KEEPING OF ANIMALS

Background and Policy Recommendations of the Washington State Board of Health for Revising WAC 246-203-130

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TABLE OF CONTENTS

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SUMMARY

In 2009 the State Board of Health (Board) received a petition to revise its rule on the Keeping of Animals, WAC 246-203-130. Work on the rule stalled and the Board devoted time to learning about issues and impacts of large animal feeding operations and related regulatory programs.

Board staff also initiated research on the health effects of nitrates in drinking water. This paper completes that work, broadening the scope and discussion of environmental health concerns associated with manure and animal feeding operations, and adding a description of the state regulatory structure to inform Board recommendations on the appropriate fit and role of its rule.

Among other powers and duties of the Board, RCW 43.20.050(2)(c) authorizes the Board to "adopt rules and standards for prevention, control, and abatement of health hazards and nuisances related to the disposal of human and animal excreta and animal remains." The Keeping of Animals rule focuses on animal excrement. The Board updated and recodified its rule on the disposal of dead animals in 2007 as WAC 246-203-121.

Poorly managed livestock manure and other domestic animal waste presents many human health and environmental health risks. National trends toward fewer, larger, and more industrialized livestock operations has resulted in concentrated food production and regionally higher levels of surface water, groundwater, and air pollution from manure and large animal feeding operations. Emissions and discharges can affect neighboring properties, pollute shellfish growing waters and drinking water aquifers, and can contribute to other cascading ecosystem effects. Other pollution sources contribute to these effects as well.

Photo Credit: Washington Department of Agriculture

Regulation of livestock manure, commercial animal feeding operations, and other domestic animal waste in Washington to protect water and air quality is framed mainly around the following:

- Licensed dairies by the Washington State Department of Agriculture (WSDA);
- Permitted discharges of Concentrated Animal Feeding Operations (CAFOs) by the Washington State Department of Ecology (Ecology) and WSDA;
- Nonpoint source pollution by Ecology;
- Nonpoint pollution, nuisance, and agricultural land use by some local governments; and
- Air emissions of large animal feeding operations by Ecology and local air agencies.

Numerous other tools and programs complement this regulatory framework to help advance good manure management and animal waste practices to protect public health and water resources.

Board policy recommendations on the Keeping of Animals rule aim to complement the newer and more specific regulatory roles and authorities of the state's established programs. The Board's unique authority is best suited to local regulation of smaller-scale activities and practices involving the handling, storage, and disposal of livestock manure and other domestic animal waste that present a clear health, sanitation, or nuisance problem.

This approach reflects the scale and intent of the Board's original rule, statutory authority, and the role and resources of the Board and local health jurisdictions. However, the rule should not necessarily be limited in scale and could appropriately be applied to larger operations and impacts when needed.

The rulemaking process should be used to discuss and determine how best to design and scale the rule's applicability to address these needs. Along with work refining the scope and scale of regulated activities, the rulemaking may explore standards defining and documenting health hazards and nuisance, standards and practices to prevent and remedy problems, and methods for property access, compliance, and enforcement.

Complementing work on the rule, the Board will continue to play a role and provide a forum for monitoring the companion regulatory programs, supporting key policy initiatives to improve the programs, and addressing environmental health concerns associated with manure management and animal feeding operations.

INTRODUCTION

This paper provides context and sets a framework for updating and amending WAC 246-203-130, Keeping of Animals, authorized by state statute in RCW 43.20.050(2)(c).

The paper gives background on the rule followed by discussion of environmental health concerns associated with manure (nutrient) management and the corresponding state regulatory structure. Environmental Health is the interrelationship between human health and well-being and the environment.

Information on environmental health concerns helps explain the need for effective management of farm animal manure and other domestic animal waste, and analysis of the regulatory structure helps identify needs and opportunities to reshape the animal-keeping rule to fill a meaningful niche in that structure. The paper closes with a series of policy recommendations by the Board, setting direction for the rule update and related work.

Key parts of the paper focus on concentrated livestock production, animal feeding operations, and related impacts because of their scale and the Board's interests and past work on these issues. However, bear in mind that Board authority is broad as it pertains to the proper handling of domestic animal waste to address and prevent nuisance situations and impacts to health and sanitation. The purpose of the following analysis is to help determine how best to apply this authority in revising the Keeping of Animals rule.

Photo Credit: Washington Conservation Commission

HISTORY AND BACKGROUND

Keeping of Animals, WAC 246-203-130, is a long-standing Board rule, codified as Washington Administrative Code in 1960 with language dating to the 1920s and '30s (WSBOH 1927, 1931, 1936). Obviously much has changed since then and advances in programs and regulations on animal keeping and manure management have far outpaced the rule, raising questions about the rule's use and relevance.

The animal-keeping rule is one section in the Board's rules on General Sanitation, chapter 246-203 WAC, covering such issues as spitting, piggeries, nuisance, disposal of dead animals, and use of common cup and common towel.

The brief animal-keeping section: (1) prohibits people or companies from creating nuisance with animal keeping or sheltering; (2) mentions contrasting manure handling practices in populous districts, farms or isolated premises, and dairy farms; and (3) prohibits manure handling that can harm drinking water sources.

It's an old code with language that doesn't fit other current codes and programs. However, it implements valuable Board authority ensuring proper handling of manure and other domestic animal waste to protect health and sanitation, prevent and abate nuisance, and protect water quality and drinking water supplies.

The authority is referenced in some local codes but the outdated language raises questions and has little practical application in today's regulatory scheme for animal keeping and management of manure and other animal waste in Washington.

In 2009, local jurisdictions in Clark County fielded a complaint involving small-scale manure handling practices on a property. Ensuing work by the local health jurisdiction and conservation district drew attention to the animal-keeping rule and raised questions about its use and enforcement.

The Board received a petition from the Washington Association of Conservation Districts to amend the rule and learned other stakeholders were also interested in work on the rule. The Board filed a CR-101, Preproposal Statement of Inquiry (WSR 09-17-132), to evaluate ways to clarify the rule's scope and intent, update requirements for best management practices (BMPs), and ensure proper fit in the current legal structure regulating livestock manure and animal waste.

State moratoria on rulemaking delayed work on the rule until 2013. While initially aiming to fashion a relatively simple amendment, strongly contrasting input led staff and the Board to spend time studying the issues and related management programs.

The Board received a briefing by numerous agencies and interests in 2014. Due to staff turnover, further analysis of the issues, limited resources, and competing demands, the work stalled. The Board received updated briefings in early 2017 on the state Dairy Nutrient Management Program (DNMP) and the Concentrated Animal Feeding Operation (CAFO) General Permit.

Board staff again picked up work on the rulemaking project in 2017. This paper helps reset and restart work on the rule in 2018 with fresh policy direction from the Board.

ENVIRONMENTAL HEALTH CONCERNS WITH LIVESTOCK MANURE AND ANIMAL FEEDING OPERATIONS

Livestock manure poses numerous risks and concerns for environmental public health. The material is rich in nutrients, carbon, phosphorus, pathogens, and other compounds (including pharmaceuticals), and concentrated animal feeding operations produce a suite of by-products that can impact water and air quality (CRS, 2014; NALBOH, 2010; NRC, 2003; USEPA, 2004). The nutrient-rich material is viewed as a valuable resource if properly processed and managed as a crop fertilizer and soil amendment. However, even if manure contained only beneficial nutrients, excess quantities in limited areas can present real problems. In excess, the nutrients and other compounds in manure can damage—not improve—soil fertility and may pollute nearby waters (USEPA, 2004). **Figure 1** illustrates and summarizes key pathways and effects of water and air pollutants from farm animal manure and concentrated feeding operations. On a smaller scale, other domestic animal waste can contribute to many of these same effects. And while not depicted in the diagram, disease can also occur and spread from direct contact with animals and animal waste (Luna et al., 2018).

Regardless of the type or size of operation, poorly managed manure can create nuisance situations; can contaminate surface water via runoff, subsurface flow, or direct discharge; can leach into groundwater; and can disperse into the air as gases, aerosols, odors, and dusts that can ultimately deposit on land and surface water. Operations concentrating large numbers of livestock and areas with large numbers of operations pose greater risks due to the density of animals and large volumes of manure. The national trend toward fewer and more industrialized livestock operations has resulted in regionally concentrated production and regionally higher levels of surface water, groundwater, and air pollution from manure and large animal feeding operations (Mallin & Cahoon, 2003; Thorne, 2007; USEPA, 2013a; USGAO, 2008).

Figure 1. Primary pathways, pollutants, exposures, and effects associated with farm animal manure and animal feeding operations. Other sources can contribute to these effects.

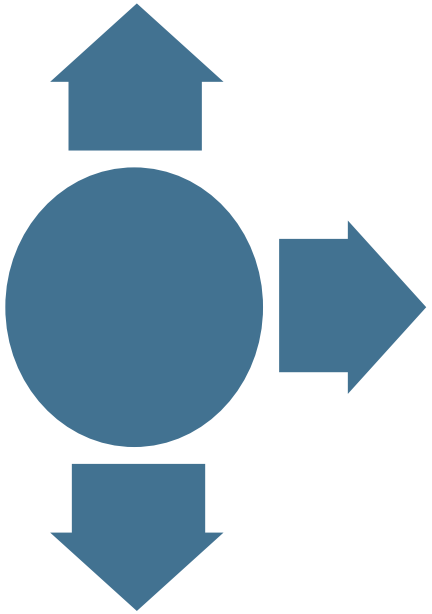
AIR

Pollutants

- Particulates (inorganic and organic dusts, allergens)
- Gases, aerosols, and odor (ammonia, hydrogen sulfide, methane, carbon dioxide, nitrous oxide)

Exposures and Effects

- Human health (respiratory disease and other health effects)
- Ecosystem health (atmospheric deposition, haze, climate change)
- Community quality of life (odor nuisance)



SURFACE WATER

Pollutants

- Pathogens (viruses, bacteria, parasites)
- Nutrients (nitrates, phosphorus)
- Pharmaceuticals (antibiotics, hormones)

Exposures and Effects

- Shellfish closures
- Water recreation
- Human health (pathogens, toxic algae, antibiotic resistance)
- Ecosystem health (eutrophication, harmful algal blooms, hypoxia, aquatic life & wildlife effects)
- Community quality of life

GROUNDWATER

Pollutants

- Nutrients (nitrates)

Exposures and Effects

- Drinking water
- Human health (methemoglobinemia and other effects)
- Community quality of life

Priority concerns for surface water are fecal contamination of recreational and shellfish harvest waters that directly expose people to zoonotic bacteria, parasites, and viruses, and nutrient enrichment (eutrophication) of surface waters. Pathogens of concern include Cryptosporidium, Giardia, Campylobacter, Shigella, Salmonella, Leptospira, Listeria, Yersinia, E. coli, and Rotavirus (USEPA, 2004, 2013a). Along with pathogen concerns, enrichment of fresh and estuarine waters from added nutrients via surface runoff and atmospheric deposition can result in cascading ecosystem effects such as algal blooms, decreased oxygen levels (hypoxia), fish kills and other harm to aquatic life, and exposure of humans and animals to toxic algae (Carpenter et al., 1998; Sobota et al., 2015; USEPA, 2013a, 2014a).

With respect to groundwater, while pathogens can contaminate shallow wells and aquifers (see, for example, Clark et al., 2000), the more common concern is nitrate contamination due to the highly soluble and mobile nature of nitrate nitrogen, the health risks associated with high nitrate levels in drinking water, and the widespread use of private wells for drinking water. Nitrate is considered the most widespread contaminant in groundwater and a good indicator of human activity. Nationally, background concentrations of nitrate in shallow groundwater are typically about 1 mg/L (Nolan & Hitt, 2003, 2006; USEPA 2013b). Groundwater nitrate levels in many areas of Washington are substantially higher. The pathways and impacts of farm animal manure on surface and groundwater resources are well documented in studies and papers by Boesch et al. (2001), Burkholder et al. (2007), Costanza et al. (2008), Howarth et al. (2002), Mallin & Cahoon (2003), NALBOH (2010), Nolan & Hitt (2006), NRC (2003), PCIFAP (2008b), Sharpley et al. (1997), Sobota et al. (2015), USEPA (2004, 2005, 2013a), WELC (2016), WSDOE (2016), and many others.

The occurrence and concentration of airborne contaminants vary substantially by animal species, type of facility, management practice, weather, and other factors (Borchardt & Burch, 2016; Jahne et al., 2015; UNL, undated). Also, the relative importance and impact of different emissions vary significantly by spatial scale. For example, odor is a major concern locally whereas carbon dioxide is a major concern globally (NRC, 2003). In addition to chemical contaminants such as ammonia and hydrogen sulfide, potentially allergenic and pathogenic microbes can be dispersed in aerosols and dusts associated with manure handling and storage (Borchardt & Burch, 2016; Jahne et al., 2015). Airborne contaminants can have direct and indirect effects on human health, the environment, and the social health of communities (UNL, undated).

There is a growing body of literature on the health effects of air emissions from animal feeding operations at various scales, anchored by occupational health studies of farm workers. May et al. (2012), describe several causative agents such as allergens, organic dusts, endotoxins, and gasses that are associated with such health problems as upper airway respiratory diseases, asthma, chronic bronchitis, chronic obstructive pulmonary disease (COPD), organic dust toxic syndrome, hypersensitivity pneumonitis, and other ailments. Research by Williams et al. (2011), observed community exposure (indoor and outdoor) to elevated airborne contaminants (particulate matter, ammonia, and allergens) across a concentration gradient at distances up to three miles from large dairy operations in Washington's Yakima Valley. Other papers on the health effects of air emissions include Greger & Koneswaran (2010), Heederik et al. (2007), Kirkhorn (undated), Kirkhorn & Garry (2000), Loftus et al. (2015); ISU/UI study group (2002), Merchant et al. (2005), Mirabelli (2006), NRC (2003), Rodriquez de Evgrafov et al. (2013), Schiffman & Williams (2005), Schiffman et al. (2006), USEPA (2004), and Von Essen & Auvermann (2005).

Medicines play an important role in the treatment and prevention of disease in humans and animals but can also adversely affect wildlife and microorganisms (Boxall, 2004). Animal feeding operations are large users and reservoirs of pharmaceuticals. The drugs fall into several categories, including antimicrobials (e.g., antibiotics), anthelmintics (antiparasitics), and hormones. They are administered to livestock via feed, water, and a variety of treatments for therapeutic purposes treating disease and for sub- or non-therapeutic purposes such as reducing disease risk, increasing feed efficiency, and promoting growth (Regassa et al., undated; Sarmah et al., 2006).

Many drugs efficiently pass through livestock and can reach soil and water environments as waste discharges or land application of manure. Environmental impacts associated with these "contaminants of emerging concern" mainly revolve around effects on soil microbial communities by antimicrobials and harm to aquatic organisms by hormones and related chemicals which can cause significant biological responses at very low concentrations (Damewood, 2013; Grenni et al., 2017; Lee et al., 2007; Meador et al., 2018). Papers characterizing veterinary drugs in animal waste or documenting impacts to soil and water environments include Bartelt-Hunt et al. (2011), Boxall (2004, 2012), Burkholder et al. (2007), Ghosh & LaPara (2007), Grenni et al. (2017), Kemper (2008), Khan et al. (2007), Khanal et al. (2006), Lee et al. (2007), Lee et al. (2012), Orlando et al. (2004), Sarmah et al. (2006), Song et al. (2010), Soto et al. (2004), USEPA (2013a), and Zheng et al. (2008).

For antimicrobials, a related concern is the increasing severity of antimicrobial resistance (AMR)—the ability of microbes to transform and resist the effects of drugs. The rise of large animal feeding operations and heavy use of antibiotics in the industry has contributed to what's now viewed as a global public health crisis (Marshall & Levy, 2011; Paulson et al., 2014; Silbergeld et al., 2008).

While 80% of the microbial agents sold in the US is for animal use (Loglisci, 2010; Paulsen et al., 2014), it's uncertain how much of the problem can be attributed to industrial food animal production (PCIFAP, 2008c; Regassa et al., undated). And the problem extends to other drug categories such as antiparasitic resistance in farm animals (USFDA, undated c). Veterinary drugs are regulated by the U.S. Food and Drug Administration, which is working with producers and other interests to phase out non-therapeutic use of antimicrobials and limit therapeutic use to treating sick animals (USFDA undated a, undated b).

Rounding out the environmental health effects of animal feeding operations are other closely related personal and community health effects. Work by Donham et al. (2007) on the health of rural residents and communities in areas of large-scale livestock production, embraces the World Health Organization's definition of health as "a complete state of physical, mental, and social well-being, not merely the absence of disease and infirmity." Impacts to air and water resources connect directly to other outcomes affecting, for example, quality of life, property values, small-scale farming economies, community conflict, and even health disparities and environmental justice as low income communities and communities of color are often disproportionately affected by large animal feeding operations (Ayres, 2017; Casey et al., 2015; Donham et al., 2007; Donham, 2010; Greger & Koneswaran, 2010; Kirkhorn, 2002; Nicole, 2013; NALBOH, 2010; PCIFAP, 2008a).

Regional Impacts In Washington

In Washington, the concentration of farm animals in two particular areas—north Puget Sound and Lower Yakima Valley—illustrates many of the environmental health pathways, exposures, and effects listed in Figure 1. However, in drawing attention to these two geographies it's important to note that certain impacts occur at different scales and can be attributed to multiple factors and pollution sources, not just animal feeding operations.

While statewide data on livestock operations are not readily available, the two areas of the state with the highest concentration of dairy cows and dairy operations are the north Puget Sound watersheds of Whatcom and Skagit counties and the Lower Yakima Valley and Columbia Basin of central Washington (WSDA, 2011). In the North Sound counties, along with other fecal pollution sources, farm animal manure has contributed to the contamination and closure of shellfish beds in Samish Bay (Samish River), Portage Bay (Nooksack River), and Drayton Harbor (WSDOH, 2009, 2010, 2015). Work controlling the pollution sources is ongoing and resulted in a notable upgrade of a portion of Drayton Harbor in 2016. While livestock operations are scattered across this rural region, the Nooksack River basin of Whatcom County has substantially more farm animals and animal feeding operations than the other watersheds. Whatcom County is home to the highest number of dairy farms in the state (WSDA, 2011).

In Whatcom County, the surface water problems dovetail with nitrate contamination of groundwater. The Sumas-Blaine Aquifer covers the U.S. portion of the larger, transboundary Abbottsford-Sumas Aquifer. A 2012 analysis by the Washington State Department of Ecology (WSDOE, 2012) summarizing groundwater studies conducted over the preceding 30 years reported the following:

> *Based on water quality studies conducted by the Washington State Department of Ecology and the U.S. Geological Survey over the past 30 years, 29% of sampled wells in the [Sumas-Blaine] aquifer exceeded the nitrate maximum contaminant level (MCL) of 10 mg/L-nitrogen (N). A total of 14% of wells had concentrations more than double the MCL. Groundwater from 36% of shallow wells (less than 40 feet deep) exceeded the MCL. About 20% of the deeper wells exceeded the MCL. The highest documented nitrate concentration in a domestic drinking water well is 73 mg/L-N. (p. 5)*

The report concluded that the aquifer's high vulnerability to nitrate contamination is attributed to several factors, including: (1) shallow depth to water (less than 10 feet in most areas); (2) the aquifer's limited thickness (mostly less than 50 feet); (3) intensive agricultural production, which contributes 97% of the estimated annual nitrogen load to the ground overlying the aquifer; and (4) heavy rainfall during the non-growing season that carries unused nitrate to the water table. Of the estimated agricultural loading, roughly two-thirds is attributed to land application of manure and one-third to application of inorganic fertilizer. Other fractional inputs include legumes, atmospheric deposition, dairy lagoons, on-site sewage systems, and irrigation (WSDOE, 2012).

The Lower Yakima Valley is similarly plagued by high nitrate levels in drinking water that are closely associated with significant numbers of farm animals and large animal feeding operations. Yakima County has the most dairy cows in the state (WSDA, 2011). About a third of the Lower Yakima Valley uses private, unregulated wells for drinking water. Between 10 and 20% of these wells have nitrate concentrations that exceed the national and state drinking water standard (USEPA, 2012b).

In recent decades, many studies have documented nitrate contamination of groundwater and drinking water wells in the Lower Yakima Valley. In 2010 the U.S. Environmental Protection Agency (EPA) initiated a study to assess potential nitrate sources (livestock, irrigated cropland, septic systems, and biosolids) and nitrate contamination of groundwater and residential drinking water wells in the Lower Yakima Valley. EPA also monitored for other chemicals using various methods to help broaden the analysis and understanding of the sources and impacts.

To help focus the analysis, EPA assessed historical monitoring data and available information on land use to estimate the amount of potential nitrogen from the sources. The analysis concluded that the sources account for about 98% of the nitrogen available to be applied to the land, with livestock (primarily dairy cows) accounting for about 65%, irrigated cropland about 30%, and septic systems/biosolids about 3% (USEPA, 2013b).

Analysis of downgradient drinking water wells combined with other data from the study confirmed that dairies in the study area are a likely source of nitrate. The results also indicated that several irrigated crop fields are a likely source of nitrate in downgradient drinking water wells, but the data for this source was not as strong as it was for the dairies. And the data did not confirm septic systems as a source of nitrate in the drinking water wells (USEPA, 2012b).

Findings of the analysis set the foundation for enforcement by EPA to address the groundwater impacts of the dairies. Under authority of the Safe Drinking Water Act, EPA negotiated a consent order in March 2013 with four Yakima Valley dairies requiring a number of actions to address and mitigate the impacts, including pollution source controls, soil and groundwater monitoring, and alternate water supply (bottled water) for affected neighbors (USEPA, 2014b, undated).

Nitrates in Drinking Water

The national drinking water standard for nitrate is 10 mg/L. This standard—or maximum contaminant level (MCL)—was originally developed to prevent methemoglobinemia, or blue baby syndrome, which results from consuming water with elevated levels of nitrate. More recently, researchers have discovered associations between exposure to nitrate-contaminated drinking water and other negative health effects such as cancer and adverse birth outcomes (Addiscott & Benjamin, 2004; Avery, 1999; Brender et al., 2013; Cantor, 1997; Chang et al., 2010a, 2010b; Chiu et al., 2012; Croen et al., 2001; De Roos et al., 2003; Fewtrell, 2004; Freedman et al., 2000; Greer et al., 2005; Ho et al. 2011; Kuo et al. 2007; Law et al. 1999; Liao et al., 2013; Manassaram et al., 2006, 2010; Morales-Suárez-Varela et al., 1995; Powlson et al., 2008; Sadeq et al., 2008; Tsezou et al., 1996; Ward et al., 2010; Weng et al., 2011; Weyer et al., 2001; WSDOH, 2007; Yang et al., 2009; Zeman et al., 2011).


Photo Credit: Washington Department of Ecology

Methemoglobinemia

Too much nitrate in the body makes it hard for red blood cells to carry oxygen. While most adults recover quickly, it can be dangerous for children and some adults, and can be severe for infants (USEPA, 2012b). While scientific evidence indicates that elevated nitrate in drinking water is closely associated with methemoglobinemia (Greer et al., 2005; Sadeq et al., 2008) recent research and review of past studies suggest that the causal role of nitrate is inconclusive.

Methemoglobinemia is complicated and is dependent on many factors other than the ingestion of nitrate in drinking water (Nolan & Hitt, 2006; Powlson et al., 2008; Ward et al., 2005). Among other causal or complicating factors, analysis of foundational studies and case histories dating to the 1940s suggest that bacteria in well water and in the digestive tract play a direct role inducing methemoglobinemia (Addiscott & Benjamin, 2004; Avery, 1999; OEPA, 2014; Powlson et al., 2008; WSDOH, 2007). Many of these early studies occurred in rural farming areas where bacterial contamination of well water and digestive tract infections may have coincided with high nitrate levels and occurrence of the disease. The studies did not control for bacteria or gastroenteritis. As summed by Fewtrell (2004), "examination of the literature suggests that a number of authors are starting to question the simple association between nitrate and infant methemoglobinemia, in favor of seeing nitrate as a co-factor in one of several causes of the disease" (p. 1373).

Ohio Environmental Protection Agency (2014) describes the condition as follows:

> *Blue-baby syndrome is caused when bacteria in the digestive tract of infants change the nitrate into nitrite, a much more harmful substance. The nitrite then enters the bloodstream, where it can lower the blood's ability to carry oxygen to the body, causing a blueness to the skin. Infants under six months of age are at higher risk than others because their digestive tract is not fully developed. By six months of age, the hydrochloric acid in the stomach increases to a level that kills most of the bacteria which change nitrate to nitrite, significantly reducing the risk of methemoglobinemia. (p.1)*

A 2007 study by the Washington State Department of Health associated drinking water nitrate with increased methemoglobin levels in infants (WSDOH, 2007). Data collected from seven central Washington counties (Grant, Adams, Benton, Franklin, Yakima, Walla Walla, and Klickitat) found that high daily nitrate intake (above 0.5 mg NO3-N per kilogram body weight) significantly increased the risk of elevated methemoglobin levels, and that nearly all infants in the study who were fed water containing at least 5 mg/L NO3-N fell into this high exposure category. The analysis also factored drinking water bacterial levels and recent or current illness (e.g. diarrhea, fever, or vomiting) into the modeling and concluded that elevated drinking water nitrate is likely one of several risk factors contributing to methemoglobinemia (WSDOH, 2007).

Other Adverse Health Effects

There is increasing evidence linking drinking water nitrates with other negative health outcomes. Researchers have found associations between elevated drinking water nitrate and multiple types of cancer including gastric, prostate, stomach, bladder, ovarian, liver, gallbladder, esophageal, colon, rectal, and thyroid cancer as well as childhood brain tumors, and non-Hodgkin's lymphoma (Cantor, 1997; Chang et al., 2010a; Chiu et al., 2012; De Roos et al., 2003; Kuo et al., 2007; Law et al., 1999; Liao et al., 2013; Morales-Suárez-Varela et al., 1995; Tsezou et al., 1996; Ward et al., 2010; Weng et al., 2011; Weyer et al., 2001). Research has also linked elevated drinking water nitrate with adverse birth outcomes such as anencephaly, spina bifida, cleft palate, cleft lip, limb deficiency, and small-for-gestational-age babies (Brender et al., 2013; Croen et al., 2001; Manassaram et al., 2006; Migeot et al., 2013). A cohort study by Zeman et al. (2011) found that elevated nitrate levels in drinking water were associated with self-reports of being unhealthy and complaints of stomach, intestinal, bone, joint and other problems.

Much of the research on these specific health outcomes is relatively recent and the body of evidence is still being established. While a large body of evidence points to the link between nitrate-contaminated drinking water and adverse health outcomes, there is not yet a large body of evidence on the association between drinking water nitrates and any one of these adverse health or birth outcomes, and the literature contains some conflicting findings (Cantor, 1997; Chang et al., 2010a; De Roos et al., 2003; Freedman et al., 2000; Ho et al., 2011; Law et al., 1999; Manassaram et al., 2006; Weyer et al., 2001; Yang et al., 2009).

It is important to note that the majority of research has focused on the impacts of exposure to nitrates below the MCL (often far below the MCL), so the studies which indicate no association between low levels of nitrates in drinking water and adverse health outcomes do not provide evidence that nitrates are safe at levels above the MCL. Even levels of nitrate far below the MCL have been linked to negative health effects. For example, Ward et al. (2010) found that individuals with sustained exposure to drinking water nitrate levels of 5 mg/L (half the MCL) or greater had an increased risk of developing thyroid cancer compared to those who were not exposed to this elevated level of drinking water nitrate. Similarly, Brender et al. (2013) found that babies were twice as likely to be born with spina bifida if their mother ingested 5 mg/L of nitrate or more each day from drinking water compared to mothers who ingested lower levels of nitrate.


Photo Credit: Kitsap Public Health District

WASHINGTON'S REGULATORY STRUCTURE FOR LIVESTOCK MANURE, ANIMAL FEEDING OPERATIONS, AND OTHER DOMESTIC ANIMAL WASTE

Agricultural animal keeping involves a variety of activities and land uses, ranging from recreational small-scale rearing and stabling to commercial/industrial farm animal production. Livestock in Washington generate an estimated 16 to 40 billion pounds of raw manure (solids and liquids) every year (WSDOE, 2016). The following overview of the state regulatory structure describes the main programs designed to work with farmers to effectively manage livestock manure and animal feeding operations to prevent and mitigate water and air quality impacts. The overview also covers companion local authority regulating agricultural land use and animal waste practices.

Before proceeding, here's important perspective of manure management in Washington. Under the state's Dairy Nutrient Management Act (chapter 90.64 RCW) and the Concentrated Animal Feeding Operation (CAFO) General Permit, requirements for manure management apply directly and solely to the regulated farm animal operation. In other words when manure moves off site for other uses in other areas, the distribution and application is not regulated unless and until there's a documented discharge or an enforceable solid waste or water quality problem. As such, manure liquids and solids are routinely applied to a variety of fields with no animals (e.g., berry fields, post-harvest corn fields, hop fields, orchards, and pasture). If mismanaged, the applications can affect water quality and public health. The comprehensive picture of manure distribution, storage, and application across the state is unknown.

For commercial animal feeding operations, the state's regulatory structure to protect water quality is framed mainly around two programs—the Dairy Nutrient Management Program (DNMP) administered by the Washington State Department of Agriculture (WSDA) and the Concentrated Animal Feeding Operation General Permit administered jointly by the Washington State Department of Ecology (Ecology) and WSDA. Farms that fall outside the scope of these programs and impact water quality may be regulated by Ecology under its Agricultural Nonpoint Program and nonpoint provisions of the State Water Pollution Control Act, chapter 90.48.RCW. Some local jurisdictions also administer local ordinances that come into play with animal keeping, manure management, and the proper handling of other domestic animal waste. Ecology and local air agencies also regulate certain large operations and practices to protect air quality. In summary, the regulatory structure works as follows:

- WSDA's DNMP covers all licensed cow dairies. Under a memorandum of understanding with Ecology, program staff also inspect all permitted CAFOs.
- Ecology issues and enforces the CAFO permit and also regulates agricultural nonpoint source impacts.
- Local ordinances, where they exist, apply mainly to agricultural land use and smaller-scale activities (nuisance or nonpoint).
- Air quality is regulated by Ecology and the seven local air agencies in Washington focusing on large animal feeding operations meeting emission or herd-size thresholds.

The following overview of these programs and authorities is organized as listed above. Unless otherwise referenced, the descriptions of DNMP and the CAFO permit are based on presentations to the Board in June 2014 and March 2017, personal communication with lead staff at WSDA (Ginny Prest and Chery Sullivan) and Ecology (Jon Jennings and Susanna Pearlstein), and program material. And the description of the air quality regulations is based mainly on personal communication with Joanna Ekrem of Ecology.

Dairy Nutrient Management Program

The Dairy Nutrient Management Program is administered by WSDA. It regulates cow dairy farms to ensure proper use and management of manure to protect the state's surface and ground waters. The program also aims to help maintain a healthy business climate for dairies.

There are just under 400 dairies in Washington, with the highest concentration of dairies, dairy cows, and heifer replacement operations in the Yakima Valley and Whatcom County. As noted previously, Whatcom County has the most dairies, but most of the state's large dairies (herd size and acreage) are located in the Yakima Valley and Columbia Basin. Roughly 40% of the state's quarter million mature dairy cows are concentrated in Yakima County (WSDA, 2011).

The state Dairy Nutrient Management Act chapter 90.64 RCW requires all licensed dairies to register in the program. Dairies must develop nutrient management plans approved and certified by local conservation districts within 24 months, operate in ways that protect against waste discharges to waters of the state, and maintain records showing agronomic application of all nutrients. Management plans must be updated in the event of a discharge, but only if the plan failed to prevent the discharge (not operator error or other reason). WSDA staff also recommend plan updates when either herd size or available acreage deviate significantly from the management plan. The law does not require producers to follow the plans. However, if permitted as a CAFO, plan implementation is enforceable.

The Dairy Nutrient Management Act authorizes an inspection program at WSDA, transferred from Ecology in 2003. The inspection program covers all licensed dairies in the state on a rotating basis every 18-22 months, looking at dairy facilities for evidence of violations, identifying actions to correct actual or imminent discharges, reviewing records, monitoring implementation of the management plans, and offering regulatory technical assistance. In addition to regular inspections, staff respond to written complaints and incident reports within three days.

The agency is able to resolve the vast majority of problems through technical assistance and informal enforcement (letter of warning or notice of correction). Common problems include lagoons at capacity without adequate room for additional needed storage, unrestricted animal access to surface water, saturated field conditions with contaminated surface discharge, and over-application of nutrients that may impact groundwater. Over the three-year tracking period, May, 1, 2014 to April 30, 2017, WSDA logged 1,499 inspection events and 202 enforcement actions.

The inspection work shows an upward trend in follow-up inspections and investigations, reflecting the program's emphasis on field presence and compliance. In turn, enforcement actions are trending down, particularly warning letters, possibly indicating that technical assistance is yielding better compliance. Formal enforcement (administrative order or notice of penalty) is reserved for failure to register in the program, failure to have an approved and certified nutrient management plan, inadequate record keeping showing field applications at acceptable agronomic rates, and discharges to waters of the state.

WSDA has conducted lagoon inspections in the Yakima Valley based on the site inventory and assessment procedure of Natural Resources Conservation Service (NRCS) Tech Note 23. Between 2015 and 2017, WSDA inspected most dairy lagoons in the Yakima Valley with a minimum of two site visits, to evaluate the lagoons when full and when empty. The lagoons are scored on criteria (e.g., soil type, aquifer susceptibility, proximity to water bodies, compliance with design standards) and ranked on a risk probability matrix for site risk and seepage/structure risk. The evaluations are being carried out in concert with the CAFO permit, giving facilities with high risks two years to develop and implement plans to address the deficiencies.

Concentrated Animal Feeding Operation General Permit

Any commercial or industrial operation that discharges waste material to state waters is required to have a permit from Ecology. A permit is essentially a license that conditionally authorizes use of state waters for the waste discharge. The CAFO permit is one of many permits that Ecology issues for waste discharges. It contains requirements to manage manure, litter (e.g., feed, bedding material), and process wastewater to protect ground and surface waters. Discharges are allowed in limited situations and cannot violate water quality standards or impair other uses of the waters.

With "discharge" serving as a permit prerequisite, unless an operation voluntarily opts into the program by submitting an application for permit coverage, Ecology can require a CAFO permit only after documenting a pollution discharge. Documenting a discharge is challenging. State inspectors monitor facilities and there is water quality monitoring in many areas, but there is no comprehensive, systematic monitoring system to identify discharges. As such, the CAFO permit does not broadly apply as a proactive tool for addressing concerns or preventing potential impacts. It's a tool for permitting and regulating known discharges.

As noted previously there are nearly 400 dairies in Washington and a number of other concentrated livestock operations such as beef feedlots and poultry operations. Not all of these meet the CAFO definition and are not required to obtain a permit based solely on herd size thresholds for different types of operations. The new CAFO permit covers a wider scope of operations than the original CAFO permit. The original CAFO permit expired in 2011 and covered about ten operations.

Ecology issued two new CAFO general permits in 2017. The permits took effect March 2017 and last five years until March 2022. One permit is issued under federal (Clean Water Act) and state (chapter 90.48 RCW) authorities. This permit is a combined National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit (combined permit). The other permit is issued under only state authority and is a State Waste Discharge General Permit (state only permit). The combined permit can authorize surface water or groundwater discharge, while the state permit can authorize only groundwater discharge. Ecology estimates that the two permits could eventually cover 200 operations. Currently about 20 operations are under permit. **Figure 2** (on the following page) compares different features and common requirements of the two CAFO permits.

Decision on CAFO Permit Appeal

On October 25, 2018, the Washington State Pollution Control Hearings Board (PCHB) issued an order on an appeal of the CAFO permits by a number of organizations on all sides of the issue. The order upheld and affirmed the permits with the exception of a condition associated with lagoon assessments. Ecology is expected to reissue the permits consistent with the order (WSPCHB, 2018).

Figure 2. Features and common requirements of the Combined and State only CAFO permits.

Combined Permit	State Only Permit
Issued under federal (CWA, NPDES) and state authorities	Issued under state authorities (chapter 90.48 RCW)
Third party/citizen lawsuits to enforce permit conditions allowed	No third party lawsuits allowed
• Conditionally authorizes groundwater discharges • Conditionally authorizes surface water discharges	• Conditionally authorizes groundwater discharges • No surface water discharges allowed

• Spring soil samples to determine nutrient values
• Nutrient budget based on planned crops, spring soil nutrient values
• Sample sources of nutrients to determine content
• Land application restrictions:
  • No application prior to T-Sum 200
  • No application to frozen, snow covered, or saturated soils	

Uses federal buffers: • 100-foot application setback • 35-foot vegetative buffer • Equivalent alternative • Berms	Buffers not specified, but must have no discharge to surface waters from land application fields
Adaptive Management Increasing fall report card sample results for nitrate require increasing levels of additional management, such as verifying assumptions, reducing the amount of manure applied, or eventually stopping application until soil nitrate levels are reduced.	
Fall report card soil sampling How well did manure application follow the nutrient budget?	
Annual Reporting Permitted operations must submit information annually such as yearly nutrient budgets and soil and manure sample results.	
Lagoon Assessment All operations that have a lagoon must have it assessed using NRCS Technical Note 23.	
Manure Pollution Prevention Plan (MPPP) The permits contain performance goals (these are the permit requirements). The MPPP is a living document. The operation documents how performance goals are being met on site.	

Any facility that meets the definition of a CAFO—and a regulatory agency has documented a pollution discharge to waters of the state—is required to apply for a CAFO permit. As noted previously, operations are not required to obtain a permit just because they exist or because there is potential to discharge waste materials. An actual discharge to state waters triggers the requirement to obtain a permit. The discharge may be to surface water or groundwater. The CAFO general permit acknowledges seepage from lagoons as a common occurrence, and is a matter of ongoing discussion. An operation may also voluntarily obtain a permit. This is usually due to the operation determining that a permit will reduce risk (e.g., lawsuit) or they may have a discharge in the future and are managing the facility proactively.

To obtain a CAFO permit, an operator must submit an application to Ecology, and for the combined permit must follow requirements for public notice and comment. For small CAFOs to obtain a permit, Ecology must go through an added step designating the facility to be a CAFO. This involves activities such as a site inspection, sampling, and determining that the operation is a significant contributor of pollutants. Designation occurs through formal action such as administrative order.

The CAFO permit applies to all operations that meet the CAFO definition and herd size thresholds of the permit. CAFO permits apply to both the operation's production area (e.g., barns and pens) and land application fields. As long as the permitted CAFO complies with all permit requirements, the CAFO may discharge to state waters in certain circumstances. Once a permit is issued, compliance and violations can be addressed with a variety of progressive enforcement actions and penalties.

WASHINGTON'S REGULATORY STRUCTURE FOR LIVESTOCK MANURE, ANIMAL FEEDING OPERATIONS, AND OTHER DOMESTIC ANIMAL WASTE (CONT'D)

Ecology and WSDA jointly administer CAFO permits and also work cooperatively on the Dairy Nutrient Management Program and Agricultural Nonpoint Source Program. The agencies are guided by a Memorandum of Understanding (MOU) that was last updated in 2011. See also the summary of roles and authorities in Appendix B of WSDA's 2017 report on DNMP and manure management.

Ecology is responsible for:

- Issuing the CAFO general permits;
- Issuing the permit coverages to individual operations that apply for a permit;
- Enforcing permit requirements at covered operations; and
- Handling complaint response and enforcement on non-dairy operations (and nonpoint sources).

WSDA is responsible for:

- Implementing the Dairy Nutrient Management Program;
- Inspecting permitted CAFOs as an agent for Ecology; and
- Handling complaint response and enforcement on dairy operations. Enforcement on CAFO-permitted operations is done in coordination with Ecology.

Photo Credit: Washington Department of Ecology

Photo Credit: State Board of Health

Agricultural Nonpoint Source Program

There are thousands of livestock operations in the state. They range considerably in size and intensity from lifestyle farms and small-scale operations to large CAFOs. Impacts from non-CAFOs are widely dispersed and are referred to as nonpoint source pollution. Despite their diffuse nature, there can still be individual or cumulative impacts from animal keeping, manure, and other domestic animal waste.

Agricultural land owners are not allowed to discharge manure, animal waste, or other polluting matter into waters of the state and are subject to regulation under the State Water Pollution Act, chapter 90.48 RCW. Ecology administers the code as it relates to discharges from agricultural activities and other nonpoint pollution sources. Ecology also has delegated authority to enforce the federal Clean Water Act.

RCW 90.48.080 prohibits any discharge to state waters except as authorized by permit. Companion language in RCW 90.48.120 leaves more room for interpretation, referring to a person creating a "substantial potential" to violate provisions of the law. Regulatory action is typically triggered by a reported incident, complaint, monitoring result, or field investigation. Priority concerns are direct deposit/discharge of manure or animal waste to surface water, damage to riparian areas, and mismanagement of manure or other animal waste (WSDOE, 2015).

When problems are identified, the agency offers technical and financial assistance and partners with conservation district staff to work with landowners to improve practices. The agency uses a risk-based approach to assess site conditions—the riparian area, animal confinement area, manure storage, and upland pasture—and to determine the best course of action to remedy a pollution problem (WSDOE, 2015a). As a tool of last resort, compliance is handled on a progressive, sequential basis. Except in situations requiring immediate action and compliance, formal enforcement is rare and can follow years of work offering assistance to resolve a problem.

In a 2013 case—Lemire v. Washington State Department of Ecology and the Pollution Control Hearings Board—the Washington State Supreme Court affirmed Ecology's authority to enforce the law and regulate agricultural activities where there's substantial evidence of conditions that cause pollution, not requiring proof of direct causation or actual contamination (Cooper, 2014; WSDOE 2015c; WSSC 2013). While action on well documented farm animal impacts is supported by such legal precedence, enforcement of the code is challenging due to the diffuse and complex nature of nonpoint pollution and the sensitive politics associated with agricultural regulation.

Ecology is currently undertaking a major project to develop voluntary clean water guidance for agricultural activities. The project aims to identify agricultural practices that are most effective in addressing nonpoint source impacts and achieving compliance with water quality standards. Impetus for the project is federal law, specifically the Clean Water Act and Coastal Zone Act Reauthorization Amendments of 1990, which require the agency to identify suites of practices for different sources of nonpoint pollution. The project is part of Ecology's 2015 Nonpoint Source Pollution Plan. The planning, stakeholder involvement, and technical analysis are expected to take a couple years (WSDOE, 2015b, 2015c, 2017).

Local Regulation

Complementing Ecology's enforcement of chapter 90.48 RCW, local governments have authority under a variety of codes to regulate agricultural land use and animal waste practices to: (1) protect health and sanitation; (2) address and abate nuisance; and (3) protect water quality and drinking water supplies. The existing authority of WAC 246-203-130 addresses all three of these objectives. Here's a sampling of related laws that support or connect with this authority:

- Powers and duties of the State Board of Health (RCW 43.20.050), local boards of health (RCW 70.05.060), and local health officers (RCW 70.05.070) to prevent, control, and abate hazards and nuisances that affect health and sanitation, including animal keeping and the handling and disposal of animal excreta and animal remains.
- Chapter 7.48 RCW defines and lists public nuisance—including any offal, filth, or noisome substance that is collected or remains in place to the harm of others, and any offal or other offensive matter that is thrown, deposited, or in any way corrupts any watercourse, stream, lake, pond, spring, or well to the harm of others—and explains that any authorized public body or officer may abate such nuisances. RCW 7.48.300 includes provisions explaining that agricultural activities and forest practices should generally be protected because they are often subject to nuisance lawsuits in urbanizing areas which can force premature conversion to other uses. RCW 7.48.305 explains that agricultural activities that are consistent with good practices and that conform with all applicable laws and rules are assumed to be reasonable and do not constitute nuisance unless the activity has a substantial adverse effect on public health and safety.
- Chapter 35.88 RCW applies to protection of public water supplies and explains that animal operations such as hog pens and feed yards that pollute municipal water supplies, storage, or conveyance are illegal and should be abated as nuisance.
- RCW 70.54.010 and RCW 90.48.080 respectively make it illegal to deposit anything deleterious that affects public water supplies or to discharge polluting matter to waters of the state.
- Chapter 70.95 RCW sets requirements for solid waste management, which extends to animal waste and includes provisions that prohibit dumping or depositing waste in waters of the state or creating a nuisance. Companion solid waste handling standards, chapter 173-350 WAC, exempt land application of manure if applied at agronomic rates. If piled, over-applied, or otherwise mismanaged to create a problem, manure can be regulated as a solid waste.
- And some of the management programs listed under "supporting tools" on page 22, such as critical areas protection (RCW 36.70A.172), groundwater management (RCW 90.44.400), and shellfish protection (RCW 90.72.030), offer limited authority regulating agricultural practices to protect sensitive waters and habitats.

Photo Credit: Washington Department of Agriculture

Sample Local Ordinances

Whatcom County is one of 12 counties using development regulations to protect critical areas from agricultural activities (WSDOC, 2016). Whatcom County's critical areas ordinance (CAO) (WCC 16.16) requires protection of critical areas and their regulated buffers from impacts. The CAO aims to "protect the functions and values of critical areas and the ecological processes that sustain them, while allowing for appropriate economically beneficial or productive use of land and property" (Whatcom County, 2017, p. 6). Agricultural activities may be permitted in critical areas and associated buffers if supported by an approved farm conservation plan under the CAO's conservation program on agricultural lands (CPAL). Otherwise, activities must comply with the standard provisions of the CAO (Whatcom County, 2017, undated).

Complementing its CAO, Whatcom County also has a manure and agricultural nutrient management ordinance (WCC 16.28) prohibiting liquid manure spreading within 50 feet of drainage ditches and prohibiting spreading on corn ground or bare ground during the non-application period of September 1 to March 15.

King County first adopted its livestock management ordinance in the mid-1990s. The purpose of KCC 21A.30, sections 040 – 075, is to support the raising and keeping of livestock and to minimize impacts on water quality and salmon habitat. The code also regulates small animals. The code regulates lot size, livestock densities, farm planning, and management practices to prevent nonpoint pollution. The management standards include many requirements for manure storage and spreading. Section 122 of KCC 21A.12 complements this with a manure storage setback of 35 feet from the property line. Commercial dairies are exempt and must meet the requirements of DNMP (King County, 2009, 2013).

Kitsap Public Health District uses its solid waste ordinance (KCBH Ordinance 2010-1) to regulate problems with manure and other animal waste. The ordinance cites the Board's general sanitation rules, chapter 246-203 WAC, and other authorities to regulate and prevent animal waste and manure from becoming a nuisance or polluting surface water or groundwater (KCBOH, 2010). Section 305 says the following:

> *Animal manure shall not be deposited, or allowed to accumulate, in any ditch, gulch, ravine, river, stream, lake, pond, marine water, or upon the surface of the ground, or on any highway or road right of way, where it may become a nuisance or menace to health, as determined by the Health Officer, through the breeding of flies, harboring of rodents, or pollution of water. Manure shall not be allowed to accumulate in any place where it can pollute any source of drinking water. (p. 35)*

Thurston County Board of Health's nonpoint source pollution code, Article VI, references statutory authority for health and water pollution. Section 4.2 applies to farm operators and animal owners, listing appropriate measures managing animals and handling and applying manure to prevent contamination of surface water and groundwater (TCBOH, 1994). This includes the following:

> *For protection of ground water and surface waters, no person shall exceed agronomic rates in the application of manure sludge, manure, or crop residues. Storage piles of manure sludge, manure, or crop residues shall be located and maintained in a manner that minimizes leaching and runoff. This requirement may be met by covering the piles, applying the stored materials as soon as possible, constructing berms, placing the piles on impervious surfaces, directing storm drainage away from the piles, or other appropriate measures. (p. 6-5)*

For Washington cities, the Municipal Research and Services Center (MRSC) explains that the keeping of farm animals is generally regulated under local zoning, including the number and kinds allowed in urban areas (MRSC, undated). MRSC's research on nuisance regulation in Washington notes that the regulation and control of animals is among the most difficult and recurring problems faced by local officials (MRSC, 2000).

Most livestock restrictions in residential areas focus on keeping animals off public property, controlling noise and odor, and providing acceptable living conditions. MRSC lists many sample codes at its web pages on livestock and other farm animals and animal nuisances.

Some codes, such as Algona's livestock code (AMC 6.20.050), regulate the accumulation and proper handling of livestock manure while many others regulate pet waste, such as Bothell (BMC 6.16.011), Edmonds (EMC 5.05.070), Seattle (SMC 9.25.082), and Spokane (SMC 10.03.100). Woodinville's robust code (WMC 21.31) requires livestock operations to either implement a farm management plan or meet livestock standards for stream access, confinement areas, and manure storage and spreading.

Photo Credit: Washington Department of Ecology

Supporting Tools

In many areas of the state, the regulatory programs are carried out in concert with management programs designed to support implementation of strategies and practices to prevent and control pollution from all sources, including livestock manure and other domestic animal waste. These include programs for watershed management, groundwater management (e.g., Lower Yakima Valley Groundwater Management Area), wellhead protection, marine recovery, growth management, shellfish protection, total maximum daily load (TMDL) water cleanup, salmon recovery, and more. In a variety of ways, these programs connect to help advance good animal-keeping practices and prevent or clean up water quality problems. And, as noted previously, some offer limited authority regulating manure management practices.

Supporting the regulatory and management programs are many technical and financial assistance programs that help put smart conservation practices on the ground to protect water quality. On the technical assistance front, agencies leading this work include the Washington State Conservation Commission (SCC), the affiliated local conservation districts, and the USDA Natural Resources Conservation Service (NRCS). Among other services, one notable program is the state's voluntary stewardship program (VSP). Enacted in 2011 under the Growth Management Act (GMA), RCW 36.70A.705, VSP is a non-regulatory collaborative process designed to help landowners and counties develop locally led work plans and incentive-based tools to promote voluntary practices that protect critical areas, comply with GMA, maintain viable agriculture, and reduce farmland conversion (WSCC, 2016). Compliance with water quality laws is intended to serve as a regulatory backstop for VSP (WSDOE, 2013, 2015b). Twenty seven counties opted into the program while the remaining 12 use development regulations to protect critical areas (WSDOC, 2016; WSCC, 2017).

And finally, in situations where best efforts, programs, and services prove ineffective, legal action provides an added backstop to address significant problems. Three recent examples include:

- As noted previously, under authority of the Safe Drinking Water Act, EPA negotiated a consent order in March 2013 with four Yakima Valley dairies based on analysis of nitrate in downgradient drinking water wells. The order required the dairies to provide alternate drinking water sources for affected neighbors, take steps to control the nitrogen sources (manure and fertilizer), and conduct ongoing soil and groundwater monitoring (USEPA, 2014b, undated).
- A 2013 lawsuit by an environmental group against these same dairies reached the summary judgment stage for one of the dairies in January 2015 and a ruling that the dairy's practices constituted discarding of manure (making it a solid waste) that violated imminent and substantial endangerment and open dumping provisions of the Resource Conservation and Recovery Act (RCRA) (Perkins Coie, 2015). The dairies settled out of court in May 2015 agreeing to measures that overlap the EPA consent order (Wheat, 2015).
- To avoid possible litigation and to chart a collaborative pathway, in January 2017 seven Whatcom County dairies signed an agreement with the Lummi Nation called the Portage Bay Partnership. The agreement is framed around the 2014 closure of tribal shellfish beds in Portage Bay attributed to fecal pollution from dairies and other sources in the Nooksack River watershed. The agreement involves steps to address the contamination and reopen the shellfish beds and includes cash payments to a recovery fund to combat the contamination and to compensate those affected by the closure (Portage Bay Partnership, undated).

Air Quality Regulation

While large animal feeding operations are not exempt from regulation under the federal Clean Air Act, the task of meeting federal air quality standards and managing emissions from large facilities is largely left to the states (CRS, 2014). Animal feeding operations meeting emission or herd-size thresholds are subject to regulation by Ecology and the seven local air agencies in Washington under authority of the state Clean Air Act, chapter 70.94 RCW. The regulatory structure focuses on registering and reporting emissions and applying best management practices to control fugitive emissions. Here are the key authorities and functions that come into play.

- General Requirements: WAC 173-400-040 sets requirements for air pollution sources to use reasonably available control technology, and includes restrictions on visible emissions; opacity; fugitive emissions and fugitive dust; off-site particulate fallout; and emissions detrimental to persons or property.

Photo Credit: Washington Department of Ecology

- Registration and Reporting: Feedlots with 1,000 or more cattle in operation between June 1 and October 1 are required to register with Ecology or their local air agency under WAC 173-400-099 to WAC 173-400-104, report emissions of certain criteria and toxic air pollutants, and undergo inspections every one to three years. Emissions are estimated based on the size, processes, and pollution controls of the animal feeding operation. Ecology recently conducted a comprehensive literature review and issued revised emissions factors for cattle feedlots in 2016.
- Permitting: For new or modified sources meeting an emission threshold in WAC 173-400-030(28), WAC 173-400-110 establishes new source review (NSR) permitting requirements (also called Notice of Construction, or NOC) for construction or modification of new or existing stationary sources. New animal feeding operations or operations undergoing modification are required to obtain NOC permits. Currently no animal feeding operations in Ecology's jurisdiction are subject to air operating permit requirements in chapter 173-401 WAC.
- Reporting Greenhouse Gas (GHG) Emissions: Under chapter 173-441 WAC, animal feeding operations that exceed the reporting threshold for greenhouse gas emissions (10,000 or more metric tons of CO2e) are required to report GHG emissions to Ecology. Five animal feeding operations issue annual reports to Ecology on their GHG emissions of methane and nitrous oxide from manure management or onsite stationary sources. Animal feeding operations are not subject to further GHG emission requirements of the state Clean Air Rule (chapter 173-442 WAC). Manure management is exempt and animal feeding operation GHG emissions are below the thresholds in the rule.
- Controlling Fugitive Emissions, Dust, and Odor: Under RCW 70.94.640, odors or fugitive dust from animal feeding operations that are applying BMPs are exempt from the requirements of the state Clean Air Act unless they have a substantial adverse effect on public health. Feedlots with 1,000 or more cattle are included in this agricultural activity exemption except they must:
  - Follow BMPs and develop and implement a fugitive dust control plan;
  - Comply with the State Implementation Plan (SIP) for air quality; and
  - Additional controls may be required as part of the SIP if an area is designated as nonattainment for particulate matter under national ambient air quality standards (NAAQS).

  Ecology or the appropriate local air agency review and approve fugitive dust control plans, inspect sources, respond to complaints, provide compliance assistance, and may issue enforcement actions. In 1995, Ecology issued guidelines on fugitive dust control for beef cattle feedlots and best management practices. These guidelines are included in the SIP to help the state meet and maintain the NAAQS and protect public health. Yakima Regional Clean Air Agency has also established policies and BMPs for animal feeding operations in their jurisdiction, specifically for dairy operations, confined heifer replacement feeding operations, and confined beef cattle feeding operations. As an added note, Ecology is working to interpret and implement changes to RCW 70.94.640 made in the 2017 legislative session by SSB 5196 (C 217, L 17) that extend the Clean Air Act exemption for odor and fugitive dust caused by agricultural activities to cattle feedlots. This will change aspects of the regulatory structure when finalized.

Unlike federal action to regulate animal feeding operation discharges under the Clean Water Act, air emissions are not regulated by any specific standards under the Clean Air Act (USEPA, 2017). In 2005, EPA entered into an air compliance agreement with approximately 2,600 animal feeding operations nationwide. The industry agreed to fund an air emissions monitoring study that EPA would then use to develop standards and methods for estimating air emissions for animal feeding operations. The participating operations agreed that once methodologies were published EPA would determine actions required to comply with the federal Clean Air Act (USGAO, 2008; CRS, 2012). Despite completing the study in 2010, EPA has completed no methodologies (USEPA, 2017).

BOARD POLICY RECOMMENDATIONS

As noted at the start of the paper, analysis of the regulatory structure helps identify needs and opportunities to reshape the Board's Keeping of Animals rule to fill a meaningful regulatory niche. The analysis also helps flag related issues and initiatives for the Board to monitor or support going forward. The following are Board policy recommendations with brief explanation based on the analysis.

Capitalize on Local Health Authority

The rule should capitalize on the authority and responsibility of local health boards and local health officers under chapter 70.05 RCW. This includes authority to:

- Supervise the maintenance of all health and sanitary measures;
- Enact and enforce local regulations as needed to preserve, promote, and improve public health; and
- Provide for the prevention, control, and abatement of nuisances detrimental to public health.

Focus the Board Rule on the Impact of Manure and other Domestic Animal Waste on Health, Sanitation, and Nuisance

The rule should focus on practices involving the handling, storage, and disposal of livestock manure and other domestic animal waste generated on site (not off-site manure transport and use) that present a clear health, sanitation, or nuisance problem. This should include related feeding practices and litter problems that can attract rodents and other pests. The scope should not include broader animal-keeping issues such as allowable types of animals, animal health, boarding, kenneling, etc. A title change may help clarify the rule's scope and purpose. With such a focus, staff should reset the rule with a unique role to efficiently dovetail with Ecology's nonpoint pollution program and its mandate of environmental and water quality protection.

Focus the Board Rule on Smaller-Scale Animal Waste Practices and Impacts

Given the laws and programs now established to regulate large, commercial animal feeding operations, the Board's authority is best suited to smaller-scale activities and operations. This approach best reflects the scale of the Board's original rule, statutory authority, and the role and resources of the Board and local health jurisdictions. However, the rule should not necessarily be limited in scale and could appropriately be applied to larger operations and impacts when needed. The rulemaking process should be used to discuss and determine how best to design and scale the rule's applicability to address these needs.

Leave Regulation of Large Animal Feeding Operations to Established Programs

WSDA manages the Dairy Nutrient Management Program and Ecology and WSDA co-manage the CAFO permit. For many reasons, the programs are complicated and hard to implement. Despite the challenges, the two agencies are best positioned to regulate the state's large commercial animal feeding operations given their legal authorities, expertise, resources, and support from many partner agencies. The same holds true for regulation of air emissions by Ecology and the local air agencies. In keeping with the preceding recommendations, the Board's rule should avoid duplicating core work of these programs and should aim to support these existing state programs with complementary authority and functions.

Develop a Practical, Purposeful Rule

The rule should be as simple as possible, written to smartly fit other authority, tools, and programs. Functional areas to consider exploring in rulemaking include defining the type and scale of regulated activities; steps and standards defining and documenting health hazards and nuisance; technical standards and practices to prevent and remedy problems; technical assistance and referral procedures; methods for property access, compliance, and enforcement; and intersections with the companion regulatory programs to ensure fit and consistency.

Support Policy Initiatives, Regulatory Improvements

The Board will continue to monitor and give input on select policy initiatives that strengthen the regulatory structure to better regulate animal keeping, animal feeding operations, and management of manure and other animal waste. This will take into account policy recommendations in WSDA's 2017 report on DNMP and manure management. Among other issues, the report recommended:

- Requiring dairy producers to follow and update nutrient management plans;
- Standardizing requirements for manure management from producers to end users; and
- Training and certifying manure applicators.

Off-site movement and management of manure is a priority issue for future policy input. There are numerous other potential ideas and needs such as EPA regulation of air emissions from animal feeding operations, exploring limits on herd size or manure production based on site conditions, and supporting efforts to better align requirements and integrate programs across the regulatory structure.

Monitor Local Issues and Management Programs

The Board has broad policy interests in public health related to animal keeping, animal feeding operations, and management of manure and other animal waste. Board interests also draw in other issues and pollution sources that contribute to some of the same impacts and health outcomes (e.g., the nexus between management of manure and commercial fertilizers as sources of groundwater nitrate contamination). As resources allow, the Board will continue to monitor community health impacts and concerns related to drinking water nitrate contamination, shellfish contamination, toxic algae, and other environmental health effects. The Board will also aim to monitor and support technical studies and management programs designed to prevent and control pollution from a variety of sources to protect water resources and public health.

Consider Rescinding the Board's Piggeries Rule

The Board has long-standing and unique authority regulating human and animal waste to protect public health. When updated, the scope of the Board's rule should apply to manure and waste from all domestic animals. In the course of updating the rule, staff should again examine the Board's piggeries rule (WAC 246-203-180) and determine if there are unique needs that warrant a stand-alone rule. If not, as recommended by Board staff in 2014, at the successful completion of this rulemaking project, staff should report back to the Board on possible action to rescind the piggeries rule.

Restart Work on the Board's Animal-Keeping Rule

And finally, Board staff should use the Board's policy recommendations to reset its rulemaking plan and timeline, reconvene stakeholders, and update the animal-keeping rule as soon as reasonable. The scope and direction of the work outlined in this paper is in keeping with the original CR-101 filed in 2009.

Photo Credit: Washington Department of Ecology

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