OREGON DEPARTMENT OF AGRICULTURE

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Upper Deschutes Agricultural Water Quality Management Area Plan

September 2020

Developed by the

Oregon Department of Agriculture

and the

Upper Deschutes Local Advisory Committee

with support from the

Deschutes Soil and Water Conservation District

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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

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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 towards achieving the goal of the Area Plan and summarizes results of water quality and land condition monitoring.

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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 603-095-3000). 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

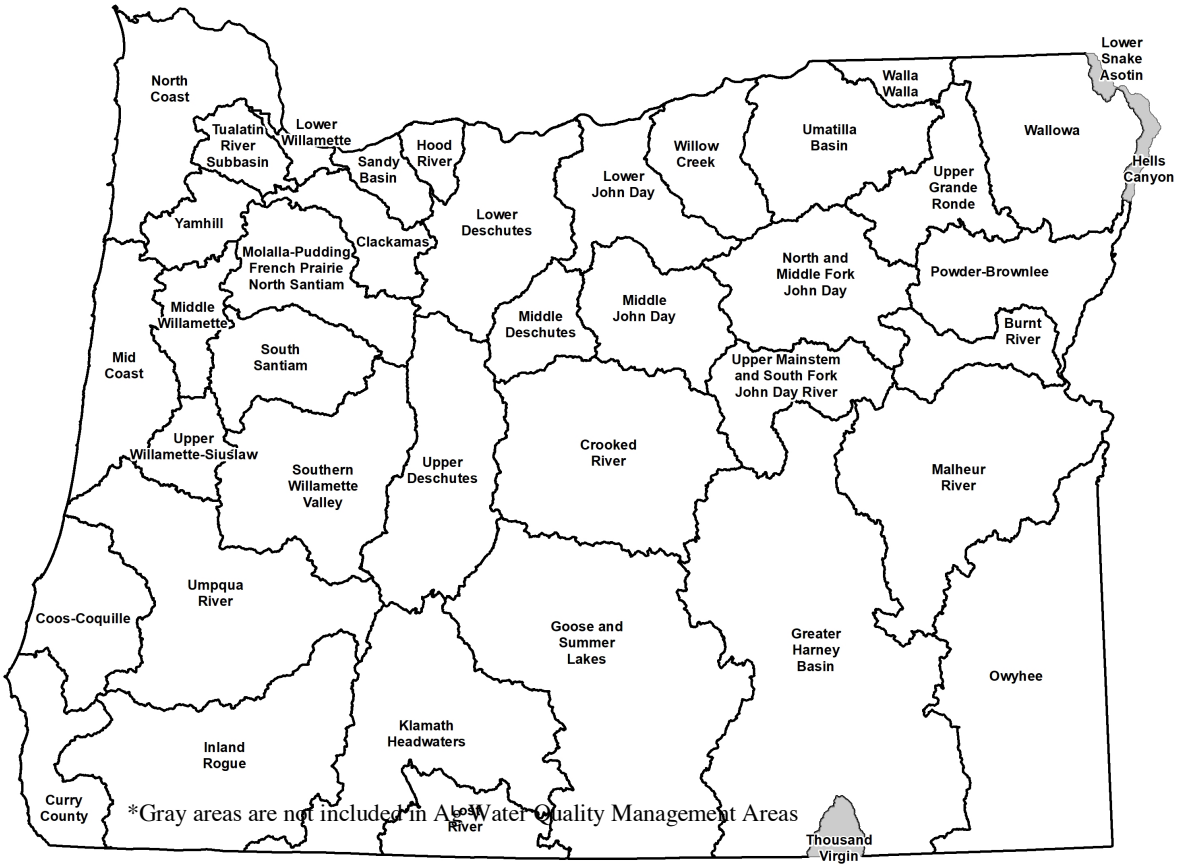
In 1993, the Oregon Legislature passed the Agricultural Water Quality Management Act directing ODA to develop plans to prevent and control water pollution from agricultural activities and soil erosion and to achieve water quality standards (ORS 568.900 through ORS 568.933). The Oregon Legislature passed 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*



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

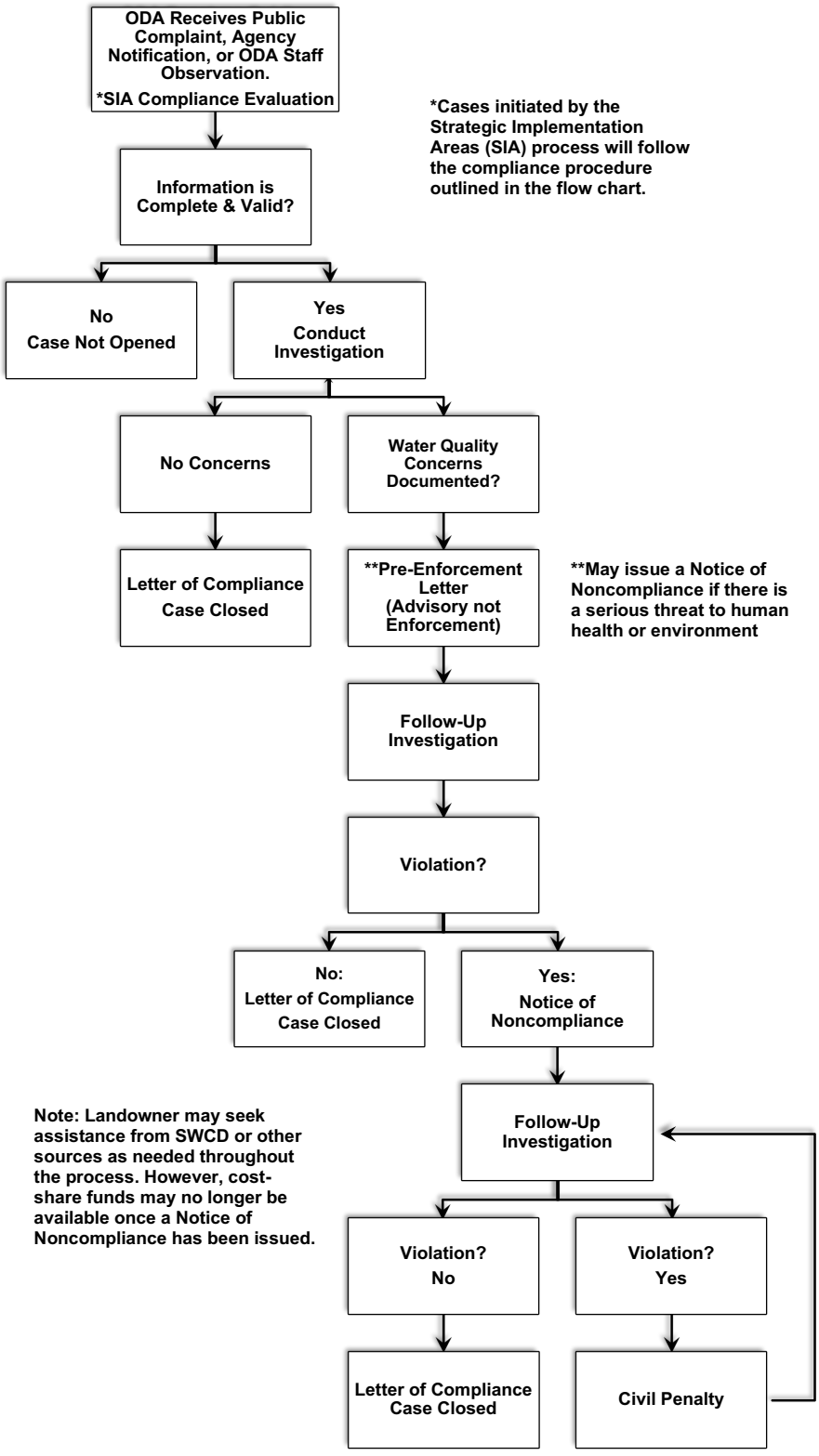
Plan or Area Rules, ODA will consult with the appropriate agencies to resolve the conflict in a reasonable manner.

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 a 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 canarygrass, grow in streamside areas. This type of vegetation has established throughout much of

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

1.4.6 Soil Health and Agricultural Water Quality

An increasingly important concept in Oregon and across the United States is soil health. The Ag Water Quality Program promotes soil health to reduce erosion and keep sediment out of surface waters, thereby helping to maintain and improve water quality. Healthy soils have relatively high organic matter and well-formed soil structure. These characteristics may resist erosion and increase water infiltration, leading to less surface runoff and greater groundwater recharge; the resultant groundwater flows in some cases can help moderate stream water temperatures. 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.

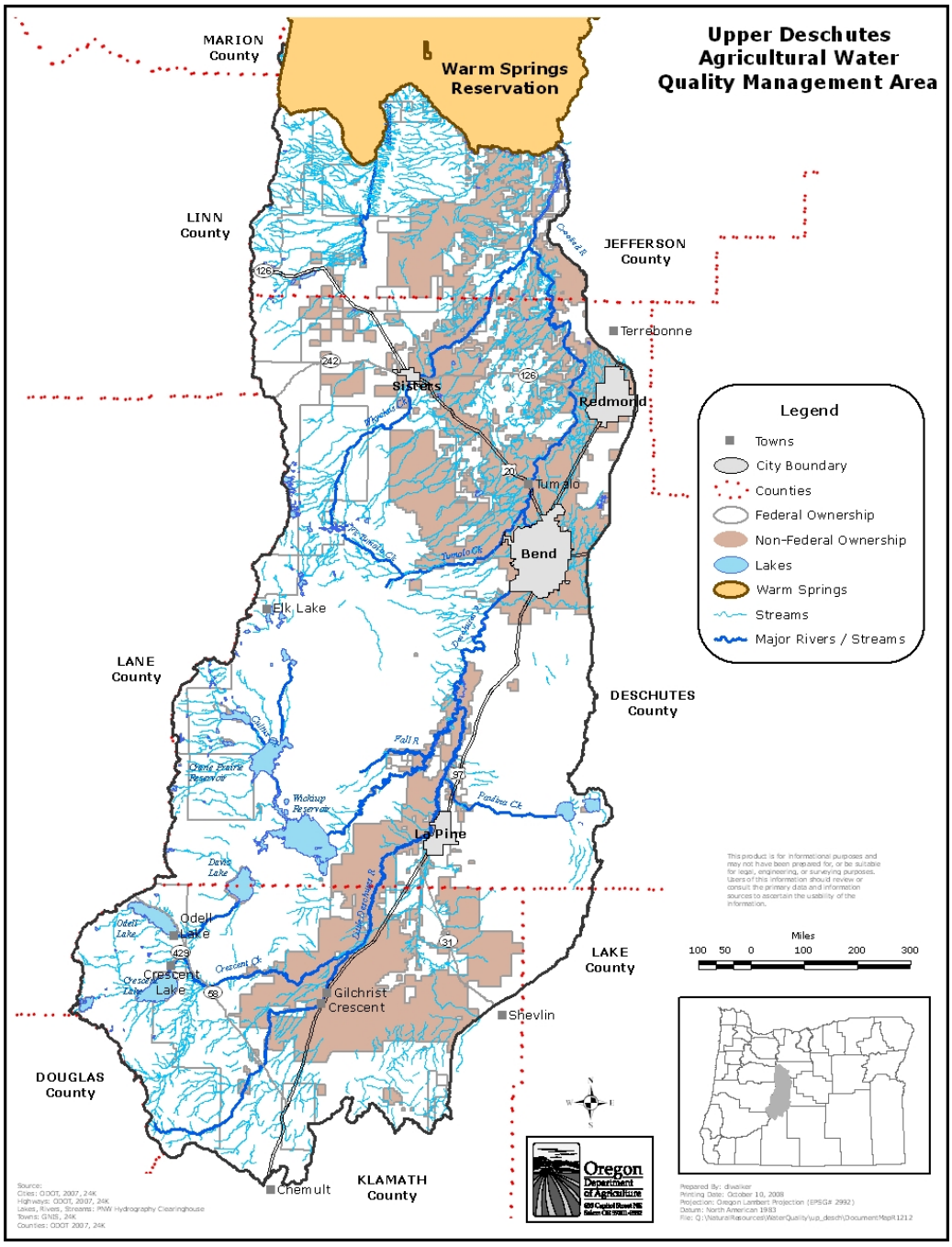
As part of monitoring water quality status and trends, DEQ regularly collects water samples every other month throughout the year at over 130 sites on more than 50 rivers and streams across the state. Sites are located across the major land uses (forestry, agriculture, rural residential, and urban/suburban). 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 encompasses approximately 3,200 square miles in Central Oregon, consisting of the Upper and Little Deschutes subbasins, as defined by the state of Oregon. Additionally, it includes lands in the Crooked River drainage south of the Crooked River and west of the range line between R12E and R13E in T14S WM to include the entire Crooked River Ranch subdivision. It is bounded to the west by the crest of the Cascades, to the south by the Klamath drainage, to the east by the Crooked River drainage, and to the north by the Reservation of the Confederated Tribes of the Warm Springs and by the Middle Deschutes Agricultural Water Quality Management Area.



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
Marc Thalacker (Chair)	Sisters	Three Sisters Irrigation District, Irrigated Farm
Rex Barber (Vice-Chair)	Lower Bridge	Irrigated Farm
Todd Cleveland	Deschutes County	Deschutes County Community Development Department
Colin Willis	Bend	Arnold Irrigation District
Kris Knight	Upper Deschutes	Watershed Council Coordinator
Ed Keith	Upper Deschutes	Noxious Weed Specialist
Bill Grafton		Irrigated Farm and Livestock
Leslie Clark	Deschutes County	Central Oregon Irrigation District
Andrew Anderson		Cannabis Producer, Deschutes County Farm Bureau

2.1.2 Local Management Agency

Implementation of the Area Plan is accomplished through an Intergovernmental Grant Agreement between ODA and the Deschutes 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.

2.2 Area Plan and Area Rules: Development and History

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

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

2.3 Geographical and Physical Setting

The Management Area consists of the drainage of the Deschutes River and all its tributaries upstream of and inclusive of the Metolius River, and a fraction of the Crooked River. Major tributaries include the Metolius River, Whychus Creek, Tumalo Creek, and the Little Deschutes River and its tributaries.

The pristine nature of the area has been recognized through federal and state designations of numerous wilderness areas and the establishment of wild, scenic, and recreational river stretches on the Deschutes River, Little Deschutes River, Crescent Creek, and Whychus Creek. Several stretches of the Deschutes River around Bend have been designated Oregon Scenic Waterways.

Additionally, the Management Area includes the communities of Crooked River Ranch, Sisters, Redmond, Bend, La Pine, and Crescent. The Management Area includes half of Deschutes County and portions of Jefferson, Klamath, and Lake counties.

Approximately one-third of the land is state- or privately-owned. The remaining lands are federally owned and mostly managed by the U.S. Forest Service.

2.3.1 Climate

The Management Area is characterized by moderate days and cool nights. Typical summers are dry and hot; winters tend to be relatively dry and cold. Most precipitation falls in the winter. Precipitation decreases from 70 inches in the forest of the Cascade Mountains to about 8 inches in the Redmond area. From north to south in the watershed there is a gradual decrease in temperature, increase moisture and increase in elevation.

Rain or snow events above 3,500 feet can cause very high peak flows in the streams and rivers, resulting in severe erosion[1]. The likelihood of flooding increases when warm "Chinook winds" arrive in the spring. Rapid snowmelt can result from these warm, southwest winds and, when accompanied by rainfall, flooding can become severe.

2.3.2 Geology and Soils

The Management Area consists primarily of a long, wide plain ranging in elevation from 2,700 feet at the confluence of the Crooked and Deschutes rivers in the north to 4,300 feet in the south. Volcanic peaks on the western boundary exceed 10,000 feet.

The geology is complex due to several periods of volcanism, faulting, and erosion dating back at least 40 million years[1]. More than 500 large volcanoes, cinder cones, or volcanic vents have been identified in Deschutes County alone. The four major periods of mountain building and river moving activities have been interspersed with periods of erosion and sedimentation associated with glaciation and stream runoff. The general permeability of volcanic rock allows rain and melting snow to trickle into the ground to the water table where underlying sediments play a primary role in natural spring occurrence. Groundwater flowing through adjacent volcanic rocks is forced to the surface due to much older and complex geologic structures of low permeability, creating springs.

Soils in the Upper Deschutes watershed are largely from volcanic materials, including volcanic ash, pumice and cinders[1]. Most of the soils are uniform over large areas and cover buried soils formed of hard basalt and andesite, tuff, breccia, glacial till, and outwash gravel. Because of the relatively recent volcanic activity, soils have not had time to develop and mature[2]. In many areas of the basin, the soil horizon is only a few feet to a few inches thick leaving much of the basalt flows, pumice fragments, and cinders exposed at the surface.

Soils in the southern part of Deschutes County near Sunriver and La Pine are very deep, poorly drained, and have a seasonal high-water table. Leaching of nutrients into ground water may harm human health and aquatic habitat. Other soils in the area are very deep and are on lava plains and hills. These soils are susceptible to compaction and erosion on steeper slopes.

Soils in the western part of Deschutes County near Sisters are moderately deep and well drained. These soils are susceptible to compaction, displacement, and erosion in the steeper areas. Other soils near Bend are very deep to moderate deep and well drained. These soils are susceptible to compaction, displacement, and soil erosion.

Soils near Terrebonne, Redmond, Tumalo and east of Bend are moderately deep, shallow, well drained, and primarily used as irrigated cropland. These soils are subject to wind erosion if left unprotected. They are very sensitive to overgrazing, and recovery rates can be slow. Leaching of nutrients is a concern due to rapid permeability, depth to bedrock, and risk of seepage. The very rapid intake rate, very low available water capacity, and rapid permeability should be considered in irrigation water management.

Volcanic soils are naturally high in phosphorus[4]. Data from the Metolius drainage suggest that natural background levels of phosphorus in the water vary between 0.05 and 0.15 mg/L.

Detailed information on soil types is found in the Upper Deschutes soil survey at *https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx*

2.3.3 Hydrology[5]

The Deschutes River and its western tributaries start high in the Cascade Mountains. The head of the Deschutes River is formed by overflow from Little Lava Lake when there is abundant water, but during dry years the source consists of large springs in Blue Pool. Along its 132-mile course to Lake Billy Chinook, the Deschutes is fed by some of the largest springs in the United States. Cultus River, Quinn River, Snow Creek, Browns Creek, Fall River, Spring River, Alder Springs, and some unnamed springs near Lake Billy Chinook are all springs that discharge the abundant groundwater that has infiltrated high in the pumice rich soils and rocks of the Cascade Mountains. Flows of many springs in the upper watershed peak in summer because of the time delay and distance from when and where the water enters the ground and where it discharges to the surface again; springs at lower elevations tend to have more constant flows. The Deschutes River is so dominated by springs that a U.S. Geological Survey concluded in 1914 that the Deschutes River at Bend was the most even-flowing river for its size of any river in the United States.

Whychus Creek and Tumalo Creek are quite a contrast to the spring-fed tributaries to the Deschutes River. Their source is very high in the Cascade Mountains at the toes of glaciers around Broken Top and the Three Sisters mountains. These two creeks typically peak at the height of snowmelt and large rain events, usually in May and June, and then reach minimum flows in late fall and winter. When there is a moderate to heavy snowpack and a warm Chinook wind, these creeks can increase in flow 20 times over in one day. These streams are also a good source of cold water to the Deschutes River.

To increase the supply of water for irrigation, several reservoirs (Crane Prairie, Crescent Lake, and Wickiup) were built high in the headwaters of the Deschutes River. All together, these three reservoirs store 341,050 acre-feet for irrigation of approximately 105,000 acres.

The flow regime of the Deschutes River changed dramatically below Wickiup Reservoir after the dam was built. During very dry years, the river was reduced to 20 to 30 cfs in the winter and in the summer time during the height of irrigation season, the flow had been as high as to 2,000 cfs. Presently, the maximum is around 1,700 cfs with the new required minimum being 100 cfs due to the Oregon Spotted Frog lawsuit settlement.

The water released from the reservoir travels down the Deschutes to Bend where nearly all of it is diverted into six major canals. The flow below these canals during the summer is very low. Until recently, the lowest flow in dry years was around 30 cfs. Recent instream transfers and conservation work has brought that minimum to approximately 130 cfs during the peak season. The canals themselves are mostly unlined and were dug through the very recent volcanic lava flows and leak a substantial amount of water. Some estimates have put the overall transmission losses at 50 percent. Some of the irrigation districts in the Management Area are working on lining and piping projects to conserve water. For example, North Unit Irrigation District has lined the first 12 miles of its canal to prevent this seepage so that the irrigators

can use the saved water on their farms. There are major piping projects underway, and the irrigation districts have been piping extensively over the past decade. Two districts, Tumalo and Three Sisters have piped major portions of their canals and have seen remarkable efficiency improvements.

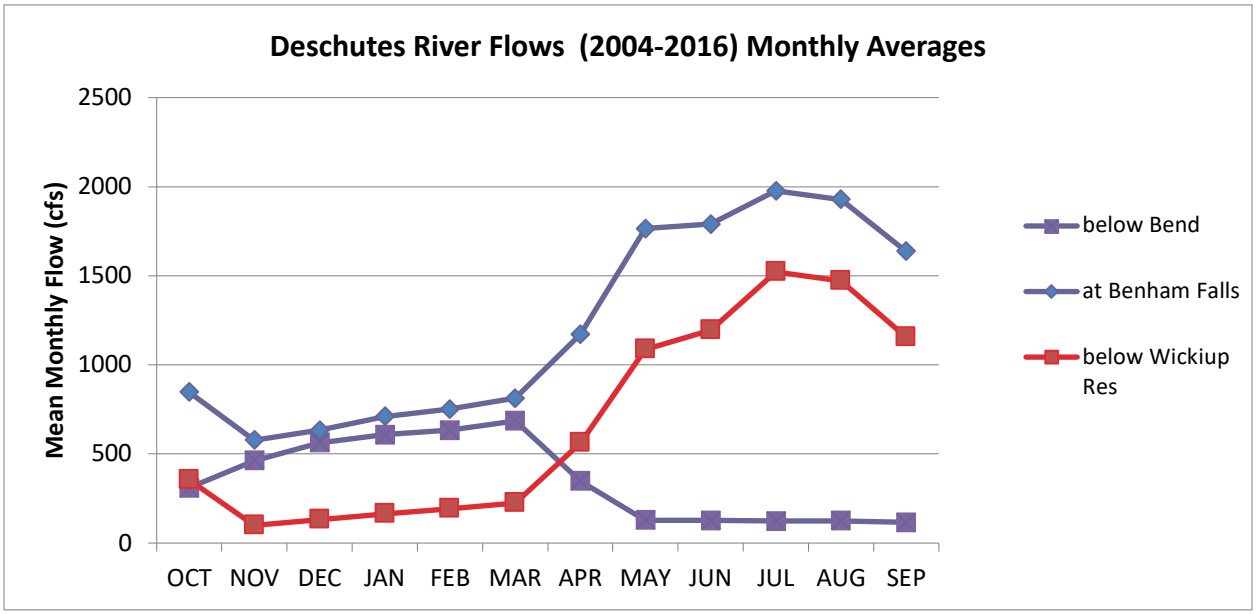
The vast majority of water diverted from the Deschutes River is taken out by the irrigation districts (Table 2.2.3). All other private diversions add up to less than 100 cfs.

Table 2.2.3. 2019 Irrigation District diversions and flow rates in the Management Area.

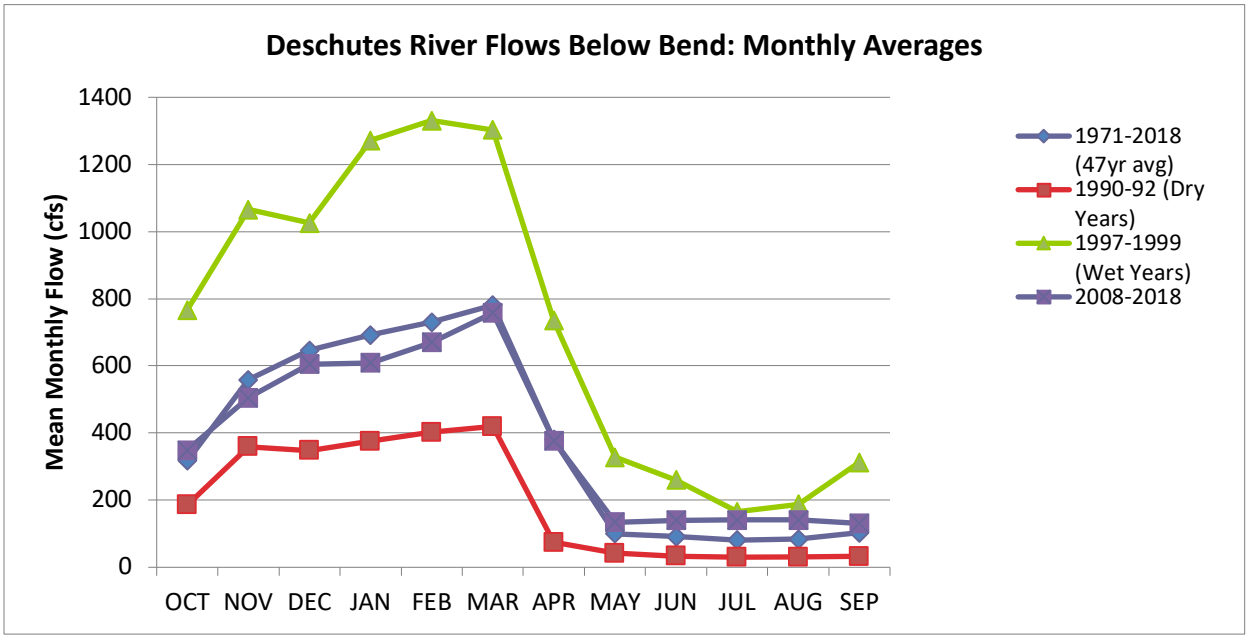
Canal	Maximum Water Right (cfs)	Usual Maximum (cfs)
Arnold	150	105
Central Oregon and North Canal	1,300	950
Bend Feed	150	125
North Unit Main	1,100	800
Swalley	85	85
Tumalo Feed	200	180
Three Sisters	125	110
Crooked River Feed	400	180

The following graphs illustrate the major flow regime of the Deschutes River. Wickiup Reservoir is managed to provide stored water and live flow to users downstream. Lowest flows below Wickiup Dam are in the fall and winter, while the reservoir fills; greatest releases are during the spring and summer irrigation season (graph 1). Flows at Benham Falls (44 miles downstream from Wickiup) reflect the addition of the tributaries Fall River and Spring River, which are unregulated and have relatively stable flows due to being spring-fed. Contributions from the Little Deschutes also add flow to the river above Benham Falls. Streamflow from the Little Deschutes is snow-melt/runoff driven, but also reflects storage releases from Crescent Lake for Tumalo Irrigation District, which diverts water in Bend. Flows measured below Bend are downstream of the irrigation district diversions and reflect summer diversions to the irrigation district delivery systems (graph 1). The flows below Bend (graph 2) reflect both streamflow improvements in the summer due to conservation efforts over the last several years (2004-2016) and supply variability throughout the year due to wet (1997-1999) and dry (1990-1992) climate periods compared to a 45-year based period (1971-2016).

Graph 1: Deschutes River Flow Monthly Averages



Graph 2: Deschutes River Flow Monthly Average Below Bend



Tumalo Creek has one major diversion now, aside from the city of Bend diversion high in the drainage on Bridge Creek. The Tumalo Irrigation District (TID) diverts water through the Tumalo Feed Canal at River Mile 2.5. Tumalo Creek below the Feed Canal was dry during late summer nearly every year from 1913 to 1992. However, conservation efforts by the Tumalo Irrigation District restored 2.5 cfs between this diversion and the mouth between 1992 and 2005. In 2005, the state approved a senior instream water right for 5.82 cfs from the Feed Canal to the mouth. More recently, with several large conserved water projects, the flow below the Feed Canal can be as high as 20 cfs of protectable water (i.e. water flow with a water right priority date).

The Little Deschutes River, above Crescent Creek is unregulated and, with few irrigation withdrawals, resembles as close to a natural stream as any in the basin. Crescent Lake is a natural lake, but its depth has been increased and its outflow regulated by the TID. This management has little effect on winter flows in the Little Deschutes River. The average summertime flows exceed natural flows but are significantly lower than the average high flows that would occur naturally during April, May and June. The stored water released from Crescent Lake actually benefits the flows in the Little Deschutes River in that summer flows generally are higher than they would be naturally, yet peak flows on Crescent Creek have been reduced by 75 percent.

Whychus Creek is used heavily for irrigation and consequently suffers low flows between the Three Sisters Irrigation District canal (River Mile 23.5) and where the springs near Camp Polk Road contribute about 7 cfs (River Mile 17). In the lower reach of Whychus Creek, Alder Springs (River Mile 2) contribute about 20 cfs, and at the mouth nearly 100 cfs discharges to the Deschutes River because of groundwater springs. Until 1998, the stream through town used to dry up. With the work of the Upper Deschutes Watershed Council, Deschutes River Conservancy, and Three Sisters Irrigation District, flows can exceed 32 cfs during the summer time through a segment that frequently was dry.

Crooked River is a very flashy stream and contrasts significantly to the Deschutes River due to the clay-rich soils and differing geology. The river is used heavily for irrigation. In the very lowest stretch of the Crooked River, large springs contribute 1,100 cfs in flow just before it enters Lake Billy Chinook. Two reservoirs authorized for flood control and irrigation are located on Ochoco Creek and Crooked River. Those two reservoirs provide cool consistent flows throughout the summertime when, historically, flows were low during summer.

2.3.4 Vegetation

Vegetation in the upper Deschutes watershed varies greatly because of the wide range in climate and contrasting topographic features.

Vegetation in higher elevations is dominated by pines and firs and is shaped by frequent fires. Western juniper grows at low elevations. Much of the juniper lands are grazed or have been converted to agriculture.

Noxious weeds populations becoming a serious management issue[x]. Within the past 20 years, periodic drought cycles and expanding commercial and residential development, have increased the spread of invasive noxious weeds. Riparian and agricultural lands within the Management Area are rapidly transforming from diverse native plant communities and productive farmlands to noxious weed infested monocultures. There are several species of concern in the watershed which include knapweed (spotted and diffuse); thistle (Bull, Canada, Scotch, and Russian); dalmatian toadflax. These species along with other listed species on the Deschutes County A and B lists impacts the overall health of the watershed by competing and dominating native vegetation, reducing water infiltration and soil nutrients, increasing soil erosion and runoff from agricultural and riparian lands, and reducing the health and vigor of forage species resulting in poor production and yields for wildlife and domestic animals[xi].

2.3.5 Land Use

Most of the Management Area is comprised of federal forest and rangelands. The US Forest Service manages the majority of Paulina Creek land, all the lands in the headwaters of the Deschutes River and its western tributaries, and lands surrounding mountain lakes and reservoirs. The Bureau of Land Management manages primarily small, sporadic areas directly adjacent to the waterways.

Approximately one quarter of the Management Area is privately owned[i]. Private owners manage the majority of the land adjacent to the Deschutes and Little Deschutes rivers and over half of the lands

adjacent to Tumalo and Whychus creeks. Use of agricultural lands varies throughout the Management Area[6]. Most grazed timberland and sub-irrigated pasture are located around the city of La Pine. Irrigated cropland is concentrated around Lower Bridge. Irrigated pastures and hay lands occur throughout the Management Area.

In the late 1800s and early 1900s, settlers realized the Deschutes River and its tributaries could irrigate thousands of acres if the water could be diverted from the river and onto potential farmland. During the first few years of the 20th century, irrigation companies dug many of the canals that divert water from the Deschutes River at Bend. Most of these companies were subsequently reorganized into irrigation districts.

Forage, cereal, and seed crops comprise the majority of crops grown on irrigated lands, with irrigated pasture and alfalfa accounting for most of the consumptive use of water[1]. The subdivision of large farms and ranches into "hobby" farms resulted in increased livestock numbers. Livestock include llamas, horses, beef and breeding cattle, poultry, sheep, goats, and a few dairy cows. There has been in increase in agricultural hemp grown in the Management Area with approximately 3,500 acres grown in 2019.

The population of Deschutes County in 1980 was 62,142. By 2017, 186,875 individuals resided in the county[8]. Deschutes County is one of the fastest growing counties in Oregon.

The Management Area continues to undergo changes in its social and economic character. Historically, agriculture and timber sectors played a major role, but they have been replaced by an urban economy based on service, trade, and government.

2.4 Agricultural Water Quality

2.4.1 Water Quality Issues

The Area Plan and Rules address temperature, sediment, turbidity, chlorophyll, pH, dissolved oxygen, biological criteria, mercury, aquatic weeds/algae, and bacteria concerns related to agricultural activities on private lands in the Management Area. All these parameters are on DEQ's 2012-303(d) list of "water quality limited" streams in the Management Area. Inadequate fish habitat and low streamflows are also concerns. Total Maximum Daily Loads (TMDLs) have not yet been developed for any of these listings in the Management Area.

Water quality standards for surface water are not designed to provide water of sufficient purity for direct human consumption or food preparation. It may be hazardous to human health to use agricultural water for direct human consumption.

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:

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 and other parameters in groundwater.

2.4.1.1 Beneficial Uses

Beneficial uses of water in the Management Area include domestic and industrial water supplies, crop irrigation, livestock watering, aquatic life, recreation, aesthetics, and hydropower. Of these, "domestic water supply," 'fish and aquatic life," and "water contact recreation" are the most sensitive uses. Bacterial contamination and toxins from harmful algal blooms are the greatest concerns for swimming and other types of human water contact. Drinking water uses are primarily affected by toxics and nitrates. However, aquatic life is affected by temperature, sedimentation, turbidity, toxics, nutrients, pH, and dissolved oxygen.

In addition, Management Area rivers provide habitat for the following federally listed species: Oregon spotted frog (threatened), summer steelhead (threatened), and bull trout (threatened).

2.4.1.2 Most Sensitive Beneficial Use: Salmonids

Migratory (anadromous) fish were eliminated from the Management Area following construction of the Pelton-Round Butte Hydropower complex[9]. Anadromous fish species in the Management Area were spring Chinook salmon, summer steelhead, and sockeye salmon. These species were found in the Metolius River, Deschutes River upstream to Big Falls, the Crooked River, and tributaries to these rivers. Whychus Creek and the Crooked River were especially important for steelhead production, while the majority of Chinook salmon production occurred in the Metolius River. Sockeye salmon were found in the Metolius and used Suttle Lake as part of their life history requirement for lake rearing.

Anadromous fish are currently being reintroduced. Releases of summer steelhead fry began in 2007 and continued with annual spring releases into Whychus Creek and the lower Crooked River until 2018. Spring Chinook salmon fry releases were initiated in 2008 and continued annually into the Metolius River, Whychus Creek, and the Lower Crooked River until 2019. Fry releases were initially supplemented with and eventually replaced by annual smolt releases of steelhead and Chinook salmon in 2019. The shift to an expanded smolt program was adaptive management measure to improve smolt survival and ultimately lead to increased adult returns. The goal of the reintroduction effort is to have naturally producing, self-sustaining populations of all three species.

Resident fish species in the Management Area were redband trout, bull trout, mountain whitefish, and other non-game species. Bull trout were eliminated from most of the area due to increased water temperatures from reservoir management, increased passage barriers resulting from human activities, and harvest. Bull trout currently are found in the Deschutes River between Lake Billy Chinook and Big Falls (below Lower Bridge), the Lower Crooked River below Opal Springs Dam, the Metolius River and tributaries, Odell Lake and some tributaries, and rarely in Davis Lake.

Lake Billy Chinook and the Metolius River supports one of the healthiest bull trout populations in the state. The trout migrate to the reservoir from the tributaries and feed on the reservoir fish. These bull trout are fluvial fish (i.e. live in rivers) that have adapted to reservoir life and become adfluvial (i.e. live in rivers and lakes). They depend on the clean, cold waters of the Metolius River and its tributaries, which contain ample gravel suitable for spawning. Currently, Lake Billy Chinook is the only harvestable bull trout fishery allowed within the state. The Endangered Species Act allows for a limited fishery to continue for species under a threatened status, provided these actions do not threaten recovery of the

species and are consistent with state law. Consequently, a signed agreement between Oregon and the U.S. Fish and Wildlife Service provides for a limited bull trout harvest to continue within Lake Billy Chinook.

2.4.1.3 WQ Parameters and 303(d) list

The following water bodies have been designated by DEQ as water-quality limited in the Management Area.

Table 2.4.1.4. Water-quality limited waters in the Upper Deschutes Management Area Source: 2012 303(d) list

Stream Segment	Water Quality Parameters						
	Temperature	pH	Dissolved Oxygen	Chlorophyll *a* or Algae	Biological Criteria	*E. coli*	Sediment and/or Turbidity
Deschutes River/Lake Billy Chinook (River Mile 110.1–118.7)		X		X			
Deschutes River; Lake Billy Chinook to Steelhead Falls (116-126.4)	X		X				
Deschutes River: Steelhead Falls to Central Oregon Canal (126.4-168.2)	X	X	X				
Deschutes River: Central Oregon Canal to Little Deschutes River (168.2-189.4)	X		X	X			X
Deschutes River: Little Deschutes River to Wickiup Reservoir (189.4-222.2)	X		X				X
Deschutes River: Wickiup Reservoir to Crane Prairie Reservoir (223.3-244.8)	X						
Deschutes River/Wickiup Reservoir (222.2-229.7)				X			
Deschutes River/Crane Prairie Reservoir (230.6-235.6)				X			
Abbot Creek (0-7.4)							X
Crystal Creek (0-2.8)			X				
Fall River (0.5-11.2)	X						
First Creek (3.6-12.1)	X						
Indian Ford (0-12.3)	X						
Lake Creek (0-5.9)	X						
Lake Creek, Middle Fork, South Fork (0-1.7)	X						
Lake Creek, Middle Fork (0-2.2)	X						
Lava Lake			X				
Link Creek (0-2.5)	X						
Metolius River (8.5-39.6)	X						
North Fork Whychus Creek (0-5.3)					X		
Odell Creek (3.4-16.3)	X	X	X	X			

Odell Lake /Odell Creek (0-16.3)		X	X	X			
Rosary Creek ()-1.9)			X				
Tumalo Creek (0-12.5)	X						
Whychus Creek (0-40.3)	X						
LITTLE DESCHUTES SUBBASIN							
Big Marsh Creek (0-15.6)	X						
Crescent Creek (0-30/1)	X						
Hemlock Creek (0-5.9)	X						
Little Deschutes River (0-92.4)	X						
Little Deschutes River (0-73.6)			X				
Paulina Creek to Paulina Lake (0-15)	X				X		
Paulina Lake				X			
CROOKED RIVER SUBBASIN							
Crooked River/Lake Billy Chinook (0-5)				X			
Crooked River to High Bridge (1-18)	X	X	X		X	X	

1. **Water temperatures** are critical to salmonid growth and survival at all life stages, and to other aquatic life. Warm stream temperatures increase stress and disease, raise metabolism, lower growth rates, and enhance conditions for introduced non-native predators. Temperature affects the dissolved oxygen potential in water - the warmer the water, the less dissolved oxygen it can hold.

   Biologically based numeric **temperature** criteria support the different life stages and species of salmonid fish (http://www.deq.state.or.us/wq/standards/temperature.htm). The standard includes maps that designate the water body and time of year where the criteria apply.

2. Excessive aquatic plant or **algal growth** can harm fish and other aquatic life by creating extremes in water **pH** and low levels of **dissolved oxygen**. These conditions can be stimulated by the availability of nutrients, warm temperatures, and light, which in turn are often caused by low stream flow and lack of protective vegetative cover. Excessive algal growth can also result in the posting of health advisories for people and pets.

3. **"Biological Criteria"** listings indicate waters that don't adequately support aquatic insects and similar 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 biological health, the community of benthic macroinvertebrates is sampled and compared to the community expected if the stream were in good shape ("reference community"). If the difference is too great, the stream section is designated as 'water-quality limited.' This designation does not identify the limiting factor (e.g. sediment, excessive nutrients, temperature).

4. **Sediments** carried in basin streams can adversely affect aquatic life by reducing light penetration and visibility, reducing water infiltration through stream substrate (harming incubating fish eggs), and irritating gill filaments. **Turbidity** is a measure of the cloudiness of water and is often used as a surrogate measure for suspended sediment.

Turbidity in the Deschutes River between Wickiup Reservoir and the Central Oregon Canal increases as much as 300 percent (from < 1 to 31 NTUs) when irrigation water is released from Wickiup Reservoir in early spring and remains to twice background until late July. The state standard allows only a 10 percent increase in turbidity.

5. **Bacteria** numbers exceeded state standards in the Crooked River, but at a sampling point about 4 miles upstream of the Management Area. Crooked River Ranch is the only portion of the Management Area that drains into the Crooked River. Crooked River Ranch consists mostly of non-irrigated, 5-acre lots, with a few horses. The lack of significant agricultural activities in Crooked River Ranch makes this area an unlikely contributor to agriculture-related water quality problems in the Crooked River. According to Bonnie Lamb at DEQ, DEQ sampled the Crooked River for *E. coli* near Crooked River Ranch in 2005 and the highest measurement was 15.8 organisms, well below the *E. coli* standard. Bacteria sampling in the Upper Deschutes drainage has not warranted 303(d) listing.

   Bacteria from livestock manure are a source of pollution to some canals and groundwater.

Stream flows have been modified throughout the Management Area, primarily related to irrigation diversions. Low flows contribute to warmer water, increased pH, reduced dissolved oxygen, a general reduction in available habitat, and, in extreme cases, interferes with fish migration. Instream leasing programs have helped increase flows in reaches of the Deschutes River and its tributaries.

Modification of physical habitat can directly harm aquatic life. Channelization reduces both the amount and complexity of habitat. Loss of streamside vegetation often destabilizes streambanks, resulting in increased erosion, and decreases shade that could help reduce stream temperatures.

Adequate riparian vegetation helps:

- Minimize streambank erosion by increasing the cohesiveness and structural strength of streambanks and by reducing flow velocities;
- Reduce increases in summer water temperature;
- Maintain late season flows by increasing the ability of the adjacent soils to store water during runoff seasons;
- Moderate winter stream temperatures through the inflows of relatively warmer ground water from adjacent soils;
- Filter out and process excess nutrients, bacteria, and sediment in runoff that could pollute adjacent streams.

2.4.1.4 TMDLs and Agricultural Load Allocations

Currently, there are no Basin TMDLs and Agricultural Load Allocations developed for the Management Area. DEQ has started development of TMDLs in the Upper and Little Deschutes Subbasins, with data collection in 2016.

2.4.1.5 Drinking Water

Several communities obtain domestic drinking water from surface and groundwater sources in the Management Area. There are one hundred and sixty-nine active public water systems using groundwater wells in the Management Area serving approximately 111,300 people. There are fifty-six community water systems using only groundwater in the area. There are also one-hundred transient non-community public water systems (estimated service population 14,500) and five non-public, state-regulated water systems (population 81).

Agricultural land uses (primarily hay/pasture and livestock) are present near many public water system wells and springs in the area, particularly around Bend and La Pine. US Forest Service land is prevalent in

the uplands, providing the contributing areas for numerous springs and creeks (many used for public and private domestic water supply), as well as grazing, in the Management Area.

Sixty public water systems in the Management Area have recent alerts for detections of total coliform and/or *E. coli* in the distribution system and/or source. Five of those systems had *E. coli* contaminant limit (MCL) violations. The drinking water MCL for nitrates is 10 mg/L. The public water systems with high nitrate are along the Deschutes River, near Bend and La Pine. The ground has high nitrate leaching potential throughout the Management Area according to the NRCS. Nitrate from fertilizers and septic systems can readily penetrate to the aquifers used for drinking water, and bacteria removal through soil filtration can be less effective in sandy soils.

DEQ only addresses drinking water issues identified for PUBLIC water systems. A query of Oregon Water Resources' water rights database for private domestic points of diversion identified 113 private domestic water rights in the Management Area. There are also numerous private groundwater wells for domestic use. The Domestic Well Testing Act database for 1989-2018 indicates 98 significant detections of nitrate (>7mg/L) in private wells out of 3,047. There were 31 private wells with nitrate concentrations ≥10mg/L. One well west of Bend had a value of 84mg/L, while another near La Pine had a value of 72mg/L. The private wells with high nitrate are concentrated along the Deschutes River, near Bend and especially around La Pine. Given that most tests were <7mg/L in this same area, attention may be needed to well depth, well construction, and proximity to nutrient sources such as septic systems, fertilizer use sites, and high concentrations of livestock.

Nitrate levels are increasing in drinking water in wells in the rural area around La Pine in southern Deschutes and northern Klamath counties and around Redmond. According to DEQ's Deschutes Basin Watershed Analysis, nitrate contamination of groundwater is one of the most widespread groundwater issues in the Management Area. The primary source appears to be contamination from septic tanks.

It is difficult to determine how much of an impact agriculture is having on groundwater sourced for drinking in this Management Area. Landowners should always properly manage manure and fertilizer to minimize leaching of nitrates and *E. coli* to groundwater.

2.4.2 Sources of Impairment

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 irrigation runoff to streams and ditches:

1. Livestock grazing and areas of concentrated livestock.
2. Irrigation water use and drainage.
3. Illegal in-stream and off-stream ponds.

The following non-agricultural sources likely contribute to water quality issues in the Management Area: the cities of La Pine, Bend, Sisters, urban and suburban developments, sewage treatment plants, activities on federal lands, and high concentrations of deer, elk, and antelope.

2.5 Regulatory and Voluntary Measures

2.5.1 Area Rules

OAR 603-95-3040(1)
Landowners must comply with OAR 603-95-3040(2) through (3) within the following limitations: (a) A landowner is responsible for only those conditions resulting from activities controllable by the landowner. A landowner is not responsible for conditions resulting from activities on other lands.

Streamside Vegetation: OAR 603-95-3040(2)
(a) Effective January 1, 2005, agricultural activities must allow the establishment and development of appropriate vegetation along natural and channelized streams, consistent with site capability. Noxious weeds are not appropriate. Vegetation must be adequate to prevent unnatural streambank erosion, moderate water temperature, and filter sediment and nutrients from surface runoff.
(b) Part (a) does not apply to irrigation water conveyance systems, including but not limited to irrigation canals, ditches, and laterals.

This rule addresses stream temperature, sediment, nutrients, and bacteria. It addresses the moderation of water temperature. Riparian vegetation can help reduce water temperatures in the summer and increase water temperatures in the winter.

Any type of vegetation other than noxious weeds qualifies as long as it assists the functions required in the rule. 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 the destruction of vegetation by wildlife browsing and grazing.

This rule also does not require that all sediment be kept out of streams. This rule refers to the filtration of sediment caused by agricultural activities, not sediment resulting from natural processes. 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.

Wastes: OAR 603-95-3040(3)
(a) Effective on rule adoption, no person subject to these rules shall violate any provision of ORS 468B.025 or ORS 468B.050.

Compliance with this rule ensures that concentrated nutrients, 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.

Livestock wastes can include manure from pastures draining to or bisected by irrigation ditches and any other situations not already covered by Oregon's Confined Animal Feeding Operation laws. Indicators of potential noncompliance include: 1) Runoff flowing through areas of livestock usage and entering waters of the state, 2) Livestock waste located in drainage ditches or areas of flooding, or 3) *E. coli* counts that exceed state water quality standards. Livestock facilities located near streams must employ an adequate runoff control and waste management system.

Wastes can also include excess sediment discharges. Indicators of potential noncompliance with this rule include:

1) Visible active erosion scars,
2) Sediment-laden runoff, or
3) Obvious deposits of sediment on the stream or canal bottom that can be traced to a specific source.

The following Area Rule provides for resolution of complaints:

Complaints and Investigations (OAR 603-095-3060)

(1) When the department receives notice of an alleged 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 603-095-3060(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 603-095-3060(4), "person" does not include any local, state or federal agency.

(6) Notwithstanding OAR 603-095-3060, 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.

2.5.2 Voluntary Measures

To help achieve water quality standards in the Management Area, an effective strategy should:

- Maintain adequate streamside vegetation,
- Minimize streambank erosion,
- Minimize runoff to ground and surface water that contains potential pollutants.

The following conservation practices (Table 2.4) address the objectives of the Area Plan and help improve and protect water quality while being economical and practical. 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. While recommended, they are not required.

Table 2.4. Recommended conservation practices for the Upper Deschutes Agricultural Water Quality Management Area (some practices may not be included)

MANAGEMENT	OBJECTIVES	RECOMMENDED CONSERVATION PRACTICES
STREAMS	*Achieve adequate riparian vegetation* *Reduce streambank erosion*	• Encourage plants that 1) Provide shade, 2) Trap or filter out excess nutrients, bacteria, and sediment in overland or shallow subsurface flow, 3) Provide vegetative cover to protect the streambank during high flows, and 4) Have root masses that will stabilize streambanks. • Stabilize streambanks, preferably with bioengineering techniques.

	Minimize stream temperature extremes beyond natural variation *Minimize pollutants from surface runoff*	• Maintain vegetative buffer: continuous Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), riparian buffers, weed control (see below). • Manage livestock (see below). • Plant and protect native riparian plant species to reduce invasive weeds and support native fish and aquatic life. • Properly place, design, and maintain roads, culverts, bridges, and crossings. Use heavy equipment in streamside areas at appropriate times of year; contact Oregon Department of Fish and Wildlife (ODFW) for sensitive locations and seasons. • Leave large woody debris (LWD) in streams. If it must be removed, don't destabilize the streambank. Time the removal of LWD to minimize disturbance to stream and streambank. • Contact ODFW for timing and technical assistance for instream activities. Oregon's Department of State Lands and the federal government require permits for some types of fill or removal activities. Deschutes County requires a fill and removal permit for removal or placement of any instream materials, including LWD. Oregon's Parks and Recreation Department administers activities in the scenic waterway.
LIVESTOCK	*Reduce soil erosion* *Limit nutrients and bacteria in surface runoff* *Achieve adequate riparian and upland vegetation*	• Improve riparian buffers. • Harrow pastures at least once per year. • Clean manure out of irrigation ditches before receiving irrigation water that will continue off property to another user. • Install adequate waste management systems: clean out water diversions; collect, store, and utilize wastes; properly operate and maintain facilities. • Control runoff from concentrated feeding areas and irrigated pastures. • Control livestock access to water that flows off-property: - Manage the timing and intensity of livestock access to streams and irrigation ditches by using a grazing strategy that addresses livestock distribution and the duration and season - Provide off-stream drinking water (stock tanks, nose pumps, etc.) - Place salt licks and supplemental feeding stations away from streams or ditches - Provide shade and shelter for livestock away from the stream - Install fencing (temporary, exclusion, etc.) - Use a herder to encourage livestock to use uplands on large properties - Pipe irrigation water conveyances
NOXIOUS WEEDS	*Minimize soil erosion* *Improve riparian and upland vegetation*	• Remove existing noxious weeds; replace with desirable vegetation. An integrated vegetation plan may include: herbicides, grazing, mowing, bio-control, cultivating, or pulling. • Control the spread of noxious weeds near moving water; weeds are transported by water. • Seed areas with noxious weeds or devoid vegetation with desirable competitors. • Use weed-free hay for forage and mulch. • Wash equipment to remove weed seeds. • Apply herbicides at appropriate rates, times, and locations; follow the pesticide label. • Maintain grass height over 3" in pastures through managing

		grazing pressure • Reduce livestock to an appropriate carrying capacity of the property • Restore previously irrigated areas to desirable dryland species if leasing irrigation water for in stream uses
IRRIGATION	*Reduce unnatural fluctuations in stream flows* *Reduce runoff* *Minimize pollutants* *Reduce soil erosion*	• Schedule irrigation based on crop needs, soil type, climate, topography, infiltration rates. • Improve irrigation efficiency through sprinkler conversion, pressurized delivery, gated pipe, rotating pooling agreements. • Minimize return flows through the use of cover crops, straw mulch, grass filter strips, berms and boarder systems. • Grade and slope property to retain runoff. • Line ponds to minimize water loss from seepage. • Pipe or line surface water delivery systems. • Manage tailwater. • Lease water rights for instream use.
CROP NUTRIENTS & FARM CHEMICALS	*Reduce potential for surface and groundwater pollution* *Reduce runoff*	• Develop nutrient application plans (“nutrient budgets”) based on water and soil testing, tissue testing, plant needs. • Apply appropriate amounts at proper times; dispose of containers properly. • Avoid potential spills and their effects: have cleanup plan, store tanks away from water, check valves on delivery trucks. • Apply non-farm chemicals appropriately on landscaping and lawns.
WASTES	*Reduce potential for water pollution*	• Store and manage waste hay, chemicals, compost, or organic wastes away from streams or flowing waters. • Compost or use organic wastes. • Don’t pump wastes into dry wells.

Contact your local SWCD for guidance on selecting appropriate management practices or for assistance with developing a voluntary, individual conservation plan.

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Chapter 3: Implementation Strategies

Goal

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

To achieve the Area Plan goal, the following water quality related strategies are established:

1. Maintain adequate streamside vegetation.
2. Minimize streambank erosion.
3. Minimize soil erosion.
4. Minimize irrigation induced erosion.
5. Minimize soil, nutrient and pesticide runoff to ground and surface water.

Achieving the following land conditions on agricultural lands throughout the Management Area will contribute to good water quality:

- Sufficient streamside vegetation to stabilize streambanks, filter overland flow, and moderate solar heating;
- Vegetative barriers, filter strips or forest riparian buffers that limit surface water run-off;
- Efficient irrigation systems that minimize run off and over use of irrigation water;
- Livestock access to open water bodies (pond, canals, streams etc.) minimized by fencing, off site watering facilities, and/or timing of grazing;
- Pastures with minimal weeds and bare areas.

Resource concerns are:

- Irrigation-induced soil erosion – improper irrigation water application and equipment operation cause soil erosion on or off the farm. Irrigation ditches may convey sediment, nutrients or pesticides;
- Streambank erosion – lack of streamside vegetation causes turbidity in surface waters;
- Soil condition – compaction caused by mechanical or livestock impedes water infiltration, promoting runoff of soil;
- Soil conditioning – nutrients from overapplication of animal manure, other organics, and commercial fertilizers can leach to ground or surface water;
- Water Quantity – irrigation systems and infrastructure are inefficient, causing over use of water and potential run off of irrigation water;
- Water Quality – excessive suspended sediment and turbidity in surface water; excessive water temperatures.

LAC Mission

Promote voluntary agricultural practices that improve and protect water quality while sustaining a healthy agricultural economy.

The LAC used the following guiding principles to develop the Area Plan:

- Protect beneficial uses of the water in the Management Area;
- Control pollution as close to its source as possible;
- Base recommended actions on best available scientific information;
- Develop cost-effective, practical, flexible, and realistic site-specific solutions that work;
- Recognize that landowners are not responsible for naturally occurring water quality conditions that violate state standards.

3.1 Measurable Objectives and Strategic Initiatives

3.1.1 Management Area

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.

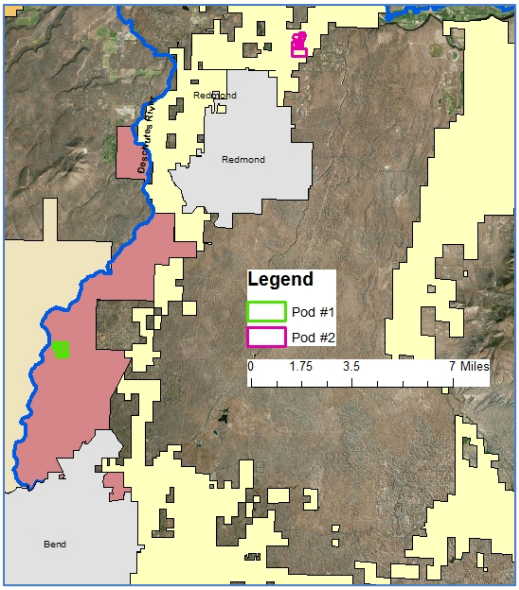
By 2022, baseline data will be collected to show what percentage of streamside areas on ag lands provide the riparian functions of shade, stabilizing streambanks, and filtering overland flows, based on site capability.

By 2024, designate irrigated lands for surface runoff and potential for WQ issues:

1. No to minimal runoff.
2. Runoff that does not have a hydrologic connection to the Deschutes River and its tributaries.
3. Runoff with a hydrologic connection to the Deschutes River and its tributaries.

3.1.2 Focus Area

Deschutes Irrigation Water Management (IWM)



The Focus Area comprises of two project areas. The G-4 Point of Diversion (POD) and the Tower Ditch Point of Diversion (POD). A POD is where the irrigation district delivers water to a group of landowners that share a private delivery system. These PODs can have several landowners which becomes a challenge in managing irrigation water to every individual landowner within the POD. For the G-4 POD, there are eight landowners that share the same delivery system. The project area encompasses 199 acres, of which 150 acres are flood irrigated. Central Oregon Irrigation District (COID) diverts irrigation water from the their main canal to the G-4 lateral, which is 4,766 ft. of open ditch. The landowners are required to utilize the water in an efficient and effective manner. This is a challenge since 80 percent of the landowners flood irrigate causing an over use of water, promoting nutrients and sediment run off from their lands. Likewise, Swalley Irrigation District (SID) diverts irrigation water from their main canal to the Tower Ditch POD. There are eight landowners that share the Tower Ditch lateral which is 4,279 ft. The project area encompasses 136 acres, of which 95 percent of the lands are under sprinkler irrigation. The Tower Ditch was selected in 2015 to convert the private lateral from existing PVC to HDPE pipe. Engineering designs and a feasibility study were completed with positive results. However, the alternative to replace the existing pipe was costly to the Tower Ditch patrons, thus prohibiting implementation of the project. Because of this, no further action can be completed and was removed from the Focus Area. The Deschutes SWCD will continue to seek funding for future implementation.

3.1.2.1 Deschutes IWM Focus Area

The Deschutes Irrigation Water Management (IWM) Focus Area is part of ODA's Focus Area strategic initiative. Below is a description of the Assessment Method, Measurable Objectives and Milestones.

Assessment Method(s):

The SWCD will track:

1. Acre-feet will be used to capture seepage loss through the G-4 irrigation delivery system.

2. Acre-inches/acre will be used to capture water savings through on-farm irrigation water management (IWM) techniques.

Measurable Objectives and Associated Milestones:

1) Current Status: 190.2 acre-feet of seepage loss in main lateral,
   Measurable Objective: By June 30, 2022, reduce the amount of seepage loss by 100%.
2) Current Status: 8 acre-inches/acre of on-farm usage,
   Measurable Objective: By June 30, 2022, 4 acre-inches/acre on farm water savings for 4 producers.

3.1.3 Indian Ford Strategic Implementation Area

The ODA completed an evaluation of agricultural management activities and landscape conditions with potential to contribute to or cause water pollution in the Indian Ford Creek Watershed in Deschutes County. The Upper and Lower Indian Ford Creek watersheds (approximately 37,000 acres; approximately 2,600 agricultural acres) include two 6th field HUC watersheds north and west of Sisters. Agricultural areas of the watershed consist mostly of pasture and small acreage livestock facilities. Water quality concerns in the watershed are for temperature but this is limited to available data.

Assessment 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 include:

- **Limited Opportunity for Improvement:** 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:** 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 remote evaluation and verified during the field evaluation from a publicly accessible location, that a potential violation of the Area Plan Rules exists.

Measurable Objectives and Associated Milestones:

100% of agricultural tax lots are likely in compliance with the streamside vegetation and waste rules in year 2017.

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		
# active events that target landowners/managers (workshops, demonstrations, tours)	8	Spring workshops, individual POD meetings, annual summer tours, Irrigation District meetings
# landowners/managers participating in active events	100	Participation will be catured by attendance numbers and informational flyers sent
Technical Assistance (TA)		
# landowners/managers provided with TA (via phone/walk-in/email/site visit)	20	

# site visits	10	
# conservation plans written*	10	
On-the-ground Project Funding		
# funding applications submitted	-	
# funding applications awarded	-	
* 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

DEQ has conducted multiple studies in the Upper Deschutes. Some of their data are presented in *Upper Deschutes AgWQ Management Area: DEQ's Water Quality Status and Trends Analysis for the Oregon Department of Agriculture's Biennial Review of Agricultural Area Rules and Plan* (http://www.oregon.gov/deq/wq/programs/Pages/wqstatustrends.aspx). The Water Quality Status and Trends mapper can be found at https://www.oregon.gov/deq/wq/programs/Pages/wqstatustrends.aspx.

DEQ monitors six sites in the Management Area as part of their ambient monitoring network Deschutes 10511 River at Mirror Pond (Bend), 10686 Deschutes River at Harper Bridge (Sunriver), 10508 Deschutes River at Lower Bridge, 10688 Deschutes River at Pringle Falls, 10696 Little Deschutes River at Highway 42, 10690 Metolius River at Bridge 99 (Camp Sherman).

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

Management Area-Wide measureable objectives will be reported during the 2024 Biennial Review.

4.1.2 Focus Areas

Table 4.1.2.1 Deschutes IWM Focus Area

Measurable Objective
1) By June 30, 2022, reduce the amount of seepage loss by 100%. 2) By June 30, 2022, 4 acre-inches/acre on-farm water savings for 4 producers.
Current Conditions
Progress Toward Measurable Objectives and Milestones By June 30, 2022, COID will install HDPE pipe for the entire length of the G-4 lateral POD. On-farm delivery systems will be installed in tandum with main delivery pipeline to take advantage of pressurized water.
Assessment Results 1) Current Status: 190.2 acre-feet of seepage loss in main lateral. 2) Current Status: 8 acre-inches/acre of on-farm usage.
Activities and Accomplishments
COID: A meeting with COID, NRCS and the Deschutes SWCD was conducted on August 2020 regarding the progress of the project. Six of the 8 patrons have been sent their final draft engineering designs. There are two landowners that will need further inventory completed before their final design. COID made the decision not to incorporate the PBC-35 lateral patrons. This significantly removed the complexity of the project. COID engineering design is 30% completed. The design covers the upper district (Lone Pine area) along with G-4. COID will not be able to implement the G-4 project for yet another year. The Deschutes SWCD has met with one landowner to adjust on-farm designs. Two landowners will need to have there designs re-evaluated. A patron meeting will be held in late February 2020 to coordinate efforts with COID.
Adaptive Management Discussion
The Tower Ditch FAAP was selected in 2015 to convert the private lateral from existing PVC to HDPE pipe. Engineering designs and a feasibility study were completed with positive results. However, the alternative to replace the existing pipe was costly to the Tower Ditch patrons, thus prohibiting implementation of the project. Because of this, no further action can be completed and must be removed from the FAAP. The Deschutes SWCD will continue to seek funding for future implementation.

4.1.3 Strategic Implementation Area(s)

Table 4.1.3 Indian Ford Strategic Implementation Area

Measurable Objective
100% of agricultural tax lots are likely in compliance with the streamside vegetation and waste rules in year 2017.
Current Conditions
Assessment Results / Compliance Results Total Parcels in Assessment Area = 277 - 177 (N/A) (Federal Land, Not Ag, etc.) 100 Parcels Evaluated

Evaluation Categories		***Pre-evaluation (11/2015)***	***Post-evaluation (8/2017)***
No Concern	=	77 parcels	97 parcels
Low Concern	=	3 parcels	3 parcels
Moderate Concern	=	12 parcels	0 parcels
Significant Concern	=	8 parcels	0 parcels
Serious Concern	=	0 parcels	0 parcels
Total	=	100 Parcels	100 Parcels

As of 2/2020, all landowners that were evaluated in the SIA are likely in compliance with the Area Rules.

Activities and Accomplishments

- Each property owner was sent an invitation to an ODA led Open House; (November 30, 2015; 63 landowner invitations were sent).
- ODA held Open House (December 16, 2015; 15 landowners attended).
- For landowners with parcels evaluated with Moderate, Significant, or Serious Concern, ODA initiated 16 compliance cases (January 2016). 14 cases were closed with no investigation after further evaluation with landowner and partners.

Adaptive Management Discussion

- ODA met their objective.
    - 100% of all evaluated agricultural tax lots in the Indian Ford SIA were determined to be in compliance with the streamside and waste Area Rules on 9/2017.
- As of 9/2020, the SWCD is working closely with landowners in the SIA on various restoration activities along Indian Ford Creek including 16 acres of riparian vegetation planting. The SWCD continues to work with landowners to provide ecological uplift within the SIA.

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 2022-2023 Biennium. Future Area Plans will compare results and targets in Table 4.2a.

Table 4.2a Activities conducted in July 2015 - June 2019 by Deschutes SWCD and NRCS

Activity	4-year results	Description
Community and Landowner Engagement		
# active events that target landowners/ managers (workshops, demonstrations, tours)	31	
# landowners/managers participating in active events	858	
Technical Assistance (TA)		
# landowners/managers provided with TA (via phone/walk-in/email/site visit	294	
# site visits	166	
# conservation plans written*	9	
On-the-ground Project Funding		
# funding applications submitted	14	
# funding applications awarded	-	

* 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 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).

Landowner	OWEB	DEQ	NRCS	DRC	BOR	Irrigation Districts	PGE	All other sources	TOTAL
$169,051	$12,376,384	$2,000,000	$366,850	$1,472,541	$8,340,633	$20,970,235	$3,003,692	$4,794,669	$53,494,055

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	12	95		Corbett Jack Creek Water Conservation project resulted in 20 acres of riparian fencing and grazing management
Fish Passage	1		1	
Instream Habitat	25			
Instream Flow	2,558		116 cfs	Instream water right transfers/irragation improvements
Wetland		2		
Road	0		0	
Upland		69,488		42,000 of the 67,193 upland acres implemented were from COID Pilot Butte Irrigation Project
TOTAL	2,597	69,583	1	

* # of structures, logs, boulders, hardened crossings, culverts, etc.

4.3 Water Quality and Land Condition Monitoring

4.3.1 Water Quality

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). The Water Quality Status and Trends mapper can be found at https://deq15.deq.state.or.us/SC/WQWebReporting/wqst_2019/deschutes/deschutes_map.html.

ODA focused on sites in DEQ's analysis that could be influenced directly by agricultural activities; those eight sites are along the Little Deschutes between Gilchrist and the mouth just south of Sunriver. This area consists primarily of rural residential properties on wells, scattered hobby farms, and city of La Pine.

Dissolved oxygen: attains water quality standard upstream of La Pine, does not attain downstream;
E. coli: the only data was from the Little Deschutes @ Hwy 20; attain;
pH: attains at all sites;
Total phosphorus and total suspended solids: unassessed;
Temperature: does not attain above Dorrance Meadow Road, no data for downstream sites.

Because this reach has interspersed land uses and little agriculture, the results do not allow any evaluation of the effects of agricultural activities on water quality in the Little Deschutes.

4.4 Biennial Reviews and Adaptive Management

ODA, the LAC, the LMA, and other partners met on September 23, 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
Share future management area wide assessment results with local partners.
Recommended Modifications and Adaptive Management
Include on-farm projects completed by Irrigation Districts in the Area Plan to track progress of conserved water. Prioritize on farm irrigation efficiency projects with limited funds within Irrigation Districts.

Table 4.4b Number of compliance actions in 2015-2019

Actions	Letter of Compliance	Pre-Enforcement Notification	Notice of Noncompliance	Civil Penalty
Compliance Actions Outside SIA	4	3	1	0
Compliance Actions Within Indian Ford SIA	2	0	0	0

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5. Ed Keith, Deschutes County Forester. Personal communication, 2020.

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7. Oregon State University Extension Service, Oregon Agricultural Information Network. *http://oain.oregonstate.edu/SignIn.asp*

8. Population Research Center – Portland State University. *https://www.pdx.edu/prc/population-reports-estimates*

9. Brett Hodgson, Oregon Department of Fish and Wildlife Biologist, Bend. Personal communication, 2020.

10. *Oregon's 2012 Section 303(d) List of Water Quality Limited Waterbodies*. Oregon Department of Environmental Quality. 2018.

11. Kollen E. Yake, Upper Deschutes Subbasin Assesment, 2003