watershed Science and Education. 2006. Map of Groundwater Contamination Susceptibility and Groundwater Quality in East-Central Wisconsin - Bacteria.

Map of well testing results for coliform bacteria in Door, Kewaunee, Brown, Manitowoc, and Calumet Counties overlain on least to most susceptible areas to groundwater contamination. Maps indicate correlation between positive bacteria test results and more susceptible areas.

UW-Stevens Point Center for Watershed Science and Education. 2006. Map of Groundwater Contamination Susceptibility and Groundwater Quality in East-Central Wisconsin - Nitrates.

Map of well testing results for nitrates in Door, Kewaunee, Brown, Manitowoc, and Calumet Counties overlain on least to most susceptible areas to groundwater

contamination. Maps indicate correlation between elevated nitrate test results and more susceptible areas.

Wisconsin Department of Natural Resources and Wisconsin Geological and Natural History Survey. 1989. Map of Groundwater Contamination Susceptibility in Wisconsin.

State map of least to most susceptible areas to groundwater contamination. Areas on map with most susceptibility to groundwater contamination within Calumet County fall within the Groundwater Protection Areas in which the Local Performance Standards for Agriculture to Improve and Protect Groundwater would apply.

Wisconsin Department of Natural Resources. 1984. Poster of Groundwater and Land Use in the Water Cycle.

Poster shows how various land uses, including manure storage, can contaminate groundwater.

Coyne, M.S., C. S. Stoddard, J. H. Grove, and W. O Thom. 1996. Infiltration of Fecal Bacteria Through Soils: Timing and Tillage Effects. Soil Science News and Views, 17(4). University of Kentucky, College of Agriculture.

Introduction: "Land applying animal waste potentially exposes humans and animals to fecal pathogens, either by direct contact with soil and produce, or via groundwater contamination. Some of these organisms are Salmonella, certain pathogenic Escherichia coli strains, protozoa such as Cryptosporidium and Giardia, and enteric viruses. Whether the soil adequately filters these pathogens before they reach groundwater depends on the interaction of porosity, texture, depth, water content, rainfall intensity and duration, and soil management."

Transport of Bacteria: "Fecal coliform movement to at least 35 inches occurred with the first leaching rain after manure application. "

Conclusions: "Regardless of when manure was applied, fecal bacteria moved downward to a depth of at least 35 inches in this study. This suggests that fecal bacterial could contaminate groundwater in a well-structured, shallow soil."

Stoddard, C. S., M. S. Coyne, and J. H. Grove. 1998. Fecal Bacterial Survival and Infiltration Through a Shallow Agricultural Soil. Journal of Environmental Quality 27 (6). Abstract.

"We performed a field experiment to measure fecal coliforms and fecal streptococci in leachate from dairy manure- amended no-tillage and conservation tillage soils. Manure significantly increased fecal bacteria in leachate compared with unmanured treatments. After manure application, the leachate that collected in zero-tension lysimeters 90 cm (36 inches) below the soil surface contained up to 6×10^4 (60,000) fecal coliforms/100 ml and general exceeded 3×10^3 (3,000) fecal coliforms/100 ml."

"In the well structured soil used in this experiment, fecal bacteria moved below the crop root zone whenever there was rainfall of sufficient duration or intensity to cause flow after manure application."

Czymmek, Karl, Harold van Es, and Larry Geohring. 2004. Manure and groundwater: the case for protective measures and supporting guidelines.

Nutrient Management Spear Program, Cornell University Department of Crops and Sciences.

“There are three general conditions that can present an increased risk for the contamination of specific groundwater resources: 1) Soils less than 40 inches deep over carbonate bedrock.”

“These characteristics make carbonate areas (referring to Karst landscapes) some of the more vulnerable to rapid surface water recharge and to changes in water quality, especially when large quantities of manure may be moved offsite during periods of heavy rainfall or snowmelt.”

Meals, Don. 2005. Research Shows Winter Application of Manure Is a Bad Idea. Partners, 23 (3). Conservation Technology Information Center.

“Considerable research has demonstrated that runoff from manure application on frozen or snow-covered ground has a high risk of serious water quality impact – and that trusted best management practices, including vegetated filters strips, can be of little help in winter.”

“In many cases, frozen soils are nearly as impervious as a parking lot. Snowmelt or rainfall following winter manure spreading is likely to generate runoff that can carry manure constituents off the field and into waterways.”

“Winter applications of manure can increase pathogen losses in runoff from agricultural land compared to applications in other seasons. Cool temperatures and moist conditions in winter favor longer survival of microorganisms on the land. Even sub-freezing temperatures do not reliably kill bacteria – research shows that *Cryptosporidium* and *Giardia* can remain viable at temperatures well below freezing.”

University of Wisconsin Discovery Farms. February 14, 2007. High Risk Period for Manure Runoff. News release.

“Livestock producers who make manure applications to agricultural fields need to understand that spreading manure – regardless of type – from now until the ground thaws is extremely risky. Studies on farms cooperating in the Discovery Farm Program indicated that solid and liquid manure applied to snow covered and /or frozen soils, both before and during conditions of snow melt or rain on snow, results in significantly higher nutrient losses than if manure was not applied. The snowmelt nutrient losses should not be underestimated, as they can contribute a majority of the nitrogen and phosphorus losses for the entire year.”

“What can livestock producers do to reduce their risk of manure runoff?”

- “Producers who must haul manure from their barns should stack it in an area where potential for runoff or groundwater infiltration is low.”
- “Producers who daily haul manure should work with their local conservation departments to identify safe stacking sites that have minimal potential to runoff into either surface or groundwater.”
- “Producers who have lots or facilities with bedded pack systems need to be cautious about spreading this manure during this high risk period. Cleaning lots and getting the manure on fields before the frost goes out can greatly increase the potential for nutrient losses.”
- “Producers who must haul manure during this high risk period should identify fields that are away from streams or lakes and have minimal risk of manure running to surface or groundwater.”

Weisenberger, Amber. 2006. Discovery Farms Data Update. The Tree, Discovery Farms' Newsletter 5(4).

“Data from field sites suggests that a majority of surface water runoff occurred when the ground was frozen (or thawing).”

“Runoff amounts during the frozen ground period can not be explained by the total amount of snowfall. Annual runoff rates are largely determined by percent of soil moisture”

“Frozen, snow-covered ground, shortly preceding snowmelt, has been identified as the most critical time of the year for manure applications. This point has been covered several times above, but it is important to remember that spreading manure during this time is very environmentally risky.”

Kingberg, Kevin. 2006. Homework: Spreading Livestock Manure In the Fall. The Tree, Discovery Farms' Newsletter 5(4).

“Important Note: Late winter through early spring is an environmentally risky time to spread manure. Again, three years of surface runoff monitoring at the edges of fields shows that large amount of runoff water leave fields in February through April. This runoff water can easily pick up and move nutrient and organic matter from recently applied manure off site.

Frame, Dennis. 2006. Manure Management – a 4-letter word. The Tree, Discovery Farms' Newsletter 5 (3).

“Data from our monitoring stations indicate that inappropriate manure applications can contribute the vast majority of nutrient (nitrogen and phosphorus) losses for the entire season. When, where, and how producers place manure is important not only in terms of protecting the environment, but also in terms of capturing the income potential from that manure”

“There are three critical factors to consider:”

- “Critical sites – select sites with little potential for manure to runoff into surface water (waterways, streams, wetlands, and lakes), groundwater (through fractured bedrock, shallow soils, sink holes, etc.), or tile drainage systems;”
- “Critical times – apply manure when the potential for runoff is low (avoid periods when soils are frozen and snow is melting or when soils are at or near saturation); and”

**Final Report, Wisconsin Manure Management Task Force, March 1, 2006
Draft Findings and Recommendations.**

“Key factors that contribute to rapid delivery of manure to surface and groundwater in acute events include spreading of liquid manure on frozen or snow-covered ground, manure applications on saturated ground, and spreading manure immediately prior to rain events or snow melts.”

“In the short-term, the Task Force agrees unanimously that the state goal should be for all farmers to implement the following key practices that can reduce the risks related to manure runoff:”

- “Winter spreading plans for farmers to identify high risk fields that should not receive winter applications of manure.

- “Manure hauling procedures and training to promote safe handling of manure.”
- “Emergency response plans to quickly contain and effectively clean up manure spills and overflows.”

“Land applied manure has contaminated private drinking water wells. A consensus of Task Force members agreed that water supply well contamination from manure was an unacceptable outcome and the issue should be addressed.”

“In addition to the recommendations below, DNR also recommends the following to reduce groundwater and water supply risks from land-applied manure:”

- a. “Identify minimum separation distance between wells, groundwater, karst features, bare rock, and other direct conduits to groundwater;”
- b. “Limit spreading on frozen ground in vulnerable areas;”
- c. “Control application of manure within pre-identified source water protection area.”

Appendix B, 2005 Manure Runoff Events, DNR Records. PowerPoint Presentation to Task Force.

- 38 of 54 reported runoff events from 7/1/04 to 6/30/05 occurred in the months of November through March.
- Land spreading of manure was the cause of 74% of the reported runoff events.
- Soil conditions during land spreading were frozen or snow covered for 84% of the reported runoff events.
- Liquid manure was involved in 60% of the reported runoff events.
- Wells were contaminated in 20 % of the reported runoff events.
- 5 out of the 11 well contaminations occurred in our region (Brown, Kewaunee, Door, and Manitowoc)

2005. Heisner Family Dairy – Discovery Farms Program Update. The Tree, Discovery Farms’ Newsletter 4 (2).

“98% of the 2005 field runoff occurred during the frozen ground period.”

Bundy, L. G., L Knobeloch, G. Jackson, and B. H. Shaw. 1994. Nitrate in Wisconsin Groundwater: Sources and Concerns. UW-Extension Publication #G3054.

“The potential for nitrate leaching from barnyards is great when they are located on sandy soils or on thin soils over creviced bedrock. In these situations, yards tend to stay porous and aerobic, allowing nitrogen to convert to nitrate and leach rapidly to groundwater.”

Chern, Laura, George Kraft, and Jeff Postle. 1999. Nitrate in Groundwater – A Continuing Issue for Wisconsin Citizens. Report of The Nutrient Management Subcommittee of the Nonpoint Source Pollution Abatement Program Redesign.

“On a statewide basis about 90% of the nitrate detected is from agricultural sources (fertilizer, manure, and legumes). Septic systems and other source contribute 9% and 1% respectively.”

“Roughly 10% of the total nitrogen added to Wisconsin soils each year leaches to groundwater as nitrate. Ninety percent of this is from agriculture, 9% from septic systems, and 1% from other Sources.”

“Without a reduction in nitrate loading to groundwater, nitrate concentrations in Wisconsin will likely increase and nitrate pollution will likely affect larger areas and large volumes of groundwater and surface water.”

Turnquist, Alan, Jeremy Foltz, and Carol Roth. 2006. Manure Management of Wisconsin Farms. PATS Research Report No. 15. Cooperative Extension, UW-Madison.

“PATS data suggests that, despite the modernization trends and regulations aimed at decreasing runoff from agricultural sources, there remains significant room for improvement in employing recommended – or in some cases, required – manure management practices on Wisconsin dairy farms.”

“In addition to storage and spreading issues, the amount of manure that farms actually collect, especially from outside areas used for exercise, grazing, and feeding deserves attention. Data indicates that as much as 40% of the manure generated by Wisconsin dairy cows is left to accumulate on these relatively small outside areas. Few farms rotate or collect manure from these areas, which may lead to “hot spots” for nutrient runoff.”

“Despite the small size of the outdoor areas that accumulate a significant portion of the manure produced, the vast majority (of) Wisconsin dairy farms (87%) do not collect manure from these areas. This holds regardless of whether farms use pasture, feedlots, or barnyards as outside areas.”

“Because much of this uncollected manure is likely to be concentrated in relatively small areas, there are potentially large environmental impacts tied to this aspect of manure management.”

Cramer, Brandon and Stacey Frisk. 2006. Final Report: Morrison Karst Investigation. Report To Brown County LCD from summer interns.

“Farms can greatly range in size, from large dairy operations of over 500 cattle to smaller family farms of less than 50 cows. Each one of these farms, large or small, poses a threat to groundwater contamination because manure spread on nearby fields can make its way directly through the shallow soils and cracks in the bedrock to the water table with little or no filtration. The only approach to minimize the threat of groundwater contamination is proper land management and limiting the amount of manure spread on areas most prone to contamination.”

DNR Environmental Communicators. 2006. Cultivating a Better Solution. Wisconsin Natural Resources 30 (6).

“Seepage from manure spreading on land has been linked to drinking water contamination and other health concerns. Runoff can flow into abandoned wells or through fissures directly into groundwater. In areas where manure is spread over fractured bedrock, the soil does not have enough time or capacity to filter out bacteria before they reach groundwater and drinking water supplies.”

Heinen, Liz. 2005. PowerPoint Presentation on Drinking Water Impacts from Manure Land Spreading.

“Well contaminations”

- “Door County 2005 – 2 wells”
- “Kewaunee County 2004 – 3 wells”
- “Brown County 2005 – 10 wells”
- “Manitowoc County 2005 – 11 wells”
- “Calumet County 2002 – 9 wells”
- “Green Lake County 2005 – 2 wells”
- “Dodge County 2005 – 6 wells”

“Problems ongoing for many years and getting worse.”

“Winter runoff occurs from relatively flat fields.”

Wallander, Andy and Eugene McLeod, editors. 2005. Recommendations to the Manure Management Task Force from Northeast Wisconsin’s Karst Bedrock Region. October 10, 2005

“Winter manure spreading prohibition areas (perhaps like atrazine prohibition areas) are needed in shallow bedrock areas where waters of the state (groundwater) could potentially be adversely impacted.”

“Winter manure spreading prohibition areas are also needed in other areas where waters of the state could potentially be adversely impacted, such as a ‘site that is susceptible to groundwater contamination’ and ‘direct conduits to groundwater’, as defined in NR 151, NR 283, NR 281, and NRCS standard 590; as well as adequate spreading prohibition setback distances from streams.”

“More emphasis must be placed on education of all individuals responsible for storing, transporting, and applying manure, specifically for local manure management “teams” of crop consultants, custom manure haulers, and landowners.