



STATE OF THE WATER Overview of Water Quality Challenges in Morrow County

October 2023

Introduction

This briefing paper provides an overview of the water quality challenges affecting water supplies and the environment in Morrow County, Oregon, and the region. Residents and businesses in the County depend on a variety of groundwater and surface water sources for water supply. The primary water supply is groundwater from basalt aquifers of the Columbia River Basalt Group and the alluvial aquifer. Sources of surface water supply include the Columbia River, Umatilla River, Willow Creek, and Butter Creek.

The Umatilla Basin in Oregon is facing significant long-term water quantity and quality issues that are affecting the environment, the health of Morrow County's residents, and the ability for the area to support existing and future agricultural and industrial operations and as well as growing drinking water demands. State and local agencies, local water providers, landowners, and other stakeholders have been working under a regulatory framework and through voluntary activities to address these issues. Morrow County is committed to supporting actions, where appropriate to address these wide-ranging water issues. This briefing paper is part of a set of four State of the Water briefing papers prepared by the County to provide context for this effort and help communicate with policymakers, local stakeholders and the public as the County works to identify policies and actions on these water issues.

Water resources and water supply in Morrow County are impacted by water quality issues—most notably the widespread elevated levels of nitrate in groundwater.

Beneficial uses of water in the County affected by water quality issues include drinking water supply, irrigation, livestock watering, salmonid fish rearing and spawning, aquatic life, wildlife, water recreation, and aesthetics. Besides nitrate, key water quality parameters of concern include temperature, bacteria, and sediment.

There are also water quantity (water availability) concerns in Morrow County (refer to the companion memorandum entitled "State of the Water: Overview of Water Quantity Challenges in Morrow County," dated October 2023).

Key Takeaways

- ✓ Water supplies in Morrow County are impacted by water quality issues—most notably elevated levels of nitrate in groundwater.
- ✓ Elevated nitrate levels in drinking water can lead to serious health effects, especially in infants or pregnant individuals.
- ✓ The state declared the Lower Umatilla Basin Groundwater Management Area in 1990 to address elevated nitrate levels. However, despite voluntary measures to address the issue, nitrate concentrations in groundwater remain elevated from desired outcomes.
- ✓ Tackling water quality issues will not be easy, but an influx of new funding sources will help. The County has an opportunity to facilitate efforts to address the nitrate issue and leverage these solutions for broader water quality benefits across the County.

Regulation of Water Pollution

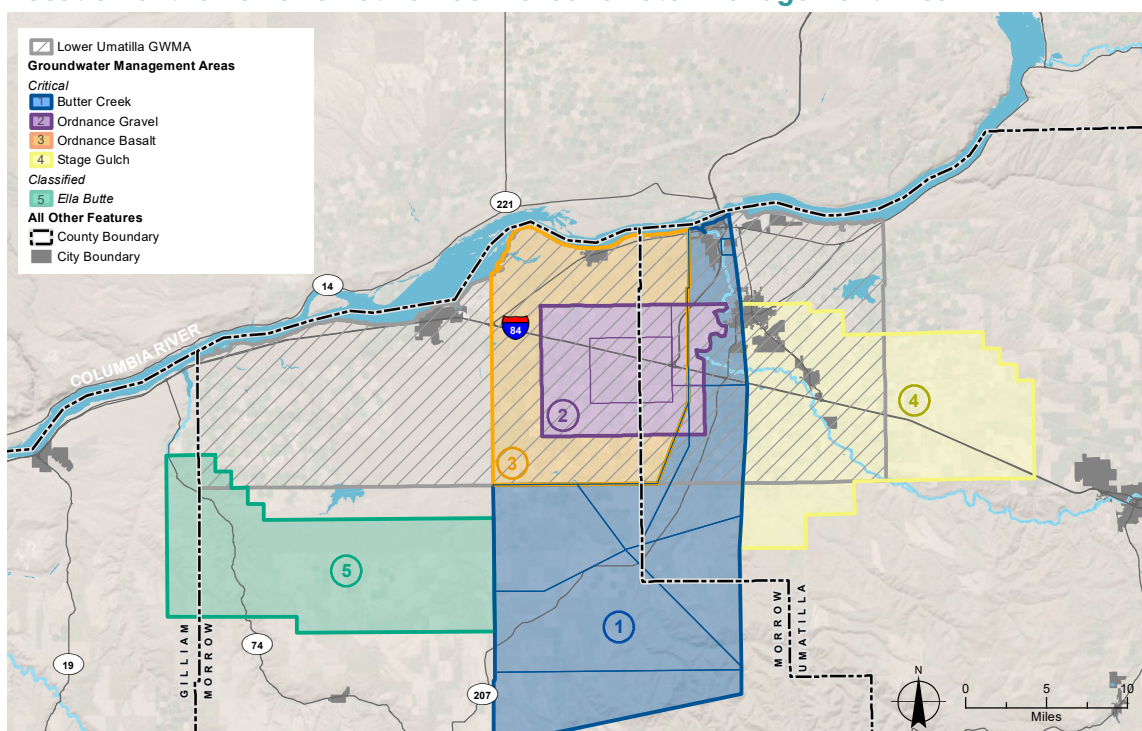
There are two types of water pollution: point and nonpoint sources. **Point source water pollution** comes from particular discharge points or pipes and must be regulated by permits that specify their pollutant limits. One example is Confined Animal Feeding Operations (CAFOs) where the Oregon Department of Agriculture (ODA) is the lead agency for permitting. Another example is water pollution control facilities operating land application of wastewater (or process water), which is permitted by Oregon Department of Environmental Quality (DEQ). **Nonpoint source water pollution** comes from the landscape and generally cannot be traced to a single source. Examples of nonpoint water pollution sources include stormwater runoff from roadways and urban areas, runoff from agricultural and forest lands, and runoff from rural residential properties. Groundwater can be polluted by nonpoint sources, including agricultural amendments (fertilizers and manure).

The U.S. Environmental Protection Agency (EPA) delegated authority to implement the 1987 federal Clean Water Act (CWA) in Oregon to DEQ as the lead state agency. DEQ then works with other state agencies to meet the requirements of the CWA. For example, DEQ sets water quality standards and develops total maximum daily loads (TMDLs) for impaired waterbodies, which are approved by the EPA. DEQ issues national pollution discharge elimination system (NPDES) permits for point sources. For nonpoint source water pollution, DEQ works with Oregon Health Authority (OHA) to implement the Source Water Protection Program for drinking water source watersheds and with ODA to implement Water Quality Management Area Plans for agricultural lands. These regulatory programs apply to all areas throughout the County.

Groundwater Quality

Under the 1989 Oregon Groundwater Quality Protection Act, DEQ has the authority to declare Groundwater Management Areas (GWMAs) to address nonpoint sources of pollution. In 1990, DEQ declared the Lower Umatilla Basin GWMA (LUBGWMA) due to regional nitrate concentrations exceeding their threshold value of 7 milligrams per liter (mg/L). The LUBGWMA encompasses approximately 550 square miles in northern Umatilla and Morrow Counties. While there are other groundwater quality issues across Morrow County, the following discussion focuses on the LUBGWMA area because it is a top priority for the County in trying to address the financial and health issues faced by the people in the County.

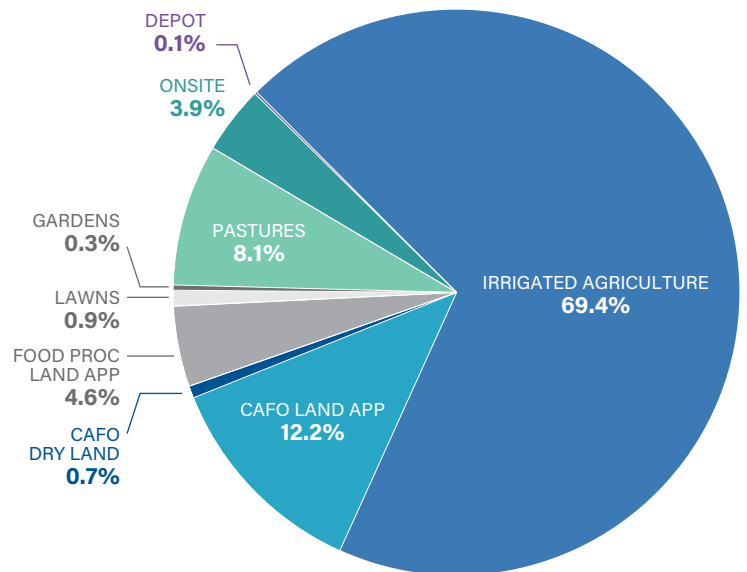
Location of the Lower Umatilla Basin Groundwater Management Area



Note: Critical Groundwater Areas (CGWAs) were declared by the Oregon Water Resources Department in response to declining groundwater levels in the alluvial and basalt aquifers. Refer to the companion briefing paper entitled "State of the Water: Overview of Water Quantity Challenges in Morrow County", dated October 2023.

The LUBGWMA is assisted by the LUBGWMA Committee, which is a planning body established by and working with DEQ and other federal and state agencies to coordinate nitrate reduction planning and action in the LUBGWMA. The Committee was formed in 1990 and was reorganized in 2022 into a formal policy body with bylaws to fulfill the statutory obligations (Oregon Revised Statute 468B.179) provided in the Oregon Groundwater Quality Protection Act. The Committee includes representatives from state, local, and Tribal governments; organizations; businesses; industries; and the public.¹ The Umatilla County Soil and Water Conservation District (SWCD) and Morrow SWCD were also involved, and Morrow SWCD was designated as the lead agency for developing and implementing Local Action Plans.

Estimation of Nitrogen Leached to Groundwater



Source: Adapted from LUBGWMA Second Action Plan, 2020

The major activities and milestones that have occurred since declaration of the LUBGWMA include:

- Initial characterization took place from 1990 to 1993 and included research led by DEQ to determine the nonpoint sources of nitrate contamination, as well as to assess the level of pollution and probable solutions to recovery in the LUBGWMA.
- The First Local Action Plan was produced in 1997 and focused on recommendations to encourage stakeholders to undertake voluntary efforts to reduce nitrate contamination. Recommended activities included (1) developing general educational materials to raise awareness of the issues, (2) encouraging research, and (3) reviewing permits and regulated sources for compliance. Lack of funding and resources was a factor in limited implementation of recommendations.
- Annual Progress Reports were written from 1997 to 2009 to outline activities and 4-year evaluations were conducted. This included sampling from DEQ's monitoring well network. Additional reports characterizing the nitrate conditions in the LUBGWMA were published by DEQ in 2011 and 2012.
- The Second Local Action Plan, produced and approved by DEQ in 2020, replaced the First Local Action Plan but followed a similar voluntary approach with annual and 4-year progress reports. One key difference is that this plan applied a more robust statistical approach to the sampling data. The recommendations were also grouped by particular interest and nitrate source category. The Second Action Plan allowed for focus areas within the LUBGWMA to evaluate and place concerted energy on potential improvement outcomes in the most important identified areas. The first 4-year assessment under the Second Local Action Plan will come in 2024.

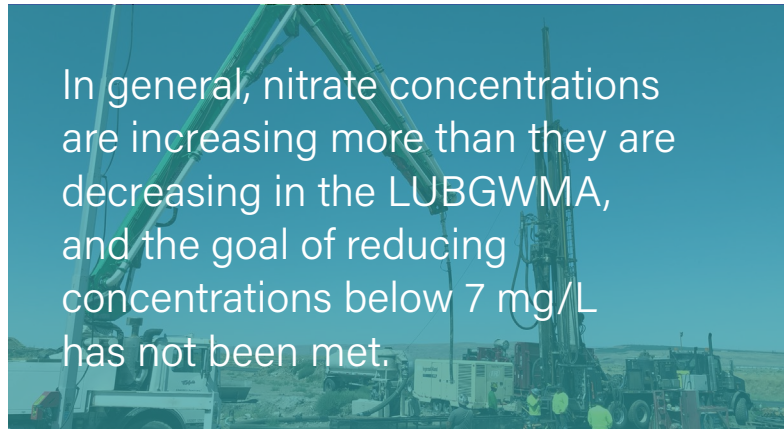
The goals of both Local Action Plans were to reduce groundwater nitrate concentrations throughout the region through voluntary actions so that the LUBGWMA declaration can be repealed. The Second Local Action Plan also had a goal to sustain this reduction so that public and private drinking water remains safe to drink. In both Local Action Plans, nitrate pollution was not attributed to a single source but rather a group of industries and activities. The LUBGWMA Committee identified the following as causes of the nitrate contamination² and

1. <https://lubgwma.org/contact-2/>

2. The U.S. Army Umatilla Chemical Depot's washout lagoons were identified as source in the First Local Action Plan, but are no longer considered a major source because federal and state authorities have implemented a cleanup action using a groundwater pump-and-treat system. The lagoons represent an estimated contribution of about 0.1 percent of nitrate.

aimed to work with these groups towards nitrate reductions:

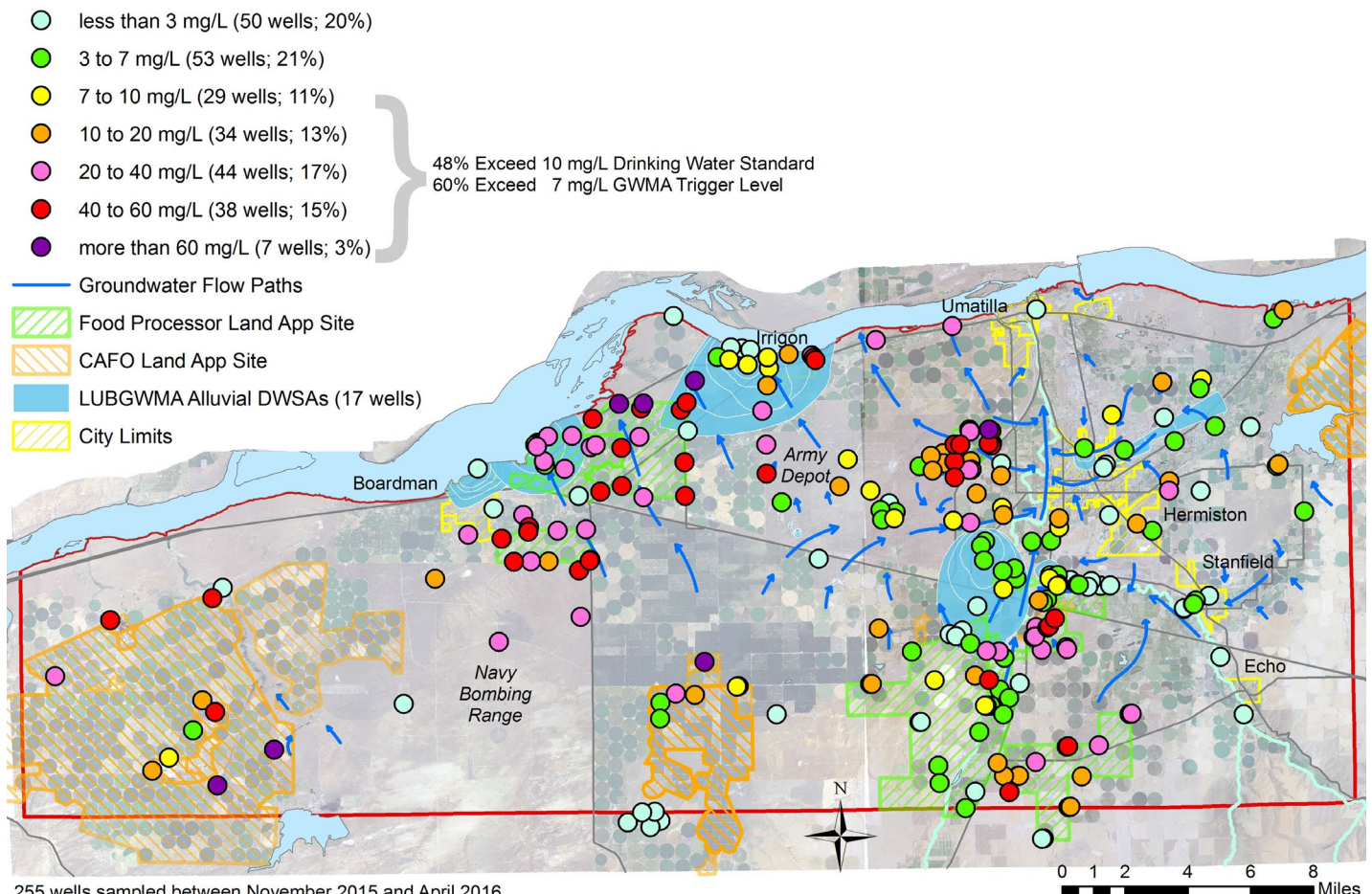
- Irrigated agriculture (fertilizer use)
- CAFOs (wastewater and manure associated with large-scale livestock operations)
- Livestock operations (pastures associated with individual household to larger-scale operations)
- Rural, open, and green spaces (including areas with septic systems and home fertilizer use)
- Food processing water reuse (land application)



In general, nitrate concentrations are increasing more than they are decreasing in the LUBGWMA, and the goal of reducing concentrations below 7 mg/L has not been met.

The First Local Action Plan focused on voluntary actions with the intention that education, awareness, and guidance would motivate the groups associated with nitrate sources to seek alternatives to reduce the likelihood of groundwater contamination. The approach was also intended to complement water quality permits issued by DEQ and ODA for point sources. However, no state funding was allocated to execute the plan's recommendations and actions. Ongoing data collected from the wells in the LUBGWMA indicate that many continue to have nitrate concentrations exceeding the 7 mg/L trigger level. In general, nitrate concentrations have increased in some areas and decreased in others, but the Second Local Action Plan concluded that while there is no consistent geographic pattern, overall concentrations are increasing more than they are decreasing and the goal of reducing concentrations below 7 mg/L has not been met.

Composite of Available Nitrate Data in the LUBGWMA



255 wells sampled between November 2015 and April 2016. Wells sampled include the 17 alluvial aquifer public supply wells, 56 private water supply wells, 10 irrigation wells, 171 monitoring wells, and 1 stock watering well.

Source: LUBGWMA Second Action Plan, 2020

Surface Water Quality

Surface water quality issues in the region are driven primarily by non-point sources of pollution, including runoff from agricultural and forest lands, urban areas, various land use development, and roads. Regional surface water quality issues include high stream temperatures, low dissolved oxygen, pH extremes (alkalinity and acidity), sediment, bacteria, algae, and excess nutrients such as nitrate and phosphorus. These conditions can harm fish, impact domestic water supplies, and make waterways unfit for recreational activities such as swimming. High levels of nutrients in warm water can cause harmful algal blooms, which have occurred in Willow Creek Reservoir near Heppner.

Several stream segments in the Umatilla River and Willow Creek basins have been declared “water quality limited” by DEQ under Section 303(d) of the CWA. DEQ established plans to improve water quality through TMDLs, which set limits on the amount of each pollutant that can enter a water body while meeting water quality standards. The total allowable amount is allocated among the sectors contributing to the issue. Because of this, meeting the TMDL goals may require efforts from agriculture, forestry, reservoir operations, industry, septic system owners, and others.

Stormwater runoff or excess irrigation runoff can carry pollutants such as bacteria and agricultural chemicals like pesticides and herbicides to surface water bodies. The region’s sandy soils can allow these pollutants to filter down through the soil, often reaching groundwater. When this occurs in areas in close proximity to surface water, the interconnection between groundwater and surface water can eventually lead to pollutants reaching surface water through the discharge of groundwater.

Key Issues/Impacts

Water quality issues have important human health, economic, and environmental consequences for Morrow County. Nitrate in particular dissolves easily in water and can leach down through the soil into groundwater. When too much nitrate enters the environment, water can become polluted, causing serious problems for human health, economic activities, and ecosystems.

As noted in the Second Local Action Plan, elevated nitrate levels may pose serious health concerns for infants or pregnant individuals. The DEQ website for the LUBGWMA states that “high levels of nitrate can increase the risk of methemoglobinemia, or blue baby syndrome, especially for infants who drink baby formula mixed with water containing nitrate above the safe level.”

A key issue is that elevated nitrate concentrations are present in many domestic wells in Morrow County and the region, and obtaining alternative drinking water supplies for domestic well users is challenging because of their geographic distribution and varying conditions. More information is presented in the companion briefing paper entitled “State of the Water: Overview of Nitrate Challenges for Domestic Well Users in Morrow County,” dated October 2023.

Agriculture and industries such as food processing are key economic drivers in the region. Both Morrow and Umatilla Counties are ranked among the top 10 counties in Oregon for production of several crops and animal products, with Morrow County being the state’s top county for cattle and dairy, and Umatilla being the top county for grains and vegetables. Farmers rely on fertilizers to provide nitrogen as an essential plant nutrient. While many farmers use sophisticated methods to avoid over-application to manage costs and for sustainability, over-application of fertilizer and overwatering of fields can cause the excess water to percolate down through the soil into groundwater, carrying nitrate with it. According to the Second Local Action Plan, irrigated agriculture (from fertilizer use) is estimated to contribute nearly 70 percent of the nitrogen leached to groundwater in the LUBGWMA. Furthermore, land application of food processing wastewater can also be a source of nitrate despite being a permitted operation by DEQ.



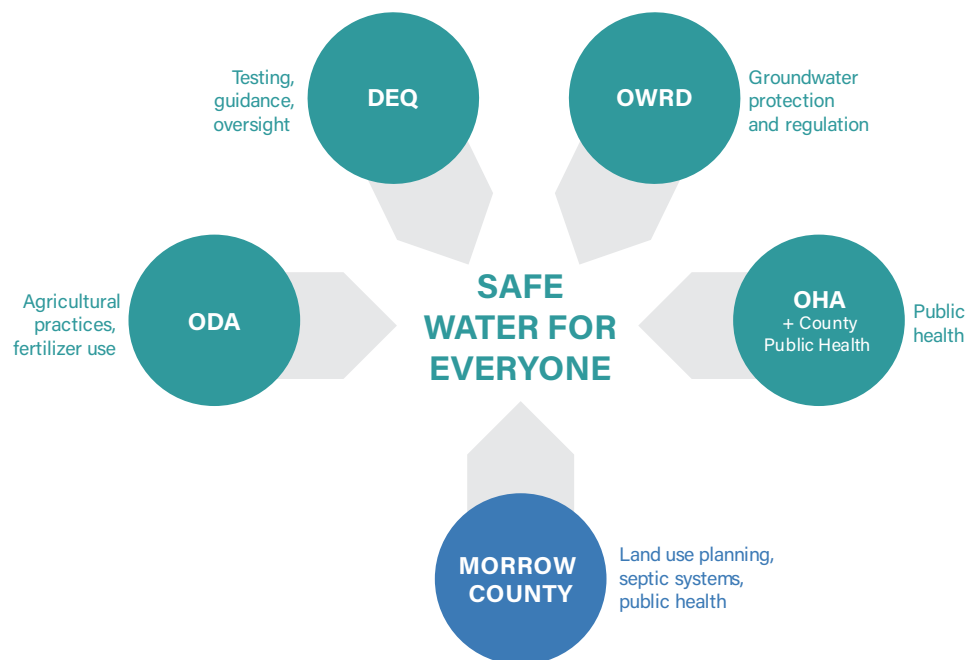
Water quality issues, including nitrate, typically affect the alluvial aquifer more than the deeper basalt aquifers in the region. Areas of the shallow alluvial aquifer adjacent to and interconnected with surface water contributes baseflow to streams and rivers, especially during the dry summer months. Most of the summertime streamflow in the lower Umatilla River downstream of Echo comes from groundwater discharge and return flows from irrigation, both of which may contain nitrate. The water quality of interconnected surface water throughout the region can be impacted by high levels of nitrate in groundwater discharging to streams, which can result in eutrophication (excess nutrients in the water body) and algae growth. The lower Umatilla River has experienced episodes of eutrophication and algal blooms in the summer due to high levels of nitrate and phosphate, and the Umatilla National Wildlife Refuge has documented algal blooms in the sloughs due to elevated nitrate. Further upgradient in Umatilla County, Wildhorse Creek and its tributary Spring Hollow Creek are on the CWA 303(d) list as being water quality-limited year-round for nitrate, primarily due to agriculture in the watersheds.

Opportunities to Address Water Quality Challenges

With enduring water quality issues, the County is faced with being proactive and directly engaged to help address the public health risks to County residents. However, Morrow County is one entity in a region with many water stakeholders and has not historically been at the forefront of water management. The County is one of several government agencies with responsibility for addressing water quality issues in the Umatilla Basin.

While elevated nitrate levels in groundwater is not the only water quality issue for Morrow County, it is the most prevalent with immediate and ongoing impacts to County residents, and its management is tied directly to the agricultural operations and land uses driving the local economy. Participation and support from the County for this issue can transfer and be instrumental in addressing other water quality issues.

The Second Local Action Plan in 2020 presents recommendations and activities that can reduce nitrate in the long-term and meet the goal of repealing the LUBGWMA. However, there was no state or federal funding allocated to execute either the First or Second Local Action Plans. Local jurisdictions, including the County, were and are resource-constrained to effectively implement voluntary tasks, which naturally become lower priority compared to mandatory programs and requirements.



Findings from the Second Local Action Plan directly or indirectly initiated a sequence of events that have recently garnered significant attention and greater urgency from regulatory agencies, government officials, and other parties. These events in turn have motivated government officials to authorize or commit funding (in the millions of dollars) to address the public health threats to domestic well users in the near term (refer to the companion memorandum entitled “State of the Water: Overview of Nitrate Challenges for Domestic Well Users in Morrow County,” dated October 2023, for more information).

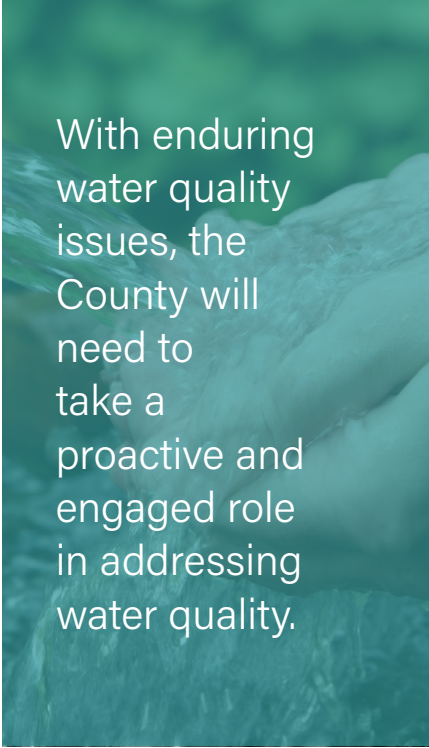
DEQ has the responsibility to determine whether the voluntary approach applied in the LUBGWMA Local Action Plans are effective or whether to enact mandatory requirements. While DEQ has not made any determinations about mandatory requirements to date, it will be important to track the review process and understand if and how mandatory requirements may be developed and the implications for the County’s role and existing programs.

State and federal funding sources are being pursued for more robust data collection. County and state agencies are collaborating to develop a peer-reviewed data set (including historical and more recent data) and a comprehensive data management system that can be used to develop a common characterization of the nature and extent of contamination, as well as to better understand the hydrogeology of the region.

The non-point sources and widespread nature of the water quality impacts in the region can make developing solutions daunting. However, there is an opportunity to approach the water quality problem through a priority lens by targeting hotspot areas to understand the source and nature and extent of contamination and develop solutions specific to that area. This is similar to how aquifer recharge projects are being developed in the region to benefit localized groundwater declines.

Regardless of the path that led to the present situation, Morrow County is in a position with its public health and economic development functions to engage all parties. The opportunity for the County will be to effectively plan for and coordinate the anticipated funding resources to prioritize their use and maximize benefits, as discussed in the companion memorandum entitled “State of the Water: Overview of Nitrate Challenges for Domestic Well Users in Morrow County,” dated October 2023.

This briefing paper was prepared by GSI Water Solutions, Inc., under contract with Morrow County.



With enduring water quality issues, the County will need to take a proactive and engaged role in addressing water quality.

