2021 Town of Trade Lake
CAFO Permitting Study Committee Report
Regarding Town of Trade Lake's
Large-Scale Livestock
Operations Ordinance

Prepared by the Town of Trade Lake CAFO Permitting Study Committee

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EXECUTIVE SUMMARY

The purpose of this report is to provide the Trade Lake Town Board with recommendations regarding additional details for the conditions listed below, to provide the Board with factual findings to support those recommendations, and for an amended CAFO operational ordinance that would incorporate those conditions. The Town of Trade Lake CAFO Permitting Study Committee (also referred to as "the Committee"), through meetings with various experts and review of scientific articles and journals, has sought to provide the Town of Trade Lake with reasonable and scientifically defensible findings of fact[1] which demonstrate the recommendations are necessary to

[1] The phrase "reasonable and scientifically defensible findings of fact" is taken from Wisconsin's CAFO siting statute, Wisc. Stat. § 93.90 and the regulations that pertain to that statute. The recommendations of this Committee do not relate to siting issues. Rather, they relate to ***operational*** regulations. Moreover, it is not the Committee's intent to recommend the imposition of water quality standards more stringent than the current existing State standards. It is the Committee's understanding, therefore, that the "reasonable and scientifically defensible findings of fact" standard does not apply to the work being done by the Committee and ultimately an amended operational ordinance passed by the Town of Trade Lake. Nevertheless, the Committee feels that providing findings of fact to support its work will help the Town Board, residents and property owners understand the Committee's rationale for the recommendations

protect the public health or safety of Trade Lake residents, property owners and visitors. The Committee also sought to provide the Town of Trade Lake with reasonable and scientifically defensible findings of fact that show the recommendations are necessary to preserve and protect the quality of the Town's natural resources, including water, land, air, wildlife and property values. The Committee also reviewed the work of other towns, Counties and existing State laws and regulations regarding siting and operational regulations pertaining to CAFOs.

CONDITIONS IN THE CAFO OPERATIONS ORDINANCE

The Town of Trade Lake's Concentrated Animal Feeding Operations Ordinance contains the following conditions for the operation of a CAFO (defined below) in the Town of Trade:

1. Conditions relating to the **operational characteristics** of the proposed operation, to protect public health, prevent point and non-point sources of air and water pollution, and prevent private nuisances and public nuisances;

2. Conditions relating to the **management of animal and other waste** that may be generated as part of an operations' ongoing operation, to protect public health, prevent point and non-point sources of air and water pollution, and prevent private nuisances and public nuisances;

3. Conditions relating to the **population and depopulation of individual animal housing facilities**, to protect public health and prevent the spread of animal-borne and vector-borne disease, to assure a safe level of sanitation, and to assure human health hazard control or health protection for the community;

4. Conditions relating to **biosecurity and the maintenance of animal health and welfare**, to prevent the spread of animal-borne and vector-borne disease, to protect public health, and provide for animal safety and welfare;

5. Conditions relating to **transportation of animals** as part of the ongoing operations, to protect public health, prevent pollution, and prevent private nuisances and public nuisances;

6. Conditions relating to **protection of private and public drinking and agricultural wells, and other public water supplies**, as part of an ongoing operation to protect public health, prevent pollution, and prevent private nuisances and public nuisances;

7. Conditions relating to **air emissions and dust control** as part of an ongoing operation, to protect public health, prevent pollution and prevent private nuisances and public nuisances;

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contained in this report. In addition, if a person or entity contends that the Town has imposed requirements more stringent than the State standards, the Town will have the factual finding to support its requirements. The Committee has found that there is a wealth of scientific articles and studies from well-respected medical, scientific, industry and educational institutions that support both the potential damage that can be caused by CAFOs, as well as the operational regulations suggested by the Committee to prevent the occurrence of such damage.

8. Conditions relating to **protection of the private and public property rights and property values** of affected property owners, as part of an ongoing operation, to protect the general welfare of the Town's residents and property owners, and to prevent private nuisances and public nuisances;

9. Conditions relating to **permit compliance, enforcement and monitoring, including establishment of fees** that may be assessed against the permittee to cover the costs of hiring, training, and maintain Town personnel, or for contracting with private consultants, to conduct permit compliance, enforcement and monitoring activities for the Town;

10. Conditions relating to the **monitoring of surface water, ground water, air quality and all other environmental factors and considerations;**

11. **Any other conditions deemed reasonably necessary or appropriate** by the Town Board to effectively, efficiently, and comprehensively regulate the operations of a facility, to protect public health (including human and animal health), safety, and general welfare, prevent pollution and the creation of private nuisances and public nuisances, and preserve the quality of life, environment, and existing small-scale livestock and other agricultural operations of the Town.

OVERVIEW OF CAFO STUDY GROUP

A. Background

The Town of Trade Lake Board of Supervisors passed a Concentrated Animal Feeding Operations Ordinance and a 12-month moratorium on Large Scale Livestock Operations on January 9, 2020. A resolution was passed on November 12, 2020, forming this Committee to study, review, consider, and determine what details need to be incorporated into the Conditions contained in the Town of Trade Lake Concentrated Animal Feeding Operations Ordinance. The resolution laid out the composition of the Study Group.

While there are currently no CAFOs in Trade Lake, one entity, Cumberland LLC, has filed applications with the DNR and Burnett County regarding a proposed CAFO site in Trade Lake. (As of the date of the submission of this report, no application has been filed with the Town of Trade Lake.) Because there is only one proposed CAFO relevant to the Town of Trade Lake, that CAFO has been referenced and used as an example throughout this report. Although this proposed facility may have been a catalyst for the 12-month moratorium, the Committee's recommendations are not intended to address any one operation. Instead, the purpose of this Committee is to consider whether the current regulations adequately protect public health, safety, and welfare throughout the Town, and then make recommendations to the Town Board that would apply to any Large-Scale Feeding Operation that might seek to locate in Trade Lake. The Town of Trade Lake CAFO Permitting Study Committee has been tasked with publishing our findings in this report, and where there are gaps in regulatory standards and local vulnerabilities, to provide scientifically defensible findings of fact to support modification to existing standards.

B. What is a CAFO?

A Concentrated Animal Feeding Operation (CAFO) is:

> … a specific type of large-scale industrial agricultural facility that raises animals, usually at high-density, for the consumption of meat, eggs, or milk. To be considered a CAFO, a farm must first be categorized as an animal feeding operation (AFO). An AFO is a lot or facility where animals are kept confined and fed or maintained for 45 or more days per year, and crops, vegetation, or forage growth are not sustained over a normal growing period (Environmental Protection Agency [EPA], 2009). CAFOs are classified by the type and number of animals they contain, and the way they discharge waste into the water supply.

Hribar C, Schultz M, Understanding Concentrated Animal Feeding Operations And Their Impact On Communities, p. 1, *National Association of Local Boards of Health,* 2010. (*Also see* 40 CFR § 122.23(b)(1)).

An operation with over 1,000 animal units is defined as a "Large CAFO." An animal unit (AU) is equal to 1,000 pounds of animal. See Table 1, below, for the number of animals of different species required to constitute a Large CAFO.

Table 1

Number of animals	Type of animal
700	Mature dairy cows, whether milked or dry
1,000	Veal calves
1,000	Cattle, other than mature dairy cows or veal calves (Cattle includes but is not limited to heifers, steers, bulls and cow/calf pairs.)
2,500	Swine, each weighing 55 pounds or more
10,000	Swine, each weighing less than 55 pounds
500	Horses
10,000	Sheep or lambs
55,000	Turkeys
30,000	Laying hens or broilers, if the AFO uses a liquid-manure handling system
125,000	Chickens (other than laying hens), if the AFO uses other than a liquid-manure handling system
82,000	Laying hens, if the AFO uses other than a liquid-manure handling system
30,000	Ducks, if the AFO uses other than a liquid-manure handling system
5,000	Ducks, if the AFO uses a liquid-manure handling system

Source: 40 CFR § 122.23(b)(4)

A new or expanding facility that reaches 1,000 AU is required to obtain a Wisconsin Pollutant Discharge Elimination System (WPDES) from the Wisconsin Department of Natural Resources

(DNR). Currently, the Town of Trade Lake has a Livestock Facility Siting Ordinances that regulates any livestock operation that has 1000 or more AU.

There are many CAFOs that have less than 1000 animal units. In Iowa, more than 50% of the state's swine operations are between 500 and 1000 animal units. (See Figure A.) One recommendation that the Committee has, therefore, is that the Town consider reducing the application threshold for its ordinance from 1000 AUs to 500 AUs.

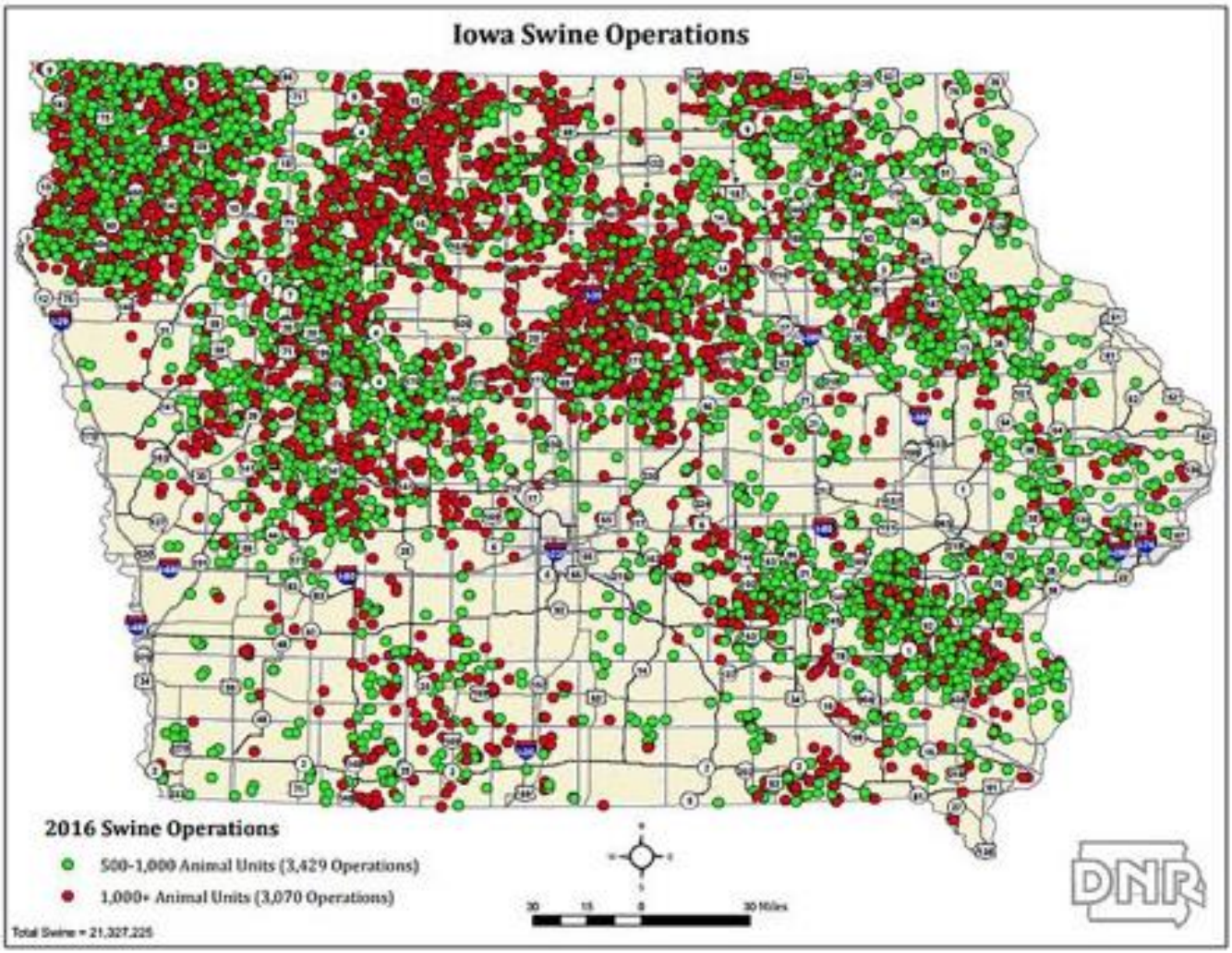

Figure A

The hazards associated with CAFOs typically result from the extraordinary amounts of animal waste generated by such facilities. For example, using the numbers from Table 2, below, a 5000-animal unit hog CAFO will generate 111,872,500 pounds of manure per year. That manure must be disposed of somehow. The typical method of disposing of the manure is to spread it on local farm fields. Fields available for the spreading of manure may be in short supply, which creates an incentive for CAFOs to apply ***as much manure per acre as possible***. Because fertilizer is an expense, traditional farmers have a financial incentive apply ***as little fertilizer as possible*** per acre

to appropriately enhance crop growth. In that way, CAFOs are different from typical local farmers who must pay for their fertilizer. This creates tension between a CAFO's need to dispose of manure and the community's desire to protect its health, natural resources, and property values.

Table 2

How much manure do different types of livestock produce?

Livestock type	Total manure	Nitrogen	Phosphorus
	------- lbs/day/1000-lb animal unit -------		
Beef[1]	59.1	0.31	0.11
Dairy[2]	80.0	0.45	0.07
Hogs and pigs[3]	63.1	0.42	0.16
Chickens (layers)	60.5	0.83	0.31
Chickens (broilers)	80.0	1.10	0.34
Turkeys	43.6	0.74	0.28

[1]High forage diet. [2]Lactating cow. [3]Grower.

Source: USDA Natural Resources Conservation Service. Agricultural Waste Management Handbook (1992)

Common concerns regarding CAFOs include:

> …changes in air quality; increased odor and noise complaints; changes in land use; groundwater and surface water quality changes; damage to local roads from increased heavy truck traffic; and impacts on quantity and quality of nearby drinking water wells.

Concentrated Animal Feeding Operations (CAFOs) and Public Health, Wisconsin Department of Health Services (https://www.dhs.wisconsin.gov/environmental/cafo.htm)

C. CAFO Permitting Study Committee Members

Andrew Marshall	Trade Lake property owner, lawyer.
Doug Wickstrom	Trade Lake resident and property owner, local farmer.
Helen Sullinger	Trade Lake resident and property owner, retired nurse.
Howard Pahl	Trade Lake resident and property owner, cabinet maker.
Norm Peterson	Trade Lake resident and property owner, retired foreign car specialist, writer.
Ramona Moody	Trade Lake resident and property owner, Chair of the Trade Lake Town Board, Supervisor for Burnett County and realtor.

Jeff Lade*	Trade Lake resident and property owner, Supervisor for Trade Lake Town Board, contractor.

*Jeff Lade served on the Committee during his tenure as a Trade Lake Supervisor. He did not run for re-election in April 2021 and stepped down after the new Board was put in place.

D. Meetings / Presentations

In addition to reviewing scientific journals, articles, and studies, as well as regulations and studies from other towns and counties, the CAFO Permitting Study Committee spoke to experts with insight into the issues being looked at by the Committee. Specifically, the Committee met with the following professionals:

Dr. Rebecca Larson spoke with the Committee on February 25, 2021. Dr. Larson is an Associate Professor and Extension Specialist with the University of Wisconsin-Madison. Dr. Larson specializes in Biological Systems Engineering. She has a B.S., M.S. and Ph.D. in Biosystems Engineering from Michigan State University. Her fields of interest include biological waste; manure management; handling and treatment of agricultural and food processing waste; agricultural sustainability; land application of various waste streams, including runoff and leaching; waste-to-energy technologies, including biogas production from anaerobic digestion; and composting. Dr. Larson has published a number of articles in her field of expertise. She gave the CAFO Study Committee a fairly comprehensive presentation regarding subjects including manure storage and timing, manure application methods, nutrient management, manure contaminants and risks, issues involving water quality, bacteria and other pathogens that may be transmitted in manure, hazards presented by phosphorus and nitrates, problems with CAFO's and air quality and managing the adverse impacts of CAFOs.

Dr. Richard Huset spoke with the Committee on March 24, 2021. Dr. Huset graduated from Stanford School of Medicine with dual degrees in Medicine and Medical Anthropology. Following a clinical internship in Duluth, Minnesota, he served 3 years as a Commander in the United States Public Health Service (USPHS). After several years in private practice, Dr. Huset took a position at the Minnesota Department of Health, directing all disease control departments and preventive medicine areas. At that time, he also taught health program evaluation at the nearby University of Minnesota's School of Public Health. Dr. Huset received a business degree from St Thomas, and then worked managing Minnesota's health programs. After leaving his job with the state, Dr. Huset formed several companies, one of which focused on reducing corporate health risks and related costs. His work involved site visits to manufacturing and other facilities across the US, finding the causes of costly workforce and public illness and injury, then designing programs for interventions and ongoing evaluation. Dr. Huset - Presented on Health Risks associated with CAFOs, including the risk of the proliferation of antibiotic resistant bacteria.

Justin Michael spoke with the Committee on May 5, 2021. Mr. Michael is an Environmental Project Scientist. He works with Braun Intertec, geotechnical engineering, environmental consulting, and testing firm with offices in Iowa, Kansas/Missouri, Louisiana, Minnesota, North Dakota, Texas and Wisconsin. Mr. Michael gave the Committee a presentation on how different nutrients/chemicals move through different environments, and remediation vs. prevention.

Dave Tolberg spoke with the Committee on July 21, 2021. R. Tolberg is an Independent Crop Consultant and Certified Crop Advisor (CCA). Mr. Tolberg studied Agronomy and Crop Science at the University of Wisconsin-River Falls. Mr. Tolberg talked about Nutrient Management Plans, how they are administrated, limitations on what Nutrient Management Plans do and do not regulate, oversight of such plans and the limits of these plans in terms of preventing overspreading, runoff, and other types of contamination.

Dr. Rachelle Beattie spoke with the Committee on January 26, 2022. Dr. Beattie is an environmental scientist. She received her Bachelor of Science degree in biology and Master of Science in biology from Northwest Missouri State University. She went on to receive her PhD in biology from Marquette University in Milwaukee Wisconsin. Dr. Beattie is a postdoctoral research associate at the Institute of Marine sciences in Morehead City North Carolina, University of North Carolina at Chapel Hill. Dr. Beattie has conducted studies regarding the effect of agricultural contamination on antibiotic resistant bacteria and authored papers on those studies. [2] Dr. Beattie's curriculum vitae is included in the appendix to this report.

FINDINGS

A. *Hazards Posed by Concentrated Animal Feeding Operations*

The potential hazards caused by CAFOs are well documented. There is an abundance of research put out by institutions such as the CDC, the World Health Organization, Johns Hopkins University and the National Association of local boards of health, just to name a few. CAFOs confine large numbers of animals of the same species—such as beef and dairy cattle, swine, broilers (poultry raised for meat consumption) and laying hens—on a small area of land. The scale, density, and practices associated with these operations present a range of public health and ecological hazards, including large volumes of untreated animal waste, the release of environmental contaminants to air, water, and soil, and the generation and spread of antibiotic-resistant pathogens. There is a significant body of evidence which shows CAFOs are directly associated with occupational and community health risks, as well as the social and economic decline of rural communities.
On November 5, 2019, the American Public Health Association (APHA) enacted a policy statement advising federal, state and local governments and public health agencies to impose a moratorium on all new and expanding CAFOs, recommending a complete halt until additional scientific data has been collected and public health concerns associated with CAFOs are addressed. The (APHA) summarized the risks posed by CAFOs as follows:

> Raising animals in large, high-density operations leads to the routine accumulation of large volumes of animal waste, often at rates far exceeding the capacity of nearby farmland to absorb it. As a result, these operations represent a significant public

[2] See for example, Rachelle E Beattie, Michael Walsh, Mercedes Cecilia Cruz, L Rex McAliley, Laurel Dodgen, Wei Zheng, Krassimira R Hristova, *Agricultural Contamination Impacts Antibiotic Resistant Gene Abundances In River Bed Sediment Temporally*, EMS Microbiology Ecology, Volume 94, Issue 9, September 2018, fiy131, https://doi.org/10.1093/femsec/fiy131 Published: 13 July 2018. (The study analyzed antibiotic resistant genes located in 20 surface water locations in Kewaunee County, Wisconsin and found higher antibiotic resistant gene presence correlated, temporally, with spreading of manure on farm fields.

> health and ecological hazard because the excess waste they produce is disposed of in a manner that can pollute surface and groundwater resources. In the United States, CAFOs produce an estimated 369 million tons of animal manure a year, approximately 13 times the sewage produced by the U.S. population. This animal waste is typically stored in open or covered pits or liquid lagoons and later spread or sprayed untreated on nearby cropland, posing additional risks to public health. Workers in animal production can be exposed to airborne waste particles, drug residues, heavy metals, potentially harmful pathogens, and antibiotic-resistant bacteria, many of which can be transferred into neighboring communities by these workers. In addition, people living near CAFOs may have an increased risk of infection owing to the transmission of harmful microbes from CAFOs via flies or contaminated water and air.

American Public Health Association Policy Number: 20194, *Precautionary Moratorium on New and Expanding Concentrated Animal Feeding Operations,* November 5 2019, p. 3-4. (*Citations omitted*.)

The impact on CAFOs of human pandemics such as Covid-19 could threaten Trade Lake and the surrounding communities. Most CAFO operators contract with processing plants to deliver milk, beef, pork or chicken. Processors across the nation and Wisconsin saw Covid-19 infection rates among workers as high as 25% early in the 2020 pandemic. These high rates forced more than 100 plants to close, according to the Centers for Disease Control. This caused problems for swine CAFOs which cannot ship animals over 280 pounds to slaughter. The closure of so many processors meant that CAFOs had nowhere to ship their animals. National Pork Producers Council president, Howard Roth said on April 29, 2020 that "millions of pigs can't enter the food chain" and will have to be killed and disposed of. The JBS plant in Worthington, MN reopened to euthanize, not process, up to 13,000 hogs a day saying that the "carcasses will be rendered, sent to landfills, composted or buried." Smithfield's Sioux Falls, SD plant shut down for four weeks. Another shutdown caused by human pandemics would leave Trade Lake vulnerable when CAFOs have to dispose of tens of thousands of animals.

Highly infectious animal diseases such as African Swine Fever (ASF) could also threaten Trade Lake. Millions of hogs have died or been killed globally due to ASF, commonly called “hog Ebola.” The disease is 100% fatal and the pathogen is especially hardy. Asian countries such as China, Vietnam and Korea have been hit hard. On July 28, 2021, the US Department of Agriculture announced the first documentation of ASF in the Western Hemisphere when it was found in the Dominican Republic. While researchers do not believe ASF is a threat to human health and cannot be transmitted from pigs to humans, many public health and environmental issues have been raised.

Articles addressing the risks of CAFO’s range from abstracts and detailed reports of scientific and medical studies to more readable narratives that summarize the scientific information included in a form that a little more readable for a lay person. One article that does a nice job of summarizing the issues to be addressed by this Committee is an article published by the National Association of Local Boards of Health entitled: *Understanding Concentrated Animal Feeding Operations and*

Their Impact on Communities. [3] (The article is cited on the CDC's website at: https://www.cdc.gov.) (The Committee realizes that what follows is an unusually long quote, but the authors of *Understanding Concentrated Animal Feeding Operations and Their Impact on Communities* clearly and succinctly explain the risks posed by CAFOs, so the Committee decided not to reinvent the wheel:

> **Environmental Health Effects**
>
> The most pressing public health issue associated with CAFOs stems from the amount of manure they produce. CAFO manure contains a variety of potential contaminants. It can contain plant nutrients such as nitrogen and phosphorus, pathogens such as *E. coli*, growth hormones, antibiotics, chemicals used as additives to the manure or to clean equipment, animal blood, silage leachate from corn feed, or copper sulfate used in footbaths for cows.
>
> Depending on the type and number of animals in the farm, manure production can range between 2,800 tons and 1.6 million tons a year (Government Accountability Office [GAO], 2008). Large farms can produce more waste than some U.S. cities—a feeding operation with 800,000 pigs could produce over 1.6 million tons of waste a year. That amount is one and a half times more than the annual sanitary waste produced by the city of Philadelphia, Pennsylvania (GAO, 2008). Annually, it is estimated that livestock animals in the U.S. produce each year somewhere between 3 and 20 times more manure than people in the U.S. produce, or as much as 1.2–1.37 billion tons of waste (EPA, 2005). Though sewage treatment plants are required for human waste, no such treatment facility exists for livestock waste.
>
> While manure is valuable to the farming industry, in quantities this large it becomes problematic. Many farms no longer grow their own feed, so they cannot use all the manure they produce as fertilizer. CAFOs must find a way to manage the amount of manure produced by their animals. Ground application of untreated manure is one of the most common disposal methods due to its low cost. It has limitations, however, such as the inability to apply manure while the ground is frozen. There are also limits as to how many nutrients from manure a land area can handle. Over application of livestock wastes can overload soil with macronutrients like nitrogen and phosphorous and micronutrients that have been added to animal feed like heavy metals (Burkholder et al., 2007). Other manure management strategies include pumping liquefied manure onto spray fields, trucking it off-site, or storing it until it can be used or treated.

[3] *Understanding Concentrated Animal Feeding Operations and Their Impact on Communities* was recently cited by the Wisconsin Supreme Court in their July 8, 2021 opinion in *Clean Wisconsin, Inc. v. Wisconsin Dep't of Nat. Res.*, 2021 WI 71, ¶ 18, 961 N.W.2d 346, 353, where, the Court held that the DNR could, as conditions of a permit for a Wisconsin Pollutant Discharge Elimination System (WPDES) for a concentrated animal feeding operation (CAFO), impose an animal unit maximum and off-site groundwater monitoring.

Manure can be stored in deep pits under the buildings that hold animals, in clay or concrete pits, treatment lagoons, or holding ponds.

Animal feeding operations are developing in close proximity in some states, and fields where manure is applied have become clustered. When manure is applied too frequently or in too large a quantity to an area, nutrients overwhelm the absorptive capacity of the soil, and either run off or are leached into the groundwater. Storage units can break or become faulty, or rainwater can cause holding lagoons to overflow. While CAFOs are required to have permits that limit the levels of manure discharge, handling the large amounts of manure inevitably causes accidental releases which have the ability to potentially impact humans.

The increased clustering and growth of CAFOs has led to growing environmental problems in many communities. The excess production of manure and problems with storage or manure management can affect ground and surface water quality. Emissions from degrading manure and livestock digestive processes produce air pollutants that often affect ambient air quality in communities surrounding CAFOs. CAFOs can also be the source of greenhouse gases, which contribute to global climate change.

All of the environmental problems with CAFOs have direct impact on human health and welfare for communities that contain large industrial farms. As the following sections demonstrate, human health can suffer because of contaminated air and degraded water quality, or from diseases spread from farms. Quality of life can suffer because of odors or insect vectors surrounding farms, and property values can drop, affecting the financial stability of a community. One study found that 82.8% of those living near and 89.5% of those living far from CAFOs believed that their property values decreased, and 92.2% of those living near and 78.9% of those living far from CAFOs believed the odor from manure was a problem. The study found that real estate values had not dropped and odor infestations were not validated by local governmental staff in the areas. However, the concerns show that CAFOs remain contentious in communities (Schmalzried and Fallon, 2007). CAFOs are an excellent example of how environmental problems can directly impact human and community well-being.

Groundwater

Groundwater can be contaminated by CAFOs through runoff from land application of manure, leaching from manure that has been improperly spread on land, or through leaks or breaks in storage or containment units. The EPA's 2000 National Water Quality Inventory found that 29 states specifically identified animal feeding operations, not just concentrated animal feeding operations, as contributing to water quality impairment (Congressional Research Service, 2008). A study of private water wells in Idaho detected levels of veterinary antibiotics, as well as elevated levels of nitrates (Batt, Snow, & Alga, 2006). Groundwater is a major source of drinking water in the United States. The EPA estimates that 53% of the

population relies on groundwater for drinking water, often at much higher rates in rural areas (EPA, 2004). Unlike surface water, groundwater contamination sources are more difficult to monitor. The extent and source of contamination are often harder to pinpoint in groundwater than surface water contamination. Regular testing of household water wells for total and fecal coliform bacteria is a crucial element in monitoring groundwater quality, and can be the first step in discovering contamination issues related to CAFO discharge. Groundwater contamination can also affect surface water (Spellman & Whiting, 2007). Contaminated groundwater can move laterally and eventually enter surface water, such as rivers or streams.

When groundwater is contaminated by pathogenic organisms, a serious threat to drinking water can occur. Pathogens survive longer in groundwater than surface water due to lower temperatures and protection from the sun. Even if the contamination appears to be a single episode, viruses could become attached to sediment near groundwater and continue to leach slowly into groundwater. One pollution event by a CAFO could become a lingering source of viral contamination for groundwater (EPA, 2005).

Groundwater can still be at risk for contamination after a CAFO has closed and its lagoons are empty. When given increased air exposure, ammonia in soil transforms into nitrates. Nitrates are highly mobile in soil and will reach groundwater quicker than ammonia. It can be dangerous to ignore contaminated soil. The amount of pollution found in groundwater after contamination depends on the proximity of the aquifer to the CAFO, the size of the CAFO, whether storage units or pits are lined, the type of subsoil, and the depth of the groundwater.

If a CAFO has contaminated a water system, community members should be concerned about nitrates and nitrate poisoning. Elevated nitrates in drinking water can be especially harmful to infants, leading to blue baby syndrome and possible death. Nitrates oxidize iron in hemoglobin in red blood cells to methemoglobin. Most people convert methemoglobin back to hemoglobin fairly quickly, but infants do not convert back as fast. This hinders the ability of the infant's blood to carry oxygen, leading to a blue or purple appearance in affected infants. However, infants are not the only ones who can be affected by excess nitrates in water. Low blood oxygen in adults can lead to birth defects, miscarriages, and poor general health. Nitrates have also been speculated to be linked to higher rates of stomach and esophageal cancer (Bowman, Mueller, & Smith, 2000). In general, private water wells are at higher risk of nitrate contamination than public water supplies.[4]

[4] In addition to the issue of contamination of groundwater, another consideration is the amount of water utilized by CAFOs. Wisconsin's constitutional public trust doctrine requires the state to protect its "navigable waters" for the public's benefit. A July 2021 ruling by the Wisconsin Supreme Court affirmed that wells above ***and*** below the 30-day period threshold require the WDNR to determine that no public water rights in navigable waters will be adversely affected and that the proposed withdrawal will not have a significant detrimental effect on the quantity and quality of the waters of the state. *Clean Wisconsin, Inc. v. Wisconsin Dep't of Nat. Res.*, 2021 WI 72, 961 N.W.2d 611. Accordingly, it is important to gather information regarding all wells that a CAFO will utilize for its operation

Surface Water

The agriculture sector, including CAFOs, is the leading contributor of pollutants to lakes, rivers, and reservoirs. It has been found that states with high concentrations of CAFOs experience on average 20 to 30 serious water quality problems per year as a result of manure management problems (EPA, 2001). This pollution can be caused by surface discharges or other types of discharges. Surface discharges can be caused by heavy storms or floods that cause storage lagoons to overfill, running off into nearby bodies of water. Pollutants can also travel over land or through surface drainage systems to nearby bodies of water, be discharged through manmade ditches or flushing systems found in CAFOs, or come into contact with surface water that passes directly through the farming area. Soil erosion can contribute to water pollution, as some pollutants can bond to eroded soil and travel to watersheds (EPA, 2001). Other types of discharges occur when pollutants travel to surface water through other mediums, such as groundwater or air.

Contamination in surface water can cause nitrates and other nutrients to build up. Ammonia is often found in surface waters surrounding CAFOs. Ammonia causes oxygen depletion from water, which itself can kill aquatic life. Ammonia also converts into nitrates, which can cause nutrient overloads in surface waters (EPA, 1998). Excessive nutrient concentrations, such as nitrogen or phosphorus, can lead to eutrophication and make water inhabitable to fish or indigenous aquatic life (Sierra Club Michigan Chapter, n.d.). Nutrient over-enrichment causes algal blooms, or a rapid increase of algae growth in an aquatic environment (Science Daily, n.d.). Algal blooms can cause a spiral of environmental problems to an aquatic system. Large groups of algae can block sunlight from underwater plant life, which are habitats for much aquatic life. When algae growth increases in surface water, it can also dominate other resources and cause plants to die. The dead plants provide fuel for bacteria to grow and increased bacteria use more of the water's oxygen supply. Oxygen depletion once again causes indigenous aquatic life to die. Some algal blooms can contain toxic algae and other microorganisms, including *Pfiesteria*, which has caused large fish kills in North Carolina, Maryland, and the Chesapeake Bay area (Spellman & Whiting, 2007). Eutrophication can cause serious problems in surface waters and disrupt the ecological balance.

Water tests have also uncovered hormones in surface waters around CAFOs (Burkholder et al., 2007). Studies show that these hormones alter the reproductive habits of aquatic species living in these waters, including a significant decrease in the fertility of female fish. CAFO runoff can also lead to the presence of fecal

including: 1) location; 2) depth; 3) pumping capacity; 4) rate of flow; and 5) ultimate use or purpose for the well. A Town may need to place conditions on wells to ensure that high-capacity wells do not cause significant environmental impact.

bacteria or pathogens in surface water. One study showed that protozoa such as *Cryptosporidium parvum* and *Giardia* were found in over 80% of surface water sites tested (Spellman & Whiting, 2007). Fecal bacteria pollution in water from manure land application is also responsible for many beach closures and shellfish restrictions.

Air Quality

In addition to polluting ground and surface water, CAFOs also contribute to the reduction of air quality in areas surrounding industrial farms. Animal feeding operations produce several types of air emissions, including gaseous and particulate substances, and CAFOs produce even more emissions due to their size. The primary cause of gaseous emissions is the decomposition of animal manure, while particulate substances are caused by the movement of animals. The type, amount, and rate of emissions created depends on what state the manure is in (solid, slurry, or liquid), and how it is treated or contained after it is excreted. Sometimes manure is "stabilized" in anaerobic lagoons, which reduces volatile solids and controls odor before land application.

The most typical pollutants found in air surrounding CAFOs are ammonia, hydrogen sulfide, methane, and particulate matter, all of which have varying human health risks. Table [3] on page [18] provides information on these pollutants.

Most manure produced by CAFOs is applied to land eventually and this land application can result in air emissions (Merkel, 2002). The primary cause of emission through land application is the volatilization of ammonia when the manure is applied to land. However, nitrous oxide is also created when nitrogen that has been applied to land undergoes nitrification and denitrification. Emissions caused by land application occur in two phases: one immediately following land application and one that occurs later and over a longer period as substances in the soil break down. Land application is not the only way CAFOs can emit harmful air emissions—ventilation systems in CAFO buildings can also release dangerous contaminants. A study by Iowa State University, which was a result of a lawsuit settlement between the Sierra Club and Tyson Chicken, found that two chicken houses in western Kentucky emitted over 10 tons of ammonia in the year they were monitored (Burns et al., 2007).

Most studies that examine the health effects of CAFO air emissions focus on farm workers, however some have studied the effect on area schools and children. While all community members are at risk from lowered air quality, children take in 20-50% more air than adults, making them more susceptible to lung disease and health effects (Kleinman, 2000). Researchers in North Carolina found that the closer children live to a CAFO, the greater the risk of asthma symptoms (Barrett, 2006). Of the 226 schools that were included in the study, 26% stated that there were noticeable odors from CAFOs outdoors, while 8% stated they experience odors from CAFOs inside the schools. Schools that were closer to CAFOs were often

attended by students of lower socioeconomic status (Mirabelli, Wing, Marshall, & Wilcosky, 2006).

Table [3] Typical pollutants found in air surrounding CAFOs.

CAFO Emissions	Source	Traits	Health Risks
Ammonia	Formed when microbes decompose undigested organic nitrogen compounds in manure	Colorless, sharp pungent odor	Respiratory irritant, chemical burns to the respiratory tract, skin, and eyes, severe cough, chronic lung disease.
Hydrogen Sulfide	Anaerobic bacterial decomposition of protein and other sulfur containing organic matter	Odor of rotten eggs	Inflammation of the moist membranes of eye and respiratory tract, olfactory neuron loss, death.
Methane	Microbial degradation of organic matter under anaerobic conditions	Colorless, odorless, highly flammable	No health risks. Is a greenhouse gas and contributes to climate change.
Particulate Matter	Feed, bedding materials, dry manure, unpaved soil surfaces, animal dander, poultry feathers	Comprised of fecal matter, feed materials, pollen, bacteria, fungi, skin cells, silicates	Chronic bronchitis, chronic respiratory symptoms, declines in lung function, organic dust toxic syndrome.

There is consistent evidence suggesting that factory farms increase asthma in neighboring communities, as indicated by children having higher rates of asthma (Sigurdarson & Kline, 2006; Mirabelli et al., 2006). CAFOs emit particulate matter and suspended dust, which is linked to asthma and bronchitis. Smaller particles can actually be absorbed by the body and can have systemic effects, including cardiac arrest. If people are exposed to particulate matter over a long time, it can lead to decreased lung function (Michigan Department of Environmental Quality [MDEQ] Toxics Steering Group [TSG], 2006). CAFOs also emit ammonia, which is rapidly absorbed by the upper airways in the body. This can cause severe coughing and mucous build-up, and if severe enough, scarring of the airways. Particulate matter may lead to more severe health consequences for those exposed by their occupation. Farm workers can develop acute and chronic bronchitis, chronic obstructive airways disease, and interstitial lung disease. Repeated exposure to CAFO emissions can increase the

likelihood of respiratory diseases. Occupational asthma, acute and chronic bronchitis, and organic dust toxic syndrome can be as high as 30% in factory farm workers (Horrigan, Lawrence, & Walker, 2002). Other health effects of CAFO air emissions can be headaches, respiratory problems, eye irritation, nausea, weakness, and chest tightness.

There is evidence that CAFOs affect the ambient air quality of a community. There are three laws that potentially govern CAFO air emissions—the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as the Superfund Act), the Emergency Planning & Community Right to Know Act (EPCRA), and the Clean Air Act (CAA). However, the EPA passed a rule that exempts all CAFOs from reporting emissions under CERCLA. Only CAFOs that are classified as large are required to report any emission event of 100 pounds of ammonia or hydrogen sulfide or more during a 24-hour period locally or to the state under EPCRA (Michigan State University Extension, n.d.). The EPA has also instituted a voluntary Air Quality Compliance Agreement in which they will monitor some CAFO air emissions, and will not sue offenders but instead charge a small civil penalty. These changes have attracted criticism from environmental and community leaders who state that the EPA has yielded to influence from the livestock industry. The changes also leave ambiguity as to whether emission standards and air quality near CAFOs are being monitored.

Greenhouse Gas and Climate Change

Aside from the possibility of lowering air quality in the areas around them, CAFOs also emit greenhouse gases, and therefore contribute to climate change. Globally, livestock operations are responsible for approximately 18% of greenhouse gas production and over 7% of U.S. greenhouse gas emissions (Massey & Ulmer, 2008). While carbon dioxide is often considered the primary greenhouse gas of concern, manure emits methane and nitrous oxide which are 23 and 300 times more potent as greenhouse gases than carbon dioxide, respectively. The EPA attributes manure management as the fourth leading source of nitrous oxide emissions and the fifth leading source of methane emissions (EPA, 2009).

The type of manure storage system used contributes to the production of greenhouse gases. Many CAFOs store their excess manure in lagoons or pits, where they break down anaerobically (in the absence of oxygen), which exacerbates methane production. Manure that is applied to land or soil has more exposure to oxygen and therefore does not produce as much methane. Ruminant livestock, such as cows, sheep, or goats, also contribute to methane production through their digestive processes. These livestock have a special stomach called a rumen that allows them to digest tough grains or plants that would otherwise be unusable. It is during this process, called enteric fermentation, that methane is produced. The U.S. cattle industry is one of the primary methane producers. Livestock production and meat and dairy consumption has been increasing in

the United States, so it can only be assumed that these greenhouse gas emissions will also rise and continue to contribute to climate change.

Odors

One of the most common complaints associated with CAFOs are the odors produced. The odors that CAFOs emit are a complex mixture of ammonia, hydrogen sulfide, and carbon dioxide, as well as volatile and semi-volatile organic compounds (Heederik et al., 2007). These odors are worse than smells formerly associated with smaller livestock farms. The anaerobic reaction that occurs when manure is stored in pits or lagoons for long amounts of time is the primary cause of the smells. Odors from waste are carried away from farm areas on dust and other air particles. Depending on things like weather conditions and farming techniques, CAFO odors can be smelled from as much as 5 or 6 miles away, although 3 miles is a more common distance (State Environmental Resource Center, 2004).

Because CAFOs typically produce malodors, many communities want to monitor emissions and odors. Quantifying odor from industrial farming can be challenging because it is a mixture of free and particle-bound compounds, which can make it hard to identify what specifically is causing the odor. Collecting data on specific gases, such as hydrogen sulfide, can be used as a proxy for odor levels.

CAFO odors can cause severe lifestyle changes for individuals in the surrounding communities and can alter many daily activities. When odors are severe, people may choose to keep their windows closed, even in high temperatures when there is no air conditioning. People also may choose to not let their children play outside and may even keep them home from school. Mental health deterioration and an increased sensitization to smells can also result from living in close proximity to odors from CAFOs. Odor can cause negative mood states, such as tension, depression, or anger, and possibly neurophysciatric abnormalities, such as impaired balance or memory. People who live close to factory farms can develop CAFO-related post-traumatic stress disorder, including anxiety about declining quality of life (Donham et al., 2007).

Ten states use direct regulations to control odors emitted by CAFOs. They prohibit odor emissions greater than a set standard. States with direct regulations use scentometers, which measure how many times an odor has to be doused with clean air before the smell is undetectable. An additional 34 states have indirect methods to reduce CAFO odors. These include: setbacks, which specify how far CAFO structures have to be from other buildings; permits, which are the most typical way of regulating CAFOs; public comment or involvement periods; and operator or manure placement training.

Insect Vectors

CAFOs and their waste can be breeding grounds for insect vectors. Houseflies, stable flies, and mosquitoes are the most common insects associated with CAFOs. Houseflies breed in manure, while stable and other flies breed in decaying organic material, such as livestock bedding. Mosquitoes breed in standing water, and water on the edges of manure lagoons can cause mosquito infestations to rise. Flies can change from eggs to adults in only 10 days, which means that substances in which flies breed need to be cleaned up regularly.

Flies are typically considered only nuisances, although insects can agitate livestock and decrease animal health. The John Hopkins Bloomberg School of Public Health found evidence that houseflies near poultry operations may contribute to the dispersion of drug-resistant bacteria (Center for Livable Future, 2009). Since flies are attracted to and eat human food, there is a potential for spreading bacteria or pathogens to humans, including microbes that can cause dysentery and diarrhea (Bowman et al., 2000). Mosquitoes spread zoonotic diseases, such as West Nile virus, St. Louis encephalitis, and equine encephalitis.

Residences closest to the feeding operations experience a much higher fly population than average homes. To lower the rates of insects and any accompanying disease threats, standing water should we cleaned or emptied weekly, and manure or decaying organic matter should be removed twice weekly (Purdue Extension, 2007). For more specific insect vector information, please refer to NALBOH's vector guide (*Vector Control Strategies for Local Boards of Health*).

Pathogens

Pathogens are parasites, bacterium, or viruses that are capable of causing disease or infection in animals or humans. The major source of pathogens from CAFOs is in animal manure. There are over 150 pathogens in manure that could impact human health. Many of these pathogens are concerning because they can cause severe diarrhea. Healthy people who are exposed to pathogens can generally recover quickly, but those who have weakened immune systems are at increased risk for severe illness or death. Those at higher risk include infants or young children, pregnant women, the elderly, and those who are immunosuppressed, HIV positive, or have had chemotherapy. This risk group now roughly compromises 20% of the U.S. population.

Table [4] Select pathogens found in animal manure.

Pathogen	Disease	Symptoms
Bacillus anthracis	Anthrax	Skin sores, headache, fever, chills, nausea,
Escherichia coli	Colibacilosis, Coliform mastitis-metris	Diarrhea, abdominal gas

Leptospira pomona	Leptospirosis	Abdominal pain, muscle pain, vomiting, fever
Listeria monocytogenes	Listerosis	Fever, fatigue, nausea, vomiting, diarrhea
Salmonella species	Salmonellosis	Abdominal pain, diarrhea, nausea, chills, fever,
Clostirdum tetani	Tetanus	Violent muscle spasms, lockjaw, difficulty breathing
Histoplasma capsulatum	Histoplasmosis	Fever, chills, muscle ache, cough rash, joint pain and stiffness
Microsporum and *Trichophyton*	Ringworm	Itching, rash
Giardia lamblia	Giardiasis	Diarrhea, abdominal pain, abdominal gas, nausea, vomiting, fever
Cryptosporidium species	Cryptosporidosis	Diarrhea, dehydration, weakness, abdominal cramping

Sources of infection from pathogens include fecal-oral transmission, inhalation, drinking water, or incidental water consumption during recreational water activities. The potential for transfer of pathogens among animals is higher in confinement, as there are more animals in a smaller amount of space. Healthy or asymptomatic animals may carry microbial agents that can infect humans, who can then spread that infection throughout a community, before the infection is discovered among animals.

When water is contaminated by pathogens, it can lead to widespread outbreaks of illness. Salmonellosis, cryptosporidiosis, and giardiasis can cause nausea, vomiting, fever, diarrhea, muscle pain, and death, among other symptoms. *E.coli* is another serious pathogen, and can be life-threatening for the young, elderly, and immunocompromised. It can cause bloody diarrhea and kidney failure. Since many CAFO use sub-therapeutic antibiotics with their animals, there is also the possibility that disease-resistant bacteria can emerge in areas surrounding CAFOs. Bacteria that cannot be treated by antibiotics can have very serious effects on human health, potentially even causing death (Pew Charitable Trusts, n.d.).

There is also the possibility of novel (or new) viruses developing. These viruses generate through mutation or recombinant events that can result in more efficient human-to-human transmission. There has been some speculation that the novel H1N1 virus outbreak in 2009 originated in swine

CAFOs in Mexico. However, that claim has never been substantiated. CAFOs are not required to test for novel viruses, since they are not on the list of mandatory reportable illness to the World Organization for Animal Health.

Antibiotics

Antibiotics are commonly administered in animal feed in the United States. Antibiotics are included at low levels in animal feed to reduce the chance for infection and to eliminate the need for animals to expend energy fighting off bacteria, with the assumption that saved energy will be translated into growth. The main purposes of using non-therapeutic doses of antimicrobials in animal feed is so that animals will grow faster, produce more meat, and avoid illnesses. Supporters of antibiotic use say that it allows animals to digest their food more efficiently, get the most benefit from it, and grow into strong and healthy animals.

The trend of using antibiotics in feed has increased with the greater numbers of animals held in confinement. The more animals that are kept in close quarters, the more likely it is that infection or bacteria can spread among the animals. Seventy percent of all antibiotics and related drugs used in the U.S. each year are given to beef cattle, hogs, and chickens as feed additives. Nearly half of the antibiotics used are nearly identical to ones given to humans (Kaufman, 2000).

There is strong evidence that the use of antibiotics in animal feed is contributing to an increase in antibiotic-resistant microbes and causing antibiotics to be less effective for humans (Kaufman, 2000). Resistant strains of pathogenic bacteria in animals, which can be transferred to humans thought the handling or eating of meat, have increased recently. This is a serious threat to human health because fewer options exist to help people overcome disease when infected with antibiotic-resistant pathogens. The antibiotics often are not fully metabolized by animals, and can be present in their manure. If manure pollutes a water supply, antibiotics can also leech into groundwater or surface water.

Because of this concern for human health, there is a growing movement to eliminate the non-therapeutic use of antibiotics with animals. In 2001, the American Medical Association approved a resolution to ban all low-level use of antibiotics. The USDA has developed guidelines to limit low-level use, and some major meat buyers (such as McDonald's) have stopped using meat that was given antibiotics that are also used for humans. The World Health Organization is also widely opposed to the use of antibiotics, calling for a cease of their low-level use in 2003. Some U.S. legislators are seeking to ban the routine use of antibiotics with livestock, and there has been legislation proposed to solidify a ban. The Preservation of Antibiotics for Medical Treatment Act (PAMTA), which was introduced in 2009, has the support of over 350 health, consumer, and environmental groups (H.R. 1549/S. 619). The act, if passed, would ban seven

classes of antibiotics important to human health from being used in animals, and would restrict other antibiotics to therapeutic and some preventive uses.

Other Effects – Property Values

Most landowners fear that when CAFOs move into their community their property values will drop significantly. There is evidence that CAFOs do affect property values. The reasons for this are many: the fear of loss of amenities, the risk of air or water pollution, and the increased possibility of nuisances related to odors or insects. CAFOs are typically viewed as a negative externality that can't be solved or cured. There may be stigma that is attached to living by a CAFO.

The most certain fact regarding CAFOs and property values are that the closer a property is to a CAFO, the more likely it will be that the value of the property will drop. The exact impact of CAFOs fluctuates depending on location and local specifics. Studies have found differing results of rates of property value decrease. One study shows that property value declines can range from a decrease of 6.6% within a 3-mile radius of a CAFO to an 88% decrease within 1/10 of a mile from a CAFO (Dakota Rural Action, 2006). Another study found that property value decreases are negligible beyond 2 miles away from a CAFO (Purdue Extension, 2008). A third study found that negative effects are largest for properties that are downwind and closest to livestock (Herriges, Secchi, & Babcock, 2005). The size and type of the feeding operation can affect property value as well. Decreases in property values can also cause property tax rates to drop, which can place stress on local government budgets.

Hribar C., *Understanding Concentrated Animal Feeding Operations and Their Impact on Communities*, p. 2-11.

B. Agricultural Vulnerabilities in the Town of Trade Lake

Trade Lake is located toward the southwest corner of Burnett County. (Figure B.)

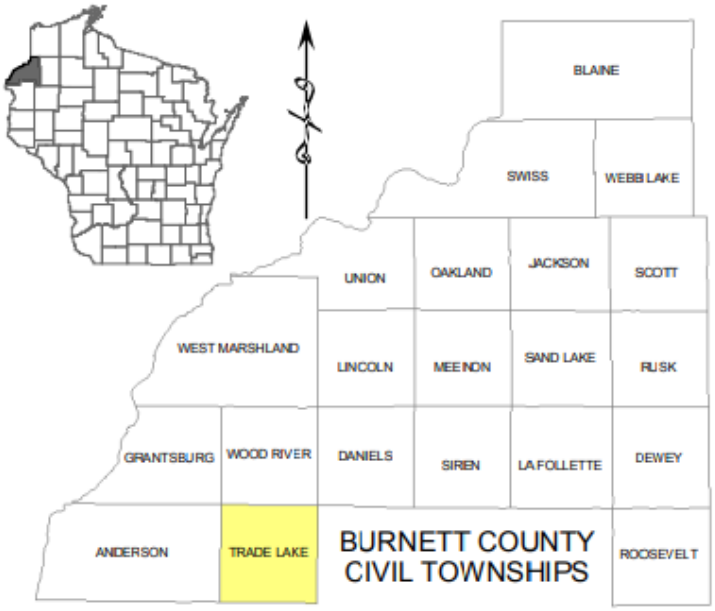

Figure B

With a year-round population of about 970 and a low population density, the Town of Trade Lake is rural. As is typical in Burnett County, the landscape is characterized mainly by its natural features including large tracts of wetlands and woodlands, and by it surface waters which include 14 named lakes, the Trade River and the St. Croix Watershed. Residential development is primarily clustered around the Town's water resources, with a scattering of development along the existing road network. Importantly, a little over a third of homes in the Town of Trade Lake are seasonal residencies. The population is expected to remain steady, with the Wisconsin Department of Administration projecting an increase of about 7 persons a year. Future development is also projected to remain steady, with an increase of about 5 homes per year. Residential housing is the primary form of projected future development.

Approximately 1/5 of the land cover in Trade Lake is agricultural. (Table 5 and Figure C.) Data for the Town of Trade Lake extracted from WiscLand 2 shows the approximate land cover as follows:

Table 5

Land Cover - WiscLand (NOT land use)	**Percent**
Agriculture	19%
Barren	0%
Forest	29%
Grassland	27%

Open Water	6%
Urban/Developed	2%
Wetland	17%

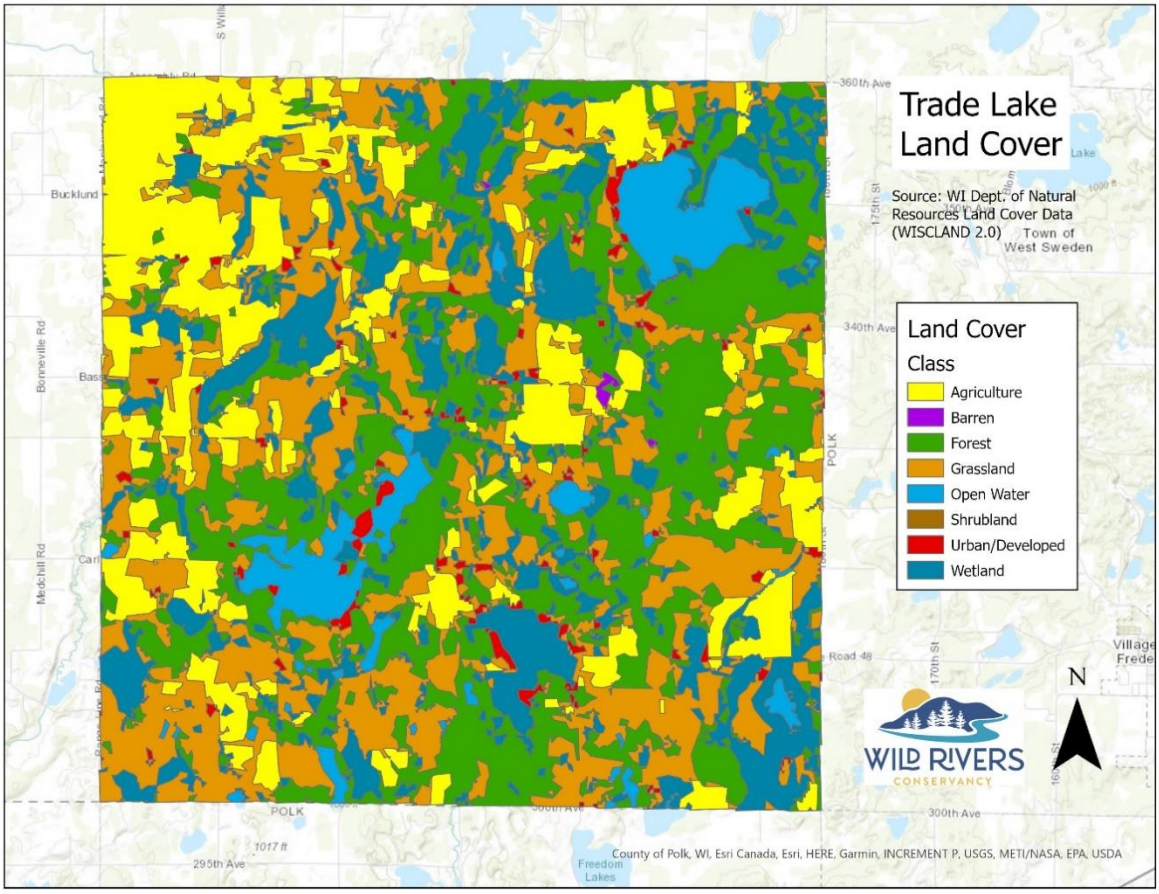

Figure C.[5]

The Town of Trade Lake-Year 2030 Comprehensive Plan, drafted June 2010 identified the following goals relative to the area's natural resources:

- encourage the efficient management of the town's natural resources
- protect and improve the quality and quantity of the town's ground and surface water
- preserve the natural and scenic qualities of lakes and shorelines in the town
- balance future development with the protection of natural resources
- protect air quality
- preserve and protect woodlands and forest resources for their economic, aesthetic and environmental values
- balance future needs for the extraction of mineral resources with potential adverse impacts on the Town

[5] Source: Appendix B, Wisconsin Land Cover Data (WISCLAND 2.0): https://dnr.wisconsin.gov/maps/WISCLAND

The intent of the Town, in terms of development has been to preserve the natural and environmental features, character, and opportunities that the residents of Trade Lake enjoy today while managing the long term physical development in concert with the market forces and land use regulation that shape it. The best agricultural lands, natural resource rich areas, and areas that support outdoor recreational opportunities will be preserved as such for future generations, but will still allow development at lower densities.

The Town of Trade Lake today is a result of its rich agricultural history and abundance of agricultural resources and land uses. Agriculture continues to contribute significantly to the economic, environmental, and social vitality of the county, and its communities. Preserving the agricultural resources remains a challenge. After Dewey Township, which is on the eastern edge of Burnett County, the Town of Trade Lake has the largest concentration of land that is currently zoned Exclusive Agriculture. This may be very significant because Burnett County recently proposed an ordinance that would limit the number of animal units to 500 (250 without a conditional use permit) in all zoning districts except Exclusive Agriculture, where the number of animal units is unlimited. If that happens, any CAFOs looking to site in Burnett County would be practically limited to Trade Lake or Dewey Township. This is another significant factor in favor of the implementation of additional operational regulations for any CAFO's wishing to locate in the Town of Trade Lake.

The Year 2030 Comprehensive Plan (created in 2010) identifies "the Agricultural, Natural, and Cultural resources element" as the most important element in the Plan, and provides:

> The *Agricultural, Natural, and Cultural Resources* element may be the most important element in the *Town of Year 2030 Comprehensive Plan.* Many of the issues and opportunities identified by the town during the planning process (refer to the *Issues and Opportunities* element) are related to these resources. The town is concerned with preserving surface water and groundwater quality, preserving woodlands and wildlife, protecting rural character and scenic views, limiting noise and light pollution, preserving agricultural lands, preventing conflicts between agriculture and rural housing development, preventing conflicts over mineral resources, and preserving historic and archeological sites. Some of the strongest points of consensus on the public opinion surveys were related to these resources and include: protecting groundwater, wetlands, and waterways; protecting forests and wildlife habitat; protecting farmland and productive soils; supporting the agriculture industry; protecting rural character; and protecting historical sites and structures.

Town of Trade Lake-Year 2030 Comprehensive Plan, p. 5-1. Large industrial CAFO operations also risk negatively affecting the health of small local farms in the area through monopolization of resources such as feed and transportation and potential depletion or contamination of the area's

surface and ground water. (Referring to the information submitted by Cumberland LLC to Burnett County, it intends to consume and over 28 million gallons of water per year.[6])

C. Natural Resource Vulnerabilities in the Town of Trade Lake

Natural and cultural resources are abundant in the town and are highly valued by the town's residents. Preserving rural character, forest resources, and outdoor recreational opportunities are primary concerns as reflected in the Town's goals and objectives, its issues and opportunities, and the results of the planning process surveys. Substantial natural resources present in the town include:

- 2,638 acres of wetlands
- 4,724 acres of floodplains
- 2,132 acres of surface water

Town of Trade Lake Year 2030 Comprehensive Plan, p. 5-1. Approximately 63% of Trade Lake is within shoreland area.

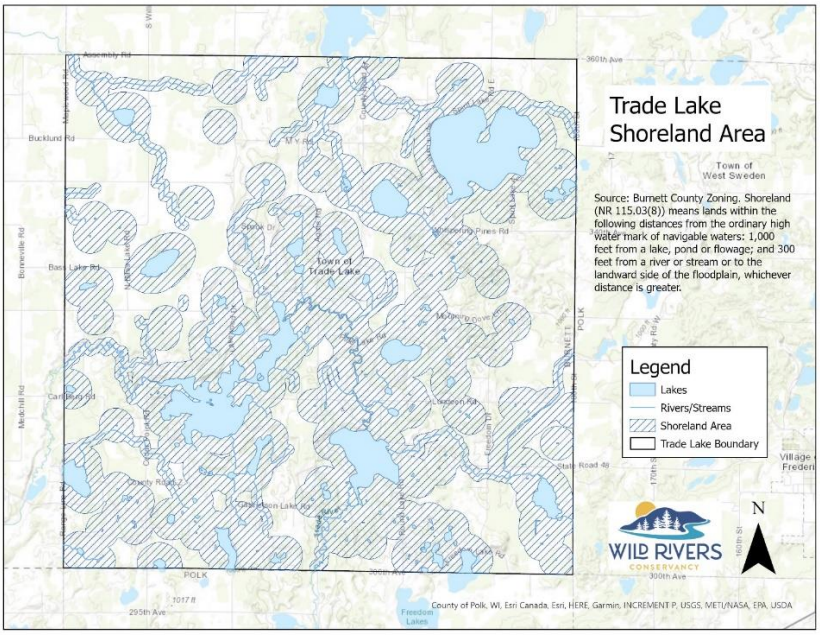

Figure D[7]

[6] Michigan State University published a chart of the amount of water consumed by various classes of swine. (https://www.canr.msu.edu/news/water_needs_of_pigs.) For this calculation, the Committee used 6 gallons per day for both gestating and lactating sows, 5 gallons per day for boars, 1 gallon per day for pigs up to 55 pounds, and 3 gallons for pigs 55 pounds to market. Cumberland's application indicates that they are asking to house 4125 pigs are 55 pounds to market, 14,625 pigs that are up to 55 pounds, 7,500 sows and 100 boars. That works out to be 72,500 gallons per day for drinking water, which is 26,462,500 gallons per year. In addition, the application indicates that the CAFO would use 2,007,501 gallons of wash water, a total annual water consumption of 28,470,001 gallons.

[7] Burnett County Ordinances, Chapters 30 and 45.

Recognizing the economic necessity of tourism and recreation to the economic well-being of the Town (and Burnett County), Trade Lake's goal has been to encourage development that maintains the attractiveness and rural character of the area. In doing so, the Town has sought to protect groundwater and surface water resources and balance the protection of farmland with the exercise of developing rights. For more than a decade, the Town Board has recognized the resident's and property owner's desire to preserve the Northwoods character as defined by scenic beauty, a variety of landscapes, undeveloped lands, forests, water resources, wildlife, farms, rural and small-town atmosphere, buildings integrated with the landscape, and enjoyment of these surroundings. Toward that end, the Town set a goal ***to preserve significant historical and cultural lands, sites, neighborhoods and structures that contribute to the community identity and character***. When implementing this objective, the town has sought to balance land use regulations and individual property rights with community interests and goals. Of particular concern to the town has been unsightly development and land use conflicts observed in other parts of the county with a widespread perception that existing land use controls and guidance have not kept pace with the changing conditions.

There are many sensitive natural resources in and around the Town of Trade Lake that are vulnerable to contamination and depletion. In addition to numerous lakes, ponds and wetlands, the Trade River runs through Trade Lake and empties into the St. Croix River. These sensitive ecologies can easily be tipped out of balance and destroyed irrevocably.

Moreover, the entire Town of Trade Lake is part of the 7,760 square mile watershed that feeds water to the St. Croix River. Lake St. Croix is listed as impaired due to excess phosphorus pollution. The Total Maximum Daily Load (TMDL) of phosphorus for Lake St. Croix is 360 metric tons. That means phosphorus pollution to the watershed will have to be reduced by 127 tons or 27%. In order to meet this reduction goal, communities and landowners in the St. Croix River watershed need to reduce, not increase, discharges from sewer plants as well as runoff from urban and agricultural land. (MPCA 2012)

The soils in Trade Lake are not favorable for spreading large amounts of animal manure. Soils are rated on a scale of "very limited," "somewhat limited," "not limited" and "not rated." The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include saturated hydraulic conductivity (Ksat), depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, soil erosion factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment. 65.5 % of the soils in Trade Lake are classified as "very limited." (See Figure E.)

Of Trade Lake's total acres:

- **65.5% Very Limited** – indicates that soil has one or more features that are unfavorable for the specific use. Limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

- **25.3% Somewhat Limited** – indicates that the soil has features that are moderately favorable for specified use. Limitations can be overcome or minimized by special planning, design, or installation.

- **0% Not Limited**

- **9.1% Not Rated**

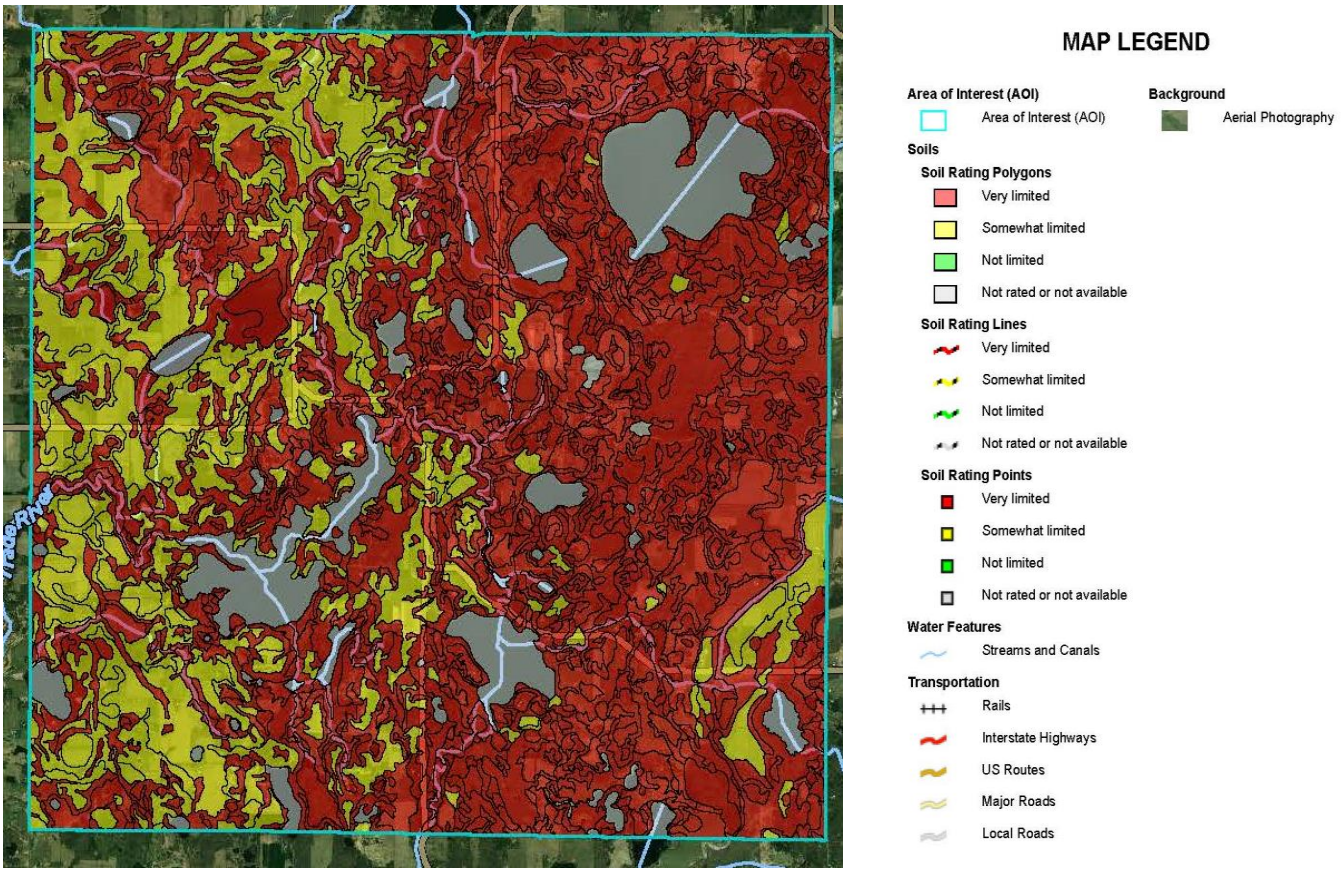

Figure E[8]

The Town has a vulnerable landscape with shallow soils, high water table and gravel formations that make large areas susceptible to groundwater pollution. Five factors contribute to groundwater susceptibility, including: type of soil, bedrock and materials between soil and bedrock; depth to bedrock; and depth to groundwater. Data from the Department of Natural Resources Groundwater

[8] Source: Appendix B, Map 6.

Susceptibility Model was divided into five evenly spread categories ranging from high to low. Of the town's total acreage approximately 4% is ranked high susceptibility to contamination, 20% moderately high, 76% moderate, 0% moderately low, and 0% ranked low susceptibility. (Table 6 and Figure F.)

Table 6

Groundwater Susceptibility Ranking	
Ranking	**Percent of Total**
High	4%
Moderately High	20%
Moderate	76%
Moderately Low	0%
Low	0%

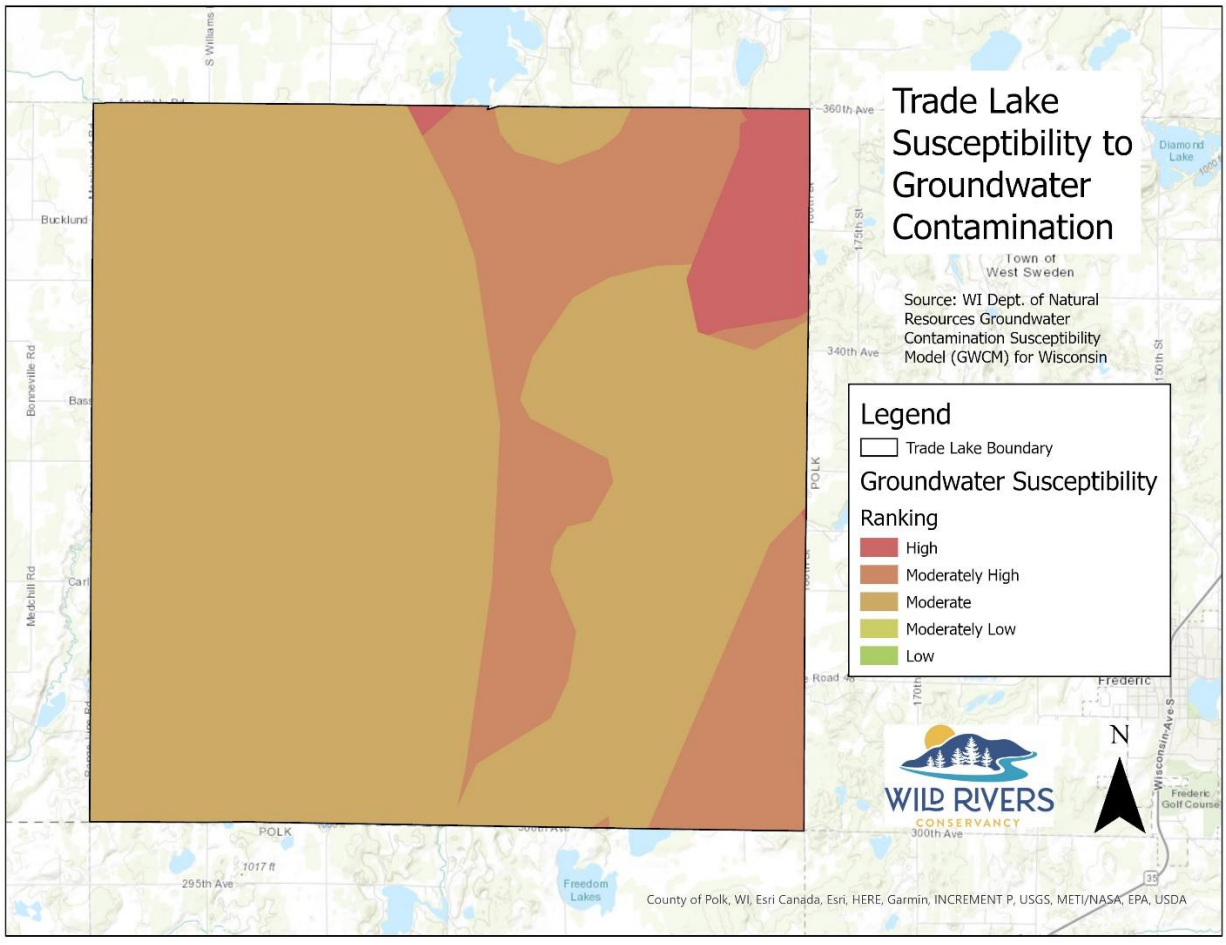

Figure F[9]

[9] Source: Appendix B, Wisconsin Department of Natural Resources. (2008). Groundwater Contamination Susceptibility Model (GCSM), Wisconsin 2008. https://geodata.wisc.edu/catalog/CF9E8298-63E5-43C7-9E8A-DEDCB93C1519

The Town of Trade Lake has relatively steep slopes, with almost no flat land that is not also floodplain. This means almost the entire Town has extreme vulnerability to erosion and pollution of waterways with excess nutrients, chemicals, or other potential contaminants. (Figure G, map generated by the University of Wisconsin and found at: https://snapmaps19.snapplus.wisc.edu/)

Figure G shows the area around Big Trade Lake, Little Trade Lake, Spirit Lake and the Trade River. The darker pink areas have slopes greater than 12% and the lighter pink areas have slopes greater than 6%.

Additionally, the yellow vertical lines in Figure G depict areas with ***less than 12 inches to ground water***. Much of the Town of Trade Lake, is covered with only a thin layer of soil, with groundwater being less than 12 inches from the surface. This is consistent with Figures H and I, below, which show that Trade Lake has areas where the bedrock is just 5 to 50 feet from the surface and that significant portions of Trade Lake Trade have a depth to ground water of 0 to 20 feet.

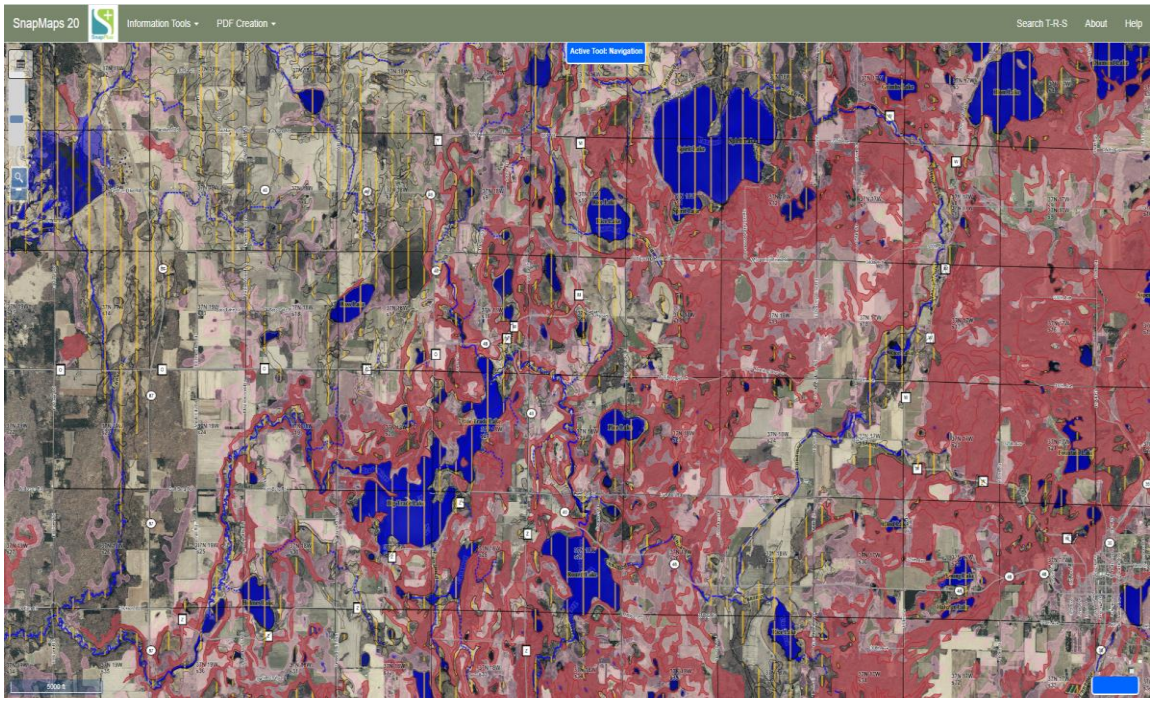

Figure G

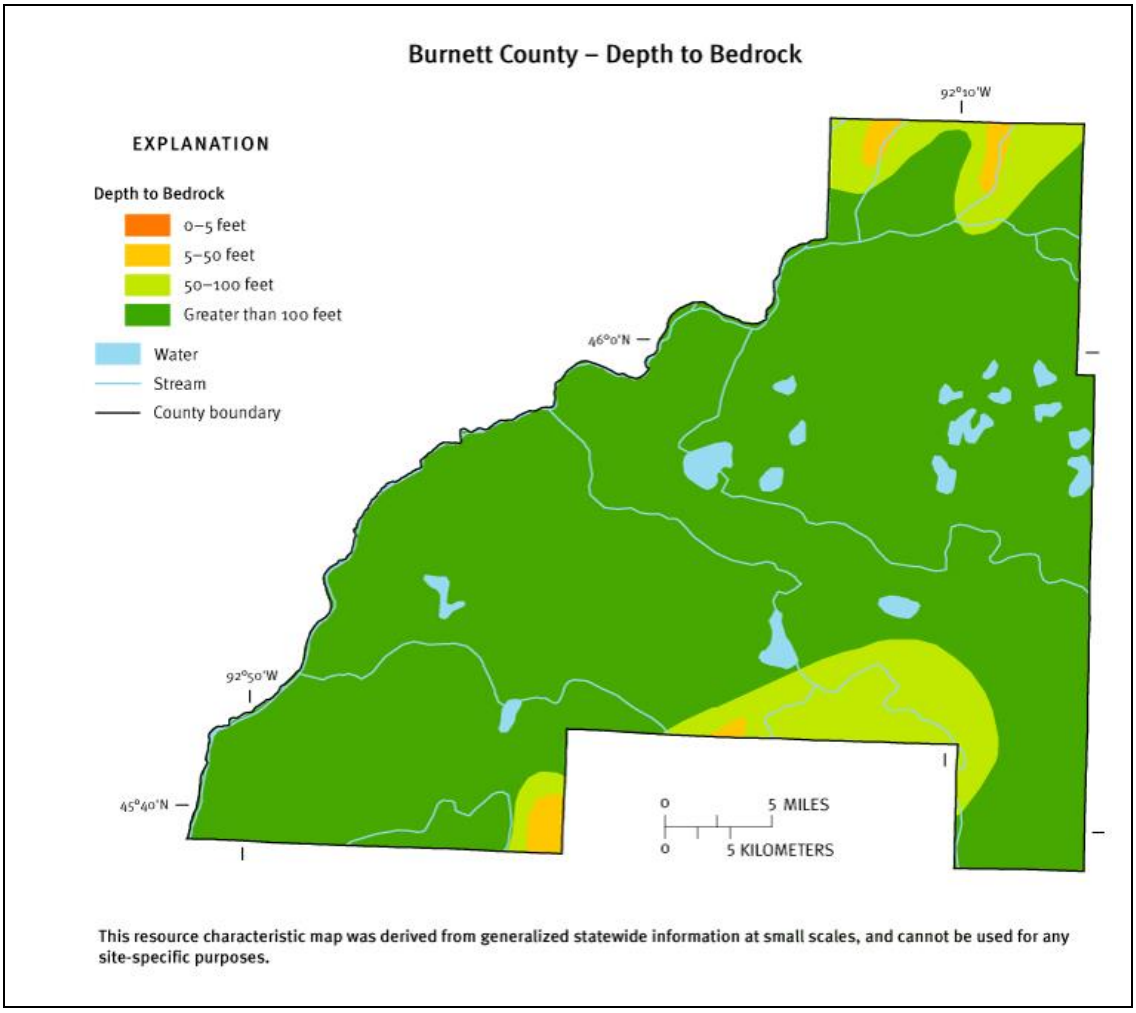

Figure H

Moreover, approximately 63% of Trade Lake's total acres have groundwater within 20 feet of the land surface. Approximately 97% is within 50 feet of the land surface. (Table 7 and Figure I.)

Table 7

Depth to Groundwater	
1-20ft	63%
20ft - 50ft	34%
Over 50ft	3%

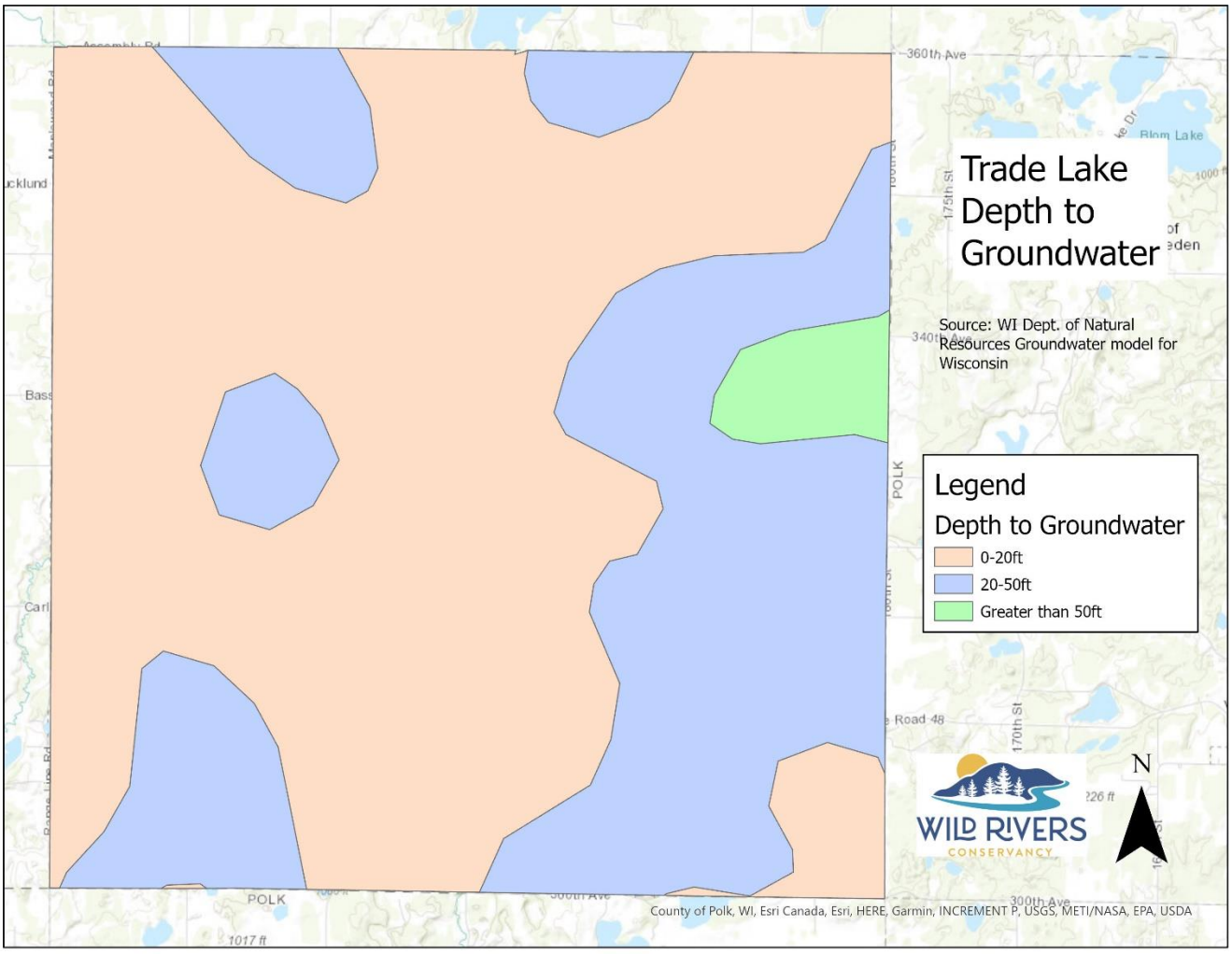

Figure I[10]

The Town of Trade Lake has roughly 300 private wells serving residences and businesses and six public supply wells. *Town of Trade Lake, Wisconsin Source Water Protection Plan*, Andrew Aslesen, Sourcewater Specialist, March 2020, p. 2.

The source of all groundwater in Trade Lake is precipitation which infiltrates the soils and recharges the aquifer. (*Id*. p. 3) The rate of infiltration and groundwater movement is affected by the soils and subsurface geology. (*Id*. p. 3-5.)

> The NRCS classifies soils into four hydraulic soils groups based on the soil's runoff potential. A soil's runoff potential has an inverse relationship with its infiltration rates, and soils with high runoff potential have low infiltration rates.

(*Id*.)

[10] Source: Appendix B, Wisconsin DNR Groundwater Susceptibility Model, Depth to Groundwater: https://data-wi-dnr.opendata.arcgis.com/datasets/wi-dnr::gcsm-water-table-depth/about.

> Infiltration rates of the surface soils in Trade Lake are highly variable, with generally high to moderate infiltration rates in the eastern part of the town and more moderate to low with some high infiltration rates in the western part of the town.

(*Id*.)[11] The subsurface geology of Trade Lake is inconsistent, made up of unconsolidated glacial deposits that allow water infiltrating the surface (and any contaminates in that water) to travel horizontally, until fine grained lenses "pinch out," at which point the water travels vertically down toward the aquifer. (*Id*. p. 3-4.) Groundwater in the Town of Trade Lake flows from higher elevation areas to the east/southeast of the Town generally west toward the St. Croix River. (*Id*. p. 6.)

This information presents a troublesome dichotomy of issues. Where the soils are more permeable and the water table closer to the surface, there is greater chance of water borne contaminants percolating down into the ground water. On the other hand, less permeable soils are more conducive to runoff. Because Trade Lake is located squarely within the St. Croix River watershed, contaminated surface runoff poses a risk to the St. Croix River.

The USGS has two test wells in Burnett County that monitor the depth of the water table. The closest well to Trade Lake is located approximately 3 miles north and 1.5 miles east of Grantsburg. In April 2020 the water levels measured just 1.38 feet below the land surface.[12]

A 2020 UW-Madison study analyzing rainfall trends showed that Wisconsin is experiencing more frequent and more extreme rainfall events, causing flash-flooding, and inundation in the floodplains.[13] This trend is expected to continue and accelerate.

Several of Trade Lake's waters are already impaired. (Table 8 and Figure J.) Excess nutrients from non-point source runoff leads to surface water quality degradation of local lakes and streams. According to the 2012 Lake St. Croix TMDL Implementation Plan, Burnett County is the fourth highest contributor of phosphorus runoff in the St. Croix Watershed. Subsequently, it has a phosphorus reduction of over 72,000 lbs/yr required by the State of Wisconsin and U.S. Environmental Protection Agency to meet Lake St. Croix TMDL goals. Trade Lake has 2.77 miles of impaired rivers and three impaired lakes, all for excess phosphorus.

[11] Also see USGS, *Hydrogeologic Characteristics of the St. Croix River Basin, Minnesota and Wisconsin: Implications for the Susceptibility of Ground Water to Potential Contamination*, USGS Scientific Investigations Report 2007-5112, Figure 2.

[12] See maps and data from the Wisconsin DNR website: https://groundwaterwatch.usgs.gov/AWLSites.asp?S=454953092432502&ncd=.

[13] Found at the following web address: https://www.ssec.wisc.edu/news/articles/12485.

Table 8

Lakes Impaired for P	Acres
Big Trade Lake	73
Little Trade Lake	37
Round Lake	150

Rivers Impaired for P	Miles
Trade River	2.77

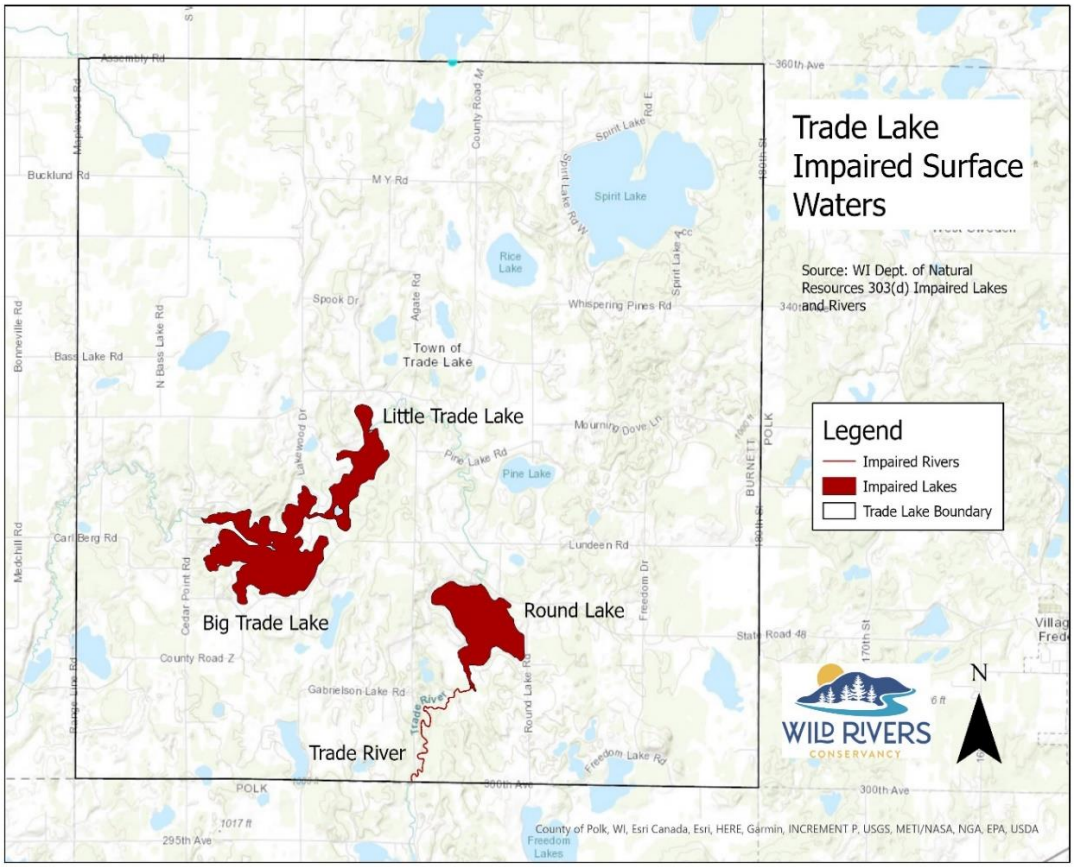

Figure J[14]

The vulnerably of the township's waterways is highlighted by a map showing property upon which the proposed Cumberland LLC hog CAFO plans to deposit approximately 9 million gallons of manure annually. (The Committee recognizes that not all CAFO's will have the same method or location of disposing of manure and the Town of Trade Lake does not intend to create regulations based upon a single applicant--the information is nevertheless informative of the potential risks.) The plotting of the properties suggested by the potential CAFO (Figure K) and enlargement

[14] Source: Appendix B, Wisconsin DNR 303(d) Impaired Lakes 2021: https://data-wi-dnr.opendata.arcgis.com/datasets/wi-dnr::303d-impaired-lakes-listed/about; Wisconsin DNR 303(d) Impaired Rivers and Streams 2021: https://data-wi-dnr.opendata.arcgis.com/datasets/wi-dnr::303d-impaired-rivers-and-streams-listed/about

(Figure L) show that the intent is to spread manure on fields that are directly adjacent to lakes, rivers drainage ditches and sensitive wildlife areas.[15]

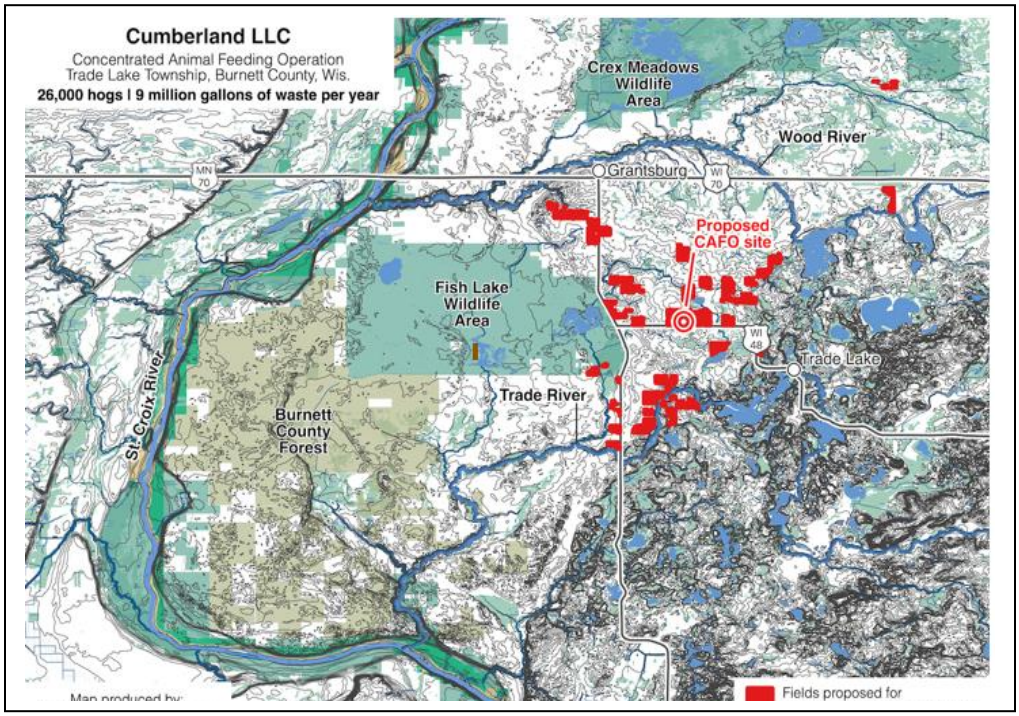

Figure K

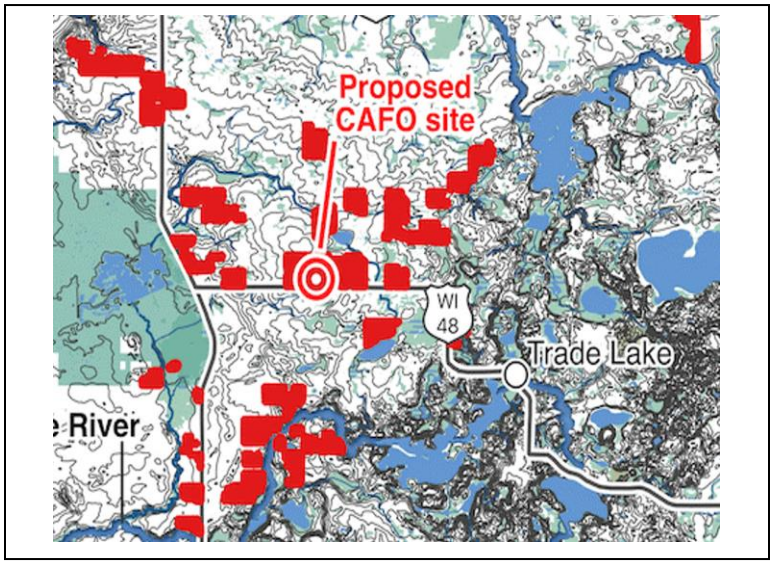

Figure L

[15] The properties identified in Figures K and L were taken from documents submitted to the State and County by Cumberland LLC.

A 2018 study looked at the chemical and antibiotic resistant gene (ARG) profiles of 20 surface water locations in Kewaunee County, Wisconsin to examine the relationship between agricultural contamination and ARG abundance over one year. The study found significantly higher gene abundances in sediment during the time when manure fertilization occurred. The study's authors concluded that Kewaunee County sediments "serve as a site of accumulation for non-point source agricultural pollution and ARG's on a temporal scale associated with manure fertilization."[16] Specially, the study identified positive correlations of nitrate, Escherichia coli, and coliforms with tetracycline resistance gene and genes associated with mobile genetic elements or gene cassettes in sediment and genes associated with mobile genetic elements or gene cassettes, sulfonamide resistance and tetracycline resistance genes in water. (*Id*. p. 1, 7) It is significant to note that that Kewaunee County study identified "non-point source pollution via cropland manure spreading [as] the major source of contamination" as opposed to the individual CAFO facility location. (*Id*. p. 17.)

The increase in concentration of livestock and poultry and transition to large, high-density, CAFOs over the last several decades has resulted in the concentration of animal waste and process water over small geographic areas.[17] While it can be a valuable fertilizer, untreated animal waste spread at the magnitude produced by CAFO operations represents a public health and ecological hazard impacting groundwater, surface water, air, property values and a community's quality of life.

Untreated wastes from these operations can contaminate ground and surface waters with nitrates, drug residues, parasites, viruses, bacteria and other hazards.[18] The Wisconsin Supreme Court has concluded that manure is a "pollutant."[19] Studies demonstrate that humans can be exposed to waterborne contaminants from livestock and poultry operations through the recreational use of contaminated surface water and the ingestion of contaminated drinking water.[20] Exposure to elevated levels of

[16] Rachelle E Beattie, Michael Walsh, Mercedes Cecilia Cruz, L Rex McAliley, Laurel Dodgen, Wei Zheng, Krassimira R Hristova, *Agricultural contamination impacts antibiotic resistance gene abundances in river bed sediment temporally*, FEMS Microbiology Ecology, Volume 94, Issue 9, September 2018, fiy131, https://doi.org/10.1093/femsec/fiy131

[17] United States Environmental Protection Agency. Literature review of contaminants in livestock and poultry manure and implications for water quality. July 2013:1-137. Link: http://ow.ly/mTDw308qwbZ.

[18] Spencer JL, Guan J., *Public health implications related to spread of pathogens in manure from livestock and poultry operations*. Public Health Microbiology: Methods and Protocols. 2004:503-515; Graham JP, Nachman KE. *Managing waste from confined animal feeding operations in the United States: The need for sanitary reform*. Journal of Water and Health. 2010;8(4):646-670; Showers WJ, Genna B, McDade T, Bolich R, Fountain JC. *Nitrate contamination in groundwater on an urbanized dairy farm*. Environ Sci Technol. 2008;42(13):4683-4688; *Relation between nitrates in water wells and potential sources in the lower Yakima Valley, Washington state*. U.S. Environmental Protection Agency, Washington, D.C., 2012.

[19] *Wilson Mut. Ins. Co. v. Falk*, 360 Wis. 2d 67, 90, 857 N.W.2d 156, 167 (2014)

[20] *Id*.; Burkholder J, Libra B, Weyer P, et al. Impacts of waste from concentrated animal feeding operations on water quality. *Environ Health Perspect*, 2007:308-312.

nitrates in drinking water is associated with adverse health effects, including cancer,[21]birth defects and other reproductive problems,[22] thyroid problems,[23]and methemoglobinemia. [24]

Animal wastes are also rich in organics and high in biochemical oxygen-demanding materials (BOD). For example, treated human sewage contains 20–60 mg BOD/L, raw human sewage contains 300–400 mg BOD/L, and swine waste slurry contains 20,000–30,000 mg BOD/L.

Nutrient runoff is implicated in the growth of harmful algal blooms,[25] which may pose health risks for people who swim or fish in recreational waters, or who consume contaminated fish and shellfish.

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[21] Ward MH. Too much of a good thing? Nitrate from nitrogen fertilizers and cancer. *Rev Environ Health.* 2009;24(4):357-363. (Nitrate, the breakdown product of nitrogen fertilizers, accumulates in groundwater under agricultural land and can spread through waterways due to agricultural field runoff. Nitrates are associated with a range of adverse health effects, including methemoglobinemia, various cancers, negative reproductive outcomes, diabetes, and thyroid conditions.); Chiu H, Tsai S, Yang C. Nitrate in drinking water and risk of death from bladder cancer: An ecological case-control study in Taiwan. *Journal of Toxicology and Environmental Health, Part A.* 2007;70(12):1000-1004. (The association between bladder cancer mortality and nitrate exposure from Taiwan drinking water was investigated in this study. The results showed a significant positive relationship between the levels of nitrates in the drinking water and the risk of death from bladder cancer, indicating that environmental exposure to nitrates plays a role in the development of bladder cancer.); Ward MH, Kilfoy BA, Weyer PJ, Anderson KE, Folsom AR, Cerhan JR. Nitrate intake and the risk of thyroid cancer and thyroid disease. *Epidemiology.* 2010;21(3):389-395. (This study examined the association between nitrate intake through public water and diet with the risk of thyroid cancer and hypo- and hyperthyroidism. The study found an increased risk of thyroid cancer with high water nitrate levels and with longer consumption of water containing nitrates. The increased intake of dietary nitrate was associated with an increased risk of thyroid cancer, and with the prevalence of hypothyroidism.); Gulis G, Czompolyova M, Cerhan JR. An ecologic study of nitrate in municipal drinking water and cancer incidence in Trnava district, Slovakia. *Environ Res.* 2002;88(3): l 82- l 87. (This study found is that a higher incidence of some cancers was associated with higher levels of nitrate in drinking water. The trend was found in women for overall cancer cases, stomach cancer, colorectal cancer and non-Hodgkin lymphoma, and in men for non-Hodgkin lymphoma and colorectal cancer.)

[22] Burkholder J, Libra B, Weyer P, et al. Impacts of waste from concentrated animal feeding operations on water quality. *Environ Health Perspect,* 2007:308-312. (This work-group, part of the Conference on Environmental Health Impacts of Concentrated Animal Feeding Operations: Anticipating Hazards—Searching for Solutions, found that current and generally accepted livestock waste management practices do not protect water resources from the pathogens, pharmaceuticals and excessive nutrients found in animal waste. As concern about the potential human and environmental health impact of long-term exposure to contaminated water grows, there is greater need for rigorous monitoring of CAF0s, improved understanding of the major toxicants affecting human and environmental health, and a system to enforce these practices.); Ward *supra*.; Manassaram DM, Backer LC, Moll DM. A review of nitrates in drinking water: Maternal exposure and adverse reproductive and developmental outcomes. *Environmental Health Perspectives.* 2006. (Animal studies support the association between nitrate exposure and adverse reproductive effects, and some studies report an association between nitrates in drinking water and spontaneous abortion, intrauterine growth restriction and various birth defects.); Brender JD, Weyer PJ, Romitti PA, et al. Prenatal nitrate intake from drinking water and selected birth defects in offspring of participants in the national birth defects prevention study. *Environ Health Perspect.* 2013;121(9):1083-1089. (This study concluded that higher maternal water nitrate consumption was associated with birth defects, including spina bifida, limb deficiency, cleft palate, and cleft lip.)

[23] Burkholder and Ward, *supra*.

[24] Burkholder, *supra.*

[25] United States Environmental Protection Agency literature review of contaminants in livestock and poultry manure and implications for water quality. July 2013:1-137. (This EPA report on the environmental occurrence and potential effects of livestock and poultry manure related contaminants on water quality found that 60-70% of manure nitrogen

Exposure to algal toxins has been linked to neurological impairments, liver damage, gastrointestinal illness, severe dermatitis, and other adverse health effects.[26]

Wisconsin CAFOs are required to have a Nutrient Management Plan (NMP) in order to get a permit under the Clean Water Act from the WDNR. The rules governing how these permits are issued and implemented are contained in NR 243. Wisconsin's agricultural standards and prohibitions for runoff management are contained in NR 151. WDNR released draft revisions to NR 151 in April 2021. However, the employment of nutrient management plans does not eliminate contamination.

> Regarding nitrates, Borchardt pointed to nutrient management plans, widely employed to reduce surface runoff from agricultural operations. "Everyone thinks these nutrient management plans help mitigate pollution, and in fact, we found that the more fields around a well with [a plan in place], the greater the likelihood of that well having a nitrate level that exceeds the standard," he says. "There's a mindset that if you have a nutrient management plan, you must be managing your nutrients well, and there's little risk of contamination. That turned out not to be true in our study site."

Nicole W, Farm to Faucet? Agricultural Waste and Private Well Contamination in Kewaunee County, Wisconsin, *Environmental Health Perspectives,* 114001-1 129(11) November 2021

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and phosphorus may not be assimilated by the farmland where it was generated due to the increasing concentration of industrial animal production. The report also notes the variety of pathogens contained in livestock and poultry manure, as well as the potential for their spread to humans when surface and groundwater and food crops come into contact with manure through runoff, spills, and land-application of manure. It also refers to research indicating that antimicrobial use in livestock and poultry production has contributed to the occurrence of anti-microbial resistant pathogens in animal operations and nearby environments. The report also relates that manure discharge to surface waters can occur by various means and have deleterious effects on aquatic life and contribute to toxic algal blooms harmful to animals, and to humans when exposed via contact with contaminated drinking water or recreational use of contaminated water.); Heisler J, Glibert PM, Burkholder JM, et al. Eutrophication and harmful algal blooms: A scientific consensus. *Harmful Algae.* 2008;8(0:3-13. (The US EPA held a roundtable discussion to develop consensus among academic, federal and state agency representatives on the relationship between eutrophication and harmful algal blooms. Seven statements were adopted during the session, which include acknowledgement of the important role of nutrient pollution and degraded water quality in the development and persistence of many harmful algal blooms.)

[26] Carmichael WW. Health effects of toxin-producing cyanobacteria: "The CyanoHABs". *Human and Ecological Risk Assessment: An International Journal.* 2001;7(5):1393-1407. (Cyanobacteria toxin poisonings (CTPs) occur in fresh and brackish waters throughout the world as a result of eutrophication and climate change. Cyanobacteria toxins are responsible for acute lethal, acute, chronic and sub-chronic poisonings of wild and domestic animals and humans. These poisonings result in respiratory and allergic reactions, gastrointestinal disturbances, acute hepatotoxicocsis and peracute neurototoxicosis.); Paerl FIW, Fulton RS ,3rd, Moisander PH, Dyble J. Harmful freshwater algal blooms, with an emphasis on cyanobacteria. *Scientific WorIcl Journal.* 2001;1:76-113. (This paper reviews the effects of harmful freshwater algal blooms, resulting from nutrient oversupply and eutrophication, on water quality. Algal blooms contribute to water quality degradation, including malodor and foul taste, fish kills, toxicity, and food web alterations, while algal bloom toxins can adversely affect human and animal health through exposure to contaminated recreational and drinking water. The control and management of blooms, and their negative outcomes, must include nutrient input constraints, particularly on nitrogen and phosphorus.)

It is troubling that organizations monitoring wildlife are seeing significant negative effects on wildlife, which they connect to water pollution. The 2020 World Wildlife Federation study showed that we are experiencing unprecedented biodiversity loss globally, with 68% of all wildlife lost in the last half century, and even more extreme drops in freshwater ecosystems, which is one of Trade Lake's precious resources. [27]

> Globally, monitored population sizes of mammals, fish, birds, reptiles, and amphibians have declined an average of 68% between 1970 and 2016, according to World Wildlife Fund's (WWF) *Living Planet Report 2020*. Populations in Latin America and the Caribbean have fared worst, with an average decline of 94%. Global freshwater species have also been disproportionately impacted, declining 84% on average. As an important indicator of planetary health, these drastic species population trends signal a fundamentally broken relationship between humans and the natural world, the consequences of which—as demonstrated by the ongoing COVID-19 pandemic—can be catastrophic.

(Press release from the World Wildlife Federation, https://www.worldwildlife.org/press-releases/68-average-decline-in-species-population-sizes-since-1970-says-new-wwf-report.)
Similar to other towns in the area, Trade Lake depends upon wildlife for recreational revenue derived from hunting, fishing and nature watching. Therefore, Trade Lake has a lot of resources to protect, and a lot to lose if the water quality is degraded.

D. Economic Vulnerabilities in the Town of Trade Lake

CAFOs pose a host of issues that threaten the local economy. The American Public Health Association generally described some of the negative effects on local communities in its November 5, 2019, Position Statement:

> Close proximity to CAFOs is frequently associated with declines in local economic and social indicators (e.g., business purchases, infrastructure, property values, population, social cohesion), which undermine the socioeconomic and social foundations of community health, often in poor and African American rural communities. There are disproportionate negative health impacts associated with CAFOs on low-income, disadvantaged, and economically distressed communities, as well as communities that are heavily dependent on groundwater and have high proportions of ethnic and racial minority residents, raising serious environmental justice concerns. In addition, studies have shown that CAFOs are clustered in areas near low-income and non-White schools. Also, low wages, lack of healthy food options, and poor access to medical care may intensify the burden of disease in these communities. Moreover, the negative health and environmental impacts associated with CAFOs can become concentrated in these communities due to their limited economic and political resources to address problems.

American Public Health Association Policy Number: 20194, *Precautionary Moratorium on New and Expanding Concentrated Animal Feeding Operations*, November 5, 2019, p. 4.

[27] Found at the following web address: https://livingplanet.panda.org/en-us/.

The University of Wisconsin Extension service at Burnett County performed the tax study using data from the 2016 County tax rolls. The study shows the percentage of taxes in the Town of Trade Lake derived from Lakeshore/vacation properties. The study showed that over 59% of the Town's tax revenues come from Lakeshore/vacation properties. (See Table 9, below.)

Table 9[28]

Location	**Total Property Tax**	**Percent of Total Property Tax in The Town of Trade Lake**
Town of Trade Lake	$1,650,705	100%
Round Lake	$239,145	14.5%
Big/Little Trade	$329,391	20.0%
Spirit Lake	$310,494	18.9%
Pine Lake	$48,122	2.9%
Pickle Lake	$18,879	1.1%
Holmes Lake	$11,771	0.7%
Gabrielson Lake	$20,924	1.3%
Total Lakeshore Property Tax Revenue in the Town of Trade Lake	$978,726	59.4%

As noted above, properties in close proximity to CAFOs can suffer decreases in values of up to 80%, which would affect the tax base for Trade Lake. Figures M and N give a sampling of the values of properties that could be affected by the presence of a CAFO in Trade Lake.

[28] Data from county tax rolls – 2016.

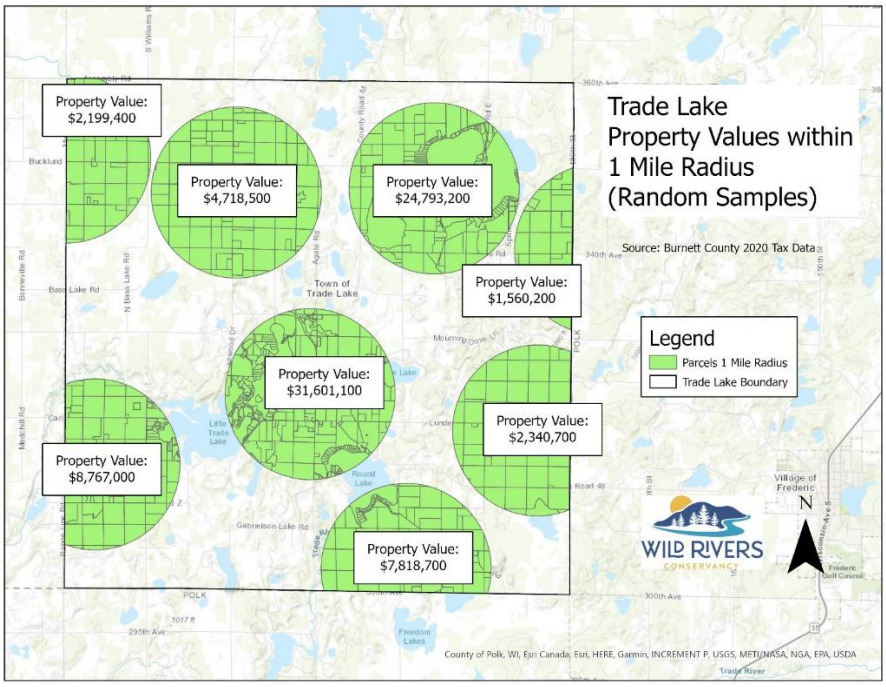

Figure M[29]

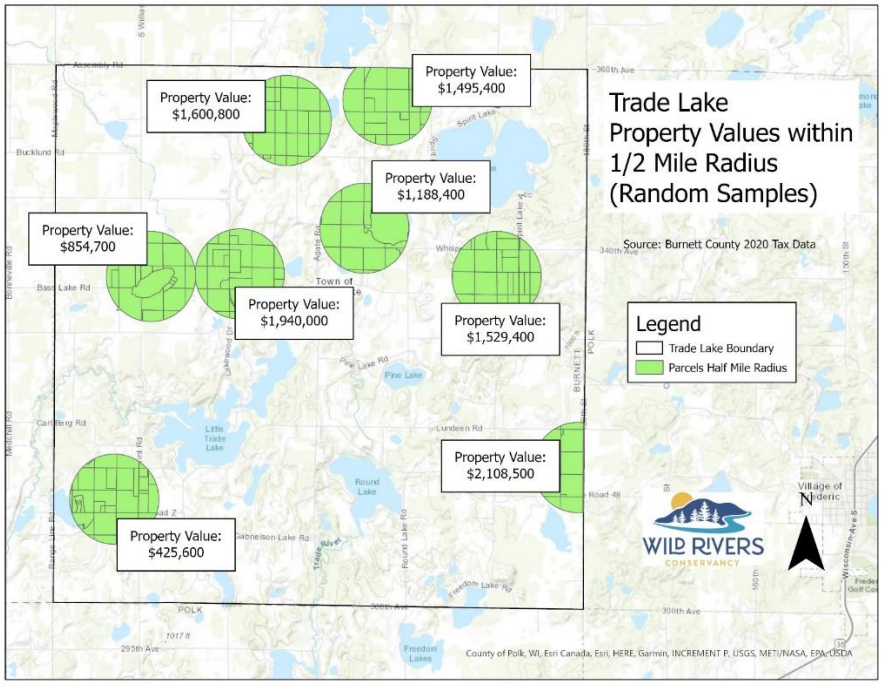

Figure N[30]

[29] Source: Appendix B, 2020Wisconsin County Parcel Data – Burnett County, WI - https://www.sco.wisc.edu/parcels/data-county/

[30] Source: Appendix B, 2020Wisconsin County Parcel Data – Burnett County, WI - https://www.sco.wisc.edu/parcels/data-county/

From the community discussions, and through CAFO Permitting Study Committee conversations, it is clear that further analysis is needed before decision-makers can be sure how the presence of CAFOs in Trade Lake will affect the overall economic development of the Town of Trade Lake. Some concerns that come to mind, but were not studied by the Committee include:

- An analysis of job the impact of CAFOs, including any job losses due to health issues around CAFOs and any job gains due to CAFOs;
- An analysis of the County and Municipalities Tax Base impacts, including expected property values and tax base decreases as well as tax base decreases due to property owners leaving, resulting in a decrease in population;
- An analysis of public spending impacts, including increased health costs, decreasing tourism & recreation dollars, rural community economic degradation, and impacts on existing local businesses;
- Impacts on county and township infrastructure and burden of increased road wear & repair;
- An analysis of the economic impact of the further loss of family farms in the Town of Trade Lake and surrounding areas;
- An analysis that Monetizes all of the public assets at risk with a CAFO;
- A cost-benefit analysis for all landowners in the Town of Trade Lake that asks: What is economic cost compared to value presented by a CAFO?

The Committee was able to review studies that discussed the impacts on property values caused by CAFOs. Based on the studies/publications reviewed by the CAFO Permitting Study Committee, it should be expected that properties adjacent to or nearby CAFOs in Trade Lake will decline in value, thus reducing property tax revenue accordingly. One study showed that property values declined up to 88% withing a tenth of a mile from a CAFO down to about a 6% decrease in value 3 miles from a CAFO.[31] Some anecdotal evidence from local realtors indicates that properties close to CAFOs will be difficult, if not impossible to sell.

In an article appearing in the July 2001 publication of The Appraisal Journal entitled, *Concentrated Animal Feeding Operations and Proximate Property Values*, author John A. Kilpatrick[32] discusses seven case studies from five different states. Discussion of the case studies is brief and worth quoting in its entirety:

[31] Hribar C., *Understanding Concentrated Animal Feeding Operations and Their Impact on Communities,* p. 11. (Available at: https://www.cdc.gov.) *Also see*: Animal Operations and Residential Property Values, The Appraisal Journal, Apr. 15, 2015; The Effect of a Large Hog Barn Operation on Residential Sales Prices in Marshall County, KY, Josre, Dec. 14, 2014; Animal Feeding Operations and Residential Value: Summary of Literature, University of Missouri, 2011; An Analysis of the Impact of Swine CAFOs on the Value of Nearby Houses, U ofNorthern Iowa, 2008; Evaluating the Effect of Proximity to Hog Farms on Residential Property Values: A GIS-Based Hedonic Price Model Approach URISA Journal, 2005; Living with Hogs in Iowa: The Impact of Livestock Facilities on Rural Residential Property Values, Iowa State University, Center for Agricultural and Rural Development, Aug. 2003.

[32] John A. Kilpatrick is a partner and senior analyst with Mundy Associates, LLC, an economic, market, and valuation firm specializing in complex real estate matters headquartered in Seattle, Washington. Kilpatrick is the author of four books and numerous articles on real estate matters, and is a frequent speaker on real estate economics and valuation. He did his graduate work in Real Estate Finance at the University of South Carolina.

Minnesota Case Study

A homeowner in Minnesota lives about two miles from one swine CAFO and about three-quarters of a mile from a second CAFO. When these CAFOs were first opened in the early 1990s, she was initially a supporter. However, she and her family immediately began suffering illnesses, which they attributed to the proximate CAFOs. She contacted him the Minnesota poison control center and for the first time learned about the dangers of hydrogen sulfide emissions. She kept track of her illnesses and weather conditions (e.g., wind and direction) and concluded that her illnesses were caused by the emissions from the CAFOs. Testing was warranted, and on at least one occasion the reading was above 1,000 ppb hydrogen sulfide, well above danger levels.

North Carolina Study

Palmquist, et. al, were the first to quantitatively determine that the distance from a residence to a CAFO has an impact on residential values. However, their study looked only at residences already near CAFOs and measured the impacts of additional CAFO capacity (either new CAFOs or additional livestock at existing CAFOs) located at 0.5-, 1.0-, and 2.0-mile distances from the residence. Nonetheless, they established a methodological model for spatial impacts of CAFOs.

University of Minnesota Study

In 1996, the Minnesota Department of Agriculture commissioned a study by researchers at the University of Minnesota on the topic of value diminution resulting from proximate CAFOs. In addition to substantial secondary research in the area, the study authors also conducted primary research into value impacts in that state. Specifically, they conducted a hedonic price analysis on 292 rural residences that were sold during 1993–1994 in two Minnesota counties. They found a statistically significant pricing impact related both to the existence of a CAFO as well as the distance from the CAFO. In other words, not only does a CAFO have a significant impact on property value, but the nearer the CAFO, the greater the impact. The researchers also found that CAFOs tend to be located near older or lower valued homes. Hence, the pricing impacts in a simple empirical study may be muted by other negative impacts to value, and high-valued residences may be impacted to a greater degree by CAFOs than would be suggested by their findings.

University of Missouri Study

Following the methodology of the Minnesota study, researchers at the University of Missouri were able to quantify both the average value impact of a CAFO and the impact by distance. An average vacant parcel within 3 miles of a CAFO experienced a value loss of about 6.6%. However, if that parcel was located within one-tenth of a mile from the CAFO (the minimum unit of measure in the study) and had a residence on it, then the loss in value was estimated at about 88.3%.

Pasco, Washington Case Study

A 309-acre family farm that had been operated for many years produced alfalfa, asparagus, corn, apples, peaches, nectarines, cherries, melons, and a range of garden produce. A CAFO was adjacent to the residence (about 1/4 mile away), and consequently the farm product was impacted by dust, flies, fly fecal matter, and odor. The farm was appraised for litigation purposes and a value diminution of over 50% was determined, using traditional farm appraisal methods. The CAFO settled the lawsuit by purchasing the plaintiff's farm and relocating the residents to a nearby farm that was not impacted by the CAFO externalities.

Michigan Horse Farm Case Study

A horse-breeding operation (owner-occupied farm) is located approximately 1,000 feet from a recently constructed large scale, pork processing facility. The use and enjoyment of the home has been diminished by airborne externalities, and the ability to use the site as a farm may be compromised as a result of flies carrying animal blood and feces that contain antibiotics and other nuisances. In 2000, the property owner appealed for a property tax reassessment representing a devaluation of over 50% from fair market value, and the county attorney concurred with that appeal.

Michigan Residence Case Study

A family purchased a "fixer upper" residence in rural Vicksburg, Michigan in 1995. In 1997, a largescale pork processing facility was located about 700 feet from the home. The reduction in air quality was so severe as to force the residents to abandon their home and move elsewhere. To date, they have not been able to sell the home. The owner of the processing facility offered to compensate them for 60% of the fair market value of the home (i.e., a 60% diminution in value). As of this writing, litigation is pending.

Summary and Conclusions

The above suggests that the establishment of a CAFO may result in value diminution to other nearby properties. The amount of the value loss is typically an inverse function of distance (closer properties diminish more), a function of property type (newer, nicer residences lose more), and a function of property use (farm will lose value due to diminished productivity and comparative marketability to other farm lands). While the appraisal profession has only begun to quantify the loss attributable to CAFOs, it is clear from the above case studies that diminished marketability, loss of use and enjoyment, and loss of exclusivity can result in a diminishment. When appraising a property located proximate to a CAFO, the appraiser needs to consider seven specific issues, each of which will have an impact on the value conclusions:

1. Type of subject property,
2. Distance to the CAFO,
3. Physical manifestations (e.g., air quality, insects),
4. Engineering/scientific testing performed (e.g., air quality),

5. Impacts on property use (e.g., habitability, rental income or vacancy),
6. Marketability evidence (e.g., time on market of comparable properties), and
7. Impact on highest and best use.

While there is little disagreement that a CAFO has an impact on surrounding property values, the degree of impact is clearly a function of the interplay of these factors.

E. Community Concerns in the Town of Trade Lake

From the data presented here, it is clear that the vast majority of the Town of Trade Lake residents value the Town's natural landscapes and resources and feel strongly about protecting and preserving the natural environment. Since residents and property owners became aware of a large CAFO seeking to locate within the Town of Trade Lake, many have expressed their concerns during a number of Town and County Board meetings, through signed petitions, with letters to the editor and by posting yard signs. Those concerns include fears that the Town's surface and groundwater will become contaminated; worries about overwhelming odors interfering with the enjoyment of their property; apprehension over the spread of disease and the proliferation of antibiotic resistant bacteria; and trepidation over potential decrease in property values. The values and concerns of the residents and property owners were also reflected in the Town's decision to formally notify the Burnett County Board that Trade Lake residents were ***overwhelmingly*** opposed to the siting of a proposed hog CAFO in Trade Lake. (See June 18, 2019 letter from Trade Lake Supervisors Roger Hinrichs and Jeff Lade to Burnett County Administrator, Nathan Ehalt.) Trade Lake residents also strongly supported the Town's passage of a CAFO Operations Ordinance and a moratorium so that the Town could study the risks and benefits of CAFOs and enact any additional ordinances necessary to protect the health of Trade Lake residents, property owners and guests, preserve the natural environment and safeguard property values.

F. Public Health Vulnerabilities in the Town of Trade Lake

There are many public health issues associated with CAFOs. Hribar C., *Understanding Concentrated Animal Feeding Operations and Their Impact on Communities, p.* 8-11. CAFO's emit noxious substances, including particulate material; hydrogen sulfide; ammonia, nitrous oxide, methane, volatile organic compounds and CO_2. (*Emissions from Animal Feeding Operations, U.S. Environmental Protection Agency, Emissions Standards Division, Office of Air Quality Planning and Standards*, August 15, 2001.)

Manure generated by CAFOs contains pathogens that can cause severe gastrointestinal disease, complications, and sometimes death in humans, including: Campylobacter and Salmonella species, Listeria monocytogenes, Yersinia enterocolitica, fecal coliforms such as Escherichia coli,

and the protozoa Cryptosporidium parvum and Giardia lamblia.[33] Studies have linked human disease outbreaks involving these pathogens to livestock waste.[34]

The DNR's 2020 Wisconsin Groundwater Coordinating Council (GCC) report noted that nutrient application from fertilizers and manure on agricultural fields accounts for ***90 percent*** of nitrate in groundwater. The report and many other studies summarize health risks from nitrate pollution, including:

- Infants below the age of 6 months are especially at risk and could become seriously ill with a condition called methemoglobinemia or "blue-baby syndrome"
- Growing evidence of a correlation between nitrate and diabetes in children
- Birth defects have been linked to nitrate exposure
- Thyroid disease
- Increased risk of non-Hodgkin's lymphoma, gastric cancer, colon cancer, bladder and ovarian cancer

The "Priority Recommendations" from the GCC's 2021 Report to the Legislature states:

> Nitrate that approaches and exceeds unsafe levels in drinking water is one of the top drinking water contaminants in Wisconsin, posing an acute risk to infants and women who are pregnant, a possible risk to the developing fetus during very early stages of pregnancy, and a chronic risk of serious disease in adults. In addition, pesticides are estimated to be present in approximately 40% of private drinking water wells in Wisconsin. Areas of the state with a higher intensity of agriculture generally have higher frequencies of detections of pesticides and nitrate. Agencies should develop and evaluate a strategy to promote practices that lead to efficient use of nitrogen and careful or reduced use of pesticides in order to protect drinking water sources.
>
> Implementation of these practices should be supported with appropriate technical tools and incentives such as:
>
> - identifying sensitive areas of the state based on geology where elevated nitrate is present and making information available through an online mapping tool;
> - assessing soil type specific nitrogen crop application rates and cropping best management practices to further minimize nitrogen losses to groundwater and encourage their use, especially in highly sensitive areas of the state;

[33] American Public Health Association Policy Number: 20194, *Precautionary Moratorium on New and Expanding Concentrated Animal Feeding Operations*, November 5, 2019, p. 5.

[34] Oun A, Kumar A, Harrigan T, Angelakis A, Xagoraraki I, *Effects of biosolids and manure application on microbial water quality in rural areas in the US. Water*, 2014;6:3701-3723; Poulsen MN, Pollak J, Sills DL, et al. *Residential proximity to high-density poultry operations associated with campylobacteriosis and infectious diarrhea*, Int J Hyg Environ Health. 2018;221:323-333.

- developing a broad outreach plan and educational materials for farmers and nutrient management planners, and agricultural industry stakeholders that identify and encourage the use of specific alternate cropping and nutrient management practices to minimize agricultural nitrogen losses to groundwater;
- supporting research to assess the ability for alternative conservation practices, including saturated buffers and bioreactors, to minimize sources of nitrogen to surface and groundwater; and
- developing strategies and outreach programs that encourage the full implementation of nutrient management plans.

A 2009 American Academy of Pediatrics policy statement recommends that pediatricians ask families if they obtain their water from private wells and encourage parents to test and maintain their wells at least annually for coliform bacteria and nitrates.[35] Tests of rural Wisconsin wells found that 47% of wells had an exceedance of one or more health-based water quality standards. Surveys from other states report similar findings.[36]

But perhaps the most serious concern presented by CAFO's is the potential for proliferating antibiotic resistant bacteria. In addition to reviewing a number of scientific articles on that subject, the Trade Lake CAFO Permitting Study Committee received presentations from Dr. Richard Huset and Dr. Rebecca Larson.

Dr. Huset explained to the CAFO Permitting Study Committee that that there is a wealth of scientific articles and journals discussing negative health effects caused by CAFOs. Manure spills from CAFOs are quite common. In Iowa alone, there are 700 manure spills per year. Unfortunately, regulatory agencies tasked with monitoring CAFOs and remedying the fallout from such spills, such as the DNR and the EPA, are focused on water quality, as opposed to human health.

Dr. Huset described four major health concerns posed by CAFOs:

1. Nitrates, which leach into the ground water, can cause blue baby syndrome in infants[37];
2. Airborne bacteria and Hydrogen Sulfide, may cause asthma, particularly in younger children;

[35] American Academy of Pediatrics, Committee on Environmental Health and Committee on Infectious Diseases, 2009, *Drinking water from private wells and risks to children*. Pediatrics 123(6):1599–1605.

[36] Knobeloch, L., Gorski, P., Christenson, M., & Anderson, H. (2013). *Private drinking water quality in rural Wisconsin*, Journal of Environmental Health, *75*(7), 16–20.; MacDonald G.J., et.al. (2017), *Strategies to Improve Private-Well Water Quality: A North Carolina Perspective*. Environmental Health Perspectives, *125*(7), 076001.

[37] According to the Wisconsin Department of Health Services, "blue baby syndrome" or "infant methemoglobinemia" is a condition where a baby's skin turns blue. This happens when there is not enough oxygen in the blood. It can be caused by exposure to a variety of substances, including eating food or drinking water that is high in nitrates. High concentrations of nitrate in drinking water can also affect adults, causing thyroid disease, increase the risk for certain types of cancer and birth defects. https://www.dhs.wisconsin.gov/publications/p02559.pdf

3. Bacterial contamination, such as E. coli, can easily get into ditches, lakes and streams[38]; and
4. Proliferation of MRSA/superbugs[39] which cannot be effectively treated with antibiotics.

On this last point, Dr. Huset explained that livestock are often provided with large amounts of antibiotics. 75% of the antibiotics fed to livestock may flow through the animal's digestive system and is excreted. Manure containment facilities and fields upon which manure is deposited allow large volumes of bacteria to come into contact with the antibiotics. Those bacteria that are naturally resistant proliferate and weaker bacteria is killed off, creating concentrations of antibiotic resistant strains of bacteria. Dr. Huset is particularly concerned that an antibiotic resistant strain of Lyme's disease, which is prevalent in the area, could develop. Lyme's disease is currently treated with tetracycline. If antibiotic resistant Lyme's disease were to develop, then treatment would require IV therapy in a hospital setting.

Dr. Huset noted that MRSA causes 23,000 deaths per year in the US. People who live close to CAFOs have three times the amount of MRSA on their skin and 40% more hospitalizations. 30% of CAFO workers have MRSA.

In 2008 Tara Smith, a researcher at the University of Iowa, decided to test pigs for MSRA at a few Iowa hog farms. She sampled 270 pigs and found that about 70% were positive for MSRA.

> Smith and her colleagues have continued to publish a series of disturbing studies showing that MRSA is all over American hog farms. They found MRSA growing in the nostrils of 64 percent of workers at one large farm and found that feed on another farm harbored MRSA even before it got unloaded from the delivery truck. Two hundred thirty-five yards downwind of another farm, Smith found MRSA floating in the air. Other resistant bacteria have been found around poultry farms: after researchers at the Johns Hopkins Bloomberg School of Public Health drove cars, windows down, behind trucks that were transporting chickens in Maryland and Virginia, along the Delmarva Peninsula, they found antibiotic-resistant enterococci—a group of bacteria that causes 20,000 infections in the U.S. every year—in the air inside the cars, as well as resting on the top of soda cans in the cars' cup holder.

Melinda Wenner Moyer, *How Drug-Resistant Bacteria Travel from the Farm to Your Table*, Scientific American, December 1, 2016. Even at very low measurable antibiotic concentrations in the environment, "evidence indicates that resistant bacteria are positively selected even at very low

[38] Some strains of E. coli (Escherichia coli) produce a powerful toxin that can cause severe illness. Infections can cause complications called hemolytic uremic syndrome (HUS) which occurs when the E. coli toxin destroys red blood cells. HUS can lead to kidney failure, neurologic damage, in some cases death. Minnesota Department of Health Fact Sheet, Escherichia coli O157:H7 (E. coli O157) Infection and Hemolytic Uremic Syndrome (HUS), https://www.health.state.mn.us/diseases/ecoli/ecoli.html

[39] MRSA stands for methicillin-resistant *Staphylococcus aureus*, a bacterium with antibiotic resistance.

concentrations." Rachelle E Beattie, Michael Walsh, Mercedes Cecilia Cruz, L Rex McAliley, Laurel Dodgen, Wei Zheng, Krassimira R Hristova, *Agricultural contamination impacts antibiotic resistance gene abundances in river bed sediment temporally*, FEMS Microbiology Ecology, Volume 94, Issue 9, September 2018, fiy131, *citing* Gullberg E, Cao S, Berg OG et al. *Selection of resistant bacteria at very low antibiotic concentrations*. PLoS Pathog. 2011;7:e1002158.

Dr. Beattie talked to the committee about her study, referenced above, in Kewaunee County Wisconsin. She and her co-authors noted elevated levels of antibiotic resistant E. coli that coincided with the spreading of manure on local farm fields. The study found that tetracycline resistant bacteria were more prevalent in manure derived from CAFOs (as opposed to smaller farms). Dr. Beattie was also able to determine similarities between antibiotic resistant bacteria found in local hospitals and at nearby CAFOs. She confirmed what we heard from other speakers, which was that between 70 and 80% of the antibiotics fed to livestock passes through the animal into its manure. In North Carolina, some testing found antibiotic resistant bacteria in the air. Dr. Beattie told the committee that bacteria can be filtered, which supports the idea that the town should require filtration of outgoing air from structures were livestock is housed, or where manure or other hazardous waste is stored. As an aside, Dr. Beattie related that, during the course of her research, she observed (and videotaped) manure that had been "knifed" into the ground bubbling back up to the surface.

Dr. Rebecca Larson explained to the Committee how the contaminants and pathogens originating in CAFOs spread to nearby communities--through surface application of manure, airborne vectors (e.g., wind and insects), groundwater contamination and surface water contamination. She specifically addressed the risks of surface water runoff and contamination of private wells.

Air quality is also a public health concern for both workers and neighboring communities. "Workers in animal production can be exposed to airborne waste particles, drug residues, heavy metals, potentially harmful pathogens, and antibiotic-resistant bacteria, many of which can be transferred into neighboring communities by these workers." [40] A recent study noted that "[a]griculture is a major contributor to air pollution, the largest environmental risk factor for mortality in the United States and worldwide."[41] "Agricultural production in the United States

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[40] Casey JA, Curriero FC, Cosgrove SE, Nachman KE, Schwartz BS. *High-density livestock operations, crop field application of manure, and risk of community-associated methicillin-resistant Staphylococcus aureus infection in Pennsylvania*. JAMA Internal Medicine. 2013 ;173 (21): 1980-1990. (Looking at the association between exposure to swine and dairy/veal industrial agriculture and the risk of methicillin-resistant *Staphylococcus aureus* (MRSA) infection, proximity to livestock operations and crop fields treated with swine manure were each associated with MRSA, skin and soft-tissue infection); Roberts RR, Hota B, Ahmad I, et al. *Hospital and societal costs of antimicrobial-resistant infections in a Chicago teaching hospital: Implications for antibiotic stewardship*. Oin Infect Dis. 2009;49(8):11751184. (Medical and societal costs attributable to antimicrobial-resistant infections are considerable. Medical costs attributable to antimicrobial-resistant infections range from $18,588 to $29,069 per patient, hospital stay durations from 6.4-12.7 days, and mortality of 6.5%. Societal costs were estimated at $10.7-$15 million.)

[41] Nina G. G. Domingoa , Srinidhi Balasubramanian, Sumil K. Thakrar , Michael A. Clark, Peter J. Adams, Julian D. Marshalld , Nicholas Z. Muller, Spyros N. Pandis, Stephen Polasky, Allen L. Robinson, Christopher W. Tessum, David Tilman, Peter Tschofen, and Jason D. Hill, *Air quality—related health damages of food*, open access article

results in 17,900 annual air quality-related deaths, 15,900 of which are from food production." (*Id*.)

A 2011 study by researchers from Department of Epidemiology, University of North Carolina at Chapel Hill and Department of Community and Preventive Medicine, Mount Sinai School of Medicine looked at the public health effect of air pollutants emitted by concentrated animal feeding operations. The study noted that concentrated animal feeding operations contribute to local regional and global air pollution. Pollutants of local importance include odor, hydrogen sulfide (H_2S), endotoxin, particulate matter and ammonia (NH_3).[42] With a "healthy study population" the researchers found that: "air pollutants near hog operations cause acute physical symptoms, particularly upper respiratory symptoms and irritation of the nose and eyes." (*Id*.)

G. Biosecurity

In the context of animal agriculture, biosecurity is a series of management steps and practices implemented to prevent the introduction of infectious agents, especially Foreign Animal Diseases (FAD), into a herd or flock, the spread of these agents through the herd, and out of the herd to other animals or humans. herds or flocks. A strong biosecurity program is critical and must be properly implemented not just developed as a plan on paper.[43]
The spread of disease throughout a CAFO facility is enhanced by the closeness of the animals and interior housing.[44] Labor shortages also make it challenging to implement strong biosecurity as crews move among multiple buildings on a CAFO and between CAFOs. Once infected, these hardy, highly transmissible diseases can re-infect animals returned to a depopulated and disinfected building.

In recognition of the serious contamination/infection risks posed by CAFOs, the EPA has published "Bio Security Procedures for Visits to Livestock and Poultry Facilities" to protect its

[42] Leah Schinasi, Rachel Avery Horton, Virginia T. Guidry, Steve Wing, Stephen W. Marshall, and Kimberly B. Morland, *Air Pollution, Lung Function, and Physical Symptoms in Communities Near Concentrated Swine Feeding Operations*, Epidemiology, 2011 Mar; 22(2): 208–215.

[43] Alarcón, L.V., Allepuz, A. & Mateu, E. Biosecurity in pig farms: a review. *Porc Health Manag* **7,** 5 (2021); Guberti, V., Khomenko, S., Masiulis, M. & Kerba S. 2019. African swine fever in wild boar ecology and biosecurity. *FAO Animal Production and Health Manual No. 22.* Rome, FAO, OIE and EC; Graham JP, Leibler JH, Price LB, Otte JM, Pfeiffer DU, Tiensin T, et al. The animal-human interface and infectious disease in industrial food animal production: rethinking biosecurity and biocontainment. Public Health Rep. 2008;123(3):282-99; Kikuti, M, Paploski IA, et al. Newly emerging PRRSV Lineage 1C variant nomenclature. *Swine Health Information Center* 2021; University of Minnesota, Pitkin, A., Biosecurity protocols for the prevention of spread of porcine reproductive and respiratory syndrome, Swine Disease Eradication Center.

[44] Sanhueza, JM, Stevenson, MA, Vilalta, C, Kikuti, M, Corzo, C. Spatial relative risk and factors associated with porcine reproductive and respiratory syndrome outbreaks in United States breeding herds. *Preventive Veterinary Medicine,* Volume 183, 2020; University of Minnesota, Pitkin, A., Biosecurity protocols for the prevention of spread of porcine reproductive and respiratory syndrome, Swine Disease Eradication Center.

workers.[45]

Neighboring farms are at risk from airborne animal diseases contracted by contained animals living in a controlled and ventilated environment. Exhaust fans running 24/7 facilitate highly pathogenic disease transmission into the surrounding community.[46]

Disease can also be transmitted from animals to humans as zoonoses, otherwise known as spillover events. Three sequentially linked populations can facilitate the transmission: the CAFO species, the CAFO workers (bridging population), and the rest of the local human population. Salmonella from dairy cows, Avian flu from poultry and H1N1Influenza from swine are examples of zoonotic diseases.[47]

Agricultural receipts for US beef, pork and dairy products totaled more than $120 billion in 2018 and support an estimated one million jobs. Given that over 25% of pork products and 12% of beef produced in the US are exported, disease incidents that trigger trade barriers have a rapid economic impact. Recent outbreaks illustrate how rapidly problems can escalate, and just how far-reaching the effects can be. One prominent example is Porcine Epidemic Diarrhea virus (PEDv), which was first detected in May 2013. Just one year later, more than 6,800 premises and 30 states had reported cases of PEDv. Prior to that, in 2003, one case of Bovine Spongiform Encephalopathy (BSE) in a cow in Washington State triggered the closure of export markets, which took seven years to recover to pre-BSE volumes.[48]

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[45] Found at the following web address: https://www.epa.gov/sites/default/files/2016-05/documents/biosecuritysop.pdf.

[46] University of Minnesota. Newly funded: Investigating swine industry biocontainment strategies for airborne diseases. August 27, 2021; University of Minnesota, Pitkin, A., Biosecurity protocols for the prevention of spread of porcine reproductive and respiratory syndrome, Swine Disease Eradication Center; Schultz, Amy A, Peppard, Paul, Ron E Gangnon, Kristen M C Malecki: Residential proximity to concentrated animal feeding operations and allergic and respiratory disease. *Environment International* 2019 Volume 130

[47] Deschuyffeleer, T. P., Tyberghien, L. F., Dickx, V. L., Geens, T., Saelen, J. M., Vanrompay, D. C., & Braeckman, L. A. (2012). Risk assessment and management of Chlamydia psittaci in poultry processing plants. *The Annals of occupational hygiene, 56(*3), 340–349; Graham JP, Leibler JH, Price LB, Otte JM, Pfeiffer DU, Tiensin T, et al. The animal-human interface and infectious disease in industrial food animal production: rethinking biosecurity and biocontainment. Public Health Rep. 2008; Jahne MA, Rogers SW, Holsen TM, Grimberg SJ, Ramler IP. Emission and dispersion of bioaerosols from dairy manure application sites: Human health risk assessment. *Environ Sci Technol.* 2015; 49(16):9842-9849; Ma W, Lager KM, Vincent AL, Janke BH, Gramer MR, Richt JA. The role of swine in the generation of novel influenza viruses. *Zoonoses Public Health.* 2009 Aug;56(6-7):326-37; Saenz RA, Hethcote HW, Gray GC. Confined animal feeding operations as amplifiers of influenza. *Vector Borne Zoonotic Dis.* 2006;6(4):338-346; Shaw, K. A., Szablewski, C. M., Kellner, S., Kornegay, L., Bair, P., Brennan, S., Kunkes, A., Davis, M., McGovern, O. L., Winchell, J., Kobayashi, M., Burton, N., de Perio, M. A., Gabel, J., Drenzek, C., Murphy, J., Holsinger, C., & Forlano, L. (2019). Psittacosis Outbreak among Workers at Chicken Slaughter Plants, Virginia and Georgia, USA, 2018. *Emerging infectious diseases, 25(*11), 2143– 2145.

[48] Shaw, K. A., Szablewski, C. M., Kellner, S., Kornegay, L., Bair, P., Brennan, S., Kunkes, A., Davis, M., McGovern, O. L., Winchell, J., Kobayashi, M., Burton, N., de Perio, M. A., Gabel, J., Drenzek, C., Murphy, J., Holsinger, C., & Forlano, L. (2019). Psittacosis Outbreak among Workers at Chicken Slaughter Plants, Virginia and Georgia, USA, 2018. *Emerging infectious diseases, 25(*11), 2143– 2145; Coffey, Brian et al., The Economic Impact of BSE on the U.S. Beef Industry: Product Value Losses, Regulatory Costs, and Consumer Reactions, Kansas State University, April

Well-conceived and executed scientific studies on virus variants are sobering. For example, a 2019 study at the University of Minnesota assessed 4,000 PRRS virus sequences from the Morrison Swine Health Monitoring Project over nine years (2009-2017). They were able to document the circulation, emergence, and sequential turnover of different PRRS lineages. Results point to immune response as a major driver of virus diversification. Rapid turnover of the dominant virus lineage leads to complex multi-strain virus dynamics in which different variants potentially interact and increase and decrease by immune-mediated competition or selection. This immune-mediated virus selection is a major challenge for vaccine development and implementation of disease prevention strategies.[49]

Implementing the protocols and technology needed to characterize rapidly evolving, highly pathogenic and efficiently transmitted viruses is extremely challenging. Understanding the ancestral relationships and evolution of virus as they spread quickly among CAFOs requires state-of-the-art genome sequencing and virology.[50]

Field reports from veterinarians managing multiple herds for multiple locations belonging to large systems indicate that new PRRS variants elude filtration systems. There are also multiple viruses in the infected animals that spread rapidly throughout the neighborhood.[51]

A September 2021 forum, which included veterinarians from academia and corporations managing multiple herds for multiple locations belonging to large systems, described the 2021 PRRS outbreak as a "complete off-the-rails disaster..." with "so much virus in the neighborhood that it overwhelmed the filters." There is little ability to track neighboring management practices such as vaccination protocol and movement of animals and personnel to and between CAFOs.[52]

The movement of people and equipment among livestock farms is a primary route of transmission for disease. Mitigation strategies to tackle outbreaks go beyond ordinary preventative measures. Strategies such as animal traceability, disease syndrome reporting and analysis and risk-based herd health management are all ways to enhance the resilience of livestock production. Inspection of

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2000; Song D, Moon H, Kang B. Porcine epidemic diarrhea: A review of current epidemiology and available vaccines. *Clin Exp Vaccine Res.* 2015;4(2):166-176. doi:10.7774/cevr.2015.4.2.166;

[49] Kikuti, M, Paploski IA, et al. Newly emerging PRRSV Lineage 1C variant nomenclature. *Swine Health Information Center* 2021; University of Minnesota. Enhanced Passive Surveillance for ASF and CSF. *Swine in Minnesota.* September 24, 2021.

[50] Kikuti, M, Paploski IA, et al. Newly emerging PRRSV Lineage 1C variant nomenclature. *Swine Health Information Center* 2021.

[51] Sanhueza, JM, Stevenson, MA, Vilalta, C, Kikuti, M, Corzo, C. Spatial relative risk and factors associated with porcine reproductive and respiratory syndrome outbreaks in United States breeding herds. *Preventive Veterinary Medicine,* Volume 183, 2020; Swine Cast, Persistent PRRS in Finishing Pigs Raises Concerns. September 3, 2021; University of Minnesota. Newly funded: Investigating swine industry biocontainment strategies for airborne diseases. August 27, 2021.

[52] Swine Cast, Persistent PRRS in Finishing Pigs Raises Concerns. September 3, 2021.

cleanliness and disinfection of incoming transport vehicles may be necessary to be effective. CAFO managers and owners must be willing to invest and workers must be willing to comply.

Animal Health is the need to keep animals within the CAFO both healthy and disease-free. Animal Health and Biosecurity overlap, especially in the need to keep the animals disease free and keep disease from spreading outside the CAFO.

Infectious disease testing, transmission-prevention and control are measures to detect disease and control it when found. Testing for infectious disease within a facility should be performed on a schedule and at a frequency based on the common diseases of concern, the age of the animal group, observations of the health of individual animals and groups of animals. If a disease is detected, response actions should be implemented immediately.

One of the greatest animal welfare concerns for CAFOs is the close confinement and crowding of animals. These conditions create boredom and stress in the animals, as well as physical and mental illnesses. They can also increase the need for antibiotics increasing the prevalence of antibiotic resistant disease.

While CAFOs have rapidly expanded, measures to protect animals, the environment, and human health have not kept pace with growth. Beginning in 2002, several states enacted ballot proposals that focused on creating minimum confinement standards for animals on CAFOs. In reaction to these ballot initiatives, state legislation concerning animal welfare on CAFOs also sprang up. California's Proposition 12 is scheduled to take effect in 2022. Typical concerns include confinement standards, the treatment of non-ambulatory animals, humane slaughter methods, force-feeding of birds, and tail docking.

H. Regulatory Gaps in the Town of Trade Lake

Current regulations do not adequately address health risks, air quality, odor, noise or traffic and do not sufficiently protect water quality. The Town of Trade Lake needs implement protections to prevent protect the health of its residents, avoid reduced air and water quality, and prevent increased odor, noise and traffic around CAFOs.

Current regulations are meant to ***minimize the risk*** of pollution of surface and groundwater resources," but they do not ***prevent*** pollution and water contamination, and they do not protect residents from the financial and health effects of when pollution and water contamination occur. It is unclear to what extent existing regulations are currently enforced, although it seems to be generally recognized that there are insufficient resources to adequately enforce the existing regulations. CAFO's are expected to self-police and many violations are caught by the public and/or by happenstance. (For example, one local violation involving runoff from a field was only caught because a DNR official happened to be driving by the field at the time the runoff occurred.) The CAFO Permitting Study Committee ***has*** determined that: 1) oversight by third-party private entities is necessary to ensure that Trade Lake's regulations are fully complied with; and 2) the cost of those third-party consultants should be borne by the CAFO operation. Additional questions the study group needs time to address include:

- What is the state's capacity to implement and regulate existing rules?
- What is the county's capacity to keep up with existing regulatory responsibilities when state agencies are unable to fully implement or regulate existing regulations?
- Existing engineering specifications are based on data that may no longer be accurate, due to increased flooding events. This is an important area of study that the CAFO Permitting Study Committee did not explore.
- The state regulations allow for local areas to specify ecologically sensitive areas. As shown in the Natural Resources section of this report, the Town of Trade Lake can make a strong and scientifically defensible argument for ecological sensitivity. However, this has not been thoroughly examined, researched, or discussed by the CAFO Permitting Study Committee.

RECOMMENDATIONS

The following recommendations provide additional guidance for the Conditions found in the Trade Lake Concentrated Animal Feeding Operations Ordinance. It is the expectation of the Committee that the recommended Conditions would provide the Town with some flexibility to attach appropriate operational Conditions to an applicant so that the Town and its residents do not have to be concerned that the applicant's operation will negatively affect the health and safety of town residents, property owners and visitors, the local environment or property values. The application of the conditions should vary depending upon the size of the applicant (for example, conditions for a 1000-animal unit CAFO would likely be different than conditions for a 6000-animal unit CAFO), whether the applicant has a track record of successful operation within the Town, the location of the proposed facility and other factors that might affect the conditions discussed below.

The recommendations are primarily aimed at addressing public health and safety. It was the committee's intent not to impose water quality standards that are more stringent than the current state standards. If any of the recommended conditions relate to water quality, it is only as a byproduct of addressing health and safety issues. To the extent that the Committee's recommendations or the conditions actually imposed by the Town are deemed to contain water quality standards that are more stringent than existing State standards, the Committee has attempted to include factual findings that constitute reasonable and scientific bases to support the recommended standards. Assuming the Trade Lake Town Board adopts the Committee's recommendations, the ordinance should have a severability clause, which states that if any clause is found to be unenforceable, the balance of the ordinance remains in force and effect.

Several local towns, including Eureka and Laketown have passed ordinances that incorporate much of what is recommended, below. In drafting the amended ordinance to incorporate this Committee's recommendations, the Eureka or Laketown ordinances could easily be amended to include some of the specifics of this committee's recommendations in order to create an amended operations ordinance for Trade Lake. A copy of the Laketown ordinance is attached to Appendix A to this report.

The Committee recommends that the CAFO Operations Ordinance allow for the grandfathering of existing operations. Existing operations that exceed the 500-animal unit threshold for application of the ordinance will have 5 years from the date the ordinance is enacted to come into compliance,

unless the existing operation increases in size by 20%, based upon the size of the operation at the time the ordinance was enacted. An existing operation that exceeds 500 animal units and increases in size by more than 20% must comply with the ordinance.

1. Conditions relating to the operational characteristics of the proposed operation, to protect public health, prevent point and non-point sources of air and water pollution, and prevent private nuisances and public nuisances.

a) Information Provided Pursuant to These Conditions and Consent to Conditions

As a condition of operating within the Town of Trade Lake the applicant agrees that the information required by the Town of Trade Lake to be produced and maintained, as set forth in these conditions, is not confidential, a trade secret or proprietary. Any claim as to the confidential or alleged protected nature of the information referenced in these conditions is waived by the applicant as a condition of operating in the Town of Trad Lake. By submitting an application to operate in the Town of Trade Lake the applicant acknowledges that the information provided pursuant to these conditions shall be accessible to representatives of the Town of Trade Lake, Representative Burnett County and representatives of the State of Wisconsin and that this information may be made public on Town, County or State websites or in response to requests made under the Freedom of Information Act. Furthermore, by accepting a permit issued by the Town containing conditions imposed hereunder, the Applicant submits itself to the jurisdiction of the Town and agrees and consents to the terms of the conditions imposed hereunder.

In addition to any other record keeping requirements referenced herein, the applicant must keep and maintain the following records:

Parameter	**Units**	**Frequency**
PERMIT AND NUTRIENT MANAGEMENT PLANS		
The CAFO/SCAFO must maintain on-site a complete copy of the current NPDES permits, including the permit authorization notice and the Nutrient Management Plans.	N/A	Maintain at all times.
The CAFO/SCAFO must maintain on-site a current, site-specific NMP that reflects existing operational characteristics. The operation must also maintain on-site all necessary records to document that the NMP is being properly implemented with respect to manure and wastewater generation, storage and handling, and land application. In addition, records must be maintained documenting that the development and implementation of the NMP is in accordance with the minimum practices defined in 40 CFR part 122.42(e).	N/A	Maintain at all times.

SOIL AND MANURE/WASTEWATER NUTRIENT ANALYSIS		
Analysis of manure, litter, and process wastewater to determine nitrogen NTK, ammonia, nitrate-nitrogen, total phosphorus content, antibiotics, and pathogens.	Ppm and Pounds/ton	At least annually after initial sampling.
Analysis of soil in all fields where land application activities are conducted to determine content of N, P, K, NH4	Ppm	At least annually after initial sampling.
OPERATION AND MAINTENANCE		
Visual inspection of all stormwater diversion devices, runoff diversion structures, and devices channeling contaminated stormwater to wastewater and manure storage and containment structure	N/A	Weekly
Cleaning and other required maintenance of the outgoing air filtration system (minimum to be the documented maintenance recommendations of the manufacturer)	N/A	As recommended by the manufacturer, but not less than once per month.
Visual inspection of all water lines	N/A	Daily
Visual inspection of rain gauge	Inches	Daily
Visual inspection of the manure, litter, and process wastewater impoundments, including documentation of depth of manure and process wastewater in all liquid impoundments	Feet	Weekly
Documentation of all corrective actions taken	N/A	As necessary
Documentation of animal mortality handling	N/A	As necessary
Design documentation for all manure, litter, and wastewater storage structures, including the following information: 1) Volume for solids accumulation 2) Design treatment volume 3) Total design storage volume 4) Days of storage capacity	 Cubic yards Cubic yards Cubic yards/gallon Days	 Once in the permit term. Once in the permit term. Once in the permit term unless revised. Once in the permit term.
Documentation of all overflows from all manure and wastewater storage structures, including: 1) Date and time of overflow 2) Estimated volume of overflow 3) Analysis of overflow (as required by	 Month/day/year Total gallons Ppm	 Per event Per event Per event

the permitting authority)		
LAND APPLICATION		
1) For each application event where manure, litter, or process wastewater is applied, documentation of the following for each field:		
2) Date of application	Month/day/year	Daily
3) Method of application	N/A	Daily
4) Weather conditions at the time of application and for 24 hours before and after application	N/A	Daily
5) Total amount of nitrogen and phosphorus applied	Pounds per acre	Daily
6) Documentation of the crop and expected yield for each field	Bushels per acre	Seasonally
7) Documentation of the actual crop planted and actual yield for each field	Bushels per acre	Seasonally
8) Documentation and test methods and sampling protocols used to sample and analyze manure, litter, wastewater and soil	N/A	Annually unless revised
9) Documentation of the basis for the application rates used for each field where manure, litter, or wastewater is applied	N/A	Annually unless revised
10) Documentation showing the total nitrogen and phosphorus to be applied to each field, including nutrients from the application of manure, litter, wastewater, and other sources	Pounds per acre	Annually unless revised
11) Documentation of manure application equipment inspection		Monthly
12) Documentation of test results from test wells, surface water sampling air sampling.	N/A	
MANURE TRANSFER		
For all manure transfers, the CAFO must maintain the following records:		
1) Date of transfer	N/A	As necessary
2) Name and address of recipient	N/A	As necessary
3) Approximate amount of manure,	Tons/gallons	As necessary

litter, or wastewater transferred		

b) Violations and Sanctions for Failure to Comply with Conditions

Violations of the Conditions contained in any permit issued pursuant to the Town's ordinance may be enforced by the Town Board or any committee authorized by the Board to oversee CAFO operations.

Violation of Conditions imposed by the Town of Trade Lake shall result in assessment to the applicant of all costs required to investigate and remediate any damages caused by the violation. Violations of Conditions imposed by the Town of Trade Lake may also result in lump-sum penalties if the violation has been cured or daily penalties that accrue until the violation has been cured. Such lump-sum or accruing penalties may include the cost of professional monitoring or assessment by engineers or other technical experts retained by the Town to address the violation.

Depending upon the nature and extent of the Violation of Conditions imposed by the Town of Trade Lake, the Town may withdraw the applicant's permit to operate until all violations have been cured. Serious or repeated Violations of Conditions imposed by the Town of Trade Lake may result in permanent withdrawal of an applicant's permit to operate.

c) False Statements or Misrepresentations

Any false statement or misrepresentation made by the applicant in its application or in information provided to the Town, County or State in association with an application to operate a CAFO within the Town of Trade Lake shall be grounds for denial of a permit.

d) Construction and Fire Plans

The Applicant must include signed engineered drawings for the measures required to meet the performance requirements of this ordinance and the measures specified in the plans submitted with the application. The Applicant shall include a fire-prevention/fire-fighting capacity/fire-water capacity needs analysis and the requisite fire water storage/fire prevention/fire-fighting equipment plans.

2. Conditions relating to the management of animal and other waste that may be generated as part of an operations' ongoing operation, to protect public health, prevent point and non-point sources of air and water pollution, and prevent private nuisances and public nuisances.

a) In addition to the requirements stated below, see requirements for disposal of manure under Condition 6.

b) Technology Based Effluent Limitations and Standards

i) Design: The production area should be designed, operated and maintained to contain the entire design storage volume. To contain means to prevent any release of any pollutant from the area, including by leakage into groundwater.

ii) Design storage volume means the sum of the following:

- Double the estimated volume of manure, litter and other processed waste waters accumulated during the storage period.
- The normal precipitation less evaporation during the storage period (based on the location of the facility.)
- The normal runoff during the storage period into the storage structure for the location
- Direct precipitation during the storage period into the storage structure for the location
- Runoff from the animal facilities into the storage structure for the location of the facility
- Residual solids after liquids are removed
- Necessary freeboard to maintain structural integrity. After settlement, the top of the embankment shall be at least 1 foot above the surrounding grade, or greater than the minimum determined by the current NRCS (Natural Resources Conservation Service) Conservation Practice Standard Code 313, whichever is greater.
- A minimum treatment volume, in the case of treatment lagoons.

New facilities may not use outdoor lagoons.

b) New Liner Construction: New double-synthetic or concrete liners constructed and maintained in accordance with NRCS design specifications shall be utilized to prevent hydrologic connection that could result in the contamination of surface waters.

- A site-specific assessment should be done by a Professional Engineer.

- If Professional assessment is unavailable, the liner shall be constructed to have hydraulic conductivities no greater than 1X10 (-7) cm/sec, with a thickness of 1.5 feet or greater or its equivalency in other materials.

c) Inspections: Each facility must conduct and record inspections of the production and storage areas (and as otherwise required of the fields where manure is deposited) according to the schedule and standards attached to this permit.

- Inspection records are public property and must be provided to listed authorities upon request and at least every 6 months.
- Each facility must correct any identified deficiencies within 48 hours of discovery. Correcting an identified deficiency does not relieve the owner or operator of responsibility for reporting any permit violation.
- Dead animals shall be disposed of in a manner that prevents creation of a public health hazard. All handling practices shall be in accordance with all applicable state and local regulatory requirements. (See Condition 3.)

- Daily visual inspections for mortalities shall be performed and mortalities shall be removed and disposed of upon discovery. (See Condition 3.)
- Clean water must be diverted, as appropriate, from the production area. Any clean water that is not diverted and comes into contact with raw materials, products or by-products including manure, litter, feed, or bedding is subject to the effluent limitations specified above.
- Each facility must prevent direct contact of confined animals with the waters of the state or with land within 30 feet of the waters of the state.
- Permittees must ensure that chemicals and other contaminants handled on-site are not disposed of in any manure, litter, or processing area or in any stormwater storage or treatment system unless specifically designed to treat such chemicals and other contaminants. (Ex. Pesticides and petroleum products).

d) Nutrient Management Plan (NMP)

i) Site Specific Conservation Practices: Site specific practices to be implemented include buffers or equivalent practices, to control runoff of pollutants to waters of the state, and specifically to minimize the runoff of nitrogen and phosphorus. The NRCS Practice Standard, Code 590, including residue management, conservation crop rotation, grassed waterways, strip cropping, vegetated buffers, riparian buffers, setbacks, terracing and diversions may be utilized to prevent runoff of pollutants. At a minimum, such practices must be adequate to keep erosion levels in each field at or below the soil loss tolerance specified by the Town of Trade Lake Permitting Authority.

ii) Additional prevention of runoff attention must be given to areas at greater risk for erosion due to topography or increased potential to contribute to pollution of the waters of the state.

iii) Injection or "knifing in" of manure onto local fields is required. No form of surface spraying shall be allowed.

iv) Signed leases with disclosure of manure spreading to property owners receiving such are required for each property utilized for disposal/spreading of manure.

v) Disclosure of loss of any leases to Trade Lake Town Board.

vi) Adherence to all record keeping requirements per separate document.

3. Conditions relating to the population and depopulation of individual animal housing facilities, to protect public health and prevent the spread of animal-borne and vector-borne disease, to assure a safe level of sanitation, and to assure human health hazard control or health protection for the community.

a) The Animal Population Control and Depopulation Plans provide for the daily recording and reporting of animal counts and mortality and reporting to the Town-designated local authority within 24 hours of any unusual mortality, as

defined in the plan, and that the provisions for managing the movement and transportation of livestock, containment and treatment of bodily fluids from carcasses, and safe disposal of carcasses, will prevent the spread of disease to other livestock, animals, workers and other residents and humans in the area.

b) Applicant's depopulation plan shall include a three-step, or 3D, process - Depopulation, Disposal and Disinfectant. All or parts of this process shall apply to three circumstances:

i) **Standard mortality** - The tonnage of dead animals produced annually by normal operations is substantial. For example, mortality rates in a typical 5,000 sow farrow-to-finish farming system run up to 10% and will produce over 200,000 pounds of carcasses annually. In many systems losses may be higher. Horizontal integration of livestock agriculture systems can concentrate mortality losses into smaller and smaller geographic areas.

ii) N**on-diseased animal catastrophe** - The need for the 3D process can be triggered by catastrophic events such as the hurricanes, tornadoes or fire. In addition, CAFOs can be impacted by human pandemics. For example, chicken and hog CAFOs were forced to depopulate in 2020 when high worker Covid-19 infection rates shutdown processing plants.

iii) **Diseased animal catastrophe** - CAFO operators face disease outbreaks such as Foot-and-Mouth, Avian Influenza and Porcine Reproductive and Respiratory Syndrome (PRRS). Minnesota and Iowa have an especially virulent PRRS mutant affecting both sow and hog finishing barns. USDA earmarked $500 million in September 2021 in an effort to keep the global African Swine Fever outbreak from entering the country.

c) Each part of the plan shall include, at a minimum the following components:

i. Removal of livestock/Euthanasia protocols.

ii. Protocols for removal of any biohazardous materials, including but not limited to animals that have been euthanized from the facility, including the use of protective equipment, temporary storage of the carcasses outside the buildings during the removal.

iii. Protocols for disposal of the carcasses or animal tissue (e.g., Composting on-site; Composting off-site; Burial; Burial above ground; Rendering; Incineration; Burning (mobile gasifier or similar). The plan shall include an estimate of the volume of animal carcasses (in pounds) expected annually and, once operations begin, actual numbers of the volume of animal carcasses (in pounds) shall be provided to the Town. Animal carcasses and related material must be removed promptly and frequently from the site so that they do not generate odors or excess insect populations. When carcasses and related materials are removed from the site, the materials being

removed must be in an enclosed truck or trailer to contain odors and ensure that debris does not fall out.

iv. If carcasses and related materials are to be composted, a plan to do this must be approved by an environmental engineering firm to ensure the health and safety of the residents of the area. If the composting results in objectionable odor the CAFO will have to use other means to dispose of the carcasses.

v. Protocols for remediation of any pollution, including contaminated soils or waters and chemical disinfection of all contaminated structures, equipment, vehicles, and surfaces on the premises follows animal euthanasia and disposal and application of insecticides and rodenticides.

vi. Protocols for repopulating the facility with stock free of major diseases. Producers should thoroughly analyze risk factors for herd re-infection as well as the level of biosecurity that can be maintained. Hog CAFOs located in swine-dense areas are at great risk for re-infection.

vii. No animal carcasses or related material may be hauled into the site from other locations.

viii. The removal of equipment.

4. Conditions relating to biosecurity and the maintenance of animal health and welfare, to prevent the spread of animal-borne and vector-borne disease, to protect public health, and provide for animal safety and welfare.

a) In the context of animal agriculture, biosecurity is a series of management steps and practices implemented to prevent: 1) the introduction of infectious agents, especially Foreign Animal Diseases (FAD), into a herd or flock; 2) the spread of these agents through the herd; and 3) the spread of these agents out of the herd to other animals or humans. Each applicant must produce an acceptable Biosecurity and Animal Health Plan. The Biosecurity and Animal Health Plan provides for the health and humane treatment of all animals, routine observation and routine testing for diseases of concern--as defined in the plan--and for the separation and quarantine of diseased animals and animals in contact with diseased animals, their euthanasia, and the handling and disposal of diseased animals, sufficient to prevent the spread of disease to workers, other livestock and animals and to humans. The Biosecurity and Animal Health Plan must also provide for quarterly reporting by a third-party inspector of animal testing results and plan-specified enforceable metrics, confirmation that the livestock and conditions at the facility (based on plan-identified metrics) are healthy, any deviations from the metrics, and that any detection of diseases of concern will be immediately reported to the local

health department and local authority. The plan must provide for adequate financing and immediate implementation of emergency containment measures by third-party contractors, including testing of workers and contractors who may have come into contact with diseased animals, and other emergency measures in the event of an outbreak of disease, based on the latest authoritative disease containment guidance

The movement of people and equipment among livestock farms is a primary route of transmission for disease. Inspection of cleanliness and disinfection of incoming transport vehicles may be necessary for the Biosecurity and Animal Health Plan to be effective. Mitigation strategies to tackle outbreaks go beyond ordinary preventative measures. Accordingly, strategies such as animal traceability, disease syndrome reporting, and analysis and risk-based herd health management should all be considered when preparing the Biosecurity and Animal Health Plan.

b) A strong biosecurity program is critical and must be properly implemented by the applicant and not just developed as a plan on paper. The protocol shall include the following components:

i) Utilization of technology needed to characterize rapidly evolving, highly pathogenic and efficiently transmitted viruses.

ii) A plan to notify the Town, County and State within 24 hours of the applicant becoming aware of the presence of infectious agents, especially Foreign Animal Diseases (FAD), into a herd or flock, the spread of these agents through the herd, and out of the herd to other animals or humans.

5. Conditions relating to transportation of animals as part of the ongoing operations, to protect public health, prevent pollution, and prevent private nuisances and public nuisances.

a) General Use of the Roadways

The Applicant will prepare a Transportation Plan which shall include a traffic study, road improvement needs analysis and road traffic and roadway improvement plans, along with letters of conformance, on agency letterhead, stating that application-submitted plans are complementary with and are in conformance with the associated traffic and road plans and requirements of and from the local, regional, state and federal road and transportation authorities.

The plan will also include the following elements:

i) Due to the recreational nature of the Trade Lake area, and the large number of people that use our roads to walk, bike, ride ATV's and ride snowmobiles, all trucking and moving of materials in and out of the CAFO facility will be done during standard

business hours of 8:00 AM to 5:00 PM Monday through Friday. This includes the use of farm tractors and any other such vehicles.

ii) All trucks, tractors and farm equipment will follow all weight limits and laws. Any and all increased or enhanced maintenance or damage to roadways will be repaired by the Town or County having jurisdiction over the roadway. The CAFO will be responsible for reimbursing the appropriate governmental subunit for the total cost of the required increased or enhanced maintenance or repairs.

iii) The exterior of trucks, tractors and all other farm vehicles when leaving the property will be free from manure and other debris in order to keep the roadways roads clean and free from debris.

iv) Jake braking will not be allowed.

v) Livestock trucks will be designed and operated in such a way so that material will not fall from them.

vi) All vehicles going in and out of the facility will comply with the cleaning and sterilization requirements contained in the Applicant's Biosecurity and Animal Health Plan.

b) Mandatory Transportation Log

The Applicant shall keep a log of all trucks entering and leaving the Applicant's facility that are used for transportation of livestock, manure, feed, other waste (including biological and non-biological waste), construction material, or any other material identified by the Town of Trade Lake as falling under this condition.

The log shall include the following information:

i) the date and time the vehicle entered and left the facility;

ii) the identify the owner and company name of the trucking company;

iii) the type of truck, including the weight per axel;

iv) the license plate number of the truck;

v) the name of the insurance carrier insuring the vehicle and the insurance policy number;

vi) the name and driver's license number for the operator;

vii) the material being transported;

viii) where the truck came from and where it's next stop will be;

ix) if the truck is hauling drugs or disinfectants, a detailed explanation of their intended use;

x) if the truck is hauling live animals to the facility, where the animals came from, a copy of a certificate of health, the number of animals and their weight;

xi) if the truck is hauling live animals away from the facility, where the animals are going, a certificate of health, the number of animals and their weight.

All trucks hauling livestock have the risk of spreading diseases. To prevent the spread of disease, the Transportation Plan provide that all trucks shall be cleaned and washed with disinfectant before leaving the Applicant's facility. All wash water and cleaning materials will be considered to be infected and will have to be removed to an appropriate facility for treatment or storage of the contaminated water.

6. Conditions relating to protection of private and public drinking and agricultural wells, and other public water supplies, as part of an ongoing operation to protect public health, prevent pollution, and prevent private nuisances and public nuisances.

The applicant will produce a Water Protection Plan that addresses protection of local wells, groundwater and surface water to protect the health, safety and welfare of Trade Lake residents and visitors. The water protection plan shall address the following:

a) If the applicant intends to dispose of manure by depositing the manure on local fields, whether those fields are within the Town of Trade Lake or outside of its boundaries, applicant will provide executed field leases for each such property. Each lease must explicitly disclose that the field is going to be used for the disposal of manure or other animal byproducts and must contain a provision allowing representatives of the Town, at its discretion, to enter the property to perform testing or inspection. Any leases that lapse, are cancelled or otherwise become unenforceable shall be reported to the Town as soon as the change in status of the lease occurs. If the loss of a lease renders an applicant unable to dispose of manure without complying with all of the conditions placed upon the applicant, the applicant shall find other methods of disposing of its manure or cease operations.

b) If the applicant intends to dispose of manure by depositing the manure on local fields, whether those fields are within the Town of Trade Lake or outside of its boundaries such manure must be injected or "knifed" into the ground or otherwise deposited below the surface of the field by other means. No surface spreading of any kind will be allowed.

c) Applicant may not deposit manure on any field where the groundwater is less than 24 inches from the surface.

d) Applicant may not deposit manure on fields that have slopes with a grade steep enough so that substantial manure runs off into adjacent ditches, streams, lakes, or adjacent fields for which the applicant does not have an executed field lease. The term "substantial" when used in this section means sufficient to adversely affect any pond, lake, stream, creak, river or wetland into which the manure may run off.

e) Applicant may not deposit manure on fields when weather conditions exist that might cause the manure to run off the field into adjacent ditches, streams, lakes, or adjacent fields for which the applicant does not have an executed field lease. For example, where precipitation is occurring or expected, or where the ground is frozen.

f) The Town is aware that there have been substantial failures, in Wisconsin and other states, of lines transmitting manure to fields where the manure is applied. Such failures would be devastating in Trade Lake because of the number of waterways, sensitive wildlife areas and the proximity to the St. Croix River. Accordingly, manure may not be transported in hoses, piping or other conduit running through or across drainage ditches, rivers, creeks, streams, ponds, lakes or wetlands.

g) Applicant must incorporate an emergency manure disposal procedure in its plan that provides for an alternative method of disposing of manure, other than knifing it into a farm field or depositing it below the surface of the field by other means, for occasions where weather conditions are not conducive to spreading manure or where the applicant no longer has sufficient acreage upon which to deposit manure. Such an alternative method may include, for example, approved waste treatment facilities. The Applicant should not expect to receive an exception to this condition.

h) In consultation with a qualified consultant, approved by or designated by the Town, the Applicant will provide the Town with a plan (and upon initiation of operations, effectuate that plan) for monitoring the groundwater on fields where manure is being spread. The consultant will determine the location, the frequency, and depth of groundwater test wells. Consultant will also determine how often test results need to be obtained. All test results for this and any other condition will be made available to the consulting expert, the Town of Trade Lake, representatives of Burnett County and representatives of the State of Wisconsin.

i) If the applicant intends to deposit manure on fields that are adjacent to ditches, streams, creeks, rivers, ponds lakes, wetlands or other bodies of water, whether those bodies of water are permanent or seasonal, applicant will, in consultation with a qualified consultant, approved by or designated by the Town, provide the Town with a plan (and effectuate that plan) for monitoring the surface waters that could be affected by the CAFOs operation.

7. Conditions relating to air emissions and dust control as part of an ongoing operation, to protect public health, prevent pollution and prevent private nuisances and public nuisances.

One of the biggest concerns regarding large livestock operations is the impact on public health and property values caused by toxic air pollution from dust and manure blown from powerful building fans and manure spreading. While science-based regulations for manure spreading attempt to protect water, there is very limited regulation of air pollution. The Town recognizes that there are odor standards in place, but the Town of Trade Lake seeks to regulate not just offensive smells, but the airborne chemicals and substances given off by CAFO's (such as ammonia, hydrogen sulfide and methane and particulate matter) which may be perceived as smells, but which also can negatively affect the health of our community.[53]

Community members living near CAFO operations face increased exposure to air pollution which can cause or exacerbate respiratory conditions including asthma[54]; eye irritation, difficulty

[53] Hribar C., *Understanding Concentrated Animal Feeding Operations and Their Impact on Communities, p.* 8-11; *Emissions from Animal Feeding Operations, U.S. Environmental Protection Agency, Emissions Standards Division, Office of Air Quality Planning and Standards*, August 15, 2001.

[54] Heederik D, Sigsgaard T, Thorne PS, et al. *Health effects of airborne exposures from concentrated feeding operations*. Environ Health Perspect. 2007:298-302. (There is evidence that psychophysiologic changes may result

breathing, wheezing, sore throat, chest tightness, nausea[55]; and bronchitis and allergic reactions.[56] Air emissions include particulates, volatile organic compounds, and gases such as nitrous oxide, hydrogen sulfide, and ammonia.[57] Odors associated with air pollutants from large-scale hog operations have been shown to interfere with daily activities, quality of life, social gatherings, and community cohesion[58] and contribute to stress and acute increased blood pressure.[59]

While it appears that some seek to minimize "odor" as simply a bad smell and a nuisance, researchers have found that exposure to malodor causes physical and psychological health problems. Specifically dealing with hog CAFOs has indicated that "[h]og odor, hydrogen sulfide, and semivolatile PM [particulate matter] are related to stress and negative mood in

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from exposure to malodors and that microbial exposures are related to deleterious respiratory health effects); Cambra-Lopez M, Aarnink AJ, Zhao Y, Calvet S, Tones AG. *Airborne particulate matter from livestock production systems: A review of an air pollution problem*. Environmental Pollution. 2010;158(1):1-17. (High concentrations of particulate matter emissions, such as those found in livestock houses, can threaten the environment and the health and welfare of humans and animals); Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. *Asthma symptoms among adolescents who attend public schools that are located near confined swine feeding operations*. Pediatrics. 2006;118(1):e66-75. The relationship between exposure to airborne effluent from swine CAFOs and asthma symptoms in adolescents age 12-14 years old was assessed in this study to better understand the health effects of living near industrial swine facilities. The study found that estimated exposure to swine CAFO air-pollution was associated with wheezing symptoms in adolescents.

[55] Schinasi L, Horton RA, Guidry VT, Wing S, Marshall SW, Morland KB. *Air pollution, lung function, and physical symptoms in communities near concentrated swine feeding operations*. Epidemiology. 2011 ;22(2):208-215.

[56] Cambra-Lopez M, Aarnink AJ, Zhao Y, Calvet S, Tones AG. *Airborne particulate matter from livestock production systems: A review of an air pollution problem*. Environmental Pollution. 2010;158(1):1-17.

[57] Heederik D, Sigsgaard T, Thorne PS, et al. Health effects of airborne exposures from concentrated animal feeding operations. *Environ Health Perspect.* 2007:298-302.

[58] *Id.*; Donham KJ, Wing S, Osterberg D, et al. *Community health and socioeconomic issues surrounding concentrated animal feeding operations*. Environ Health Perspect. 2007:317-320 (The Workgroup on Community and Socioeconomic Issues examined the impacts of CAFOs on the health of rural communities, using the World Health Organization's definition of health, "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." The workgroup recommended more stringent CAFO permitting, limiting animal density per watershed, improving local control, mandating environmental impact statements and considering bonding for manure storage basins); Wing S, Wolf S. *Intensive livestock operations, health, and quality of life among eastern North Carolina residents*, Environ Health Perspect. 2000;108(3):233-238 (Reports of decreased health and quality of life from people who live near industrial animal operations were explored in this study through community surveys in three rural communities, one located near a large swine operation, one near two intensive cattle operations, and one area without nearby livestock operations using liquid waste management systems. Residents near the swine operation reported increased occurrences of poor health, such as headaches, diarrhea, sore throat, excessive coughing and burning eyes and reduced quality of life compared to those in the other two communities); Horton RA, Wing S, Marshall SW, Brownley KA. *Malodor as a trigger of stress and negative mood in neighbors of industrial hog operations*. Am J Public Health. 2009;99(53):S610-S615.

[59] Wing S, Horton RA, Rose KM. Air pollution from industrial swine operations and blood pressure of neighboring residents. Environmental Health Perspectives (Online) 2013;121(1):92 (Malodor and some air pollutants were found to be associated with blood pressure increases and reported stress, which could contribute to the development of chronic hypertension)

disproportionately low-income communities near industrial hog operations in eastern North Carolina. Malodor should be considered in studies of health impacts of environmental injustice."[60]

Statistical analyses confirm that source terms such as distance to a hog CAFO and live weight per operation, as well as temperature, wind speed and wind direction are important predictors of atmospheric ammonia (NH_3) at community locations. The results indicate potential zones of exposure for human populations who live or go to school near hog CAFOs. North Carolina citizens show high rates of infant mortality, asthma, low birth weights, kidney disease and tuberculosis in communities near hog factories. Wisconsin rural residents living in close proximity to CAFOs report increases in allergies, asthma, uncontrolled asthma, medication use and impaired lung function. North Carolina now recognizes the impact of air pollution on communities in the 2020 Odor Control Check List as part of "Title VI: Increasing equity, transparency and environmental protection...."

Under Wisconsin Statute 93.90 and Wis. Admin. Code Ch. ATCP 51 setbacks for livestock structures with an infinite number of animals cannot exceed 200 feet. Maximum setbacks allowed for manure storage cannot exceed 350 feet. The 2019 Technical Expert Committee (TEC) of the Wisconsin Department of Agriculture Trade and Consumer Protection recommends that setbacks be established using the University of Minnesota Extension's "Odor From Feedlots Estimation Tool" (OFFSET). In 2019, Wisconsin Department of Agriculture Trade and Consumer Protection developed a "draft rule" and a "final draft rule" for Wis. Admin. Code Ch. ATCP 51. In the draft rule, setbacks for high odor structures run from 600 to 2,560 feet. In the final draft setbacks run from 350 to 1,450 feet. However, the Wisconsin Legislature refused to take action on the proposed rule and none of the proposed changes were adopted.

Neighboring farms are at risk from airborne animal diseases contracted by contained animals living in a controlled ventilated environment where exhaust fans move airborne particles to the outdoors. Highly pathogenic disease transmission in the air flow into the environment threatens herds in the surrounding community. As Dr. Beattie informed the Committee, air from CAFO barns has been shown to carry antibiotic resistant bacteria.[61]

Accordingly, the Applicant will submit an Air Emissions and Dust Control Plan that includes the following conditions:

a) In consultation with a qualified consultant, approved by or designated by the Town, the Applicant will provide the Town with a plan (and upon initiation of operations,

[60] Horton RA, Wing S, Marshall SW, Brownley KA. *Malodor as a trigger of stress and negative mood in neighbors of industrial hog operations*. Am J Public Health. 2009;99(53):
S610-S615.

[61] Chapin A, Rule A, Gibson K, Buckley T, and Schwab K, Airborne Multidrug-Resistant Bacteria Isolated from a Concentrated Swine Feeding Operation, *Environ Health Perspect* 113:137–142 (2005) Johns Hopkins Bloomberg School of Public Health, Department of Environmental Health Sciences, Baltimore, Maryland, USA.(High-level multidrug-resistant *Enterococcus*, coagulase-negative staphylococci, and viridans group streptococci were detected in the air of a concentrated swine feeding operation. These findings suggest that the inhalation of air from these facilities may serve as an exposure pathway for the transfer of multidrug-resistant bacterial pathogens from swine to humans.)

effectuate that plan) for filtration of air exiting barns or other structures that are part of its operation.

b) The plan referenced in the preceding paragraph must include:

i) the incorporation of a filtration system for outgoing air exiting any building housing livestock or used for storage of manure, carcasses or other waste.
ii) engineering drawings of the outgoing air filtration system;
iii) identification of the make, model and specifications for the outgoing air filtration system;
iv) protocols for replacing and/or cleaning the filters or other components incorporated in the filtration system that require such maintenance;
v) protocols for the testing of air outside of the facility to monitor odor, chemicals including, but not limited to ammonia, hydrogen sulfide and methane, particulate matter and any other chemical or biological hazards that may be identified by the consultant. Such monitoring may also apply to field where manure is deposited.
vi) a description of setbacks and/or physical barriers incorporated into the design of the Applicant's facility

8. Conditions relating to protection of the private and public property rights and property values of affected property owners, as part of an ongoing operation, to protect the general welfare of the Town's residents and property owners, and to prevent private nuisances and public nuisances.

Economic concentration of agricultural operations tends to remove a higher percentage of money from rural communities than when the industry is dominated by smaller farm operations, which tend to circulate money within the community. Communities dominated by smaller owner-operated farms have a richer civic and social fabric with more retail purchases made locally and with income more equitably distributed,

Concentration of agriculture is associated with local economic and community decline, including decreased tax receipts and declining local purchases with larger operations. The social and economic well-being of local rural communities benefits from increasing the number of farmers, not simply increasing the volume of commodity produced.

The financial health of government and citizens is based in large part on property values. Large livestock facilities can negatively impact property values. Specifically, CAFOs can have a significant adverse impact on the value of property within 3 miles and directly downwind. Empirical evidence indicates that residences near Animal Operations are negatively affected, depending on distance, wind direction, and other factors. It has been reported that the market value of properties immediately abutting a CAFO can be diminished by as much as 88 percent. Nearby small farms can be impacted by such factors as water degradation, insects and monopolization of local resources such as feed.

Accordingly, the Applicant will submit a Community Economic, Land-Use and Property Value Assessment and Impact Study performed by a licensed appraiser and qualified land use planner which demonstrates that there will be no negative impact to properties within 3 miles of Applicant proposed facility. Applicant will provide the Town with any studies appraisals or other information referenced in the Community Economic, Land-Use and Property Value Assessment and Impact Study.

9. Conditions relating to permit compliance, enforcement and monitoring, including establishment of fees that may be assessed against the permittee to cover the costs of hiring, training, and maintain Town personnel, or for contracting with private consultants, to conduct permit compliance, enforcement and monitoring activities for the Town.

The Wisconsin Department of Natural Resources (WDNR) has struggled to keep up with CAFOs required to have WPDES permits as the number grew from 135 in 2005 to 321 in 2021. Eighty-six (86) or 26% of Wisconsin CAFOs are operating under expired WPDES permits. In Polk County, four of the five CAFOs' WPDES permits are expired.

Enforcement of WPDES permits relies, for the most part, on self-reporting and whistleblowers. One WDNR regional staff person covers compliance for eight counties running 245 miles from Douglas County on Lake Superior to Buffalo County on the Mississippi River.

Issues with Emerald Sky Diary illustrate the enforcement challenges communities face. Located in St. Croix County, Emerald Sky is owned by a Nebraska company. They have had five known manure violations in three years. The worst was a 2017 spill of 275,000 gallons that was reported by a whistleblower. In November 2019, an anonymous call reported manure flowing down a ditch that dumps into Hutton Creek. DNR staff documented manure flowing into the creek and dead fish. St. Croix County Development Corporation had to send a letter to the DNR in February 2020 demanding "full and quick enforcement of manure application rules and statutes for CAFO's located in St. Croix County.

Enforcement by Wisconsin Department of Justice (DOJ) under the state Attorney General on CAFOs with WPDES permits can be very uneven. Enforcement of 2017 violations in St. Croix County took years. In 2021, the DOJ has taken enforcement action against CAFOs owned by Rolling Hills, Kostechka, Tri-Star, Maple Leaf, Redtail Ridge, Jon-De Capital and Verhasselt Farms.

Tracking where animal wastes are spread is very challenging. In one Iowa study, public records were used to document manure management by CAFOs housing 59,700 finishing hogs in a 3,840 acre area. Together, they generated an estimated 1.79 million pounds of nitrogen (N) each year, more than 70% of which volatilized into the atmosphere. CAFOs minimized the area required for applying manure by underestimating the nitrogen content of manure, projecting above average crop yields, and applying manure to soybeans. Some fields were claimed by more than one operator, and some field sizes were overestimated. Manure application based on crop demand for phosphorus would require 23,104 acres of cropland, compared to the 2,446 acres actually used.

All of this demonstrates to the Committee that local enforcement measures must be available in order to ensure compliance. Accordingly, the Committee recommends that the Town require financial surety to help enforce compliance with the conditions imposed by the Town**.**

a) Fees

The applicant shall include and sign a statement that the applicant agrees to fully compensate the Town for all legal services, expert consulting services, and other expenses which may be reasonably incurred by the Town in reviewing and considering the application, regardless of whether or not the application for a permit is subsequently approved, with or without conditions, or denied by the Town Board. The applicant statement shall also state that the applicant agrees to fully compensate the Town for all legal services, expert consulting services and other expenses, for verifying and enforcing compliance with the terms of the permit, with or without conditions, if approved by the Town Board. The applicant shall submit an administrative fee deposit as required by the Town Clerk.

b) Financial Surety

i) Notification.
The Trade Lake Town Board shall determine the required financial assurance level of the CAFO and shall notify the applicant. As a condition of a permit, the Town Board shall require financial assurance to be filed with the Town Board in an amount sufficient to clean-up environmental contamination if the same were to occur, to abate public nuisances caused by CAFO operations, including but not limited to the testing and replacement of any potentially contaminated private and public wells and water supplies within the areas subject to CAFO operations, and to ensure proper closure of the CAFO, should the applicant elect to close or should the closure occur for some other reason. Upon notification of the required financial assurance levels by the Town Board, but prior to commencing operations of the CAFO, the applicant shall file with the Town Board said financial assurance conditioned on faithful performance of all requirements of this chapter and the permit. Upon notification by the Town Board of financial assurance or deposit approval and conformance with permit conditions, the applicant may commence CAFO operations.

c) Bond Requirements.

i) Bonds shall be issued by a surety company licensed to do business in this state. At the option of the applicant or permit holder a performance bond or a forfeiture bond may be filed. Surety companies may have the opportunity to complete the clean-up of environmental contamination or complete proper closure of the CAFO in lieu of cash payment to the Town of Trade Lake.

ii) Each bond shall provide that the bond shall not be canceled by the surety, except after not less than 90 days' notice to the Town Board, in writing, by registered or certified mail. Not less than 30 days prior to the expiration of the 90 day notice of cancellation, the applicant or permit holder under this chapter must deliver to the Town Board a

replacement bond or approved alternate financial assurance in absence of which all CAFO operations shall cease.

iii) The bond shall be payable to "Town of Trade Lake, Wisconsin."

iv) The bond shall provide that the Town may obtain recovery from the bond through arbitration under the rules of the American Arbitration Association. The Town may recover against the bond for any damages to public or private property, degradation or impairment of surface water, groundwater or air quality. Trade Lake property owners may also bring action against the bond where they are damaged by the Applicant's failure to comply with the terms of the conditions imposed hereunder.

d) Alternate Financial Assurance.

An applicant or permit holder may deposit cash, irrevocable letters of credit, irrevocable trusts, established escrow accounts, negotiable certificates of deposit or negotiable government securities with the County in lieu of a bond. Certificates of Deposit shall be automatically renewed or replaced with an alternate security before the maturity date. Any interest earned by the financial assurance will be paid to the applicant at the time such financial assurance is cancelled or withdrawn.

e) Financial Assurance Reevaluation.

i) The Trade Lake Town Board may reevaluate and adjust accordingly the amount of the financial assurance required for the CAFO, including reevaluating said financial assurance when requested to do so by the applicant or permit holder, provided that the applicant or permit holder may only request a reevaluation once per year.

ii) The applicant or permit holder shall notify the Trade Lake Town Board in writing if there is a ten percent (10%) change in the average daily number of animal units housed at the CAFO in any 365 day period. This notification shall be provided at any time such a change occurs, and not just for financial assurance reevaluation.

iii) The Trade Lake Town Board shall notify the applicant in writing within 60 days of a decision to adjust the amount of the financial assurance for the CAFO, whether the adjustment results in a greater or lesser financial assurance requirement.

f) Financial Assurance on Multiple Projects.

Any applicant or permit holder that receives a permit from the Trade Lake Town Board for two or more CAFOs may elect, at the time the second or subsequent CAFO is approved, to post a single financial assurance in lieu of separate financial assurance on each CAFO. Any financial assurance so posted shall be in an amount equal to the estimated cost to the Town to clean-up environmental contamination if the same were to occur at all such CAFOs, to abate public nuisances caused by CAFO operations, including but not limited to the testing and replacement of any potentially contaminated private and public wells and water supplies within the areas subject to CAFO operations, and to ensure proper closure of all such CAFOs, should the applicant elect to close or should the closure occur for some other reason. When an applicant elects to post a single financial assurance in lieu of separate financial assurance previously

posted on an individual CAFO the separate financial assurance shall not be released until the new financial assurance has been accepted by the Town Board.

g) Financial Assurance Release.

The Trade Lake Town Board shall release the applicant's or permit holder's financial assurance after providing notice to all property owners within 3 miles of the CAFO of the intent to release financial insurance and allowing such owners 90 days to object, if it finds, after inspection of the CAFO and documentation provided by the permit holder, that the permit holder has completed or ceased CAFO operations at the permitted location and all associated parcels, and that there is no environmental contamination or public nuisance remaining at any locations used for any part of the CAFO operations, after operations have ceased. Title 5, Chapter 6, Public Safety Adopted in its Entirety 1-26-16 Published 1-30-16 8

h) Cancellation.

The financial assurance shall provide that it may not be canceled by the surety or other holder or issuer except after not less than a 90 days' notice to the Town Board in writing by registered or certified mail. Not less than 30 days prior to the expiration of the 90 days' notice of cancellation, the applicant or permit holder shall deliver to the Town Board a replacement financial assurance. In the absence of this replacement financial assurance, all CAFO operations shall cease until the time the required financial assurance is delivered and in effect.

i) Changing Methods of Financial Assurance.

The operator of a CAFO may change from one method of financial assurance to another. This may not be done more than once a year unless required by an adjustment imposed pursuant to this chapter. The permit holder shall give the Trade Lake Town Board at least 60 days' notice prior to changing methods of financial assurance and may not actually change methods without the written approval of the Town Board.

j) Bankruptcy Notification.

The applicant or permit holder under this chapter shall notify the Trade Lake Town Board by certified or registered mail of the commencement of voluntary or involuntary proceedings under the United States Bankruptcy Code, U.S. Code Title 11--Bankruptcy, naming the applicant or permit holder as a debtor, within 10 days of commencement of the bankruptcy proceeding.

10. Conditions relating to the monitoring of surface water, ground water, air quality and all other environmental factors and considerations.

The Applicant shall submit a Compliance Assurance Testing, Sampling and Monitoring Plan which provides for an identified chain-of-command, including local authority incident

commanders, for the reporting and correction, including emergency measures, of any and all deviation(s) from the plan's enforceable metrics, as well as the daily monitoring of all operations for compliance with the enforceable metrics identified in the plan, including inspection and sampling of storm water discharges, quarterly ground water monitoring at locations that will allow corrective actions and containment measures to prevent offsite migration or vertical migration of contamination, identification and verification of the efficacy of testing methods and quality assurance reviews of test results, and reporting within 24 hours of any and all deviations from compliance metrics to the owner, the third-party corrective measures contractor, and the local authorities identified in the local permit.

The Compliance Assurance Testing, Sampling and Monitoring Plan shall document that the prepared plans and procedures are based on sound science and include an updated review of best practices and technologies and test methods, and provide for specific compliance metrics to assure the performance requirements of the plan are met and the permit approval conditions are satisfied, and for audits, inspections, and certification by qualified and experienced, and licensed third party(ies), of compliance with the procedures and provisions of the various operational plans, including with the identified metrics in the plans.

11. Any other conditions deemed reasonably necessary or appropriate by the Town Board to effectively, efficiently, and comprehensively regulate the operations of a facility, to protect public health (including human and animal health), safety, and general welfare, prevent pollution and the creation of private nuisances and public nuisances, and preserve the quality of life, environment, and existing small-scale livestock and other agricultural operations of the Town.

The committee recognizes that scientific and technical developments continue and the Town requires some flexibility to impose additional conditions not referenced above, or relax conditions as technology improves, in order to protect the health, safety and general welfare of Trade Lake's property owners and residents. Accordingly, the Town may impose additional conditions, at the discretion of the Board, where the Board determines that they are required by reasonable and scientifically defensible findings of fact.

Trade Lake Permitting Study Committee Report

Appendix A

Journal Articles

1. Alarcón, L.V., Allepuz, A. & Mateu, E. Biosecurity in pig farms: a review. *Porc Health Manag* **7,** 5 (2021).
   Link: https://doi.org/10.1186/s40813-020-00181-z
   The perception of the importance of animal health and its relationship with biosecurity has increased in recent years with the emergence and re-emergence of several diseases difficult to control. This is particularly evident in the case of pig farming as shown by the recent episodes of African swine fever or porcine epidemic diarrhea. Moreover, a better biosecurity may help to improve productivity and may contribute to reducing the use of antibiotics. Biosecurity can be defined as the application of measures aimed to reduce the probability of the introduction (external biosecurity) and further spread of pathogens within the farm (internal biosecurity). Thus, the key idea is to avoid transmission, either between farms or within the farm. This implies knowledge of the epidemiology of the diseases to be avoided that is not always available, but since ways of transmission of pathogens are limited to a few, it is possible to implement effective actions even with some gaps in our knowledge on a given disease. The development of quantitative assessment methods will permit a more precise selection of measures and a fine evaluation of their impact. Collaboration with other branches of science such as sociology or psychology may help to the sustainable implementation of biosecurity plans.

2. American Academy of Pediatrics. Committee on Environmental Health and Committee on Infectious Diseases, 2009. Drinking water from private wells and risks to children. *Pediatrics* 123(6):1599–1605.
   Link: Drinking Water From Private Wells and Risks to Children (aappublications.org)
   Drinking water for approximately one sixth of US households is obtained from private wells. These wells can become contaminated by pollutant chemicals or pathogenic organisms and cause illness. Although the US Environmental Protection Agency and all states offer guidance for construction, maintenance, and testing of private wells, there is little regulation. This policy statement provides recommendations for inspection, testing, and remediation for wells providing drinking water for children.

3. American Association of Swine Veterinarians. Holding Time Calculations for Feed Ingredients to Mitigate Virus Transmission. February 4, 2020
   Link: Holding-Time-Calculations-for-Feed-Ingredients-to-Mitigate-Virus-Transmission
   Imported feedstuffs are not all manufactured and handled in the same way. Consideration should be given to the conditions of manufacture and how these products are handled and transported. Feedstuffs that are manufactured, sealed, handled and shipped under biosecure conditions that produce a product free of pathogens and prevents post-processing contamination are not a risk to animal health. If a feedstuff is not produced under biosecure conditions, is produced under unknown conditions or is not sealed to prevent post-processing contamination, a holding time gives an opportunity for viral contaminants to naturally degrade and to not be infectious.

4. American Association of Swine Veterinarians. On-Farm Euthanasia of Swine. 2016 #04970-11/16
   Link: 2016EuthRec-EN.pdf (aasv.org)
   Euthanasia is the humane process whereby the pig is rendered insensible, with minimal pain and distress, until death. For the euthanasia process or method to be considered humane, it must be quick, effective and reliable. Key elements for determining if a method is humane include: • minimal pain and distress to the pig during administration, • rapid loss of consciousness, • death is achieved quickly and consistently. This brochure provides practical recommendations for the on-farm euthanasia of swine. It also highlights euthanasia methods that have been shown to meet the definition for humane euthanasia based on the available scientific literature. However, this list may not be all-inclusive. Other options may be used as long as they meet the definition and key elements for euthanasia discussed above.

5. American Association of Swine Veterinarians. Swine Disease Manual - Porcine Reproductive and Respiratory Syndrome
   Link: Porcine Reproductive and Respiratory Syndrome (PRRS)
   In some operations, it may be economically feasible to depopulate, clean and disinfect the facilities and, after a few weeks, repopulate with stock free of PRRS and other major diseases. Herd closure for at least 200 days has also been used as another means to stabilize a breeding herd without depopulating. Most breeding stock companies today provide PRRS-free seed stock which was once a major limitation. Before embarking on this strategy, one should honestly assess risk factors for re-infection of the herd as well as the level of biosecurity that can be maintained by the producer. Herds located in swine-dense areas are at great risk for re-infection.

6. American Public Health Association. Precautionary Moratorium on New and Expanding Concentrated Animal Feeding Operations. November 5, 2019. Policy Number: 20194
   Link: Precautionary Moratorium on New and Expanding CAFOs (apha.org)
   These operations function with the high throughput and rapid turnover of an industrialized system. The enormous accumulation of manure and other untreated waste is often stored and disposed of in a manner that pollutes the air, surface, and groundwater, posing risks to the environment and human health, particularly for CAFO workers and nearby residents. This policy statement calls for a moratorium on the establishment of new CAFOs and

expansion of existing CAFOs until regulation and enforcement conditions are in place to adequately protect the public's health.

7. Arora, K. General Guidelines on Composting of HPAI Infected Carcasses. *Iowa State Extension Store.* July 2017.
   Link: General Guidelines on Composting of HPAI Infected Carcasses (iastate.edu)
   Containment of highly pathogenic avian influenza (HPAI) is a critical step which must be properly performed to ensure human and animal safety. This publication discusses how to prepare to contain a potential outbreak and what should be done to safely contain it.

8. Baykov B, Stoyanov M. Microbial air pollution caused by intensive broiler chicken breeding. *FEMS Microbiol Ecol.* 1999;29(4):389-392.
   Link: https://academic.oup.com/femsec/article/29/4/389/527380/Microbial-air-pollution-caused-by-intensive-broiler-breeding-operations
   This study examined the extent of microbial atmospheric pollution caused by industrial broiler breeding operations and found that as birds aged, microbial numbers increased in the indoor air and were spread into the environment to a greater degree. The study also found that microorganisms could be spread by air flow up to 3000 meters from the production buildings.

9. Beattie R, Walsh M, Cruz M, McAliley R, Dodgen L, Zheng W, Hristova K, Agricultural contamination impacts antibiotic resistance gene abundances in river bed sediment temporally, *FEMS Microbiology Ecology*, Volume 94, Issue 9, September 2018, fiy131, https://doi.org/10.1093/femsec/fiy131

10. Brender JD, Weyer PJ, Romitti PA, et al. Prenatal nitrate intake from drinking water and selected birth defects in offspring of participants in the national birth defects prevention study. *Environ Health Perspect.* 2013;121(9):1083-1089.
    Link: https://www.ncbi.nlm.nih.gov/pubmed/23771435
    The relationship between prenatal exposure to nitrates in drinking water and birth defects was examined in this study. The study concluded that higher maternal water nitrate consumption was associated with birth defects, including spina bifida, limb deficiency, cleft palate, and cleft lip.

11. Broom, DM. (2003) Causes of Poor Welfare in Large Animals During Transport. *Veterinary research communications, 27 Suppl 1*, 515–518.
    Link: Causes of poor welfare in animal transport (nih.gov)
    The welfare of animals during transport should be assessed using a range of behavioral, physiological and carcass quality measures. In addition, health is an important part of welfare so the extent of any disease, injury or mortality resulting from, or exacerbated by, transport should be measured. Many of the indicators are measures of stress in that they involve long-term adverse effects on the individual. Key factors affecting the welfare of animals during handling and transport which are discussed are: attitudes to animals and the need for training of staff; methods of payment of staff; laws and retailers' codes; genetics, especially selection for high productivity; rearing conditions and experience; the mixing of animals from different social groups; handling procedures: driving methods; stocking density; increased susceptibility to disease and increased spread of disease.

12. Brumm, M. Patterns of Drinking Use in Pork Production Facilities. (2006) *Nebraska Swine Reports.* 221.
Link: Patterns of Drinking Water Use in Pork Production Facilities
The amount of drinking water needed daily by the pig depends on numerous influences, including temperature, diet, stage of production and health. Daily drinking water needs for pigs range from less than 0.5 gal/pig/day for newly weaned pigs to greater than 1.5 gal/pig/day for grow-finish pigs. Water requirements for breeding swine range from 3 to 4 gal/day for gestating females and 6 gal/day for lactating swine.

13. Burgos J, Ellington B, Varela M. Presence of multidrug-resistant enteric bacteria in dairy farm topsoil. *J Dairy Sci.* 2005;88(4):1391-1398.
Link: https://www.ncbi.nlm.nih.gov/pubmed/15778307
In addition to human and veterinary medicine, antibiotics are extensively used in agricultural settings, such as for treatment of infections, growth enhancement, and prophylaxis in food animals, leading to selection of drug and multidrug-resistant bacteria. To help circumvent the problem of bacterial antibiotic resistance, it is first necessary to understand the scope of the problem. However, it is not fully understood how widespread antibiotic-resistant bacteria are in agricultural settings. The lack of such surveillance data is especially evident in dairy farm environments, such as soil. It is also unknown to what extent various physiological modulators, such as salicylate, a component of aspirin and known model modulator of multiple antibiotic resistance (mar) genes, influence bacterial multi-drug resistance. We isolated and identified enteric soil bacteria from local dairy farms within Roosevelt County, NM, determined the resistance profiles to antibiotics associated with mar, such as chloramphenicol, nalidixic acid, penicillin G, and
tetracycline. We then purified and characterized plasmid DNA and detected mar phenotypic activity. The minimal inhibitory concentrations (MIC) of antibiotics for the isolates ranged from 6 to >50 microg/mL for chloramphenicol, 2 to 8 microg/mL for nalidixic acid, 25 to >300 microg/mL for penicillin G, and 1 to >80 microg/mL for tetracycline. On the other hand, many of the isolates had significantly enhanced MIC for the same antibiotics in the presence of 5 mM salicylate. Plasmid DNA extracted from 12 randomly chosen isolates ranged in size from 6 to 12.5 kb and, in several cases, conferred resistance to chloramphenicol and penicillin G. It is concluded that enteric bacteria from dairy farm topsoil are multidrug resistant and harbor antibiotic-resistance plasmids. A role for dairy topsoil in zoonoses is suggested, implicating this environment as a reservoir for development of bacterial resistance against clinically relevant antibiotics.

14. Burkholder J, Libra B, Weyer P, et al. Impacts of waste from concentrated animal feeding operations on water quality. *Environ Health Perspect.* 2007:308-312.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/F'MC1817674/
This work-group, part of the Conference on Environmental Health Impacts of Concentrated Animal Feeding Operations: Anticipating Hazards—Searching for Solutions, found that current and generally accepted livestock waste management practices do not protect water resources from the pathogens, pharmaceuticals and excessive nutrients found in animal waste. As concern about the potential human and environmental health impact of long-term exposure to contaminated water grows, there is greater need for rigorous monitoring of CAFOs, improved understanding of the major toxicants affecting human and environmental health, and a system to enforce these practices.

15. Cambra-Lopez M, Aarnink AJ, Zhao Y, Calvet S, Tones AG. Airborne particulate matter from livestock production systems: A review of an air pollution problem. *Environmental Pollution.* 2010;158(1):1-17.
Link: https://www.ncbi.nlm.nih.gov/pubmed/19656601
This paper reviews research on particulate matter inside and emitted from livestock production system and reports that livestock housing is an important source of particulate matter emissions. The paper recommends additional research to characterize and control particulate matter in livestock houses, as high concentrations such as those found in livestock houses can threaten the environment and the health and welfare of humans and animals.

16. Carmichael WW. Health effects of toxin-producing cyanobacteria: "The CyanoHABs". *Human and Ecological Risk Assessment: An International Journal.* 2001;7(5):1393-1407.
Link: http://www.tandfonline.com/doi/abs/10.1080/20018091095087
Current understandings of cyanobacteria toxin poisonings (CTPs) and their risk to human health were reviewed in this paper. CTPs occur in fresh and brackish waters throughout the world as a result of eutrophication and climate change. Cyanobacteria toxins are responsible for acute lethal, acute, chronic and sub-chronic poisonings of wild and domestic animals and humans. These poisonings result in respiratory and allergic reactions, gastrointestinal disturbances, acute hepatotoxicosis and peracute neurotoxicosis.

17. Casey JA, Curriero FC, Cosgrove SE, Nachman KE, Schwartz BS. High-density livestock operations, crop field application of manure, and risk of community-associated methicillin-resistant *Staphylococcus aureus* infection in Pennsylvania. *JAMA Internal Medicine.* 2013;173(21):1980-1990.
Link: https://www .ncbi .nlm .nih .gov/pubmed/24043228
Nearly 80% of antibiotics in the United States are sold for use in livestock feeds. The manure produced by these animals contains antibiotic-resistant bacteria, resistance genes, and antibiotics and is subsequently applied to crop fields, where it may put community members at risk for antibiotic-resistant infections. The objective of this study was to assess the association between individual exposure to swine and dairy/veal industrial agriculture and risk of methicillin-resistant *Staphylococcus aureus* (MRSA) infection. This study was a population-based, nested case-control study of primary care patients from a single health care system in Pennsylvania from 2005 to 2010. Incident MRSA cases were identified using electronic health records, classified as community-associated MRSA or health care—associated MRSA, and frequency matched to randomly selected controls and patients with skin and soft-tissue infection. Nutrient management plans were used to create 2 exposure variables: seasonal crop field manure application and number of livestock animals at the operation. In a sub-study, we collected 200 isolates from patients stratified by location of diagnosis and proximity to livestock operations. The study measured community-associated MRSA, health care—associated MRSA, and skin and soft-tissue infection status (with no history of MRSA) compared with controls. From a total population of 446,480 patients, 1,539 community-associated MRSA, 1335 health care-associated MRSA, 2895 skin and soft-tissue infection cases, and 2914 controls were included. After adjustment for MRSA risk factors, the highest quartile of swine crop field exposure was significantly associated with community-associated MRSA, health care-associated MRSA, and skin and soft-tissue infection case status (adjusted odds ratios, 1.38 [95% CI, 1.13-1.69], 1.30 [95% CI, 1.05-1.61], and 1.37 [95% CI, 1.18-1.60], respectively); and there was a trend of increasing odds across quartiles for each outcome ($P \leq .01$ for trend in all comparisons). There were similar but weaker associations of swine operations with community-associated MRSA and skin and

soft-tissue infection. Molecular testing of 200 isolates identified 31 unique *spa* types, none of which corresponded to CC398 (clonal complex 398), but some have been previously found in swine. Proximity to swine manure application to crop fields and livestock operations each was associated with MRSA and skin and soft-tissue infection. These findings contribute to the growing concern about the potential public health impacts of high-density livestock production.

18. Center for Food Security and Public Health, Iowa State University. Prepare for animal disease threats.
    Link: CFSPH - Center for Food Security and Public Health (iastate.edu)
    African Swine Fever was confirmed for the first time in recent years in samples from pigs in the Dominican Republic on July 28. Keeping this transboundary disease out is key.

19. Centro del los Derechos Del Migrante. Recruitment Revealed: Fundamental Flaws in the H-2 Temporary Worker Program and Recommendations for Change. 2018
    Link: Recruitment_Revealed
    This report reveals the reality of international labor recruitment for low-wage, temporary jobs in the United States, examining recruitment in Mexico, home to the largest number of temporary migrants who labor under H-2 visas in the U.S. The findings are based on data gathered by Centro de los Derechos Migrante through a groundbreaking survey and lengthy interviews of hundreds of H-2 workers.

20. Chambers, PG, Grandin, T, et.al. *Guidelines for humane handling, transport, and slaughter of livestock*. Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific. RAP Publication 2001/4
    Link: https://www.fao.org/3/x6909e/x6909e.pdf
    Guidelines with several specifics on handling, design of pens and chutes, and good animal welfare standards.

21. Chapin A, Rule A, Gibson K, Buckley T, and Schwab K, Airborne Multidrug-Resistant Bacteria Isolated from a Concentrated Swine Feeding Operation, *Environ Health Perspect* 113:137–142 (2005) Johns Hopkins Bloomberg School of Public Health, Department of Environmental Health Sciences, Baltimore, Maryland, USA.

    High-level multidrug-resistant *Enterococcus*, coagulase-negative staphylococci, and viridans group streptococci were detected in the air of a concentrated swine feeding operation. These findings suggest that the inhalation of air from these facilities may serve as an exposure pathway for the transfer of multidrug-resistant bacterial pathogens from swine to humans.

22. Chen, C-T, Crespi, et. al. Long-run impacts of trade shocks and export competitiveness: Evidence from the U.S. BSE event. *Agricultural Economics*. 2020; 51: 941– 957.
    Link: https://doi.org/10.1111/agec.12602
    Examines how comparative advantages of major beef exporters changed following the 2003 bovine spongiform encephalopathy (BSE) outbreak, which significantly disrupted the U.S. beef trade until approximately 2007. Using longitudinal data on beef export values and constructed revealed comparative advantage measures, we

show that while some measures of the long-run impacts of BSE on U.S. beef export competitiveness have returned to pre-2003 levels, the U.S.'s comparative advantage has not. Long-term trade competitiveness may not simply return to normal even after a short-term disruption.

23. Chiu H, Tsai S, Yang C. Nitrate in drinking water and risk of death from bladder cancer: An ecological case-control study in Taiwan. *Journal of Toxicology and Environmental Health, Part* A. 2007;70(12):1000-1004.
Link: https://www.ncbi.nlm.nih.gov/pubmed/17497410
The association between bladder cancer mortality and nitrate exposure from Taiwan drinking water was investigated in this study. The results showed a significant positive relationship between the levels of nitrates in the drinking water and the risk of death from bladder cancer, indicating that environmental exposure to nitrates plays a role in the development of bladder cancer.

24. Coffey, Brian et al., The Economic Impact of BSE on the U.S. Beef Industry: Product Value Losses, Regulatory Costs, and Consumer Reactions, Kansas State University, April 2000
Link: Economic Impact of BSE
As BSE spread outside Europe to Japan and, in mid-2003, to Canada, USDA enhanced its surveillance efforts and increased funding for BSE related research. Regulatory efforts to counter the disease were further strengthened when, on December 23, 2003, it was reported that a dairy cow in Washington state had tested positive. Within days of the announcement, 53 countries banned imports of U.S. cattle and beef products. In 2003, U.S. beef exports were valued at $3.95 billion and accounted for 9.6 percent of U.S. commercial beef production. The import bans caused U.S. beef exports to plummet and exports for the year declined 82 percent below 2003's level.

25. Costa, T, Akdeniz, N. A review of the animal disease outbreaks and biosecure animal mortality composting systems. *Waste Management*, Volume 90, 2019, Pages 121-131,
Link: https://doi.org/10.1016/j.wasman.2019.04.047
Despite the development of new vaccines and the application of rigorous biosecurity measures, animal diseases pose a continuing threat to animal health, food safety, national economy, and the environment. Intense livestock production, increased travel, and changing climate have increased the risk of catastrophic animal losses due to infectious diseases. In the event of an outbreak, it is essential to properly manage the infected animals to prevent the spread of diseases. The most common disposal methods used during a disease outbreak include burial, landfilling, incineration and composting. Biosecurity, transportation logistics, public perception, and environmental concerns limit the use of some of these methods. During a disease outbreak, the large number of mortalities often exceeds the capacity of local rendering plants and landfills. Transporting mortalities to disposal and incineration facilities outside the production operation introduces biosecurity risks. Burying mortalities is limited by the size and availability of suitable sites and it has the risk of pathogen survival and contamination of groundwater and soil. Portable incinerators are expensive and have the potential to aerosolize infectious particles. Composting, on the other hand, has been recognized as a biosecure disposal method. Although composting has been shown to eliminate HPAI, FMD, PED, and PRRS viruses, no studies have been reported regarding African swine fever. More studies are needed to show the biosecurity of composting in eliminating infectious diseases and especially microbial DNA, which is often referred to be the reason for reoccurring diseases.

26. Costa, D. Employers increase their profits and put downward pressure on wages and labor standards by exploiting migrant workers. *Economic Policy Institute,* Aug 27, 2019.
Link: Employers and Migrant Workers
Our current immigration system isn't working for workers. Instead, it benefits low-road employers who exploit the immigration status of unauthorized immigrants and authorized guestworkers through a legal framework that puts downward pressure on wages and leaves migrant workers powerless to enforce their labor rights and hold employers accountable. This hurts both migrants and the U.S. workers—citizens and lawful permanent residents—who work alongside them. Congress needs to reform the U.S. immigration system by granting lawful permanent resident status to the current unauthorized immigrant population; revising temporary work visa program rules; enacting new protections from retaliation for migrant workers; appropriating more funding for labor standards enforcement; and permanently banning employers from hiring through temporary work visa programs if they have violated immigration or labor laws.

27. Cullens, F. Water Use on Dairy Farms. Michigan State University Extension. October 18, 2011.
Link: Water use on dairy farms - MSU Extension
A reliable, high quality water supply is essential to dairy farms. Water is used for animal consumption, milk cooling, cleaning and sanitizing equipment, cow cooling, irrigating crops, producing value added products, moving manure and cleaning the barns via flush systems.

28. Dee SA, Deen J. Evaluation of an industry-based sanitation protocol for transport vehicles contaminated with porcine reproductive and respiratory syndrome virus. *J Swine Health Prod.* 2006;14(3):126-132.
Link: Evaluation of an industry-based sanitation protocol
Contaminated livestock trailers certainly represent a significant risk for movement of the virus between and within herds. Historically, this disease risk has been effectively mitigated in some cases with the use of trailer washing, disinfection protocols, and thermo-assisted drying and decontamination (TADD) systems. This paper summarizes four studies that evaluated individual aspects of trailer sanitation programs including TADD and multiple disinfectants alone, as well several protocols that include washing, disinfection and TADD. To test a protocol, using conditions found on commercial swine production units, for sanitation of 1:150 scale models of commercial transport vehicles contaminated with porcine reproductive and respiratory syndrome virus (PRRSV). High-pressure washing of transport trailers, followed by 90 to 120 minutes exposure to either modified potassium monopersulfate or quaternary ammonium chloride disinfectants applied with a hydrofoamer is likely to eliminate residual infectious PRRSV.

29. Dee, SA, Bauermann, FV, Niederwerder, et. al (2018). Survival of viral pathogens in animal feed ingredients under transboundary shipping models. *PloS one*, *13*(3), e0194509.
Link: https://doi.org/10.1371/journal.pone.0194509
The goal of this study was to evaluate survival of important viral pathogens of livestock in animal feed ingredients imported daily into the United States under simulated transboundary conditions. Eleven viruses were selected based on global significance and impact to the livestock industry, including Foot and Mouth Disease Virus (FMDV), Classical Swine Fever Virus (CSFV) and African Swine Fever Virus (ASFV). Surrogate viruses with similar genetic and physical properties were used for 6 viruses. Results support published data on transboundary risk of PEDV in feed, demonstrate survival of

certain viruses in specific feed ingredients ("high-risk combinations") under conditions simulating transport between continents and provide further evidence that contaminated feed ingredients may represent a risk for transport of pathogens at domestic and global levels.

30. Deschuyffeleer, T. P., Tyberghien, L. F., Dickx, V. L., Geens, T., Saelen, J. M., Vanrompay, D. C., & Braeckman, L. A. (2012). Risk assessment and management of Chlamydia psittaci in poultry processing plants. *The Annals of occupational hygiene*, *56*(3), 340–349.
Link: https://doi.org/10.1093/annhyg/mer102
Chlamydia psittaci causes respiratory disease in poultry and can be transmitted to humans. Historical outbreaks of psittacosis in poultry workers indicated the need for higher awareness and an efficient risk assessment and management. This group reviewed relevant previous research, practical guidelines, and European directives. Subsequently, basic suggestions were made on how to assess and manage the risk of psittacosis in poultry processing plants based on a classical four-step approach. Collective and personal protective measures as well as the role of occupational medicine are described. Despite the finding that exposure is found in every branch, abattoir workstations seem to be associated with the highest prevalence of psittacosis. Complete eradication is difficult to achieve. Ventilation, cleaning, hand hygiene, and personal protective equipment are the most important protective measures to limit and control exposure to C. psittaci. Adequate information, communication, and health surveillance belong to the responsibilities of the occupational physician. Future challenges lay in the rigorous reporting of infections in both poultry and poultry workers and in the development of an avian and human vaccine.

31. Donham KJ, Wing S, Osterberg D, et al. Community health and socioeconomic issues surrounding
concentrated animal feeding operations. *Environ Health Perspect.* 2007:317-320.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817697/
The Workgroup on Community and Socioeconomic Issues examined the impacts of CAFOs on the health of rural communities, using the World Health Organization's definition of health, "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." The workgroup recommended more stringent CAFO permitting, limiting animal density per watershed, improving local control, mandating environmental impact statements and considering bonding for manure storage basins.

32. Dyal JW, Grant MP, Broadwater K, et al. COVID-19 Among Workers in Meat and Poultry Processing Facilities — 19 States, April 2020. *MMWR Morb Mortal Wkly Rep* 2020:557-561
Link: COVID-19 Among Workers in Meat and Poultry Processing Facilities (cdc.gov)
Congregate work and residential locations are at increased risk for infectious disease transmission including respiratory illness outbreaks. SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19), is primarily spread person to person through respiratory droplets. Nationwide, the meat and poultry processing industry, an essential component of the U.S. food infrastructure, employs approximately 500,000 persons, many of whom work in proximity to other workers (*1*). Because of reports of initial cases of COVID-19, in some meat processing facilities, states were asked to provide aggregated data concerning the number of meat and poultry processing facilities affected by COVID-19 and the number of workers with COVID-19 in these facilities, including COVID-19–

related deaths. Qualitative data gathered by CDC during on-site and remote assessments were analyzed and summarized. During April 9–27, aggregate data on COVID-19 cases among 115 meat or poultry processing facilities in 19 states were reported to CDC.

33. Eastridge, M. Water Usage on Dairy Farms. *Buckeye Dairy News Ohio State University Extension* Volume 8 Issue 1.
Link: Water Usage on Dairy Farms (osu.edu)
As we always say "water is the most important nutrient", but all too often it is the most ignored nutrient when we are thinking of nutrition and animal performance. Therefore, we must constantly monitor water quality and quantity on dairy farms for animal health and performance and for protecting the environment.

34. Filice GA, Nyman JA, Lexau C, et al. Excess costs and utilization associated with methicillin resistance for patients with *Staphylococcus aureus* infection. *Infection Control & Hospital Epidemiology.* 2010;31(04):365-373.
Link: https://www.ncbi.nlm.nih.gov/pubmed/20184420
Healthcare costs of methicillin-resistant *S. aureus* (MRSA) infections and methicillin-susceptible *S. aureus* (MSSA) were compared in this study. MRSA infections were found to be
independently associated with higher costs, more comorbidities, and higher likelihood of death than MSSA infections.

35. Foltz JD, Jackson-Smith D, Chen L. Do purchasing patterns differ between large and small dairy farms? Econometric evidence from three Wisconsin communities. *Agric Resour Econ.* Rev. 2002;31(1):28–38
Link: Do Purchasing Patterns Differ Between Large and Small Dairy Farms? (umn.edu)
Using farm data from three dairy-dependent communities in Wisconsin, this study addresses
the question: Do small farms spend more locally than large farms? The work develops a theoretical model of farm cost functions with transaction costs varying between local and distant input sources. This model is then tested econometrically, describing farm costs and where they were spent as a function of transaction/search costs and farm characteristics. The results suggest that scale does matter to farm spending patterns.

36. Fox, M. A., et. al. (2016). Meeting the public health challenge of protecting private wells: Proceedings and recommendations from an expert panel workshop. *Science of the Total Environment, 554-555*, 113-118.
Link: https://doi.org/10.1016/j.scitotenv.2016.02.128
Private wells serving fewer than 25 people are federally unregulated, and their users may be exposed to naturally occurring agents of concern. This panel assessed current conditions of ground water as a source for private wells, identified emerging threats, critical gaps in knowledge, and public health needs, and recommended strategies to guide future activities to ensure the safety of private drinking water wells.

37. Fry JP, Laestadius LI, Grechis C, Nachman KE, Neff RA. Investigating the role of state permitting and agriculture agencies in addressing public health concerns related to industrial food animal production. *PloS one.* 2014;9(2):e89870.
Link: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0089870

This study explored how state permitting and agriculture agencies respond to environmental public health concerns regarding industrial food animal production through qualitative interviews with state agency staff in seven states. The study found that the agencies were unable to adequately address these environmental public health concerns due to narrow regulations, limited resources and a lack of public health expertise. When these constraints are considered alongside those faced by health departments, significant gaps in the ability to respond to and prevent public health concerns and issues are revealed.

38. Gomes A, Quinteiro-Filho W, Ribeiro A, et al. Overcrowding stress decreases macrophage activity and increases *Salmonella* enteritidis invasion in broiler chickens. *Avian Pathol.* 2014;43(1):82-90.
Link: https://www.ncbi.nlm.nih.gov/pubmed/24350836
This study sought to characterize the immunosuppressive effect of overcrowding stress in broiler chickens. Overcrowding was found to compromise the intestinal immune barrier and integrity of the small intestine, resulting in inflammation and decreased nutrient absorption. The study concludes that animal welfare measures and avoiding overcrowding stress factors in maintaining poultry health and decreased susceptibility to *Salmonella* infection.

39. Graham JP, Leibler JH, Price LB, Otte JM, Pfeiffer DU, Tiensin T, et al. The animal-human interface and infectious disease in industrial food animal production: rethinking biosecurity and biocontainment. Public Health Rep. 2008;123(3):282-99.
Link: https://www.ncbi.nlm.nih.gov/pubmed/19006971
Understanding interactions between animals and humans is critical in preventing outbreaks of zoonotic disease. This is particularly important for avian influenza. Food animal production has been transformed since the 1918 influenza pandemic. Poultry and swine production have changed from small-scale methods to industrial-scale operations. There is substantial evidence of pathogen movement between and among these industrial facilities, release to the external environment, and exposure to farm workers, which challenges the assumption that modern poultry production is more biosecure and biocontained as compared with backyard or small holder operations in preventing introduction and release of pathogens. An analysis of data from the Thai government investigation in 2004 indicates that the odds of H5N1 outbreaks and infections were significantly higher in large-scale commercial poultry operations as compared with backyard flocks. These data suggest that successful strategies to prevent or mitigate the emergence of pandemic avian influenza must consider risk factors specific to modern industrialized food animal production.

40. Graham JP, Evans SL, Price LB, Silbergeld EK. Fate of antimicrobial-resistant enterococci and staphylococci and resistance determinants in stored poultry litter. *Environ Res.* 2009;109(6):682-689.
Link: https://www .ncbi.nlm.nih .gov/pubmed/19541298
This study examined the survival of anti-microbial resistant enterococci and staphylococci and resistance genes in poultry litter to better understand how land application of poultry litter can affect the surrounding population's environment. The study found that poultry litter storage practices do not eliminate drug-resistant bacterial strains, thus allowing the spread of these drug-resistant pathogens into and through the environment via land application of poultry litter.

41. Graham JP, Price LB, Evans SL, Graczyk TK, Silbergeld EK. Antibiotic resistant enterococci and staphylococci isolated from flies collected near confined poultry feeding operations. *Sci Total Environ.* 2009;407(8):2701-2710.
Link: https://www.ncbi.nlm.nih.gov/pubmed/19157515
This study examined if and how antibiotic resistant bacteria are transferred from poultry operations to nearby communities, and found that flies caught near poultry operations carried the same drug-resistant pathogens as those found in poultry litter. The study concludes that flies may be an important vector in the spread of drug resistant bacteria from poultry operations and may increase human exposure to these resistant pathogens.

42. Graham JP, Nachman KE. Managing waste from confined animal feeding operations in the United States: The need for sanitary reform. *Journal of Water and Health.* 2010;8(4):646-670.
Link: https://www.ncbi.nlm.nih.gov/pubmed/20705978
Trends affecting food animal waste production, risks associated with food-animal wastes, and differences between food-animal waste and human biosolid management practices were examined in this study. The study found that no standards exist for the 335 million tons of food animal waste applied to land in the US, while human biosolids, which make up just 1% of all land-applied wastes, are subject to standards. Hormones, arsenicals, high nutrient loads, antibiotics, and pathogens, including antibiotic-resistant pathogens, are often present in animal waste. The authors made recommendations for improving management of food-animal waste through existing and new policies.

43. Guberti, V., Khomenko, S., Masiulis, M. & Kerba S. 2019. African swine fever in wild boar ecology and biosecurity. *FAO Animal Production and Health Manual No. 22.* Rome, FAO, OIE and EC.
Link: en-manual-asfinwildboar-2019-web.pdf (oie.int)
African swine fever (ASF) is a devastating hemorrhagic viral disease of pigs, affecting domestic and wild pigs of all ages and sexes. The disease is the cause of major economic losses, threatens food security and safe trade, and challenges sustained swine production in affected countries. Since ASF emergence in Georgia in 2007, the disease has spread to many countries in Europe and in 2018 was detected in East Asia, where over 60 percent of global domestic pig inventories are found.

44. Gulis G, Czompolyova M, Cerhan JR. An ecologic study of nitrate in municipal drinking water and cancer incidence in Trnava district, Slovakia. *Environ Res.* 2002;88(3):182-187.
Link: https://www.ncbi.nlm.nih.gov/pubmed/12051796
This ecologic study was conducted to assess the association between nitrate levels in drinking water with non-Hodgkin lymphoma and cancers of the digestive and urinary tracts in an agricultural district. The study found is that a higher incidence of some cancers was associated with higher levels of nitrate in drinking water. The trend was found in women for overall cancer cases, stomach cancer, colorectal cancer and non-Hodgkin lymphoma, and in men for non-Hodgkin lymphoma and colorectal cancer.

45. Gurian-Sherman, D, CAFOs Uncovered, The Untold Costs of Confined Animal Feeding Operations, Union of Concerned Scientists, April, 2008.
Link: https://www.ucsusa.org/sites/default/files/2019-10/cafos-uncovered-executive-summary.pdf
By describing several of the subsidies and other often hidden costs of CAFOs that are imposed on society (referred to as externalized costs or "externalities"), this report attempts to clarify the real price we pay—and can no longer afford—for this harmful system. These

externalities are associated with the damage caused by water and air pollution (along with cleanup and prevention), the costs borne by rural communities (e.g., lower property values), and the costs associated with excessive antibiotic use (e.g., harder-to-treat human diseases). Subsidies have included payments to grain farmers that historically supported unrealistically low animal feed prices, and payments to CAFOs to prevent water pollution.

46. Guthrie, T. Water Needs of Pigs. Michigan State Extension. May 2011
Link: Water needs of pigs - MSU Extension
How much water do pigs need? Pigs lose water through four routes: kidneys (urination), intestines (defecation), lungs (respiration) and some through evaporation (skin- sweat glands are largely dormant).

47. Harmon, J. Drip Cooling for Sows in Farrowing House. *Iowa State Extension Store.* October 2008
Link: Drip Cooling of Sows in Farrowing House (iastate.edu)
Research indicates that summer heat stress on sows can be reduced by using a system that continually drips water on the sow's shoulder in hot weather.

48. Heaney CD, et. al. Source tracking swine fecal waste in surface water proximal to swine concentrated animal feeding operations. *Sci Total Environ.* 2015;511:676-683.
Link: http://www.sciencedirect.com/science/article/pii/S0048969714017641
The microbial quality of surface water proximal to swine CAFOs was investigated in this study to better understand the impact of CAFOs on the surrounding environment. The results demonstrate overall poor water quality in areas with a high density of swine CAFOs, with high fecal indicator bacteria concentrations in waters both up- and down-stream of CAFO lagoon waste land application sites. The swine-specific microbial source tracking markers used in the study were also shown to be useful for tracking off-site conveyance of swine fecal wastes and during rain events.

49. Heederik D, Sigsgaard T, Thorne PS, et al. Health effects of airborne exposures from concentrated animal feeding operations. *Environ Health Perspect.* 2007:298-302.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817709/
This report from a Conference on Environmental Health Impacts of Concentrated Animal Feeding Operations: Anticipating Hazards —Searching for Solutions working group states that toxic gases, vapors and particles are emitted from CAFOs into the general environment, and that while these agents are known to be harmful to human health, there are few studies that explore the health risks of exposure to these agents for the people living near CAFOs. While there is evidence that psychophysiologic changes may result from exposure to malodors and that microbial exposures are related to deleterious respiratory health effects, the working group concluded that there is great need to study and evaluate the health effects of community exposure to these CAFO related air pollutants to better understand the impact of CAFOs on the health of community members and farm workers.

50. Heisler J, Glibert PM, Burkholder JM, et al. Eutrophication and harmful algal blooms: A scientific consensus. *Harmful Algae.* 2008;8(1):3-13.
Link: http://www.sciencedirect.com/science/article/pii/S1568988308001066
The US EPA held a roundtable discussion to develop consensus among academic, federal and state agency representatives on the relationship between eutrophication and harmful algal blooms. Seven statements were adopted during the session, which include

acknowledgement of the important role of nutrient pollution and degraded water quality in the development and persistence of many harmful algal blooms.

51. Horton RA, Wing S, Marshall SW, Brownley KA. Malodor as a trigger of stress and negative mood in neighbors of industrial hog operations. Am *J Public Health.* 2009;99(S3):S610-S615.
Link: https://www.ncbi.nlm.nih.gov/pubmed/19890165
The association between malodor and air pollutants from nearby hog CAFOs and reported stress and negative mood was evaluated in this study to better understand the role of CAFOs in human health. The study found that malodor and air pollutants acted as environmental stressors and triggers of negative mood and recommended their inclusion in studies of the health impacts of environmental injustice.

52. Hribar C, Schultz M. Understanding concentrated animal feeding operations and their impact on communities. Bowling Green, OH: *National Association of Local Boards of Health.* 2010.
Link: https://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf
The National Association of Local Boards of Health produced this report with the support of the Centers for Disease Control and Prevention and the National Center for Environmental Health to assist local board of health members better understand their role in mitigating potential issues with CAFOs. The report concludes that large-scale industrial food animal production can cause numerous public health and environmental problems and should thus be monitored to prevent harm to surrounding communities. Suggested actions include passing ordinances and regulations, and increasing water and air quality monitoring and testing. The report also concludes that local boards of health, in collaboration with state and local agencies, are an appropriate body for instituting these actions due to the local nature of CAFO concerns and risks.

53. Hseu Z-Y, Chen Z-S. Experiences of Mass Pig Carcass Disposal Related to Groundwater Quality Monitoring in Taiwan. *Sustainability*. 2017; 9(1):46.
Link: https://doi.org/10.3390/su9010046
Although burial is widely used to dispose of the large number of pig carcasses generated from FMD outbreaks, this disposal method has not undergone comprehensive scientific investigation. After the burial of culled pigs, dissolved components from carcass decomposition are slowly released into the external environment in the form of leachate, depending on the local environmental conditions. Nevertheless, the properties of groundwater, including total bacterial count, fecal coliform, *Salmonella* spp., nitrite-N, nitrate-N, ammonium-N, sulfate, NPOC, total oil, and TDS, are recognized as indicators of groundwater contamination resulting from the pig carcass burial during the FMD outbreak in Taiwan. Because very few studies have been performed, there is not enough information on the characteristics of groundwater at the burial sites, duration of pig carcass decomposition, and effects of leachate on groundwater quality worldwide. Although information on the biological and chemical characteristics of leachate is gradually being accumulated from the limited number of studies, guidelines for groundwater quality control should be established for livestock carcass disposal in all modern countries.

54. Isakson, Hans R. An analysis of the impact of swine CAFOs on the value of nearby houses. A*gricultural Economics*. November 2008; pages 365-372.
Link: https://doi.org/10.1111/j.1574-0862.2008.00339.x
The impact of 39 swine confined or concentrated animal feeding operations (CAFOs) in Black Hawk County, Iowa on 5,822 house sales is explored by introducing a new variable that more accurately captures the effects of prevailing winds, exploring potential adverse effects within concentric circles around each CAFO, managing selection bias, and

incorporating spatial correlation into the error term of the empirical model. Large adverse impacts suffered by houses that are within 3 miles and directly downwind from a CAFO are found. Beyond 3 miles, CAFOs have a generally decreasing adverse impact on house prices as distance to the CAFO increases.

55. Jackson, L, Keeney, D, Gilbert, E. Swine manure management plans in North-Central Iowa: Nutrient loading and policy implications. *Journal of Soil and Water Conservation* April 2000, 55 (2) 205-212.

Link: Swine manure management plans in North-Central Iowa...

Public record were used to document the manure management practices of CAFOs housing 59,700 finishing hogs in a 1,554 ha area of Hamilton County, Iowa. Together, they generated an estimated 811,500 kg of nitrogen (N) each year, more than 70% of which volatilized into the atmosphere. CAFOs minimized the area required for applying manure by underestimating manure N content, projecting above average crop yields, and applying manure to soybeans. Some fields were claimed by more than one operator, and some field sizes were overestimated. Manure application based on crop demand for phosphorus would require 9,350 ha of cropland, compared to the 990 ha actually used. Several policy changes could alleviate the nutrient management problems...

56. Jahne MA, Rogers SW, Holsen TM, Grimberg SJ, Ramler IP. Emission and dispersion of bioaerosols from dairy manure application sites: Human health risk assessment. *Environ Sci Technol.* 2015; 49(16):9842-9849 .

Link: https://www.ncbi.nlm.nih.gov/pubmed/26158489

Understanding interactions between animals and humans is critical in preventing outbreaks of zoonotic disease. This is particularly important for avian influenza. Food animal production has been transformed since the 1918 influenza pandemic. Poultry and swine production have changed from small-scale methods to

industrial-scale operations. There is substantial evidence of pathogen movement between and among these industrial facilities, release to the external environment, and exposure to farm workers, which challenges the assumption that modern poultry production is more biosecure and biocontained as compared with backyard or small holder operations in preventing introduction and release of pathogens. An analysis of data from the Thai government investigation in 2004 indicates that the odds of H5N1 outbreaks and infections were significantly higher in large-scale commercial poultry operations as compared with backyard flocks. These data suggest that successful strategies to prevent or mitigate the emergence of pandemic avian influenza must consider risk factors specific to modern industrialized food animal production.

57. Johns Hopkins Bloomberg School of Public Health. Putting Meat on the Table: Industrial Farm Animal Production in America. January 2008

Link: Putting-the-meat-on-the-table.pdf (jhsph.edu)

One of the most serious unintended consequences of industrial food animal production is their growing public health threat. They can be harmful to workers, neighbors, and even those living far from the facilities through air and water pollution, and via the spread of disease. Workers in and neighbors experience high levels of respiratory problems. In addition, workers can serve as a bridging population, transmitting animal-borne diseases to a wider population. A lack of appropriate treatment of enormous amounts of waste may

result in contamination of nearby waters with harmful levels of nutrients and toxins, as well as bacteria, fungi, and viruses.

58. Kilpatrick, J. Concentrated Animal Feeding Operations and Proximate Property Values. *The Appraiser Journal*, July 2001 Pages: 301-306.
    Link: Concentrated Animal Feeding Operations and Proximate Property Values (state.ar.us)
    Property located near a concentrated animal feeding operation (CAFO) will be negatively impacted by this externality. The degree of impairment depends on proximity and property type and use. Properties with higher unimpaired values are probably impacted more than otherwise lower valued properties.

59. Kilpatrick, J. Animal Operations and Residential Property Values. *The Appraisal Journal*, Winter 2015: 41-50
    Link: animaloperationsJKwinter2015.pdf (greenfieldadvisors.com)
    Animal feeding and processing operations have grown more concentrated, with each facility handling much larger numbers of animals than traditional farms. The larger concentration of animals impacts the quality of surrounding air and water. In addition, the facilities impact the economic conditions of the communities where they are located. All of these factors can potentially affect the value of nearby houses. This article summarizes the current literature on how animal operations may affect the value of residential properties located near such facilities... Overall, the empirical evidence indicates that residences near Animal Operations are significantly affected, and data seems to suggest a valuation impact of up to 26% for nearby properties, depending on distance, wind direction, and other factors. Further, there has been some suggestion that properties immediately abutting an AO can be diminished as much as 88%. ... Not only are residences affected, but nearby small farms can be impacted by such factors as water degradation and insects.

60. Kikuti, M, Paploski IA, et al. Newly emerging PRRSV Lineage 1C variant nomenclature. *Swine Health Information Center* 2021
    Link: SHMP 2020l21.34 [Lineage 1C variant nomenclature].pdf
    Recent outbreaks caused by a highly similar PRRSV variant have been reported. As we move forward with investigations of these farm level outbreaks, we continue to confirm that these form a tight genetic cluster not similar (using a 98% nucleotide identity as a cutoff) to any other sequences from our dataset. Because this is such a specific variant and because the common nomenclature used in the field has been restriction fragment length polymorphism (RFLP) typing, a review of the limitations of different PRRSV classification systems is warranted.

61. Kim, J, Goldsmith P. Using Spatial Econometrics to Assess the Impact of Swine Production on Residential Property Values American Agricultural Economics Association, Denver, July, 2004
    Link: Microsoft Word - Paper 2 v.4pete.doc (rosemonteis.us)
    A spatial hedonic model is developed to assess monetary harm of confined animal feeding operations (CAFOs) on property values, taking explicitly spatial dependence in property values into account. Spatial autocorrelation was found in the form of spatial lag dependence, not spatial error dependence. When spatial lag dependence is explicitly taken into account, on average the impact is reduced by 18%. The magnitude of the spatial autoregressive parameter was about 0.2 for the 1-mile distance band, meaning one-fifth of the house value could be explained by the values of the neighboring houses.

62. MacDonald L, Salna B, Hogan A, Postle J, Anderson H. Blue babies and nitrate-contaminated well water. *Environ Health Perspect.* 2000;108(7):675-678.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1638204/
Two cases of infant methemoglobinemia associated with nitrate contaminated private well water were described in this paper. The case studies underscore the danger that this contaminated water poses to infants during the first six months of life, as well as the risks of long-term exposure, which include cancer, thyroid disease and diabetes. Steps to reduce nitrate inputs in groundwater and routine well water testing are recommended to protect health.

63. Knobeloch, L., Gorski, P., Christenson, M., & Anderson, H. (2013). Private drinking water quality in rural Wisconsin. *Journal of environmental health*, *75*(7), 16–20.
Link: Private drinking water quality in rural Wisconsin - PubMed (nih.gov)
Between July 1, 2007, and December 31, 2010, Wisconsin health departments tested nearly 4,000 rural drinking water supplies for coliform bacteria, nitrate, fluoride, and 13 metals as part of a state-funded program that provides assistance to low-income families. The authors' review of laboratory findings found that 47% of these wells had an exceedance of one or more health-based water quality standards. Test results for iron and coliform bacteria exceeded safe limits in 21% and 18% of these wells, respectively. In addition, 10% of the water samples from these wells were high in nitrate and 11% had an elevated result for aluminum, arsenic, lead, manganese, or strontium. The high percentage of unsafe test results emphasizes the importance of water quality monitoring to the health of nearly one million families including 300,000 Wisconsin children whose drinking water comes from a privately owned well.

64. Kravchenko J, Rhew S, Akushevich I, Agarwal P, Lyerly, HK: Mortality and Health Outcomes in North Carolina Communities Located in Close Proximity to Hog Concentrated Animal Feeding Operations. *NC Med J* Sep-Oct 2018;79(5):278-288.
Link: https://www.ncbi.nlm.nih.gov/pubmed/30228132
Background Life expectancy in southeastern North Carolina communities located in an area with multiple concentrated animal feeding operations (CAFOs) after adjusting for socioeconomic factors remains low. We hypothesized that poor health outcomes in this region may be due to converging demographic, socioeconomic, behavioral, and access-to-care factors and are influenced by the presence of hog CAFOs.
Methods We studied mortality, hospital admissions, and emergency department (ED) usage for health conditions potentially associated with hog CAFOs-anemia, kidney disease, infectious diseases, and low birth weight (LBW)-in North Carolina communities located in zip codes with hog CAFOs (Study group 1), in zip codes with > 215hogs/km^2 (Study group 2), and without hog CAFOs (Control group). We compared cause-specific age-adjusted rates, the odds ratios (ORs) of events in multivariable analyses (adjusted for 6 co-factors), and the changes of ORs relative to the distance to hog CAFOs.
Results Residents from Study groups 1 and 2 had higher rates of all-cause mortality, infant mortality, mortality of patients with multimorbidity, mortality from anemia, kidney disease, tuberculosis, and septicemia, and higher rates of ED visits and hospital admissions for LBW infants than the residents in the Control group. In zip codes with > 215hogs/km^2, mortality ORs were 1.50 for anemia ($P < 0.0001$), 1.31 for kidney disease ($P < 0.0001$), 2.30 for septicemia ($P < 0.0001$), and 2.22 for tuberculosis ($P = 0.0061$). *Limitations* This study included a lack of individual

measurements on environmental contaminants, biomarkers of exposures and co-factors, and differences in residential and occupational locations.
Conclusions North Carolina communities located near hog CAFOs had higher all-cause and infant mortality, mortality due to anemia, kidney disease, tuberculosis, septicemia, and higher hospital admissions/ED visits of LBW infants. Although not establishing causality with exposures from hog CAFOs, our findings support the need for future studies to determine factors that influence these outcomes, as well as the need to improve screening and diagnostic strategies for these diseases in North Carolina communities adjacent to hog CAFOs.

65. Lawley, Chad. Hog Barns and Neighboring House Prices: Anticipation and Post-Establishment Impacts. *American Journal of Agricultural Economics.* 2021 May; Vol. 103. Issue 3: 1099-1121
Link: https://doi.org/10.1111/ajae.12203
The impact of large-scale hog barns on residential property values is at the forefront of local concerns about livestock development. In this article, I examine the impact of hog barns on house prices in an intensive production region of Manitoba, Canada. Timing of barn establishment and precise locations of houses and barns are used to gain a better understanding of the dynamic impacts of hog barns on house prices. I find that ***houses within 2 km of a hog barn sell for 5.7% less*** than similar houses located a little farther away from a barn. Quasi-myopic specifications indicate that ***house prices fall by 6.2% up to three years prior*** to barn establishment, consistent with market anticipation of the future location of hog barns. Accounting for anticipation increases the post-establishment discount to 8%, suggesting that ignoring anticipation of new barn establishment biases estimated post-establishment impacts downwards.

66. Lowe, J., Gauger, P., et.al. (2014). Role of Transportation in Spread of Porcine Epidemic Diarrhea Virus Infection, United States. *Emerging Infectious Diseases*, *20*(5), 872-874.
Link: https://doi.org/10.3201/eid2005.131628
Harvest facilities serve as a source of contact between many swine farms with different health statuses. This study suggests that collection points, such as harvest facilities and livestock auction markets, can be an efficient source of contamination of transport vehicles that return to pig farms and likely played a role in rapidly disseminating PEDV across vast geographic regions shortly after PEDV was first identified in the United States. These data also suggest that the contamination of transport vehicles leaving the harvest facilities increased as the prevalence of PEDV–positive transport vehicles and virus load coming into the facility increased.

67. Ma W, Lager KM, Vincent AL, Janke BH, Gramer MR, Richt JA. The role of swine in the generation of novel influenza viruses. *Zoonoses Public Health*. 2009 Aug;56(6-7):326-37.
Link: https://www.ncbi.nlm.nih.gov/pubmed/19486316
The ecology of influenza A viruses is very complicated involving multiple host species and viral genes. Avian species have variable susceptibility to influenza A viruses with wild aquatic birds being the reservoir for this group of pathogens. Occasionally, influenza A viruses are transmitted to mammals from avian species, which can lead to the development of human pandemic strains by direct or indirect transmission to man. Because swine are also susceptible to infection with avian and human influenza viruses, genetic reassortment between these viruses and/or swine influenza viruses can occur. The potential to generate novel influenza viruses has resulted in swine being labelled 'mixing vessels'. The mixing vessel theory is one mechanism by

which unique viruses can be transmitted from an avian reservoir to man. Although swine can generate novel influenza viruses capable of infecting man, at present, it is difficult to predict which viruses, if any, will cause a human pandemic. Clearly, the ecology of influenza A viruses is dynamic and can impact human health, companion animals, as well as the health of livestock and poultry for production of valuable protein commodities. For these reasons, influenza is, and will continue to be, a serious threat to the wellbeing of mankind.

68. Malecki, K., Schultz, A. A., Severtson, D. J., Anderson, H. A., & VanDerslice, J. A. (2017). Private-well stewardship among a general population based sample of private well-owners. *The Science of the total environment*, *601-602*, 1533–1543.
Link: https://doi.org/10.1016/j.scitotenv.2017.05.284

Private well stewardship, including on-going testing and treatment, can ensure private well users are able to maintain source-water quality and prevent exposures to potentially harmful constituents in primary drinking water supplies. Unlike municipal water supplies, private well users are largely responsible for their own testing and treatment and well stewardship is often minimal. The importance of factors influencing regular testing, and treatment behaviors, including knowledge, risk perception, convenience and social norms, can vary by geography and population characteristics. The primary goals of this study were to survey a general statewide population of private well users in Wisconsin in order to quantify testing and treatment patterns and gather data on motivations and barriers to well stewardship. The majority of respondents reported using and drinking well water daily but only about one half of respondents reported testing their wells in the last ten years and of these, only 10% reported testing in the last 12months. Bacteria and nitrates were contaminants most often tested; and, a private laboratory most often conducted testing. The most commonly reported water treatment was a water softener. Living in a particular geographic region and income were the most significant predictors of water testing and treatment. Iron and hardness, which influence water aesthetics but not always safety, were the most commonly reported water quality problems. Health concerns or perceived lack thereof were, respectively, motivators and barriers to testing and treatment. Limited knowledge of testing and treatment options were also identified as barriers. Results confirm previous findings that well stewardship practices are minimal and often context specific. Understanding the target population's perceptions of risk and knowledge are important elements to consider in identifying vulnerable populations and developing education and policy efforts to improve well stewardship.

69. Manassaram DM, Backer LC, Moll DM. A review of nitrates in drinking water: Maternal exposure and adverse reproductive and developmental outcomes. *Environmental Health Perspectives.* 2006.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1392223/

The relationship between maternal exposure to nitrates through drinking water and adverse reproductive and developmental outcomes was reviewed in this study. Animal studies support the association between nitrate exposure and adverse reproductive effects, and some studies report an association between nitrates in drinking water and spontaneous abortion, intrauterine growth restriction and various birth defects, though a direct exposure-response relationship remains unclear and there is insufficient evidence to establish a causal relationship.

70. Mathewson P, Evans S, Byrnes T, Joos A, Naidenko O. *Environmental Monitoring Assessment (*2020) 192: 724. Link: Health & economic impact of nitrate pollution in drinking water: a Wisconsin case study
Link: https://doi.org/10.1007/s10661-020-08652-0

Nitrate contamination of drinking water, common in agricultural areas, increases the risk of certain cancers and impacts fetal development during pregnancy. Building on previously published methodology, this study evaluates nitrate-attributable disease cases and adverse birth outcomes as well as their economic costs for Wisconsin, USA. Nitrate is the most common contaminant in groundwater in Wisconsin. Two-thirds of the state's residents use groundwater as the primary source of drinking water. Here, we analyze nitrate exposure from drinking water in Wisconsin based on nitrate test results for community water systems for the period of 2010–2017 and a novel methodology for estimating nitrate exposure for the 28% of state's residents who use private wells. We estimate that annually, 111–298 combined cases of colorectal, ovarian, thyroid, bladder, and kidney cancer in Wisconsin may be due to nitrate contamination of drinking water. Each year, up to 137–149 cases of very low birth weight, 72–79 cases of very preterm birth, and two cases of neural tube defects could be due to nitrate exposure from drinking water. The direct medical cost estimates for all nitrate-attributable adverse health outcomes range between $23 and $80 million annually. Simulating targeted reductions in the counties with the highest current drinking water nitrate concentrations resulted in similar reductions in adverse health outcomes as statewide reduction efforts, up to nitrate reductions of 20%. Time trend analysis suggests that groundwater nitrate concentrations are overall increasing. Thus, nitrate contamination of water supplies in Wisconsin is a public health problem that needs to be addressed.

71. MacDonald G.J., et.al. (2017). Strategies to Improve Private-Well Water Quality: A North Carolina Perspective. *Environmental health perspectives*, *125*(7), 076001.
Link: https://doi.org/10.1289/EHP890

Evidence suggests that the 44.5 million U.S. residents drawing their drinking water from private wells face higher risks of waterborne contaminant exposure than those served by regulated community water supplies. These recommendations could improve the health of North Carolinians facing elevated risks of exposure to waterborne contaminants because of their reliance on inadequately monitored and maintained private wells. Because many of the challenges in N.C. are common nationwide, these recommendations could serve as models for other states.

72. May, J. Estimating Water Usage on Michigan Swine Farms. Michigan State University Extension.
Link: Water_Use_for_Swine_Farms

Swine farms use well water for watering animals, cleaning facilities, animal cooling and in some instances for moving manure from the barn to the storage structure. Most pigs are raised in an all-in/all-out environments where one group of pigs, at the same stage of production, is moved into a location and stays there until that group is ready to move to the next location or on to slaughter. Between groups the facility is thoroughly cleaned by pre-soaking and/or pressure washing.

73. Milligan, W. R., Fuller, Z. L., Agarwal, I., Eisen, M. B., Przeworski, M., & Sella, G. (2021). Impact of essential workers in the context of social distancing for epidemic control. *PloS one*, *16*(8), e0255680.

Link: https://doi.org/10.1371/journal.pone.0255680
New emerging infectious diseases are identified every year, a subset of which become global pandemics like COVID-19. In the case of COVID-19, many governments have responded to the ongoing pandemic by imposing social policies that restrict contacts outside of the home, resulting in a large fraction of the workforce either working from home or not working. To ensure essential services, however, a substantial number of workers are not subject to these limitations, and maintain many of their pre-intervention contacts. To explore how contacts among such "essential" workers, and between essential workers and the rest of the population, impact disease risk and the effectiveness of pandemic control, we evaluated several mathematical models of essential worker contacts within a standard epidemiology framework. The models were designed to correspond to key characteristics of cashiers, factory employees, and healthcare workers. We find in all three models that essential workers are at substantially elevated risk of infection compared to the rest of the population, as has been documented, and that increasing the numbers of essential workers necessitates the imposition of more stringent controls on contacts among the rest of the population to manage the pandemic. Importantly, however, different archetypes of essential workers differ in both their individual probability of infection and impact on the broader pandemic dynamics, highlighting the need to understand and target intervention for the specific risks faced by different groups of essential workers. These findings, especially in light of the massive human costs of the current COVID-19 pandemic, indicate that contingency plans for future epidemics should account for the impacts of essential workers on disease spread.

74. Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. Asthma symptoms among adolescents who attend public schools that are located near confined swine feeding operations. *Pediatrics.* 2006;118(1):e66-75.
Link: http://pediatrics .aappublications .org/content/118/1/e66/
The relationship between exposure to airborne effluent from swine CAFOs and asthma symptoms in adolescents age 12-14 years old was assessed in this study to better understand the health effects of living near industrial swine facilities. The study found that estimated exposure to swine CAFO air-pollution was associated with wheezing symptoms in adolescents.

75. Miralhaa L, Muenicha R, Schaffer-Smithb D, Myintd S, Spatiotemporal land use change and environmental degradation surrounding CAFOs in Michigan and North Carolina, *Science of the Total Environment*, 800 (2021) 149391

76. Morrow, WE, Ferket, PR. Alternative Methods for the Disposal of Swine Carcasses Factsheet. *North Carolina State University, Raleigh, NC* Nov 2001. ANS01-815S
Link:
https://projects.ncsu.edu/project/swine_extension/publications/factsheets/815s.pdf
There is probably no one best way to dispose of swine mortality carcasses. The optimum system for any particular farm location would need to be selected based on a number of criteria, including the current state of the protein/oil market, the biosecurity required, the distance to processing sites, the local public's perception, and the government regulations that apply to that location. The tonnage of dead pigs produced annually is substantial. A typical 5000 sow farrow-to-finish farming system (with mortality losses of 7%, 10%, 5%, 1%, and 1% in the sow,

neonatal, nursery, growing, and finishing herd, respectively) will produce over 200,000 pounds of dead pigs annually. In many farming systems in the USA, actual losses may be much higher. The integration of swine agriculture has concentrated these mortality losses into smaller and smaller geographic areas.

77. Nicole W, Farm to Faucet? Agricultural Waste and Private Well Contamination in Kewaunee County, Wisconsin, *Environmental Health Perspectives*, 114001-1 129(11) November 2021.
Link: https://doi.org/10.1289/EHP10034

The more fields around a well with [a nutrient management plan in place], the greater the likelihood of that well having a nitrate level that exceeds the standard. "There's a mindset that if you have a nutrient management plan, you must be managing your nutrients well, and there's little risk of contamination. That turned out not to be true..."

78. Niederwerder MC, Stoian A, Rowland R, et al. Infectious Dose of African Swine Fever Virus When Consumed Naturally in Liquid or Feed. *Emerging Infectious Diseases*. 2019;25(5):891-897
Link: Infectious Dose of AFS virus when Consumed Naturally in Liquid or Feed

Although plant-based feed has been identified as a potential route for African Swine Fever Virus (ASFV) virus introduction onto swine farms, little is known about the risks for ASFV transmission in feed. We aimed to determine the minimum and median infectious doses of the Georgia 2007 strain of ASFV through oral exposure during natural drinking and feeding behaviors. The minimum infectious dose of ASFV in liquid was 10^0 50% tissue culture infectious dose ($TCID_{50}$), compared with 10^4 $TCID_{50}$ in feed. The median infectious dose was $10^{1.0}$ $TCID_{50}$ for liquid and $10^{6.8}$ $TCID_{50}$ for feed. Our findings demonstrate that ASFV Georgia 2007 can easily be transmitted orally, although higher doses are required for infection in plant-based feed.

79. Oun A, Kumar A, Harrigan T, Angelakis A, Xagoraraki I. nk: Effects of Biosolids and Manure Application on Microbial Water Quality in Rural Areas in the US. *Water* 2014;6:3701–3723.
Link: https://doi.org/10.3390/w6123701

Most of the waterborne disease outbreaks observed in North America are associated with rural drinking water systems. The majority of the reported waterborne outbreaks are related to microbial agents (parasites, bacteria and viruses). Rural areas are characterized by high livestock density and lack of advanced treatment systems for animal and human waste, and wastewater. Animal waste from livestock production facilities is often applied to land without prior treatment. Biosolids (treated municipal wastewater sludge) from large wastewater facilities in urban areas are often transported and applied to land in rural areas. This situation introduces a potential for risk of human exposure to waterborne contaminants such as human and zoonotic pathogens originating from manure, biosolids, and leaking septic systems. This paper focuses on waterborne outbreaks and sources of microbial pollution in rural areas in the US, characterization of the microbial load of biosolids and manure, association of biosolid and manure application with microbial contamination of surface and groundwater, risk assessment and best management practice for biosolids and manure application to protect water quality. Gaps in knowledge are identified, and recommendations to improve the water quality in the rural areas are discussed.

80. Paerl FIW, Fulton RS ,3rd, Moisander PH, Dyble J. Harmful freshwater algal blooms, with an emphasis on cyanobacteria. *Scientific World Journal.* 2001;1:76-113.
Link: http://dx.doi.org/10.1100/tsw.2001.16
This paper reviews the effects of harmful freshwater algal blooms, resulting from nutrient oversupply and eutrophication, on water quality. Algal blooms contribute to water quality degradation, including malodor and foul taste, fish kills, toxicity, and food web alterations, while algal bloom toxins can adversely affect human and animal health through exposure to contaminated recreational and drinking water. The control and management of blooms, and their negative outcomes, must include nutrient input constraints, particularly on nitrogen and phosphorus.

81. Paploski, IA, Corzo C, Rovira Al, et al. Temporal Dynamics of Co-circulating Lineages of Porcine Reproductive and Respiratory Syndrome Virus. *Frontiers in Microbiology*. 2019 Vol 10: 2486
Link: https://www.frontiersin.org/article/10.3389/fmicb.2019.02486
Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) is the most important endemic pathogen in the U.S. swine industry. Despite control efforts involving improved biosecurity and different vaccination protocols, the virus continues to circulate and evolve. One of the foremost challenges in its control is high levels of genetic and antigenic diversity. Here, we quantify the co-circulation, emergence and sequential turnover of multiple PRRSV lineages in a single swine-producing region in the United States over a span of 9 years (2009–2017) using the Morrison Swine Health Monitoring Project housed at the University of Minnesota.

82. Polaris Project. Recruitment, Human Trafficking, and Temporary Visa Workers. Sept 2021
Link: Recruitment, Human Trafficking, and Temporary Visa Workers
This report examines the roles recruitment practices, regulations, and enforcement play in the experiences of trafficking victims who are in the United States on temporary worker visas. Data from the U.S. National Human Trafficking Hotline identified 4,8163 likely victims from January 1, 2015 – December 31, 20204 who were in the United States and working under any of the visa categories listed at the time of their abuse.

83. Polaris Project. Human Trafficking on Temporary Work Visas: A Data Analysis 2015-2017.
Link: Human Trafficking on Temporary Work Visas
This report details how human traffickers are using workers under H-2A, H-2B and other temporary work visas and making legitimate businesses, consumers and the U.S. government complicit in the $150 billion business of global human trafficking.
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84. Poulsen, Melissa N.a,,b; Pollak, Jonathana; Sills, Deborah L.c; Casey, Joan A.d; Nachman, Keeve E.a,,e,,f; Cosgrove, Sara E.g,,h; Stewart, Daltonc; Schwartz, Brian S. High-density poultry operations and community-acquired pneumonia in Pennsylvania. *Environmental Epidemiology*: June 2018 - Volume 2 - Issue 2 - p e013
Link:https://journals.lww.com/environepidem/Fulltext/2018/06000/High_density_poultry_operations_and.5.aspx
Background Air pollution from industrial food animal production may increase vulnerability to pneumonia among individuals living in nearby communities. We evaluated the association between individual-level residential proximity to high-density poultry operations and diagnosis with community-acquired pneumonia (CAP).

Methods We conducted a nested case–control study among patients of a large health system in Pennsylvania, USA. We used diagnostic codes for pneumonia and chest imaging from electronic health records from 2004 to 2015 to identify 11,910 child and adult cases of CAP and 59,550 frequency-matched outpatient controls. We estimated exposure to poultry operations using data from nutrient management plans, calculating an inverse-distance squared activity metric based on operation and residential addresses that incorporated number, size, and location of operations. Mixed effects logistic regression models evaluated associations between quartiles of the activity metric and CAP diagnosis. Models controlled for sex, age, race/ethnicity, Medical Assistance (proxy for low socioeconomic status), and smoking status.
Results Individuals living in the highest (versus lowest) quartile of the poultry operation metric had 66% increased odds of CAP diagnosis (adjusted odds ratio [confidence interval]) Q2, 0.98 [0.74, 1.31]; Q3, 1.17 [0.93, 1.46]; Q4, 1.66 [1.27, 2.18]).
C*onclusions* Findings suggest that living in closer proximity to more and larger poultry operations may increase risk of CAP, contributing to growing concern regarding public health impacts of industrial food animal production.

85. Powlson, David. et.al. (2008) When Does Nitrate Become a Risk for Humans? *J. Environ. Qual*. 37:291–295
    Link: When Does Nitrate Become a Risk for Humans? (unl.edu)
    Is nitrate harmful to humans? Are the current limits for nitrate concentration in drinking water justified by science? Th ese questions were addressed at a symposium on "Th e Nitrogen Cycle and Human Health" held at the annual meeting of the Soil Science Society of America (SSSA). Although they sound like old questions, it became clear there is still substantial disagreement among scientists over the interpretation of evidence on the issue—disagreement that has lasted for more than 50 years.

86. Price LB, Graham JP, Lackey LG, Roess A, Vailes R, Silbergeld E. Elevated risk of carrying gentamicin-resistant *Escherichia coli* among US poultry workers. *Environ Health Perspect.* 2007:17381742.
    Link: https://www.ncbi.nlm.nih.gov/pubmed/18087592
    Occupational and environmental pathways of human exposure to antimicrobial-resistant bacteria were explored in this study by comparing the relative risk of antimicrobial-resistant *E. coli* among poultry workers compared with community referents. The study concluded that occupational exposure to antimicrobial-resistant bacteria may be an important route of entry for the bacteria into the community, as poultry workers had 32 times the odds of carrying resistant *E. coli* compared to the community referents.

87. Rasmussen SG, Casey JA, Bandeen-Roche K, Schwartz BS. Proximity to Industrial Food Animal Production and Asthma Exacerbations in Pennsylvania, 2005–2012. *International Journal of Environmental Research and Public Health*. 2017; 14(4):362.
    Link: https://doi.org/10.3390/ijerph14040362
    The research on industrial food animal production (IFAP) and asthma exacerbations in the United States has relied on small sample sizes and/or self-reported outcomes. We assessed associations of proximity to large-scale and densely stocked swine and dairy/veal IFAP with three types of asthma exacerbations: hospitalizations, emergency encounters, and oral corticosteroid (OCS) medication orders from Geisinger Clinic in Pennsylvania. We used a diagnosis code (*International Classification of Diseases, 9th Revision, Clinical Modification* code 493.x) and medication orders from electronic health records to identify these exacerbations among asthma patients (n = 35,269) from 2005–2012. We compared

residential proximity to swine or dairy/veal IFAP (dichotomized as <3 miles (4.8 km) or ≥3 miles) among asthma patients with and without exacerbations and estimated odds ratios using multilevel logistic regression. In adjusted models, proximity to IFAP was associated (odds ratio (95% confidence interval)) with OCS orders (1.11 (1.04–1.19)) and hospitalizations (1.29 (1.15–1.46)), but not emergency encounters (1.12 (0.91–1.37)). This study contributes to growing evidence that IFAP may impact health, in this case clinically-documented asthma exacerbations. No prior study has evaluated the association of IFAP and clinically-documented asthma exacerbations in the United States.

88. Rinsky JL, Nadimpalli M, Wing S, Hall D, Baron D, Price LB, et al. Livestock-Associated Methicillin and Multidrug Resistant *Staphylococcus aureus* Is Present among Industrial, Not Antibiotic-Free Livestock Operation Workers in North Carolina. PLoS One. 2013;8(7).
Link: https://www.ncbi.nlm.nih.gov/pubmed/23844044

Objectives. Administration of antibiotics to food animals may select for drug-resistant pathogens of clinical significance, such as methicillin-resistant *Staphylococcus aureus* (MRSA). In the United States, studies have examined prevalence of MRSA carriage among individuals exposed to livestock, but prevalence of multidrug-resistant *S. aureus* (MDRSA) carriage and the association with livestock raised with versus without antibiotic selective pressure remains unclear. We aimed to examine prevalence, antibiotic susceptibility, and molecular characteristics of *S. aureus* among industrial livestock operation (ILO) and antibiotic-free livestock operation (AFLO) workers and household members in North Carolina.

Methods. Participants in this cross-sectional study were interviewed and provided a nasal swab for *S. aureus* analysis. Resulting *S. aureus* isolates were assessed for antibiotic susceptibility, multi-locus sequence type, and absence of the sen gene (a marker of livestock association).

Results. Among 99 ILO and 105 AFLO participants, *S. aureus* nasal carriage prevalence was 41% and 40%, respectively. Among ILO and AFLO *S. aureus* carriers, MRSA was detected in 7% (3/41) and 7% (3/42), respectively. Thirty seven percent of 41 ILO versus 19% of 42 AFLO *S.* aureus-positive participants carried MDRSA. *S. aureus* clonal complex (CC) 398 was observed only among workers and predominated among ILO (13/34) compared with AFLO (1/35) *S.* aureus-positive workers. Only ILO workers carried scn-negative MRSA CC398 (2/34) and scn-negative MDRSA CC398 (6/34), and all of these isolates were tetracycline resistant.

Conclusions. Despite similar *S. aureus* and MRSA prevalence among ILO and AFLO-exposed individuals, livestock-associated MRSA and MDRSA
(tetracycline-resistant, CC398, scn-negative) were only present among ILO-exposed individuals. These findings support growing concern about antibiotics use and confinement in livestock production, raising questions about the potential for occupational exposure to an opportunistic and drug-resistant pathogen, which in other settings including hospitals and the community is of broad public health importance.

89. Rioja-Lang, FC. A Review of Swine Transportation on Priority Welfare Issues. *Frontiers in Veterinary Science* February 22, 2019.

Link: Review of Swine Transportation Research(frontiersin.org)
Review is to present the best available scientific knowledge on key animal welfare issues during swine transport, such as transport duration and distance, time off feed and water, rest intervals, environmental conditions, loading density, and transport of young animals, based on their impact on stress, injury, fatigue, dehydration, body temperature, mortality, and carcass and meat quality.

90. Roberts RR, Hota B, Ahmad **I,** et al. Hospital and societal costs of antimicrobial-resistant infections in a Chicago teaching hospital: Implications for antibiotic stewardship. *Clin Infect Dis*. 2009;49(8):11751184.
Link: https://doi.org/10.1086/605630
Medical and societal costs attributable to antimicrobial-resistant infections are considerable, and important factors in understanding the potential benefits of prevention programs. Medical costs attributable to antimicrobial-resistant infections range from $18,588 to $29,069 per patient, hospital stay durations from 6.4-12.7 days, and mortality of 6.5%. Societal costs were estimated at $10.7-$15 million.

91. Rosov K, Mallin M, Cahoon L: Waste nutrients from U.S. animal feeding operations: Regulations are inconsistent across states and inadequately assess nutrient export risk. *Journal of Environmental Management*, Volume 269, 2020
Link: https://doi.org/10.1016/j.jenvman.2020.110738
Livestock production in the United States has been transformed over the past several decades, largely as a result of widespread development of industrial-scale mass production facilities, termed Animal Feeding Operations (AFOs). These facilities generate massive amounts of animal waste that can concentrate in small areas. Animal wastes from AFOs have led to high levels of nutrients and other pollutants in nearby surface waters, as well as groundwater. The environmental problems associated with these disposal practices have led to federal and state modifications to the rules and regulations governing waste practices. We summarize the federal guidelines for AFO nutrient management, focusing on swine, and compare the regulations of four AFO-rich states in different regions of the USA. Furthermore, we discuss inconsistencies among regulations and regulatory gaps, and identify issues with waste nutrient management practices that lead to environmental degradation in watersheds hosting AFOs. Finally, we address these shortcomings and the need to implement policy updates that would alleviate some of these environmental and human concerns.

92. Rostagno MH. Can stress in farm animals increase food safety risk? *Foodborne pathogens and disease.* 2009;6(7):767-776.
Link: http://online.liebertpub.com/doi/pdf/10.1089/fpd.2009.0315
This study reviewed current knowledge to assess the potential impact of stress—such as that from inadequate nutrition, deprivation of water and/or feed, heat, cold, overcrowding, handling and transport—in farm animals on food safety risk. The review focused on stress mechanisms influencing the colonization and shedding of enteric pathogens in food animals due to the potential for their dissemination into the human food chain, a serious public health and economic concern. The review concluded that there is a growing body of evidence that demonstrates the negative impact of stress on food safety through a variety of potential mechanisms, and recommends additional research to optimize animal welfare and minimize production loses and food safety risks.

93. Rule AM, Evans SL, Silbergeld EK. Food animal transport: A potential source of community exposures to health hazards from industrial farming (CAFOs). *Journal of Infection and Public Health.* 2008;1(1):33-39.
Link: https://www.ncbi.nlm.nih.gov/pubmed/20701843
The results of this study support the hypothesis that current methods of food animal transport from farm to slaughterhouse result in the transfer of bacteria, including antibiotic-resistant bacteria, to the vehicles travelling the same road. Bacteria were isolated from air and surface samples from vehicles following open poultry trucks, suggesting a new route of exposure to pathogens and the further dissemination of these pathogens to the general environment.

94. Sanhueza, JM, Stevenson, MA, Vilalta, C, Kikuti, M, Corzo, C. Spatial relative risk and factors associated with porcine reproductive and respiratory syndrome outbreaks in United States breeding herds. *Preventive Veterinary Medicine*, Volume 183, 2020,
Link: https://doi.org/10.1016/j.prevetmed.2020.105128
Details of incident cases of porcine reproductive and respiratory syndrome (PRRS) in United States breeding herds were obtained from the Morrison's Swine Health Monitoring Project. Herds were classified as cases if they reported an outbreak in a given season of the year and non-cases if they reported it in a season other than the case season or if they did not report a PRRS outbreak in any season. The geographic distribution of cases and non-cases was compared in each season of the year. The density of farms that had a PRRS outbreak during summer was higher in Southern Minnesota and Northwest-central Iowa compared to the density of the underlying population of non-case farms. This does not mean that PRRS outbreaks are more frequent during summer in absolute terms, but that there was a geographical clustering of herds breaking during summer in this area. Similar findings were observed in autumn. In addition, the density of farms reporting spring outbreaks was higher in the Southeast of the United States compared to that of the underlying population of non-case farms. A similar geographical clustering of PRRS outbreaks was observed during winter in the Southeast of the United States. Pig dense areas were associated with a higher incidence rate throughout the year. However, this association tended to be stronger during the summer. Additionally, herds with ≥2500 sows had an increased incidence rate during all seasons except spring compared to those with <2500 sows. PRRS incidence was lower in year-round air-filtered herds compared to non-filtered herds throughout the year. We showed that not only the spatial risk of PRRS varies regionally according to the season of the year, but also that the effect of swine density, herd size and air filtering on PRRS incidence may also vary according to the season of the year. Further studies should investigate regional and seasonal drivers of disease. Breeding herds should maintain high biosecurity standards throughout the year.

95. Saenz RA, Hethcote HW, Gray GC. Confined animal feeding operations as amplifiers of influenza. *Vector Borne Zoonotic Dis*. 2006;6(4):338-346.
Link: Confined Animal Feeding Operations as Amplifiers of Influenza (nih.gov)
Influenza pandemics occur when a novel influenza strain, often of animal origin, becomes transmissible between humans. Domestic animal species such as poultry or swine in confined animal feeding operations (CAFOs) could serve as local amplifiers for such a new strain of influenza. A mathematical model is used to examine the transmission dynamics of a new influenza virus among three sequentially linked populations: the CAFO species, the CAFO workers (the bridging population), and the rest of the local human population. Using parameters based on swine data, simulations showed that when CAFO workers comprised 15-45% of the community, human influenza cases increased by 42-86%.

Successful vaccination of at least 50% of CAFO workers cancelled the amplification. A human influenza epidemic due to a new virus could be locally amplified by the presence of confined animal feeding operations in the community.

96. Sapkota AR, Curriero FC, Gibson KE, Schwab KJ. Antibiotic-resistant enterococci and fecal indicators in surface water and groundwater impacted by a concentrated swine feeding operation. *Environ Health Perspect.* 2007:1040-1045.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1913567/
Surface and groundwater located up and down gradient from a swine facility was analyzed for the presence of antibiotic-resistant enterococci and other fecal indicators in this study. Both were detected at elevated levels in down gradient water sources relative to the swine facility compared to up-gradient sources, providing evidence that water contaminated with swine manure can contribute to the spread of antibiotic resistance.

97. Schinasi L, Horton RA, Guidry VT, Wing S, Marshall SW, Morland KB. Air pollution, lung function, and physical symptoms in communities near concentrated swine feeding operations. *Epidemiology.* 2011; 22(2):208-215.
Link: https://www .ncbi .nlm .nih .gov/pubmed/21228696/
This study examined the associations between reported malodor and monitored air pollutants with lung function and physical symptoms in people residing within 1.5 miles of hog operations to better understand the effect of CAFO air pollutants on human health. The study reported that acute physical symptoms, including eye irritation, respiratory symptoms, difficulty breathing, wheezing, declined forced expiratory volume, sore throat, chest tightness, and nausea were related to pollutants measured near hog operations.

98. Schmalzried, Hans D., and L. Fleming Fallon Jr. "Proposed Mega-Dairies and Quality-of-Life Concerns: Using Public Health Practices to Engage Neighbors." *Public Health Reports* 125.5 (2010): 754.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2925014/
This article describes the steps taken by the Henry County Health Department (Ohio) to engage with concerned community members by collaborating in baseline data collection prior to the arrival of a large-scale dairy operation. Data collection included water quality testing of residential wells neighboring the dairy operation, a fly trapping and counting program, and a review of local property values. As a dairy with 690 cows will have average water requirements of 35,000 gallons/day, the Health Department coordinated a pumping test to assess groundwater levels and found that groundwater volumes were sufficient to supply the needs of the dairy and the surrounding residential wells. Residential wells were tested for coliform bacteria and field-tested for nitrates and hydrogen sulfide gas, and some of the wells tested unsafe for bacteria. In these cases, homeowners were given instructions on how to disinfect their wells and advised to do follow-up testing. The narrative concludes that data obtained prior to operations can be very useful and that local health departments can work with neighbors and facility operators to ensure that
appropriate preventive measures are in place before operation to protect the public.

99. Schultz, Amy A, Peppard, Paul, Ron E Gangnon, Kristen M C Malecki: Residential proximity to concentrated animal feeding operations and allergic and respiratory disease. *Environment International* 2019 Volume 130

Link: https://doi.org/10.1016/j.envint.2019.104911

Background: Air emissions from concentrated animal feeding operations (CAFO) have been associated with respiratory and allergic symptoms among farm workers, primarily on swine farms. Despite the increasing pre-valence of CAFOs, few studies have assessed respiratory health implications among residents living near CAFOs and few have looked at the health impacts of dairy CAFOs.

Objectives: The goal of this study was to examine objective and subjective measures of respiratory and allergic health among rural residents living near dairy CAFOs in a general population living in the Upper Midwest of the United States.

Methods: Data were from the 2008–2016 Survey of the Health of Wisconsin (SHOW) cohort (n= 5338), a re-presentative, population based sample of rural adults (age 18+). The association between distance to the nearest CAFO and the prevalence of self-reported physician-diagnosed allergies, asthma, episodes of asthma in the last12 months, and asthma medication use was examined using logistic regression, adjusting for covariates and sampling design. Similarly, the association between distance to the nearest CAFO and lung function, measured using spirometry, was examined using multivariate linear regression. Restricted cubic splines accounted for nonlinear relationships between distance to the nearest CAFO and the aforementioned outcomes.

Results: Living 1.5 miles from a CAFO was associated with increased odds of self-reported nasal allergies(OR = 2.08; 95% CI: 1.38, 3.14), lung allergies (OR = 2.72; 95% CI: 1.59, 4.66), asthma (OR = 2.67; 95% CI:1.39, 5.13), asthma medication (OR = 3.31; 95% CI: 1.65 6.62), and uncontrolled asthma, reported as an asthma episode in last 12 months (OR = 2.34; 95% CI: 1.11, 4.92) when compared to living 5 miles from a CAFO. Predicted FEV1 was 7.72% (95% CI:−14.63,−0.81) lower at a residential distance 1.5 miles from a CAFO when compared with a residence distance of 3 miles from a CAFO.

Conclusions: Results suggest CAFOs may be an important source of adverse air quality associated with reduced respiratory and allergic health among rural residents living in close proximity to a CAFO.

100. Schulz J, Friese A, Klees S, et al. Longitudinal study of the contamination of air and of soil surfaces in the vicinity of pig barns by livestock-associated methicillin-resistant *Staphylococcus aureus. Appl Environ Microbiol.* 2012;78(16):5666-5671.
Link: https://www .ncbi .nlm .nih .gov/pubmed/22685139/

This study examined the presence and concentration of MRSA in air and soil downwind from swine CAFOs. The results demonstrate regular transmission and deposition of airborne livestock-associated MRSA to areas up to **at least 300 meters** around pig barns that tested positive for MRSA, suggesting that swine CAFOs can expose other farm animals, wildlife, and people to MRSA.

101. Shaw, K. A., Szablewski, C. M., Kellner, S., Kornegay, L., Bair, P., Brennan, S., Kunkes, A., Davis, M., McGovern, O. L., Winchell, J., Kobayashi, M., Burton, N., de Perio, M. A., Gabel, J., Drenzek, C., Murphy, J., Holsinger, C., & Forlano, L. (2019). Psittacosis Outbreak among Workers at Chicken Slaughter Plants, Virginia and Georgia, USA, 2018. *Emerging infectious diseases*, *25*(11), 2143–2145.
Link: https://doi.org/10.3201/eid2511.190703

During August-October, 2018, an outbreak of severe respiratory illness was reported among poultry slaughter plant workers in Virginia and Georgia, USA. A multiorganizational team investigated the cause and extent of illness, determined that the

illness was psittacosis, and evaluated and recommended controls for health hazards in the workplace to prevent additional cases.

102. Showers, William J., et al. "Nitrate contamination in groundwater on an urbanized dairy farm." *Environmental Science & Technology* 42.13 (2008): 4683-4688.
Link: http://pubs.acs.org/doi/ful1/10.1021/es071551t
Urbanization of rural farmland is a pervasive trend around the globe, and maintaining and protecting adequate water supplies in suburban areas is a growing problem. Identification of the sources of groundwater contamination in urbanized areas is problematic but will become important in areas of rapid population growth and development. The isotopic composition of NO3(815NNO3 and M80 NO3), NH4 (815NNH4), groundwater (62Hwt and 8180wt) and chloride/bromide ratios were used to determine the source of nitrate contamination in drinking water wells in a housing development that was built on the site of a dairy farm in the North Carolina Piedmont, U.S. The 615NNO3 and 6180 NO3 compositions imply that elevated nitrate levels at this site in drinking well water are the result of waste contamination, and that denitrification has not significantly attenuated the groundwater nitrate concentrations. 615NNO3 and 6180NO3compositions in groundwater could not differentiate between septic effluent and animal waste contamination. Chloride/bromide ratios in the most contaminated drinking water wells were similar to ratios found in animal waste application fields and were higher than Cl/Br ratios observed in septic drain fields in the area. 6180wt was depleted near the site of a buried waste lagoon without an accompanying shift in 62Hwt suggesting water oxygen exchange with CO2. This water—0O2 exchange resulted from the reduction of buried lagoon organic matter, and oxidation of the released gases in aerobic soils. 6180wt is not depleted in the contaminated drinking water wells, indicating that the buried dairy lagoon is not a source of waste contamination. The isotope and Cl/Br ratios indicate that nitrate contamination in these drinking wells are not from septic systems, but are the result of animal waste leached from pastures into groundwater during 35 years of dairy operations which did not violate any existing regulations. Statutes need to be enacted to protect the health of the homeowners that require well water to be tested prior to the sale of homes built on urbanized farmland.

103. Song D, Moon H, Kang B. Porcine epidemic diarrhea: A review of current epidemiology and available vaccines. *Clin Exp Vaccine Res*. 2015;4(2):166-176. doi:10.7774/cevr.2015.4.2.166
Link: Porcine epidemic diarrhea: A review (nih.gov)
Until 2013, PED was thought to have been restricted to Asian countries. However, an outbreak of PEDV infection occurred in the United States in Iowa in April 2013, and within 1 year, PEDV had spread to Canada and Mexico, which share borders with the United States. Additionally, PED outbreaks occurred in Korea and Japan, across the Pacific Ocean, also within 1 year of the US outbreak. The PEDV strain isolated in the United States was genetically related to the Chinese PEDV strain reported in 2012. Interestingly, the Korean and Taiwanese PEDV strains isolated after the US outbreak were genetically related to the US PEDV strain.

104. Spencer JL, Guan J. Public health implications related to spread of pathogens in manure from livestock and poultry operations. *Public Health Microbiology: Methods and Protocols.* 2004:503-515.
Link: https://www.ncbi.nlm.nih.gov/pubmed/15156064
Objectionable odors, flies, excessive levels of nitrogen and phosphorus and the potential spread of human pathogens are among the public concerns with the disposal of animal

manure and the spread of dust and manure blown from powerful building fans. The study also finds that importance of animal manure in the spread of infectious pathogens is often underestimated despite the linkages between livestock operations and gastroenteritis in humans.

105. Steinmann J. (2004). Surrogate viruses for testing virucidal efficacy of chemical disinfectants. *The Journal of hospital infection, 56 Suppl 2,* S49–S54.
Link: https://doi.org/10.1016/j.jhin.2003.12.030
Since important agents of viral nosocomial infections like hepatitis B and C viruses and norovirus do not replicate sufficiently in cell culture systems, disinfectants with suspected efficacy against these viruses must be evaluated by different methods. Besides molecular approaches and indirect tests, the use of surrogate viruses with similar biophysical properties and genomic structure allows the assessment of virucidal efficacy of chemical disinfectants in quantitative suspension tests. Furthermore, insights into the survival of these viruses in the environment are possible.

106. Thomas, C. Estimating Water Usage on Michigan Dairy Farms. Michigan State University Extension
Link: Water Use for Large Dairies (ashland.wi.us)
Water usage on dairy farms can be divided into two general categories: 1) direct usage by dairy animals, and 2) indirect usage required for the general operation of the dairy facility.

107. Thomas, PR, et. al. (2015) Methods for Inactivating PEDV in Hog Trailers. *Animal Industry Report*: AS 661, ASL R3028.
Link: https://lib.dr.iastate.edu/ans_air/vol661/iss1/91
Contaminated livestock trailers certainly represent a significant risk for movement of the virus between and within herds. Historically, this disease risk has been effectively mitigated in some cases with the use of trailer washing, disinfection protocols, and thermo-assisted drying and decontamination (TADD) systems. This paper summarizes four studies that evaluated individual aspects of trailer sanitation programs including TADD and multiple disinfectants alone, as well several protocols that include washing, disinfection and TADD.

108. Thompson, RW. (2001) Transmission of pathogens via transportation vehicles. Retrieved from the University of Minnesota Digital Conservancy.
Link: https://hdl.handle.net/11299/147436
Outbreaks of Foot and Mouth Disease (FMD) and Classical Swine Fever (CSF) in Europe and the United Kingdom, have raised our awareness of disease transmission. Realizing how rapidly these diseases spread, industry must restrict pathogen transmission at all production levels. Our focus in this presentation will be on transportation. Because of the increasing movement of pigs in multisite production, the economics of finishing pigs in the Midwest, plus location of the US packing industry, the chances of transmission of respiratory or enteric organisms have increased. All trucks, trailers, and other vehicles used for transporting animals, animal products, products, feed, offal, and contaminated equipment are a potential risk in the spread of disease.

109. Ueijo, C. K., et. al. (2014). Drinking water systems, hydrology, and childhood gastrointestinal illness in central and northern Wisconsin. *American Journal of Public Health,* 104(4):639- 646.
Link: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4025711/

110. US Meat Export Federation. FAQ: How do Red Meat Exports Benefit the Industry?

Link: FAQ : U.S. Meat Export Federation (usmef.org)

111. Ward MH. Too much of a good thing? Nitrate from nitrogen fertilizers and cancer. *Rev Environ Health.* 2009;24(4):357-363.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3068045/
Nitrate, the breakdown product of nitrogen fertilizers, accumulates in groundwater under agricultural land and can spread through waterways due to agricultural field runoff. Nitrates are associated with a range of adverse health effects, including methemoglobinemia, various cancers, negative reproductive outcomes, diabetes, and thyroid conditions. Additional research is needed to further evaluate the health effects of nitrate exposure, especially as environmental exposure to nitrates has increased over the last 50 years and 90% of rural Americans depend on groundwater for drinking water, many relying on private wells, which are not regulated by the Safe Drinking Water Act.

112. Ward MH, Kilfoy BA, Weyer PJ, Anderson KE, Folsom AR, Cerhan JR. Nitrate intake and the risk of thyroid cancer and thyroid disease. *Epidemiology.* 2010;21(3):389-395.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2879161/
This study examined the association between nitrate intake through public water and diet with the risk of thyroid cancer and hypo- and hyperthyroidism. The study found an increased risk of thyroid cancer with high water nitrate levels and with longer consumption of water containing nitrates. The increased intake of dietary nitrate was associated with an increased risk of thyroid cancer, and with the prevalence of hypothyroidism.

113. Weyer, P.J., J.R. Cerhan, B.C. Kross , G.R. Hallberb, J. Kantamneni, G. Breuer, M.P. Jones, W. Zheng, C.F. Lynch. 2001. *Epidemiology*, 11(3):327-338. Municipal Drinking Water Nitrate Level and Cancer Risk in Older Women: The Iowa Women's Health Study, Epidemiology: May 2001 - Volume 12 - Issue 3 - p 327-338
Link: Municipal Drinking Water Nitrate Level and Cancer Risk
Nitrate contamination of drinking water may increase cancer risk, because nitrate is endogenously reduced to nitrite and subsequent nitrosation reactions give rise to N-nitroso compounds; these compounds are highly carcinogenic and can act systemically. We analyzed cancer incidence in a cohort of 21,977 Iowa women who were 55–69 years of age at baseline in 1986 and had used the same water supply more than 10 years (87% >20 years); 16,541 of these women were on a municipal supply, and the remainder used a private well. We assessed nitrate exposure from 1955 through 1988 using public databases for municipal water supplies in Iowa (quartile cutpoints: 0.36, 1.01, and 2.46 mg per liter nitrate-nitrogen). As no individual water consumption data were available, we assigned each woman an average level of exposure calculated on a community basis; no nitrate data were available for women using private wells. Cancer incidence (N = 3,150 cases) from 1986 through 1998 was determined by linkage to the Iowa Cancer Registry. For all cancers, there was no association with increasing nitrate in drinking water, nor were there clear and consistent associations for non-Hodgkin lymphoma; leukemia; melanoma; or cancers of the colon, breast, lung, pancreas, or kidney. There were positive associations for bladder cancer [relative risks (RRs) across nitrate quartiles = 1, 1.69, 1.10, and 2.83] and ovarian cancer (RR = 1, 1.52, 1.81, and 1.84), and inverse associations for uterine cancer (RR = 1, 0.86, 0.86, and 0.55) and rectal cancer (RR = 1, 0.72, 0.95, and 0.47) after adjustment for a variety of cancer risk/protective factors, agents that affect nitrosation (smoking, vitamin C, and vitamin E intake), dietary nitrate, and water source. Similar results were obtained when analyses were restricted to nitrate level in drinking water from 1955 through 1964. The positive association for bladder cancer is consistent with some previous data; the associations for ovarian, uterine, and rectal cancer were unexpected.

114. Wichmann F, Udikovic-Kolic N, Andrew S, Handelsman J. Diverse antibiotic resistance genes in dairy cow manure. *MBio.* 2014; 5(2):e01017-13.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3993861/

Application of manure from antibiotic-treated animals to crops facilitates the dissemination of antibiotic resistance determinants into the environment. However, our knowledge of the identity, diversity, and patterns of distribution of these antibiotic resistance determinants remains limited. We used a new combination of methods to examine the resistome of dairy cow manure, a common soil amendment. Metagenomic libraries constructed with DNA extracted from manure were screened for resistance to beta-lactams, phenicols, aminoglycosides, and tetracyclines. Functional screening of fosmid and small-insert libraries identified 80 different antibiotic resistance genes whose deduced protein sequences were on average 50 to 60% identical to sequences deposited in GenBank. The resistance genes were frequently found in clusters and originated from a taxonomically diverse set of species, suggesting that some microorganisms in manure harbor multiple resistance genes. Furthermore, amid the great genetic diversity in manure, we discovered a novel Glade of chloramphenicol acetyltransferases. Our study combined functional metagenomics with third-generation PacBio sequencing to significantly extend the roster of functional antibiotic resistance genes found in animal gut bacteria, providing a particularly broad resource for understanding the origins and dispersal of antibiotic resistance genes in agriculture and clinical settings. The increasing prevalence of antibiotic resistance among bacteria is one of the most intractable challenges in 21st-century public health. The origins of resistance are complex, and a better understanding of the impacts of antibiotics used on farms would produce a more robust platform for public policy. Microbiomes of farm animals are reservoirs of antibiotic resistance genes, which may affect distribution of antibiotic resistance genes in human pathogens. Previous studies have focused on antibiotic resistance genes in manures of animals subjected to intensive antibiotic use, such as pigs and chickens. Cow manure has received less attention, although it is commonly used in crop production. Here, we report the discovery of novel and diverse antibiotic resistance genes in the cow microbiome, demonstrating that it is a significant reservoir of antibiotic resistance genes. The genomic resource presented here lays the groundwork for understanding the dispersal of antibiotic resistance from the agroecosystem to other settings.

115. Wilson SM, Serre ML. Examination of atmospheric ammonia levels near hog CAFOs, homes, and schools in eastern North Carolina. *Atmos Environ* 41(23):4977–4987 (2007)
Link: http://dx.doi.org/10.1016/j.atmosenv.2006.12.055

Hog concentrated animal feeding operations (CAFOs) release ammonia (NH_3) in Eastern North Carolina (NC) to the atmosphere which is potentially hazardous for nearby human populations at community locations particularly homes and schools. We present NH_3 weekly average concentrations that were collected using passive diffusion tubes from October 2003 to May 2004 (20 sites) and from July 2004 to October 2004 (23 sites) near community locations in close proximity to hog CAFOs. The data for each phase of sampling was stratified by distance from the nearest hog CAFO. The mean Phase I levels were 16, 8, 7 and 5 ppb for distances <0.5, 0.5-1, 1-2, and 2 km or more, respectively. The mean levels for Phase II were 29, 16, and 11 ppb for distances <0.5, 0.5-1, and 1 km or more, respectively. The results of the distance stratification are the best results of this study and provide the strongest evidence that distance to one or more CAFOs is the key variable in controlling weekly NH_3 atmospheric concentration at the community level in Eastern

NC. Statistical analyses confirmed that source terms such as distance to a hog CAFO and live weight per operation, as well as temperature, wind speed and wind direction were important predictors of atmospheric NH_3 at community locations. The results indicate potential zones of exposure for human populations who live or go to school near hog CAFOs.

116. Wing S. Intensive livestock operations, health, and quality of life among eastern North Carolina residents. *Environ Health Perspect.* 2000;108(3):233-238.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1637983/
Reports of decreased health and quality of life from people who live near industrial animal operations were explored in this study through community surveys in three rural communities, one located near a large swine operation, one near two intensive cattle operations, and one area without nearby livestock operations using liquid waste management systems. Residents near the swine operation reported increased occurrences of poor health, such as headaches, diarrhea, sore throat, excessive coughing and burning eyes and reduced quality of life compared to those in the other two communities.

117. Wing S, Horton RA, Rose KM. Air pollution from industrial swine operations and blood pressure of neighboring residents. *Environmental Health Perspectives (Online).* 2013;121(1):92.
Link: https://ehp.niehs.nih.gov/1205109/
The association of air pollution and malodor with stress and blood pressure were assessed in this study to improve understanding of the effects of industrial swine operations on human health. Malodor and some air pollutants were found to be associated with blood pressure increases and reported stress, which could contribute to the development of chronic hypertension.

118. Woods, J. et.al. (2008). Fatigue: a major cause of commercial livestock truck accidents. *Veterinaria italiana*, *44*(1), 259–262.
Link: Woods 259-262.doc (izs.it)
Accident reports on 415 commercial livestock truck accidents were tabulated between 1994 and June 2007 in the United States and Canada. Data was collected from Google internet searches of newspaper and television news reports, unpublished industry sources and Alberta government agencies. Fifty-nine percent of the accidents occurred during the early morning hours from midnight to 9:00 am and 80% involved a single vehicle. Driver error was blamed for 85% of the wrecks. In 83% of the accidents, the vehicle rolled over and 84% of the truckers tipped over on their right side. In North America, vehicles travel on the right-hand side of the road and if a driver falls asleep at the wheel he usually drifts off toward the right. Driver fatigue is the most likely explanation for many of these accidents.

University Programs

119. Drake University Agricultural Law Center. Manure Agreement Decision Making Tool
Link: Drake Decision Making Tool

120. Iowa State University, Center for Food Security and Public Health, 2021 *Protecting Your Herd/Flock Biosecurity Tip Sheet.*
Link: https://www.cfsph.iastate.edu/Assets/tip-sheet-protecting-your-herd-flock.pdf

This sheet describes basic biosecurity practices to keep disease out of a facility, and to avoid transport of disease within a facility or to the outside of a facility

121. University of Minnesota. Pitkin, A. Biosecurity protocols for the prevention of spread of porcine reproductive and respiratory syndrome. Swine Disease Eradication Center.
Link: Biosecurity protocols for the prevention of PRRS

Preventing the spread of PRRSV within and between pig populations is a critical component of a farm's disease control program. To aid in controlling the spread of this agent, this manual provides a summary of data from experiments conducted from our group at the University of Minnesota that were specifically designed to identify the routes of PRRSV transmission and to develop protocols of biosecurity to reduce this risk. All protocols have been, and continue to be validated during an ongoing experiment that has been in process over the past 2 years at our Swine Disease Eradication Center (SDEC) production region model farm.

122. University of Minnesota. Enhanced Passive Surveillance for ASF and CSF. *Swine in Minnesota*. September 24, 2021
Link: Enhanced Passive Surveillance for ASF and CSF

Center for Animal Health and Food Safety at the University of Minnesota shares preliminary results regarding a project looking at enhanced surveillance for two Foreign Animal Diseases: African Swine Fever and Classical Swine Fever.

123. University of Minnesota. Operation Guidance Manual for Harvest Facilities during FAD/EDI Investigations. October 2015
Link: Operation Guidance Manual for Harvest Facilities

This document provides guidance for livestock harvesting facilities operating during a foreign animal disease (FAD) or an emerging disease incident (EDI) investigation. Includes Issues for Consideration and General Recommendations for Facilities. Outlines actions that a facility can take to better prepare for a potential FAD/EDI, while considering individual facility needs and continuity of business concerns, as well as concerns about potential disease spread.

124. University of Minnesota. Risk Assessment for the Transmission of Foot and Mouth Disease via Movement of Swine and Cattle Carcasses from FMD-infected Premises to a Disposal Site. February 18, 2014.
Link: Carcass Movement RA Final UMN

Time for disease detection was estimated by a disease spread model to be between 4-10 days for swine and beef cattle and 3-9 days for dairy cattle premises of different sizes. Total time from infection to depopulation (including detection and confirmation) for the first FMD infected case was estimated to be between 10-15 days for swine, 8-12 days for dairy and 10-14 days for beef cattle premises. The average concentration of FMDv in a carcass in experimental inoculation studies was 103 Plaque Forming Unit per gram (PFU/g) for a pig carcass and 106 PFU/g for a cattle carcass. The total amount of infected carcasses moved to the disposal site (relative to the size of the animal carcass and the capacity of the truck trailer) was between 23-390 cattle carcasses and 117-780 pig carcasses per truck. Any small amount of body fluids (1 mL) would contain virus that is equal and greatly

exceeds the infective dose by oral and inhalation route for pigs and cattle. The likelihood that swine and cattle carcasses moved from FMD positive premises will contain an infective dose was high. The use of a Bio-Zip™ bag in a standard rendering truck (tailgate sealed and tarp cover) reduces the likelihood of leakage, spillage and aerosolization to negligible.

125. University of Minnesota. Newly funded: Investigating swine industry biocontainment strategies for airborne diseases. August 27, 2021
Link: Swine industry biocontainment strategies for airborne diseases
Airborne animal diseases in today's agricultural settings are difficult to contain. Let's say a pig raised in confinement with other swine contracts porcine reproductive and respiratory syndrome virus (PRRS); more than likely, the swine are in a controlled ventilated environment, where exhaust fans move airborne particles to the outdoors. In short order, air containing PRRS virus will flow into the environment and potentially to the swine farm across the road, causing an outbreak. How could the outbreak have been contained?

126. University of Minnesota Extension. Odor From Feedlots Estimation Tool (OFFSET).
Link: offset-users-guide.pdf
The amount of odor emitted from a particular farm is a function of animal species, housing types, manure storage and handling methods, the size of the odor sources, and the implementation of odor control technologies. However, the impact of these odors on the surrounding neighborhood or community is a function of both the amount of odor emitted and the weather conditions. Weather conditions strongly influence the movement and dilution of odors. Odor impact includes the strength of the odors and the frequency and duration of the odor events. OFFSET combines odor emission measurements with the average weather conditions to estimate the strength and frequency of odor events at various distances from a given farm.

127. University of Missouri. Securing Manure Spreading Rights through Easements. *Agricultural MU Guide.* G-361
Link: G0361_03.qxd (missouri.edu)
Several trends in modern animal agriculture are causing people to look at easements as a legal tool to help them meet their business objectives. Animal feeding operations are getting larger, and animals are housed in facilities engineered to capture and store manure. These larger animal feeding operations are highly specialized, sometimes owning less land than would be necessary to use the manure agronomically. Another trend is an increase in environmental regulation affecting many of these animal feeding operations. Recent concerns over the environmental impacts of animal feeding operations have led to new regulations. These trends often create a need to regularly export manure to neighboring farms; easements can be used to formalize this arrangement.

128. University of Wisconsin. **S**oil **N**utrient **A**pplication **P**lanner (SnapPlus)
Link: SnapPlus – Wisconsin's Nutrient Management Planning Software
SnapPlus is a Nutrient Management Planning software program designed for the preparation of nutrient management plans in accordance with Wisconsin's Nutrient Management Standard Code 590. SnapPlus will calculate:

- Crop nutrient (N, P_2O_5, K_2O) recommendations for all fields on a farm taking into account legume N and manure nutrient credits consistent with University of Wisconsin recommendations
- A RUSLE2-based soil loss assessment that will allow producers to determine whether fields that receive fertilizer or manure applications meet tolerable soil loss (T) requirements.
- A rotational Phosphorus Index value for all fields as required for using the P Index for phosphorus management.
- A rotational P balance for using soil test P as the criteria for phosphorus management.

Regulatory & Court Documents

129. California Department of Food and Agriculture. Proposition 12 Implementation Plan.
Link: CDFA - Proposition 12 Implementation (ca.gov)

130. California Environmental Protection Agency, Regional Water Quality Control Board, Central Valley Region, 2010, *Groundwater Quality Protection Strategy Central Valley Region "Roadmap"*
Link:https://www.waterboards.ca.gov/centralvalley/water_issues/groundwater_quality/2010aug_gwq_protect_strat_approved.pdf
Section 4.1 Confined Animal Facilities Page 34-35, Dairy General Order established a schedule for dischargers to develop and implement measures protective of water quality and confirm protection of groundwater quality through monitoring. Requirements of the General Order were phased to allow a systematic approach for implementation of regulatory measures recognizing available resources on behalf of dischargers, consultants, and the Central Valley Water Board. Measures required by the General Order are for both the dairy production area and land application area and include development of a Nutrient Management Plan by July 2009 with full implementation by 2012 and development of a Waste Management Plan by July 2010 and full implementation by 2012. The Dairy General Order requires each Discharger to immediately begin sampling each of the domestic and agricultural wells present at the dairy and discharges from any subsurface (tile) drains. Groundwater monitoring at existing dairies is necessary to: determine background groundwater quality; determine existing groundwater conditions near retention ponds, corrals, and land application areas; determine the effect of the improved management practices required in the Dairy General Order On groundwater quality.

131. Food & Water Watch. Octo 26, 2021. *Petition to Rescind the Air Consent Agreement and Enforce Clean Air Laws Against Animal Feeding Operations.*
Link: FINAL EPA Petition re 2005 Air Consent Agreement.docx (foodandwaterwatch.org)
Over sixteen years ago, the Environmental Protection Agency (EPA), announced an Agreement and Final Order it had secretly negotiated with the National Pork Producers Council. In the agreement, EPA refrained from enforcing key air pollution control and public disclosure laws against any animal feeding operation (AFO) that agreed to pay a nominal penalty to fund a nationwide air monitoring program to establish Emission Estimating Methodologies (EEMs) for AFOs. Nearly 14,000 AFOs signed up for this deal,

known as the Air Consent Agreement. We ask that you rescind the Air Consent Agreement, enforce all applicable laws against AFOs, and prioritize environmental justice in enforcement and climate actions.

132. Minnesota Department of Transportation Research Services & Library. August 2014, *Assessing the Effects of Heavy Vehicles on Local Roadways.*
Link: https://www.lrrb.org/pdf/201432.pdf
This report documents the development of an analysis procedure and an associated computation tool to estimate the impact of heavy vehicles on local agency pavements. The heavy vehicles of interest are those which were not anticipated at the time the pavement structure was designed, but which cause additional damage and thus create the need for rehabilitation or reconstruction sooner than expected, including pork farms. The tool described in this report implements the procedure, and provides users with the ability to analyze a single roadway segment (for detailed impacts estimates) or an agency's entire network (for summary statistics over the system). The tool is contained in a macro-enabled Microsoft Excel spreadsheet and does not need additional files or external functionality to conduct an analysis.

133. Minnesota Pollution Control Agency. Implementation Plan for the Lake St, Croix Nutrient TMDL. February 2013 Appendix B Polk County Page 1
Link: Implementation Plan Lake St. Croix TMDL (state.mn.us)
The TMDL allows for 108,000 lbs/yr of phosphorus to be loaded to the St. Croix River from Polk County. This requires 53,000 lbs/yr of reduction from the estimated TMDL baseline load of 161,000 lbs/yr in the early 1990s. Polk County's required reduction ranks 1st largest among the 19 counties in the basin. To achieve the St. Croix Basin Partners' goal of 20% reduction by 2020, Polk County needs to reduce loadings by 39,000 lbs/yr by the year 2020. To attain this goal, activities must be implemented that achieve an average annual rate of phosphorus reduction of 1,300 lbs/yr over 30 yrs, or 3,900 lbs/yr over 10 yrs.

134. Minnesota Pollution Control Agency. Lake St. Croix Nutrient Total Maximum Daily Load (TMDL) May 2012
Link: Lake St Croix_TMDLFinalReport.pdf
The St. Croix River and Lake St. Croix are highly valued resources that provide exceptional recreational opportunities and support a highly diverse ecology of aquatic and terrestrial species. However, over the years eutrophication, or nutrient enrichment, has occurred in Lake St. Croix due to excess phosphorus loading. This loading drives nuisance algae blooms which diminish the enjoyment and use of the lake. This report represents an important step in the improvement of Lake St. Croix by focusing on establishing the needed reduction in the loading of phosphorus from its contributing basin in order to achieve water quality standards.

135. National Fire Protection Association. NFPA 1141 Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas. 2017
Link: NFPA 1141: Standard for Fire Protection for Wildland, Rural, and Suburban Areas
Provides requirements for the development of fire protection and emergency services infrastructure to make sure that wildland, rural, and suburban areas undergoing land use changes or land development have the resources and strategies in place to protect people

and property from fire dangers, and allow fire fighters to do their jobs safety and effectively.

136. National Fire Protection Association. NFPA 1142 Standard on Water Supplies for Suburban and Rural Fire Fighting. 2022
Link: NFPA 1142: Standard on Water Supplies for Suburban and Rural Firefighting
An adequate and reliable municipal-type water supply is sufficient every day of the year to control and extinguish anticipated fires in the jurisdiction. NFPA 1142 identifies minimum standards to assist rural and suburban fire departments in developing sufficient water supplies where no in-ground hydrant system, or an inadequate one, exists. Provides methods for determining water supply requirements based on occupancy and construction classifications. Also provides information regarding apparatus construction for water tankers.

137. National Fire Protection Association. NFPA 1144 Standard for Reducing Structure Ignition Hazards from Wildland Fires. 2018
Link: NFPA 1144: Standard for Reducing Structure Ignition Hazards from Wildland Fire
This standard provides a methodology to assess wildland fire ignition hazards around existing structures and new structures located in wildland interface areas. Also provides minimum requirements for new construction to reduce the potential of structure ignition from wildland fires.

138. National Fire Protection Association. NFPA 150 Fire and Life Safety in Animal Housing Code. 2022
Link: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=150
This code provides the minimum requirements for the design, construction, fire protection, and classification of animal housing facilities.

139. North Carolina Department of Environmental Quality. Title VI: Increasing Equity, Transparency, and Environmental Protection in the Permitting of Swine Operations. Attachment C: Updated Odor Control Checklist May 4, 2020
Link: Updated Odor Control Checklist.pdf

140. Polk County Extension - University of Wisconsin. Sample Manure Management Agreement.
Link: Manure Management Agreement (wisc.edu)

141. Polk County, Wisconsin Board of Supervisors. Resolution 39-21Urging the State of Wisconsin to Adequately Fund State Agencies Regarding CAFO Regulations to Protect Groundwater and Air Quality. August 21, 2021.
Link: Polk County Resolution No 39-21
The Polk County Board of Supervisors hereby urges the State of Wisconsin to adequately fund the Department of Natural Resources and the Department of Agriculture, Trade and Consumer Protection so they can vigorously monitor and regulate all of the existing and future CAFOs to the fullest extent of its authority. Supervisors urge the State Legislature and the Governor to fully fund the various regulatory agencies so that they have the resources they need to adequately monitor and regulate CAFOs.

142. Polk County, Wisconsin Board of Supervisors. Resolution 03-20 Extending Moratorium on Swine CAFOs. February 20, 2020.
Link: Resolution 03-20 Extending CAFO_Moratorium
Limits research into making swine CAFOs a conditional use for areas subject to the Shoreland Use Ordinance. Includes no Findings of Facts.

143. Polk County, Wisconsin Board of Supervisors. Resolution 37-20 Swine CAFO Amendment. September 15, 2020
Link: Resolution 37-20 Amended Polk County Comprehensive Land Use
Targets swine CAFO development in towns with areas zoned Agriculture-20 and non-shoreland lands in un-zoned towns such as Laketown. CAFO developments with 2,499 hogs or less (1,000 animal units) in zoned towns also have no restrictions. Developers interested in non-shoreland areas of Laketown have no county siting restrictions. Manure from CAFOs in un-zoned areas can be spread in shoreland areas throughout the county.

Developers planning more than 2,499 hogs (1,000 animal units) in zoned towns must be in areas zoned Agriculture-20. In addition, they are required to get a conditional use permit through the county's Environmental Services Committee that will include at least the following provisions:

- **a. Setbacks -** 200' setback for waste storage and housing for an infinite number of hogs. 100' setback for driveway entrance.
- **b. Waste -** Requires nutrient and mortality management plans.
- **c. Overweight Loads -** Requires town approval during spring break-up.
- **d. Spills -** Developers **s**hall notify the town and county of spills within 24 hours. The county will publicly notice the spill.
- **e. Previous livestock violations** - Violations by the owner/parent company must be reported
- **f. Suspected hazards** - Environmental or human health hazards must be referred to the county.
- **g. Residency** - Owner or operator must live within five (5) miles of the development.
- **h. Plans** - Professionally designed and drafted plans required for the main facility.

This swine CAFO ordinance was developed during a 12-month moratorium that required the county to study a wide range of environmental and health issues. This was supposed to be done because Wisconsin law requires ordinances to be based on "reasonable and scientifically defensible findings." However, the county did not do the needed work and provided no findings. As a result, DATCP staff issued a letter to the county that the ordinance is vulnerable to legal challenge.

144. St. Croix County, Wisconsin Community Development Committee (CDC). February 20, 2020 letter to Wisconsin DNR
Link: SCC-CDC-letter-to-DNR-ESD-2020.pdf
The documented violations and citizen concerns together are the reason this letter was prepared. Along with close scrutiny of the WPDES re-authorization application, CDC asks that additional measures and accountability be included in WPDES Permit 00593315-04-0 if the DNR chooses to re-issue the permit to Emerald Sky Dairy. The CDC requests full

and quick enforcement of manure application rules and statutes for CAFO's located in St. Croix County. According to the Wisconsin Land and Water Conservation Association, loss of nutrients from cropland and pastures is the largest source of nonpoint source nutrient pollution in surface and groundwater in Wisconsin.

145. Town of Laketown, Polk County, Wisconsin. Town of Laketown Comprehensive Plan. October 27, 2009
Link: Town of Laketown Comprehensive Plan
In July of 2007 Polk County, along with twenty-five of its municipalities, was awarded a multi-jurisdictional Comprehensive Planning Grant through the Wisconsin Department of Administration to develop Comprehensive Plans. The Town of Laketown participated in the grant and began working on the plan in September of 2007. In order to review the issues and opportunities unique to the Town of Laketown, the following will be addresses.

146. Town of Laketown, Polk County, Wisconsin. Moratorium on Livestock Facility Licensing Committee Report. December 22, 2020
Link: Laketown Livestock Facility Report
Study, review, consider and determine whether amendments to the Large Scale Development Ordinance or the creation of a Livestock Facilities Licensing Ordinance or other ordinances are required to protect the environment, public health or safety and property in Laketown Township in light of the unique environment and the key concerns identified in the Town of Laketown Comprehensive Plan.

147. United Nations Food and Agriculture Organization. 2020 Global control of African swine fever - 2020 to 2025. Paris
Link: Global control of African swine fever (fao.org)

148. United States Department of Agriculture. Mass Depopulation & Euthanasia- Swine Euthanasia. *Powerpoint slide show*
Link: mde_swine_presentation.pptx (live.com)

149. United States Department of Agriculture. Mass Depopulation & Euthanasia- Avian Euthanasia. *Powerpoint slide show*
Link: mde_avian_presentation.pptx (live.com)

150. United States Department of Agriculture. Depopulation, Disposal and Decontamination Consideration for African Swine Fever. August 13, 2019.
Link: Depopulation, et al for African Swine Fever
This webinar began with a discussion of lessons learned from past outbreaks presented by Mike Starkey of the Minnesota Department of Agriculture. Lori Miller of USDA then presented an overview of depopulation, disposal, and decontamination considerations and tools related to African swine fever. Dr. Mike Neault of North Carolina Department of Agriculture and Consumer services wrapped up the webinar with a presentation regarding activities that have occurred, our readiness at present, and what still needs to be accomplished.

151. United States Department of Agriculture. African Swine Fever Information
Link: USDA APHIS | African Swine Fever (ASF) Information
African swine fever is a highly contagious and deadly viral disease affecting both domestic and feral swine of all ages. ASF is not a threat to human health and cannot be transmitted

from pigs to humans. It is not a food safety issue. ASF is found in countries around the world, particularly in sub-Saharan Africa. More recently, it has spread through China, Mongolia and Vietnam, as well the European Union, Dominican Republic and Haiti.

152. United States Department of Agriculture. African Swine Fever Herd Plan: Euthanasia, Depopulation, Disposal, & Virus Elimination Procedures. November 2020
Link: ASF Domestic Herd Plan
This African Swine Fever Herd Plan template is intended to serve as a guide. It must be amended as necessary to be specific to the single premises identified below.

153. United States Department of Agriculture. ASF Action Week September 2021.
Link: USDA APHIS | ASF Action Week Webinar
The USDA invites you to join us September 13-17, 2021 for daily webinars to learn more about African swine fever and its global spread, actions being taken to safeguard the United States, and biosecurity measures you can implement now to protect the U.S. herd. Recorded sessions are available.

154. United States Department of Agriculture. African Swine Fever- An Unwelcome Arrival in Germany. *Foreign Agricultural Service Report.* Number: GM2020-0052. September 10, 2020.
Link: FAS Report GM2020-0052
On September 10, Germany's Federal Minister of Food and Agriculture confirmed a case of ASF in a wild boar found near the German-Polish border in the village of Sebtem, Spree-Neiße district. This is the first ASF case in Germany and it was only a matter of time especially given the recent rise of cases in Western Poland. The risk of introducing the pathogen into Germany was rated as high according due to the proximity to the border of the latest Polish cases. However, an introduction by humans via contaminated food cannot be excluded. On-site ASF control measures are being conducted by the general veterinary authorities and the Provincial Crisis Management Center. A fence is now being erected around a 4 km radius of the site where the infected wild boar was found. Samples taken from bones of the decomposing carcass of the wild boar suggest that ASF entered Germany several weeks ago, indicating that additional ASF detections are likely. Search parties are looking for more dead boar carcasses in the area.

155. United States Department of Agriculture Foreign Agriculture Service. 2020 U.S. Agricultural Export Yearbook.
Link: 2020-ag-export-yearbook.pdf (usda.gov)
Provides a statistical summary of U.S. agricultural commodity exports to the world. The 16 product groups or commodity aggregations, displayed in the Yearbook, are based on the United States' largest export categories. The United States' top 15 export destinations are included as well as a page for the United Kingdom (UK). The European Union (EU27+UK), a customs union comprised of 28 member states, is included as a single trading partner. The only exception is that the UK has its own yearbook page given the importance of its withdrawal from the EU-28. The top 14 export markets represent 80 percent of total U.S. agricultural exports in 2020.

156. United States Department of Agriculture - Secretary Vilsack Message on African Swine Fever.
Link: African Swine Fever Message from USDA Secretary Tom Vilsack

African swine fever (ASF) is a highly contagious and deadly viral disease affecting both domestic and feral swine of all ages. ASF has never been found in the United States – and we want to keep it that way. ASF is a devastating, deadly disease that would have a significant impact on U.S. livestock producers, their communities and the economy if it were found here. There is no treatment or vaccine available for this disease.

157. United States Department of Transportation, Federal Highway Administration, *Developing Safety Plans, A Manual for Local Rural Road Owners.* March 2012
Link: https://safety.fhwa.dot.gov/local_rural/training/fhwasa12017/

Over three-fourths of all road miles in the U.S. are in rural areas. Of those three million miles of rural roads, almost 80 percent are owned and operated by local entities. In 2009, rural roads accounted for approximately 33 percent of the vehicle miles traveled in the U.S.3, but 56 percent of fatalities. Local roads in rural areas may have design elements that increase the risk of fatalities or serious injuries, such as inappropriately high speed limits, narrow lane widths and shoulders, steep ditches, or trees close to the roadway. Additionally, the low population density and sparse land use of rural communities can increase detection, response, and travel times for emergency services, reducing key factors in crash survivability. It typically takes more than twice as long for emergency services to arrive at a crash scene in a rural community compared to an urban community. Recommendations for developing a Local Road Safety Plan include: defining specific areas of emphasis to evaluate: eg, intersection safety, speed management, hazardous locations, and roadway/lane departures. Evaluation of specific hazards may include engineering evaluation to be sure the roads will meet the needs of heavier and more frequent truck traffic related to the CAFO.

158. United States Environmental Protection Agency. *Carcass Management of Non-Diseased Animals in Response to the Coronavirus Outbreak.*
Link: Carcass Management in Response to the Coronavirus (Covid-19) Outbreak

Help for producers and facilities with non-diseased carcass management during the current Coronavirus outbreak (COVID-19). Due to Covid-19, animal production and processing facilities are encountering challenges associated with certain livestock and poultry processing plant closures due to workforce and staffing issues related to the COVID-19 outbreak at those plants. As a result of these shutdowns, and other factors, some animal production facilities may need to depopulate by euthanizing animals. Unlike mortalities at normal rates, large-scale mortalities present challenges that are not part of the typical operation of these facilities. Operators are typically advised to have plans for emergency large-scale mortalities; for example, due to extreme weather or disease. However, those plans may be insufficient given the extensive challenges being faced at the current time.

159. United States Environmental Protection Agency. Sept 2017. *Eleven Years After Agreement, EPA Has Not Developed Reliable Emission Estimation Methods to Determine Whether Animal Feeding Operations Comply With Clean Air Act and Other Statutes.* 7-P-0396
Link: Eleven Years After Agreement

Until the EPA develops sound methods to estimate emissions, the agency cannot reliably determine whether animal feeding operations comply with applicable Clean Air Act requirements.

160. United States Environmental Protection Agency. *Exposure Assessment of Livestock Carcass Management Options During a Foreign Animal Disease Outbreak.* April 2018
Link: Exposure Assessment of Livestock Carcass Management
Evaluation of livestock carcass management options following a foreign animal disease outbreak. This assessment helps to inform a scientifically-based selection of environmentally protective methods. If carcasses cannot be managed immediately after death, the temporary carcass storage pile appears to be the most likely source to possibly expose nearby livestock. This assessment estimates livestock exposure to FMDv released from a temporary storage pile where carcasses are placed for 48 hours while further management is prepared. The assessment also considers seven well-established carcass management options with sufficient capacity for a large-scale mortality: on-site open burning (pyre), on-site air-curtain burning, on-site unlined burial, on-site composting, off-site fixed-facility incineration, off-site landfilling, and off-site carcass rendering

161. United States Environmental Protection Agency. *Handbook Groundwater and Well Head Protection.* EPAl625/R-94/001 September 1994
Link: 30004NCA.PDF (epa.gov)
Anyone responsible for delineating the boundaries of a wellhead protection area, Identifying and evaluating potential contaminants, and Identifying wellhead management options Will find the handbook useful. Most of this handbook does not require specialized training in hydrogeology. Basic math skills, including high school-level algebra, are required.

162. United States Environmental Protection Agency. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019.* May 2021 pages 5-1 to 5-59.
Link: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019
Agricultural activities contribute directly to emissions of greenhouse gases through a variety of processes. Chapter 5 of the report assesses methane (CH4) and nitrous oxide (N2O) emissions from enteric fermentation in domestic livestock, livestock manure management, rice cultivation, agricultural soil management, and field burning of agricultural residues; as well as carbon dioxide (CO2) emissions from liming and urea fertilization.

163. United States Environmental Protection Agency. *Literature review of contaminants in livestock and poultry manure and implications for water quality*. July 2013:1-137.
Link: http://ow.ly/mTDw308qwbZ
This EPA report on the environmental occurrence and potential effects of livestock and poultry manure related contaminants on water quality found that 60-70% of manure nitrogen and phosphorus may not be assimilated by the farmland where it was generated due to the increasing concentration of industrial animal production. The report also notes the variety of pathogens contained in livestock and poultry manure, as well as the potential for their spread to humans when surface and groundwater and food crops come into contact with manure through runoff, spills, and land-application of manure. It also refers to research indicating that antimicrobial use in livestock and poultry production has contributed to the occurrence of anti-microbial resistant pathogens in animal operations and nearby environments. The report also presents that manure discharge to surface waters can occur by various means and have deleterious effects on aquatic
life and contribute to toxic algal blooms harmful to animals, and to humans when exposed via contact with contaminated drinking water or recreational use of contaminated water.

164. United States Environmental Protection Agency, *National Management Measures to Control Nonpoint Source Pollution from Agriculture,* EPA 841-B-004, July 2003
Link: https://www.epa.gov/nps/monitoring-guidance-determining-effectiveness-nonpoint-source-controls.

This Guidance addresses design of water quality monitoring programs to assess impacts from nonpoint source pollution (including agriculture) and evaluate success of control practices and management measures. Since each situation is different, this guidance presents the theory and information needed to design monitoring programs tailored to particular situations.

165. United States Environmental Protection Agency. *NPDES Permit Writers' Manual for CAFOs.* February 2021
Link: NPDES Permit Writers' Manual for CAFOs

Provides information to National Pollutant Discharge Elimination System (NPDES) permit writers on permitting requirements for Concentrated Animal Feeding Operations (CAFOs). The information in the Manual may also be useful for inspectors, facility operators, and the general public. Under the Clean Water Act (CWA), it is unlawful to discharge any pollutant from a point source without an NPDES permit. The CWA defines point source to include "any discernible, confined, and discrete conveyance, including but not limited to any … concentrated animal feeding operation … from which pollutants are or may be discharged." Under the NPDES CAFO regulations, a CAFO that discharges must seek NPDES permit coverage.

166. United States Environmental Protection Agency. *Relation between nitrates in water wells and potential sources in the lower Yakima Valley, Washington state*. Washington, D.C., 2012.
Link: Relation between Nitrates in Water Wells and Potential Sources in the Lower Yakima Valley, Washington (epa.gov)

This study examined the effectiveness of various techniques to identify specific sources of high nitrate levels in residential drinking water well. Dairy waste was concluded to be a likely source of nitrate contamination in the wells due to isotopic data and contextual evidence such as the historical and current volumes of dairy waste in the area, lack of other potential sources of nitrogen in the area, and soil indicators.

167. United States Environmental Protection Agency. *Risk Assessment Evaluation for Concentrated Animal Feeding Operations.* May 2004: 1-124.
Link: US EPA Risk Management Evaluation For Concentrated Animal Feeding Operations

The National Risk Management Research Laboratory (NRMRL) developed a Risk Management Evaluation (RME) to provide information to help plan research dealing with the environmental impact of concentrated animal feeding operations (CAFOs). Methods of animal production in the U.S. have undergone fundamental changes in the last 30 years. The majority of meat, dairy, and poultry production has been concentrated into large facilities. Dairies with more than 2,000 cows and swine operations with more than 10,000 hogs are not unusual. Broiler houses with 50,000 birds are common. With the concentration of animals has come a concomitant concentration of manure production. One animal facility with a large population of animals can easily equal a small city in terms of waste

production. Current practices of waste handling often include minimal or no treatment before the wastes are disseminated into the environment. The RME was developed to provide characterization of the waste problem, and a description of common environmental stressors and their movement including the air transport of pollutants. Current risk management practices in the animal industry are described, along with treatment approaches such as anaerobic/aerobic digestion, constructed wetlands, and disturbed land reclamation. Finally, suggested areas for future research are presented to help focus planning for the near future.

168. United States Environmental Protection Agency. April 19, 2013. *SAB Review of Emissions-Estimating Methodologies for Broiler Animal Feeding Operations and for Lagoons and Basins at Swine and Dairy Animal Feeding Operations.*
Link: EPA-SAB-13-003
This Science Advisory Board (SAB) report responds to a request from the EPA's Office of Air and Radiation (OAR) to review and provide advice on scientific issues associated with development of Emissions-Estimating Methodologies (EEMs) at two types of animal feeding operations (AFOs): EEMs for barns or buildings at confined broiler AFO facilities and an EEM for open lagoons and basins at swine and dairy AFO facilities. EEMs are tools for estimating air pollutant emissions from industries where site-specific emissions data are not available.

169. United State House of Representatives - Select Subcommittee on Coronavirus Crisis. Coronavirus Infections and Deaths Among Meatpacking Workers at Top Five Companies Were Nearly Three Times Higher than Previous Estimate. October 27, 2021
Link: 2021.10.27 Meatpacking Report.Final_.pdf (house.gov)
Newly obtained documents from five of the largest meatpacking conglomerates, which represent over 80 percent of the market for beef and over 60 percent of the market for pork in the United States—JBS USA Food Company (JBS), Tyson Foods, Inc. (Tyson), Smithfield Foods (Smithfield), Cargill Meat Solutions Corporation (Cargill), and National Beef Packing Company, LLC (National Beef)—reveal that coronavirus infections and deaths among their meatpacking workers were substantially higher than previously estimated.

170. Wisconsin Attorney General. AG Kaul Announces $86,000 Agreement with Jon-De Capital, Inc. for Violations of Wisconsin's Wastewater Laws. October 1, 2021
Link: AG Kaul Announces $86,000 Agreement with Jon-De Capital

171. Wisconsin Circuit Court - St. Croix County Case no. 2019-000002. State of Wisconsin vs Emerald Sky Dairy. May 3, 2019.
Link: Circuit court St. Croix 2019-000002

172. Wisconsin Department of Agriculture Trade and Consumer Protection. Livestock Facility Siting Technical Expert Committee Four-Year Review of ATCP 51, April 23, 2019
Link: LivestockSitingTECReport2019.pdf (wi.gov)
The 2019 Technical Expert Committee (TEC) was convened as part of the Department of Agriculture Trade, and Consumer Protection's required four year review of the livestock facility siting standards under ch. ATCP 51, Wis. Admin. Code. The recommendations in this report reflect the consensus of the TEC on the issues presented for their consideration.

The committee's recommendations are arranged according to the following issues: Odor Management and Setbacks, Manure and Other Waste Storage, Runoff Management, Monitoring, Completeness Determinations and Permit Modifications, and Groundwater Protections.

173. Wisconsin Department of Agriculture Trade and Consumer Protection. Chapter ATCP 10. Animal Disease and Movement.
Link: Wisconsin Legislature: Chapter ATCP 10

174. Wisconsin Department of Agriculture Trade and Consumer Protection. Chapter ATCP 93.90 Livestock Facility Siting and Expansion
Link: Wisconsin Legislature: Chapter ATCP 93.90

175. Wisconsin Department of Agriculture Trade and Consumer Protection. Wi Admin. Code Ch. ATCP 51
Link: Wisconsin Legislature: Chapter ATCP 51

176. Wisconsin Department of Agriculture Trade and Consumer Protection. Animal Movement
Link: DATCP Animal Movement (wi.gov)
This information provides general rules for importing any animal into Wisconsin. Species-specific information and other references regarding the movement of animals are listed.

177. Wisconsin Department of Agriculture Trade and Consumer Protection. Runoff Risk Advisory Forecast.
Link: Runoff Risk Advisory Forecast (wi.gov)
The tool helps determine the potential for manure runoff from a field depending on weather conditions and soil temperature. Spreading manure when there is an elevated risk of runoff can send manure into streams and threaten water quality.

178. Wisconsin Livestock Facility Siting Rule modifies Wis. Admin. Code Ch. ATCP 51 (Final Draft Rule), October 24, 2019.
Link: ProposedATCP51FinalDraftRulePacket.pdf (wi.gov)
• Reflects revisions necessary to address the technical and implementation issues raised through three 4-year technical committee review processes, twelve statewide public hearings including verbal testimony from over 160 Wisconsin citizens and 465 written comments submitted to the department, as well as dozens of conversations with interested and potentially impacted parties to arrive at workable compromise to achieve multiple, diverse goals.
• Updates the water quality standards, including related Natural Resources Conservation Service (NRCS) technical standards, to ensure consistency with provisions in NR 151 and ATCP 50, including incorporation of the 2017 NRCS standard for waste storage structures, 2015 NRCS standard for nutrient management, the 2017 NRCS standard for waste treatment, and the 2016 NRCS standard for vegetated treatment areas.
• Modifies standards (subch. II of ATCP 51) consistent with the requirements in Wis. Stat. § 93.90(2), based on the technical recommendations of the 2014 and 2018 Technical Expert

Committees and public input. Key changes include modifications to setback and odor standards.

• Modifies the procedures (subchs. I and III of ATCP 51) that local governments must follow in issuing a siting permit under a zoning or licensing ordinance including application completeness determinations, permit modifications, and the use of checklists to monitor facility compliance.

• Modifies local permit application forms and worksheets to reflect changes in requirements and to ensure that they are clear, complete, and elicit information that documents compliance with applicable siting standards.

• Makes other changes, clarifications and updates as necessary to improve implementation of the siting rule, consistent with the requirements in Wis. Stat. § 93.90(2).

179. Wisconsin Department of Agriculture Trade and Consumer Protection. Memo on Polk County Swine CAFO ordinance. August 2020

Link: f3e1b58a-f0a9-42be-a7e5-023bb772e8a7.pdf

Wis. Stats 93.90(3) does not grant the authority to political subdivisions to disapprove a permit based on species. Therefore, it cannot regulate only those livestock facilities that house swine... The proposed ordinance requires compliance with several more stringent local standards, identified as Section 10.4.6(C)(2) criteria; a, b, c, d, e, g, i, j, k, l, m, p. These more stringent standards do not meet all of the conditions laid out by ATCP 51.10(3). If the county wishes to adopt more stringent local standards than those included in ATCP 51, it must base those standards on reasonable and scientifically defensible findings of fact adopted by the county's governing authority and clearly show that those standards are needed to protect public health or safety...

180. Wisconsin Department of Natural Resources. Beneficial Management Practices for Mitigating Hazardous Air Emissions. December 13, 2010

Link: Recommended Beneficial Management Practices

Report from the Agricultural Waste Air Emissions Advisory Group identifies and recommends suitable best management practices (BMPs) for the reduction of emissions of hazardous air pollutants from various types of livestock operations in Wisconsin. Report focuses on two hazardous air contaminants: ammonia and hydrogen sulfide. As part of the development of 30 BMPs specific to ammonia and hydrogen sulfide, air quality co-benefits and potential impacts to water quality were identified.

181. Wisconsin Department of Natural Resources. CAFO Applications within Surface Water Quality Management Areas (SWQMA) NR 243 – CAFO Factsheet #1

Link: NR 243 – CAFO Factsheet #1

CAFO permits do not prohibit applications of manure and process wastewater within the SWQMA. However, CAFOs must take additional precautions when applying manure or process wastewater within the SWQMA. One option when applying manure within the SWQMA is to maintain a 100-foot setback from navigable waters and their conduits. Another option is to implement practices equal to or better than the 100-foot setback. There are other options which an operation can use to reduce the 100-foot setback to 25 feet on fields that have been in long-term no-till.

182. Wisconsin Department of Natural Resources. NR 151 Rule Changes for Nitrate
Link: NR 151 rule changes for nitrate

183. Wisconsin Department of Natural Resources NR 243 CAFOs, Water Permits and NR 243
Link: CAFOs, water permits and NR 243

184. Wisconsin Department of Revenue Case No: 16-76-01
Link: WI-DOR-Tax-Appeal-Findings-and-Order
Property taxes were lowered by 27% ($60,000) for a Green County, Wisconsin neighbor to a 2,400-head hog finisher (just under 1000 animal units). This is shown in the Findings of Fact and Order from Todd Knutson's property tax appeal in Green County, Oct 2016.

185. Wisconsin's Green Fire. High Capacity Well Impacts on Wisconsin Lakes, Streams, and Wetlands. June 3, 2020
Link: High Capacity Wells
Wells pump groundwater. In Wisconsin, groundwater is usually well-connected to local lakes, streams, and wetlands, so when groundwater is pumped from wells, water levels in aquifers (the geology that holds groundwater) drop, as do the levels of connected lakes and wetlands and the flows of connected streams. The effects of pumping on fish, wildlife, and public water rights are a matter of degree: a little pumping may have a barely perceptible impact, but larger amounts can be devastating. A high capacity well as defined in Wisconsin statutes is one with a "… capacity to withdraw more than 100,000 gallons [of groundwater] per day…" or that "… together with all other wells on the same property, has a capacity of more than 100,000 gallons per day." Wisconsin has some 9500 wells capable of pumping more than 100,000 gallons per day, and only a handful were evaluated for their impacts on lakes, streams, and wetlands before receiving regulatory approval. High capacity well pumpage is typically about 250 billion gallons per year (reported for 2013, a fairly average weather year), with roughly 40% attributable each for agricultural irrigation and municipal use, and lesser amounts for industry, stock watering, mining, and others.

186. Wisconsin Legislative Audit Bureau. Wastewater Permitting and Enforcement, Report 16-6, June 2016.
Link: Wastewater Permitting and Enforcement DNR June 2016
The Wisconsin DNR struggles to keep up with the growth of CAFOs in Wisconsin from 135 in 2005 to 319 in 2020. For example, a 2016 study by the Legislative Audit Bureau of the WPDES program found that one-third of the CAFOs were operating under expired permits. In 2020, 91 (28%) CAFOs are operating under expired permits.

187. Wisconsin State Legislature. Chapter NR 151 Runoff Management
Link: Wisconsin Legislature: Chapter NR 151

188. Wisconsin Supreme Court Case No.: 2018AP59, July 8, 2021
Link: WI Supreme Court - Clean WI vs Wi DNR - High Capacity Wells
Court ruled that the DNR must exercise its authority to protect Wisconsin's water resources. Case looked at the impact of a controversial 2011 law known as Act 21 on the DNR's ability to use its permitting process to protect water resources. Centered around eight high-capacity well permits issued by the DNR in the Central Sands region

of the state for large-scale agriculture irrigation. Clean Wisconsin and co-litigant Pleasant Lake Management District challenged those permits, pointing to DNR's own statements that the wells would harm nearby lakes and streams. The Wisconsin Legislature and industry groups intervened, arguing that Act 21 prevented the DNR from taking steps through its permitting process to keep groundwater and waterways from harm. DNR changed its position shortly after the election of Governor Tony Evers to support Clean Wisconsin's challenges.

189. Wisconsin Supreme Court Case No.: 2016AP1688, July 8, 2021
Link: WI Supreme Court - Clean WI & MEA vs Wi DNR & Kinnard - Groundwater Monitoring

Court ruled that the DNR must exercise its authority to protect Wisconsin's water resources. Case looked at the impact of a controversial 2011 law known as Act 21 on the DNR's ability to use its permitting process to protect water resources. Case involved a wastewater discharge permit issued by the DNR in 2012 for Kinnard Farms, a large dairy operation in Kewaunee County. Clean Wisconsin and co-litigant Midwest Environmental Advocates (MEA) argued the DNR should have required offsite groundwater monitoring and imposed an animal unit limit as conditions of its wastewater permit renewal to reduce the risk of manure contamination of nearby drinking water wells. The Wisconsin Legislature and Kinnard Farms dairy intervened, arguing that Act 21 prevented the DNR from taking steps through its permitting process to keep groundwater and waterways from harm. DNR changed its position shortly after the election of Governor Tony Evers to support Clean Wisconsin and MEA's challenges.

190. Wisconsin Supreme Court Case No.: 2016AP1688, July 8, 2021
Link: WI Supreme Court - Clean WI & MEA vs Wi DNR & Kinnard - Groundwater Monitoring

191. Wisconsin Towns Association. Comments on Wisconsin Livestock Facility Siting – Draft Rule ATCP 51. 2019 pages 1-8.
Link: DATCP Documents

Thank you for authorizing public comment on Draft Rule ATCP 51 and for allowing us to testify here today. The proposed rules bring consistency and clarity to the law and ensure that standards are based on current scientific research and findings. We applaud the Board for demonstrating a willingness to engage the public and for its efforts at serving the broad needs of all Wisconsinites.

Media Articles

192. Agweek TV. JBS Pork Plant Euthanizing Market Hogs. April 29, 2020
Link: AgweekTV: JBS Pork Plant Euthanizing Market Hogs - YouTube

193. Buntjer, Julie. JBS begins euthanizing hogs. *AgWeek* April 29, 2020
Link: JBS begins euthanizing hogs at Worthington plant | Agweek

The process of euthanizing market-weight hogs began Wednesday morning, April 29, at the JBS pork processing facility in Worthington, but at a far lower capacity than the 13,000 estimated to be handled by the plant.

194. Clemons, Michelle. About 4,000 swine killed in barn fire near Mondovi. *WEAU-13*. March 13, 2019

Link: About 4,000 swine killed in barn fire near Mondovi

On Wednesday, March 13, 2019 at about 5:40AM the Buffalo County Sheriff's Office received a report of a large hog barn on fire at Holden Farms, located at W20 Gonty Road in the Town of Naples, east of Mondovi.

195. Egan, Dan. Changes in America's dairy land foul the waters of Green Bay. *Milwaukee Journal Sentinel.* September 2, 2021

Link: Changes in America's Dairyland foul the waters of Green Bay (jsonline.com)

196. Kremer, R. DNR Investigating 'Large' Manure Spill at St. Croix CAFO, Spill Wasn't Reported Until 3 Months After Leak. *WPR.* Apr 13, 2017

Link: DNR Investigating 'Large' Manure Spill At St. Croix CAFO

The Department of Natural Resources says it's investigating a large manure spill in St. Croix County that happened in December but wasn't reported until March 29.

197. Moran, Tim. 12,000 Pigs Killed In Minnesota Barn Fire a 'Tragedy'. *Patch* May 20, 2021

Link: 12,000 Pigs Killed In Minnesota Barn Fire A 'Tragedy'

Trucks from nine fire departments responded to the Woodville Pork farm on 368th Avenue in Waseca Sunday night, taking several hours to fully put out the barn fire that killed the pigs, KEYC and others have reported. Waseca Fire Chief Jason Forshee told the news station about 9,000 piglets and about 3,000 sows died in the fire. The cause of the fire hadn't been determined by Thursday, and Marshall Radio said it could be several days before it's determined. Farming experts in the area have said the lack of rain, coupled with high winds, have caused other farm building fires, KEYC reported.

198. Narishkin, A, Cameron, S, Barranco, V. Why 1 million pigs could be euthanized due to COVID-19-related supply chain issues. *Business Insider*. June 25, 2020

Link: Why 1 Million Pigs May Be Euthanized

Beginning in April 2020, the US experienced a meat shortage and unprecedented meat prices. That's because COVID-19 outbreaks in at least 167 meat-processing plants forced almost 40 plants to close. In an already compact industry, any one plant closure strands millions of pigs at farms. Could this break in the supply chain been avoided? Agricultural economist Jayson Lusk says automation in meat-processing plants could be one solution. Another? Smaller, vertically integrated farms, like Belcampo Meat Co. in Northern California.

199. National Pork Producers Council. Statement on Implementation of Defense Production Act. April 29, 2020.

Link: NPPC Statement on Implementation of Defense Production Act

President Trump last night invoked the Defense Production Act (DPA) to extend much-needed federal support to the U.S. pork production system. By triggering the DPA, the federal government will prioritize the continuity of pork processing plant operations. The following statement may be attributed to Howard "A.V." Roth, NPPC president and a producer from Wauzeka, Wisconsin.

200. Neeley, Todd. Farms Exempt from Emissions Reporting. *Ohio Country Journal June 5, 2019*

Link: Farms Exempt From Emissions Reporting – Ohio Ag Net|

Farms are now exempt from reporting air emissions from animal waste after the EPA on Tuesday finalized a new rule amending the emergency release notification regulations under the Emergency Planning and Community Right-to-Know Act, or EPCRA.

201. Swine Cast, Persistent PRRS in Finishing Pigs Raises Concerns. September 3, 2021

Link: SwineCast 1168, Persistent PRRS in Finishing Pigs Raises Concerns

Various PRRS strains, including 144 lineage C, remain dangerously active in the Midwest pig production belt, despite a hot, dry summer. Three veterinarians describe what they are seeing and doing to reverse PRRS-driven losses. Dr. Deb Murray (New Fashion Pork), Dr. Kat Wood (Christensen Farms), and Dr. Ryan Strobel (Swine Vet Center), have a lively and timely discussion with the At the Meeting team (Dr. Montserrat Torremorell - College of Veterinary Medicine, University of Minnesota, Dr. Gordon Spronk - Pipestone Veterinary Services, and Dr. Tom Wetzell - Swine Veterinary Consultant).

202. Weingarten D, Davis T: A Minnesota mega-dairy is transforming Arizona's aquifer and farming lifestyles. *High Country News.* August 4, 2021

Link: A mega-dairy is transforming Arizona's aquifer and farming lifestyles (Sucked Dry) (hcn.org)

Minnesota's Riverview Dairy has deep pockets and long straws. Hundreds of people, mostly low- to middle-income, living in Arizona's high-desert landscape whose groundwater is rapidly disappearing as water is pumped to grow alfalfa, corn, nuts, wheat and barley. Kerkhoven, Minnesota, farmers Jim and LeeAnn VanDerPol have watched as their community lost many of its residents following decades of shrinking agricultural margins and increased corporate consolidation in the livestock sectors. Their former neighbors have been replaced by the five huge Riverview facilities within 10 miles of their house. In Chokio, Minnesota, about an hour away, locals successfully fought to keep Riverview from building a 9,200-cow dairy, citing concerns about pollution and groundwater decline.

203. Ziemba, L. Yakima Case a Bellwether of Future Challenges Ahead. June 15, 2015 *Hoards*

Link: Yakima case a bellwether of future challenges ahead (hoards.com)

For decades CAFOs thought the federal Resource Conservation and Recovery Act (RCRA), applied to garbage landfills. That changed in 2015, when a federal judge in Washington State ruled that RCRA did apply to CAFO waste as part of a lawsuit against the 7,000 head Cow Palace. Settlement required mitigation measures including manure

storage liners, monitoring wells, compliance monitoring and a reduction in the use of manure as fertilizer.

Other

204. *Town of Trade Lake, Wisconsin Source Water Protection Plan,* Andrew Aslesen, Sourcewater Specialist, March 2020.

205. USGS, *Hydrogeologic Characteristics of the St. Croix River Basin, Minnesota and Wisconsin: Implications for the Susceptibility of Ground Water to Potential Contamination,* USGS Scientific Investigations Report 2007-5112. https://pubs.usgs.gov/sir/2007/5112/#fig1

206. Proposed Draft of the Amended Trade Lake Operational Ordinance

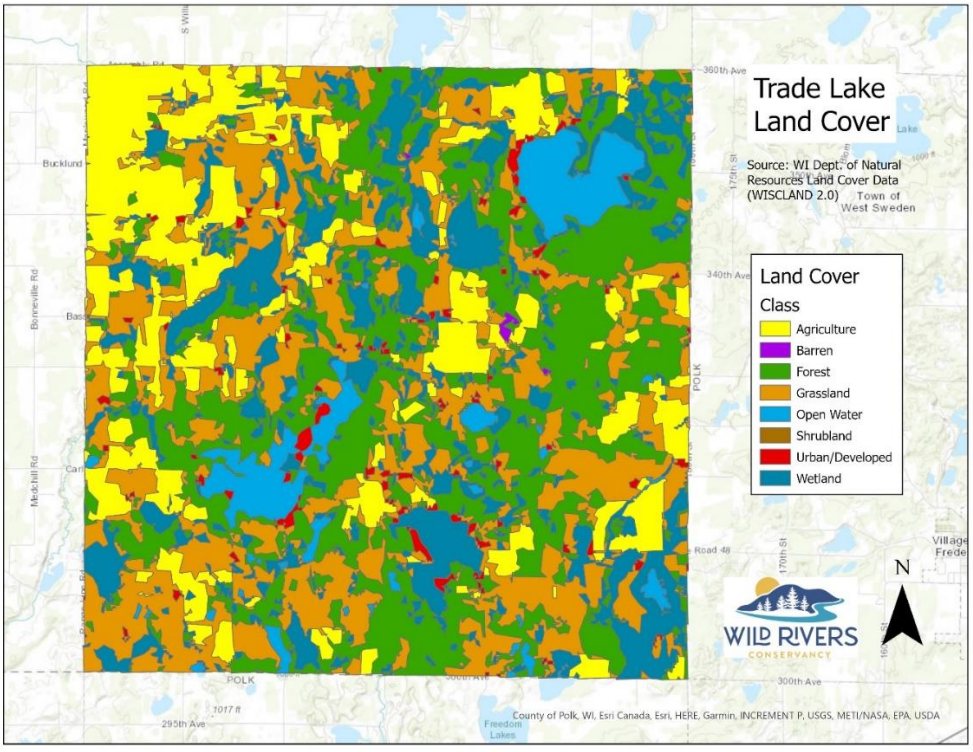
APPENDIX B.

TOWN OF TRADE LAKE
BURNETT COUNTY, WISCONSIN

Map 1. Land Cover

Data for the Town of Trade Lake extracted from WiscLand 2 shows the approximate land cover as follows:

Land Cover - WiscLand (NOT land use)	Percent
Agriculture	19%
Barren	0%
Forest	29%
Grassland	27%
Open Water	6%
Urban/Developed	2%
Wetland	17%

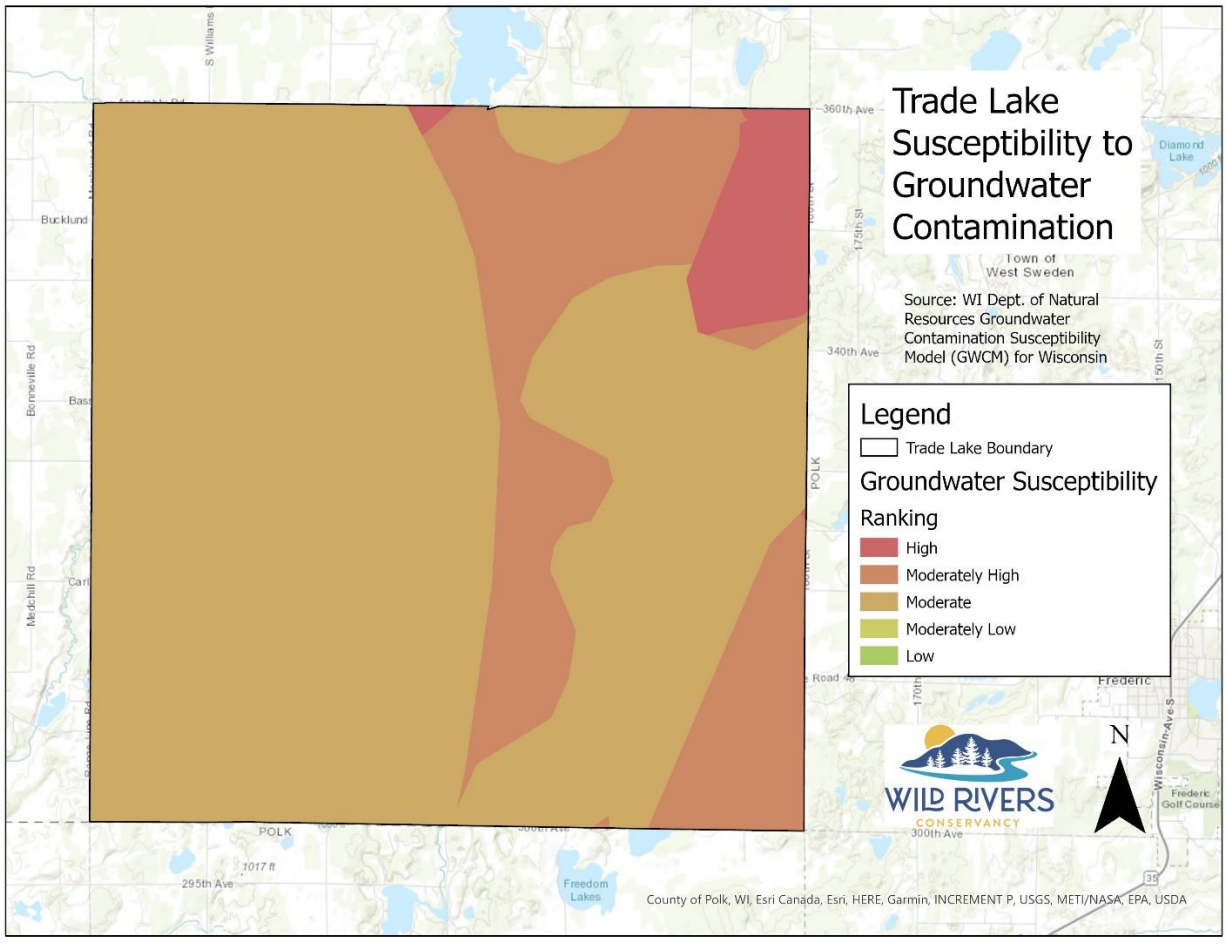


Source: Wisconsin Land Cover Data (WISCLAND 2.0) https://dnr.wisconsin.gov/maps/WISCLAND

Map 2. Groundwater Susceptibility to Contamination Model

The Town has a vulnerable landscape with shallow soils, high water table and gravel formations that make large areas susceptible to groundwater pollution. Five factors contribute to groundwater susceptibility, including: type of soil, bedrock and materials between soil and bedrock; depth to bedrock; and depth to groundwater. Data from the Department of Natural Resources Groundwater Susceptibility Model was divided into five evenly spread categories ranging from high to low. Of the town's total acreage approximately 4% is ranked high susceptibility to contamination, 20% moderately high, 76% moderate, 0% moderately low, and 0% ranked low susceptibility.

Groundwater Susceptibility Ranking	
Ranking	**Percent of Total**
High	4%
Moderately High	20%
Moderate	76%
Moderately Low	0%
Low	0%

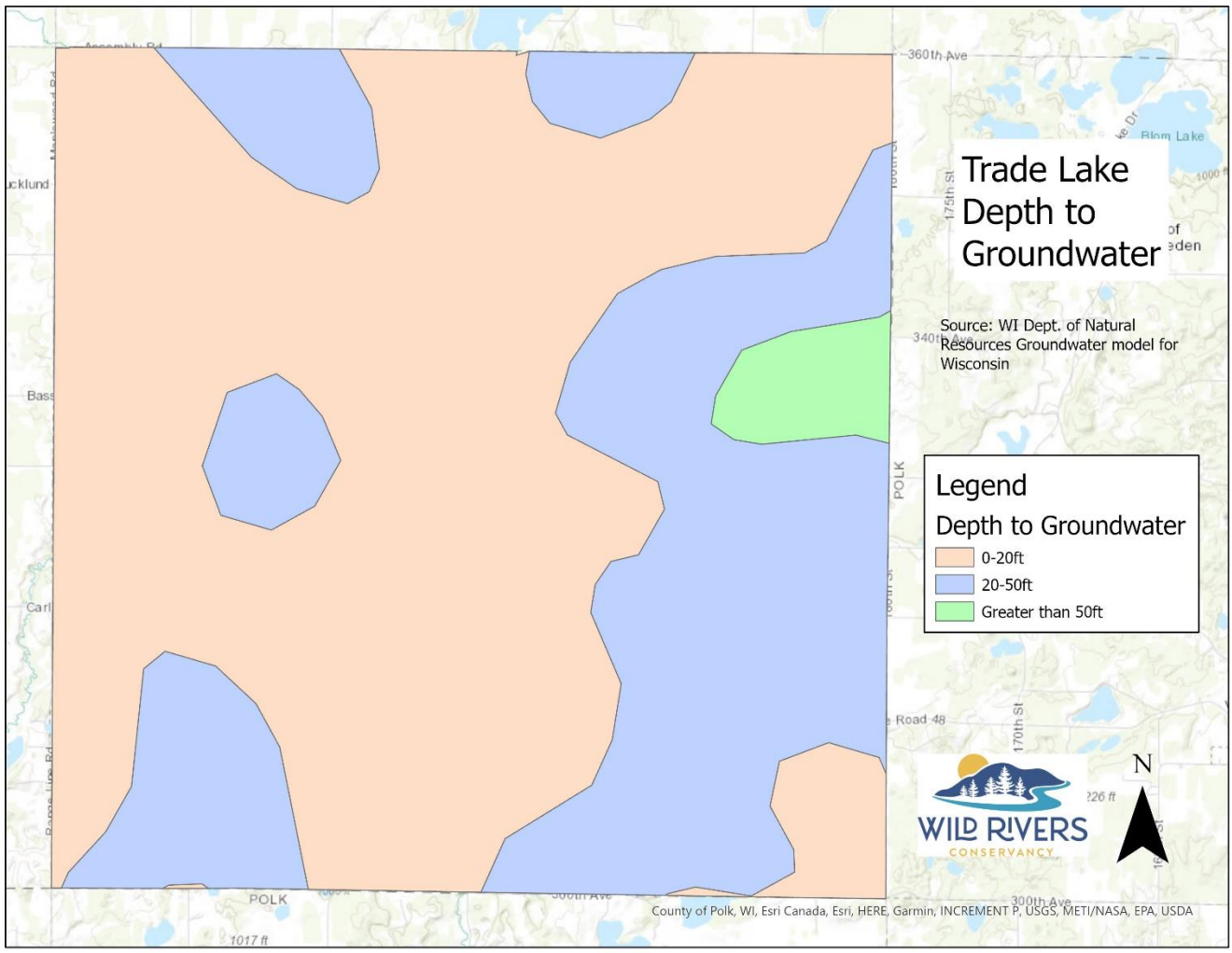


Source:
Wisconsin Department of Natural Resources. (2008). Groundwater Contamination Susceptibility Model (GCSM), Wisconsin 2008. https://geodata.wisc.edu/catalog/CF9E8298-63E5-43C7-9E8A-DEDCB93C1519

Map 3. Depth to Groundwater

Approximately 63% of Trade Lake's total acres have groundwater within 20 feet of the land surface. Approximately 97% is within 50 feet of the land surface.

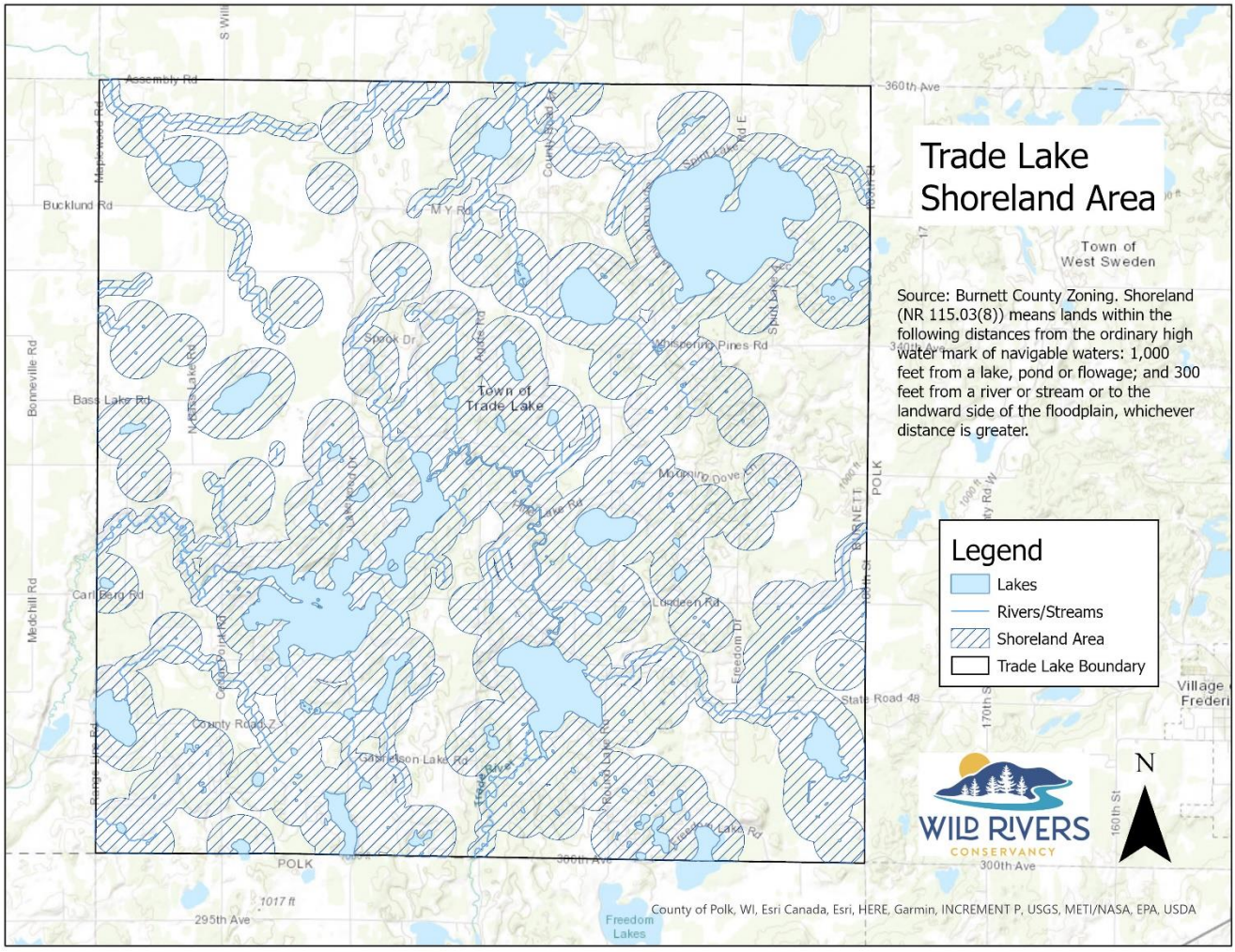
Depth to Groundwater	
1-20ft	63%
20ft - 50ft	34%
Over 50ft	3%



Source:
Wisconsin DNR Groundwater Susceptibility Model, Depth to Groundwater: https://data-wi-dnr.opendata.arcgis.com/datasets/wi-dnr::gcsm-water-table-depth/about

Map 4. Shoreland Area Trade Lake

Approximately 63% of Trade Lake is within shoreland area.



Source: Burnett County Ordinances, Chapters 30 and 45.

Map 5. Fragile Soil Index

WSS provides soil data (Soil Survey Geographic Database) and information produced by the National Cooperative Soil Survey. It is operated by the USDA – NRCS and provides access to the largest natural resource information system in the world. Soil surveys can be used for general farm, local and wider area planning.

https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

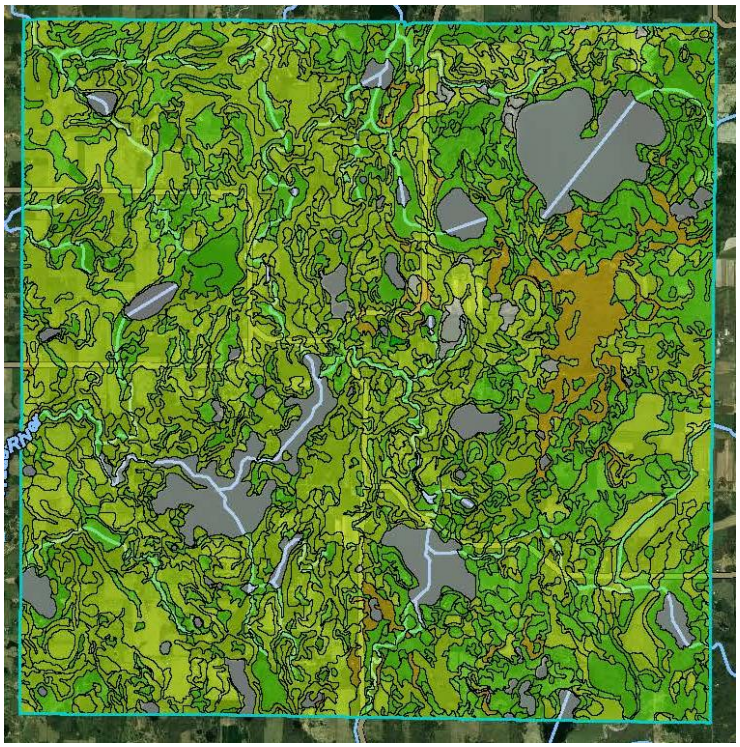
Fragile Soil Index:

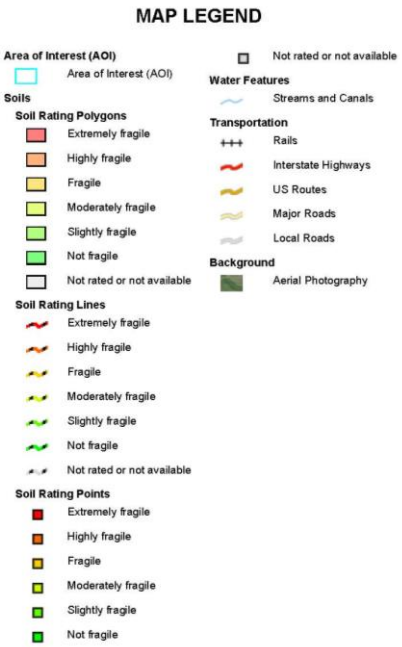
Fragile soils are those that are most vulnerable to degradation. They are easily degraded and are highly susceptible to erosion with low resilience. They are characterized as having low organic matter contents, low water-stable aggregates and low soil structure. Fragile soils are generally located on sloping ground, have sparse plant cover and tend to be in arid and semiarid regions. A fragile soil index interpretation was developed to rate soils based on their fragility. The index can be used in conservation and watershed planning to assist in identifying soils and areas with greater vulnerability to degradation.

Finding #10:

Of Trade Lake's total acres:

- 0% Extremely to Highly Fragile
- 3.8% Fragile
- 52.4% Moderately Fragile
- 34% Slightly Fragile
- 0.1% Not Fragile
- 9. 7% Not Rated





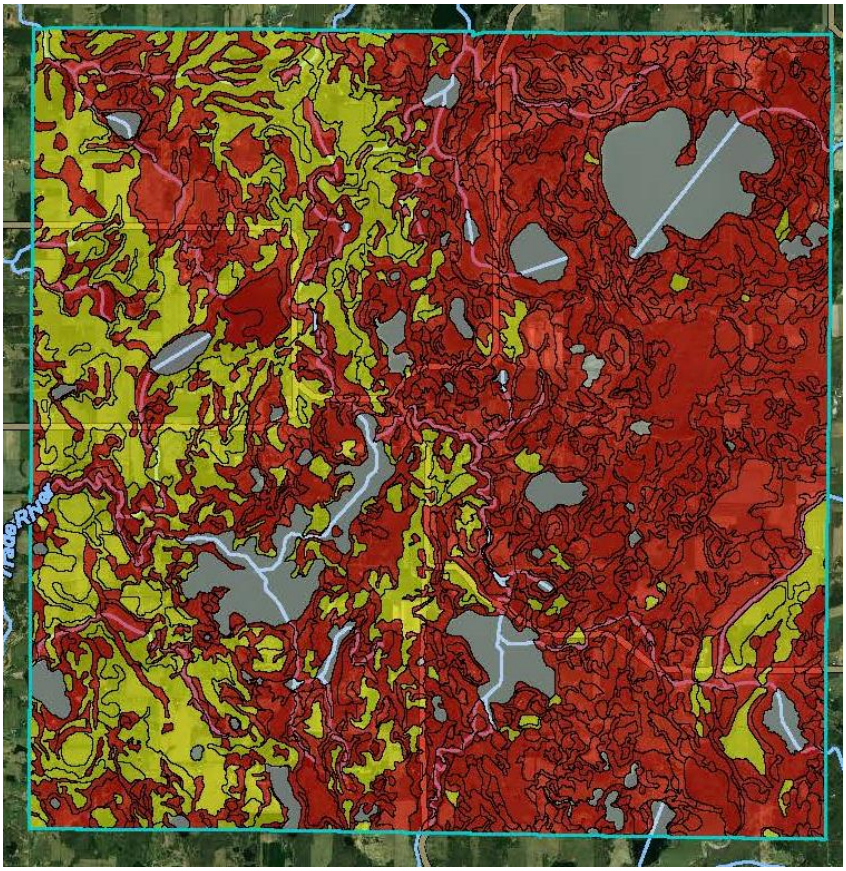
Map 6. Manure and Food-Processing Waste

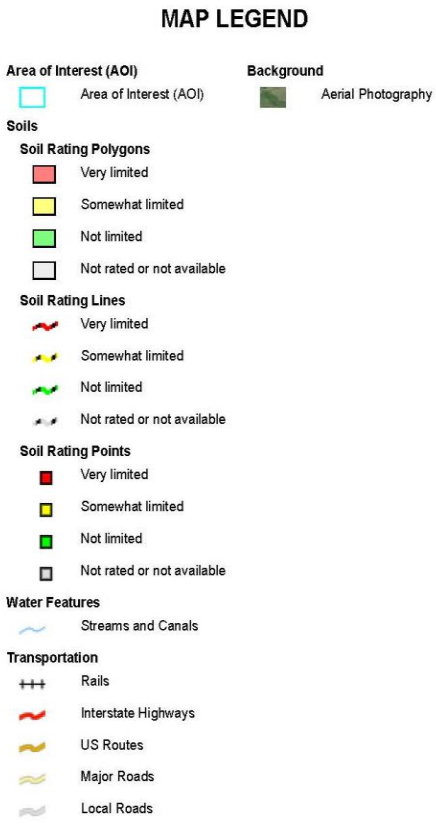
The application of manure and food-processing waste not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include saturated hydraulic conductivity (Ksat), depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, soil erosion factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Finding #11:

Of Trade Lake's total acres:

- **65.5% Very Limited** – indicates that soil has one or more features that are unfavorable for the specific use. Limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.
- **25.3% Somewhat Limited** – indicates that the soil has features that are moderately favorable for specified use. Limitations can be overcome or minimized by special planning, design, or installation.
- **0% Not Limited**
- **9.1% Not Rated**



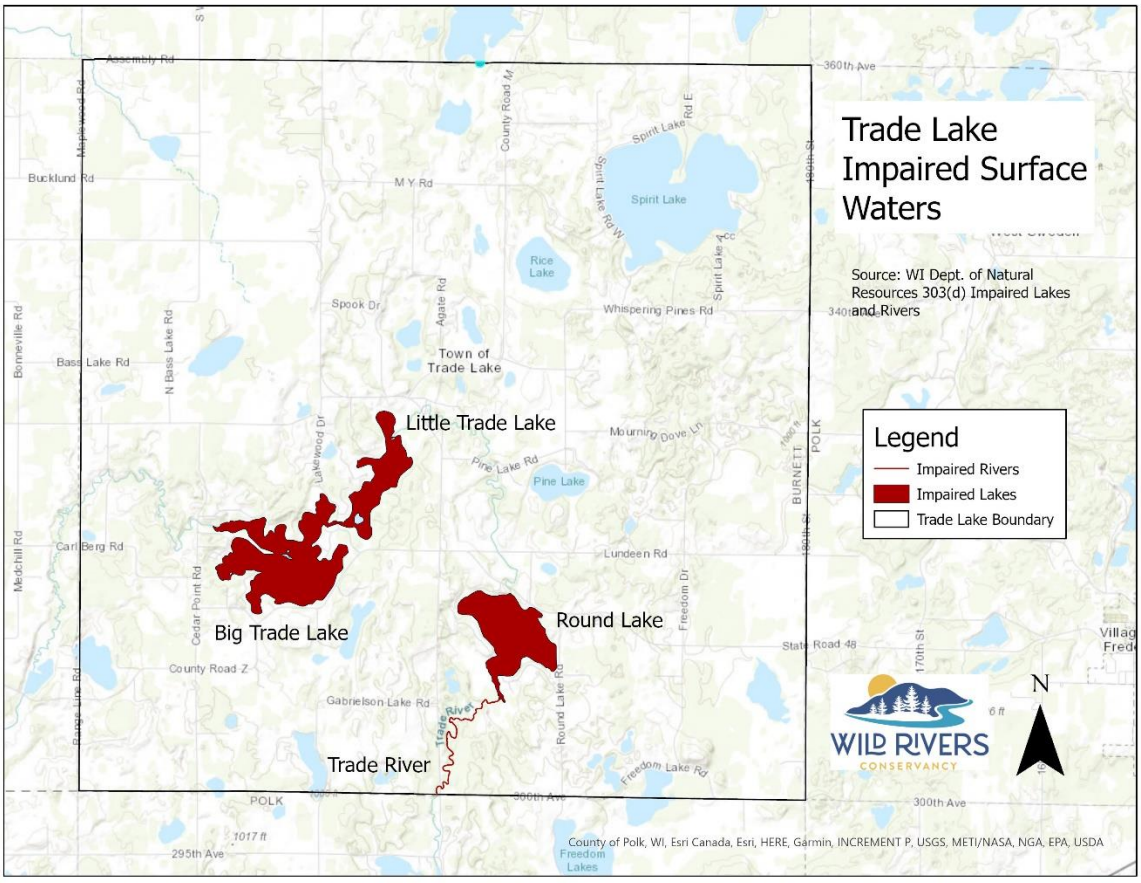


Map 7. Impaired Waters

Excess nutrients from non-point source runoff leads to surface water quality degradation of local lakes and streams. According to the 2012 Lake St. Croix TMDL Implementation Plan, Burnett County is the fourth highest contributor of phosphorus runoff in the St. Croix Watershed. Subsequently, it has a phosphorus reduction of over 72,000 lbs/yr required by the State of Wisconsin and U.S. Environmental Protection Agency to meet Lake St. Croix TMDL goals. Trade Lake has 2.77 miles of impaired rivers and three impaired lakes, all for excess phosphorus.

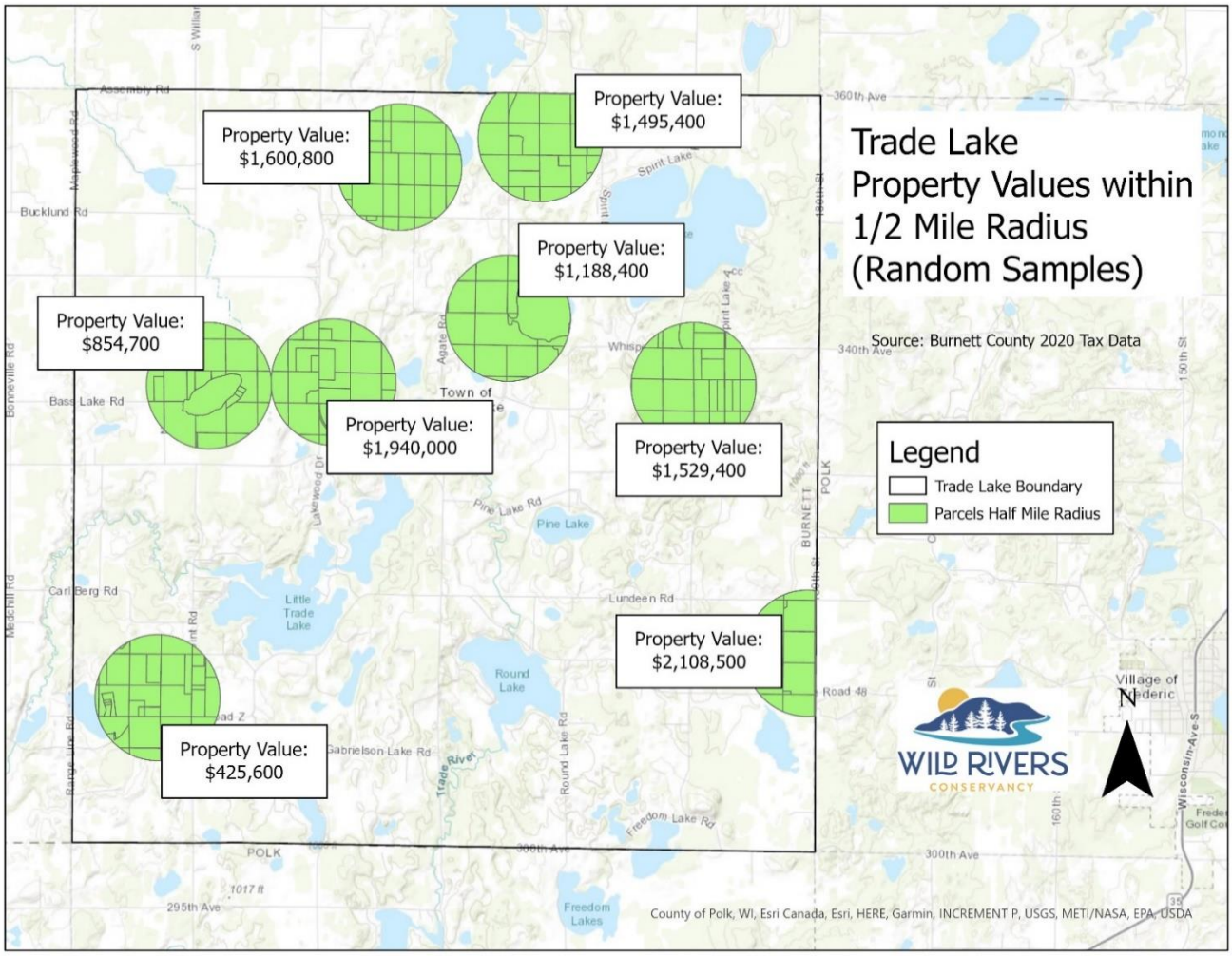
Lakes Impaired for P	Acres
Big Trade Lake	73
Little Trade Lake	37
Round Lake	150

Rivers Impaired for P	Miles
Trade River	2.77



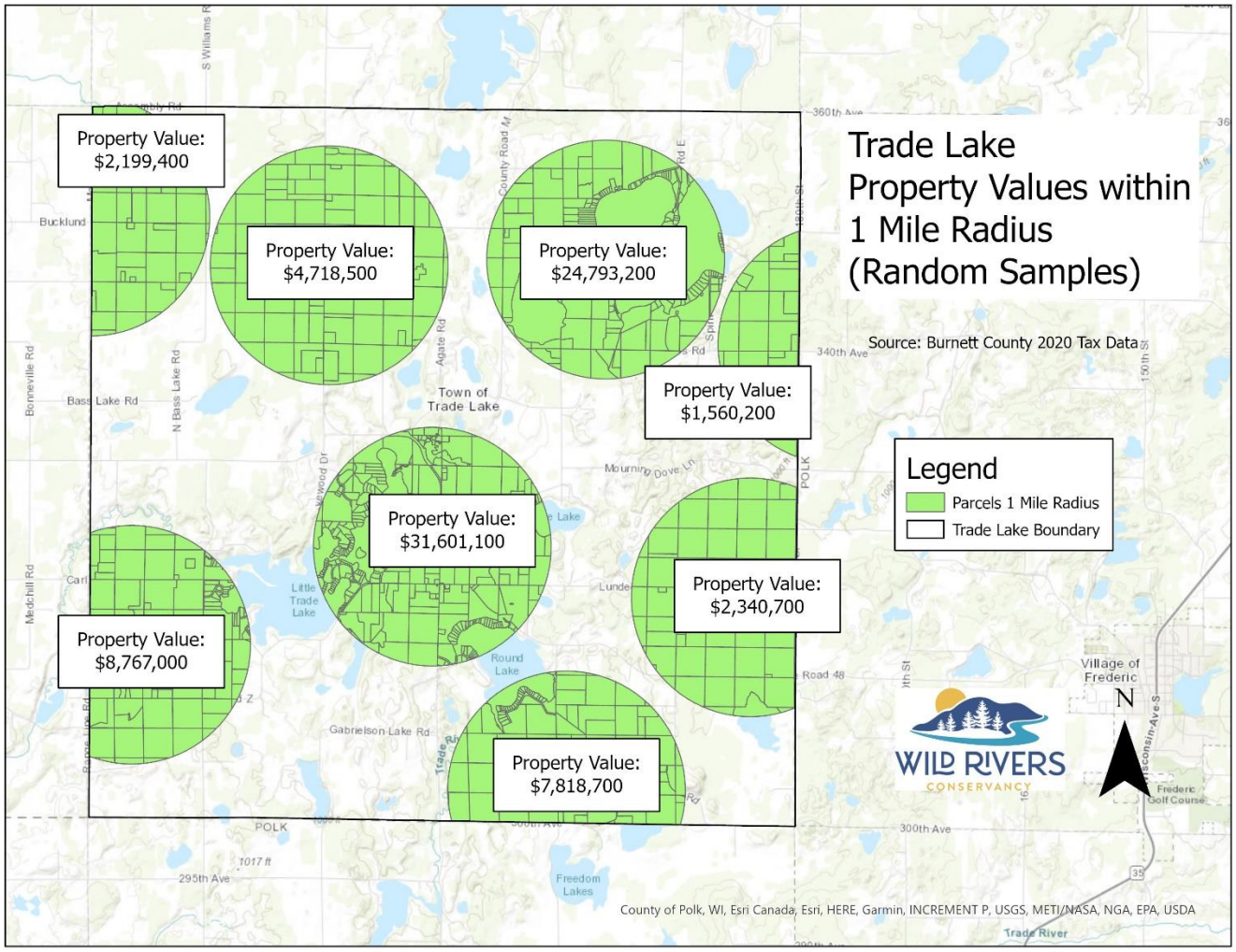
Source:
Wisconsin DNR 303(d) Impaired Lakes 2021: https://data-wi-dnr.opendata.arcgis.com/datasets/wi-dnr::303d-impaired-lakes-listed/about
Wisconsin DNR 303(d) Impaired Rivers and Streams 2021: https://data-wi-dnr.opendata.arcgis.com/datasets/wi-dnr::303d-impaired-rivers-and-streams-listed/about

Map 8. Property Tax Values Within 0.5 mile radius of 8 Randomly Selected Potential CAFO Sites



Source: 2020Wisconsin County Parcel Data – Burnett County, WI - https://www.sco.wisc.edu/parcels/data-county/

Map 9. Property Tax Values within 1 mile radius of 8 Randomly Selected Potential CAFO Sites



Source: 2020Wisconsin County Parcel Data – Burnett County, WI - https://www.sco.wisc.edu/parcels/data-county/