OREGON DEPARTMENT OF AGRICULTURE

Upper Willamette and Upper Siuslaw Agricultural Water Quality Management Area Plan

March 2023

Developed by the

Oregon Department of Agriculture

and the

Upper Willamette and Upper Siuslaw Local Advisory Committee

with support from the

Upper Willamette Soil and Water Conservation District

Oregon Department of Agriculture
Water Quality Program
635 Capitol St. NE
Salem, OR 97301
(503) 986-4700

Upper Willamette SWCD
3291 W. First Ave
Eugene, OR 97402
(541) 852-6680
admin@uwswcd.org

Website: oda.direct/AgWQPlans

(This page is blank)

Table of Contents

(This page is blank)

Acronyms and Terms

Ag Water Quality Program – Agricultural Water Quality Program
Area Plan – Agricultural Water Quality Management Area Plan
Area Rules – Agricultural Water Quality Management Area Rules
CAFO – Confined Animal Feeding Operation
CWA – Clean Water Act
DEQ – Oregon Department of Environmental Quality
GWMA – Groundwater Management Area
HUC – Hydrologic Unit Code
LAC – Local Advisory Committee
LMA – Local Management Agency
Management Area – Agricultural Water Quality Management Area
NRCS – Natural Resources Conservation Service
OAR – Oregon Administrative Rules
ODA – Oregon Department of Agriculture
ORS – Oregon Revised Statute
OWEB – Oregon Watershed Enhancement Board
OWRI – Oregon Watershed Restoration Inventory
PSP – Pesticide Stewardship Partnership
SIA – Strategic Implementation Area
SWCD – Soil and Water Conservation District
TMDL – Total Maximum Daily Load
US EPA – United States Environmental Protection Agency

(This page is blank)

Foreword

This Agricultural Water Quality Management Area Plan (Area Plan) provides guidance for addressing water quality related to agricultural activities in the Agricultural Water Quality Management Area (Management Area). The Area Plan identifies strategies to prevent and control water pollution from agricultural lands through a combination of outreach programs, suggested land treatments, management activities, compliance, and monitoring.

The Area Plan is neither regulatory nor enforceable (Oregon Revised Statute (ORS) 568.912(1)). The Area Plan refers to associated Agricultural Water Quality Management Area Rules (Area Rules). The Area Rules are Oregon Administrative Rules (OARs) and are enforced by the Oregon Department of Agriculture (ODA).

Required Elements of Area Plans

Area Plans must describe a program to achieve the water quality goals and standards necessary to protect designated beneficial uses related to water quality as required by federal and state law (OAR 603-090-0030(1)).

Plan Content

Chapter 1: Agricultural Water Quality Program Purpose and Background. Presents consistent and accurate information about the Ag Water Quality Program.

Chapter 2: Local Background. Provides the local geographic, water quality, and agricultural context for the Management Area. Describes the water quality issues, Area Rules, and potential practices to address water quality issues.

Chapter 3: Implementation Strategies. Describes activities to make and track progress towards the goals of the Area Plan. Presents goals, measurable objectives, strategic initiatives, proposed activities, and monitoring efforts.

Chapter 4: Progress and Adaptive Management. Describes progress toward achieving Area Plan goals and measurable objectives by summarizing accomplishments and monitoring results.

(This page is blank)

Chapter 1: Agricultural Water Quality Program

1.1 Purpose of Agricultural Water Quality Program and Applicability of Area Plans

As part of Oregon's Agricultural Water Quality Program (Ag Water Quality Program), the Area Plan guides landowners and partners such as Soil and Water Conservation Districts (SWCDs) in addressing water quality issues related to agricultural activities. The Area Plan identifies strategies to prevent and control "water pollution from agricultural activities and soil erosion" (ORS 568.909(2)) on agricultural and rural lands within the boundaries of this Management Area (OAR 603-090-0000(3)) and to achieve and maintain water quality standards (ORS 561.191(2)). The Area Plan has been developed and revised by ODA and the Local Advisory Committee (LAC), with support and input from the SWCD and the Oregon Department of Environmental Quality (DEQ). The Area Plan is implemented using a combination of outreach, conservation and management activities, compliance with Area Rules, monitoring, evaluation, and adaptive management.

The provisions of the Area Plan do not establish legal requirements or prohibitions (ORS 568.912(1)).

Each Area Plan is accompanied by Area Rules that describe local agricultural water quality regulatory requirements. ODA will exercise its regulatory authority for the prevention and control of water pollution from agricultural activities under the Ag Water Quality Program's general regulations (OAR 603-090-0000 to 603-090-0120) and under the Area Rules for this Management Area (OAR 603-095-2600). The general regulations guide the Ag Water Quality Program, and the Area Rules for the Management Area are the regulations with which landowners must comply. Landowners are encouraged through outreach and education to implement conservation and management activities.

The Area Plan and Area Rules apply to all agricultural activities on non-federal and non-Tribal Trust land within this Management Area including:

- Farms and ranches,
- Rural residential properties grazing animals or raising crops,
- Agricultural lands that lay idle or on which management has been deferred,
- Agricultural activities in urban areas,
- Agricultural activities on land subject to the Forest Practices Act (ORS 527.610).

Water quality on federal land in Oregon is regulated by DEQ and on Tribal Trust land by the respective tribe, with oversight by the United States Environmental Protection Agency (US EPA).

1.2 History of the Ag Water Quality Program

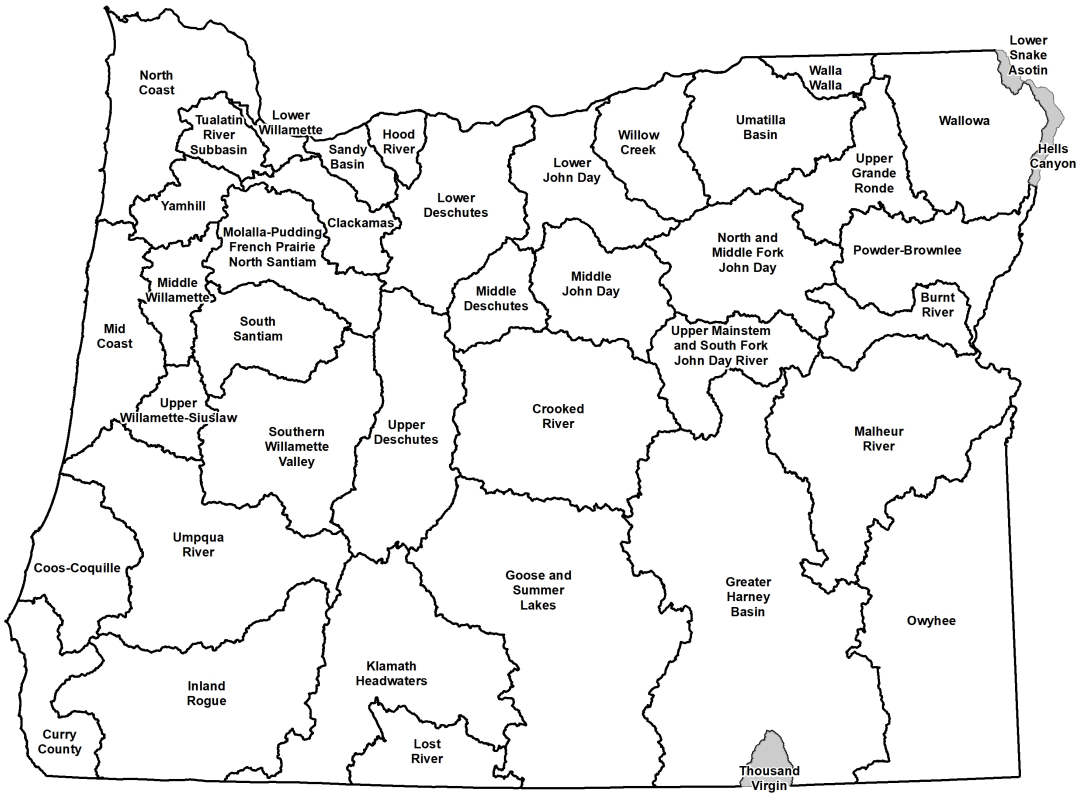
In 1993, the Oregon Legislature passed the Agricultural Water Quality Management Act directing ODA to develop plans to prevent and control water pollution from agricultural activities and soil erosion and achieve water quality standards and to adopt rules as necessary (ORS 568.900 through ORS 568.933). The Oregon Legislature passed additional legislation in 1995 to clarify that ODA is the lead agency for regulating agriculture with respect to water quality (ORS

561.191). The Area Plan and Area Rules were developed and subsequently revised pursuant to these statutes.

Between 1997 and 2004, ODA worked with LACs and SWCDs to develop Area Plans and Area Rules in 38 watershed-based Management Areas across Oregon (Figure 1.2). Since 2004, ODA, LACs, SWCDs, and other partners have focused on implementation including:

- Providing education, outreach, and technical assistance to landowners,
- Implementing projects to improve agricultural water quality,
- Investigating complaints of potential violations of Area Rules,
- Conducting biennial reviews of Area Plans and Area Rules,
- Monitoring, evaluation, and adaptive management,
- Developing partnerships with state and federal agencies, tribes, watershed councils, and others.

Figure 1.2 Map of 38 Agricultural Water Quality Management Areas*



*Gray areas are not included in Ag Water Quality Management Areas

1.3 Roles and Responsibilities

1.3.1 Oregon Department of Agriculture

ODA is the agency responsible for implementing the Ag Water Quality Program (ORS 568.900 to 568.933, ORS 561.191, OAR 603-090, and OAR 603-095). The Ag Water Quality Program was established to develop and implement water quality management plans for the prevention

and control of water pollution from agricultural activities and soil erosion. State and federal laws that drive the establishment of an Area Plan include:

- State water quality standards,
- Load allocations for agricultural or nonpoint source pollution assigned under Total Maximum Daily Loads (TMDLs) issued pursuant to the federal Clean Water Act (CWA), Section 303(d),
- Approved management measures for Coastal Zone Act Reauthorization Amendments (CZARA),
- Agricultural activities detailed in a Groundwater Management Area (GWMA) Action Plan (if DEQ has established a GWMA in the Management Area and an Action Plan has been developed).

ODA bases Area Plans and Area Rules on scientific information (ORS 568.909). ODA works in partnership with SWCDs, LACs, DEQ, and other partners to implement, evaluate, and update the Area Plans and Area Rules. If and when other governmental policies, programs, or rules conflict with the Area Plan or Area Rules, ODA will consult with the appropriate agencies to resolve the conflict in a reasonable manner.

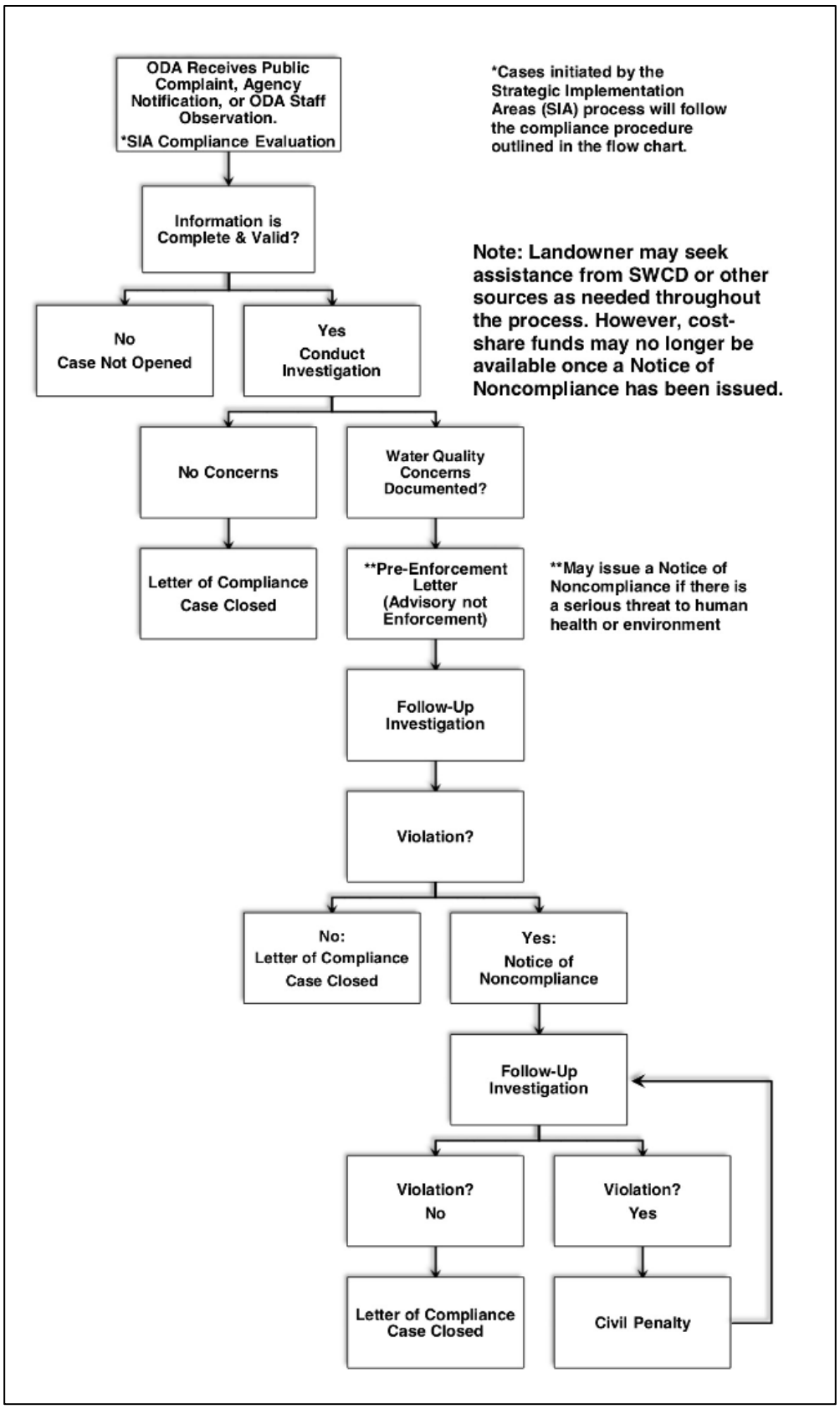
1.3.1.1 ODA Compliance Process

ODA is responsible for any actions related to enforcement or determination of noncompliance with Area Rules (OAR 603-090-0080 through OAR 603-090-0120). ORS 568.912(1) and ORS 568.912(2) give ODA the authority to adopt rules that require landowners to perform actions necessary to prevent and control pollution from agricultural activities and soil erosion.

The Area Rules are a set of standards that landowners must meet on all agricultural or rural lands. “Landowner” includes any landowner, land occupier, or operator per OAR 603-95-0010(24). All landowners must comply with the Area Rules. ODA will use enforcement where appropriate and necessary to achieve compliance with Area Rules. Figure 1.3.1 outlines ODA’s compliance process. ODA will pursue enforcement action only when reasonable attempts at voluntary solutions have failed (OAR 603-090-0000(5)(e)). If a violation is documented, ODA may issue a pre-enforcement notification or an enforcement order such as a Notice of Noncompliance. If a Notice of Noncompliance is issued, ODA will direct the landowner to remedy any conditions through required corrective actions under the provisions of the enforcement procedures outlined in OAR 603-090-060 through OAR 603-090-120. If a landowner does not implement the required corrective actions, ODA may assess civil penalties for continued violation of the Area Rules.

Any member of the public may file a complaint, and any public agency may file a notification of a potential violation of the Area Rules. ODA also may initiate an investigation based on its own observation or from cases initiated through the Strategic Implementation Area process (See Figure 1.3.1.1).

Figure 1.3.1.1 Compliance Flow Chart



1.3.2 Local Management Agency

A Local Management Agency (LMA) is an organization designated by ODA to assist with the implementation of an Area Plan (OAR 603-090-0010). The Oregon Legislature intended that SWCDs be LMAs to the fullest extent practical, consistent with the timely and effective implementation of Area Plans (ORS 568.906). SWCDs have a long history of effectively assisting landowners to voluntarily address natural resource concerns. Currently, all LMAs in Oregon are SWCDs.

The day-to-day implementation of the Area Plan is accomplished through an Intergovernmental Grant Agreement between ODA and each SWCD. Every two years, each SWCD submits a scope of work to ODA to receive funding to implement the Area Plan. Each SWCD implements the Area Plan by providing outreach and technical assistance to landowners. SWCDs also work with ODA and the LAC to establish implementation priorities, evaluate progress toward meeting Area Plan goals and objectives, and revise the Area Plan and Area Rules as needed.

1.3.3 Local Advisory Committee

For each Management Area, the director of ODA appoints an LAC (OAR 603-090-0020) with up to 12 members. The LAC serves in an advisory role to the director of ODA and to the Board of Agriculture. The role of the LAC is to provide a high level of citizen involvement and support the development, implementation, and biennial reviews of the Area Plan and Area Rules. The LAC's primary role is to advise ODA and the LMA on local agricultural water quality issues as well as evaluate the progress toward achieving the goals and objectives of the Area Plan. LACs are composed primarily of agricultural landowners in the Management Area and must reflect a balance of affected persons.

The LAC is convened at the time of the biennial review; however, the LAC may meet as frequently as necessary to carry out its responsibilities, which include but are not limited to:

- Participate in the development and subsequent revisions of the Area Plan and Area Rules,
- Recommend strategies necessary to achieve the goals and objectives in the Area Plan,
- Participate in biennial reviews of the progress of implementation of the Area Plan and Area Rules,
- Submit written biennial reports to the Board of Agriculture and the ODA director.

1.3.4 Agricultural Landowners

The emphasis of the Area Plan is on voluntary action by landowners to control the factors affecting water quality in the Management Area. In addition, each landowner in the Management Area is required to comply with the Area Rules. To achieve water quality goals or compliance, landowners may need to select and implement an appropriate suite of measures. The actions of each landowner will collectively contribute toward achievement of water quality standards.

Technical assistance, and often financial assistance, is available to landowners who want to work with SWCDs or other local partners, such as watershed councils, to achieve land conditions that contribute to good water quality. Landowners may also choose to improve their land conditions without assistance.

Under the Area Plan and Area Rules, agricultural landowners are not responsible for mitigating or addressing factors that are caused by non-agricultural activities or sources, such as:

- Hot springs, glacial melt water, unusual weather events, and climate change,
- Wildfires and other natural disasters,
- Septic systems and other sources of human waste,
- Public roadways, culverts, roadside ditches, and shoulders,
- Dams, dam removal, hydroelectric plants, and non-agricultural impoundments,
- Housing and other development in agricultural areas,
- Impacts on water quality and streamside vegetation from wildlife such as waterfowl, elk, and feral horses,
- Other circumstances not within the reasonable control of the landowner.

However, agricultural landowners may be responsible for some of these impacts under other legal authorities.

1.3.5 Public Participation

The public was encouraged to participate when ODA, LACs, and SWCDs initially developed the Area Plan and Area Rules. In each Management Area, ODA and the LAC held public information meetings, a formal public comment period, and a formal public hearing. ODA and the LACs modified the Area Plan and Area Rules, as needed, to address comments received. The director of ODA adopted the Area Plan and Area Rules in consultation with the Board of Agriculture.

ODA, LACs, and LMAs conduct biennial reviews of the Area Plan and Area Rules. Partners, stakeholders, and the general public are invited to participate in the process. Any revisions to the Area Rules will include a formal public comment period and a formal public hearing.

1.4 Agricultural Water Quality

The federal CWA directs states to designate beneficial uses related to water quality, decide on parameters to measure to determine whether beneficial uses are being met, and set water quality standards based on the beneficial uses and parameters.

1.4.1 Point and Nonpoint Sources of Water Pollution

There are two types of water pollution. Point source water pollution emanates from clearly identifiable discharge points or pipes. Point sources are required to obtain permits that specify their pollutant limits. Agricultural operations regulated as point sources include permitted Confined Animal Feeding Operations (CAFOs), and all permitted CAFOs are subject to ODA's CAFO Program requirements. Irrigation return flow from agricultural fields may drain through a defined outlet but is exempt under the CWA and does not currently require a permit.

Nonpoint-source water pollution originates from the general landscape and is difficult to trace to a single source. Nonpoint water pollution sources include runoff from agricultural and forest lands, urban and suburban areas, roads, and natural sources. In addition, groundwater can be polluted by nonpoint sources including agricultural amendments (fertilizers and manure).

1.4.2 Beneficial Uses and Parameters of Concern

Beneficial uses related to water quality are defined by DEQ for each basin. The most sensitive beneficial uses usually are fish and aquatic life, water contact recreation, and public and private domestic water supply. These uses generally are the first to be impaired because they are affected at lower levels of pollution. While there may not be severe impacts on water quality from a single source or sector, the combined effects from all sources can contribute to the impairment of beneficial uses in the Management Area. Beneficial uses that have the potential to be impaired in this Management Area are summarized in Chapter 2.4.1.1.

Many waterbodies throughout Oregon do not meet state water quality standards. The most common water quality concerns statewide related to agricultural activities are temperature, bacteria, biological criteria, sediment, turbidity, phosphorous, nitrates, algae, pH, dissolved oxygen, harmful algal blooms, pesticides, and mercury. Water quality impairments vary across the state; they are summarized for this Management Area in Chapter 2.4.

1.4.3 Impaired Waterbodies and Total Maximum Daily Loads

Every two years, DEQ is required by the CWA to assess water quality in Oregon, resulting in the "Integrated Report." CWA Section 303(d) requires DEQ to identify "impaired" waters that do not meet water quality standards. The resulting list is commonly referred to as the "303(d) list" (http://www.oregon.gov/deq/wq/Pages/WQ-Assessment.aspx). In accordance with the CWA, DEQ must establish TMDLs for pollutants on the 303(d) list. For more information, visit www.oregon.gov/deq/wq/tmdls/Pages/default.aspx.

A TMDL includes an assessment of conditions (based on water quality data, land condition data, and/or computer modeling) and describes a plan to achieve water quality standards. TMDLs specify the daily amount of pollution a waterbody can receive and still meet water quality standards. TMDLs generally apply to an entire basin or subbasin, not just to an individual waterbody on the 303(d) list. In the TMDL, point sources are assigned waste load allocations that are then incorporated into National Pollutant Discharge Elimination System permits. Nonpoint sources (agriculture, forestry, and urban) are assigned a load allocation to achieve.

As part of the TMDL process, DEQ identifies Designated Management Agencies and Responsible Persons, which are parties responsible for submitting TMDL implementation plans. TMDLs designate ODA as the lead agency responsible for implementing the TMDL on agricultural lands. ODA uses the applicable Area Plan(s) as the implementation plan for the agricultural component of the TMDL. Biennial reviews and revisions to the Area Plan and Area Rules must address agricultural or nonpoint source load allocations from relevant TMDLs.

The 303(d) list, the TMDLs, and the agricultural load allocations for the TMDLs that apply to this Management Area are summarized in Chapter 2.4.1.

1.4.4 Oregon Water Pollution Control Law – ORS 468B.025 and 468B.050

In 1995, the Oregon Legislature passed ORS 561.191. This statute states that any program or rules adopted by ODA "shall be designed to assure achievement and maintenance of water quality standards adopted by the Environmental Quality Commission."

To implement the intent of ORS 561.191, ODA incorporated ORS 468B.025 and 468B.050 into all 38 sets of Area Rules.

ORS 468B.025 (prohibited activities) states that:
"(1) Except as provided in ORS 468B.050 or 468B.053, no person shall:
(a) Cause pollution of any waters of the state or place or cause to be placed any wastes in a location where such wastes are likely to escape or be carried into the waters of the state by any means.
(b) Discharge any wastes into the waters of the state if the discharge reduces the quality of such waters below the water quality standards established by rule for such waters by the Environmental Quality Commission.
(2) No person shall violate the conditions of any waste discharge permit issued under ORS 468B.050."

ORS 468B.050 identifies the conditions when a permit is required. A permit is required for CAFOs that meet minimum criteria for confinement periods and have large animal numbers or have wastewater facilities. The portions of ORS 468B.050 that apply to the Ag Water Quality Program state that:
"(1) Except as provided in ORS 468B.053 or 468B.215, without holding a permit from the Director of the Department of Environmental Quality or the State Department of Agriculture, which permit shall specify applicable effluent limitations, a person may not:
(a) Discharge any wastes into the waters of the state from any industrial or commercial establishment or activity or any disposal system."

Definitions used in ORS 468B.025 and 468B.050:

" 'Pollution' or 'water pollution' means such alteration of the physical, chemical, or biological properties of any waters of the state, including change in temperature, taste, color, turbidity, silt or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state, which will or tends to, either by itself or in connection with any other substance, create a public nuisance or which will or tends to render such waters harmful, detrimental or injurious to public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses or to livestock, wildlife, fish or other aquatic life or the habitat thereof" (ORS 468B.005(5)).

" 'Water' or 'the waters of the state' include lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or affect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction" (ORS 468B.005(10)).

" 'Wastes' means sewage, industrial wastes, and all other liquid, gaseous, solid, radioactive or other substances, which will or may cause pollution or tend to cause pollution of any waters of the state.' (ORS 468B.005(9)). Additionally, the definition of 'wastes' given in OAR 603-095-0010(53) "includes but is not limited to commercial fertilizers, soil amendments, composts, animal wastes, vegetative materials or any other wastes."

1.4.5 Streamside Vegetation and Agricultural Water Quality

Across Oregon, the Ag Water Quality Program emphasizes streamside vegetation protection and enhancement. Streamside vegetation can provide three primary water quality functions: shade to reduce stream temperature warming from solar radiation, streambank stability, and filtration of pollutants. Other water quality functions from streamside vegetation include water

storage in the soil for cooler and later season flows, sediment trapping that can build streambanks and floodplains, narrowing and deepening of channels, and biological uptake of sediment, organic material, nutrients, and pesticides. In addition, streamside vegetation provides habitat for numerous species of fish and wildlife. Streamside vegetation conditions can be monitored to track progress toward achieving conditions that support water quality.

Site-Capable Vegetation

The Ag Water Quality Program uses the concept of "site-capable vegetation" to describe the streamside vegetation that can be expected to grow at a particular site, given natural site factors (e.g., elevation, soils, climate, hydrology, wildlife, fire, floods) and historical and current human influences that are beyond the program's statutory authority (e.g., channelization, roads, modified flows, previous land management). Site-capable vegetation can be determined for a specific site based on current streamside vegetation at the site, streamside vegetation at nearby reference sites with similar natural characteristics, Natural Resources Conservation Service (NRCS) soil surveys and ecological site descriptions, and/or local or regional scientific research.

The goal for Oregon's agricultural landowners is to provide the water quality functions (e.g., shade, streambank stability, and filtration of pollutants) produced by site-capable vegetation along streams on agricultural lands. The Area Rules for each Management Area require that agricultural activities allow for the establishment and growth of streamside vegetation to provide the water quality functions equivalent to what site-capable vegetation would provide.

Occasionally, mature site-capable vegetation such as tall trees may not be needed along narrow streams. For example, shrubs and grass may provide shade, protect streambanks, and filter pollutants. However, on larger streams, mature site-capable vegetation is needed to provide the water quality functions.

In many cases, invasive, non-native plants, such as introduced varieties of blackberry and reed canarygrass, grow in streamside areas. This type of vegetation has established throughout much of Oregon due to historic and human influences and may provide some of the water quality functions of site-capable vegetation. ODA's statutory authority does not require the removal of invasive, non-native plants, however, ODA encourages landowners to remove these plants voluntarily. In addition, the Oregon State Weed Board identifies invasive plants that can impair watersheds. Public and private landowners are responsible for eliminating or intensively controlling noxious weeds, as described in state and local laws. For more information, visit www.oregon.gov/ODA/programs/weeds.

1.4.6 Soil Health and Agricultural Water Quality

An increasingly important concept in Oregon and across the United States is soil health. The Ag Water Quality Program promotes soil health to reduce erosion and keep sediment out of surface waters, thereby helping to maintain and improve water quality. Healthy soils have relatively high organic matter and well-formed soil structure. These characteristics may resist erosion and increase water infiltration, leading to less surface runoff and greater groundwater recharge; the resultant groundwater flows in some cases can help moderate stream water temperatures. (Note that the beneficial effects on water quality vary based on factors such as soil type and ecoregion.) According to the NRCS and others, there are four soil health principles that together build highly productive and resilient soils: minimize disturbance; and maximize cover, continuous living roots, and diversity above and below the surface.

Building soil health increases resiliency to extreme weather, protects water quality, and helps keep farms and ranches viable. Incorporating soil health practices can help landowners adapt and reduce risks. For more information, visit www.nrcs.usda.gov/wps/portal/nrcs/detail/or/soils/health.

1.5 Other Water Quality Programs

The following programs complement the Ag Water Quality Program and are described here to recognize their link to agricultural lands.

1.5.1 Confined Animal Feeding Operation Program

ODA is the lead state agency for the CAFO Program, which was developed to ensure that operators do not contaminate ground or surface water with animal manure or process wastewater. The CAFO Program coordinates with DEQ to issue permits. These permits require the registrant to operate according to a site-specific, ODA-approved, Animal Waste Management Plan that is incorporated into the CAFO permit by reference. For more information, visit oda.direct/CAFO.

1.5.2 Groundwater Management Areas

Groundwater Management Areas (GWMAs) are designated by DEQ where groundwater is polluted from, at least in part, nonpoint sources. After designating a GWMA, DEQ forms a local groundwater management committee comprised of affected and interested parties. The committee works with and advises the state agencies that are required to develop an action plan to reduce groundwater contamination in the area.

Oregon DEQ has designated three GWMAs because of elevated nitrate concentrations in groundwater: Lower Umatilla Basin, Northern Malheur County, and Southern Willamette Valley. Each GWMA has a voluntary action plan to reduce nitrates in groundwater. After a scheduled evaluation period, if DEQ determines that voluntary efforts are not effective, mandatory requirements may become necessary.

Any GWMA in this Management Area is described in Chapter 2.4.1.5. Any Measurable Objectives for the GWMA will be described in Chapter 3.1.5.

1.5.3 The Oregon Plan for Salmon and Watersheds

In 1997, Oregonians began implementing the Oregon Plan for Salmon and Watersheds, referred to as the Oregon Plan (www.oregon-plan.org). The Oregon Plan seeks to restore native fish populations, improve watershed health, and support communities throughout Oregon. The Oregon Plan has a strong focus on salmonids because of their great cultural, economic, and recreational importance to Oregonians, and because they are important indicators of watershed health. ODA's commitment to the Oregon Plan is to develop and implement Area Plans and Area Rules throughout Oregon.

1.5.4 Pesticide Management and Stewardship

ODA's Pesticides Program holds the primary responsibility for registering pesticides and regulating their use in Oregon under the Federal Insecticide, Fungicide, and Rodenticide Act. ODA's Pesticide Program administers regulations relating to pesticide sales, use, and distribution, including pesticide operator and applicator licensing as well as proper application of pesticides, pesticide labeling, and registration.

In 2007, Oregon formed the interagency Water Quality Pesticide Management Team to expand efforts to improve water quality in Oregon related to pesticide use. This team facilitates and coordinates activities such as monitoring, analysis and interpretation of data, effective response measures, and management solutions. The team relies on monitoring data from the Pesticide Stewardship Partnership (PSP) program and other federal, state, and local monitoring programs to assess the possible impact of pesticides on Oregon's water quality. Pesticide detections in Oregon's streams can be addressed through multiple programs and partners, including the PSP.

Through the PSP, state agencies and local partners work together to monitor pesticides in streams and to improve water quality (www.oregon.gov/ODA/programs/Pesticides/Water/Pages/PesticideStewardship.aspx). ODA, DEQ, and Oregon State University Extension Service work with landowners, SWCDs, watershed councils, and other local partners to voluntarily reduce pesticide levels while improving water quality and crop management. Since 2000, the PSPs have made noteworthy progress in reducing pesticide concentrations and detections.

Any PSPs in this Management Area are described in Chapter 3.1.4.

ODA led the development and implementation of a Pesticides Management Plan (PMP) for the state of Oregon (www.oregon.gov/ODA/programs/Pesticides/water/pages/AboutWaterPesticides.aspx). The PMP, completed in 2011, strives to protect drinking water supplies and the environment from pesticide contamination, while recognizing the important role that pesticides have in maintaining a strong state economy, managing natural resources, and preventing human disease. By managing the pesticides that are approved for use by the US EPA and Oregon in agricultural and non-agricultural settings, the PMP sets forth a process for preventing and responding to pesticide detections in Oregon's ground and surface water.

1.5.5 Drinking Water Source Protection

Oregon implements its drinking water protection program through a partnership between DEQ and the Oregon Health Authority. The program provides individuals and communities with information on how to protect the quality of Oregon's drinking water. DEQ and the Oregon Health Authority encourage preventive management strategies to ensure that all public drinking water resources are kept safe from current and future contamination. For more information, visit www.oregon.gov/deq/wq/programs/Pages/dwp.aspx.

1.5.6 Oregon's Coastal Management Program

The mission of the Oregon Coastal Management Program is to work in partnership with coastal local governments, state and federal agencies, and other partners and stakeholders to ensure that Oregon's coastal and ocean resources are managed, conserved, and developed consistent

with statewide planning goals. Oregon's Coastal Nonpoint Pollution Control Program (CNPCP) has been developed to comply with requirements of Section 6217 of the federal Coastal Zone Authorization Re-Authorization Act (CZARA). The US EPA and the National Oceanic and Atmospheric Administration administer CZARA at the federal level. The federal requirements are designed to restore and protect coastal waters from nonpoint source pollution and require coastal states to implement a set of management measures based on guidance published by the US EPA. The guidance contains measures for agricultural activities, forestry activities, urban areas, marinas, hydro-modification activities, and wetlands. In Oregon, the Department of Land Conservation and Development and DEQ coordinate the program. The geographic boundaries for the CNPCP include the North Coast, Mid-Coast, South Coast, Rogue, and Umpqua basins. Oregon has identified the ODA coastal Area Plans and Area Rules as the state's strategy to address agricultural measures. The Area Plan and Area Rules are designed to meet the requirements of CZARA and to implement agriculture's part of Oregon's CNPCP. For more information, visit www.oregon.gov/lcd/OCMP/Pages/Coastal-Zone-Management.aspx.

1.6 Partner Agencies and Organizations

1.6.1 Oregon Department of Environmental Quality

The US EPA delegated authority to DEQ to implement the federal CWA in Oregon. DEQ is the lead state agency with overall authority to implement the CWA in Oregon. DEQ works with other state agencies, including ODA and the Oregon Department of Forestry to meet the requirements of the CWA. DEQ sets water quality standards and develops TMDLs for impaired waterbodies, which ultimately are approved or disapproved by the US EPA. In addition, DEQ develops and coordinates programs to address water quality including National Pollutant Discharge Elimination System permits for point sources, the CWA Section 319 grant program, the Source Water Protection Program (in partnership with the Oregon Health Authority), the CWA Section 401 Water Quality Certification, and Oregon's Groundwater Management Program. DEQ also coordinates with ODA to help ensure successful implementation of Area Plans.

A Memorandum of Agreement between DEQ and ODA recognizes that ODA is the state agency responsible for implementing the Ag Water Quality Program. ODA and DEQ updated the Memorandum of Agreement in 2012 and reviewed and confirmed it in 2018 (www.oregon.gov/ODA/shared/Documents/Publications/NaturalResources/DEQODAmoa.pdf).

The Environmental Quality Commission, which serves as DEQ's policy and rulemaking board, may petition ODA for a review of part or all of any Area Plan or Area Rules. The petition must allege, with reasonable specificity, that the Area Plan or Area Rules are not adequate to achieve applicable state and federal water quality standards (ORS 568.930(3)(a)).

1.6.2 Other Partners

ODA and SWCDs work in close partnership with local, state, and federal agencies and other organizations, including: DEQ (as described above), the NRCS and United States Department of Agriculture Farm Service Agency, watershed councils, Oregon State University Agricultural Experiment Stations and Extension Service, tribes, livestock and commodity organizations, conservation organizations, and local businesses. As resources allow, SWCDs and local partners provide technical, financial, and educational assistance to individual landowners for the

design, installation, and maintenance of effective management strategies to prevent and control agricultural water pollution and to achieve water quality goals.

1.7 Measuring Progress

Agricultural landowners have been implementing effective conservation projects and management activities throughout Oregon to improve water quality for many years. However, it has been challenging for ODA, SWCDs, and LACs to measure progress toward improved water quality. ODA is working with SWCDs, LACs, and other partners to develop and implement strategies that will produce measurable outcomes. ODA is also working with partners to develop monitoring methods to document progress.

1.7.1 Measurable Objectives

A measurable objective is a numeric long-term desired outcome to achieve by a specified date. Milestones are the interim steps needed to make progress toward the measurable objective and consist of numeric short-term targets to reach by specific dates. Together, the milestones define the timeline and progress needed to achieve the measurable objective.

The Ag Water Quality Program is working throughout Oregon with SWCDs and LACs toward establishing long-term measurable objectives to achieve desired conditions. ODA, the LAC, and the SWCD will establish measurable objectives and associated milestones for each Area Plan. Many of these measurable objectives relate to land conditions and primarily are developed for focused work in small geographic areas (Chapter 1.7.3). ODA's longer-term goal is to develop measurable objectives, milestones, and monitoring methods at the Management Area scale.

The State of Oregon continues to improve its ability to use remote-sensing technology to measure current streamside vegetation conditions and compare these to the conditions needed to meet stream shade targets. As the State's use of this technology moves forward, ODA will use the information to help LACs and LMAs set measurable objectives for streamside vegetation. These measurable objectives will be achieved through implementing the Area Plan, with an emphasis on voluntary incentive programs.

At each biennial review, ODA and its partners will evaluate progress toward measurable objectives and milestone(s) and why they were or were not achieved. ODA, the LAC, and LMA will evaluate whether changes are needed to continue making progress toward the measurable objective(s) and will revise strategies to address obstacles and challenges.

The measurable objective(s) and associated milestone(s) within the Management Area are in Chapter 3.1 and progress toward achieving the measurable objective(s) and milestone(s) is summarized in Chapter 4.1.

1.7.2 Land Conditions and Water Quality

Land conditions can serve as useful surrogates (indicators) for water quality parameters. For example, because shade blocks solar radiation from warming the stream, streamside vegetation, or its associated shade, generally is used as a surrogate for water temperature. In some cases, sediment can be used as a surrogate for pesticides or phosphorus, which often adhere to sediment particles.

The Ag Water Quality Program focuses on land conditions, in addition to water quality data, for several reasons:

- Landowners can see land conditions and have direct control over them,
- Improved land conditions can be documented immediately,
- Water quality impairments from agricultural activities are primarily due to changes in land conditions and management activities,
- It can be difficult to separate agriculture's influence on water quality from other land uses,
- There is generally a lag time between changes on the landscape and the resulting improvements in water quality,
- Extensive monitoring of water quality would be needed to evaluate progress, which would be expensive and may not demonstrate improvements in the short term.

Water quality monitoring data will help ODA and partners to measure progress or identify problem areas in implementing Area Plans. However, as described above, water quality monitoring may be slower to document changes than land condition monitoring.

1.7.3 Focused Implementation in Small Geographic Areas

Focus Areas

A Focus Area is a small watershed with water quality concerns associated with agriculture. The Focus Area process is SWCD-led, with ODA oversight. The SWCD delivers systematic, concentrated outreach and technical assistance. A key component is measuring conditions before and after implementation to document the progress made with available resources. The Focus Area approach is consistent with other agencies' and organizations' efforts to work proactively in small watersheds.

Focus Areas have the following advantages: a proactive approach that addresses the most significant water quality concerns, multiple partners that coordinate and align technical and financial resources, a higher density of projects that may lead to increased connectivity of projects, and a more effective and efficient use of limited resources.

Any Focus Areas in this Management Area are described in Chapter 3.1.2. SWCDs will also continue to provide outreach and technical assistance to the entire Management Area.

Strategic Implementation Areas

Strategic Implementation Areas (SIAs) are small watersheds selected by ODA, in consultation with partners, based on a statewide review of water quality data and other available information. ODA conducts an evaluation of likely compliance with Area Rules and contacts landowners with the results and next steps. The Oregon Watershed Enhancement Board (OWEB) and other partners make funding and technical assistance available to support conservation and restoration projects. These efforts should result in greater ecological benefit than relying solely on compliance and enforcement. Landowners have the option of working with the SWCD or other partners to voluntarily address water quality concerns. ODA follows up, as needed, to enforce the Area Rules. Finally, ODA completes a post-evaluation to document progress in the SIA.

Any SIAs in this Management Area are described in Chapter 3.1.3.

1.8 Progress and Adaptive Management

1.8.1 Biennial Reviews

The ODA, LAC, LMA, and partners evaluate progress of Area Plan implementation through the biennial review process. At each biennial review, they discuss: 1) Progress toward meeting measurable objectives and implementing strategies, 2) Local monitoring data from other agencies and organizations, including agricultural land conditions and water quality, and 3) ODA compliance activities. As a result of these discussions, ODA and partners revise implementation strategies and measurable objectives in Chapter 3 as needed.

ODA provides information from the Oregon Watershed Restoration Inventory (OWRI) on restoration project funding and accomplishments at biennial reviews and uses the information for statewide reporting. The majority of OWRI entries represent voluntary actions of private landowners who have worked in partnership with federal, state, and local groups to improve aquatic habitat and water quality conditions. OWRI is the single largest restoration information database in the western United States. For more information, visit www.oregon.gov/oweb/data-reporting/Pages/owri.aspx.

1.8.2 Agricultural Water Quality Monitoring

In addition to monitoring land conditions, ODA relies on water quality monitoring data where available. These data may be provided by other state or federal agencies or local entities; ODA seldom collects water quality samples outside of compliance cases.

As part of monitoring water quality status and trends, DEQ regularly collects water samples every other month throughout the year at more than 130 sites on more than 50 rivers and streams across the state. Sites are located across the major land uses (forestry, agriculture, rural residential, and urban/suburban). Parameters measured include alkalinity, biochemical oxygen demand, chlorophyll a, specific conductance, dissolved oxygen, bacteria (*E. coli)*, ammonia, nitrate and nitrite, pH, total phosphorus, total solids, temperature, and turbidity.

DEQ provides status and trends reports for selected parameters in relation to water quality standards. ODA will continue to work with DEQ to summarize the data results and how they apply to agricultural activities.

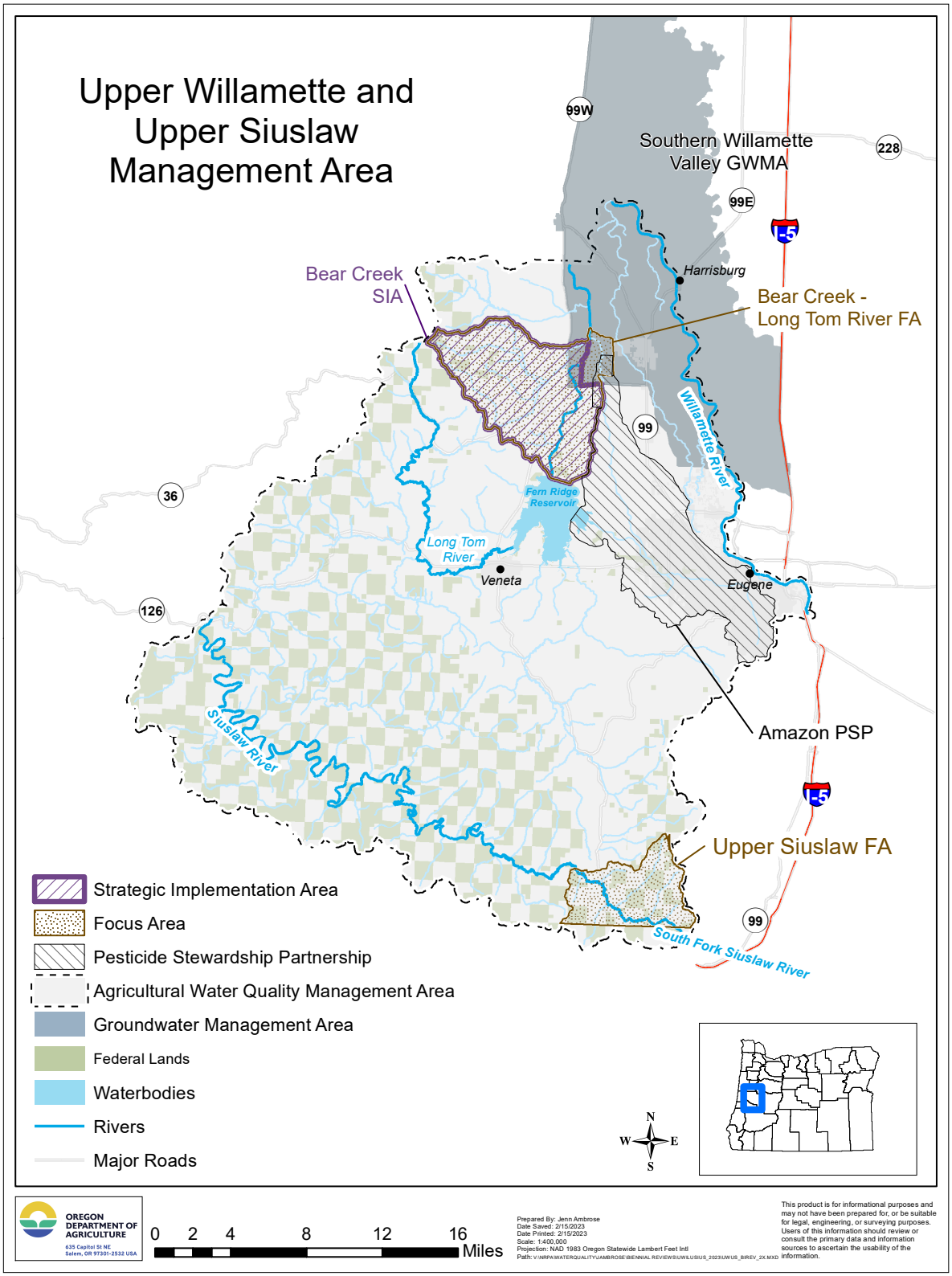
Water quality monitoring efforts in this Management Area are described in Chapter 3, and the data are summarized in Chapter 4.

Chapter 2: Local Background

Chapter 2 provides the local geographic, water quality, and agricultural context for the Management Area. It also describes the water quality issues, Area Rules, and potential practices to address water quality issues.

The Upper Willamette and Upper Siuslaw Agricultural Water Quality Management Area includes the drainages of the Long Tom River, Upper Siuslaw River, and several smaller streams that drain directly to the Willamette River (Figure 2). The Management Area is generally bounded by the Willamette River.

Figure 2 Upper Willamette and Upper Siuslaw Management Area



2.1 Local Roles

2.1.1 Local Advisory Committee

The LAC was formed to assist with the development of the Area Plan and Area Rules and with subsequent biennial reviews. Table 2.1.1 lists the current members of the LAC.

Table 2.1.1 Current LAC members

Name	Geographic Representation	Description
Jerry Marguth (Chair)	Junction City/Long Tom	Grass seed, vegetables, mint
Robin Pfeiffer (Vice Chair)	Junction City/Long Tom	Wine grapes, timber
Michael Gibson	Monroe/Long Tom	Grass seed, vegetables, mint, livestock
Scott Gibson	Monroe/Long Tom	Grass seed, vegetables, mint, dairy
Jan Nelson	Crow/Long Tom	Farm, forest
Brian Parker	Junction City/Long Tom	Grass seed, flower and vegetable seed
John Reerslev	Junction City/Long Tom	Grass seed, mint, sugar beet seed
Vacant		
Vacant		
Vacant		
Vacant		
Vacant		

2.1.2 Local Management Agency

SWCDs implement Area Plans through OWEB capacity grants, with details negotiated between ODA and each SWCD. The resulting Scopes of Work define the SWCDs as the LMAs for implementation of the Ag Water Quality Program in specific Management Areas. The LMA for this Management Area is Upper Willamette Soil and Water Conservation District. This SWCD was also involved in development of the Area Plan and Area Rules.

The LMA implements the Area Plan by conducting activities detailed in Chapter 3, which are intended to achieve the goals and objectives of the Area Plan.

2.2 Area Plan and Area Rules: Development and History

The director of ODA approved the initial Area Plan and Area Rules in 2003.

Since approval, the LAC has met biennially to review the Area Plan and Area Rules. The biennial review process includes an assessment of progress toward achieving the goals and objectives in the Area Plan.

2.3 Geographical and Physical Setting

The Management Area is located in the southernmost part of the Willamette Valley west of the Willamette River and consists of 495,000 acres. The Management Area includes the Long Tom watershed and the Upper Siuslaw watershed (Upper Siuslaw, Wolf Creek, and Wildcat Creek), as well as several small streams that drain directly into the Willamette River, including Spring Creek, Flat Creek, and a small portion of Muddy Creek.

Long Tom River

The Long Tom River starts on the east side of the Coast Range near Noti. The river flows for several miles through forestlands, rural residential areas, and small acreage farms until it reaches the Willamette Valley floor. The river then flows through rural residential areas and small farms and empties into Fern Ridge Reservoir. Below Fern Ridge Dam, the river meanders mostly through large-scale commercial farms and empties into the Willamette River at Norwood Island and Sam Daws Bend.

Coyote Creek, a major tributary to the Long Tom River, flows through forest and small acreage agricultural lands before emptying into Fern Ridge Reservoir. Amazon Creek also supplies some of the water to Fern Ridge Reservoir. Much of the upper Amazon Creek watershed is within the city of Eugene's urban growth boundary.

Above Fern Ridge Reservoir, other major tributaries include Noti Creek and Elk Creek. Both watersheds are mostly forested with a few rural residential properties and mid-sized family farms.

Below Fern Ridge Dam, Ferguson and Bear creeks are major tributaries of the Long Tom. The headwaters for both streams are in the Coast Range and much of the watersheds are forested. These creeks also flow through agricultural and rural residential lands before emptying into the Long Tom River.

Spring Creek and Flat Creek

Spring and Flat creeks both flow through industrial and agricultural lands before their confluence with the Willamette River. Flat Creek flows parallel to Amazon Creek and may mix with Amazon Creek and the Long Tom River during high-flow events (Thieman, 2000).

Upper Siuslaw River

The Upper Siuslaw River also begins east of the Coast Range, but it flows west to the Pacific Ocean. The Upper Siuslaw is included as part of this Management Area, instead of the Mid Coast Management Area along with the Lower Siuslaw, because the climate, soils, and some agricultural land uses are more similar to those in the Upper Willamette than most of the coastal watersheds.

Except for an agricultural area around Lorane, most of the Upper Siuslaw watershed is forested. Agricultural lands in the Lorane Valley include family livestock and hay operations, vineyards, nurseries, and rural residential properties. Agricultural activities combined with rural residential land use are lightly distributed through lower portions of the Wildcat Creek watershed and the Chickahominy Creek drainage.

Major tributaries of the Siuslaw River within the Management Area include Wolf, Wildcat, and Chickahominy creeks. There are also many small tributaries that flow directly into the Upper Siuslaw River from steep Coast Range slopes.

Geology and Soils

Coast Range
Soils in the Coast Range Mountains are formed primarily from sedimentary material such as shale, sandstone, and siltstone, as well as some volcanic material. They are relatively unstable and subject to puddling and active erosion. Soils in the Coast Range foothills formed from alluvial and colluvial deposits, which have been weathered extensively. They are less subject to slumping than soils in steeper areas.

Willamette Valley
Willamette Valley lowlands are composed of alluvial material deposited during the Missoula floods and by the rivers and their tributaries. The alluvial material is underlain by sedimentary and volcanic formations, deposited through erosion as uplift processes that created the Coast Range. Depending on the composition of the deposited material, soils in bottomlands and terraces range from excessively drained loams and well-drained gravelly loams to poorly drained silty clay loams and silt loams (Patching et al, 1987).

Climate
Like most of Western Oregon, the climate of the Management Area is relatively mild throughout the year. Temperatures rarely fall below zero during the winter and exceed 90° F for an average of 22 days per year in the summer. Average summer temperatures range from the low 50s to low 80s, and average temperatures in the winter are generally between the low 30s to above 50 F. The mean growing season (the number of days between 32° F temperatures) is 150 to 250 days in the valley.

Precipitation in the Management Area ranges from approximately 40 to 45 inches on the valley floor to 35 to 62 inches in the foothills and Coast Range. Approximately 70 percent of the precipitation falls during November through March. Most of the precipitation is in the form of rain on the Willamette Valley floor. The amount of snowfall increases with elevation. In 2022, the Eugene area saw 31 inches of rain, more than 9 inches below average.

Although climate change is almost certain to affect the Willamette Valley (OCCRI 2010; Schafer et al. 2001), there is uncertainty about the direction and specific consequences it will have to its species and habitats. The University of Washington (UW) studied the potential effects of a changing climate on the Willamette Valley and its results indicate a trend toward warmer and wetter winters, and hotter and drier summers (Michalak et al. 2013).

Biological Resources
Various species depend on the Management Area's aquatic and upland habitats. In foothill and Coast Range forests, vegetation includes both deciduous and coniferous trees. Much of the lowland areas were historically wet prairie or oak savannah and remnants of these areas are scattered throughout the lower Long Tom watershed and Lorane Valley. Vegetation in these habitats includes Oregon white oak, California black oak, red alder, Oregon ash, and a variety of grasses, rushes and sedges, and wildflowers. Lowland riparian and wetland vegetation in the Management Area includes Oregon ash, willow, red osier dogwood, black cottonwood, snowberry, serviceberry, Pacific ninebark, and wild rose (Guard, 1995). Aquatic and riparian-obligate species in the Management Area include beaver, western pond turtle, northern red-legged frog, Pacific tree frog, Oregon chub (Long Tom watershed, historically present), steelhead (Siuslaw watershed), cutthroat trout, Coho (Siuslaw watershed), Pacific and brook lamprey, and other resident fish species. Species native to the area are important when understanding wildlife effects on water quality where they may overlap with agricultural

producers. Vegetation native to the management area is integral to creating riparian management and planting plans.

Land Use/Land Ownership

Forestry and agriculture are the predominant land uses in the area. There are approximately 324,310 acres of forestlands in the area (Oregon Geospatial Data Clearinghouse, 2002). Most of the forestlands are in the Coast Range and foothills. Major forest landowners and managers include the Bureau of Land Management, U.S. Forest Service, and many large and small private landowners.

Agricultural lands account for approximately 121,000 acres, or 25 percent of the Management Area (Oregon Geospatial Data Clearinghouse, 2002). Agriculture includes grass seed, row crops, sheep, cattle, horses, and other livestock, hay, Christmas trees, vineyards, orchards, and nurseries. Farm sizes range from five acres with pasture and horses to diverse farms of several thousand acres.

Urban

Eugene is the largest urban area in the Management Area though the entirety of its population (178,259) is not within the Management Area. The second largest municipality in the Management Area is Springfield with a population of 62,189. The third largest is the unincorporated community of Elmira with a population of 27,204.

Water Resources

Water Availability

As with most streams with headwaters in the Coast Range, rainfall provides much of the surface water supply in Management Area watersheds. Seasonal fluctuations in stream flow are much more pronounced in the Long Tom and Siuslaw watersheds than in streams with headwaters in the Cascade Mountains because snowmelt supplies a relatively small portion of the stream flow. It is important to note the seasonal variations of flow throughout the Management Area as they affect the attainment of the temperature and mercury TMDLs.

Groundwater in much of the Coast Range and foothills is relatively meager because there are few porous, permeable geologic formations to absorb and transmit water. Alluvial materials along major streams and rivers are the most abundant source of groundwater, with some of these wells capable of providing more than 300 gallons per minute.

Water Use

Sources of appropriated water are reservoirs, surface water, and groundwater. Table 2.3 summarizes surface water allocations in the area. Allocations in cubic feet per second (cfs) represent the maximum amount of water that may be withdrawn at any given time; allocations in acre-feet (af) represent the total amount of water that may be withdrawn during a water year. In this table, “agriculture” appropriations are for agricultural uses other than irrigation, such as livestock watering.

Table 2.3 Water allocations in several waterbodies in the Management Area
Allocations are in cubic feet per second (cfs) or acre-feet (af) (Oregon Water Resources Department, 2003).

Waterbody	Irrigation	Agriculture	Domestic	Industrial	Municipal	Fish and Wildlife/ Other
Flat Creek	52 cfs 230 af	.08 cfs 0 af	.05 cfs 0 af	2 cfs 0 af	8 cfs 0 af	0 cfs 2 af
Long Tom	355 cfs 8,000 af	.2 cfs 285 af	.6 cfs 3 af	34 cfs 370 af	4 cfs 0 af	6 cfs 644 af
Upper Siuslaw	14 cfs 17 af	1 cfs 34 af	.4 cfs 0 af	1 cfs 0 af	0 cfs 0 af	245 cfs 154 af

2.4 Agricultural Water Quality

2.4.1 Water Quality Issues

The DEQ evaluated data from its own monitoring program, the Lane Council of Governments, the U.S. Geological Survey, and data collected in other local studies to determine the listing status of stream segments in the Management Area. Several stream segments exceed state standards for temperature, bacteria, dissolved oxygen, methyl mercury, and turbidity.

2.4.1.1 Beneficial Uses

Beneficial uses impaired by these water quality concerns include fish and aquatic life, drinking water, and water contact recreation.

Temperature
DEQ developed the temperature TMDL to protect salmon and trout spawning, rearing, and passage as the most sensitive beneficial uses in the Upper Willamette Subbasin.

Bacteria
As the most sensitive beneficial use, DEQ developed the Upper Willamette bacteria TMDL to protect human water contact recreation (risk of infection and disease to people who come in contact with fresh water while recreating, for example fishing, swimming, or boating).

Mercury
Human fish consumption is the most sensitive beneficial use for which DEQ developed the Willamette mercury TMDL. Mercury is toxic to humans and aquatic life at low concentrations and can accumulate via the food chain in fish that humans consume. Mercury sources have contributed to numerous fish consumption advisories in the Willamette Basin.

Dissolved Oxygen
The Willamette dissolved oxygen TMDL was developed to protect cool water aquatic life and salmonid and trout spawning and rearing in the Amazon Diversion Channel and Coyote Creek.

Turbidity
As the most sensitive beneficial uses, DEQ developed the turbidity TMDL for Fern Ridge Reservoir to address trout rearing, resident fish and aquatic life, and water supply and aesthetics.

2.4.1.2 Water Quality Parameters of Concern

DEQ's 2022 Integrated Report identifies several water quality parameters that are not meeting water quality standards (https://www.oregon.gov/deq/wq/Pages/epaApprovedIR.aspx). Parameters impacted by agricultural activities and land condition that are of primary concern include dissolved oxygen, temperature, mercury, and E. coli. There are also concerns with biocriteria, nutrients, and some pesticides. These are parameters for which water bodies are on the 303(d) list and those with an approved TMDL.

Temperature
Oregon's temperature standard and associated numeric criteria were established to protect coldwater aquatic life, the most sensitive beneficial use affected by stream temperature. On agricultural lands, absence of streamside vegetation, water withdrawals, and land management that leads to widened stream channels contribute to elevated stream temperatures. DEQ has identified the existing nonpoint source pollution sources as solar heating of the Management Area's waterways due to a lack of riparian vegetation from forestry, agriculture, rural-residential, and urban activities. In the Management Area, conditions and activities on agricultural lands that may affect temperature are predominantly streamside vegetation. Vegetation may either be in poor condition, improving condition, or providing expected water quality benefits.

Bacteria
On agricultural lands, *E. coli* generally comes from livestock waste, either deposited directly into waterways or carried to waterways via runoff and soil erosion. Runoff and soil erosion from agricultural lands may also carry bacteria from other sources. There are multiple potential sources of bacteria in streams, including humans (from failing septic systems) and wildlife.

Mercury
Primary sources in the Management Area include atmospheric deposition from global sources, land management activities and natural conditions that result in runoff or sediment erosion that can transport mercury to streams, and point sources (wastewater, stormwater, and industrial discharges). Mercury is tightly bound to organic matter in soils, and has accumulated over long periods of time, resulting in legacy concentrations in soil.

Turbidity
Turbidity refers to the clarity of a waterbody. It includes the amount of suspended solids in the water column. Sediment, algae, and other particles contribute to turbidity. High turbidity levels can negatively affect aquatic life by consuming dissolved oxygen, clogging gills and other respiratory organs, reducing water infiltration through stream substrate (harming incubating fish eggs), and reducing animals' ability to see predators and prey. In addition, high turbidity can increase the difficulty and cost of adequately treating drinking water. For potential sources of turbidity and fine sediment, DEQ has identified urban storm water discharge, urban and agricultural run-off, and bank erosion from areas where the riparian vegetation has been removed.

Dissolved Oxygen
Dissolved oxygen refers to the amount of oxygen that is dissolved in water. Oregon's dissolved oxygen standards protect cool and cold-water aquatic life, which require relatively high levels of dissolved oxygen to breathe.

Dissolved oxygen levels can vary over the course of the day based on algal growth and decay. An increase in available nutrients may result in elevated algal production, eventually depleting

dissolved oxygen when algae decay. Temperature and dissolved oxygen exhibit an inverse relationship; as water temperature falls, dissolved oxygen levels rise; as water temperature rises, dissolved oxygen levels fall. Elevated stream temperatures, in addition to affecting the metabolic processes of aquatic animals, cause further physical stress by lowering the dissolved oxygen available for respiration.

Nitrate
Nitrate is highly soluble in water, easily mobile in the soil, and can potentially leach through the soil and into the groundwater. Shallow groundwater is hydrologically connected to surface water in many areas. Connectivity may vary depending on the time of the year and water availability (usually precipitation).

A low level of nitrate can be naturally occurring in groundwater and surface water. However, the use of synthetic and natural fertilizers, and animal manure management practices are potential sources of excess nitrate in drinking water (ground and surface water). When fertilizer containing nitrate is applied to crops, any amount that plants cannot take up can readily percolate down to groundwater or run off to nearby streams. Nitrate in uncovered manure piles can easily move to groundwater or streams and rivers during the rainy months or during snow-melt events. Irrigation and precipitation events can accelerate the movement of nitrate on the landscape to groundwater and surface water. High nitrate levels in drinking water cause a range of human health problems, particularly with infants, the elderly, and pregnant and nursing women.

Pesticides
Agricultural pesticides of concern include substances in current use and substances no longer in use but that persist in the environment. Additional agricultural pesticides without established standards have also been detected. On agricultural lands, sediment from soil erosion can carry these pesticides to water. Current use agricultural pesticide applications, mixing-loading, and disposal activities may also contribute to pesticide detections in surface water. For more information, see www.oregon.gov/deq/wq/Pages/WQ-Standards-Toxics.aspx.

2.4.1.3 TMDLs and Agricultural Load Allocations

Table 2.4.1.3a Pollutants with Approved TMDLs* and Load Allocations for the Management Area

Temperature: Applies to perennial and/or fish bearing waterbodies in the Willamette Basin portion of the Management Area.

Load Allocation: All nonpoint sources collectively (agriculture's allocation is not separate): background solar radiation loading based on system potential vegetation near the stream; maximum increase of 0.05°C.

Surrogate: Effective shade.

Current TMDL: Willamette Basin TMDL, Chapters 4 and 10 (DEQ; approved 2006).

TMDL Revisions: DEQ is under a court order to update and replace the Willamette Basin temperature TMDL to be consistent with current temperature standards:

- DEQ must issue the revised TMDL for tributaries in the Upper Willamette and Upper Siuslaw Management Area by January 2024 (DEQ is convening a Rules Advisory Committee in winter 2023 and EQC will adopt the rules in late 2023). Rulemaking website: www.oregon.gov/deq/rulemaking/Pages/willamettetempTMDL.aspx.

- DEQ must issue the revised for the mainstem Willamette River and Long Tom River by February 2025 (timeline for Rules Advisory Committee and EQC is TBD).
- For more information: www.oregon.gov/deq/wq/tmdls/Pages/tmdlreplacement.aspx.

Bacteria (*E. coli*.): Applies to all waterbodies in the Management Area.

Load Allocation: 66 percent reduction compared to average loads in 2006.

- 47% for Lower Long Tom River
- 63% for Luckiamute River
- 65% for Calapooia River
- 66% for Coyote Creek
- 77% for Upper Long Tom River
- 33% for A-3 Drain
- 58% for Willamette River

TMDL: Willamette Basin TMDL, Chapters 2 and 10 (DEQ; approved 2006).

Mercury: Applies to all perennial and intermittent streams in the Willamette Basin portion of the Management Area.

Load Allocation: For agriculture, forested, developed, and other non-urban land types:

- Upper Willamette Subbasin (Hydrologic Unit Code 17090003): 97 percent reduction in mercury.

Surrogate: Total Suspended Solids (TSS). TSS is used as a surrogate because (1) the focus is on controlling soil erosion and (2) sampling mercury is complex and expensive. The target is a 75 percent reduction compared to 2019 levels.

Timeline: Load reductions must be achieved by 2048; the TMDL provides interim milestones.

Reporting: ODA will report to DEQ (annually, with 5-year reviews) on progress toward implementing the TMDL for the entire Willamette Basin.

TMDL: Willamette Basin Mercury TMDL (issued by US EPA in 2021); the mercury TMDL was updated to reflect revised water quality standards that (1) establish safe levels of human fish consumption without unacceptable health risks and (2) protect aquatic life.

* TMDL information and documents can be found at: www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Willamette-Basin.aspx

Table 2.4.1.3b Dissolved Oxygen agricultural load allocations for the Management Area from the 2006 Willamette TMDL, Chapter 10

Geographic Scope in Management Area	Load Allocation for Agriculture
Amazon Creek and Diversion Channel	40% reduction in loads of BOD, nutrients, and volatile suspended solids
Coyote Creek	20% reduction in loads of BOD, nutrients (including ammonia), and volatile suspended solids

2.4.1.4 Drinking Water

DEQ summarizes drinking water issues in each Management Area prior to biennial reviews. DEQ's full report is available at: https://www.oregon.gov/deq/wq/programs/Pages/Nonpoint-Implementation.aspx.

Sixty-eight public water systems obtain public drinking water to serve approximately 21,664 persons regularly. Note that while the city of Eugene is partially within the Management Area boundary, its drinking water source area is not.

Recent alerts for *E. coli* bacteria exist for four water systems with four Maximum Contaminant Load (MCL) violations. Twenty-one systems have recent alerts for total coliform bacteria with no violations. Four water systems have alerts for elevated nitrate concentrations with one MCL violation. A total of 119 of 736 private domestic wells sample results in the area have elevated (≥ 3 mg/L) nitrate concentrations.

Bacteria
Four public water systems in the Management Area have recent alerts (past 10 years) for detections of *E. coli* bacteria. Ninety-two public water systems have recent alerts for total coliform and no violations. There are 27 animal Potential Contaminant Sites within agricultural areas in the Management Area, in grass/pasture production.

Nitrates
Nitrate alerts (generated when nitrate exceeds 5 mg/L) exist for four public water systems with one recent MCL violation. The drinking water MCL for nitrates is 10 mg/L. These contaminants are often related to animal and cropland agriculture. Of the soils assessed in the Management Area, most have high nitrate leaching potential, according to the National Cooperative Soil Survey, based on slope, precipitation, and land use. Nitrate from fertilizers and septic systems can readily penetrate to the aquifers used for drinking water when leaching potential is high. There are 37 sites of crop potential contamination sites within agricultural areas in the Management Area, most of which are in grass seed production.

Many resources have been developed to address the groundwater contamination issues. DEQ recommends ODA and the SWCDs include a task in the area plan to coordinate with ongoing GWMA efforts and further evaluate agricultural land uses in and around the GWMA as there are recent elevated levels of nitrate in public drinking water in the GWMA. Recommended best practices to improve Drinking Water in the plan area include: improved fertilizer use practices (e.g. timing adjustments and use of multiple, smaller applications), planting of nitrogen-scavenging cover crops to reduce nitrate movement into aquifers used for drinking water, and livestock exclusion from surface water and off-channel watering. Measures to reduce leachable nitrate in soils would reduce risk to groundwater sources of drinking water.

2.4.1.5 Groundwater Management Area

In May 2004, DEQ declared a portion of the Southern Willamette Valley (SWV) a Groundwater Management Area (GWMA) because of elevated groundwater nitrate levels. A portion of the Management Area is within the SWV GWMA.

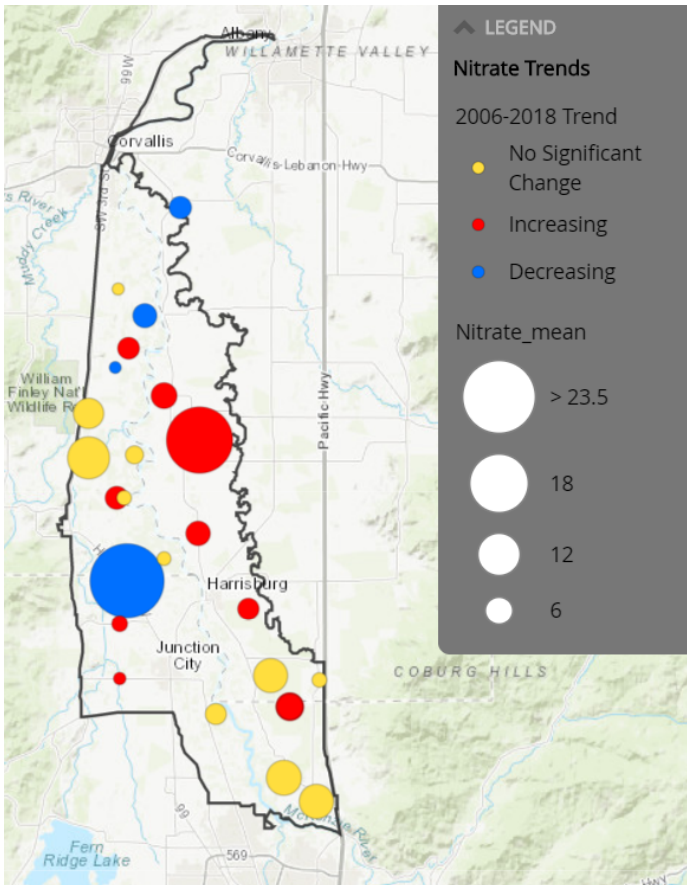
Although low background levels of nitrate (2 to 3 ppm) can be naturally occurring, a variety of human activities have caused high nitrate concentrations in the groundwater. Currently, 93 percent of the land area within the GWMA is in agricultural use. Although agricultural use makes up the vast portion of land area, there are also many non-agricultural potential sources of nitrate such as urban or rural residential land uses. Detailed information about the SWV GWMA can be found at http://gwma.oregonstate.edu. A new DEQ story map can be found at https://arcg.is/1H4ynu that provides information and new analysis of the ground water nitrate trends.

The SWV GWMA stakeholder committee Action Plan for the SWV GWMA was finalized in 2009. The SWV GWMA Action Plan is not a regulatory document but includes many recommendations and voluntary strategies to address the issue of excess nitrate in regional groundwater. To address this, the SWV GWMA Action Plan provides recommendations and strategies to reduce nitrate inputs. The agricultural portion of the action plan is carried out by many partners. A cross-walk to identify actions that are implemented by ODA and the Upper Willamette SWCD is provided in Appendix A. Agricultural practices to address nitrates in groundwater are integrated into Chapter 2.5.

In the recent analysis of groundwater nitrate trends in the SWV GWMA, important factors in explaining the nitrate concentrations in the long-term monitoring sites included water source, estimated fertilizer input, and proximity to a dairy operation (Piscitelli 2019). The full report can be found at https://ir.library.oregonstate.edu/concern/graduate_thesis_or_dissertations/cr56n703s.

Figure 2.4.1.5 Nitrate concentrations and trends in the Southern Willamette Valley GWMA

(2006-2018). Size of the dot illustrates the concentration range, and color indicates the long-term trend. Wells that are stable did not have a significant ($p<0.10$) change over time (from Piscitelli 2019).



2.5 Regulatory and Voluntary Measures

This Area Plan serves as a guidance document and, as stated in the Foreword, does not establish provisions for enforcement. The Area Rules developed with input from the LAC (OAR 603-095-2600 to 603-095-2660) are enforceable and are included in this document only as a reference for landowners.

Each Area Rule relates directly to water quality concerns identified on the 303(d) list in the Management Area, and addresses the Upper Willamette TMDLs as required under the federal Clean Water Act. The concerns addressed in the Area Rules are described below.

Landowners in the Management Area are required to achieve the conditions outlined in the Area Rules below. Each Rule has a box around it and appears in italics. Relevant definitions are included after each Rule. The applicable rule is provided within each section below.

> ***OAR 603-095-2640***
>
> *(1) All landowners or operators conducting activities on lands in agricultural use shall comply with the following criteria. A landowner shall be responsible for only those conditions caused by activities conducted on land controlled by the landowner. A landowner is not responsible for violations of the Prevention and Control Measures resulting from actions by another landowner. Conditions resulting from unusual weather events (equaling or exceeding a 25-year, 24-hour storm event) or other exceptional circumstances are not the responsibility of the landowner. Limited duration activities may be exempted from these conditions subject to prior written approval by the department.*

The following preferred management tables are intended as recommendations for landowners to meet Area Rules and generally maintain and enhance natural resources on their property. The practices below benefit a variety of water quality parameters, not just those parameters of concern within the Management Area. The tables provide some idea of the water quality benefits of each practice as well as potential costs and benefits to landowners. The tables are organized by resource, such as nutrients and manure.

2.5.1 Nutrients and Manure Management

Waste, Nutrients, and Other Pollutants Rule

> ***OAR 603-095-2640(1)***
>
> *(b) Effective upon rule adoption, no person subject to these rules shall violate any provision of ORS 468B.025 or 468B.050.*
> *(c) Corralled or enclosed livestock areas will be managed to control runoff of sediment and animal waste. Application and storage of manure will be done in a manner that minimizes the introduction of nutrients and bacteria to waterways.*

Wastes has the meaning given in ORS 468B.005(7): sewage, industrial wastes, and all other liquid, gaseous, solid, radioactive or other substances which will or may cause pollution or tend to cause pollution of any waters of the state.

Waters of the state has the meaning given in ORS 468B.005(8): lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the state of Oregon and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private, (except those private waters which do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction.

Nutrient and Manure Management

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
a. Apply nutrients according to soil test results (Hart, Pirelli, and Cannon, 1995; Marx, Hart, and Stevens, 1999; Natural Resources Conservation Service, 1997i; Sullivan, 1998; Waskom, 1994).	Helps prevent nutrient runoff into waters of the state and leaching into groundwater.	May help reduce fertilizer costs; ensures that plants receive needed nutrients for growth; makes plants more competitive against weeds. Practice may be eligible for cost-sharing programs.	Costs of soil testing; time associated with taking soil samples. Practice may be eligible for cost-sharing programs.
b. Store manure under a tarp or roof; preferably on an impervious surface such as concrete or plastic (Gamroth and Moore, 1996; Godwin and Moore, 1997; Moore and Wilrich, 1993).	Helps prevent nutrient and bacteria runoff into waters of the state and leaching into groundwater.	Prevents nutrient leaching so manure applied on crops or pasture has higher nutrient content; may save some fertilizer costs; producers may be eligible for cost-sharing programs.	Cost of constructing manure storage facilities. Practice may be eligible for cost-sharing programs.
c. Establish animal heavy-use areas where animals are confined during the winter to protect other pastures from trampling and compaction. Limit livestock access to pastures when soils are saturated; cover heavy-use areas with rock, hogged fuel, and/or geotextile. Clean manure regularly from heavy-use area (Natural Resources Conservation Service, 1997d).	Helps prevent sediment, nutrient and bacteria runoff into waters of the state and leaching into groundwater. Helps protect streamside areas.	Protects pastures from compaction during the winter, improving growth. May improve animal health by covering heavy-use areas with material so animals are not wading in mud. Practice may be eligible for cost-sharing programs.	Cost of fencing heavy-use area; cost of feeding hay during the winter; cost of materials for protecting heavy-use area. Practice may be eligible for cost-sharing programs.

d. Site barns and heavy-use areas away from streams (Godwin and Moore, 1997).	Helps prevent sediment, nutrient, and bacteria runoff into waters of the state. Helps protect streamside areas.	Helps prevent flooding in barns and heavy-use areas. Practice may be eligible for cost-sharing programs.	Need either off-stream watering facility or other source of water for livestock. Practice may be eligible for cost-sharing programs.
e. Prevent silage leaching and/or store and manage leachate from silage and other vegetative materials (Bruneau, Hodges, and Lucas, 1995; Feise, Adams, and LaSpina, 1993).	Helps prevent nutrient runoff into waters of the state and leaching into groundwater.	Preventing leaching maintains higher nutrient content of ensiled feed material. Practice may be eligible for cost-sharing programs.	May require cost of facility development and purchase of moisture-absorbing materials. Practice may be eligible for cost-sharing programs.
f. Installing gutters and downspouts in areas with high livestock use. Connect downspout water to drainage system or, if possible, route clean downspout to a location where it can soak into the ground (Natural Resources Conservation Service, 1997f).	Helps prevent sediment, nutrient and bacteria runoff into waters of the state. Helps protect streamside areas.	May improve animal health by lessening mud during the winter, so animals are not wading in mud. Practice may be eligible for cost-sharing programs.	Cost of installation and maintenance of gutters and downspouts. Practice may be eligible for cost-sharing programs.
g. Cover heavily used animal walkways with sand, rock, and/or geotextile (Natural Resources Conservation Service, 1997c).	Helps prevent sediment, nutrient and bacteria runoff into waters of the state. Helps protect streamside areas.	Can improve animal health because animals are not wading in mud. Can help prevent animal health problems such as scratches, hoof or foot rot, and worms. Practice may be eligible for cost-sharing programs.	Cost of sand, rock or other materials. Owners should be aware that feeding equine species on sand may result in sand colic. Practice may be eligible for cost-sharing programs.

2.5.2 Streamside Area Management

Temperature
The primary driver of water temperature in the Management Area is direct solar radiation.

Riparian Areas Rule

OAR 603-095-2640(1)

(a) Effective upon rule adoption, agricultural activities shall allow the establishment and development of riparian vegetation along perennial and intermittent streams for streambank stability, shading, and proper riparian function, consistent with site capability.
(A) Legally constructed drainage and irrigation ditches are exempt from OAR 603-095-2640(1)(a).

Riparian vegetation means plant communities consisting of plants dependent upon or tolerant of the presence of water near the ground surface for at least part of the year (OAR 603-095-0010(36)).

Site capability means the ability of a site to provide for the development of potential structural and functional properties. Structural properties include, among other things, vegetation and soil characteristics. Functional properties include processes such as energy and nutrient flow. Capabilities to produce and sustain these properties are site-specific.

Riparian Areas and Streams

Practice	Resource Concerns Addressed	Potential Benefits of Practice to Producer	Potential Costs of Practice to Producer
a. Light rotational grazing in riparian area; timed when growth is palatable to animals and when riparian areas are not saturated (Adams, 1994; Chaney, Elmore and Platts, 1993; Rogers and Stephenson, 1998).	Helps establish desirable riparian vegetation, promotes streambank integrity; helps filter nutrients and sediment from runoff; helps reduce stream temperatures by providing shade.	May lessen streambank erosion and loss of pastures; allows limited use of riparian area for grazing, improves wildlife habitat, and may control weeds. Practice may be eligible for cost-sharing programs.	May require time and financial investment for livestock control and off-stream watering facilities. Practice may be eligible for cost-sharing programs.
b. Livestock exclusion from riparian area; establish off-stream watering facilities (Natural Resources Conservation Service, 1997g and 1997h).	Helps promote desirable riparian vegetation; promotes streambank integrity; helps filter nutrients and sediment from runoff; may help narrow channel and reduce erosion in channel.	May lessen streambank erosion and loss of pastures; less time involved in managing livestock grazing in riparian area, improves wildlife habitat. Practice may be eligible for cost-sharing programs.	May require higher weed control costs than seasonal riparian grazing. May require financial investment for livestock control and off-stream watering facilities. Practice may be eligible for cost-sharing programs.
c. Plant perennial vegetation in riparian area. Recommend using native vegetation, or if using non-native vegetation, avoid using invasives (Guard, 1995; Pojar and MacKinnon, 1994).	Helps establish perennial riparian vegetation rapidly; promotes streambank integrity; may help narrow channel and reduce erosion in channel.	May lessen streambank erosion and loss of pastures. If livestock are excluded from riparian area, area may be eligible for federal cost-share programs. Some alternative perennial agricultural products may be harvested from riparian areas.	Costs of vegetation and weed control. May require financial investment for riparian fencing and off-stream watering facilities while vegetation establishes. Practice may be eligible for cost-sharing programs.

2.5.3 Soil Erosion Prevention and Control

Agricultural landowners do not have any control over air deposition of mercury (past, present, or future), but they can adopt management strategies that reduce the runoff of sediment and water

that carry mercury to stream systems. ODA has identified minimizing bare ground in winter as the strategy most likely to reduce sediment and mercury reaching streams. Additional high priority strategies are to limit livestock access to streamside areas, establish streamside vegetation for filtering, and stabilize channel banks. Addressing erosion from roads and road-related structures (referenced below) will also help prevent mercury from reaching stream systems. Soil health strategies promote infiltration of precipitation, which reduces runoff of mercury to streams.

Erosion and Sediment Control Rules

> ***OAR 603-095-2640(1)***
> *(d) Effective January 1, 2004, agricultural activities will not cause the following visual indicators of erosion where erosion may cause sediment runoff into waters of the state:*
> *(A) Sheet erosion; noted by scoured surfaces or pedestals of soil at the base of plants on sparsely vegetated or bare ground;*
> *(B) Visible active gullies;*
> *(C) Multiple rills, which have the form of gullies, but are smaller in cross-sectional area than one foot.*
> *(D) This prevention and control measure applies to farm roads and staging areas, pastures, cropland, and other areas where agricultural activities occur.*

Erosion, sheet means the removal of a fairly uniform layer of soil from the land surface by runoff water.
(OAR 603-095-0010(15)).

(e) Construction, maintenance, and use of surface drainage field ditches or surface irrigation field ditches shall cause no pollutant delivery to waters of the state from soil erosion induced by excessive channel slope, unstable channel cross section or placement of disposed spoils.

(f) Agricultural activities shall not cause pollution from active channel erosion or other means of sediment delivery from intermittent streams and drainage ways.

Active channel erosion means gullies or channels which at the largest dimension have a cross-sectional area of at least one square foot and which occur at the same location for two or more consecutive years (OAR 603-095-0010(1)).

> *(g) Roadways, staging areas, and heavy-use areas shall be constructed and maintained to prevent sediment or runoff contaminants from adversely affecting waters of the state.*

Erosion and Sediment Control

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
a. Grazing management: graze pasture plants to appropriate heights, rotate animals between several pastures; provide access to water in each pasture (Ko, 1999; Lundin, 1996; Hirschi, 1997).	Helps prevent sediment, nutrient, and bacteria runoff into waters of the state. Helps protect streamside areas.	May improve pasture production; easy access to water may increase livestock production as well. May improve composition of pasture plants and help prevent weed problems. Practice may be eligible for cost-sharing programs.	Cost of installing fencing, watering facilities for rotational grazing system; time involved in moving animals through pastures. Practice may be eligible for cost-sharing programs.
b. Farm road construction: construct fords appropriately, install water bars or rolling dips to divert runoff to roadside ditches (Blinn, 1998; U.S. Forest Service, 1998).	Helps prevent sediment runoff to waters of the state.	May help prevent water damage on farm roads. Practice may be eligible for cost-sharing programs.	Cost of installation and maintenance. Practice may be eligible for cost-sharing programs.
c. Plant appropriate vegetation along drainage ditches; seed ditches following construction (Natural Resources Conservation Service, 1997a).	Helps prevent sediment runoff into waters of the state.	May help prevent ditch bank erosion and slumping. Practice may be eligible for cost-sharing programs.	Costs of establishing vegetation. Practice may be eligible for cost-sharing programs.
d. Plant cover crops on erosion-sensitive areas (Natural Resources Conservation Service, 1997b; Hirschi, 1997).	Helps prevent sediment runoff into waters of the state; filters nutrients and slows runoff.	May reduce weed problems; prevents loss of applied nutrients. Practice may be eligible for cost-sharing programs.	Costs of establishing cover crops; cover crops may compromise primary crop. Practice may be eligible for cost-sharing programs.
e. Irrigate pasture or crops according to soil moisture and plant water needs (Hansen and Trimmer, 1997; Trimmer and Hansen, 1994).	Helps prevent irrigation return flow and associated nutrients and sediment to waters of the state.	May reduce costs of irrigation; may help crop or pasture production. Practice may be eligible for cost-sharing programs.	Installation/ maintenance cost. Monitoring time. Practice may be eligible for cost-sharing programs.
f. Install/maintain diversions or French drains to prevent unwanted drainage into barnyards and heavy-use areas (Natural Resources Conservation Service, 1997e).	Helps prevent nutrient runoff into waters of the state.	Decreases muddiness and shortens saturation period in protected areas. Practice may be eligible for cost-sharing programs.	Cost of installation. Practice may be eligible for cost-sharing programs.

g. In areas where gullies repeatedly appear, install underground outlet or grassed waterway to capture and convey water (Natural Resources Conservation Service, 1997j and 1997k; Hirschi, 1997).	Prevents gully erosion and sediment runoff to waters of the state.	Prevents loss of soil and fertilizers, lessens inconvenience of driving equipment over gullies. Practice may be eligible for cost-sharing programs.	For underground outlet, costs of installing inlets and plastic pipe; for grassed waterways, costs of installation, seeding, weed control, and any land put out of production. Practice may be eligible for cost-sharing programs.
h. Install and manage field borders/filter strips along field boundaries (Natural Resources Conservation Service, 2001**)**	Controls sediment and nutrient movement to waters of the state. Erosion control during high water events.	Prevents loss of soil and fertilizers, lessens inconvenience of driving equipment in wet areas. Practice may be eligible for cost-sharing programs.	Cost of installation. Cost of management. Practice may be eligible for cost-sharing programs.

2.5.4 Pesticides

Oregon has strict laws and regulations related to pesticide use, storage, and reporting, and that improper application and storage may lead to surface or groundwater quality problems. All pesticide users are required to apply and store pesticides according to the label (ORS 634.372). Users of restricted-use pesticides are required to obtain certification from ODA's Pesticides Division.

Pest Management

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
a. Apply pesticides and herbicides according to the label. Use the correct rate and timing. Comply with label restrictions and precautions.	Reduces risk of pesticide runoff to streams or other water resources.	Compliance with federal and Oregon law; reduces health risks to applicator, may decrease costs.	N/A
b. Triple rinse pesticide application equipment; apply rinsates to sites; dispose of or recycle clean containers according to Oregon law.	Reduces risk of pesticide runoff to streams.	Dilutes pesticide residues; correct disposal or rinsate ensures compliance with federal and Oregon law; eliminates disposal costs of collected rinsates identified as hazardous waste.	Triple rinsing creates more volume that must be disposed of.
c. Calibrate, maintain, and correctly operate application equipment.	Reduces risk of pesticide runoff to streams.	Helps protect drinking water and aquatic habitat; may reduce use and therefore cost of pesticides; reduces health risks to applicator.	
d. Integrated pest management practices such as pheromone traps, beneficial insect release, and field monitoring.	Reduces risk of pesticide runoff to streams, may reduce loss of non-target species.	May improve effectiveness of pest control system. Practice may be eligible for cost-sharing programs.	Time involved to scout fields is usually offset by reduced or more effective pesticide use.
e. Store and mix pesticides on leak-proof facilities.	Reduces risk of pesticide runoff to streams.	Helps protect drinking water and aquatic habitat; reduces health risks to applicator.	Cost of installation and maintenance.
f. Petroleum products such as fuel and oil in leak proof containers and facilities; clean up spills of petroleum products properly.	Reduces risk of runoff of petroleum products to streams or soil contamination.	Helps protect drinking water and aquatic habitat; reduces health risks to landowner or operator.	

Hirschi, 1994 and 1997

2.5.5 Optional Issues: Upland, Irrigation, and Livestock Management

Role of Upland Vegetation to Prevent and Control Pollution
Upland areas are the rangelands, forests, and croplands located upslope from streamside areas. Upland areas extend to the ridgetops of watersheds. With a protective cover of crops and crop residue, grass (herbs), shrubs, or trees, these areas will capture, store, and safely release precipitation, thereby reducing the potential of excessive soil erosion or delivery of soil or pollutants to the receiving stream or other body of water.

Healthy upland areas provide several important ecological functions, including:

- Capture, storage, and moderate release of precipitation reflective of natural conditions;
- Plant health and diversity that support cover and forage for wildlife and livestock;
- Filtration of sediment;
- Filtration of polluted runoff;
- Plant growth that increases root mass, utilizes nutrients, and stabilizes soil to prevent erosion.

Nutrient and Irrigation Efficiencies

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
Apply fertilizer at the correct rate and time applications for crop uptake.	Reduces the risk of excess nitrogen in the soil at the end of the growth season.	Precise application saves the producer money in fertilizer costs.	Time related to precision application.
Sample soil prior to fertilizer application to know existing nutrients.	Prevents the application of excess nutrients.	Precise application saves the producer money in fertilizer costs.	Cost of soil sampling and analysis.
Plant winter cover crops to take up excess nitrogen left over after crops are harvested.	Takes up extra nitrogen and limits potential for leaching into groundwater.	Stores extra nitrogen in plant matter for later release when cover crop is incorporated into the soil.	Cost of seed and fuel to plant cover crop.
Properly maintain irrigation systems to prevent over-irrigation.	Prevents leaching of excess nitrogen past the root zone.	Uniform irrigation application and save producer money on nitrogen costs.	Replacement nozzles at least every four years is recommended.
Monitor soil water content and adjust irrigation schedules to maintain soil water content in an appropriate range in the root zone.	Prevents over-irrigation and leaching of excess nitrogen past the root zone.	Allows accurate irrigation application and keeps nutrients available to crops.	Soil monitoring equipment and time to evaluate soil water content.
Schedule irrigation applications based on expected evapotranspiration rates.	Prevents over-irrigation and leaching of excess nitrogen past the root zone.	Allows accurate irrigation application and keeps nutrients available to crops.	Time to evaluate expected evapotranspiration rates.

Selker et al, 2004

Chapter 3: Implementation Strategies

Chapter 3 describes efforts to make and track progress toward the goals of the Area Plan. It presents the goals, measurable objectives, strategic initiatives, proposed activities, and monitoring efforts.

Goal

Prevent and control water pollution from agricultural activities and soil erosion, and achieve applicable water quality standards.

The LAC established these objectives to achieve the Area Plan goal:

- Prevent runoff of agricultural wastes: agricultural activities will not discharge any wastes or place waste where it is likely to run off into waters of the state;
- Prevent upland and cropland soil erosion using practical and available methods;
- Control active channel erosion to protect against sediment delivery to streams;
- Prevent bare areas due to livestock overgrazing near streams;
- Allow streamside vegetation along streams on agricultural properties to establish and grow, to provide streambank stability, filtration of overland flow, and moderation of solar heating.

The following conditions on agricultural lands contribute to good water quality in this Management Area:

1. Sufficient site-capable vegetation is established along streams to stabilize streambanks, filter overland flow, and moderate solar heating,
2. Crop lands are covered throughout the year with either production crops, crop residues, or cover crops,
3. Pastures have minimal bare ground,
4. Irrigation runoff does not deliver sediment, nutrients, or chemicals to streams,
5. Leachate and residues from livestock manure are not entering streams or groundwater.

LAC Mission

The mission of the LAC is to advise ODA on the development of methods to improve water quality directly related to agricultural practices in the Management Area.

3.1 Measurable Objectives and Strategic Initiatives

ODA is working with SWCDs and LACs throughout Oregon toward establishing long-term measurable objectives to achieve desired conditions. Currently, ODA and the Upper Willamette SWCD are using the Bear Creek SIA to show progress in this Management Area. These are described below.

3.1.1 Management Area

TMDLs

Assessment Method: To be determined.

Measurable Objective and Associated Milestones:
For TSS, the mercury TMDL establishes a measurable objective for maximum instream TSS at 4 mg/L in 2049, with a 2019 milestone of 17 mg/L. Progress is reported in Chapter 4.1.1. TSS will be reduced by additional adoption of strategies to reduce upland and streambank erosion.

ODA, the LAC, and the Upper Willamette SWCD would like to develop additional measurable objectives at the Management Area scale to track progress in meeting agricultural water quality goals, including TMDL targets.

Measurable objectives could include streamside vegetation conditions (related to shade and the temperature TMDL) and bare ground in winter (related to erosion and the mercury TMDL). ODA does not currently have methods to quantify land conditions across large geographic areas, therefore measurable objectives cannot be developed for them at this time.

3.1.2 Focus Areas and Other Coordinated Efforts in Small Watersheds

Bear Creek-Long Tom River Focus Area

With the adoption of the Strategic Implementation Area (SIA) model, this Focus Area was converted to an SIA in 2021. This Focus Area is considered closed with an SIA in its place.

3.1.3 Strategic Implementation Areas (SIA)

Bear Creek SIA (2021)

Work in the Bear Creek-Long Tom River Focus Area was initiated at the beginning of the 2019 fiscal biennium. It was converted to an SIA in 2021. The Upper Willamette SWCD's established partnerships in this area make it an ideal place to focus efforts to improve streamside conditions. The selection was based on assessments, demographics, land use characteristics, resources and capacity considerations. The watershed is over 30,000 acres with 33 percent of the area in agricultural use. Primary crops include hay, pasture, livestock, vineyards, grass seed, Christmas trees, row crops, and peppermint.

SIA Compliance Evaluation Method:
ODA evaluated all agricultural tax lots within the SIA to identify opportunities to improve water quality and ensure compliance with Area Rules. The evaluation considered the condition of streamside vegetation, areas of bare ground, and potential livestock impacts (including manure management). The process involved both a remote evaluation and field verification from publicly accessible areas. For more information see:
www.oregon.gov/oda/shared/Documents/Publications/NaturalResources/SIAProgressReport.pdf

Opportunity levels:

- **Likely in Compliance (LC):** ODA identified no likely agricultural water quality regulatory concerns, and the goals of the Area Plan are likely being achieved.
- **Restoration Opportunity (RO):** ODA identified no likely agricultural water quality regulatory concerns, but there is likely some opportunity for improvement through voluntary measures to reach the goals of the Area Plan.
- **Compliance Opportunity (CO):** ODA identified that agricultural activities may impair water quality or evaluation was inconclusive. There also may be an opportunity for improvement through voluntary measures to reach the goals of the Area Plan.

- **Potential Violation (PV):** During the Field Evaluation, ODA observed a potential violation of the Area Rules. There also may be an opportunity for improvement through voluntary measures to reach the goals of the Area Plan.

Measurable Objective:
By November 30, 2025, all 36 tax lots identified as a Potential Violation or Compliance Opportunity will be downgraded to Compliance Opportunity or Likely in Compliance.

A monitoring plan for this SIA has not yet been submitted to the state for approval. The first Local Monitoring Team meeting is scheduled for April 14, 2023. SIA monitoring goals will be evaluated for use as additional measurable objectives for the SIA.

3.1.4 Pesticide Stewardship Partnerships (PSP)

Amazon PSP

The Amazon Creek Pesticide Stewardship Partnership (PSP) was initiated in 2011, led by the Long Tom Watershed Council. The Amazon PSP is partnering with key business and agricultural constituents, the City of Eugene, the Upper Willamette Soil and Water Conservation District, the Upper Willamette Working Lands Program, the Oregon State University IPM (Integrated Pest Management) Center, and others.The PSP has support from key business and agricultural constituents, SureCrop Farm Service, the city of Eugene, Meyer Memorial Trust, and others. Although pesticides are generally only detected at very low levels in Amazon Creek, pesticides can have aggregate and compounding effects where multiple substances are present in a waterway, meaning that mixes of compounds may be much more toxic to aquatic life than any one alone. This is one of the top concerns in Amazon Creek. The PSP has been collecting data to determine the level of concern of these pesticides and conducting outreach to landowners.

Assessment Method:
The PSP monitors pesticides and their constituents at five locations, two of which are in the City of Eugene. The other locations are Amazon Creek and the A-1 Channel near the Eugene Airport (above agricultural lands) and the mouth of Amazon Creek west of Junction City. Pesticides are categorized as shown in Table 3.1.4.

The PSP uses the decision matrix shown in Table 3.1.4 to determine pesticides of high and moderate concern based on the most recent three years of pesticide monitoring data. In 2022, pesticides of high concern that were detected at the ag monitoring location (near the mouth of Amazon Creek) include diuron and propiconazole. The pesticide of moderate concern detected at this site is BAM, a degradate of dichlobenil. Detections of diuron at the ag monitoring site included five exceedances of the relevant aquatic life benchmark in 2022.

Table 3.1.4 Pesticide levels of concern. ALB = Aquatic Life Benchmark.

FREQUENCY OF DETECTION IN % LAST 3 YEARS	REFERENCE LEVEL CRITERIA			
	≥1 detection at or above 50% of an acute ALB	≥3 detections at or above 50% of a chronic ALB	1 to 2 detections at or above 50% of a chronic ALB	No detections over 50% of any ALB
100 to 65.1	High Level of Concern	High Level of Concern	High Level of Concern	Moderate Level of Concern
65 to 35.1	High Level of Concern	High Level of Concern	Moderate Level of Concern	Moderate Level of Concern
35 to 0	High Level of Concern	High Level of Concern	Moderate Level of Concern	Low Level of Concern

Measurable Objectives and Associated Milestones:
A 10 percent reduction in the frequency of detection of pesticides of Moderate Concern by 2025, compared to 2020 results. No benchmark exceedances of diuron at the ag monitoring location within five years.

3.1.5 Groundwater Management Area (GWMA)

There is no measurable objective for the Southern Willamette Valley GWMA. A description of the SWV GWMA and recent nitrate trends are provided in section 2.4.1.5. Monitoring is described in Chapter 3.3.

3.2 Proposed Activities

ODA, the LAC, the LMA, and other partners have identified the following priority activities to track progress toward meeting the goals and objectives of the Area Plan (Table 3.2).

Table 3.2 Planned Activities for 2023-2028 throughout the Management Area by Upper Willamette SWCD, Long Tom Watershed Council, and Marys River Watershed Council

Activity	6-year Target	Description
Landowner Engagement		
# events that actively engage landowners (workshops, demonstrations, tours)	19	3 events per year plus GWMA tour with ODA, LAC, DEQ, and more
# landowners participating in active events	380	Approx. 20/event on average
Technical Assistance (TA)		
# landowners provided with TA (via phone/walk-in/email/booth/site visit)	500	
# site visits	180	
# conservation plans written*	30	
On-the-ground Project Funding		
# funding applications submitted	24	
* Definition: any written management plan to address agricultural water quality concerns, such as: nutrients, soil health, grazing, irrigation, and streamside vegetation. Can include farm and ranch plans (including small acreages) and NRCS-certified plans. Excludes projects with weak connection to agricultural water quality.		

3.3 Additional Agricultural Water Quality and Land Condition Monitoring

3.3.1 Water Quality

3.3.1.1 DEQ Monitoring

DEQ monitors water quality in the Management Area as part of its ambient monitoring network.

3.3.1.2 ODA Temperature Monitoring

The Long Tom Watershed Council is participating in a state-wide, long-term project spearheaded by ODA to determine whether reduced summer stream temperatures can be documented as a result of streamside vegetation enhancement on agricultural lands. Monitoring started in 2017 and will continue for 20 years. Data are collected on stream temperature, air temperature, stream flows, and streamside vegetation. The Watershed Council selected Owens and Ferguson Creeks because both were part of the Willamette Model Watershed Program. They are monitoring eight sites; stream temperature data are provided to DEQ annually and are incorporated in its Status and Trends Reports. ODA will write the final report.

3.3.1.3 GWMA Monitoring

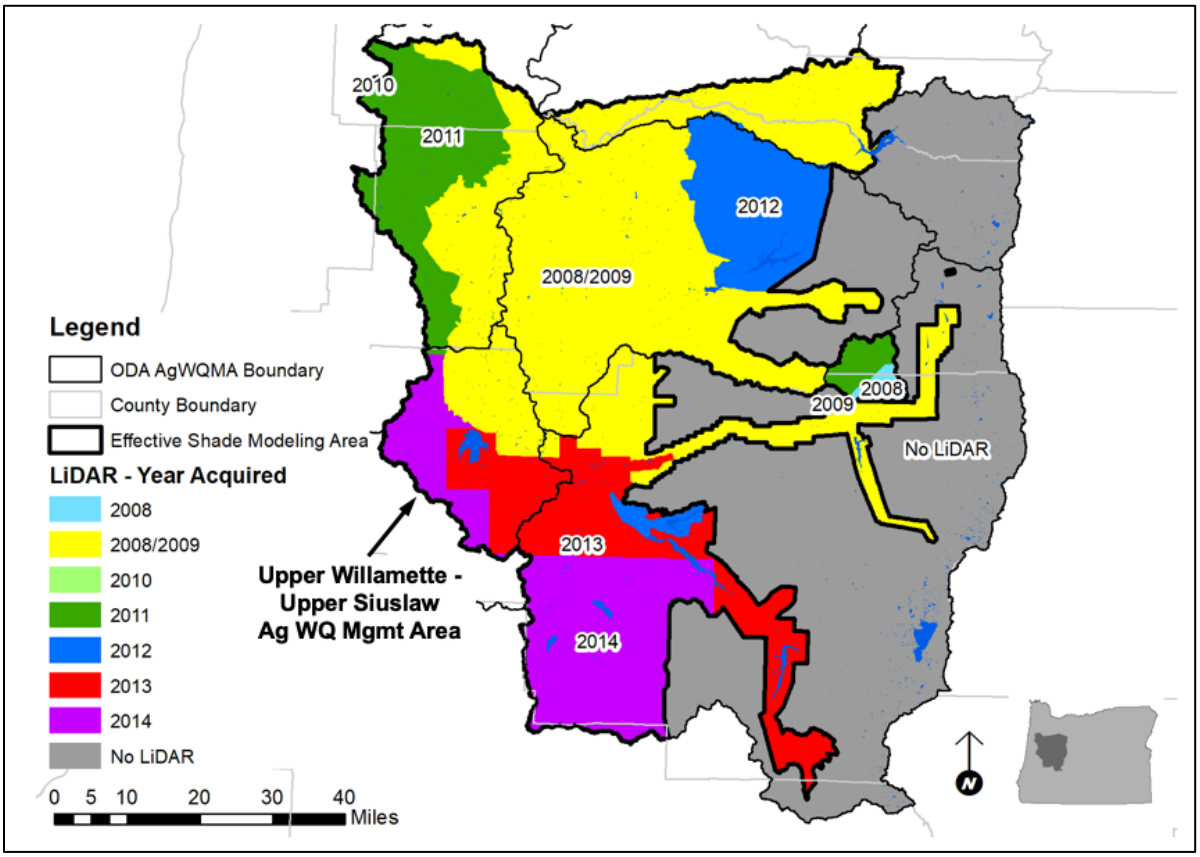
DEQ currently collects quarterly samples from 12 groundwater monitoring wells installed in the southern Willamette Valley, in addition to annual well sampling at 27 locations and six surface water locations. Some locations are also sampled for chloride and phosphorous. This program includes monitoring 23 shallow monitoring wells, 16 domestic wells, and six surface water sites. The domestic wells are generally installed deeper than the monitoring wells. EPA continues to provide stable isotopic analyses on surface and groundwater samples collected by DEQ's laboratory. EPA published an article in 2021 summarizing the results of this study, which included identification of nitrogen sources across monitoring wells (Weitzman et al., 2021). EPA and DEQ are collaborating on a web based tool to display historical data collected at these sites for public access.

3.3.2 Land Conditions

The following section describes the process DEQ used to assess streamside vegetation and shade conditions in the Southern Willamette Basin. Shade helps reduce the rate of stream warming from solar radiation. Results of the assessment are summarized in Section 4.3.2 of this Area Plan. The results show where conditions may be sufficient, as well as where ODA and partners should focus efforts to improve conditions in the future. This shade assesment will be included in the Willamette Subbasins TMDL which is currently being developed and will be completed by January 2024.

In 2019, DEQ hosted a Willamette TMDL implementation workshop, which included a presentation, "Assessing the Status of Riparian Restoration, Protection, and Shading in the Southern Willamette Basin" (presentation and results are posted at: www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Willamette-Basin.aspx#implementation). In this study, DEQ assessed nonpoint source solar heating along streams in the southern half of the Willamette Basin (including the Willamette portion of this Management Area; see Figure 3.3.2a), to compare current conditions to targets established in the TMDL. DEQ assessed current levels of "effective shade" (shade), which measures the percent of a stream that is shaded by streamside vegetation plus topography.

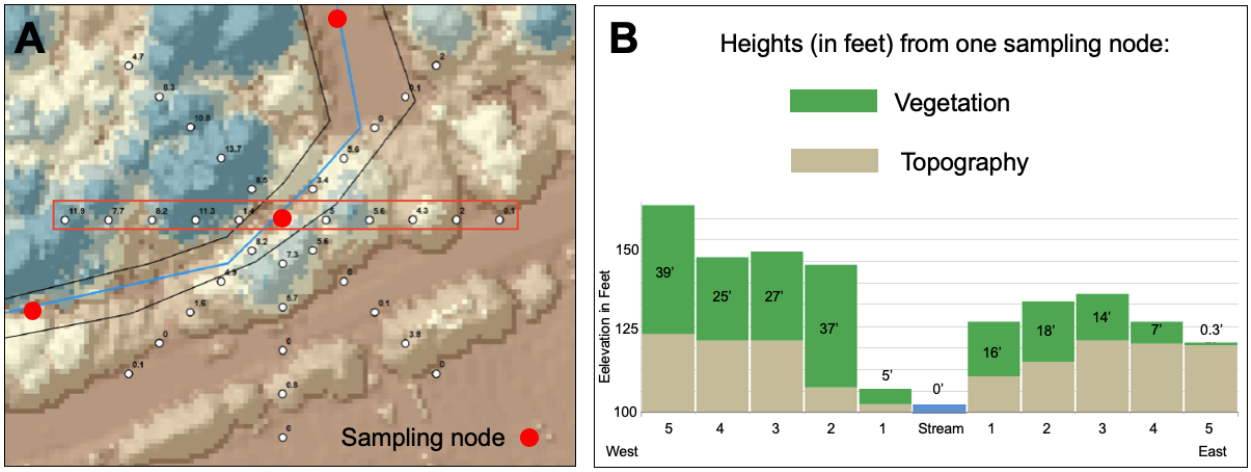
Figure 3.3.2a Southern Willamette study area; Willamette portion of this Management Area is shown



DEQ assessed shade along perennial and intermittent streams in the U.S. Geological Survey's National Hydrography Dataset (NHD). DEQ included all NHD streams because of known inaccuracies in stream flow classification. Many streams classified as intermittent streams are actually fish-bearing, with aquatic life using residual pools in the dry season. When and where more accurate stream classification is provided, DEQ will revise the shade assessment. DEQ recommends using the methods described by EPA in 2015 (www.epa.gov/measurements-modeling/streamflow-duration-assessment-method-pacific-northwest) to determine stream flow duration.

DEQ used Lidar data, computer mapping, and computer modeling to calculate current shade levels (as of the date Lidar was acquired, which ranges from 2009 to 2014 in this Management Area). DEQ set up sampling nodes to model shade every 656 feet (200 meters) along streams (red dots in Figure 3.3.2b). For each sampling node, DEQ used the Heat Source model to calculate effective shade (amount of sun blocked) throughout a mid-summer day, using vegetation and topographic heights from Lidar.

Figure 3.3.2b A: Background shows Lidar imagery, color-coded by vegetation height; for each sampling node (red dot), DEQ calculated vegetation and topographic heights in seven directions (white dots), out to a distance of 246 feet (75 m); B: Cross section, west and east of the sampling node, shows vegetation and topographic heights



Results of these additional monitoring activities are presented in Chapter 4.3.

Chapter 4: Progress and Adaptive Management

Chapter 4 describes progress toward achieving Area Plan goals and measurable objectives by summarizing accomplishments and monitoring results. Tracking activities is straightforward; monitoring water quality or land conditions takes more effort; relating changes in land conditions to changes in water quality is important but more challenging.

4.1 Measurable Objectives and Strategic Initiatives

The following tables provide the assessment results and progress toward measurable objectives and milestones in the past four years (2019-2022). See Chapter 3.1 for background and assessment methods.

4.1.1 Management Area

ODA is working with SWCDs and LACs throughout Oregon toward establishing long-term measurable objectives to achieve desired conditions. Currently, ODA and the Upper Willamette SWCD are using the Bear Creek SIA to show progress in this Management Area.

TMDLs

For TSS, the mercury TMDL establishes the long-term target for maximum instream TSS at 4 mg/L in 2049, with a short-term 2019 target of 17 mg/L.

To date, the only available TSS data are from the DEQ Status and Trends Report; results are described in Section 4.3.1, which indicate that the 2019 target was met in Flat Creek but not in Muddy or Amazon Creeks.

4.1.2 Strategic Implementation Areas

Table 4.1.2 2021 Bear Creek SIA

Evaluation Results		
As of November 30, 2021, 36 tax lots were identified as either a Potential Violation or a Compliance Opportunity. PV = 5, CO = 31, RO = 74, LC = 669		
Measurable Objective		
As of November 30, 2025, all 36 tax lots identified as a Potential Violation or a Compliance Opportunity will be downgraded to Restoration Opportunity or Likely in Compliance.		
Post Evaluation		
SIA is open and SIA work is continuing. An adaptive management discussion will be available at the next biennial review.		
Monitoring Activities		
Activity	**Accomplishment**	**Description**
ODA		
# acres evaluated	4,799	
# stream miles evaluated	33	
# landowners at Open House	30	
# landowners receiving outreach materials	320	

SWCD and Conservation Partners		
# landowners provided with technical assistance	116	
# site visits	13	
# conservation plans written	4	
SIA and Project Funding		
# funding applications submitted	4	1 application funded, 1 application denied funding, 2 applications TBD
# funding applications awarded	1	

4.1.3 Focus Areas

There are no active Focus Areas within this Management Area

4.1.4 Pesticide Stewardship Partnerships

Table 4.1.4 Amazon PSP

Measureable Objective
A 10 percent reduction in the frequency of detection of pesticides of Moderate Concern by 2025, compared to 2020 results.
Current Conditions
Minor reduction in number of exceedances from 2021.

4.1.5 Groundwater Management Area

No measurable objective has been developed for this GWMA.

4.2 Activities and Accomplishments

ODA, the LAC, the LMA, and other partners identified the following priority activities to track progress toward meeting the goals and objectives of the Area Plan.

Table 4.2a Activities conducted in 2019-2022 throughout the Management Area by by Upper Willamette SWCD, Long Tom Watershed Council, and Marys River Watershed Council

Activity	4- year target	4-year result	Discussion
Landowner Engagement			
# events that actively engage landowners (workshops, demonstrations, tours)	6	13	Note: Fire, COVID, fewer staff
# landowners participating in active events	125	263	
Technical Assistance (TA)			
# landowners provided with TA (via phone/walk-in/email/site visit)*	200	202	
# site visits	32	60	
# conservation plans written*	10	10	
On-the-ground Project Funding			
# funding applications submitted	6	5	
# funding applications awarded	6	1	1 application was not funded, 3 applications are TBD
* Number reported likely double-counts some landowners due to tracking methods.			

** Definition: any written management plan to address agricultural water quality concerns, such as: nutrients, soil health, grazing, irrigation, and streamside vegetation. Can include farm and ranch plans (including small acreages) and NRCS-certified plans. Excludes projects with weak connection to agricultural water quality.

Tables 4.2b and 4.2c summarize information from the OWRI on restoration project funding and accomplishments on agricultural lands in the Management Area. The majority of OWRI entries represent voluntary actions of private landowners who have worked in partnership with federal, state, and local groups to improve aquatic habitat and water quality conditions. OWRI results are provided annually in January after a year of proofing and GIS management.

ODA initiated annual reporting to DEQ for agricultural water quality implementation related to TMDLs. Table 4.2d shows a subset of key on-the-ground practices implemented in this Management Area in 2020. Practices are reported by Practice Group (suite of similar practices that use the same reporting unit). Table 4.2d also conveys which practice groups help to address the temperature, bacteria, and/or mercury TMDLs.

Table 4.2b Implementation funding (cash and in-kind) for projects on agricultural lands reported 1997-2021 (OWRI data include most, but not all projects, implemented in the Management Area.)

Landowners	OWEB	DEQ	NRCS*	All other sources**	TOTAL
$290,704 ($592,954 In Kind)	$4,605,434	$50,507	$2,148,539	$1,809,435	$8,904,619

* This table may not include all NRCS funding due to privacy concerns.
**Includes city, county, tribal, other state and federal programs, and non-profit organizations. There were too many entities to list.

Table 4.2c Miles and acres treated on agricultural lands reported 1997-2021 (OWRI data include most, but not all, projects implemented in the Management Area.)

Activity Type*	Miles	Acres	Count**	Activity Description
Upland		350		
Road	0		2	
Streamside Vegetation	215	1,051		
Wetland		636		
Instream Habitat	0			
Instream Flow	0		cfs	
Fish Passage	80		17	
TOTAL	**295**	**2,037**	**19**	

* This table may not include all NRCS projects due to privacy concerns.
** # hardened crossings, culverts, etc.

Table 4.2d Upper Willamette 2022 on-the-ground practices implemented (2020-21 annual report (data sources: SWCD Scope of Work and NRCS. Duplicate reporting has been removed; additional practices may have been implemented by landowners on their own or by other conservation partners)

Practice Group	Unit	# Implemented	Temperature	Bacteria	Mercury
UPLAND					
Irrigation	Acres	9	x		x
Fence	Feet			x	x
Woody Plantings	Acres				x
Cover Plantings	Acres				x
Heavy Use Area	#	1		x	x
RIPARIAN					
Woody Plantings	Acres		x	x	x
Fence	Feet		x	x	x

4.3 Additional Agricultural Water Quality and Land Condition Monitoring

4.3.1 Water Quality

4.3.1.1 DEQ Status and Trends Report

DEQ analyzed data for dissolved oxygen, *E. coli*, pH, total phosphorus, temperature, and total suspended solids in the Management Area. (DEQ. 2022 Oregon Water Quality Status and Trends Report; https://www.oregon.gov/deq/wq/programs/Pages/wqstatustrends.aspx).

Data are from DEQ, US EPA, and USGS databases for 2001 through 2020. DEQ determined status for stations in five-year periods and trends for stations with at least eight years of data collected at the same time of year.

Many of the stations with status and trends results are within Eugene's urban area or in the Willamette River. Only one site in DEQ's ambient monitoring network may be helpful for characterizing agricultural water quality (Amazon Creek at High Pass Road). However, additional monitoring conducted by ODA found that the Amazon Creek at High Pass Road site is heavily influenced by the industrial area along the A1 Channel, a major tributary. Since then, ODA has worked with DEQ to establish a new ambient monitoring site on Muddy Creek along Peoria Road.

The values in the table below correlate to sites most likely to be influenced by agricultural properties or practices. They do not represent all the sites in the Status and Trends Report.

Table 4.3.1.1 Attainment of water quality standards for 2016-2020, and 2000-2020 trends

Site Description (# of sites)	Parameter					
	E. coli	pH	Dissolved Oxygen	Temperature	Total Phosphorus (mg/L)	Total Suspended Solids (mg/L)
	Attainment Status and Trend				median; maximum[1]	median; maximum[2]
Muddy Creek S of Corvallis Airport	No	Yes	Yes	-	-0.1;0.23	**9;32**
Amazon Creek at High Pass Rd	No	Yes	Yes	-	**0.13; 0.2** ↑	**7; 49** ↑
Flat Creek watershed (~5)	-	Yes	Yes	Mix	0.22-0.81;1.37↑	2.8-8.5;16↑
Ferguson Creek watersheds(4)	-	-	-	NoYes	-	-

[1] DEQ has no benchmark for total phosphorus in this Management Area; ODA benchmark for potential water quality concerns = 0.08 mg/L
[2] DEQ has no benchmark for total suspended solids in this Management Area
↑ Statistically significant improving trend
↓ Statistically significant degrading trend

Data from many locations are needed to determine status and trends of agricultural water quality in the Management Area. It would be helpful to have a comprehensive evaluation of all data, including those not provided to DEQ, and develop and implement a monitoring plan for determining agricultural water quality and identifying issues throughout the Management Area.

Key Conclusions

- The DEQ results validate ODA's focus on efforts within the Long Tom, Bear Creek, and Amazon Creek watersheds to improve streamside vegetation and address soil health and nutrient management. Over time, ODA can test various practices, and future Status and Trends Reports will help evaluate progress.
- The southern watershed above Wolf Creek is consistently showing attainment of various standards. An evaluation of what is occurring there may help inform growers about what practices may be useful in other parts of the Management Area. However, the Long Tom, Bear Creek, and Amazon Creek watersheds are more complex and challenging in terms of being more populated areas.

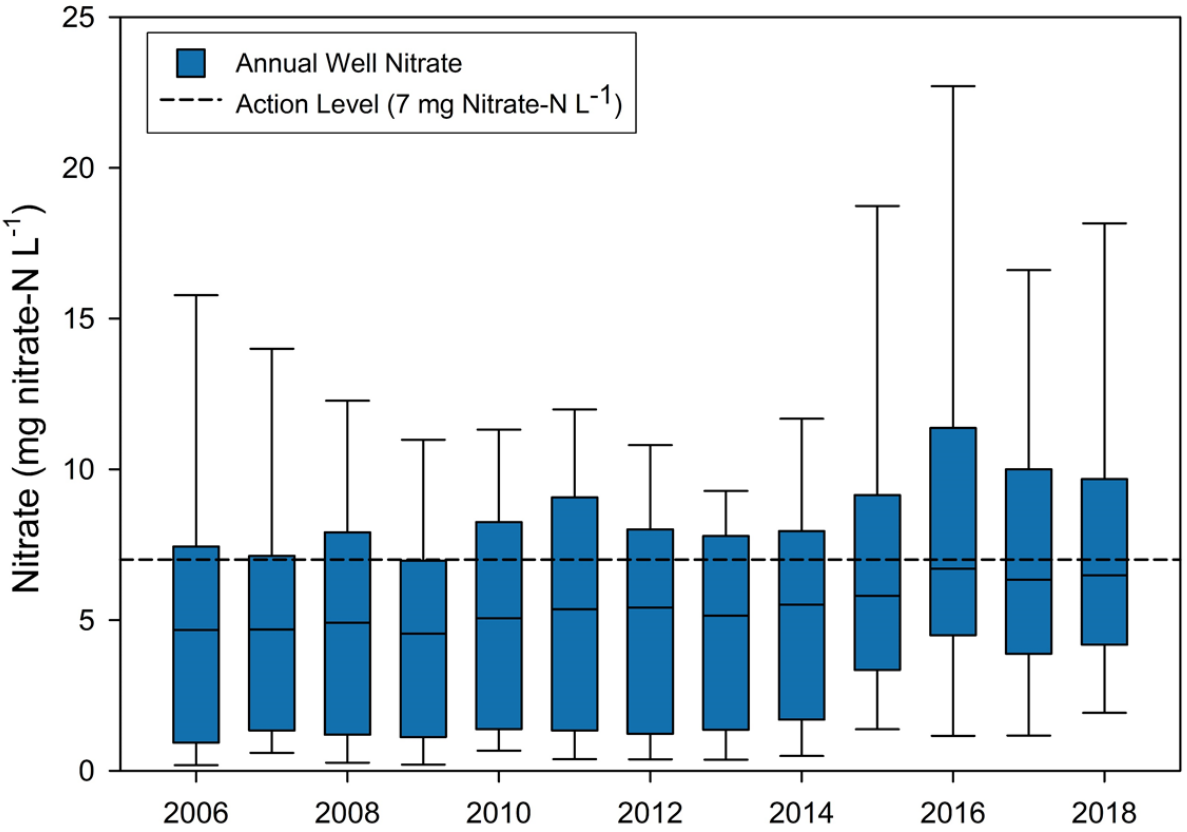
4.3.1.2 ODA Temperature Monitoring

Temperature data are included in DEQ's Status and Trends Report.

4.3.1.3 SWV GWMA Monitoring and Research

From 2006 to 2019, 33 percent of the mean well nitrate concentrations in the SWV GWMA exceeded the State of Oregon's 7 mg nitrate-N L^{-1} Action Level, and 12 percent exceeded the U.S. EPA's Maximum Contaminant Level (MCL) of 10 mg nitrate-N L-1. Approximately 57 percent of the wells showed an overall increase in nitrate throughout the total study period, and the total mean nitrate-N concentration increased from the 2006 through 2011 mean of 5.41 mg nitrate-N L^{-} to a mean of 6.28 mg nitrate-N L^{-1} from 2012 to 2019. The findings indicate despite the greater public awareness of the issue of groundwater nitrate contamination in the SWV GWMA, concentrations have increased during the past 14 years. Statistical analyses identified the presence of confined animal feeding operations, well recharge source, and surface nitrogen fertilizer inputs to be significant drivers of nitrate concentrations. It is not clear why the nitrate concentrations are increasing. To address this nitrate contamination problem, future efforts may need to find new and different approaches to improve drinking water quality in the SWV GWMA.

Figure 4.3.1.3 Box and whisker plot of the nitrate concentrations in 34 well water monitoring sites over time in the SWV GWMA. The box represents the 25th to the 75th percentile of the data, while the whiskers represent the 5th and 95th percentile. The horizontal line is the median concentration, which has increased over time. From Piscitelli (2019).



4.3.2 Land Conditions

DEQ's assessment of streamside vegetation and shade in the Southern Willamette Basin shows that conditions are sufficient in some areas and highlights where ODA and partners should focus efforts in the future.

In the 2019 presentation, "Assessing the Status of Riparian Restoration, Protection, and Shading in the Southern Willamette Basin," DEQ summarized stream shading within 246 feet (75 m) of perennial and intermittent streams in the southern half of the Willamette Basin. The presentation and results are posted at: www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-Willamette-Basin.aspx#implementation.

For all land uses in the Southern Willamette study area, the average current shade is 66 percent, and the average target shade in the TMDL is 92 percent. The difference between the current shade and the target shade, or "shade gap" (additional shade needed to achieve the target) is 26 percent.

For agricultural streams in the Southern Willamette study area, the average current shade is 33 percent, the average target shade in the TMDL is 82 percent, and the shade gap (additional shade needed to achieve the target) is 49 percent.

Figure 4.3.2a shows the model results for current shade (blue) and target shade (gray) for agricultural streams only: for the entire study area, for the Willamette portion of this Management Area, and for the two partial watersheds in the Willamette portion of this Management Area. The shade gap on agricultural streams is very consistent (48-49 percent) in these four areas, which means that the shade gap in this Management Area is representative of the shade gap in the full Southern Willamette study area. In the 13 smaller sub-watersheds in the Willamette portion of this Management Area, the shade gaps on agricultural lands vary considerably, from 25 percent in the Spring Creek-Willamette River sub-watershed to 78 percent in the Amazon Creek sub-watershed. This shade assesment will be included in the Willamette Subbasins TMDL which is currently being developed and will be completed by Jan. 2024.

Figure 4.3.2a Shade results for agricultural lands, across the entire study area, the Willamette portion of this Management Area, and the two partial watersheds in the Willamette portion of this Management Area

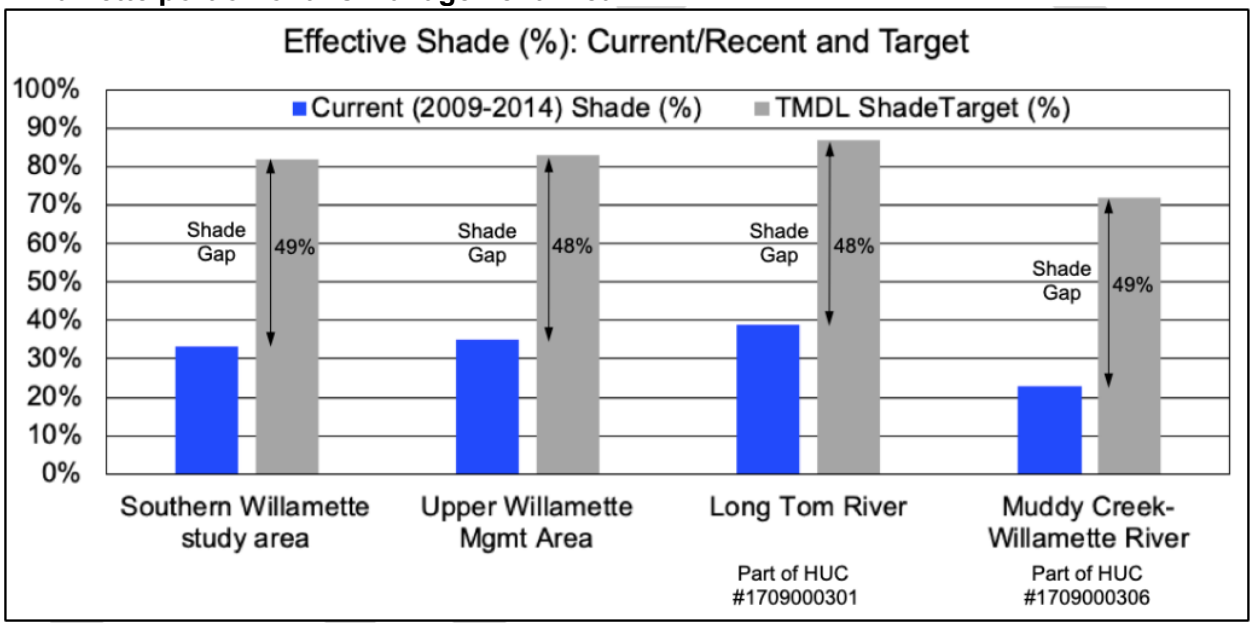
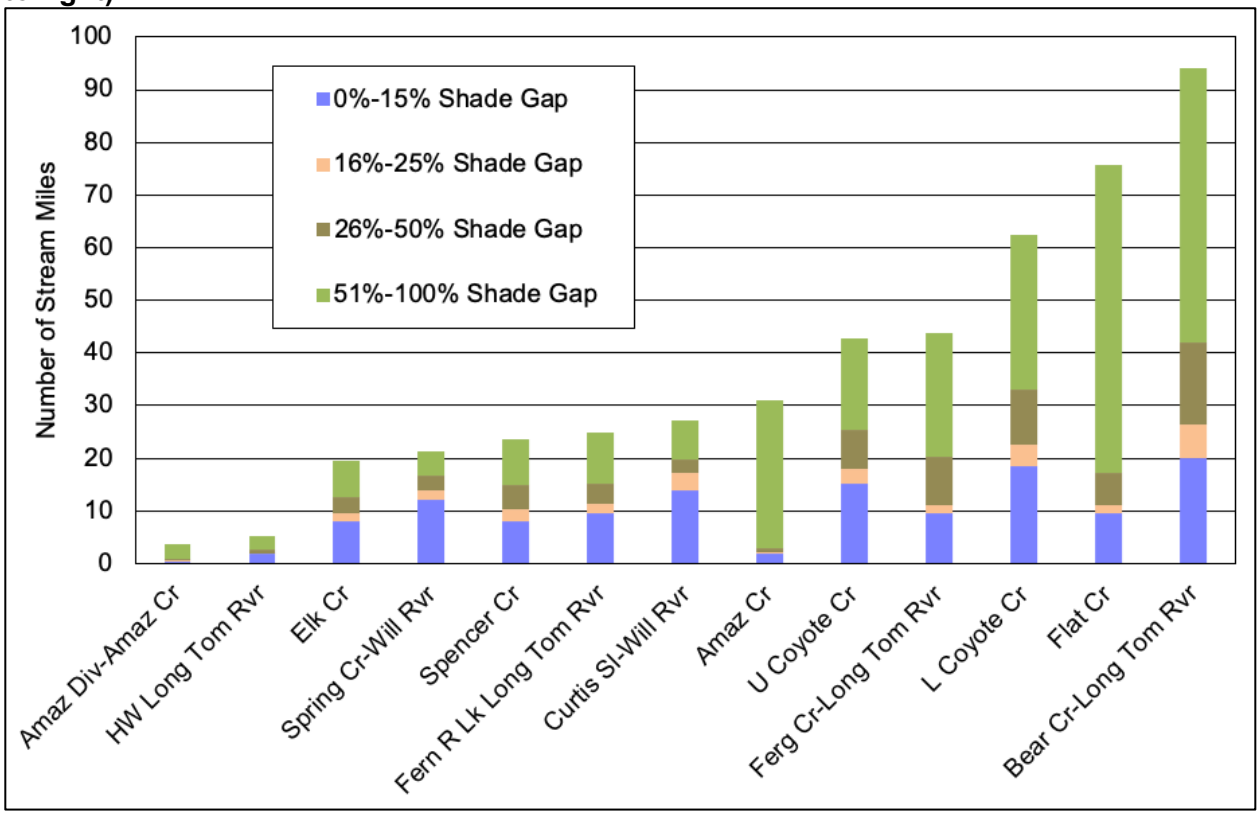


Figure 4.3.2b shows the model results for the number of agricultural stream miles in each of the 13 sub-watersheds, and the number of stream miles that have smaller to larger shade gaps. The Bear Creek-Long Tom River sub-watershed has the highest number of agricultural stream miles (94 miles) and the second highest number of stream miles with a shade gap between 51 percent and 100 percent (52 miles), making this sub-watershed an excellent choice as the Upper Willamette SWCD's current Focus Area. The results by sub-watershed can also be used to help prioritize future implementation, e.g. to select future SIAs or Focus Areas.

Figure 4.3.2b Number of stream miles on agricultural lands with smaller to larger shade gaps, by sub-watershed in the Willamette portion of this Management Area; sub-watersheds are arranged by number of agricultural stream miles (lowest to left, highest to right)



Completed streamside vegetation restoration projects in the Willamette Basin portion of this Management Area (Table 4.2c) have contributed to current shade levels, and as the vegetation grows, it will contribute additional shade over time. Instream restoration projects that add channel complexity also help to reduce stream temperatures.

ODA and partners plan to use the information from the DEQ assessment to identify where to focus work in the future. The assessment also helps ODA and partners to understand how changes to land conditions improve water quality, and how much remains to be done. This will help ODA and partners to set objectives for future improvements. ODA, DEQ, the LMA, and the LAC recognize that TMDL implementation is a community effort that may take decades. DEQ is interested in calculating updated shade levels within the next few years, to document additional progress.

4.4 Biennial Reviews and Adaptive Management

ODA, the LAC, the LMA, and other partners met on March 9, 2023, to review implementation of the Area Plan and provided recommendations for the future (Tables 4.4a and 4.4b).

Table 4.4a Summary of biennial review discussion

Progress
Outreach to landowners has increased in the past year after COVID. More vineyards are moving to biodynamic practices and third-party certification.
Impediments
• No implementation funding for SIAs. • LAC, GWMA lack of retention of ag landowner participants. • So many constantly changing variables and legacy issues in the GWMA affecting nitrates there is no straight fix. • Landowners do not understand that SWCDs are voluntary, not regulatory so don't want to work with SWCD. • Small entiuties don't have the capactiy to deal with government mandates and regulations coming down on them, such as TMDLs. • Younger and newer farmers don't know the traditional conservation partners like ODA, SWCDs, etc. Younger and new farmers get most of their information through their cell phones.
Recommended Modifications and Adaptive Management
• LAC members recruit more members. • Advertise outreach events through grower groups, e.g. hazelnuts and grass seed.

Table 4.4b Number of ODA compliance activities in 2019-2022

Location	Cases		Site Visits	Agency Actions				
				Letter of Compliance		Pre-Enforcement Notification	Notice of Noncompliance	Civil Penalty
	New	Closed		Already in compliance	Brought into compliance			
Outside SIA	4	4	15	3	2	4	1	2
Within SIA	4	0	2	0	0	2	0	0

References

Adams, E.B. 1994. Riparian grazing. Washington State University, Spokane, Washington.

Blinn, C. 1998. Managing water on roads, skid trails, and landings. Minnesota Department of Natural Resources, St. Paul, Minnesota.

Bruneau, A., S. Hodges, and L. Lucas. 1995. Water quality and home lawn care. North Carolina Cooperative Extension Service, Raleigh, North Carolina.

Chaney, E., W. Elmore, and W.S. Platts. 1993. Livestock grazing on western riparian areas. U.S. Environmental Protection Agency, Seattle, Washington.

Feise, C., E. Adams, and J. LaSpina. 1993. Silage storage. Washington State University Cooperative Extension Service, Pullman, Washington.

Gamroth, M. and J.A. Moore. 1996. Assessing your manure management for water quality risk. Oregon State University Extension Service, Corvallis, Oregon.

Godwin, D. and J.A. Moore. 1997. Manure management on small farm livestock operations. Oregon State University Extension Service, Corvallis, Oregon.

Guard, J. 1995. Wetland plants of Oregon and Washington. Lone Pine Publications, Redmond, Washington.

Hansen, H. and W. Trimmer. 1997. Irrigation runoff control strategies. Pacific Northwest Extension, Corvallis, Oregon.

Hart, J., G. Pirelli, and L. Cannon. 1995. Fertilizer guide for pastures in western Oregon and western Washington. Oregon State University Extension Service, Corvallis, Oregon.

Hirschi, M. 1994. 50 ways farmers can protect their groundwater. North Central Regional Extension, Urbana, Illinois.

Hirschi, M. 1997. 60 ways farmers can protect surface water. North Central Regional Extension, Urbana, Illinois.

Ko, L. 1999. Tips on land and water management for small acreages in Oregon. Oregon Association of Conservation Districts, Portland, Oregon.

Lundin, F. 1996. Pasture management guide for coastal pastures in Oregon and Washington. Oregon State University Extension Service, Corvallis, Oregon.

Marx, E.S., J. Hart, and R.G. Stevens. 1999. Soil test interpretation guide. Oregon State University Extension Service, Corvallis, Oregon.

Moore, J. and T. Willrich. 1993. Manure management practices to reduce water pollution. Oregon State University Extension Service, Corvallis, Oregon.

Natural Resources Conservation Service. 1997a. Conservation practice standard for critical area planting. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997b. Conservation practice standard for cover and green manure crop. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997c. Conservation practice standard for animal trails and walkways. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997d. Conservation practice standard for heavy-use area protection. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997e. Conservation practice standard for diversion. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997f. Conservation practice standard for roof runoff management. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997g. Conservation practice standard for use exclusion. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997h. Conservation practice standard for livestock watering facility. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997i. Conservation practice standard for nutrient management. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997j. Conservation practice standard for underground outlet. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997k. Conservation practice standard for grassed waterway. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 2001. Conservation practice standard for filter strip. Natural Resources Conservation Service, Portland Oregon.

Oregon Geospatial Data Clearinghouse. 2002. Watershed information for Oregon. Oregon Geospatial Data Clearinghouse, Portland, Oregon.

Oregon Water Resources Department. 2003. Water Rights Information System. Oregon Water Resources Department, Salem, Oregon.

Patching, W.R. et al. 1987. Soil survey of Lane County Area, Oregon. United States Department of Agriculture – Natural Resources Conservation Service, Portland, Oregon.

Piscitelli, C.M., 2019. A Trend Analysis of Nitrate in the Southern Willamette Valley Groundwater Management Area (GWMA). M.S. Thesis. Oregon State University, Corvallis, Oregon.

Pojar, J. and A. MacKinnon. 1994. Plants of the Pacific Northwest Coast. Lone Pine Publishing, Redmond, Washington.

Rogers, B. and G. Stephenson. 1998. Livestock and forage management in western Oregon riparian areas. Section III, Chapter 3 in Watershed Stewardship: A Learning Guide. Oregon State University Extension Service, Corvallis, Oregon.

Selker, J. et al. 2004. Nitrates and Groundwater: Why Should We Be Concerned with Our Current Fertilizer Practices? Special Report 1050. Oregon State University, Corvallis, Oregon.

Thieman, C. 2000. Long Tom Watershed Assessment. Long Tom Watershed Council, Eugene, Oregon.

Trimmer, W. and H. Hansen. 1994. Irrigation scheduling. Pacific Northwest Extension, Corvallis, Oregon.

Waskom, R. 1994. Best management practices for phosphorus fertilization. Colorado State University Cooperative Extension, Fort Collins, Colorado.

Appendix A: SWV GWMA Agricultural Action Plan and Crosswalk to the Agricultural Water Quality Management Area Plan

This table provides information about the Goals, Objectives, and Actions identified in the Southern Willamette Valley GWMA. These actions are carried out by many different partners. The crosswalk column indicates the sub-set of actions that are implemented as part of the Upper Willamette and Upper Siuslaw Agricultural Water Quality Management Area Plan by ODA and the Upper Willamette SWCD.

Goals for Agricultural Lands in the SWV GWMA	Crosswalk to UWUS Area Plan
Goal 1: Prevent and control pollution of groundwater from agricultural activities and achieve applicable water quality standards that protect beneficial uses through voluntary management actions. **Goals 2:** Reduce existing concentrations of nitrate and prevent further contamination from agricultural sources of groundwater in the GWMA. Identify: practices contributing to contamination, best management practices to prevent nitrogen inputs to groundwater, and a schedule for implementation of actions.	The goals of the GWMA and the Agricultural Water Quality Management Area Plan are very similar. The UWUS Area Plan goal can be found at the beginning of Chapter 3. Practices related to GWMA Goal 2 are identified in Chapter 2.5 of this Plan.
Objective 1: Education and Outreach Organize education and outreach efforts to increase the agricultural community's awareness of groundwater vulnerability and best management practices.	
Strategy 1.1 Within the GWMA, coordinate agricultural surface and groundwater pollution control efforts. Coordinate groundwater pollution control efforts among the various agricultural-related organizations and plans in the GWMA. ***Actions*** • Annually evaluate the Benton, Upper Willamette, and Linn SWCD Scopes of Work to include groundwater quality tasks. These tasks should focus on nitrogen use efficiency, irrigation use efficiency, and manure management. • During biennial reviews of the South Santiam, Middle Willamette, and Upper Willamette Agricultural Water Quality Management Area Plans, update groundwater quality items in the Goals and Objectives. The Area Plans Goals and Objectives sections should include a focus on nitrogen use efficiency, irrigation efficiency, and manure management. • Communicate to NRCS local work groups the priority of spending funds on nutrient use efficiency, irrigation efficiency, and manure management within the GWMA.	The SWCD Scopes of Work are reviewed as part of the OWEB Capacity Grant. The SWV GWMA SWCD's Scopes of Work include tasks that relate to the SWV GWMA Action Plan. This is accomplished on an ongoing basis. The SWV GWMA Agricultural Actions are identified in Chapter 2.5, 3.2, 4.2 and in this Appendix. ODA and the SWCDs participate annually on NRCS Local Work Groups to advocate for funding for SWV GWMA implementation.
Strategy 1.2 Organize and deliver workshops and demonstration projects aimed at producers to show BMP implementation and increase BMP adoption. At the workshops, educate producers about groundwater conditions, populations at risk from high nitrate levels, federal assistance programs, and sustainable agriculture opportunities. ***Actions*** • Each SWCD develop one demonstration project showcasing successful BMPs and systems. • Organize one tour (field or virtual) of each demonstration project for agricultural managers and producers. Partner with agribusiness for tours of demo projects.	See Chapter 3.2 and 4.2 for targets and results. ODA and DEQ are planning a field visit for fall 2023. This will include a presentation at a work group meeting, a driving tour of the GWMA, and a site visit to an agricultural producer's property.

• Each year partners sponsor two small acreage resource management workshops that provide presentations (either as a stand-alone presentation or part of a broader presentation) on surface and groundwater quality issues. • Include information on sustainable practices, incentive programs, and third-party certification at the workshops. The goal is to attract 100 producers annually to the demonstrations and workshops.	
Strategy 1.3 Write and publish articles to promote/improve the agricultural community's awareness of water quality issues in the GWMA. ***Actions*** • Once per year, provide an update on the status of the GWMA and associated water quality data in the Benton SWCD newsletter. The Linn and Upper Willamette SWCDs do not have a newsletter, and therefore, should provide an update to be included in a partner newsletter or other media source. This may include OSU Extension for the Linn SWCD. • Publish two media articles or public service announcements per year in the GWMA about successful agricultural resource management practices.	DEQ publishes a SWV GWMA newsletter that includes SWV GWMA water quality status information about successful agricultural resource management practices. The Upper Willamette SWCD began publishing a newsletter which provides an opportunity to include information about SWV GWMA status and associated water quality data as well as information about successful agricultural management practices.

Strategy 1.4 Share information and coordinate with agribusiness, producers, and producer groups to promote practices and conditions that protect and improve water quality.
 	
Actions
• Follow-up meeting with agribusiness field representatives active in the GWMA to review the groundwater nitrate issue and share appropriate outreach materials. This should occur in 2012 and once every three years thereafter. Possible ways to meet with field representatives include:
  o Grower meetings
  o Individual company meetings
  o Oregon Agriculture Chemical and Fertilizer safety training workshops
• Each SWCD will deliver one groundwater quality presentation (either as a stand-alone presentation or part of a broader presentation) at one agribusiness or producer group meeting per year.
• Make at least 100 contacts (total) with landowners about groundwater quality per year within the areas served by the Benton, Upper Willamette, and Linn SWCDs.
• Provide or develop outreach materials for producers that summarizes practical resource management for groundwater quality.
	Table 3.2 indicates what the Upper Willamette SWCD and other organizations plan to do during the next six years.
	
	Table 4.2 indicates what the Upper Willamette SWCD and other organizations implemented during the past four years.

Objective 2: Resource Management Implement BMPs in the GWMA to improve groundwater quality.	
Strategy 2.1 Work with agricultural producers in the GWMA to implement practices to improve groundwater quality. ***Actions*** • Provide technical assistance to producers in the GWMA. Each SWCD will have a minimum of 10 contacts with producers within the GWMA annually promoting irrigation efficiency, and nutrient and manure management.	The Upper Willamette SWCD works with producers on an ongoing basis to provide technical assistance. See 3.2 and 4.2 for targets and results.

• Promote proper nutrient management, irrigation efficiencies, and manure management to reduce nitrogen loss to groundwater. Each SWCD will work with two producers within the GWMA annually to design and implement best management practices.	
Strategy 2.2 Obtain sufficient financial assistance to support technical assistance to producers and implementation of resource management practices. ***Actions*** • Include tasks in the SWCDs Scopes of Work for technical assistance to producers and to seek funds for implementation of practices related to groundwater quality. • Communicate to NRCS local work groups the priority of spending funds on nutrient use efficiency, irrigation efficiency, and manure management within the GWMA. • Include the promotion and support of USDA programs such as the Environmental Quality Incentives Program and the Conservation Reserve Enhancement Program into SWCD work plans and Scopes of Work. • Seek funds from USDA incentive based financial assistance programs to assist producers to implement groundwater protection practices. • Seed DEQ 319 funds to assist with agricultural on-the-ground projects and management practices that minimize groundwater nitrate pollution.	SWCD Scopes of Work include tasks for providing technical assistance to producers and for seeking funding for the implementation of resource management practices. The SWCD and ODA participate on annual NRCS Local Work Groups to communicate the need for SWV GWMA implementation consideration.
Strategy 2.3 Develop and target a priority area within the GWMA to evaluate progress related to implementation of the Agricultural Water Quality Plans and GWMA Action Plan. (The purpose of the priority area is to evaluate the area before and after targeting and demonstrate progress. Progress is a measurement of improvement of water quality parameters or surrogates.) As resources and time allows, multiple priority areas will be identified for targeting. ***Actions*** • Identify a priority area to target education, outreach, and other resources. • Identify BMPs that will be promoted for improvement of groundwater quality. • Identify management practices or conditions that assure agricultural contributions of nitrate to groundwater are at acceptable levels. • Measure soil nitrate levels at enough sites in the priority area to assess potential of nitrate leaching. • Contact all landowners within the priority area with information on the GWMA and best management practices to reduce nitrate inputs. • Develop targets and milestones specific to the priority area. • Implement management practices with all willing landowners in the priority area.	**ODA Focus Areas** In the past, the SWCD's Bear Creek and Long Tom River Focus Areas provided an opportunity for the SWCD to provide targeted education, outreach, and other resources to producers who manage lands within the Focus Areas. **Neighborhoods Project** In 2017, SWV GWMA partners identified an area within the GWMA where nitrates have been persistently high. ODA is working with producers in this area on an ongoing basis to identify potential practices to test ideas that may lead to reduced nitrates.
Strategy 2.4 Obtain adequate funding for implementation of desired practices within the priority area. ***Actions*** • Develop implementation and funding plan for the identified priority area.	An ODA fertilizer grant was sought for the Neighborhoods Project during 2019 but it was not funded.

• Work with producers in the priority area to determine interest in implementation of specific practices. • Work with partners to submit funds proposals to cost-share implementation of practices.	
Objective 3: Monitoring and Research Monitor groundwater quality in agricultural areas to evaluate the impacts of agricultural management practices. Research best management practice effectiveness, adoption of best management practices, and priority research needs.	
Strategy 3.1 Evaluate current domestic and monitoring wells to determine monitoring needs in agricultural areas. ***Actions*** • Monitoring is ongoing and sites are identified. Monitoring is being conducted by DEQ in partnership with OSU. The end date of monitoring is not identified. • Evaluate aquifer characteristics to determine whether the existing monitoring wells provide comprehensive data on nitrate concentrations or if additional wells are necessary to monitor nitrate levels in the GWMA. • Evaluate LiDAR (light detection and ranging) data to understand connections between wells.	This evaluation was completed. See SWV GWMA web page for details (https://wellwater.oregonstate.edu/swvgwma)

Strategy 3.2 Measure the success of BMPs implementation efforts.
 	
Actions
• Measure producer (within the priority area from Strategy 2.3):
  ○ Awareness of groundwater quality issues,
  ○ Level of BMPs implementation,
  ○ Ease of implementing BMPs, and
  ○ Barriers to BMPs implementation.
• This measurement should be completed in the fall of 2013 and repeated two years later to determine any changes. Target: 50 percent of the producers surveyed in 2013 using groundwater protection BMPs as identified by groundwater staff and agricultural partners.
	See SWV GWMA web page for additional information.

Strategy 3.3 Document groundwater related investigations and violations of Agricultural Water Quality Management Area Rules and CAFO permit conditions within the GWMA. ***Actions*** • Document the number, issue, validity, and outcome investigations regarding potential violations of Agricultural Water Quality Management Area Rules where the violations could impact groundwater. • Document CAFO violations and outcomes.	See Table 4.4b for a summary of water quality investigations and violations of the Agricultural Water Quality Management Area Rules.
Strategy 3.4 Research, document and coordinate BMP effectiveness. Implement priority research identified at February 2010 researchers meeting. ***Actions*** • Follow-up to the February 2010 researchers meeting to track progress related to identified priority research and funding needs. Research needs identified include:	See SWV GWMA web page for research and monitoring results.

○ Nitrogen budgets and BMPs for other and nontraditional crops (such as specialty seed crops) ○ Nitrogen mineralization under different crop scenarios ○ Bioreactors on tile lines ○ Time of groundwater travel (data needs improved) ○ No till vs. conventional (difference in cost and potential leaching) ○ Study nitrate sources and how nitrate moves ○ Impact of tile lines on nitrate concentration and movement • Maintain a prioritized research plan and identified sources of funding. • Work with OSU or other partners to design a nitrate leaching study to further characterize potential nitrate leaching from various agricultural sources in the GWMA. • Implement research to measure BMP and systems effectiveness and identify factors affecting groundwater nitrate levels from agricultural practices. • Research and document effectiveness and impacts of specific BMPs on nitrate leaching.	
Strategy 3.5 Obtain sufficient funding to support priority research needs. ***Actions*** • Submit research grant applications to support high priority research needs. Potential grant sources include the DEQ 319 program, ODA's fertilizer research funds, EPA, the USDA, and other agencies and private organizations.	See SWV GWMA web page for information about funding.