OREGON DEPARTMENT OF AGRICULTURE

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Middle Deschutes Agricultural Water Quality Management Area Plan

November 2020

Developed by the

Oregon Department of Agriculture

and the

Middle Deschutes Local Advisory Committee

with support from the

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Table of Contents

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
CNPCP – Coastal Nonpoint Pollution Control Program
CWA – Clean Water Act
CZARA – Coastal Zone Act Reauthorization Amendments
DEQ – Oregon Department of Environmental Quality
GWMA – Groundwater Management Area
LAC – Local Advisory Committee
LMA – Local Management Agency
Management Area – Agricultural Water Quality Management Area
NPDES – National Pollution Discharge Elimination System
NRCS – Natural Resources Conservation Service
OAR – Oregon Administrative Rules
ODA – Oregon Department of Agriculture
ODF – Oregon Department of Forestry
ORS – Oregon Revised Statute
OWEB – Oregon Watershed Enhancement Board
OWRI – Oregon Watershed Restoration Inventory
PMP – Pesticides Management Plan
PSP – Pesticides Stewardship Partnership
SIA – Strategic Implementation Area
SWCD – Soil and Water Conservation District
TMDL – Total Maximum Daily Load
USDA – United States Department of Agriculture
US EPA – United States Environmental Protection Agency
WPCF – Water Pollution Control Facility
WQPMT – Water Quality Pesticides Management Team

Foreword

This Agricultural Water Quality 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.

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. Presents goal(s), measurable objectives, strategic initiatives, proposed activities, and monitoring.

Chapter 4: Progress and Adaptive Management. Describes progress toward achieving the goal of the Area Plan and summarizes results of water quality and land condition monitoring.

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 603-095-1600). 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

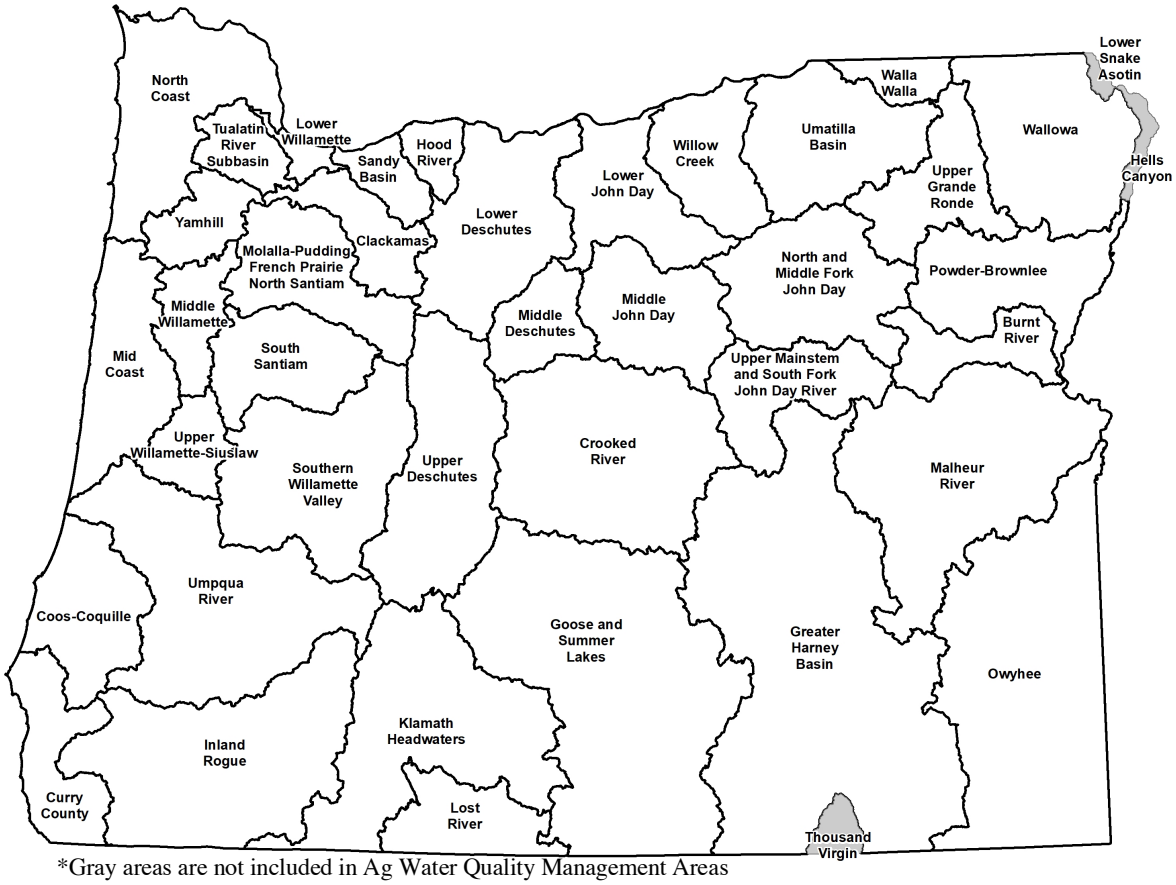
In 1993, the Oregon Legislature passed the Agricultural Water Quality Management Act directing ODA to develop plans to prevent and control water pollution from agricultural activities and soil erosion and to achieve water quality standards (ORS 568.900 through ORS 568.933). The Oregon Legislature passed additional legislation in 1995 to clarify that ODA is the lead agency for regulating agriculture with respect to water quality (ORS 561.191).

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).

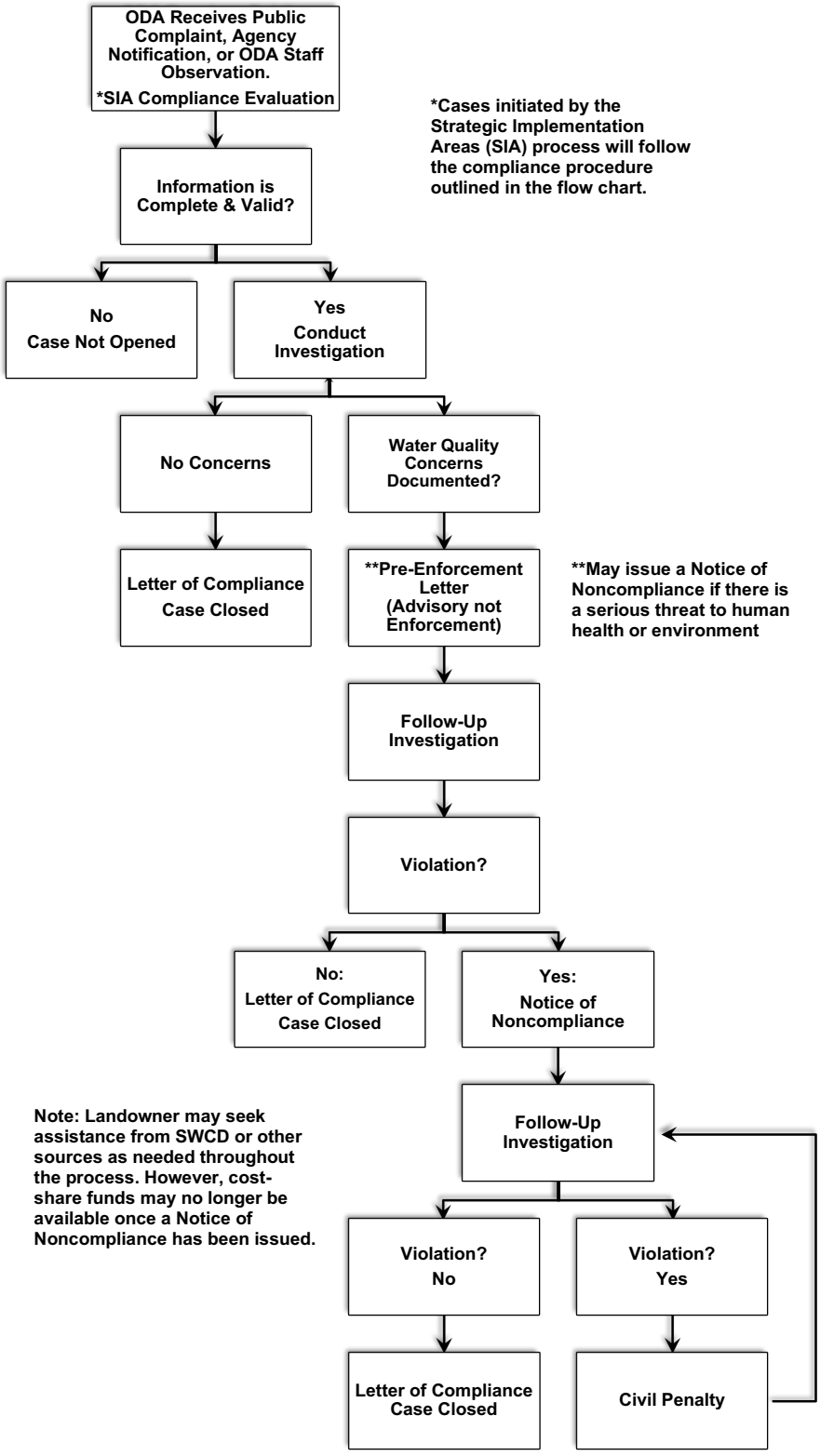
ODA bases Area Plans and Area Rules on scientific information (ORS 568.909). ODA works in partnership with SWCDs, LACs, DEQ, and other partners to implement, evaluate, and update the Area Plans and Area Rules. If and when other governmental policies, programs, or rules conflict with the Area Plan or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

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).

Figure 1.3.1 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 in 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,
- 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

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.

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 and 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.

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 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 (NPDES) permits. Nonpoint sources (agriculture, forestry, and urban) are assigned a "load allocation".

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.

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 of the Area Rules in Oregon.

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 canary-grass, 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. 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.

Healthy soils make farms and ranches more resilient. The western United States is experiencing higher temperatures, more weather variability, and greater storm intensity. Forecasts predict continued high-intensity storms in the winter and spring, combined with more frequent droughts, which may result in more erosion, especially on bare ground. 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.

If there is a GWMA in this Management Area, it is described in Chapter 2.

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 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 (WQPMT) to expand efforts to improve water quality in Oregon related to pesticide use. The WQPMT facilitates and coordinates activities such as monitoring, analysis and interpretation of data, effective response measures, and management solutions. The WQPMT relies on monitoring data from the Pesticides 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.

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.

1.6 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 (ODF), 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 NPDES permits for point sources, the CWA Section 319 grant program, the Source Water Protection Program, 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 (http://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 United States Department of Agriculture (USDA) NRCS and 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 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 (section 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 and progress toward achieving the measurable objective(s) and milestone(s) is summarized in Chapter 4.

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.

The current Focus Area for this Management Area is described in Chapter 3.

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.

1.8 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 Water Quality Monitoring

In addition to monitoring landscape 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 over 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 (BOD), chlorophyll a, specific conductance, dissolved oxygen (DO), DO percent saturation, 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.

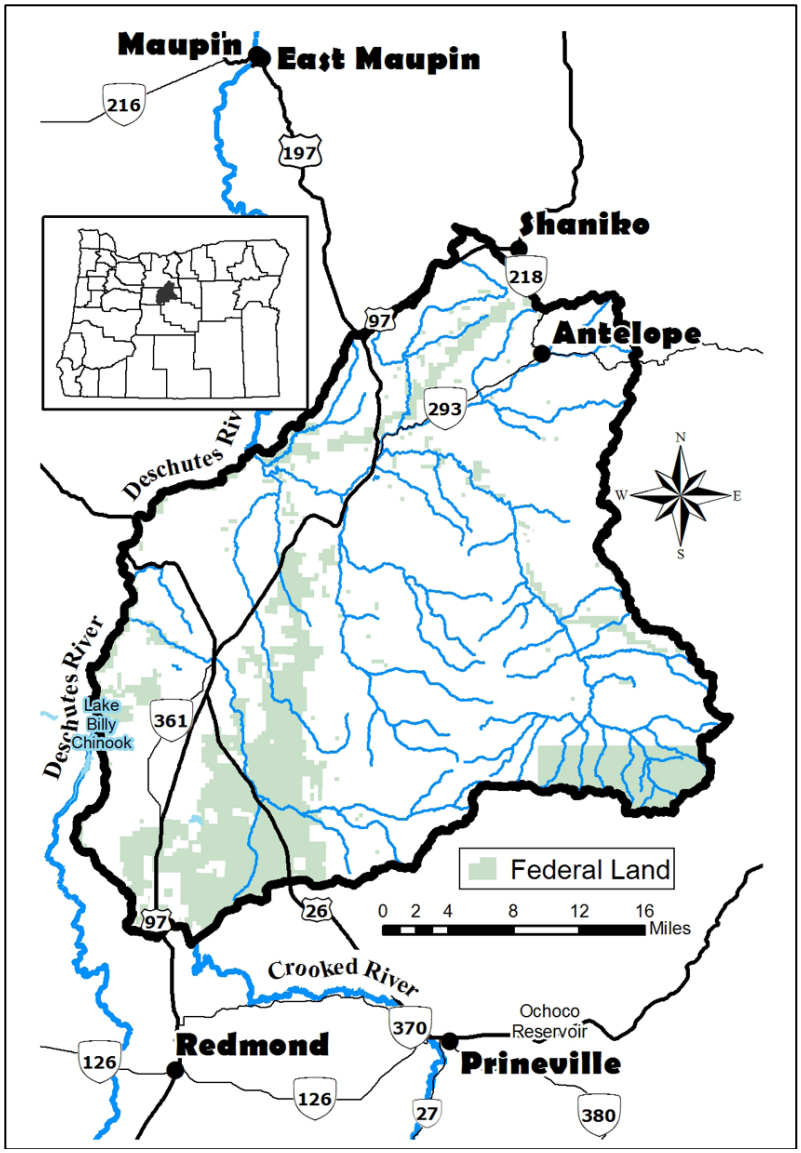
Water quality monitoring efforts in this Management Area are described in Chapter 3, and the data are summarized in Chapter 4.

Chapter 2: Local Background

The Management Area includes the Trout Creek and Willow Creek drainages, the area along the eastern side of the Deschutes River between Trout Creek and Crooked River, and the area east of Crooked River between its confluence with the Deschutes River to the north and Sherwood Canyon to the south. This includes the entire North Unit Irrigation District (NUID).

Principal water bodies include:

- Trout Creek
- Willow Creek
- Deschutes River from confluence with Trout Creek upstream to confluence with the Crooked River (approx. 25 miles)
- Crooked River from mouth to just north of Smith Rock (approx. 21½ miles)



2.1 Local Roles

2.1.1 Local Advisory Committee

The Area Plan was developed with the assistance of the LAC. 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	Agricultural Product or Interest Representation
Roy Hyder (Chair)	Metolius	Landowner
Lowell Forman (Vice-Chair)	Antelope	Ranching
Mike Britten		North Unit Irrigation District
Lori Campbell		Portland General Electric, Biologist
Lloyd Forman	Antelope	Livestock and Hay
Mickey Killingsworth	Madras	Sheep
Brad Klann	Agency Plains	Row Crops
Evan Thomas	Culver	Row Crops
Rob Galyen	Agency Plains	Row Crops
Chase Duncan		Unit Forester, ODF

2.1.2 Local Management Agency

Implementation of the Area Plan is accomplished through an Intergovernmental Grant Agreement between ODA and the Jefferson County SWCD. This Intergovernmental Grant Agreement defines the SWCD as the LMA for implementation of the Ag Water Quality Program in this Management Area. The SWCD was also involved in development of the Area Plan and Area Rules.

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

2.1.3 Middle Deschutes Watershed Council

The Middle Deschutes Watershed Council is composed of a diverse group of landowners, residents, government agencies, and organizations working together to enhance the natural resources of the Trout Creek and Willow Creek watersheds. The Council collaborates with the community at large, including landowners and partner organizations, to foster an understanding of watershed resources and to improve watershed health through voluntary restoration actions. To accomplish this, the Council works with the community to identify and design projects with objectives that address the Area Plan goals, and then follows with securing funding to implement projects.

2.2 Area Plan and Area Rules: Development and History

The director of ODA initially approved the Area Plan and Area Rules in 2001.

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

2.3.1 Geography

Location

The Middle Deschutes Agricultural Water Quality Management Area encompasses just over 1,000 square miles in central Oregon and includes the towns of Madras, Culver, Metolius, Antelope, and Ashwood. The Management Area includes most of the eastern half of Jefferson County and portions of Wasco and Crook counties. Elevation above sea level ranges from 1,250 to 5,940 feet and averages 2,400 feet around Madras. Typical summers are dry and hot (temperatures up to 100°F), and winters tend to be wet and cold (temperatures down to -10° F).[1] Summer maximum temperatures average 87°F (July and August); winter minimum temperatures average 33°F (December-January).[2] Extreme temperatures in the last 40 years are 106°F and -31°F. Average annual precipitation ranges from 9 to 25 inches.[1] Almost all the precipitation falls between November and April, and in the highest elevations, more than half of it falls as snow.

Soils and Geology

The Management Area constitutes the far western corner of the John Day Ecological Province.[1] This rugged province is characterized by extensive, geologically eroded, steeply dissected hills of thick, ancient sedimentary materials interspersed with buttes and plateaus capped with basalt or tuffaceous rock. The area around Madras also includes flat to slightly rolling farmlands.

During the last 60 million years, Central Oregon has experienced major episodes of volcanic activity interspersed by periods of sedimentation.[1] In the Trout Creek watershed, soils on the north and east facing slopes consist mostly of volcanic ash and loess over or mixed with colluvium of fine to medium textured volcanic ash. The rock content in the soil profile is high. Productivity varies greatly between shallow and deep soils. Plateau tops, upper south-facing slopes, and ridge-tops have very shallow soils and have lower productivity. Lower slopes and drainages, sideslopes and swales offer better vegetative growth and regeneration potential. The ash soils in this area potentially can produce large amounts of sediment from accelerated runoff when exposed, compacted, or channeled.

Most soils used for irrigated crops, hay, and pastures are in the *Madras-Agency-Cullius Association*. This consists of moderately deep, well-drained soils on upland terraces and plateaus.[3] Slopes range from 0 to 15 percent. These soils formed in medium-textured windblown deposits and are underlain by gravels and basalt of the Deschutes Formation. The soils are fine loamy and depth to basalt or tuff bedrock is 10 to 40 inches. Wind erosion is a concern if the soils are left unprotected. Sediment from runoff due to over-irrigation or storm events may be moderate to high on slopes greater than 10 percent. *Era* soils are sandy loam with a cobbly substratum, 0-3 percent slopes, and with a depth of over 60-inches to bedrock. They are well drained and occur on mountains. Water erosion is a potential hazard.

The *Caphealy-Reute*r complex occurs in rolling hills and supports rangeland, dryland grain, and pasture[3]. *Caphealy* consists of loamy well-drained soils and has a depth of 20-40 inches to bedrock. *Reuter* soil is 10-20 inches to bedrock and is loamy and well drained. This association is limited by slope, wind erosion, and low available water capacity. Wind erosion is a concern if the soils are left unprotected. The soils are very sensitive to overgrazing and recovery rates can be slow. The very low available water capacity and the shallow depth of the Reuter soil limit the choice of species for range seeding to those that are drought-tolerant. The very low available water capacity and moderately rapid permeability should be considered in irrigation water management. Sediment from runoff due to over irrigation or storm events may be moderate to high on slopes greater than 10 percent.

Willowdale-Rail soils are used for irrigated hay and pastureland.[3] Slopes range from 0 to 2 percent. Soils are 40 to 60-inches deep. Willowdale soils are well drained; Rail soils are not. This association is limited by high water table and prone to flooding. Shallow excavations are limited due to water table. Runoff is slow and hazard from erosion is slight. Streambank erosion is high when flooding events occur or when riparian or vegetation condition is poor.

Vegetation

Three general vegetation types occur in the Management Area.[4] The upper Trout and Willow Creek watersheds near the Jefferson/Crook County line consist of coniferous forest dominated by ponderosa pine, Douglas fir, or grand fir. Middle elevations consist primarily of juniper savanna interspersed with treeless grassland (now mostly converted to dryland cropping in the Wasco County portion of the Management Area). Irrigated croplands cover the lower elevation areas known locally as Mud Springs, Gateway, Little Agency Plains, Agency Plains, Culver, Henderson Flat, and Trail Crossing. Irrigated crops include: grass seed, alfalfa, seed potatoes, carrot seed, grains, flower seed, hay, nursery crops, herbs, mint, onion seed, garlic, hemp and some vegetable crops. Non-irrigated crops include hay, small grains, pasture, and perennial vegetation planted under the Conservation Reserve Program (CRP).

Juniper density has increased dramatically over the past 90 years[4]. The increase in juniper has reduced the uplands' ability to collect and store precipitation.[5,6] The potential for recovering rangeland vegetative cover exists if practical ways can be found to control soil erosion and plants such as juniper.[1]

In 2018, the Jefferson County Weed Advisory Committee and Management Area was formed to address noxious weeds in the Management Area. Noxious weeds found in the Management Area include yellow starthistle; Scotch and Canada thistle; Dalmatian toadflax; spotted, diffuse, and Russian knapweed; whitetop; kochia; and teasel.[4] Weeds can affect water quality by providing inadequate soil cover and root mass, which can induce upland and streambank erosion.[7]

2.3.2 Hydrology

The Management Area incorporates two distinct drainages (Trout and Willow creeks) and the area irrigated by the NUID. NUID provides water to 58,860 acres from Gateway (mouth of Trout Creek) to Trail Crossing (Smith Rock). These NUID irrigated lands drain primarily into the Crooked River, Deschutes River, Mud Springs Creek, and Willow Creek.

Trout Creek[4]

Trout Creek drains approximately 700 square miles. Its headwaters are in the Ochoco National Forest in the Ochoco Mountains. These headwaters are forested; however, most of the watershed consists of juniper/sagebrush rolling hills. Mud Springs Creek drains irrigated croplands.

Seasonal precipitation patterns result in flows in Trout Creek that peak in winter and early spring and rapidly diminishes to low flows in summer. The NRCS estimates that current peak flows in some stream segments are two to three times greater than under pre-settlement conditions (Trout Creek Assessment, pages 8 and 12). Changes in vegetative cover appear to be most responsible for this increase in flow volume.

The annual flows of Trout Creek at Ashwood between 1966 and 1991 averaged 26.3 cfs. Annual means during this period range from 1.0 (1977) to 62.9 cfs (1982). The highest daily mean measured was 1,510 cfs (February 23, 1986).

Willow Creek[8]

Willow Creek drains approximately 180 square miles and flows from the Crook/Jefferson County line northwest through Madras to the Deschutes River. It drains the northwestern portion of the Ochoco Mountains and flows through several miles of the Crooked River National Grasslands.

Willow Creek is typical of the high desert region. High flows occur during winter in unusually wet periods or when rain falls on snow, which melts the existing snow and sends large quantities of water down the drainage. In the summer, the remaining small flows are typically diverted for irrigation of hay fields and pasture throughout the drainage. An unusual occurrence of groundwater springs discharge in the lower 1.5 miles of Willow Creek, which increases the flow substantially at the mouth above what flows through the town of Madras. Temperature measurements on these springs ranged from 54°F to 70°F, and a flow measurement on a collection of seven springs yielded 1.25 cfs.

Streamflow above the town of Grizzly between October 1967 and December 1978 averaged 1.51 cfs with long periods of no flow. The flow peaked at 52 cfs on April 26, 1978. Most of the flow occurred during the months of February, March, April, and May.

1964 Flood[4]

A large accumulation of snow, over frozen ground in some areas, followed by rapid warming and heavy rains caused widespread flooding through eastern Oregon in December 1964. Trout Creek completely inundated the Willowdale valley and dropped the streambed over 10 feet in places due to head-cutting and channel widening. Many of these cut banks are still visible today. Major channelization by the Army Corps of Engineers followed the 1964 flood and the resultant berms have interfered with stream function by disconnecting streams from their floodplain.

North Unit Irrigation District (NUID)[9,10]

The NUID supplies water to 92 square miles (58,860 acres) of irrigable farmland that stretch from Gateway (mouth of Trout Creek) throughout the Agency Plains, Madras, and Culver areas, around Juniper Butte, and to Trail Crossing (just northwest of Smith Rock). NUID pulls water from both natural live-stream and stored flow for both the Crooked and Deschutes River systems. First from natural Deschutes River live flow (if available), second from storage in Wickiup Reservoir, third from the Crooked River natural flow and fourth purchasing 10,000-acre feet from the storage in Prineville reservoir. During the irrigation seasons it has become more of a regular practice to pull a combination of all four of these to meet demands. Haystack Reservoir, east of Culver, provides off-stream storage and serves as a re-regulating reservoir; it was constructed to drastically reduce seasonal canal transmissions and spill losses. There was a three-day lag time between "turnout" from Wickiup Reservoir and "on-farm delivery." Haystack Reservoir reduced this time lag considerably. Substantial seepage losses occur between Bend and Crooked River crossing. As a result, NUID has adjusted their operation, management, and on-farm delivery over many years to match water availability. In the last 20 years, NUID has lined 12.5 miles of the Main Canal between Bend and Redmond thereby reducing seepage losses and increasing on-farm deliveries. NUID is also quite active in piping laterals to improve water quality and quantity, operations, and reduce seepage.

The NUID system consists of 65 miles of main canal and 235 miles of laterals. No on-farm tailwater is returned to the main canal or the laterals. The distribution system has an average conveyance efficiency of approximately 52 percent. Flow is intensively measured throughout the system. All water at the main diversion points from the Deschutes River and Crooked River, all laterals receiving water from main canals, and all points of delivery (on-farm) are accurately measured.

Average annual available deliveries usually do not exceed 2.25 acre-feet per acre. This delivery is inadequate to fully meet all crop water needs for all the irrigated farmland. Agricultural operators

frequently direct water to high-value crops, sometimes leaving inadequate water for full growth of lower value crops.

Estimated on-farm irrigation efficiency is 60-65 percent, with a low of approximately 50 percent on flood-irrigated land to a high of 80 percent on late-model center pivot systems. There is also a trend toward installation of micro or drip irrigation systems on high value crops.

Landowners are delivered water out of the canals, pump out of drain ditches, or combine water from both sources in a pond and then pump out of that; drainage water is reused up to five or six times on land that is flood irrigated. There is little to no runoff from sprinkler-irrigated lands. NUID has three emergency spills (at the Crooked River, Juniper Butte, and Willow Creek) that are rarely used and three regular drains (at Culver, Campbell Creek, and Mud Springs Creek). Most water in the Culver and Campbell Creek is used up by landowners at the "end of the line" before the water can exit the natural drainage ways into the Deschutes River.

Water Rights[4,8]
The earliest priority date for Antelope and Trout creeks is 1870; most of the water rights of Trout Creek and its tributaries are dated prior to 1909. The earliest groundwater right on Trout Creek has a priority date of 1953. Most of the groundwater rights were developed in the 1960s and 1970s.

Water withdrawals are allowed year-round from Trout Creek. In 1980, the Oregon Water Resources Commission withdrew all unappropriated waters of Trout Creek and its tributaries, except for Mud Springs Creek, to protect fish spawning. This withdrawal still allows human and livestock consumption and allows waters to be legally stored and released from storage.

The oldest water right on Willow Creek dates back to 1875 for the irrigation of 25 acres from the North Side Ditch. The primary use of water on Willow Creek is for irrigation. There is an instream water right with a 1990 date for Willow Creek for the reach from Coon Creek to the mouth.

2.3.3 Land Use

Historical[4]
Before the treaty of 1855, with the Tribes of Middle Oregon (now the Confederated Tribes of the Warm Springs Reservation), native peoples frequented the area for seasonal fishing, hunting, and subsistence food gathering.

Hay Creek saw the first permanent white settlement in Central Oregon. During the 1860s and early 1870s, stockmen settled the area and water from Trout Creek was first used for cropping in 1877. Logging of the forested headwaters of Trout and Willow creeks began around this time.

Current
The Management Area is characterized by rural land ownership. Less than 20 percent of the lands are in Federal ownership, managed by the US Forest Service and the Bureau of Land Management (BLM). The Ochoco National Forest includes the headwaters of Trout Creek; the Crooked River National Grasslands (managed by the Forest Service) include juniper/sage lands around Madras. BLM lands primarily line the Deschutes River and include the ridge between Antelope and Ward creeks. Forest Service and BLM lands have grazing leases.

Most of the range and forestlands are used for beef cattle production.[4] The beef industry is made up primarily of cow/calf operations with most calves being sold in late fall or early winter. A small number of yearlings are purchased from the outside area and grazed in the watershed.

Trout Creek has little cropping, consisting primarily of non-irrigated small-grain/fallow, with other dryland cropping systems including grass or grass/alfalfa in rotation with grains.[4] Some fields adjacent to streams are flood-irrigated from diversions; others have been enrolled in CRP, which keeps lands under perennial vegetation.

Gentle upland slopes in the north central Trout Creek watershed have been converted from native vegetation to dry farming.[4] Also, some larger bottoms or low terraces along major streams are now irrigated fields. Rangeland throughout the watershed is generally in fair condition. However, most highly accessible low-elevation range near water is in poor condition, while steeper rangeland or more remote areas are still in good condition. Riparian areas have been altered by grazing from livestock and big game animals, logging, and fire suppression. Increased runoff peaks have overloaded and exceeded the capacity of the natural flood plains in some places. Consequently, many streambanks and most riparian areas are in low ecological condition.

The Willow Creek watershed is approximately 11 percent forestland, 63 percent rangeland, 3 percent urban and 7 percent dryland crops by acreage. Sixty-eight percent of the cropland is irrigated.[8] Irrigated crops include: grass seed, alfalfa, seed potatoes, carrot seed, grains, flower seed, hay, nursery crops, herbs, mint, sugar beets, onion seed, and garlic. Non-irrigated crops include hay, small grains, CRP, and pasture. Sixty-five percent of the irrigated land is watered by sprinkler and 35 percent by flood. Sixty percent of the cropland (15,000 acres) is classified as Highly Erodible Land.

Most of Willow Creek's 85,000 acres of grazed forestland and rangeland have poor livestock distribution[8]. Approximately 10 percent of the rangeland is overstocked with juniper. Juniper numbers have increased dramatically on many areas of historically open juniper/grassland savanna.

Landowners voluntarily have undertaken many projects to improve the watershed health of Trout and Willow creeks. These include juniper cutting, spring improvements, riparian plantings, streambank stabilization, riparian fencing, conversion from flood to sprinkler irrigation; installation of instream structures for fish habitat, infiltration galleries, and sediment control basins; and changes in irrigation and livestock management.

2.4 Agricultural Water Quality

2.4.1 Water Quality Issues

In September 2011, DEQ published the Deschutes Basin Water Quality Status and Action Plan. It discussed water quality concerns and emphasized the following actions related to agriculture in the Management Area:

1. Surface Water Actions

- Reduce temperatures, improve flow volume and patterns, and improve habitat through:
    - Better land management and conservation,
    - Increasing native, streamside vegetation,
    - Improved water conservation,
    - Increased instream flows,
    - Channel restoration,
    - Juniper reduction,
    - Combating invasive weeds.
- Reduce erosion and nutrient and pesticide levels in water through better land and crop management.

2. Groundwater Actions

- Minimize nitrate contamination from agriculture and other sources,
- Assess effects of groundwater pumping and irrigation efficiency projects on stream flows,
- Assess cause, extent and magnitude of risks associated with bacteria in groundwater.

2.4.1.1 Beneficial Uses

Water quality standards have been developed to protect the following beneficial uses in the Deschutes Basin (OAR 340-41-0130, Table 130A): public and private domestic water supply, industrial water supply, irrigation, livestock watering, fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, and aesthetic quality. In addition, hydropower is identified as a beneficial use for the Deschutes River from the Pelton Regulating Dam upstream to the Bend diversion dam and for the Crooked River. In practice, water quality standards are set at a level to protect the most sensitive beneficial uses.

The beneficial uses which are most sensitive to water quality impairment are typically fish and aquatic life, public and private drinking water supply (both groundwater and surface water), and water contact recreation. Temperature, dissolved oxygen, pH, sediment and pesticides are examples of pollutants which directly affect fish and aquatic life. Bacteria, turbidity and toxics are examples of pollutants which directly affect human health.

2.4.1.2 Most Sensitive Beneficial Use: Salmonids

Steelhead and bull trout in this area are listed as Threatened under the Federal Endangered Species Act.

Location

1. The Deschutes River from Trout Creek to the Reregulation Dam (River Mile 87 to 101) has several fish species, which are present year-round: fall Chinook, summer steelhead, bull trout, and resident rainbow "redband" trout. All species with the exception of bull trout spawn and rear year-round in this section.

2. Trout Creek has summer steelhead and resident redband. These species are present in the system all year. Both steelhead and redband spawn and rear in Trout Creek.

3. Willow Creek has resident redband that are present all year. Redband spawn and rear in certain upper and lower reaches. There is seasonal use in areas around the city of Madras.

4. Lake Billy Chinook and Lake Simtustus have bull trout, redband trout, and kokanee. These three species all rear in the lake, and various age groups are present all year.

5. The Crooked River has resident redband, which spawn and rear and are present year-round.

6. Corresponding to completion of a fish transfer facility in Lake Billy Chinook, a full- scale fish reintroduction plan began in 2009 in the Crooked, Deschutes, and Metolius River basins. Steelhead and Chinook fry were released in tributaries to the Crooked and Deschutes rivers; only Chinook were released into the Metolius.

Habitat Requirements

Steelhead spawn during March to May in areas with good gravel, usually downstream of pools. From fertilization to when the fry swim up from the gravel takes about 60 days. The fry rear in the stream for one to three years and, on average, smolt in the second year. In the spring, fry begin to smolt and migrate

to the ocean between March and June. After one to three years in the ocean, the adults begin their return to their natal stream to repeat the cycle.

Redband trout exhibit similar characteristics to steelhead except they don't migrate to the ocean. Adult redband in headwater reaches and in small tributaries can be as small as five inches.

Steelhead and redbands require cool water with varied habitat that includes diversity within pools and riffles aided by overhanging banks and vegetation, boulders, root wads, and large woody debris.

Kokanee salmon rear and mature in Lake Billy Chinook. These fish feed on zooplankton in deep areas of the lake. Most kokanee spawn in the Metolius River system with a few spawning in the Deschutes River above Lake Billy Chinook.

Bull trout rear and mature in both the lakes and in the Deschutes and Metolius rivers; they are fish-eaters and need cold water. Diverse habitat provides cover and ambush areas to feed from. The eggs for this species generally need water colder than 50°F.

2.4.1.3 WQ Parameters and 303(d) list

Table 2.4.1.3. consists of water quality limited streams from DEQ's 2012 303(d) list.

Location and seasonality of exceedances of Oregon's Water Quality Criteria in the Middle Deschutes Area, from DEQ's 2012-303(d) list[12]. Current information on the 303(d) list can be found at *http://www.deq.state.or.us/wq/assessment/rpt2012/search.asp*

Stream Segment	Water Quality Parameters							
	Sediment	Temperature	pH	Dissolved Oxygen	Chlorophyll *a*	*E. coli*	Biological Criteria	Total Phosphorus
Trout Creek	X	X	X				X	X
Trout Creek tributaries: Auger, Big Log, Bull, Cartwright, Dick, Dutchman, Potlid	X	X						
Trout Creek tributary: Mud Springs Creek and unnamed tributary to Mud Springs Creek			X					
Trout Creek tributary: Tenmile Creek		X						
Trout Creek tributary: Antelope Creek							X	
Willow Creek		X						
Lake Simtustus and Lake Billy Chinook			X		X			
Deschutes River (below Reregulation Dam)		X	X	X				
Crooked River		X	X	X		X	X	X (RM 0-70)

The 303(d)-listed parameters indicate problems for fish and humans:

- Sediment fills in the gravels needed for salmonid spawning and clouds up water, thereby reducing aquatic productivity.

- Lethal temperatures for adult salmonids vary according to a variety of factors but generally are reported in the range of 70° to 77°F. Salmonid eggs and juveniles are much more sensitive to high temperatures. Generally, water temperatures above 55°F inhibit salmonid spawning, egg incubation and fry emergence from the gravel. However, salmonids have successfully survived in some areas where natural water temperatures are higher. Egg development and the subsequent timing of emergence are closely associated with stream temperatures. Juvenile rearing and growth may be impaired by temperatures greater than 64°F. Optimal water temperature for juvenile bull trout is less than 50°F. Temperature criteria, which are applied to streams in the Management Area, can be found in Figures 130A and B referred to in OAR 340-041-0028(4) and can be accessed at *http://www.oregon.gov/deq/Regulations/Pages/OARDiv41.aspx*

  The NorWeST model of stream temperature data shows that no perennial stream reaches outside of USFS boundaries attain the temperature standard in August.

- High pH and low dissolved oxygen generally result from excessive plant growth (chlorophyll *a*), which is stimulated by high nutrient concentrations in the water and warm water temperatures. When plants die, they drop to the stream bottom and are broken down by bacteria, which use up oxygen in the process. The breakdown of aquatic plants can use up large amounts of the oxygen needed by other aquatic life for survival. High pH levels (9-14) can harm fish by denaturing cellular membranes and can transform nitrogen in the water column into a more toxic form of ammonia that can poison fish.

- Bacteria are used to determine the safety for "human contact recreation." High levels of *E. coli* bacteria can cause severe gastric illness and even death. *E. coli* are also indicators of other pathogens. Bacteria are not believed to be a problem in groundwater in the Management Area; *E. coli* were detected in only one out of nine sampled wells based on data in Oregon's Real Estate Transaction database. Bacteria have been detected at levels that are harmful to human health in Trout Creek, Antelope Creek and the Lower Crooked River.

- Biological criteria listings indicate waters that do not adequately support aquatic insects and other invertebrates (benthic macroinvertebrates). These organisms are important as the basis of the food chain and are very sensitive to changes in water quality. To assess a stream's ecological health, the community of benthic macroinvertebrates is sampled and compared to a reference community (community of organisms expected to be present in a healthy stream). If there is a significant difference, the stream is listed as water quality limited. This designation does not identify the actual limiting factor, although sediment and temperature are two of the likely causes.

Three additional water quality concerns are not on the 303(d) list:

- Nitrate levels above 10 mg/L can cause blue-baby syndrome and other issues in humans. High nitrate levels can also contribute to algae blooms. Groundwater north and west of Madras contains nitrate levels of 3-8 mg/L.

- Habitat modification refers primarily to riparian areas that have been so modified that they no longer provide sufficient habitat to sustain aquatic life. Examples include: denuded streambanks, lack of large woody debris, and insufficient pools and riffles.

- Flow modification refers to reduced streamflow. Reduced streamflow can result in warmer water temperatures. Slower flows can also lead to lower concentrations of dissolved oxygen because the slow-moving water does not pick up oxygen as readily from the air.

2.4.1.4 TMDLs and Agricultural Load Allocations

Currently, there are no Basin TMDLs and Agricultural Load Allocations developed for the Management Area. TMDL development work has not yet been scheduled for the Middle Deschutes Management Area.

2.4.1.5 Drinking Water

Ten active public water systems use groundwater to serve approximately 14,140 people, including the cities of Antelope (wells), Madras (Opal Springs), and the Deschutes Valley Water District (Opal Springs and artesian wells). Seven non-community public water systems serve 1,619 people. Opal Springs and the Deschutes Valley Water District wells are supplied by an aquifer hundreds of feet below lava in the Crooked River canyon.

Agricultural land uses (primarily alfalfa, grains, hay/pasture and livestock) are concentrated in the western portion of the Management Area. The soils in this area 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 penetrate to the aquifers used for drinking water, and bacteria removal through soil filtration can be less effective in sandy soils.

The drinking water standard for nitrate is 10 mg/L. Sampling of private wells and springs by the Deschutes SWCD shows that nitrates are high (above 5 mg/L) in groundwater in northern Agency Plains and in the Mud Springs drainage. Based on existing information, either fertilizer (current or historic applications) or soils naturally high in nitrogen are the most likely source of the nitrates, and more study is needed to confirm (see Section 2.5.2 for recommended practices). The Domestic Well Testing Act database for 1989-2018 indicates no detections of nitrate >7mg/L in the 46 tested wells, however four had nitrates $\geq$ 5 mg/L. Those private wells are in the western portion of the Management Area also.

In the last ten years, the City of Antelope has had an alert for bacteria, the source of which is unidentified. None of the bacteria alerts for other public water systems are likely to be related to agriculture based on their locations or water sources. There are no recent nitrate alerts.

The SWCD will conduct nitrate sampling and monitoring in and around North Agency Plains as part of the Campbell Creek SIA to see if nitrates are coming from fertilizers or are naturally high in the soils. Monitoring will take place over approximately 10 years and will be reported during the next Biennial Review.

2.4.2 Potential Contributors to Pollutions

Potential contributors to pollution in the Management Area include runoff and erosion from agricultural and forest lands, leaching of pollutants to groundwater, eroding streambanks, runoff from roads and urban areas, and waste discharges from pipes. Rerouting of runoff via road building, construction, and land surfacing such as parking areas can lead to excessive erosion or pollutant transport. Pollutants can be carried to the surface water or groundwater through the actions of rainfall, snowmelt, irrigation, and leaching. Increased heat input due to vegetation removal, seasonal flow reduction, changes in channel shape, and floodplain alteration is a major source of water quality impairment. Channelization and bank instability may alter gradient, width/depth ratio, and sinuosity, thereby causing undesirable changes in sediment transport regime, erosional and depositional characteristics, and stream temperature.

Land conditions associated with the following agricultural activities were identified as sources of water quality impairment through their effects on streambank stability, soil erosion, vegetation on uplands and along streams, and the amount and content of runoff to ground or surface water:

1. Use of streambanks and uplands.
2. Livestock grazing and areas of concentrated livestock.

3. Irrigation water use and drainage.
4. Application and storage of crop nutrients and farm chemicals.

The following non-agricultural sources likely contribute to water quality issues in the Management Area: the city of Madras, urban and suburban developments, sewage treatment plants, municipal sludge spread on fields, off-road vehicles, railroad beds, hydroelectric dams on the Crooked and Deschutes rivers, activities on federal lands, and high concentrations of deer, elk, antelope, and feral swine. In addition, the Deschutes and Crooked rivers drain huge areas upstream of the Management Area; the Deschutes and Crooked rivers will show cumulative effects from upstream sources.

2.5 Regulatory and Voluntary Measures

Water quality is maintained or enhanced through a combination of landowner education and implementation of appropriate Management Measures. Management Measures include both voluntary management practices and regulatory requirements.

Voluntary efforts are the primary means to prevent and control agricultural sources of pollution. Local, state, and federal agencies and organizations provide information and technical and financial assistance. The Jefferson and Wasco County SWCDs are the main support agencies at the local level.

Regulations complement the voluntary strategies. ODA pursues enforcement to gain compliance with the requirements only when reasonable attempts at a voluntary solution have failed.

Landowners have flexibility in choosing management approaches and practices to address water quality issues on their lands. Landowners may choose to develop management systems to address problems on their own, or they may choose to develop a voluntary conservation plan to address applicable resource issues. Landowners may seek planning and financial assistance from any agency or a consultant.

To help achieve water quality standards in the Management Area, an effective strategy:
- Maintains adequate riparian vegetation,
- Minimizes streambank erosion,
- Minimizes runoff that contains potential pollutants.

2.5.1 Area Rules

In addition to the voluntary strategies, regulations (OAR 603-095-1600 through 603-095-1660) are included as an implementation strategy.

Landowners in the Middle Deschutes Management Area are required to manage:
- Riparian vegetation,
- Irrigation water diversions,
- Manure and other wastes,
- Sediment in irrigation tail water,
- Application of crop nutrients.

Healthy riparian systems are expected to withstand a 25-year flood with minimal damage. Structural conservation practices generally are designed to withstand different levels of storms or floods. For instance, terraces and waterways typically are designed for a 10-year, 24-hour storm, while drop structures, streambank protection, and larger dams are designed for at least a 25-year flood. Most agronomic practices can withstand a two to five-year flood event.

OAR 603-095-1640

(1) Landowners must comply with OAR 603-095-1640(2) through (6) within the following limitations:

(a) A landowner is responsible for only those conditions resulting from activities controlled by the landowner. A landowner is not responsible for conditions resulting from activities by landowners on other lands. A landowner is not responsible for conditions that: are natural, could not have been reasonably anticipated, or that result from unusual weather events or other exceptional circumstances.

Some regulations may become more specific over time, as additional information becomes available on land conditions and water quality.

Streamside Area: OAR 603-095-1640(2)

(a) By January 1, 2005, activities must allow the establishment and development of riparian vegetation, consistent with site capability, for streambank stability and stream shading.

(b) By January 1, 2005, activities must allow the establishment and development of vegetation or the presence of an equally effective erosion control device or practice for filtering out sediments before they enter perennial streams.

The streamside area requirements address stream temperature, sediment, nutrients, bacteria, and habitat modification. The LAC encourages ODA to 1) develop a map that reflects general vegetative site capability; and 2) determine targets for adequate vegetation to provide root mass for bank stability and herbaceous vegetation to reduce heat inputs to surface water. ODA will include this as part of their compliance evaluation process.

Streambanks are the usual boundaries of a stream channel and do not extend to the flood boundaries. Banks of *perennial* streams (streams that flow continuously and are named on a US Geological Survey quadrangle map) include the area up to the ordinary high-water mark (OAR 603-095-0010(32) and (46)).

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 is the highest ecological status (vegetation) an area can attain given political, social, or economic constraints. Common constraints include the presence of a bridge, water gap, building, or highway. Natural factors determining site capability include: channel morphology, climate, elevation, and soil parent material (Process for Assessing Proper Functioning Condition. Bureau of Land Management. TR 1737-9. 1995).

Rule (a) requires activities that prevent vegetation from developing to cease. Reasonable rates of recovery include 50 percent retention in annual vegetative growth within 15 to 25 feet of the stream. The rule does not specify any activities that must cease and does not require any particular activity to take place. Landowners are not responsible for wildlife browsing and grazing use.

Rule (b) requires activities that keep vegetation from developing or that inhibit the presence of an equally effective erosion control device to cease. This rule refers to the filtration of sediment caused by human activities, not sediment resulting from natural processes. This rule does not require that the vegetation be riparian; any type of vegetation other than noxious weeds, such as a grassed filter strip, may be used to filter out sediment. Different types of vegetated buffers (riparian, forest, grass, etc.) have different NRCS standards. Sufficient vegetation to filter out sediment also helps reduce the number of bacteria and

nutrients entering streams; nutrients can bind to sediments and can be carried into waterways in greater proportions than by water flow without sediments.

Instream Structures: OAR 603-095-1640(3)

(a) Effective on rule adoption, temporary irrigation diversions must:
  (A) Be constructed and operated only during periods of irrigation.
  (B) Not hinder channel carrying capacity between November 1 and March 1 to accommodate anticipated or expected seasonal streamflow.
  (C) Not increase instream turbidity during operation by more than 10%, compared to a point just upstream of the diversion.

(b) By January 1, 2007, temporary irrigation diversions must not contribute to channel instability.

This rule addresses stream temperature, sediment, and habitat modification.

Temporary irrigation diversions can reduce water quality and impede fish passage. This rule addresses water quality concerns related to temporary irrigation diversions of less than 50 cubic yards of fill. Larger diversions require Oregon Fill and Removal Permits and must be managed to minimize water quality impairments as provided by ORS 196.800 through 196.990. State law, as provided by ORS 498.351, requires that all artificial stream structures allow fish passage. The intention on Trout Creek (which has a year-round irrigation season) is that landowners breach their temporary diversions when no longer in use (and remove the fill or spread it so it isn't likely to erode), instead of allowing winter and spring floodwaters to blow through the dams. This reduces the possible damage from flooding. Additionally, instream structures in use during a winter irrigation season should allow sufficient carrying capacity to withstand expected, seasonal high flows. The '10 percent increase' is based on the current state water quality standard for turbidity.

The later date for channel instability will give landowners time to develop appropriate structural or agronomic alternatives. Also, instream work is only feasible during certain times of the year.

Waste Management: OAR 603-095-1640(4)

(a) Effective on rule adoption, no person subject to these rules shall violate any provision of ORS 468B.025 or ORS 468B.050.

This rule ensures that concentrated nutrient concentrations, pathogens associated with high animal density areas, high sediment concentrations in run-off, toxics, or other potential pollutants are not readily transported to waters of the state.

Wastes associated with livestock operations can include manure from seasonal feeding and birthing areas, gathering pastures and corrals, rangelands and pasture, and any other situations not already covered by Oregon's Confined Animal Feeding Operation laws. Potential indicators of noncompliance include 1) runoff flowing through areas of high livestock usage and entering waters of the state; 2) livestock waste located in drainage ditches or areas of flooding; and 3) fecal coliform counts that exceed state water quality standards. Livestock grazing is allowed to the extent it does not violate state water quality standards and complies with the regulations. Livestock facilities located near streams should employ an adequate runoff control and waste management system. Compliance with the streamside area rule will help keep wastes from being carried into waters of the state. Landowners can contact the NRCS and SWCD for assistance with complying with this rule.

Wastes also include excess sediment discharges. Landowners who, based on visible erosion scars and/or sediment-laden runoff, are discharging significant quantities of sediment, may be in violation of this rule.

Irrigation Tailwater: OAR 603-095-1640(5)

(a) Effective on rule adoption, irrigation tailwater must not increase the turbidity of the perennial stream into which it drains by more than 10%, compared to a point just upstream of the tailwater discharge.

This rule helps reduce sediment and nutrients entering perennial streams. It reflects current state water quality standards and applies both to irrigated lands watered directly from perennial streams and to lands served by the NUID. The NUID system is fairly complex (see NUID in Section 1). On lands served by the NUID, individual landowners are responsible for the water quality of return flows from their lands to both NUID and private drains. If a shared drain violates the above rule, each landowner contributing to that drain water is expected to take appropriate action to reduce turbidity. ODA will consider each individual's proportional contribution to the problem when deciding on actions to take. The Jefferson County SWCD assists landowners with plans for improved sediment control where necessary.

Nutrients: OAR 603-095-1640(6)

(a) Effective on rule adoption, nutrient application rates and timing must not exceed specific crop requirements. Crop nutrients will be based on recommendations from the best available data applicable to a specific site.

Fertilizers (both chemical and manure) can contribute nutrients to streams. By requiring that nutrients be applied at appropriate rates, the amounts of nitrates and phosphates that can enter streams will be reduced. Careful application of manure also reduces the amount of bacteria that could enter streams. Nutrients already present in the soil and irrigation water should be accounted for when calculating application rates.

2.5.2 Voluntary Measures

The following Recommended Management Practices address the objectives of the Area Plan and generally are accepted as effective, economical, practical, and they protect water quality. They are not required. Widespread adoption of these practices addresses the water quality parameters of concern in the Management Area. These practices should also maintain the economic viability of agriculture in the area. Appropriate management practices for individual farms and ranches may vary with the specific cropping, topographical, environmental, and economic conditions that exist at a given site. Because of these variables it is not possible to recommend uniform management practices for all farms or ranches in the Management Area.

The Natural Resources Conservation Service's *Field Office Technical Guide* contains extensive lists of management practices as well. NRCS offices are in The Dalles and Redmond. The Jefferson and Wasco County SWCDs, Cooperative Extension Agents, and Oregon Department of Fish and Wildlife biologists can also recommend practices.

Streamside Management:

Objectives: achieve adequate riparian vegetation, increase streambank stability, and filter out pollutants

- Minimize channelization,
- Stabilize streambanks without confining the channel over any significant length,
- Maintain vegetative buffer: CRP, Conservation Reserve Enhancement Program (CREP), riparian buffers, control weeds,
- Manage livestock (see below),
- Properly place, design, and maintain roads, culverts, bridges, and crossings.

Cropland Management:
Objectives: reduce soil erosion, reduce and capture runoff, reduce potential pollutants in runoff

- Use conservation tillage: reduced tillage, direct seeding, subsoiling, and chemical fallow,
- Plant annual and perennial cover crops,
- Farm on the contour: strip cropping, divided slopes, terraces, contour tillage,
- Select crops that hold soil in place and enhance a crop rotation,
- Seed early or double in critical areas,
- Create and maintain sediment basins and vegetative buffer strips: riparian buffers, filter strips, grassed waterways, field borders, contour buffer strips, and interception ditches,
- Control weeds.

Upland Management:
Objectives: reduce soil erosion, improve infiltration of water into soil, and capture runoff

- Manage livestock (see below),
- Encourage vegetation that provides good ground cover and enhances water capture. Practices include: prescribed burning, range plantings, juniper control, weed control,
- Use sediment retention basins,
- Roads: close seasonally; properly maintain, design, and place.

Livestock Management:
Objectives: reduce soil erosion, manage manure, and achieve adequate riparian vegetation

- Manage grazing: livestock distribution; grazing intensity, duration, frequency, and season,
- Improve riparian buffers,
- Install fencing: temporary, cross, exclosure,
- Control livestock watering through spring developments and off-stream water,
- Provide salt, minerals, and shade away from streams,
- Install adequate waste management systems: clean water diversions; waste collection, storage, and utilization; properly operate and maintain facilities,
- Control runoff from concentrated feeding areas and irrigated pastures.

Irrigation Management:
Objectives: reduce runoff, minimize potential pollutants, reduce soil erosion, improve fish habitat

- Schedule irrigation based on crop needs, soil type, climate, topography, and infiltration rates,
- Improve irrigation efficiency,
- Pipe or line mainline and delivery systems,
- Select, locate, maintain, and operate diversions to minimize effects on water quality; install fish screens. [Infiltration galleries have the potential to take more water out of streams during low flows than is taken via conventional methods. The LAC recommends that infiltration galleries be designed following the guidelines in the NRCS' *Infiltration Galleries of the Deschutes Basin*; June 1999.],
- Minimize return flows through the use of cover crops, straw mulch, and grass filter strips,
- Install backflow devices,
- Grade and slope property to retain runoff whenever possible.

Crop Nutrient and Farm Chemical Management:
Objectives: reduce potential for pollution, reduce runoff

- Develop nutrient budgets based on water and soil testing, tissue testing, plant needs,
- Apply appropriate amounts at proper times; dispose of containers properly,
- Potential spills: have a cleanup plan, store tanks away from streams, check the valves on delivery trucks,
- Manage tail water,

- Use Integrated Pest Management,
- Municipal sludge: keep on site and out of waters of the state. Preferably don't apply on agricultural lands at all.

Ditch Management:
Objectives: reduce erosion, filter out potential pollutants
- Manage vegetation: burning, chemical, clipping, and critical area planting,
- Stabilize banks (structural and bioengineering),
- Install outfall protection to reduce erosion at culverts,
- Pipe or line ditches,
- Construct offstream or headwater storage,
- Develop wetlands at end of line to filter and process drain water,
- Size ditches appropriately to handle maximum flows.

2.5.3 Area Rule Enforcement

In addition to the voluntary strategies, regulations (OAR 603-095-1600 through 603-095-1660) are included as an implementation strategy. The following regulations provide for resolution of complaints.

OAR 603-095-1660

(1) When the department receives notice of an apparent occurrence of agricultural pollution through a written complaint, its own observation, through notification by another agency, or by other means, the department may conduct an investigation. The department may, at its discretion, coordinate inspection activities with the appropriate Local Management Agency.

(2) Each notice of an alleged occurrence of agricultural pollution will be evaluated in accordance with the criteria in ORS 568.900 to 568.933 or any rules adopted thereunder to determine whether an investigation is warranted.

(3) Any person allegedly being damaged or otherwise adversely affected by agricultural pollution or alleging any violation of ORS 568.900 to 568.933 or any rules adopted thereunder may file a complaint with the department.

(4) The department will evaluate or investigate a complaint filed by a person under section OAR 603-095-1660(3) if the complaint is in writing, signed and dated by the complainant and indicates the location and description of:

(a) The waters of the state allegedly being damaged or impacted; and

(b) The property allegedly being managed under conditions violating criteria described in ORS 568.900 to 568.933 or any rules adopted thereunder.

(5) As used in section OAR 603-095-1660(4), "person" does not include any local, state or federal agency.

(6) Notwithstanding OAR 603-095-1660, the department may investigate at any time any complaint if the department determines that the violation alleged in the complaint may present an immediate threat to the public health or safety.

(7) If the department determines that a violation of ORS 568.900 to 568.933 or any rules adopted thereunder has occurred, the landowner may be subject to the enforcement procedures of the department outlined in OARs 603-090-0060 through 603-090-0120.

Chapter 3: Implementation Strategies

Goal

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

The LAC recognizes that certain water quality improvement projects may be prohibitively expensive for many landowners. In some cases, it is reasonable to expect that the expense may be disproportionate towards the overall benefits to water quality. In either case, the LAC recognizes that the landowner would be accountable for the improvement of water quality within the constraints of economic feasibility. The LAC expects that funding will be available from private and public sources to assist landowners with implementing projects.

To achieve the Area Plan goals, the following water quality related objectives are established:

1. Maintain Adequate Riparian Vegetation along Surface Waters
   Riparian vegetation consists of plants that depend on or tolerate the presence of water near the ground surface for at least part of the year.

   Adequate riparian vegetation helps:
   - Minimize streambank erosion by increasing the cohesiveness and structural strength of streambanks and by reducing flow velocities;[13,14,15]
   - Reduce increases in summer water temperature;[16,17]
   - Maintain late season flows by increasing the ability of the adjacent soils to store water during runoff seasons;[18,19,20]
   - Moderate winter stream temperatures through the inflows of relatively warmer groundwater from adjacent soils;[21]
   - Filter out and process excess nutrients, bacteria, and sediment in runoff that could pollute adjacent streams.[22,23,24,25]

   Adequate riparian vegetation should:
   - Include a variety of plant species and ages;
   - Include plants that have root masses capable of withstanding high stream flows;
   - Provide adequate cover to protect the streambank and dissipate energy during high flows;
   - Include sufficient ground cover to filter out excess sediment or nutrients in overland flows;
   - Provide shade, where allowed by site capability.

   Adequate vegetation includes:
   - Visible ongoing renewal of riparian vegetation, vigorous growth, and the maintenance of a majority of each year's new growth of woody vegetation (trees and shrubs).
   - Noxious weeds are undesirable as they generally provide less shade, filtering capacity, and stabilizing root mass than the plants they replace.
   - Native vegetation is preferred, where practical, due to its integral role within the ecosystem.
   - As riparian vegetation matures, stream channels are expected to narrow and deepen. These stream channels will have less water surface area exposed to solar radiation (thereby reducing heating rates during summer) and will be more connected to their floodplain. Better floodplain connectivity has the added benefit of increasing storm water storage and reducing storm water velocities. These streams will also meander more, which will reduce flow velocities and damage from flooding.

2. Minimize Streambank Erosion[26]
   Streambanks naturally change in form or location over time. Some bank instability usually occurs in undisturbed streams, and human activities can increase the speed and amount of streambank erosion. Adequate vegetation can significantly increase streambank stability.

   Bank stability can be an important indicator of watershed condition and can directly affect several beneficial uses. Unstable banks contribute to:
   - Sediment in the stream channel caused by slumps and surface erosion,
   - Fine sediment in the water,
   - Wider channels, which increases exposure of water to solar radiation,
   - Decreasing stream depth and alteration of fish habitat.

3. Minimize Runoff that Contains Potential Pollutants
   Potential pollution is reduced by having less runoff and fewer possible pollutants (sediment, nutrients, bacteria, toxics) in the runoff.

   Sediments can enter from overland flow or gullies on croplands, rangelands, farmsteads, and roads. Reduction in sediment 1) reduces nutrient concentrations in streams, since many nutrients, especially phosphorus, attach to soil particles; and 2) increases dissolved oxygen due to a reduction in sediment oxygen demand.[27,28]

In addition, this Area Plan will minimize agriculture's contribution to the following water quality concerns, while acknowledging that these parameters are present at some natural level:
- Sediment: keep soil on the land and out of streams (minimize soil erosion and amount of soil-laden runoff; maintain adequate riparian and upland vegetation);
- Nutrients: keep nutrients on site and out of streams and groundwater (apply at appropriate rates; minimize amount of nutrient-laden runoff and percolation to groundwater);
- Toxics: keep toxics, such as pesticides and municipal sludge on site and out of streams and groundwater (apply pesticides and municipal sludge at appropriate rates; prevent runoff);
- Temperature: maintain adequate riparian vegetation based on site capability and enhance channel morphology;
- Bacteria: keep livestock waste and municipal sludge on the land and out of streams;
- Dissolved oxygen: reduce agriculture's contribution to high temperatures, low flows, high nutrients, organic carbon and sediment;
- Habitat modification: maintain adequate riparian and upland vegetation; enhance channel morphology; minimize impacts of irrigation diversions;
- Flow modification: encourage efficient irrigation; improve the ability of uplands to capture, store, and beneficially release water.

The SWCD selected the highest priority watersheds for work based on the following criteria:
- Documented water quality concerns,
- A high percentage of agricultural land,
- Suspected water quality concerns,
- Waterways used by anadromous fish,
- A size that matches SWCD capacity to address resource issues in a reasonable time frame.

The highest priority watersheds were ranked from high to low:
1. Upper and Lower Trout Creek (documented high temperatures, 303(d) listing for biological criteria, anadromous fish).

2. Mud Springs (documented temperature and pesticide issues, concerns with bacteria and nutrients).
3. Rattlesnake Canyon (documented sediment and bacteria issues, concerns with bacteria and nutrients).
4. Campbell Creek (documented sediment, bacteria, pesticides, and nutrient issues).
5. Upper Willow Creek (concerns with temperature, bacteria, and nutrients).
6. Antelope Creek (concerns with bacteria and nutrients, bacteria, and temperature; anadromous).
7. Lower Willow Creek (concerns with nutrients).

Work is already being done in all of seven of these watersheds at some level. The priority rankings will be reviewed and updated during the 2024 Biennial Review.

3.1 Measurable Objectives and Strategic Initiatives

Measurable objectives allow the Ag Water Quality Program to evaluate progress toward meeting water quality standards and TMDL load allocations. Any measurable objectives are stated here. Progress is reported in Chapter 4.

3.1.1 Management Area

In 2016, the LAC requested that ODA complete an assessment to determine the percentage of lands that are likely in compliance with the streamside and waste rules. At the 2018 biennial review, ODA presented an assessment method to help the LAC develop measurable objectives based on the percentage of agricultural lands likely in compliance with the Riparian and Waste Rules. ODA presented the results at the 2020 Biennial Review. The assessment method and results are described below.

Ideally, vegetation along at least 90 percent of agricultural stream miles in the Management Area will support water quality functions as described earlier in this document. This may take some years to achieve due to management changes and landowner turnover.

3.1.1.1 Measurable Objectives

By 2032, 90% of perennial stream miles will likely be in compliance with the streamside area rule.
By 2032, 95% of acres evaluated along perennial streams will likely be in compliance with the Waste Rule (ODA did not evaluate agricultural lands within NUID boundary. See Assessment Method below).

*Landownership may change and tax lots may not stay in compliance with the Area Rules.

Assessment Method: Land Condition Assessment (LCA)
ODA completed a LCA of agricultural activities and potential concerns related to surface and ground water. The evaluation considered the condition of streamside vegetation, bare ground, and potential livestock impacts (including manure piles). The process involved both a remote evaluation and field verification from publicly accessible areas. Each tax lot was given a category listed below. Based on the numbers of tax lots of each category, ODA was able to determine the percentage of agricultural lands in compliance with the Streamside and Waste Rules. ODA evaluated only perennial streams due to the large workload involved in the LCA and the uncertainty of what site capable vegetation to expect on intermittent streams.

In addition, ODA did not evaluate agricultural lands within the NUID boundary for likely compliance with the Waste Rule. ODA did not have a process to evaluate irrigated agricultural lands within an irrigation district at that time. Determining likely compliance of flood-irrigated fields within an irrigation district using LCA methodology (remote imagery and public roads) is challenging, because it can be

difficult to determine the ultimate fate of runoff in a multiple-landowner system with reuse of field irrigation field runoff and use of sediment and pump back ponds.

Categories for evaluation include:

- **Limited Opportunity for Improvement:** ODA identified no likely regulatory concerns, but there may be an opportunity for improvement (uplift) to reach the ecological goals of the Area Plan,
- **Opportunity for Improvement:** ODA identified that agricultural activities may be impairing water quality, or evaluation was inconclusive using remote and field verifications,
- **Potential Violation:** ODA identified during the field evaluation that a potential violation of the Area Plan Rules exists.

Current Status:
Based off of 2019 LCA, 82% of evaluated perennial stream miles in the Management Area are likely in compliance with the Streamside Area Rule.
Based off of 2019 LCA, 99.98% of evaluated agricultural lands in the management area are likely in compliance with the Waste Rule (ODA did not evaluate agricultural lands within NUID boundary).

Table 3.1.1.1. Percentage of lands likely in compliance with streamside area and waste rules

Metric	% stream miles likely in compliance with Streamside Area Rule	% ag lands outside of NUID likely in compliance with the Waste Rule
MO	90%	95%
Amount evaluated	256 miles	207,690 acres (281 tax lots)
Current status	82% (209 miles)	99.98% (207,650 acres; 279 tax lots)

Associated Milestones for Riparian Rule:
By 2024, 84% of perennial stream miles will likely be in compliance with the streamside Area Rule.
By 2028, 86% of perennial stream miles will likely be in compliance with the streamside Area Rule.
By 2032, 88% of perennial stream miles will likely be in compliance with the streamside Area Rule.

Associated Milestones for Waste Rule:
Agricultural tax lots are already meeting the waste rule measurable objective. ODA, LAC, and local partners will work to keep and maintain 95% through 2032.

LCA will be completed every four years and results will be presented during each Biennial Review.

3.1.2 Focus Areas

Each Focus Area will be assessed before, during, and after the focused work to show progress towards meeting water quality and land condition objectives. The SWCD and LAC will work together to develop measurable objectives and milestones for each Focus Area. Each Focus Area may have a monitoring plan.

Mud Springs is the current Focus Area. The SWCD is selecting Campbell Creek and Rattlesnake Canyon as their next Focus Areas, to be started in 2021.

3.1.2.1 Mud Springs Creek Focus Area

The Mud Springs Creek Focus Area is part of ODA's Focus Area strategic initiative. Mud Springs Creek watershed is north and east of Madras. Mud Springs flows into Trout Creek about 2 miles above its confluence with the Deschutes River. About 75% of the watershed is privately owned; the rest is managed by the US Forest Service as a National Grassland The watershed is 95 square miles (75% range and 25% irrigated agriculture). Agriculture consists of beef cattle, hay, pasture, and seed crops. Sagebrush Creek is

the main tributary of Mud Springs Creek. The main stem of Mud Springs and Sagebrush creeks consist of 11.5 perennial stream miles and 3.5 subsurface miles. Another 207 miles of tributary streams are intermittent. There are also 41 miles of irrigation delivery ditches and canals in this sub watershed. Laterals 58-9 and 58-11 have been piped and provide pressurized irrigation water to patrons.

Assessment Method:
Jefferson County SWCD evaluated riparian conditions using three methods. One was the Streamside Vegetation Assessment (SVA) were streamside vegetation was evaluated to characterize features within 35 feet of the stream. The metric is the number of acres of different categories of land cover, interpreted from aerial photographs. Categories are: agricultural infrastructure; open water; and bare ground and vegetation at various heights (grass, shrub, and tree) designated as agricultural or natural.

Table 3.1.2.1a Mud Springs Riparian Condition Classification	
Class	**Description**
I	Provides functions. SVAP = 9-10. Ag activities (grazing) were discontinued, vegetation is filling in the stream corridor and the riparian vegetation is sufficient to provide water quality function.
II	Not yet providing functions. SVAP = 5-8.9. Ag activities are not hampering water quality functions of riparian vegetation; however the vegetation is not sufficient to protect water quality.
III	Functions impeded by agricultural activity. SVAP < 5.
IV	Functions impeded by non-agricultural activities, e.g. the railroad bermed and relocated the stream channel.
V	Legacy agricultural issues that are not likely to change in the immediate future, for instance where Mud Springs Creek was piped under a field at the upper end of the watershed in the 1940s and has since been farmed over.

Table 3.1.2.1b Mud Springs Irrigated Cropland Classification	
Class	**Description**
I	Agricultural activity likely causing discharge of E. coli and sediment delivery to Mud Springs or Sagebrush Creek.
II	Agricultural activity not likely to cause E. coli or sediment to enter into to Mud Springs or Sagebrush Creek.
III	Agricultural property has no potential for delivery of E. coli or sediment to Mud Springs or Sagebrush Creek.

The other classified vegetation based on its ability to provide water quality functions, using surveys that followed the NRCS Streamside Vegetation Assessment Protocol (SVAP) (Table 3). For the latter, the SWCD used the riparian area quantity, riparian area quality, and canopy cover metrics.

A third assessment is being completed in the Focus Area which evaluates all irrigated cropland, including those with seasonal or perennial streams or irrigation runoff, north of the Grasslands. The assessment is based on aerial photos, visual observations, proximity to stream, and knowledge of the farming practices on a particular property.

In addition, the SWCD used best professional judgement to evaluate properties for likelihood of contributing sediment or *E. coli* to Focus Area creeks (Table 4). Evaluations were based on 2006-2008 water quality monitoring, livestock presence, field verification, and aerial imagery.

The measurable objectives and milestones for the Mud Springs Focus Area SVAP are based on the reference site between the mouth of Mud Springs Creek and the first railroad crossing.

Measurable Objectives and Associated Milestones:

Measurable Objectives: By June 30, 2020

- Riparian Streamside Vegetation Assessment: Tree + Shrub + Grass = 183 acres or 72%
- SVAP (lower 6 miles): Class III = 0.5 miles or 3%
- Irrigated cropland classification Class III = 297 acres or 2%

3.1.3 Strategic Implementation Area

The ODA is in the process of completing an evaluation of agricultural management activities and landscape conditions with potential to contribute to or cause water pollution in the Campbell Creek Watershed in Jefferson County. The Campbell Creek watershed consists of approximately 15,000 acres north and west of Madras. For areas that are not yet in compliance with the Area Rules, concerns consist mostly of irrigation water use and drainage, application and storage of fertilizers and farm chemicals, unmanaged livestock access to streamside areas, and soil erosion. Documented water quality concerns within the SIA are for stream temperature, *E. coli*, sediment, and nutrients.

SIA Compliance Evaluation Method:
ODA completed a compliance evaluation of agricultural activities and potential concerns related to surface and ground water. The evaluation considered the condition of streamside vegetation, bare ground, and potential livestock impacts (including manure piles). The process involved both a remote evaluation and field verification from publicly accessible areas.

Categories for evaluation are:

- **Limited Opportunity for Improvement (L):** ODA identified that there are likely no regulatory concerns,
- **Low Opportunity for Improvement (LL):** ODA identified that there are likely no regulatory concerns, but there may be an opportunity for improvement (uplift) to reach the ecological goals of the Area Plan,
- **Opportunity for Improvement (OFI):** ODA identified that agricultural activities may be impairing water quality, or evaluation was inconclusive using remote and field verifications,
- **Potential Violation (PV):** ODA identified during the remote evaluation and verified during the field evaluation from a publicly accessible location, that a potential violation of the Area Plan Rules exists.

Measurable Objective:
By 2025, all tax lots identified as Opportunities for Improvement or Potential Violations will be downgraded to Low Opportunity for Improvement or Limited Opportunity for Improvements levels. ODA understands that landownership may change and tax lots may not stay in compliance with the Area Rules.

3.1.4 Pesticide Stewardship Partnerships

The Jefferson County SWCD is currently in the process of developing a Strategic Action Plan, which will include measurable objectives and milestones. These will be reported in the 2024 Biennial Review.

3.2 Proposed Activities

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

Table 3.2 Planned Activities for 2020-2023

Activity	4-year Target	Description
Community and Landowner Engagement		
# of active events that target landowner/managers (workshops, demonstrations, tours)	6	Conduct events for landowners directly related to the Area Plan and Rules.
# of landowners/managers participating in active events	375	Landowner attendance will be tracked to try to quantify the impact of the SWCD sponsored events.
Technical Assistance (TA)		
# of landowners/managers provided with TA (via phone/walk-in/email/site visit)	300	Landowners will receive one-on-one technical assistance.
# of on-site technical assistance visits	100	Site visits will be scheduled to develop project plans, fund applications, and provide technical assistance to landowners.
# of acres in project plans that were written	600	Acres in plans with conservation practices will be tracked.
On-the-ground Project Funding		
# funding applications submitted	16	Project plans implemented that support agricultural water quality improvement.
# of acres, or appropriate units of measure with conservation practices implemented	600	Acres or appropriate units of measure with conservation practices implemented will be tracked.
* Definition: any written management plan to address agricultural water quality. Can include NRCS-level plans. Can include: nutrients, soil health, grazing, riparian planting, forest thinning to improve upland pastures to reduce livestock pressure on riparian areas, etc. Cannot include projects with no or weak connection to agricultural water quality (weed eradication not for riparian restoration, fuels reduction, alternative energy, rain gardens/rain harvesting, non-agricultural culvert replacement, and instream habitat enhancement that does not also improve water quality)		

3.3 Water Quality and Land Condition Monitoring

3.3.1 Water Quality

Monitoring of water and land conditions in the Management Area is helping:

- Characterize baseline conditions,
- Track Area Plan implementation and compliance with the regulations,
- Evaluate Area Plan effectiveness (improvements in water quality and land conditions),
- Identify priority areas and annual and long-range strategies for Area Plan implementation.

The Middle Deschutes Watershed Council is in the process of developing a monitoring strategy for the entire watershed. Data will be sourced from local partners to identify data available. Watershed-specific questions will be posed to align with the Middle Deschutes Watershed Council goals and priorities for the current biennium and into the future.

In 2006-2008, the Jefferson County SWCD, ODA, Confederated Tribes of Warms Springs (CTWS), and others intensively monitored water quality in the Madras area.[31, 32, 33] Their analyses of irrigation delivery water, irrigation tailwater, streams, and ground water identified water quality issues, which resulted in prioritized conservation projects. Results demonstrate that nitrates are not a concern in irrigation surface runoff, but that sediment, phosphorus, and *E. coli* are concerns in the Campbell Creek and Mud Springs Creek drainages. While drains flowing directly over the bluff into the Deschutes River are occasionally high in phosphorus and *E. coli*, the volume of water entering the Deschutes River from these drains is very low. Therefore, the 'bluff drains' deliver inconsequential amounts of nutrients and bacteria to the Deschutes River.

The monitoring clearly shows higher nitrates (3 - 8 mg/L) in groundwater, with the highest values near Gateway. It is unclear at this time whether the high nitrates are due to historical or current agricultural practices. Determining the ages of groundwater throughout the study area will help answer this question; as will additional monitoring of nutrients in groundwater and analyses of groundwater flow patterns.

The following monitoring activities are planned or in progress:

A. Nitrates
   The SWCD and ODA would like to know more about the source of nitrates in the Management Area. In the future, the SWCD and ODA may seek researchers/partners to conduct a study to evaluate nitrates that will answer two questions: 1) what is the source of the nitrates, and 2) are they diminishing over time in ground and surface water.

B. Turbidity
   The SWCD has monitored turbidity since 2015 in the Mud Springs, Rattlesnake, and Campbell Creek drainages to measure sediment inputs from irrigation tail-water. Sediment in irrigation return flows to the Deschutes River has been a concern for many years and has resulted in the implementation of multiple sediment reduction and water conservation projects.

C. Temperature
   The Middle Deschutes Watershed Council volunteered to participate 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 was sporadic due to logistical issues and discontinued after 2020 due to COVID-related funding issues.

D. DEQ monitoring
   DEQ monitors two sites in the Management Area as part of their ambient monitoring network (Deschutes River @ Hwy 26 and Trout Creek below Mud Springs Creek). The site on the Deschutes is strongly influenced by the Pelton-Round Butte Dam complex, not by agriculture.

E. PSP Monitoring
   Since 2014, agricultural tributaries to the main stem of the Middle Deschutes River have been monitored for pesticide and nutrient loads that exceed the EPA's Aquatic Life Benchmarks as part of the PSP pilot project. During the irrigation season, water samples were collected at numerous locations throughout the Middle Deschutes watershed. From 2014 through the 2020 irrigation season, several pesticides have been detected that exceed the EPA's Aquatic Life Benchmark allowances causing concern for damage to aquatic life in the main stem of the Deschutes River. The pesticide concentrations of concern have predominantly been detected in drainages flowing off of the high agency plains flowing into the Middle Deschutes River as well as the sub-watershed of Trout Creek. In July of 2019, the JSWCD Board passed the motion to transfer the PSP Pilot Program to an established PSP Program which will entail a minimum of

two more years of water sampling. The JSWCD has not yet received the 2020 irrigation season's field sampling data.

F. Portland General Electric (PGE) and CTWS
In 2019, PGE and CTWS finalized a Water Quality Study for the Pelton Round Butte Project and the Lower Deschutes River (LDR). The Study communicated water quality monitoring and modeling data to identify the water quality status of tributaries, impoundments, and the LDR.

For a description of monitoring and evaluation results, see Chapter 4.

3.3.2 Land Conditions

North Agency Plains Conservation Implementation Strategy (CIS)
The North Agency Plains CIS was developed in 2013 after JSWCD, the CTWS, landowners, and stakeholders prioritized addressing resource concerns associated with irrigation runoff in the North Agency Plains portion of Jefferson County. Water quality monitoring in Rattlesnake Canyon has provided the JSWCD and NRCS with compelling data that identifies the benefit to water quality such a program can have. The North Agency Plains CIS has been implemented for over five years and has contributed to agriculture's successful improvement to agricultural water quality entering the Deschutes River. The goal of the CIS was to:

1) Improve irrigation water efficiency on croplands northwest of Madras
2) Reduce irrigation tailwater runoff to the Deschutes River below Pelton Dam

For a description of monitoring and evaluation results, see Chapter 4.

Chapter 4: Progress and Adaptive Management

4.1 Measurable Objectives and Strategic Initiatives

The following tables provide the assessment results and progress toward measurable objectives and milestones in the last four years. See Chapter 3.1 for background and assessment methods.

4.1.1 Management Area

Table 4.1.1 Management Area Results

Measurable Objective #1
By 2032, 90% of perennial stream miles will likely be in compliance with the streamside Area Rule.
Milestones
By 2024, 84% of perennial stream miles will likely be in compliance with the streamside Area Rule. By 2028, 86% of perennial stream miles will likely be in compliance with the streamside Area Rule. By 2032, 88% of perennial stream miles will likely be in compliance with the streamside Area Rule.
Current Conditions
Progress Toward Measurable Objectives and Milestones To be reported during 2024 Biennial Review.
Assessment Results 82% of evaluated perennial stream miles in the Management Area are likely in compliance with the Streamside Area Rule.
Activities and Accomplishments
To be reported during 2024 Biennial Review.
Adaptive Management Discussion
TBD

Measurable Objective #2
By 2032, 95% of evaluated tax lots are likely in compliance with the Waste Rule (outside of NUID).
Milestones
Agricultural tax lots are already meeting the waste rule measurable objective. ODA, LAC, and local partners will work to keep and maintain 95% through 2031.
Current Conditions
Progress Toward Measurable Objectives and Milestones To be reported during 2024 Biennial Review.
Assessment Results 99.98% of evaluated agricultural lands in the management area are likely in compliance with the Waste Rule (ODA did not evaluate agricultural lands within NUID boundary).
Activities and Accomplishments
To be reported during 2024 Biennial Review.
Adaptive Management Discussion
TBD

4.1.2 Focus Areas

Table 4.1.2.1 Mud Springs Focus Area

Measurable Objectives: Streamside Vegetation Assessment					
By June 30, 2020, Riparian Streamside Vegetation Assessment: Tree + Shrub + Grass = 183 acres or 72% By June 30, 2020, Riparian classification (lower 6 miles): Class III = 0.5 miles or 3% By June 30, 2020, Irrigated cropland classification Class III = 200 acres or 1.3%					
Current Conditions					
Progress Toward Measurable Objectives and Milestones Projects completed in the FAAP were related to irrigation efficiency and on farm practices and did not have an effect on the SVA classes.					
	Assessment Method	Percent of ag lands in each category by year			
		2015	2017	2019	2020
	SVA: Tree+Shrub+Grass acres)	72	72	72	72
	SVAP: class III stream miles	5	3	3	3
	Irrigated Cropland: Class III (acres)	7	3	2	1.3
Activities and Accomplishments			**2015-2017**		**2017-2019**
Community and Landowner Engagement					
# active events that target landowners/ operators			**3**		**1**
# landowners/operators participating in active events			**51**		**20**
Technical Assistance (TA)					
# landowners/operators provided with TA			**66**		**40**
# site visits			**25**		**22**
# conservation plans written			**6**		**6**
Ag Water Quality Practices Implemented in the Focus Area					
Piping – 58-11 Irrigation Pipeline - 430			**6**		**3**
Piping – 58-11 Irrigation Canal - 320			**6**		**2**
Pumping Plant-Three fold farms flood to sprinkler - 533			**-**		**1**
Comments:					
Adaptive Management Discussion					
None					

4.1.3 Strategic Implementation Area(s)

Table 4.1.3 Strategic Implementation Area(s)

Measurable Objective (ODA)
By 2025, all tax lots identified as Opportunities for Improvement or Potential Violations will be downgraded to Low Opportunity for Improvement or Limited Opportunity for Improvements levels. ODA understands that landownership may change and tax lots may not stay in compliance with the Area Rules.
Local Partner Objectives
TBD
Current Conditions
Compliance Evaluation Results: TBD
Compliance Actions: TBD
Activities and Accomplishments
TBD
Adaptive Management Discussion
TBD

4.1.4 Pesticide Stewardship Partnership

The Jefferson County SWCD is currently in the process of developing a Strategic Action Plan which will include measurable objectives and milestones. These will be reported in the 2024 Biennial Review.

4.2 Activities and Accomplishments

ODA, the LAC, the LMA, and other partners identified the following priority activities to track progress toward meeting the goal and objectives of the Area Plan. ODA will review the four-year results and then provide a report at the end of the 2021-2023 Biennium.

Future Area Plans will compare results and targets in Table 4.2a.

Table 4.2a Activities conducted in 2015-2019 by Jefferson County SWCD and Middle Deschutes Watershed Council.

Activity	4-year results	Description
Community and Landowner Engagement		
# active events that target landowners/ managers (workshops, demonstrations, tours)	10	4 Annual Meeting Presentations at the Jefferson County Farm Fair(s); 2 Presentations of Annual Report; Landowner meeting on Agency Plains to discuss water quality and irrigation efficiency projects; a tour with the Hay Grower's Association and MDWC in Jefferson County; Irrigation Tour with OSU in Jefferson County
# landowners/managers participating in active events	542	Total in attendance of above events, tours, etc.
Technical Assistance (TA)		
# landowners/managers provided with TA (via phone/walk-in/email/site visit	254	Many inquiries (via phone, walk-ins and email) to discuss potential projects, water quality issues and various other resource concerns
# site visits	57	Numerous site visits discussing current and potential projects including juniper removal, irrigation efficiency pipelines, fencing (cattle exclusion), drip irrigation, large pond cleaning/water reuse, sediment control and riparian restoration
# conservation plans written*	5	
On-the-ground Project Funding		
# funding applications submitted	24	Applications included irrigation efficiency projects, juniper removal, CREP (including cattle exclusion and riparian restoration) and various small grant project applications
# funding applications awarded	21	Including all of the above project types
* Definition: any written management plan to address agricultural water quality. Can include NRCS-level plans or simpler plans. Can include: nutrients, soil health, water quality, irrigation, grazing, riparian planting, forest thinning to improve upland pastures to reduce livestock pressure on riparian areas, etc. Cannot include projects with no or weak connection to ag water quality (weed eradication that is not for riparian restoration, fuels reduction, alternative energy, non-ag rain gardens/rain harvesting, non-ag culvert replacement, and instream habitat enhancement that does not also improve water quality)		

Table 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.

Table 4.2b Implementation funding (cash and in-kind) for projects on agricultural lands reported 1997-2018 (OWRI data include most, but not all projects, implemented in the Management Area).

Landowners	OWEB	DEQ	NRCS	PGE	BOR	BPA	All other sources*	TOTAL
$906,822	$2,971,505	$0	$327,590	$2,709,973	$2,413,817	$880,123	$2,451,944	**$12,661,744**

*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 1997-2018 (OWRI data include most, but not all projects, implemented in the Management Area).

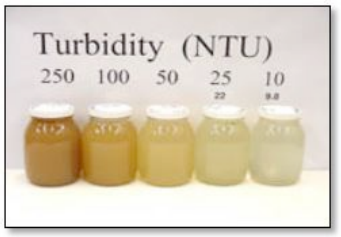
Activity Type	Miles	Acres	Count*	Activity Description
Riparian	94	286	-	
Fish Passage	404	-	15	
Instream Habitat	36	-	-	
Instream Flow	68		27 cfs	Note on CFS: the number of miles is the number of stream miles with some kind of enhanced flow; the number of cfs is the number of cfs increased anywhere within those miles.
Wetland	-	2	-	
Road	0	-	1	
Upland	-	20,519	-	
TOTAL	601	20,807	16	

* # of hardened crossings, culverts, etc.

4.3 Water Quality and Land Condition Monitoring

4.3.1. Water Quality

A. SWCD-collected Turbidity



Turbidity is often used as a surrogate for suspended sediment due to the ease and cost of measurement. A value of <25-30 Nephelometric Turbidity Units (NTUs) is generally considered beneficial for fish. OWEB has a general guideline of 50 NTUs. The SWCD measured turbidity at five sites from January through October in 2015-2017 and added a sixth location in 2018. The SWCD has the following questions: 1) How does turbidity change as landowners improve irrigation and farming practices to reduce sediment laden tailwater runoff? 2) Where and when are sediment inputs most prevalent in the creeks? The data collected seem to correspond with conservation practices implemented in each watershed. Sediment inputs are most prevalent in each of the watersheds during April – June and correspond with the start of the irrigation season.

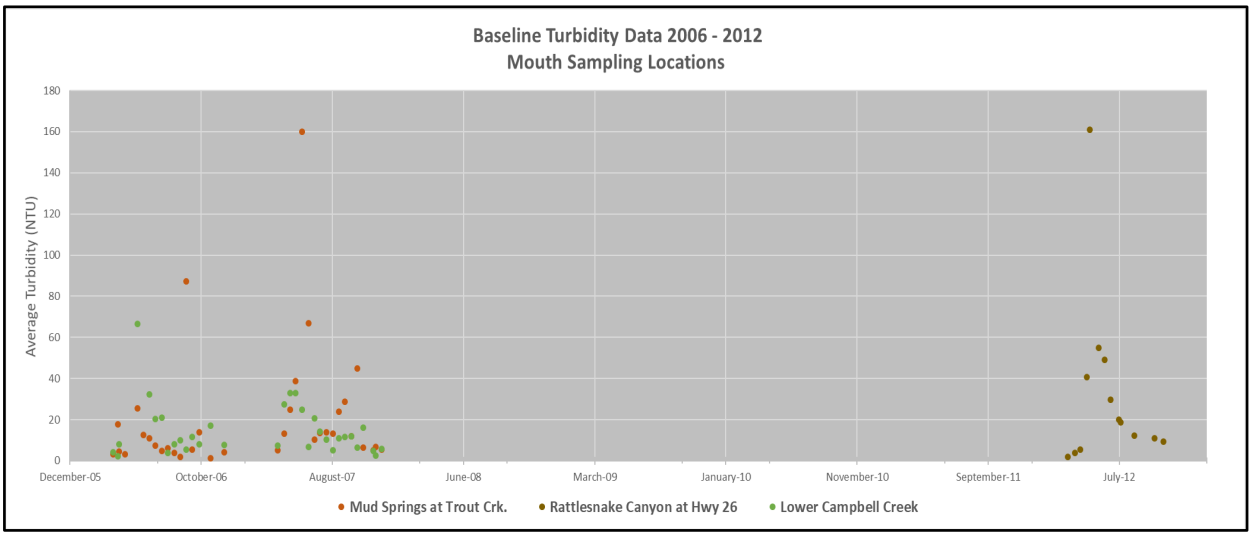
Mud Springs Creek: Turbidity values have improved since 2006 and 2007. Turbidity peaks in the spring (50 NTU in 2019) and then gradually decreases as the irrigation season progresses.

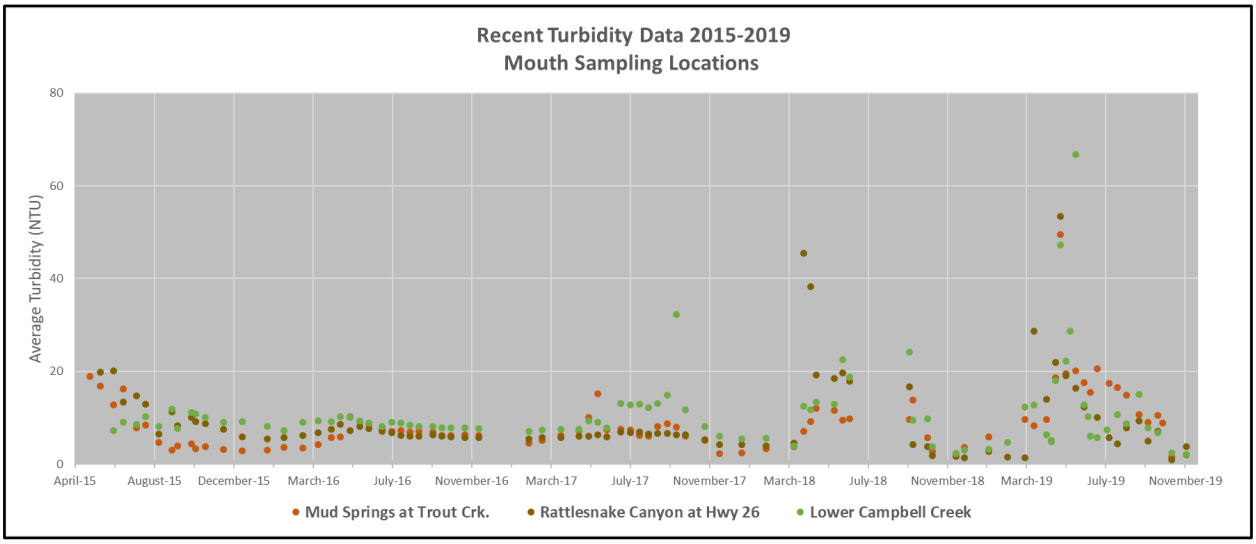
Rattlesnake Canyon: Values have also improved since 2012. Again, turbidity peaks in the spring (53 NTU in 2019) and decreases for the remainder of the year. An NRCS Outcomes Report developed by the SWCD, found that 22% of the 23 samples collected in 2012 exceeded the OWEB threshold (50 NTU) for over a month. This compares to just 13% of the 31 samples

recorded above the threshold in 2019. Both datasets were for the upper and lower sampling locations in Rattlesnake Canyon.

Campbell Creek: Turbidity values have remained relatively unchanged when compared to 2006. Turbidity peaks in the spring (67 NTU in 2019) and then decreases.

Baseline data for both Mud Springs (2006/2007) and Rattlesnake (2012) watersheds peaked in the spring around 160 NTU and remained relatively high (50-67 NTU) for weeks. Since then, both watersheds have received considerable investment to improve on-farm irrigation water management which has appeared to correspond well with an improvement in agricultural water quality. The Campbell Creek watershed has recently been included in the Agency Plains NRCS CIS. Progress will continue to be tracked in that watershed.





There exist obvious discrepancies regarding turbidity values between what has been reported since the last update of this document. Data collected between 2015 – 2017 seemed to describe relatively low values and uniform results. This data suggests no improvement in water quality and an increasing trend in turbidity when compared to data collected more recently. However, given

the apparent limitations with grab sampling, the timing of data collection, and the natural variability in measuring environmental conditions, the confidence in the 2015 – 2017 data is low. Sampling frequency and timing appear to be important factors influencing how turbidity can indicate water quality for each of the watersheds. Future efforts should consider timing and frequency of sampling events to adequately measure events that cause peak turbidity conditions (i.e. precipitation events, start of the irrigation season, etc.).

B. DEQ

DEQ analyzed data for dissolved oxygen, *E. coli*, pH, total phosphorus, temperature, and total suspended solids in the Management Area. (DEQ. 2019 Oregon Water Quality Status and Trends Report. Available at https://www.oregon.gov/deq/wq/programs/Pages/wqstatustrends.aspx).

Two sites (Deschutes River @ Hwy 26 and Trout Creek below Mud Springs Creek) are part of DEQs ambient monitoring network, where grab samples have been collected every two months since 2012. The site on the Deschutes is strongly influenced by the Pelton-Round Butte Dam complex, not by agriculture. Trout Creek below Mud Springs Creek is likely influenced by agriculture. During the summer, Mud Springs contributes almost the entire flow of Trout Creek at the second sampling site because Trout Creek is almost completely dewatered by upstream irrigation. Trout Creek drains mostly forest, rangeland, and streamside irrigated pastures; Mud Springs drains primarily irrigated row crops and pasture.

The Status and Trends Report provided status of a few additional locations in the Management Area.

Table 4.3.1 Attainment of water quality standards for 2015-2018

Parameter	Monitoring Locations	
	Trout Creek below Mud Springs	**Other locations**
Dissolved oxygen	Attains	Two upstream locations in Trout Creek also attained the standard for grab samples.
E. coli	Not Attaining. However, most samples (19/22) attain, and the average concentration is around half the standard for grab samples.	No recent data for other locations
pH	Not Attaining. Most values met the standard but were close to the upper limit of 8.5.	Two locations upstream on Trout Creek attained the standard.
Total phosphorus[1]	Values generally between 0.10 and 0.15 mg/L, exceeding ODA benchmark of 0.08 mg/L.	
Temperature	No data.	Temperatures mostly attained the standard in the headwaters of Trout Creek.
TSS[2]	Values generally < 25 mg/L.	

[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 TSS in this Management Area

According to these data, dissolved oxygen and *E. coli* are likely not concerns in Trout Creek. Trout Creek below Mud Springs Creek has total phosphorus concerns. Two likely sources of phosphorous are from agricultural runoff from the Mud Springs drainage and/or that Central Oregon volcanic soils are naturally high in phosphorus. Central Oregon volcanic soils may also contribute to a higher pH in local waters.

C. PSP Monitoring

The 2017 PSP pesticide sampling results have raised the level of concern above that indicated for 2014 results. At most sampling locations, multiple pesticides were detected thus raising concern regarding potential synergistic effects from multiple pesticides at low/medium concentrations present at the same time:

- Seventeen pesticides were detected at the mouth of Campbell Creek;
- Fourteen pesticides were detected at the Campbell Creek Hwy 26 site;
- Seven pesticides were detected at the Mud Springs (Gateway) location;
- Three pesticides were detected at the Culver Drain location;
- One pesticide detection occurred at the Trout Creek site;
- The overall detection frequency across sites exceeded 50% from several pesticides including, diuron, linuron, ampa, metribuzin and prometryn;
- The presence of dacthal at both of the Campbell Creek locations is of concern due to the potential for groundwater contamination from one of its degradates;
- EPA benchmarks were exceeded on several occasions, for both Dimethoate and Linuron in Campbell Creek;
- Detections of numerous pesticides including Diuron, Metribuzin, Prometry Dimethenamid, Oxyfluorfen were between 50 and 100 percent of the lowest benchmark; the rest of the pesticides were all less than 50 percent of the lowest EPA benchmark concentration.

The most recent report will not be available until January 2021; it is hoped to be available in time for Farm Fair. Latest results and progress of the full PSP will be discussed at the 2022 Biennial Review and updated in the Area Plan in 2024.

D. PGE and CTWS Water Quality Study

The study found:

-Concentrations of nitrate in the Crooked River were elevated and provide over 86% of the nitrate input to Lake Billy Chinook.

-The Lower Deschutes River has high concentrations of nitrogen and phosphorus.

-Nitrate concentrations show a substantial decline from the Re-Regulating Dam to the mouth of the Deschutes River, indicating considerable net uptake of nitrogen.

4.3.2 Land Conditions

Agency Plains CIS

The water quality data collected in 2012 captured poor water quality entering the Deschutes River over a sustained period of time during the spring when the irrigation season began. Turbidity values regularly exceeded the OWEB threshold of 50 NTU for over a month and then gradually decreased. Approximately 22% of the 23 samples recorded that year were above the threshold. Water quality data collected in 2019 shows a significant reduction in sediment being transported to surface water. Again, the poorest water quality at the bottom of the canyon was observed during the spring and corresponded with the start of the irrigation season. The impact snow melt had on water quality at the bottom of the drainage was insignificant even though values at the top of the canyon reached 188 NTU. The amount of flow associated with this event is unknown, yet determined to be inconsequential compared to the flow at the bottom based on turbidity records. The peak event witnessed in the spring of 2019 was only 3 NTUs above the threshold and was sustained for little over a week before decreasing.

Approximately 13% of the 31 samples recorded were above the threshold. The conversion of 700 acres (14%) under furrow irrigation corresponds with the improvement to water quality data collected in 2012 and 2019 in the Rattlesnake Sub-Watershed. This data provides an indication that the tailwater concern has been reduced. The water quality problem has not been resolved entirely, however, real progress has

been made to improve agriculture's use of water resources and reduce the amount of irrigation tailwater runoff entering the Deschutes River. Factors worth investigating further include how precipitation events might exacerbate sediment loading, the importance of reuse and retention ponds, and how soil cover may armor the soil surface in the non-irrigation season to prevent field and ditch erosion during the spring.

4.4 Biennial Reviews and Adaptive Management

ODA, the LAC, the LMA, and other partners met on November 18, 2020 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

Summary of Progress and Impediments
• Provide more communication to LAC members and hold shorter meetings • Continue to have interim LAC meetings • Climate conditions in the MA have impacted how agricultural producers implement ag water quality related projects
Recommended Modifications and Adaptive Management
• The Area Plan was modified to include new drinking water section and management area-wide measurable objectives. Updates were provided for Focus Area, SIAs, and most recent water quality data

Table 4.4b Number of compliance actions in 2018-2020

Actions	Letter of Compliance	Pre-Enforcement Notification	Notice of Noncompliance	Civil Penalty
Compliance Actions	1	1	0	0

SOURCES OF FOOTNOTED CITATIONS

[1] The Ecological Provinces of Oregon. E. William Anderson, Michael M. Borman, and William C. Krueger. Oregon Agricultural Experiment Station. May 1998.

[2] Oregon Climate Data (Oregon State University). www.ocs.orst.edu/ocs_data.htm.

[3] Soil Survey of Upper Deschutes River Area, Oregon, including parts of Deschutes, Jefferson, and Klamath Counties. USDA Natural Resources Conservation Service. 2020.

[4] Trout Creek Watershed Resource Inventory, Problem Assessment, and Treatment Alternatives. Edited by NRCS and sponsored by the Jefferson County Soil and Water Conservation District. December 1996.

[5] Eddleman, L. Some ecological attributes of western juniper. Special Report. Oregon State University Agricultural Experiment Station, Corvallis, OR. Pages 32-34. 1983.

[6] Miller, R.F. and J.A. Rose. Historic expansion of *Juniperus occidentalis* (western juniper) in southeastern Oregon. Great Basin Naturalist 55:37-45. 1994.

[7] Lacey, J.R., C.B. Marlow, and J.R. Lane. Influence of spotted knapweed (*Centaurea maculos*a) on surface runoff and sediment yield. Weed Technology 3:627-631. 1989.

[8] DRAFT Willow Creek Analysis. Edited by the Jefferson County Soil and Water Conservation District and the Willow Creek Watershed Council, with assistance from the NRCS. Final version anticipated June 2001.

[9] Mike Britton, Manager of North Unit Irrigation District and LAC member.

[10] Upper Deschutes River Basin Water Conservation Study. Special Report. US Bureau of Reclamation and Oregon Water Resources Department. April 1997.

[11] Tom Nelson, Oregon Department of Fish and Wildlife, fisheries biologist.

[12] Oregon's 2012 Integrated Report and Section 303(d) List of Water Quality Limited Waterbodies. Oregon Department of Environmental Quality, November 2020.

[13] Green, T.R., S.G. Beavis, C.R. Dietrich, and A.J. Jakeman. Relating stream-bank erosion to in-stream transport of suspended sediment. Hydrological Processes 13:777-787. 1999.

[14] Selby, M.J. Hillslope materials and processes. Oxford University Press, Oxford. 1982.

[15] Abernathy, B., and I.D. Rutherford. Where along a river's length will vegetation most effectively stabilize stream banks? Geomorphology 23:55-75. 1998.

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