OREGON DEPARTMENT OF AGRICULTURE

Lost River Subbasin Agricultural Water Quality Management Area Plan

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Developed by the

Oregon Department of Agriculture

and the

Lost River Local Advisory Committee

with support from the

Klamath Soil and Water Conservation District

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

Klamath SWCD
1945 Main St., Suite 200
Klamath Falls, OR 97601
(541) 883-6924
frontdesk@klamathswcd.org

Website: oda.direct/AgWQPlans

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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
CWA – Clean Water Act
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
NRCS – Natural Resources Conservation Service
OAR – Oregon Administrative Rules
ODA – Oregon Department of Agriculture
ORS – Oregon Revised Statute
OWEB – Oregon Watershed Enhancement Board
OWRI – Oregon Watershed Restoration Inventory
PSP – Pesticide Stewardship Partnership
SIA – Strategic Implementation Area
SWCD – Soil and Water Conservation District
TMDL – Total Maximum Daily Load
US EPA – United States Environmental Protection Agency

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Foreword

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

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

Required Elements of Area Plans

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

Plan Content

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

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

Chapter 3: Implementation Strategies. Presents goal(s), measurable objectives, strategic initiatives, proposed activities, and monitoring efforts.

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

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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 603-095-3900). The general regulations guide the Ag Water Quality Program, and the Area Rules for the Management Area are the regulations with which landowners must comply. Landowners are encouraged through outreach and education to implement conservation and management activities.

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

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

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

1.2 History of the Ag Water Quality Program

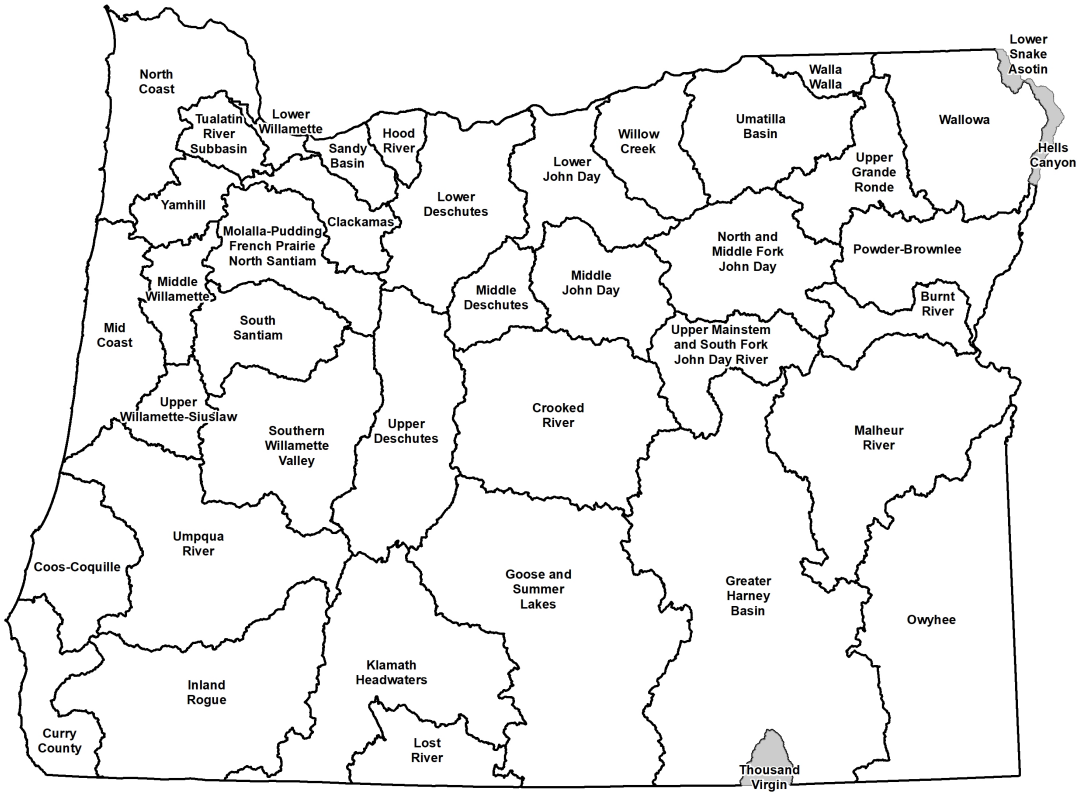
In 1993, the Oregon Legislature passed the Agricultural Water Quality Management Act directing ODA to develop plans to prevent and control water pollution from agricultural activities and soil erosion and achieve water quality standards and to adopt rules as necessary (ORS 568.900 through ORS 568.933).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

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

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

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

Figure 1.2 Map of 38 Agricultural Water Quality Management Areas*



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

1.3 Roles and Responsibilities

1.3.1 Oregon Department of Agriculture

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

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

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

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

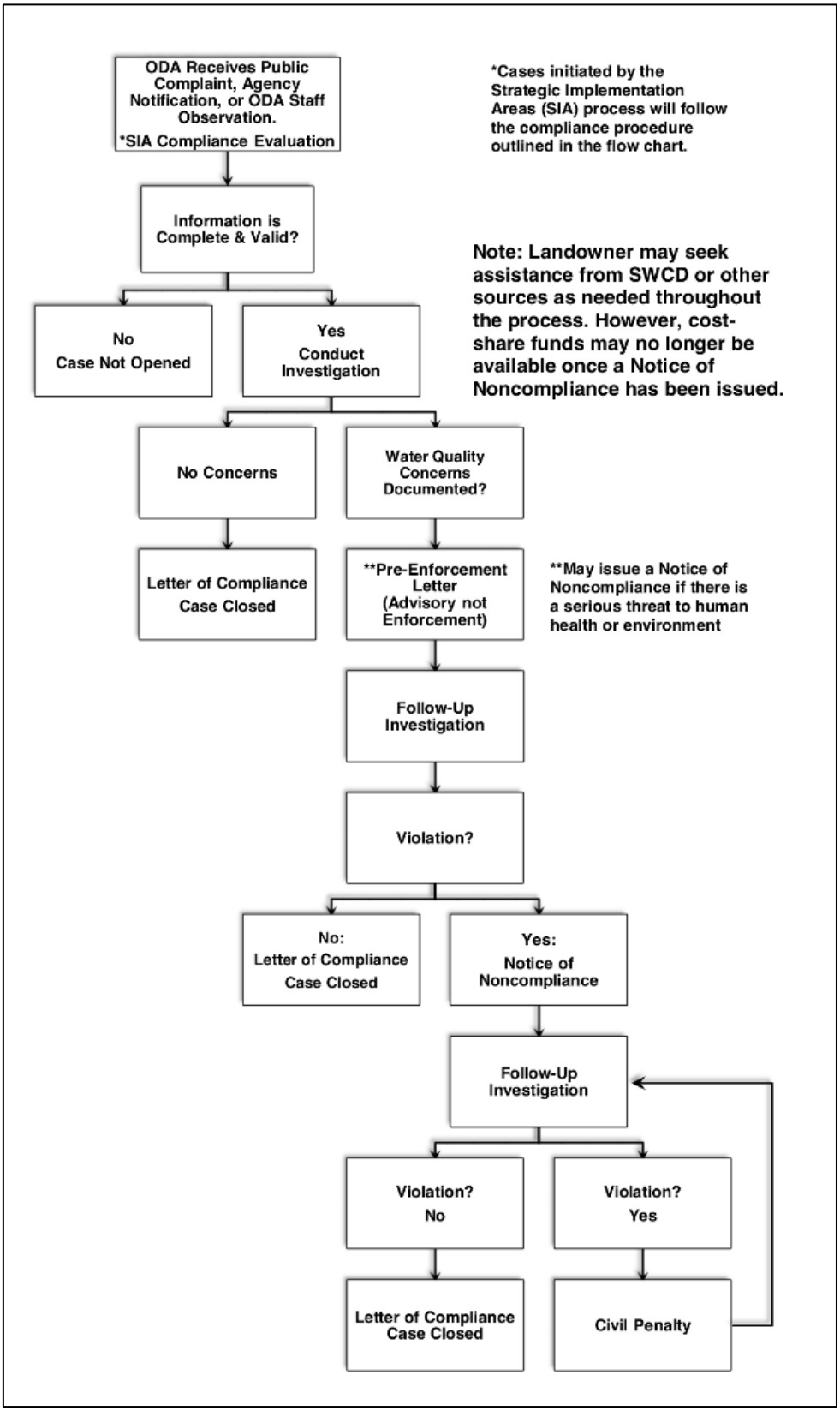
1.3.1.1 ODA Compliance Process

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

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

Any member of the public may file a complaint, and any public agency may file a notification of a potential violation of the Area Rules. ODA also may initiate an investigation based on its own observation or from cases initiated through the Strategic Implementation Area process (See Figure 1.3.1).

Figure 1.3.1 Compliance Flow Chart



1.3.2 Local Management Agency

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

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

1.3.3 Local Advisory Committee

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

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

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

1.3.4 Agricultural Landowners

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

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

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

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

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

1.3.5 Public Participation

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

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

1.4 Agricultural Water Quality

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

1.4.1 Point and Nonpoint Sources of Water Pollution

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

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

1.4.2 Beneficial Uses and Parameters of Concern

Beneficial uses related to water quality are defined by DEQ for each basin. The most sensitive beneficial uses usually are fish and aquatic life, water contact recreation, and public and private

domestic water supply. These uses generally are the first to be impaired because they are affected at lower levels of pollution. While there may not be severe impacts on water quality from a single source or sector, the combined effects from all sources can contribute to the impairment of beneficial uses in the Management Area. Beneficial uses that have the potential to be impaired in this Management Area are summarized in Chapter 2.4.1.1.

Many waterbodies throughout Oregon do not meet state water quality standards. The most common water quality concerns statewide related to agricultural activities are temperature, bacteria, biological criteria, sediment 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 2.4.

1.4.3 Impaired Waterbodies and Total Maximum Daily Loads

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

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

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

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

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

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

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

ORS 468B.025 (prohibited activities) states that:
"(1) Except as provided in ORS 468B.050 or 468B.053, no person shall:

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

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

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

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

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

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

1.4.5 Streamside Vegetation and Agricultural Water Quality

Across Oregon, the Ag Water Quality Program emphasizes streamside vegetation protection and enhancement. Streamside vegetation can provide three primary water quality functions: shade to reduce stream temperature warming from solar radiation, streambank stability, and filtration of pollutants. Other water quality functions from streamside vegetation include water storage in the soil for cooler and later season flows, sediment trapping that can build streambanks and floodplains, narrowing and deepening of channels, and biological uptake of

sediment, organic material, nutrients, and pesticides. In addition, streamside vegetation provides habitat for numerous species of fish and wildlife. Streamside vegetation conditions can be monitored to track progress toward achieving conditions that support water quality.

Site-Capable Vegetation

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

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

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

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

1.4.6 Soil Health and Agricultural Water Quality

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

Building soil health increases resiliency to extreme weather, protects water quality, and helps keep farms and ranches viable. Incorporating soil health practices can help landowners adapt

and reduce risks. For more information, visit www.nrcs.usda.gov/wps/portal/nrcs/detail/or/soils/health.

1.5 Other Water Quality Programs

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

1.5.1 Confined Animal Feeding Operation Program

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

1.5.2 Groundwater Management Areas

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

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

Any GWMA in this Management Area is described in Chapter 3.1.5.

1.5.3 The Oregon Plan for Salmon and Watersheds

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

1.5.4 Pesticide Management and Stewardship

ODA's Pesticides Program holds the primary responsibility for registering pesticides and regulating their use in Oregon under the Federal Insecticide Fungicide 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 PSP program and other federal, state, and local monitoring programs to assess the possible impact of pesticides on Oregon's water quality. Pesticide detections in Oregon's streams can be addressed through multiple programs and partners, including the PSP.

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

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

ODA led the development and implementation of a Pesticides Management Plan for the state of Oregon (www.oregon.gov/ODA/programs/Pesticides/water/pages/AboutWaterPesticides.aspx). The Pesticides Management Plan, 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 plan 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 (OHA). The program provides individuals and communities with information on how to protect the quality of Oregon's drinking water. DEQ and OHA 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 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 (in partnership with OHA), 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 NRCS and United Stated Department of Agriculture Farm Service Agency, watershed councils, Oregon State University Agricultural Experiment Stations and Extension Service, tribes, livestock and commodity organizations, conservation organizations, and local businesses. As resources allow, SWCDs and local partners provide technical, financial, and educational assistance to individual landowners for the design, installation, and maintenance of effective management strategies to prevent and control agricultural water pollution and to achieve water quality goals.

1.7 Measuring Progress

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

1.7.1 Measurable Objectives

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

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

The State of Oregon continues to improve its ability to use remote-sensing technology to measure current streamside vegetation conditions and compare these to the conditions needed

to meet stream shade targets. As the State's use of this technology moves forward, ODA will use the information to help LACs and LMAs set measurable objectives for streamside vegetation. These measurable objectives will be achieved through implementing the Area Plan, with an emphasis on voluntary incentive programs.

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

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

1.7.2 Land Conditions and Water Quality

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

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

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

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

1.7.3 Focused Implementation in Small Geographic Areas

Focus Areas

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

Focus Areas have the following advantages: a proactive approach that addresses the most significant water quality concerns, multiple partners that coordinate and align technical and

financial resources, a higher density of projects that may lead to increased connectivity of projects, and a more effective and efficient use of limited resources.

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

Strategic Implementation Areas

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

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

1.8 Progress and Adaptive Management

1.8.1 Biennial Reviews

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

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

1.8.2 Agricultural Water Quality Monitoring

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

As part of monitoring water quality status and trends, DEQ regularly collects water samples every other month throughout the year at 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,

chlorophyll a, specific conductance, dissolved oxygen (concentration and 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.

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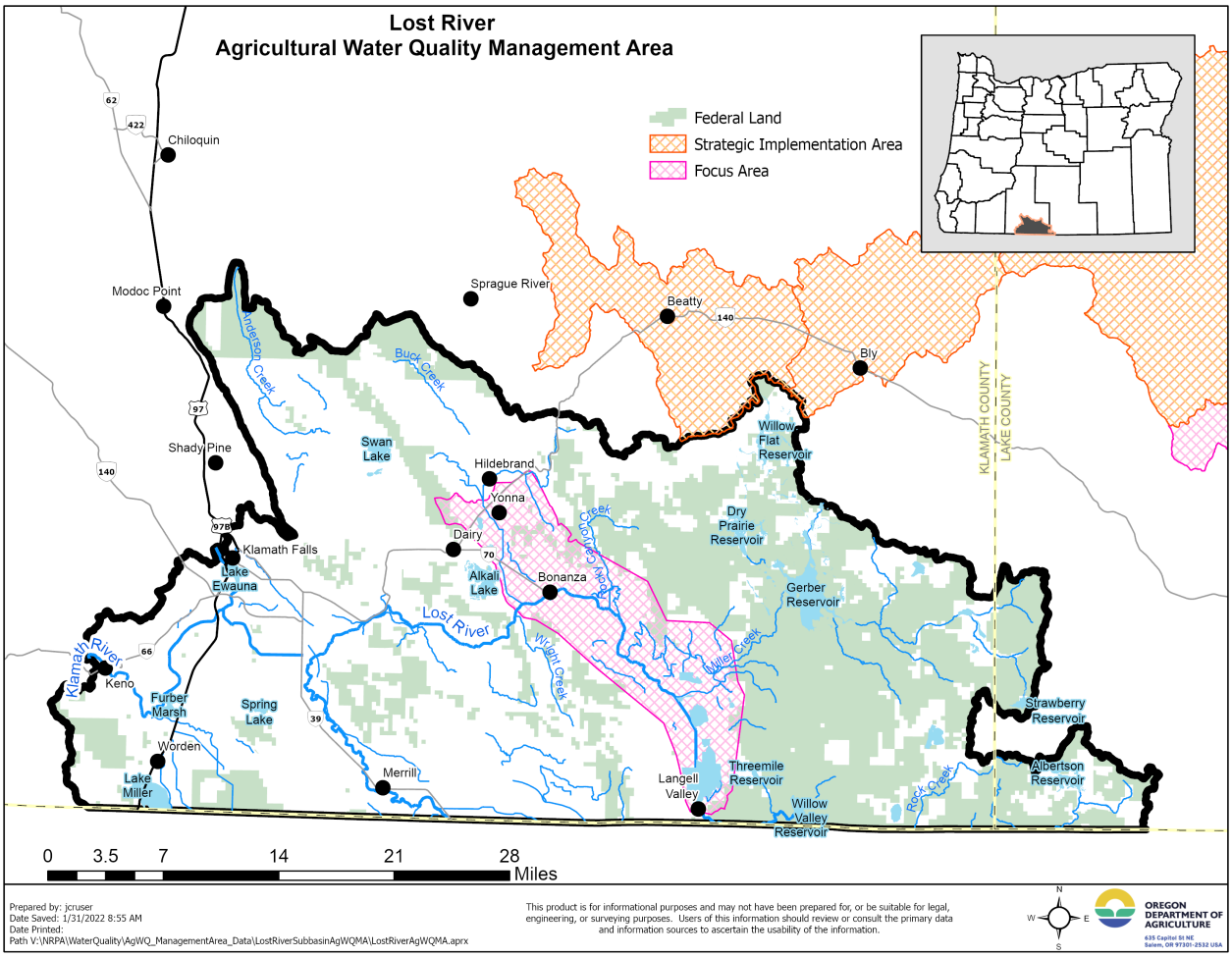
Chapter 2: Local Background

The Management Area is located in extreme south-central Oregon near Klamath Falls and consists of the Oregon portion of the Lost River subbasin, as defined by the U.S. Geological Survey (Figure 2).

Figure 2. Lost River Subbasin Agricultural Water Quality Management Area



2.1 Local Roles

2.1.1 Local Advisory Committee

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

Table 2.1.1 Current LAC members

Name	Geographic Representation	Description
Bill Kennedy (Co-Chair)	Poe Valley	Rancher
Glenn Barrett (Co-Chair)	Langell Valley	Rancher
Bob Gasser	Management Area	Basin Fertilizer and Chemical Company
Frank Hammerich	Langell Valley	Rancher
John Vrandenburg	Management Area	Klamath National Wildlife Refuge
Luther Horsley	Straits Drain	Small grains
Mark Buettner	Management Area	Klamath Tribes (Environmental Scientist)
Mark Johnson	Management Area	Klamath Watershed Partnership
Tracey Liskey	Straights Drain	Cattle, crops
Vacant		
Vacant		
Vacant		

2.1.2 Local Management Agency

SWCDs implement Area Plans through OWEB capacity grants, with details negotiated between ODA and each SWCD. The resulting Scopes of Work define the SWCDs as the LMAs for implementation of the Ag Water Quality Program in specific Management Areas. The LMA for this Management Area is Klamath SWCD. This 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 approved the initial Area Plan and Area Rules in 2004.

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

Location
The Management Area's 1,313 square miles (840,320 acres) include the land draining into the Klamath River between Link River and Keno dams, Swan Lake Valley, and the Oregon portion of the Lost River drainage[1]. Another 1,685 square miles (1,078,380 acres) of the Lost River Subbasin are in California and are outside the jurisdiction of this Area Plan. The Management Area is in Klamath County except for a small area in Lake County. Principal cities are Merrill, Malin, Bonanza, and most of Klamath Falls. Elevation above sea level ranges from 4,050 to 6,300 feet, and averages around 4,200 feet.

The Management Area includes about one-half of the lands that rely on the U.S. Bureau of Reclamation Klamath Project for irrigation.

Principal water bodies are:

- Klamath River from Link River Dam downstream to Keno Dam, including Lake Ewauna,
- Oregon portions of the Lost River and its tributaries,
- Swan Lake Valley, a naturally closed subbasin northeast of Klamath Falls,
- Floodwaters from the Pine Flats area near Dairy are pumped to the Lost River in the winter.

More detailed maps are available from the U.S. Geological Survey (http://www.usgs.gov) and other sources.

Climate

Temperatures at Klamath Falls average 29ºF in winter and 67ºF in the summer[2]. Average winter minimum throughout the Management Area are 11-20ºF,and average summer maximum are 68-72ºF[3]. Monthly rainfall peaks in December, with a secondary peak in May just prior to the dry summers[1,4]. Average annual precipitation is 14 inches[2], with a low of 10-12 inches near Malin and Merrill and a high of 18-20 inches near Gerber Reservoir[3]. Lake evaporation in the area is 36 to 42 inches annually of which 80 percent occurs from May through October[4]. The growing season varies considerably from year to year, but averages about 120 days from about May 15 to September 15[2].

Geology and Soils

The Management Area lies in the Klamath Ecological Province and is typified by large basins consisting of lakebeds surrounded by extensive ancient lake terraces interspersed with basaltic mountains[3].

Many soils in the Klamath Province are related to ancient sedimentary and fragmented volcanic rock lakeshore terraces and basins[3]. These soils generally have loamy surface layers and loamy to clayey subsoils. The surface is often stony or gravelly and hard unbroken ground may be present. These features are important to irrigated cropland agriculture on sloping lands. Many rangelands are typified by basalt stones and outcrops on the surface, especially on upland slopes and plateaus. Associated soils commonly are shallow over clayey subsoils. These soils readily erode if herbaceous cover is depleted. Stones exposed by erosion, can form a stone pavement that seriously impedes re-establishment of forage plants.

Bottomlands, low terraces, and floodplains are dominated by moderately deep or very deep, moderately well-drained to very poorly drained soils[4]. These soils have slopes of 0 to 2 percent, are sometimes subject to flooding, and all have a high water table. Benches, terraces, and low hills are dominated by shallow to very deep, excessively drained and well-drained soils. Slopes range from 0 to 35 percent, and land is mostly used for irrigated crops. Mountainous areas are dominated by shallow to very deep, well-drained soils derived from tuff and basalt. Rock outcrops are common. Slopes range from 1 percent to 60 percent, and land generally is used for timber, range, and wildlife habitat.

High concentrations of phosphorus may enter Management Area streams via two natural soil pathways. Soils naturally high in phosphorus have been documented in the Wood River Valley upstream of the Management Area[5]. In the Management Area, mapping by the Oregon Department of Geology has shown a high percentage of basaltic andesites (volcanic rock) as the surface rocks in and near Langell Valley[6]. These basaltic andesites have higher phosphorus percentages ($P_2 0_5$ = 0.52-0.84 mg/L) than are typical in most volcanic terrains.

Hydrology

The Management Area consists of a modified hydrologic system. A large Bureau of Reclamation agricultural project known as the Klamath Project reconstructed the hydrology of this basin through a complex system of pumps and canals. The water from the Lost River is reused many times by the different users, mainly agriculture and wildlife refuges.

The Lost River begins with California tributaries to Clear Lake, a large shallow reservoir[1]. Upon leaving Clear Lake, the Lost River enters Oregon and flows through Langell Valley. Miller Creek flows into the Lost River in Langell Valley; Miller Creek's flows are regulated at Gerber Reservoir. Near Bonanza, the river turns west; large springs in this area contribute substantial inflow (more than 35,000 acre-feet per season) to the shallow, sluggish stream with a gradient of < 1 foot/mile[7]. Upon flowing through Olene Gap, 10 miles east of Klamath Falls, the river turns southeast and flows along the base of Stukel Mountain. It re-enters California near Merrill, Oregon, and flows through a series of canals to provide irrigation water to the Tule lake area[2]. It floods and is retained in two National Wildlife Refuges (NWRs) (Tule and Lower Klamath lakes) before re-entering Oregon and flowing to the Klamath River via Straits Drain.

The Lost River historically ended in Tule Lake in California and did not flow to the Klamath River; Tule Lake and Lower Klamath Lake were not connected[8]. The Klamath Project connected Tule and Lower Klamath lakes via a tunnel through Sheepy Ridge through which water is now pumped.

The US Geological Survey and the Oregon Water Resources Department cooperated in the Upper Klamath Basin Groundwater Study http://or.water.usgs.gov/projs_dir/or180/. This study characterizes and quantifies the groundwater system in 8,000 square miles of California and Oregon. The results help agencies and water users evaluate potential effects of new development on existing groundwater users and help identify areas where additional groundwater development can occur without adversely affecting streamflow.

Historical

Tule Lake was a large natural sump with no surface outlet, which at times had a surface covering 90,000 acres[1]. During periods of high runoff, flows from Lost River would raise Tule Lake to its highest elevation. The lake would then slowly recede during the summer and fall due to evaporation. Lower Klamath Lake received its waters when the Klamath River naturally backed up around Keno, raising the water level enough for the Klamath River water to flow through a natural channel (where Straits Drain now exists) to Lower Klamath Lake[9].

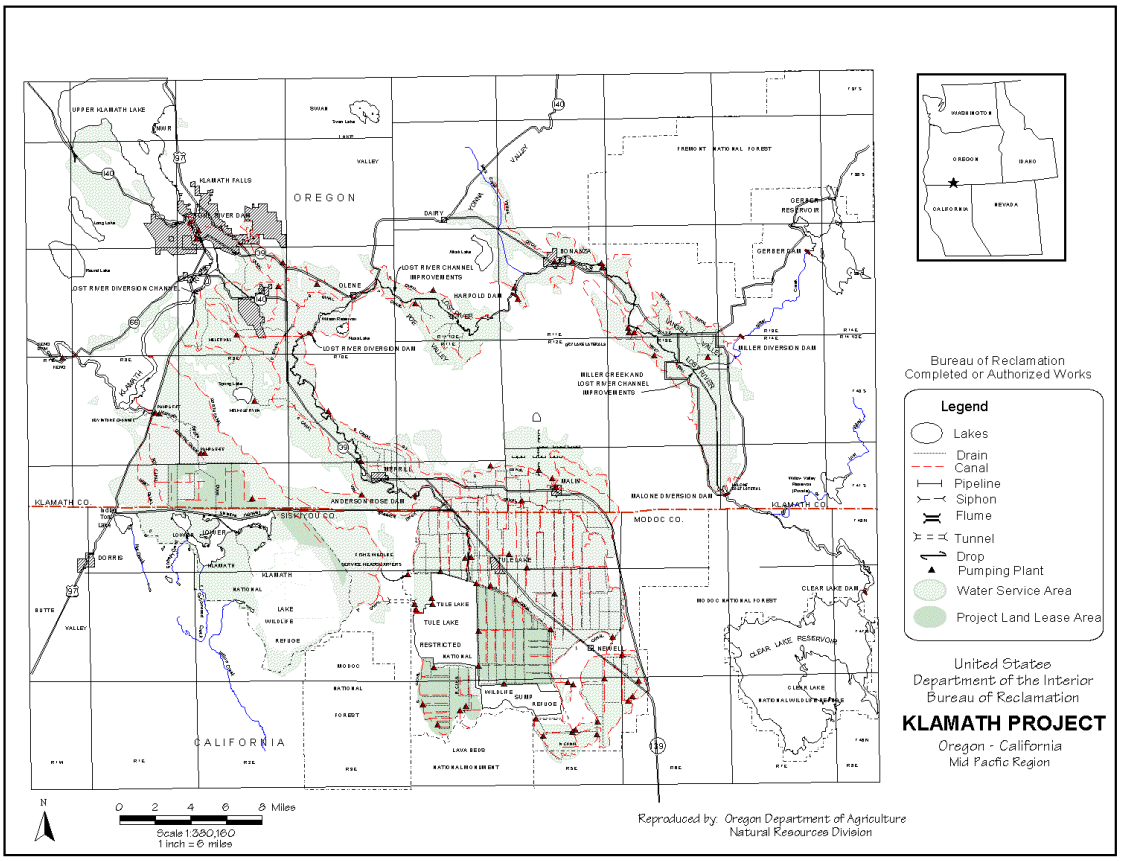
Klamath Project

The Klamath Project, located on the Oregon-California border, was one of the earliest federal reclamation projects[1,2,9] (Figure 2). In early 1905, Oregon and California state legislatures ceded title ("Cession Acts") in Lower Klamath and Tule lakes to the United States for project development under provisions of the Reclamation Act of 1902. Construction was authorized by the Secretary of the Interior on May 15, 1905, for project works to drain and reclaim lakebed lands of the Lower Klamath and Tule lakes; to store waters of the Klamath and Lost rivers; to divert irrigation supplies; and to control flooding of the reclaimed lands. As Tule Lake receded, reclaimed lands were leased by the government for farming until opened to homesteading. To protect developed homestead lands from flooding, areas at lower elevations were designated as sump areas and reserved for flood control and drainage. Some of the marginal sump acreage subject to less frequent flooding was made available for leasing, but retained in federal ownership. The ceded lands were offered by the United States to homesteaders from 1917-1948. Project construction costs were repaid to the U.S. government. The flood control sumps

and the remaining leased lands are now part of Tule Lake NWR in California and the Lower Klamath NWR.

The Bureau of Reclamation manages the Lost River primarily for irrigation and flood control[2]. The Klamath Project irrigates 123,767 acres in Oregon, almost all of which are in the Management Area[4]. Two main sources supply water for the Klamath Project. The natural source consists of the Lost River. The Lost River is controlled by various dams in Oregon. The other source consists of Upper Klamath Lake and the Klamath River, which are introduced artificially into the Lost River through the Lost River Diversion Canal. Water can flow both ways in the nearly eight-mile long canal, allowing excess water from Lost River to flow to the Klamath River during periods of high flow and providing water from Klamath River to Lost River when irrigation demand is high. The A-Canal diverts water from Upper Klamath Lake a short distance above Link River Dam. This allows Klamath Lake water to enter the Lost River at several locations, the farthest upstream being approximately 2 miles below Harpold Dam. Upstream of that point, irrigation water is supplied exclusively by Clear Lake and Gerber Reservoir. Malone Dam and the Miller Creek Diversion Dam (below Gerber Reservoir) divert water into peripheral canals that irrigate approximately 18,000 acres of pasture and cropland. Langell Valley, historically a complex of wetlands, was drained via the Lost River Improvement Channel in 1949. The channelized portion of the Lost River below Malone Reservoir functions as drainage, flood control, and water delivery to the Langell Valley Irrigation District river pumps and the Horsefly Irrigation District pumping plants near Bonanza.

Figure 2.3 Klamath Project



Between 1951 and 1967, Klamath Project lands in the Management Area received about 368,000 acre-feet per year[1]. Roughly 266,000 acre-feet (73 percent of the total Klamath Project

water supply) were diverted annually from Upper Klamath Lake and the Klamath River, primarily through the A-Canal. The amount of water diverted varies every year, depending on seasonal flows and rainfall, and is a small percentage of the average 1,154,000 acre-feet of Klamath River water that annually flows over the Link River Dam[10]. About 20,000 ac-ft are diverted annually from the Klamath River via the Lost River Diversion Canal. Clear Lake, Gerber Reservoir, and Bonanza-Big Springs each contribute 35,000-38,000 acre-feet annually to the Project[1].

The average annual efficiency across to the Klamath Project is 92 percent[11]. This efficiency allows a high percentage of the diverted water to be used for irrigation and not lost through conveyance (percolation, evaporation) in canal infrastructure. An effective sophisticated seasonal pattern of water use has evolved in the Klamath Project. Early in the irrigation season water is distributed to meet immediate irrigation requirements and to replenish soil moisture throughout the Project area. The stored soil moisture allows the Project to meet peak consumptive use demands even when these demands exceed the Projects' capacity to divert and deliver surface water. Tailwater is reused multiple times and therefore is vital for maintaining the high irrigation efficiency.

Klamath Basin lakes evaporate 3.5 acre-feet of water annually[12]. This is greater than the 2.5 acre-feet consumed by Klamath Project crops.

The Klamath Drainage District serves more than 27,000 acres that drain into the Straits Drain[13]. An average of 2.27 acre-feet per acre is diverted annually from the Klamath River. Some water is reused within the district with the assistance of tailwater recovery pumps, and an average of 43,430 acre-feet is returned to the Straits Drain annually.

Historical summer streamflows on the Klamath River at Link River Dam range from 200-1,100 cubic feet per second (cfs[4]). In addition, two power plants along the Link River have 'power claims' established prior to 1905 that amount to 355 cfs[1]. Average annual stream flow of the Lost River at Malone Diversion Dam is 33,960 acre-feet, and 174,830 acre-feet at Harpold Reservoir[4].

Geothermal Activity

Many hot springs are located in the river and in aquifers near the river[15]. Hundreds of warmwater wells are present with temperatures ranging from 68ºF to 104ºF. Some springs with temperatures exceeding 140ºF are found near Olene Gap, the northeastern part of Klamath Falls, and the southwest flank of the Klamath Hills[15]; temperatures of 199ºF have been recorded on the east flank of the Klamath Hills[14]. The hot waters are located near, and are presumably related to, major geologic fault and fracture zones. Additional undeveloped geothermal resources are known to exist in the region; numerous studies have been conducted and reports are available.

Geothermal activity can increase water temperatures locally, but its effect in the Management Area on a larger scale is unknown.

Land Use

The Management Area is characterized by rural lands. More than 60 percent (509,000 acres) is privately owned[16]. The rest is managed primarily by the U.S. Fish and Wildlife Service, BLM, and the U.S. Forest Service.

Farm and Ranch Lands

Agriculture is a significant land use in Klamath County. Klamath County's gross farm and ranch sales approximated $192 million in 2017[19]. Crops accounted for approximately $101 million. Livestock, including primarily beef cattle, horses, and $36 million from dairies, contribute the rest. With an economic multiplier of 2.0, each dollar of agricultural income in the county generated $2 million of economic activity locally, thus contributing almost $400 million in 2017. The Management Area includes a significant portion of the crop production in Klamath County. Crops include alfalfa, potatoes, sugar beets, garlic, onions, strawberry plantlets, mint, field peas, small grains, pasture, and range lands (primarily used for cattle production). The Management Area also includes Klamath County's dairies.

The irrigation season extends year-round, but is predominantly March through October[2]. The first water rights for irrigation were claimed in 1870, for lands in Swan Lake Valley and in Langell Valley along the Lost River[4]. Water rights have been adjudicated for Langell Valley and much of Poe Valley, whose water comes solely from Gerber Reservoir and Clear Lake, but water rights associated with Klamath River water currently are being adjudicated.

Approximately 70,000 acres of agricultural lands upstream of the Management Area (in the Upper Klamath Lake watershed) have been converted to wetlands or short-term water storage sites.

Sage-Steppe Ecosystem

Limited forests exist in the Management Area, with most of the rangeland/woodlands consisting of juniper stands[4] in a sage-steppe ecosystem. The site specific management of these ecosystems is critical to the success of the Area Plan. The sage-steppe ecosystem is a type of shrub-steppe, a grassland characterized by the presence of shrubs, and usually dominated by sagebrush.[1] This ecosystem is found in the Intermountain West in the United States[2] and in the Lost River Management Area. These areas are used primarily for range and wildlife habitat.

Western juniper have expanded rapidly in the sage-steppe ecosystem of the Lost River Management Area. Juniper were once naturally restricted to rocky ridges and cliffs where there was little grass to fuel fires. Juniper expansion is largely a result of fire suppression policies, although land management trends have also accelerated its expansion. Although western juniper is a native plant, the expansion of the western juniper into rangelands is a primary watershed health concern.

Juniper expansion is changing vegetation communities and reducing forage availability for livestock and wildlife, in addition to increasing erosion potential. Increased soil erosion can contribute nutrients, including phosphorus, to streams[14]. Juniper are known for high water consumption and aggressive competition for forage species[12,17,18]. Heavy infestations diminish water recharge to streams and groundwater. Juniper crowns intercept more than half of the annual precipitation (reduced capture), and juniper transpires water year-round compared to seasonal transpiration of other vegetation (reduced storage). Juniper woodlands have up to 10 times the erosion rate of sagebrush-grass ecotypes.

Juniper is recognized as valuable habitat for some wildlife species. So, Oregon's commitment to water quality must include effective control of juniper expansion.

National Wildlife Refuges

The US Fish and Wildlife Service manages a system of NWRs in the Klamath Basin primarily for waterfowl habitat; the wide and shallow lakes are important stops for migratory waterfowl on the

Pacific Flyway. Bear Valley NWR and about 7,000 acres of Lower Klamath NWR are in the Management Area. Clear Lake NWR is in California at the headwaters of the Lost River. Upper Klamath and Klamath Marsh NWRs are upstream of the Management Area via the Klamath River. Most of Lower Klamath NWR (43,000 acres) and all of Tule Lake NWR (37,000 acres) are in California; the Lost River floods and flows through them and exits into Oregon via Straits Drain. Three of these Klamath Basin refuges (Clear Lake, Tule Lake, and Lower Klamath) are within the Klamath Project, and the Bureau of Reclamation manages some of these waters for flood control and irrigation while the Fish and Wildlife Service manages for fish and wildlife. All of these areas, whether in the Management Area or not, contribute to water quality concerns in the Management Area.

HISTORICAL PERSPECTIVE

Sources: 1999-2000 interviews with Barney Hoyt, Mary Taylor, Ann Fairclo, George Stevenson, Taylor High, Van Landrum (1924-2002), Alvin Cheyne, Walter Smith, Ron McVay, Tag Howland, Louis Randall, Earl Miller, Marilyn Livingston, and Margaret Cheyne.

Of the people interviewed, the earliest memories go back to 1925 with many families homesteading the area as early as 1885. It was unanimous amongst all interviewees that the water in the Lost River was always “green” with algae. Most people could remember swimming in the river at some point in their childhood but had to bathe immediately afterward to remove the algae.

Several species of fish were remembered: suckers, catfish, chubs, sunfish, perch and occasionally a trout or bass was caught. Many people stated that during the early part of the 1900s, it was very unusual to see a deer. There is a story (recorded by Peter Skene Ogden) of 50 experienced hunters nearly starving to death in the Klamath Basin on one of their expeditions. They reportedly had to eat their horses to stay alive and said it had not been worth the effort it took to get here. Most people interviewed remembered a wide variety of animals: beaver, otter, muskrat, quail, pheasant, deer, coyotes, cougars, bobcats, and antelope. There are documented claims of six cougars killed in one day. Wolves were present and believed to have been a factor in the lack of game.

It was said repeatedly that the Lost River flooded nearly every year and would be intermittent some years during the summer months until the Wilson Reservoir Dam was built in 1911.

Crops were more limited than today. The primary crops grown were grain, hay (mostly meadow), pasture, potatoes, and dry land rye[20]. John Applegate, an early explorer, stated in one of his reports that potatoes were grown commercially prior to 1900. There were cattle and sheep (several thousand sheep at one time) and most people had several milk cows.

There are many hot springs in the Lost River and surrounding area. People used to scald hogs at Olene Gap. The water was believed to have been around 150ºF. Bathhouses were located throughout the Lost River subbasin on the hot springs. Walt Smith heats his home from one of the hot springs near the river and it is 145ºF. The hot spring at the old bathhouse near Cheese Factory Road is 150ºF.

Water from Klamath Lake enters the Management Area via the Klamath River. The water quality of Klamath Lake was always bad. Applegate reported having to travel during the cool part of the day and having to wear masks or scarves to help eliminate the odor. In 1855, Abbot journeyed to Cove Point; his journal stated that the water was brown and bitter, and animals would not

drink it. Fremont reported that the water in Klamath Lake at Rattlesnake Point was too putrid to water horses.

2.4 Agricultural Water Quality

2.4.1 Water Quality Issues

2.4.1.1 Beneficial Uses

As described by DEQ, beneficial uses for the Management Area include domestic water, irrigation, livestock watering, fisheries, recreation, and aesthetics.

2.4.1.2 WQ Parameters and 303(d) list

Oregon's water quality standards are found at https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1458.

According to the 2018/20 Integrated Report, temperature and nutrient-related parameters are of greatest concern (https://www.oregon.gov/deq/wq/Pages/epaApprovedIR.aspx) (Table 2.4.1.2). See Appendix B for descriptions of parameters. Total dissolved gas is usually related to reservoir operations, not agriculture. The source of arsenic is unknown.

Table 2.4.1.2. Parameters of concern in the Management Area.

Assessment Unit Name	Existing TMDL	Needs TMDL
Lost River Diversion Channel: Lost River to Klamath River	Temperature; Chlorophyll-a; Dissolved Oxygen	None
Miller Creek: below Gerber Dam	Temperature	None
Lost River: Diversion Channel to Tule Lake	Chlorophyll-a; Dissolved Oxygen; Temperature	Arsenic; Total Dissolved Gas
Lost River: Miller Creek to Yonna Ditch	Ammonia; Chlorophyll-a; Dissolved Oxygen; Temperature	Total Dissolved Gas
Link River: Link River Dam to Lake Ewuana	Chlorophyll-a; pH; Dissolved Oxygen	Arsenic
Klamath River: Keno Dam to Lost River Diversion	Chlorophyll-a; Dissolved Oxygen; Harmful Algal Blooms	Arsenic
Lost River: Yonna Ditch to Olene Hot Springs	pH; Ammonia; Dissolved Oxygen; Temperature	Total Dissolved Gas
Lost River: Olene Hot Springs to Lost River Pool	Ammonia; Temperature	None
Lost River: Malone Dam to Miller Creek	Chlorophyll-a; Temperature	Total Dissolved Gas
Klamath River: Lost River Diversion to Lake Ewuana	Harmful Algal Blooms; Chlorophyll-a; Dissolved Oxygen	None
Malone Pool	None	Total Dissolved Gas
Lost River Pool	None	Total Dissolved Gas
HUC12 Name: Keno Reservoir-Klamath River	Temperature; Dissolved Oxygen; Chlorophyll-a	None
HUC12 Name: East Branch Lost River	Temperature	None
HUC12 Name: Rock Creek	Temperature	Arsenic; Total Dissolved gas
HUC12 Name: Klamath Strait Drain	Chlorophyll-a; Dissolved Oxygen; Temperature	Total Dissolved gas
HUC12 Name: Lower Buck Creek-Lost River	Temperature	Arsenic
HUC12 Name: Mallory Reservoir	Temperature	Arsenic
HUC12 Name: Antelope Creek	Temperature	Total Dissolved Gas
HUC12 Name: Long Branch Creek	Temperature	None
HUC12 Name: Barnes Valley Creek	Temperature	Total Dissolved Gas

HUC12 Name: Weed Valley-North Fork Willow Creek	Temperature	None

Based on the available data, the following general observations have been noted:

- Water quality at low elevation sites of the Lost River is generally worse than water quality at high elevation sites.
- Water quality in the Lost River deteriorates within the NWRs. The NWRs are located on a reach of the Lost River that flows from Oregon into California and then back to Oregon. This California reach of the river is outside the jurisdiction of this Area Plan.
- The amount of dissolved oxygen in the Klamath River decreases as the river moves downstream from Link River to Keno Dam. Dissolved oxygen levels are very low at times during the summer. Possible sources include very large loads of algae discharging from Upper Klamath Lake and the slow, meandering nature of the river. At times, dissolved oxygen in the Straights Drain is higher than in the Klamath River where it enters.

Low dissolved oxygen, high pH, ammonia toxicity, and excessive chlorophyll-*a* generally result from excessive plant growth, which is stimulated by high nutrient concentrations in the water. Higher temperatures also stimulate plant growth. These parameters are related to the designated benefical use (fish habitat).

2.4.1.3 TMDLs and Agricultural Load Allocations

The Upper Klamath and Lost River Subbasins Nutrient and Temperature TMDLs include the Klamath River from Link River Dam to the California state line and the Lost River Subbasin (www.oregon.gov/deq/wq/Documents/tmdlUpKLosttempTMDL.pdf and www.oregon.gov/deq/wq/tmdls/Pages/uklrNutrient.aspx). They address temperature, dissolved oxygen, pH, chlorophyll-a, and ammonia toxicity. Although approved by EPA in 2019, these TMDLs have been challenged and are being heard in court with no exact date for conclusion; concerns are related to the role of irrigation districts.

Pollutants responsible for water quality impairments include phosphorus, nitrogen, biochemical oxygen demand, and temperature. Because these TMDLs were developed by Oregon as part of a comprehensive multi-state analysis of pollutant loadings to the Klamath River, they were also designed to meet California water quality standards at the state line.

The TMDLs indicate that reductions in phosphorus, nitrogen, biochemical oxygen demand, and heat loading are necessary to attain water quality standards in Oregon waterbodies and California's water quality standards at the state line.

Temperature

Human caused temperature increases are associated with excessive thermal inputs of solar radiation due to the removal or reduction in streamside vegetation. Reservoirs, irrigation districts and dam operations are considered nonpoint sources that influence the quantity and timing of heat delivery to down stream river reaches. Nonpoint source load allocations use effective shade as a surrogate measure of reduced solar radiation.

The temperature allocations for agricultural sources discharging to the Klamath River are no additional thermal input (0.00 °C) above ambient river temperatures. The allocation for all other nonpoint sources is attainment of percent effective shade targets. Percent effective shade is the amount of shade that reaches the stream. For example, 30 percent effective shade means that shade has kept 30 percent of the sunshine on an August day from reaching the stream.

Historic vegetation is not required along streams. Native trees, which may have historically lined Management Area streams, may not be desirable in some areas. Smaller native vegetation, such as willow, sedges, and cattails may provide sufficient shade along smaller streams to attain the shade targets. Also, there will be some sites where woody vegetation will not establish at all.

These targets may not be appropriate for all areas. For instance, streams at road crossings and road right-of-ways may not be shaded for visibility/safety reasons. Site capability will restrict or enhance the species, structure, and density of vegetation communities expected on Management Area streambanks.

Nutrients

TMDL nonpoint source targets for nutrients in the Management Area are set for two locations in the Managemet Area (Table 2.4.1.3). Most LAC members consider these targets to be unachievable.

Table 2.4.1.3. Nonpoint source load allocations and water quality targets (from Table 2-10 in the TMDL cited above)

	Total Phosphorus		**Total Nitrogen**	
	mg/L	% reduction	mg/L	% reduction
Lost River diversion	0.029	89	0.37	83
Klamath Straights Drain	0.035	92	0.45	87

Lands used for agriculture can contribute nutrients in a variety of ways. Soil erosion can carry nutrients with it, particularly phosphorus. Animal manure is another potential source of nutrients and particulate organic matter. Finally, fertilizers run off can contribute nutrients to the stream. Riparian buffers, where they exist, help to intercept and retain both sediments and nutrients.

Numerous natural processes also add nutrients to the river: leaching from the soil, degradation of plant material, and fish returning to spawn from the ocean. In the Klamath Basin, springs can contribute significant amounts of phosphorus because of the volcanic origins of the rock and soil.

ODA was named as a Designated Management Agency for the TMDLs, and this Area Plan serves as agriculture's implementation plan for the TMDLs. This Area Plan is expected to fulfill DEQ's expectations for implementing the Lost River Subbasin TMDLs by addressing the loads allocated to agriculture. ODA and DEQ continue to work together through this process to develop planning efforts that help to address water quality concerns.

2.4.1.4 Drinking Water

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

Thirty-nine active public drinking water systems in the Management Area use groundwater to serve approximately 47,800 persons. Most of this water is sourced from 14 wells.

Six public water systems had recent alerts for nitrates and/or bacteria. All locations were either parks, small businesses, or a mobile home court. DEQ does not know whether the sources are

related to agriculture, but the locations suggest that septic systems may be more likely than agriculture as a source of the pollutants.

Soils in the largely agricultural portion of the Management Area have a moderately high to high potential for leaching nitrate to groundwater. Nitrate from fertilizers, livestock manure, and septic systems can readily penetrate to the aquifers used for drinking water when leaching potential is high or very high, and bacteria removal through soil filtration can be less effective in sandy soils.

Agricultural land uses (e.g., irrigated crops, pasture, and livestock) are present near many of the public water system wells and springs in the Management Area. Agricultural areas south of Upper Klamath Lake and Klamath Falls have the majority of both intensive agriculture area and human population, providing the contributing areas for numerous streams (many used for private domestic water supply) in the Management Area.

Oregon Health Authority rated some of the public wells in the Management Area for contaminant susceptibility. The majority of evaluated wells rate as high susceptibility. The nitrate and other contamination issues described above and the ready movement of nitrogen into aquifers in the area verify this susceptibility. Measures to reduce leachable nitrate in soils would reduce risk to groundwater sources of drinking water.

The Domestic Well Testing Act database (real estate transaction testing data) for 1989-2018 indicates that out of 701 private wells results, 31 had nitrate concentrations above 7 mg/L; half of these exceeded 10 mg/L, the drinking water standard.

Agricultural landowners should always work to keep bacteria and nitrates from entering ground and surface water.

2.4.2 Sources of Impairment

Sources of impairment include impaired water delivered from Upper Klamath Lake; impaired water delivered from the Lost River Diversion Chanel from the Upper Klamath River; water diverted from Upper Klamath River from the ADY and North Canals; land disturbance; and land uses including agriculture, forestry, urban (including field application of treated wastewater), illegal cannabis grows (reduced water flows and chemicals in wastewater), and rural residential. Agricultural contributions include excessive livestock use of riparian areas, loss of streamside vegetation by cropping up to streams, and irrigation runoff containing sediment, nutrients, and bacteria. Lack of summer streamflow also contributes to the impairment of water quality.

Although the sources have been identified, pinpointing the numeric contributions from nonpoint sources is difficult due to the complex hydrological system.

The LAC recognizes that water quality from Upper Klamath Lake, river operations by the Bureau of Reclamation, wildlife refuges, urban areas, irrigation districts, and activities in California affect water quality. These issues are outside the responsibilities and control of private landowners in the Management Area.

2.5 Regulatory and Voluntary Measures

To achieve clean water, an effective strategy must reduce transport of pollutants to surface water and infiltration of pollutants into ground water. The primary strategies to minimize pollution from agricultural and rural lands lie in reducing erosion, pollutants in runoff, and infiltration of pollutants to groundwater. Pollution is minimized through a combination of landowner education, land treatment, and implementation of appropriate management practices.

Voluntary efforts are the primary means to prevent and control agricultural sources of pollution. However, regulatory measures are included as an implementation strategy. ODA pursues enforcement to gain compliance with Area Rules only when reasonable attempts at a voluntary solution have failed. (See below.)

Prevention and control of agricultural pollution is encouraged in a cooperative spirit through the voluntary efforts of landowners, aided by information and technical and financial assistance from the Klamath SWCD; Klamath Watershed Partnership; local, state, and federal agencies, and others.

Education plays a critical role in the success of this Area Plan. The NRCS and SWCD work together to provide farmers and ranchers in the Management Area with information about the goals and objectives of the Area Plan and requirements of the Area Rules.

Landowners have flexibility in choosing management approaches and practices to address water quality issues on their lands. (Area Rules cannot prohibit specific practices.) Landowners may choose to develop management systems to address problems on their own, or they may choose to develop a voluntary conservation plan to address applicable resource issues. Landowners may seek planning assistance from the Klamath SWCD, Klamath Watershed Partnership, NRCS, USFWS Partners for Fish and Wildlife Program, and any other agency, or a consultant.

2.5.1 Area Rules as Implementation Strategy

In addition to voluntary strategies, Area Rules are included as an implementation strategy. Area Rules are developed and adopted to achieve water quality standards and to prevent and control water pollution. Area Rules that describe conditions on the land are based on a scientific relationship between the land condition and specific water quality problems. For example, Area Rule (3)(a) addresses those characteristics of riparian areas that provide water temperature moderation and filtration of potential pollutants. Land condition-based Area Rules provide landowners a straightforward way to determine if their management is protective of water quality. Landowners are not required to monitor water quality to determine compliance with land condition-based Area Rules. Landowners that are in compliance with the Area Rules are not held responsible for water quality conditions that the Rule was designed to protect.

In addition to the land condition-based rules that address upland erosion, streamside areas, and livestock waste, a general waste management rule, Area Rule (5), is included. Rule (5) cites a long-standing law that prohibits causing pollution or allowing waste to enter public waters. The purpose of including reference to this existing law is to clarify that ODA would have direct enforcement authority under the rules, and would have the additional authority, when necessary, to levy civil penalties for flagrant* violations. ODA recognizes and accepts that some level of erosion and run-off are natural or unavoidable with agricultural operations. Rule (5) is used when agricultural activities cause conditions that significantly limit attainment of water

quality standards or threaten beneficial uses of the water. If additional land management activities are necessary to address water quality problems, ODA does not initiate enforcement actions, except for flagrant violations, if the landowner undertakes voluntary remedial action consistent with this Plan. This enforcement policy is consistent with existing rules in OAR 603-090-0000(4)(e).

The following Area Rules provide for resolution of complaints and possible water quality problems.

Complaints and Investigations (OAR 603-095-3960)

(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 603-095-3960(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 603-095-3960(4), "person" does not include any local, state or federal agency.

(6) Notwithstanding OAR 603-095-3960, 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 Area Rules

The Area Rules are enforceable by ODA and are cited here in bold text in boxes for your information. The Area Plan is not enforceable. The Area Plan and Rules complement each other. The Area Plan provides an overall proactive strategy for meeting the Plan's water quality objectives and for complying with the Area Rules.

The appropriate SWCD is informed by ODA of compliance actions.

Area Rules may change over time as information becomes available on land conditions and water quality.

Oregon Administrative Rules 603-095-3940

Requirements

(1) (a) A landowner is responsible for only those conditions resulting from activities controlled by the landowner. A landowner is not responsible for conditions resulting from activities by landowners on other lands. A landowner is not responsible for conditions that are natural, could not have been reasonably anticipated, or that result from unusual weather events or other exceptional circumstances. Landowners will not be required to implement practices or management systems that are not practical and effective for their operation. Where a prohibited condition results from the requirement(s) of another government entity, ODA will work with the other government entity and the landowner to resolve the condition. As long as the landowner is cooperating with ODA in resolving the condition, ODA will not assess a civil penalty against the landowner for that condition. ODA will consider costs, benefits, and economic feasibility when working with a landowner to resolve a compliance issue. ODA will seek input from the local management agency prior to requiring a schedule of corrective practices.

(b) Unless otherwise restricted by state or federal law, conditions resulting from limited duration activities are exempt.

The following Area Rules 603-095-3940(2) through (5) establish requirements where there are agricultural management or soil-disturbing activities.

2.5.2.1 Sheet, Rill, and Wind Erosion *(Parameter addressed: nutrients)*

Definitions:

Wind erosion: The actual movement of soil by wind to such a degree that the top soil is being noticeably destroyed or conditions which will result in a noticeable movement of the topsoil by wind action. (ORS 568.810 (2))

Sheet erosion: Removal of a fairly uniform layer of soil from the land surface by runoff water. (OAR 603-95-0010(15))

Rill erosion: Process in which numerous small channels only several inches deep are formed and which occurs mainly on recently disturbed soils. The small channels formed by rill erosion would be obliterated by normal smoothing or tillage operations. (OAR 603-95-0010(14))

“T”: Maximum average annual amount of soil loss from erosion, expressed in tons per acre per year, that is allowable on a particular soil. This represents the tons of soil (related to the specific soil series) that can be lost through erosion annually without causing significant degradation of the soil or potential for crop production. “T” values for the Management Area are listed in the 1971 Klamath County Soil Survey.

Requirement (OAR 603-095-3940):

(2) (a) Combined sheet, rill, and wind erosion of soil, averaged through a crop rotation period, must be less than or equal to T.

(b) If an alternative standard is needed for certain soils, ODA and the Klamath SWCD, acting as the Local Management Agency, will request an alternative recommendation from the NRCS State Conservationist for an appropriate erosion control standard.

2.5.2.2 Streamside Areas *(Parameters addressed: bacteria, nutrients, temperature)*

Role of Streamside Vegetation to Prevent and Control Pollution

Across Oregon, the Ag Water Quality Program emphasizes streamside vegetation protection and enhancement where needed to prevent and control agricultural water pollution. There are several reasons for this emphasis.

- Streamside vegetation improves water quality for multiple parameters, including temperature, sediment, bacteria, nutrients, toxics, and pesticides.
- The presence of healthy streamside vegetation indicates that agriculture is addressing water quality concerns.
- Landowners have the authority and ability to take steps to improve streamside vegetation.
- Streamside vegetation provides additional functions, including fish and wildlife habitat.
- Streamside vegetation keeps water cool and banks stable.

Adequate streamside vegetation provides three primary water quality functions (Council for Agricultural Science and Technology, 2012; National Council for Air and Stream Improvement, 2000; State of Oregon, 2000). Local agricultural water quality regulations require that agricultural activities provide these functions:

- Stream temperature moderation (vegetation blocks direct solar radiation).
- Reduced streambank erosion (roots stabilize banks and dissipate Stream Energy).
- Filtration of pollutants (e.g., bacteria, nutrients, toxics, sediment) from overland flows.

Adequate streamside vegetation also provides additional water quality functions (see references listed in paragraph above):

- Water storage that provides cooler and longer duration late season flows.
- Sediment trapping that builds streambanks and floodplains.
- Infiltration of water into the soil profile.
- Narrowing and deepening of channels.
- Biological uptake of sediment, organic material, nutrients, and pesticides.
- Maintenance of streamside integrity during high flow storm events.

Requirement (OAR 603-095-3940):

(3) (a) By December 31, 2005, agricultural activities must allow the establishment or improvement of vegetation to provide bank stability and shading of natural streams, consistent with the vegetative capability of the site. Evaluation of vegetation will consider conditions for a stream reach in contiguous ownership.
(b) Except as provided in (a), grazing, weed control, and other common agricultural activities are allowed in riparian areas.
(c) Channel maintenance provided or under ORS 196.600 to 196.905 (Removal Fill laws) is not subject to 603-095-3940(4)(a).

As a general guideline, landowners should maintain the most effective band or buffer of vegetation along the stream that they can accomodate because of the many corollary benefits to the landowner. Streamside vegetation buffers also absorb manure runoff, reduce streambank erosion, and filter sediment during high flow events, additionally reducing potential phosphorus loading as an indirect benefit.

The LAC recognizes that properly designed water gaps may be an acceptable tool when used in conjunction with appropriate riparian management. Appropriate riparian management can

include fencing and off-stream drinking water. Juniper removal in uplands can also enhance riparian vegetation by increasing the amount of water in the soil available for that vegetation.

Greenline Riparian-Wetland Monitoring is recommended, but not required, for monitoring riparian condition[22]. It is a process developed by the BLM to generate baseline data that describes existing conditions, and it is designed to detect changes in plant community succession.

2.5.2.3 Livestock Waste Management *(Parameters addressed: bacteria, nutrients)*

Requirement (OAR 603-095-3940):

(4) (a) Effective on rule adoption, landowners must prevent movement of animal waste into waters of the state from animal handling or feeding operations that concentrate animal waste.

(b) Waste storage and application shall be done in such a way as to keep from exceeding beneficial use for forage and/or crops.

2.5.2.4 Waste Management *(Parameters addressed: bacteria, nutrients, all wastes)*

Requirement (OAR 603-095-3940):

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

This rule is explained in Chapter 1.4.4.

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Chapter 3: Implementation Strategies

LAC Mission

Protect water quality in the Lost River Subbasin Agricultural Water Quality Management Area, while sustaining the agricultural economy.

Guiding Principles:

- Rely on scientifically credible data and techniques,
- Emphasize maintenance, restoration, education, and monitoring,
- Use common sense to develop cost-effective, practical, flexible, and realistic solutions,
- Maintain a non-threatening, positive atmosphere,
- Recognize natural background water quality, including geothermal input,
- Recognize that proper agricultural practices improve water quality,
- Recognize that economic viability of agriculture is necessary to achieve improvements.

Area Plan Goal

1. Prevent and control water pollution from agricultural activities and achieve applicable water quality standards to protect beneficial uses in the Management Area. However, LAC members do not believe that agriculture is solely responsible for achieving standards and most do not believe that all the standards are achievable.

2. Achieve the following land conditions on agricultural lands throughout the Management Area that contribute to good water quality:
    - Streamside vegetation provides streambank stability, filtration of overland flow, and moderation of solar heating, consistent with site capability.
    - Combined sheet, rill, and wind erosion of soil, averaged through a crop rotation period, is less than or equal to T.
    - Livestock waste is prevented from entering waters of the state.
    - Waste storage and application is carried out in such a way as to keep from exceeding beneficial use for forage and/or crops.
    - Reduced impact of juniper in rangelands on water yield and water quality (soil erosion).
    - Provisions in 468B are not violated:
        - No person shall cause pollution of 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 waters of the state by any means.

This Area Plan focuses on:

- Bacteria
- Nutrients
- Temperature
- Sediment

Reductions in nutrient levels are expected to alleviate the concerns related to low dissolved oxygen, high pH, chlorophyll *a*, ammonia toxicity, and aquatic weeds and algae.

Objectives

1. Acknowledge the beneficial effects of agricultural irrigation and grazing practices on bacteria loads, nutrients, and water temperature, while acknowledging that background water quality is limited due to hot springs, historic channelization, and the volcanic origin of soils.

2. Increase public awareness of water quality concerns beyond the realm of this Area Plan or the responsibility of the private landowner, including:
   - Natural background conditions (geothermal springs, nutrients, algae, low-gradient streams),
   - Fluctuation of flow in the Lost River (Bureau of Reclamation),
   - Commingled waters (Lost River and Klamath River),
   - Interstate waters (Oregon and California),
   - High water temperatures correlated with solar radiation and high ambient temperature,
   - Lack of streambank shade on wide channelized streams and impoundments,
   - Unusual weather,
   - Urban and suburban runoff.

Progress and success of implementation efforts are assessed through compliance with Area Rules and state standards and the measurement of water quality improvement over time.

3.1 Measurable Objectives and Strategic Initiatives

The TMDL nonpoint source targets for temperature are 1) No temperature increase from agricultural discharges, and 2) Attainment of system potential effective shade.

TMDL nonpoint source targets for nutrients are provided in Table 2.4.1.3. Most LAC members consider these targets to be unachievable. However, the LAC agreed to continue making progress toward improving stream temperatures and reducing nutrients.

Scientifically sound monitoring can provide valuable information on how much effect the Area Plan is having, how extensively it is being implemented, and where more efforts are needed. The LAC acknowledges that monitoring is an important, ongoing activity throughout the Management Area. Several assessments are being conducted that will help determine current water quality conditions.

The LAC, ODA, and the Klamath SWCD will evaluate the effectiveness of the Area Plan in improving water quality and riparian conditions. The monitoring program will be revisited upon TMDL establishment to address TMDL goals.

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 in Chapter 3.1. Progress is reported in Chapter 4.1.

ODA is working to establish long-term measurable objectives and associated milestones for each Area Plan in Oregon. Many of these measurable objectives relate to land conditions and primarily are implemented through focused work in small geographic areas. ODA has a long-term goal of developing measurable objectives and monitoring methods at the Management Area scale. As ODA works with state and local partners to determine methods for measuring change in land conditions at this large scale, it will continue to work with SWCDs and LACs to focus on smaller watersheds to define and measure change.

3.1.1 Management Area

Currently, ODA and the Klamath SWCD are using Focus Area and SIA measurable objectives to show progress in this Management Area. These are described below.

3.1.2 Focus Areas

3.1.2.1 Poe Valley Focus Area

The Poe Valley Focus Area in the Lost River Management Area closed in 2017.

3.1.2.2 Upper Lost River Focus Area (started 2017)

The Klamath SWCD's Upper Lost River Focus Area lies within the Gerber Watershed approximately 40 miles east of Klamath Falls. The Focus Area begins at Malone Reservoir at the south end of the Langell Valley and runs north approximately 22 miles and ends at Harpold Dam near the small town of Bonanza. The Focus Area encompasses approximately 7,773 acres of mixed agriculture/farm use, mixed conifer forest, and rural residential. The primary agricultural crops are irrigated alfalfa and cattle production with irrigated pasture. There are 36 miles of perennial streams, 127 miles of seasonal streams, and eight miles of streams categorized as ephemeral. Implemented practices are expected to improve streamside vegetation and reduce pollutants in irrigation return flows to the Lost River.

The Upper Lost River Focus Area was selected based on current needs of agricultural landowners in the Klamath Basin and the opportunities to assist with the allocation of substantial funding available from the NRCS through the National Water Quality Initiative, OWEB, USFWS Partners Program, Bureau of Reclamation (BOR) WaterSmart, and various other partners.

Assessment Methods:

1. Streamside Vegetation: Use of ODA's Streamside Vegetation Assessment (SVA) method to characterize the type of land cover within 35 feet of agricultural streams. The metric is the number of acres and percent of different types of landcover viewed on aerial photographs. Categories are: trees, shrubs, grass, and bare ground (classified by vegetation height and designated as agriculture or not); agricultural infrastructure; and open water.

    2017: Trees + Shrubs + Grass = 61 out of 358 assessed acres.

2. Conversion from wild flood to improved flood or sprinkler irrigation: Count the number of acres in flood irrigation (wild and improved) and sprinkler irrigation, using publicly available satellite imagery, local knowledge, and on-site ground truthing (where available).

    2017: Wild flood = 18,798 out of 39,393 assessed acres

3. Riparian fencing: Calculate the number of streambank miles with riparian fencing using local knowledge, satellite imagery, and on-site ground truthing (where public access is available).

    2017: 8 out of 36 assessed stream miles

4. Livestock water facilities: Count the number of livestock wells/off-stream watering facilities using publicly available satellite imagery, local knowledge, and onsite ground truthing (where available).

    2017: 44 out of 75 assessed sites

Table 3.1.2.2 Measurable Objectives and Associated Milestones: number (percent of total elements measured)

Metric	Milestone (June 30, 2023)	Measurable Objective (Dec 31, 2027)
Streamside veg (Trees + Shrubs + Grass) acres	101 (28%)	148 (41%)
Wild flood acres	18,498 (47.0%)	18,398 (46.7)
Fenced stream miles	13 (36%)	18 (50%)
Livestock water facilities	49 (65%)	55 (73%)

3.1.3 Strategic Implementation Areas (SIA)

There are currently no SIAs in this Management Area. However, one is expected in the Management Area in the next six years. The Klamath SWCD is focusing its energies on two SIAs in the adjacent Klamath Headwaters Area.

3.1.4 Pesticide Stewardship Partnership (PSP)

There are no PSPs in this Management Area.

3.1.5 Groundwater Management Area (GWMA)

There is no GWMA in this Management Area.

3.2 Proposed Activities

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

Table 3.2 Planned Activities for 2022-2023 throughout the Management Area by the Klamath SWCD and conservation partners
(A challenge in the Management Area is that more and more landowners are becoming absentee and are less engaged in the management of their operations.)

Activity	2-year Target	Description
Landowner Engagement		
# events that actively engage landowners (workshops, demonstrations, tours)	10	Outreach through irrigation district websites and other ways to engage landowners
# landowners participating in active events	50	
Technical Assistance (TA)		
# landowners provided with TA (via phone/walk-in/email/site visit)	25	
# site visits	40	
# conservation plans written*	13	
On-the-ground Project Funding		
# funding applications submitted	13	

* 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 ag water quality (weed eradication not for riparian restoration, fuels reduction, alternative energy, rain gardens/harvesting, non-agricultural culvert replacement, and instream habitat enhancement that does not also improve water quality)

Antricipated SWCD projects:

- One OWEB small grant to remove 45 acres of juniper; the application submitted in January 2022.
- Working with NRCS and BOR to fence approximately 2 miles of the Lost River.
- The Bureau of Reclamation will start replacing at least 50 old drain structures along the Lost River beginning in spring 2022. These structures carry field runoff directly into the Lost River and were identified as contributing sediment to the river, but no funding was available at the time for replacement.
- Creating permanent wetland on private property in the Langell Valley, potentially with funding from the USFWS PFW.
- BOR will be tearing out illegal riparian fencing placed within its easement. The SWCD asked BOR to provide the affected landowners with SWCD contact information for potential funding and technical assistance, e.g., mapping new fences either inside or outside BOR easements.

DEQ Special Project: Lost River/Lower Klamath Lake Watershed Stewardship Project

The proposed Lost River/Lower Klamath Lake Watershed Stewardship Support Project supports a recently funded project to conduct a stakeholder assessment and to facilitate development of a charter to guide the planning and implementation of a Lost River/Lower Klamath Lake Watershed Stewardship Plan. Together, these two projects will help address the requirements of the TMDLs; water supply needs for local agricultural operations; and water needs for the Lower Klamath Wildlife Refuge, Upper Klamath Lake, and Klamath River. The comprehensive nature of these two projects is both a challenge and an opportunity to achieve workable solutions for water resource protection and management issues in the Klamath Basin. The proposed Project will focus on logistical activities to support the recently funded Stakeholder Assessment and Stewardship Facilitation Project. The project will also provide analyses of relevant existing environmental data to inform the planning process meetings. Together, the projects will support development and implementation of coordinated watershed stewardship strategies that will directly and indirectly benefit the public through strategic planning for agricultural water conservation and groundwater recharge and enhanced sucker habitat.

3.3 Additional Agricultural Water Quality and Land Condition Monitoring

3.3.1 Water Quality

Natural background water quality is affected by low gradient streams, hot springs, channelization, phosphorus from eroding volcanic bedrock, wetland processes, high waterfowl populations, and other local phenomena. Due to the complex nature of the system, it has been difficult to quantify natural background water quality.

Insufficient data has been collected to determine the geographic extent, magnitude, and source of water quality concerns. The LAC strongly desires to see more extensive analysis of existing data and collection of new data to more precisely determine agriculture's contribution to water quality in this subbasin. This will help the LAC refine and improve the Area Plan in the coming years.

DEQ monitors four sites in the Management Area as part of its ambient monitoring network.

The Klamath Watershed Partnership worked with NRCS, landowners, Klamath County officials, Klamath SWCD, BOR, DEQ, irrigation districts, and others to assess the Upper Lost River Watershed through the National Water Quality Initiative. This included one year of monitoring in 2017.

For results of these additional monitoring activities, see Chapter 4.3.

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 past four years. See Chapter 3.1 for background and assessment methods.

4.1.1 Management Area

The SWCD is relying on showing progress through Focus Areas and SIAs. Although there is currently no SIA in this Management Area (the Klamath SWCD is involved in two SIAs in the adjacent Klamath Headwaters Management Area), an SIA is expected in this Management Area within six years.

4.1.2 Focus Areas

4.1.2.1 Poe Valley Focus Area (closed)

The Poe Valley Focus Area closed in 2017. In 2014, the SWCD shifted focus to the Sprague River Focus Area in the Klamath Headwaters Management Area.

The Klamath SWCD did not complete a pre-assessment or complete conservation measures in this focus area. Therefore, there are no accomplishments to report. The Upper Lost River is the current Focus Area in this Management Area (see below).

4.1.2.2 Upper Lost River Focus Area (started 2017)

Table 4.1.2.2 Upper Lost River Focus Area

Measurable Objectives: See below for December 31, 2027.

Milestones: See below for June 30, 2023.

Current Conditions: See 2021 results below

Progress Toward Measurable Objectives and Milestones
Progress will be determined after the 2023 assessment.

Assessment Results: number (% of total)					
	2019	**2021**	**2023**	**Milestone (2023)**	**Measurable Objective (2027)**
Trees + Shrubs + Grass acres	61 (17)	64 (18)	TBD	101 (28)	148 (41)
Wild flood irrigation acres	18,798 (48)	18,798 (48)	TBD	18,498 (47)	18,398 (46.7)
Fenced stream miles	8 (22)	9 (25)	TBD	13 (36)	18 (50)
Livestock water facilities	44 (59	45 (60)	TBD	49 (65)	55 (73)

Activities and Accomplishments	
Community and Landowner Engagement	
# events that actively engage landowners	1
# landowners participating in active events	12
Technical Assistance (TA)	
# landowners provided with TA	60
# site visits	22
# conservation plans written	Projects were completed, but didn't meet ODA's definition of a conservation plan
Ag Water Quality Practices Implemented in the Focus Area	
Juniper removal (acres)	2,240

Livestock wells (nose pump)	2
Fencing (feet)	5,050
Ditch piping (feet)	1,620
Adaptive Management Discussion	
Currently planned projects (NRCS): Wild flood to improved flood (gated pipe), livestock wells (3), plantings, juniper removal (600 acres), riparian fencing (12,650 feet). These projects are in planning with funding set aside through National Water Quality Initiative and will be mostly completed in 2022.	

4.1.3 Strategic Implementation Area(s)

There is no SIA in this Management Area.

4.1.4 Pesticide Stewardship Partnership

There is no PSP in this Management Area.

4.1.5 Groundwater Management Area

There is no GWMA in this Management Area.

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.

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

Table 4.2a Activities conducted in 2018-2021 throughout the Management Area by the Klamath SWCD and Klamath Watershed Partnership The COVID-19 pandemic limited the ability to reach out to landowners.

Activity	4-year results	Description
Landowner Engagement		
# events that actively engage landowners (workshops, demonstrations, tours)	3	Grazing in riparian areas; Langell Valley projects and project planning
# landowners participating in active events		Not reported to ODA
Technical Assistance (TA)		
# landowners provided with TA (via phone/ walk-in/email/site visit	100	
# site visits	29	Fencing
# conservation plans written*	1	Fencing
On-the-ground Project Funding		
# funding applications submitted	8	Fencing
# funding applications awarded	7	Fencing
* Definition: any written management plan to address agricultural water quality. Can include NRCS-level plans or simpler plans. Can include: nutrients, soil health, water quality, irrigation, grazing, riparian planting, forest thinning to improve upland pastures to reduce livestock pressure on riparian areas, etc. Cannot include projects with no or weak connection to ag water quality (weed eradication that is not for riparian restoration, fuels reduction, alternative energy, non-ag rain gardens/rain harvesting, non-ag culvert replacement, and instream habitat enhancement that does not also improve water quality)		

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

Table 4.2b Implementation funding (cash and in-kind) for projects on agricultural lands reported 1997-2019
(OWRI data include most, but not all projects, implemented in the Management Area.)

Landowners	OWEB	DEQ	NRCS*	Irrigation Districts	Klamath SWCD	Energy Trust	All other sources**	TOTAL
$307,309	660,867	0	17,337	143,689	93,295	65,000	13,879	1,301,376

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

Table 4.2c Miles and acres treated on agricultural lands reported 1997-2019
(OWRI data include most, but not all projects, implemented in the Management Area.)

Activity Type*	Miles	Acres	Count**	Activity Description
Upland		6,239		Mostly irrigation projects; some juniper clearing
Road	0		0	
Riparian	5	81		Plantings and weed control
Wetland		80		
Instream Habitat	0			
Instream Flow	0		0 cfs	
Fish Passage	3		2	
TOTAL	**8**	**6,401**	**2**	

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

4.3 Additional Agricultural Water Quality and Land Condition Monitoring

4.3.1 Water Quality

DEQ Status and Trends Report
DEQ analyzed data for dissolved oxygen, *E. coli*, pH, total phosphorus, temperature, and total suspended solids in the Management Area. (DEQ. 2020 Oregon Water Quality Status and Trends Report (https://www.oregon.gov/deq/wq/programs/Pages/wqstatustrends.aspx).

Data were from DEQ, EPA, and USGS databases for 2000 through 2019. DEQ determined attainment of water quality standards for stations in four-year periods and trends for stations with at least eight years of data collected at the same time of year.

While there were multiple sampling sites, the ones that consistently had enough information to determine status and trends were the four ambient monitoring sites: Klamath River at Keno; Link River at mouth (Lake Ewauna); Klamath Strait at USBR Pump Station E; and Lost River at Highway 39 (upstream of Merrill). Because of the complex hydrology in the Management Area and the intermingling of waters among basins, most of these locations actually reflect the water quality of Upper Klamath Lake. Therefore, these locations cannot be used to characterize

agricultural inputs in the Management Area. And, the hydrology of Klamath Straits Drain is so altered that water flows both ways in the channel and no water was pumped to the Klamath River in 2021; the Klamath Drainage District is proposing to let it flow directly to Lower Klamath Refuge, which needs the water.

Table 4.3.1 Attainment of water quality standards for 2016-2019, and 2000-2019 trends

Site Description	Parameter					
	E. coli	pH	Dissolved Oxygen	Temperature	Total Phosphorus (mg/L)	Total Suspended Solids (mg/L)
	Attainment Status and Trend				median; maximum[1]	median; maximum[2]
Klamath River at Keno	Yes	Yes	Yes	Yes ↓	0.12; 0.34	7; 101
Link River at mouth (Lake Ewauna)	Yes	Yes	Yes	-	0.09; 0.35	11; 69
Klamath Strait at USBR Pump Station	Yes ↑	Yes	No	-	0.38; 0.74	14; 344
Lost River at Hwy. 39	Yes ↓	Yes	Yes ↑	-	0.30; 0.69	10; 75

[1] DEQ's TMDL targets are 0.029 mg/L at the Lost River Diversion and 0.035 mg/L in the Klamath Straits Drain (Table 2.4.1.3)

[2] DEQ has no benchmark for total suspended solids in this Management Area

↑ Statistically significant improving trend

↓ Statistically significant degrading trend

Data from these locations indicate that phosphorus and sediment are too high to support beneficial uses.

Upper Lost River Watershed Assessment: National Water Quality Initiative[23]

In March-December 2017, the Klamath Watershed Partnership and others assessed water quality at 11 locations in the Lost River watershed. Six sites were on the Lost River between Harpold and Malone Dams; the other sites were the Lost River 'tributaries' of Miller and Buck creeks (upstream and mouth) and the Langell Valley Irrigation District ditch at Teare. Data were provided to DEQ and are part of its 2019 Status and Trends Report.

Total Nitrogen: Most river samples were 0.8-1.0 mg/L July through December. The tributary sites were generally higher, with the mouth of Buck Creek having 3-5 mg/L in spring and fall.

Nitrate-Nitrate: Most river samples were below 0.1 mg/L, with higher concentrations in November through March. Tributary sites were slightly higher, except for the mouth of Buck Creek at 2-5 mg/L in spring and fall.

Total Phosphorus: River samples were 0.05 – 0.25 mg/L, with highest levels June through October. The highest concentrations were at the mouth of Buck Creek in the spring (0.3-0.7 mg/L) and the Langell Valley Irrigation District ditch in the summer (0.3-0.5 mg/L).

The data indicate that Buck Creek and the Langell Valley Irrigation District ditch had the highest concentrations in 2017. However, because flows and loads weren't reported, it is unclear if the higher values in Buck Creek in spring and fall are due to low flows or higher inputs of nutrients into the creek. More data need to be collected over time to better understand nutrient inputs in the Upper Lost River watershed.

4.4 Biennial Reviews and Adaptive Management

ODA, the LAC, the LMA, and other partners met on March 15, 2022, to review implementation of the Area Plan and provide recommendations for the future (Tables 4.4a and 4.4b).

Key areas of discussion were:

1. Need to develop and implement a long-term water quality and/or land condition monitoring plan to identify current status, develop measurable objectives, and track progress toward water quality goals.
2. Need to develop and promote a suite of recommended projects that support water quality and don't diminish watershed health.
3. Need for quantifying past, current, and future landowner work.
4. Need for achievable measurable objectives to focus work and capture progress in improving land conditions related to agricultural water quality. (There is likely too much variability in flow and water deliveries to be able to attribute changes to improvements from agricultural producers.)

A major decision at this Biennial Review was to hold off making Area Plan edits to text related to measurable objectives, monitoring, and practices until the next full review, which is expected in two years. In the meantime, the LAC enthusiastically recommended that a group be formed to develop processes and recommend Area Plan text regarding: 1) Monitoring plan to identify and determine where agricultural water quality concerns exist, 2) Measurable objectives and water quality goals based on existing conditions, and 3) Promotion of beneficial practices landowners could implement. This group would consist of ODA, the LAC, and other interested parties including other landowners, irrigation districts, Klamath SWCD, Klamath Watershed Partnership, DEQ, OWRD, Klamath Tribes, and Bureau of Reclamation. This group could also help improve community unity.

Table 4.4a Summary of biennial review discussion

Progress
• Klamath Drainage District is working to deliver water to the refuge and their neighbors to keep its operations going. • Irrigation districts are working to return no or cleaner water to rivers. • Progress is being made toward improving riparian condition through fencing, off-stream water, stock water wells, and other projects; the number of projects has been increasing over time. • The local community is increasingly aware of the fragility of the area ecosystem. • Landowners are sharing knowledge and ways to move forward, while understanding they don't have to improve background levels of pollutants. • Farmer ingenuity is creating an understanding and focus on addressing challenges. • Active forest management in the upper watershed is contributing to more water and better water quality.
Impediments
• No comprehensive inventory of implemented practices. • Practices implemented solely by landowners are not tracked anywhere and other tracking methods are not integrated. • Insufficient water quality data to determine what the AgWQ issues are and where they are located. • Different perspectives on what practices to recommend and potential unintended consequences. • Ag community is fractured; farmers have a difficult time working together. They are not unified in moving their community forward. • Still tension between landowners and agencies. • Lack of water in the system for establishing riparian vegetation.

- Bureau of Reclamation Interim Operating Plan is unrealistic.
- Uncertainty of water supply distracts from more holistic view of watershed.
- Landowners need to be prosperous to implement practices.
- No water budget for the Management Area.
- No nutrient budget for the Management Area.
- Lost River TMDL requires increased flows for addressing temperature, but is contrary to natural conditions and the ability of the Lost River to meet temperature TMDLs.
- Detrimental effects of climate change on water quantity and quality.
- No delineation of the agricultural contributions (sources and geographic areas) to water quality impairment in the Management Area.
- No documentation of enhancements to water quality by agricultural activities.
- Don't know whether implemented practices have been effective in addressing water quality concerns.
- More and more landowners are becoming absentee and are less engaged in the management of their operations.

Recommended Modifications and Adaptive Management

- Look at ways that theLAC can engage when issues come up with zoning or new proposed projects; ODA doesn't always provide comments with which the LAC agrees.
- Acknowledge past achievements.
- Take climate change into account when developing water quality goals.
- Determine relative contributions of different types of ag, e.g., livestock manure, irrigation runoff.
- Nutrient budget for the Management Area.
- Water budget for the Management Area.

Table 4.4b Number of ODA compliance activities in 2018-2021

Location	Cases		Site Visits	Agency Actions				
				Letter of Compliance		Pre-Enforcement Notification	Notice of Noncompliance	Civil Penalty
	New	Closed		Already in compliance	Brought into compliance			
Outside SIA	0	0	0	0	0	0	0	0
Within SIA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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Appendix A: Interviews with Local Residents

LOST RIVER LAC HISTORICAL SUBCOMMITTEE

August 11, 1999: Interview with Barney Hoyt conducted by Don Russell and Deb Crisp

Barney Hoyt moved to this area in 1950. He has been active in the agricultural community ever since.

He recalls the condition of the river as being much like it is now. Barney commented that he couldn't recall anyone in his family ever swimming in the Lost River, however, he stated that he would not want to swim in it now or then.

Barney stated that the river has always fluctuated depending on the time of year.

Barney recalled that the plant communities haven't changed a lot since the 1950s. He also recalled the flooding that occurred in 1964. He believes that a lot of the lease lands were opened up to store the extra water. He stated that if it weren't for the facilities for water movement in the basin, the flooding would have been much worse than it was.

Don asked if Barney knew of any hot springs or geothermal areas in the Lost River. Barney recalled that at one time there was talk of using the hot springs in the Olene area for barley malting facilities.

Barney recalled there being an abundance of catfish in the river. He did not recall the tribes using the river for sustenance.

Barney remembers the U.S. Bureau of Reclamation working on the Diversion Canal after he moved here. Barney used to be on the Soil Conservation Service committee and recalled using trees and other objects to help control erosion in the river after it had been channelized. He recalled working with Bill Johnson (Klamath Soil and Water Conservation District).

Barney stated that he believes that the movement from flood irrigation to sprinkler irrigation has helped to reduce the amount of water needed to irrigate crops and also to reduce erosion. He recalls that there are fewer acres of potatoes in the basin and almost no flood irrigated row crops grown now. The majority of the crops are now sprinkler irrigated with the exception of pastures.

Don stated that it is an accepted number that the irrigation water is used six to seven times as it passes through the system.

Barney stated that he thinks the algae content in the irrigation system is lower than it used to be. He also stated that there are fluctuations in the algae content at different times of the year. At times, the water is very clear and you can see the bottom of the ditch.

Barney believes sprinkler irrigation is very vital to improving water quality.

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Appendix B: Common Agricultural Water Quality Parameters of Concern

The following parameters are used by DEQ in establishing the 303(d) List and assessing and documenting waterbodies with TMDLs. Note: This is an abbreviated summary and does not contain all parameters or detailed descriptions of the parameters and associated standards. Specific information about these parameters and standards can be found at: www.oregon.gov/deq/wq/Pages/WQ-Standards.aspx.

Bacteria: *Escherichia coli (E. coli)* is measured in streams to determine the risk of infection and disease to people. Bacteria sources include humans (recreation or failing septic systems), wildlife, and agriculture. On agricultural lands, E. coli generally comes from livestock waste, which is deposited directly into waterways or carried to waterways by livestock via runoff and soil erosion. Runoff and soil erosion from agricultural lands can also carry bacteria from other sources.

Biological Criteria: To assess a stream's ecological health, the community of benthic macro invertebrates is sampled and compared to a reference community (community of organisms expected to be present in a healthy stream). If there is a significant difference, the stream is listed as water quality limited. These organisms are important as the basis of the food chain and are very sensitive to changes in water quality. This designation does not always identify the specific limiting factor (e.g., sediment, nutrients, or temperature).

Dissolved Oxygen: Dissolved oxygen criteria depend on a water body's designation as fish spawning habitat. Streams designated as salmon rearing and migration are assumed to have resident trout spawning from January 1 through May 15, and those streams designated core cold water are assumed to have resident trout spawning January 1 through June 15. During non-spawning periods, the dissolved oxygen criteria depend on a stream's designation as providing for cold, cool, or warm water aquatic life; each defined in OAR 340 Division 41.

Harmful Algal Blooms: Some species of algae, such as cyanobacteria or blue-green algae, can produce toxins or poisons that can cause serious illness or death in pets, livestock, wildlife, and humans. As a result, they are classified as harmful algae blooms. Several beneficial uses are affected by harmful algae blooms: aesthetics, livestock watering, fishing, water contact recreation, and drinking water supply. The Public Health Department of the Oregon Health Authority is the agency responsible for posting warnings and educating the public about harmful algae blooms. Under this program, a variety of partners share information, coordinate efforts, and communicate with the public. Once a water body is identified as having a harmful algal bloom, DEQ is responsible for investigating the causes, identifying sources of pollution, and writing a pollution reduction plan.

Nitrate: While nitrate occurs naturally, the use of synthetic and natural fertilizers can increase nitrate in drinking water (ground and surface water). Applied nitrate that is not taken up by plants is readily carried by runoff to streams or infiltrate to ground water. High nitrate levels in drinking water cause a range of human health problems, particularly with infants, the elderly, and pregnant and nursing women.

Pesticides: Agricultural pesticides of concern include substances in current use and substances no longer in use but persist in the environment. Additional agricultural pesticides without established standards have also been detected. On agricultural lands, sediment from soil

erosion can carry these pesticides to water. Current use agricultural pesticide applications, mixing loading, and disposal activities may also contribute to pesticide detections in surface water. For more information, see: www.oregon.gov/deq/wq/Pages/WQ-Standards-Toxics.aspx

Phosphorous/Algae/pH/Chlorophyll a/Ammonia: Excessive algal growth can contribute to high pH and low dissolved oxygen. Native fish need dissolved oxygen for successful spawning and moderate pH levels to support physiological processes. Excessive algal growth can also lead to reduced water clarity, aesthetic impairment, and restrictions on water contact recreation. Warm water temperatures, sunlight, high levels of phosphorus, and low flows encourage excessive algal growth. Agricultural activities can contribute to all of these conditions.

Sediment and Turbidity: Sediment includes fine silt and organic particles suspended in water, settled particles, and larger gravel and boulders that move at high flows. Turbidity is a measure of the lack of clarity of water. Sediment movement and deposition is a natural process, but high levels of sediment can degrade fish habitat by filling pools, creating a wider and shallower channel, and covering spawning gravels. Suspended sediment or turbidity in the water can physically damage fish and other aquatic life, modify behavior, and increase temperature by absorbing incoming solar radiation. Sediment comes from erosion of streambanks and streambeds, agricultural land, forestland, roads, and developed areas. Sediment particles can transport other pollutants, including bacteria, nutrients, pesticides, and toxic substances.

Temperature: Oregon's native cold-water aquatic communities, including salmonids, are sensitive to water temperature. Several temperature criteria have been established to protect various life stages and fish species. Many conditions contribute to elevated stream temperatures. On agricultural lands, inadequate streamside vegetation, irrigation water withdrawals, warm irrigation water return flows, farm ponds, and land management that leads to widened stream channels contribute to elevated stream temperatures. Elevated stream temperatures also contribute to excessive algal growth, which leads to low dissolved oxygen levels and high pH levels.

Appendix C: Pesticide Management for Water Quality Protection

The following practices can help avoid water quality issues related to pesticide use

- Always apply chemicals in accordance with the label requirements in order to minimize crop damage, build up of chemicals in the soil, potential runoff, and leaching into groundwater. Read the label, and as required by ORS 634.372(2) and (4), follow label recommendations for both restricted use and non-restricted use pesticides. DEQ now requires a permit for pesticide applications in, over, or within 3 feet of water. This permit provides coverage for pesticide applications to control mosquitoes and other flying insect pests, weeds, algae, nuisance animals, and area-wide pest control (www.deq.state.or.us/wq/wqpermit/pesticides.htm).

- Calibrate, maintain, and correctly operate application equipment. Spray rigs need to be calibrated each time there is a change in product and/or application rate. Nozzles need to be replaced often, particularly if an abrasive pesticide formulation (such as wettable powders) is used. Sprayers need to be operated in the correct pressure range (dictated by the material and nozzle combination used), to prevent excess drift to non-target areas (e.g., waters of the state).

- Adopt integrated pest management (IPM) strategies. IPM promotes a diverse, multi-faceted approach to pest control. This strategy establishes an economic threshold for control actions, to guide the manager to use a variety of field/orchard sanitation and cultural practices, field scouting, beneficial insects, and other biological controls, and the use of properly selected chemical pesticides. While IPM does not exclude the use of chemical pesticides, it does seek to optimize their use and minimize off-target movement into the environment.

- Establish appropriate vegetative buffer strips. Buffer strips will help to retain soil (which may include pesticides) and surface runoff (which may have dissolved pesticides) from making contact with waters of the state.

- Store and handle pesticide materials correctly. Storage and handling facilities should be secure and include a leak-proof pad with curbing for mixing and loading. An alternative to a permanent, concrete pad is to always mix pesticides in the field and frequently moving sites prevent chemical buildup. Wash/rinse water should be directly applied to the appropriate crop. Empty liquid pesticide containers should be triple rinsed, then punctured and disposed of in an approved manner. Dry chemical bags should be emptied completely. Bundle and store paper bags until they can be disposed of in an approved manner.

- Watch for a pesticide waste collection day in your area. These events allow individuals to safely and anonymously drop off unwanted, unused, or out-of-date agricultural pesticides, along with some empty containers.