Oregon
Department
of Agriculture

Molalla-Pudding, French Prairie and North Santiam Agricultural Water Quality Management Area Plan

November 2018

Developed by the

Oregon Department of Agriculture

Molalla, Pudding, French Prairie and North Santiam Local Advisory Committee

With support from the

Marion, Linn, and Clackamas Soil and Water Conservation Districts

ODA
Water Quality Program
635 Capitol Street NE
Salem, Oregon 97301
Phone: (503) 986-4700

Marion SWCD
338 Hawthorne Ave NE
Salem, OR 97301
Phone: (503) 391-9927
marionswcd.oacd.net

Clackamas SWCD
221 Molalla Ave.
Suite 102
Oregon City, OR 97045
Phone: (503) 210-6000
info@conservationdistrict.org

Linn SWCD
33935 Hwy. 99E
Tangent, OR 97389
Phone: (541) 926-2483
linnswcd.oacd.org

http://oda.direct/AgWQPlans

Table of Contents

Acronyms and Terms Used in this Document

Ag Water Quality Program – Agricultural Water Quality Management Program
Area Plan – Agricultural Water Quality Management Area Plan
Area Rules – Agricultural Water Quality Management Area Rules
CAFO – Confined Animal Feeding Operation
CNPCP – Coastal Nonpoint Pollution Control Program
CWA – Clean Water Act
CZARA – Coastal Zone Act Reauthorization Amendments
DEQ – Oregon Department of Environmental Quality
DMA – Designated Management Agency
GWMA – Groundwater Management Area
HABs – Harmful Algal Blooms
LAC – Local Advisory Committee
LMA – Local Management Agency
Management Area – Agricultural Water Quality Management Area
MOA – Memorandum of Agreement
NPDES – National Pollution Discharge Elimination System
NRCS – Natural Resources Conservation Service
OAR – Oregon Administrative Rules
ODA – Oregon Department of Agriculture
ODF – Oregon Department of Forestry
OHA – Oregon Health Authority
ORS – Oregon Revised Statute
OWEB – Oregon Watershed Enhancement Board
PMP – Pesticides Management Plan
PSP – Pesticides Stewardship Partnership
RCA – Required Corrective Action
SIA – Strategic Implementation Area
SWCD – Soil and Water Conservation District
TMDL – Total Maximum Daily Load
USDA – United States Department of Agriculture
US EPA – United States Environmental Protection Agency
WPCF – Water Pollution Control Facility
WQPMT – Water Quality Pesticides Management Team

Foreword

This Agricultural Water Quality 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)). It references associated Agricultural Water Quality Management Area Rules (Area Rules), which are Oregon Administrative Rules (OARs) 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 state and federal law (OAR 603-090-0030(1)). At a minimum, an Area Plan must:

- Describe the geographical area and physical setting of the Management Area.
- List water quality issues of concern.
- List impaired beneficial uses.
- State that the goal of the Area Plan is to prevent and control water pollution from agricultural activities and soil erosion and to achieve applicable water quality standards.
- Include water quality objectives.
- Describe pollution prevention and control measures deemed necessary by ODA to achieve the goal.
- Include an implementation schedule for measures needed to meet applicable dates established by law.
- Include guidelines for public participation.
- Describe a strategy for ensuring that the necessary measures are implemented.

Plan Content

Chapter 1: Agricultural Water Quality Management Program Purpose and Background. The purpose is to have 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 available practices to address water quality issues.

Chapter 3: Implementation Strategies. Presents goal(s), measurable objectives, timelines, and strategies to achieve these goal(s) and objectives.

Chapter 4: Implementation, Monitoring, and Adaptive Management. ODA and the Local Advisory Committee (LAC) will work with knowledgeable sources to summarize land condition and water quality status and trends to assess progress toward the goals and objectives in Chapter 3.

Chapter 1: Agricultural Water Quality Management Program Purpose and Background

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

As part of Oregon's Agricultural Water Quality Management 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 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 developed to implement the Area Plan, 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 603-095-1900). The Ag Water Quality Program's general rules guide the Ag Water Quality Program, and the Area Rules for the Management Area are the regulations that landowners are required to follow. Landowners will be encouraged through outreach and education to implement conservation 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 a few 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 lands in Oregon is regulated by DEQ and on Tribal Trust lands by the respective tribe, with oversight by the United States Environmental Protection Agency (US EPA).

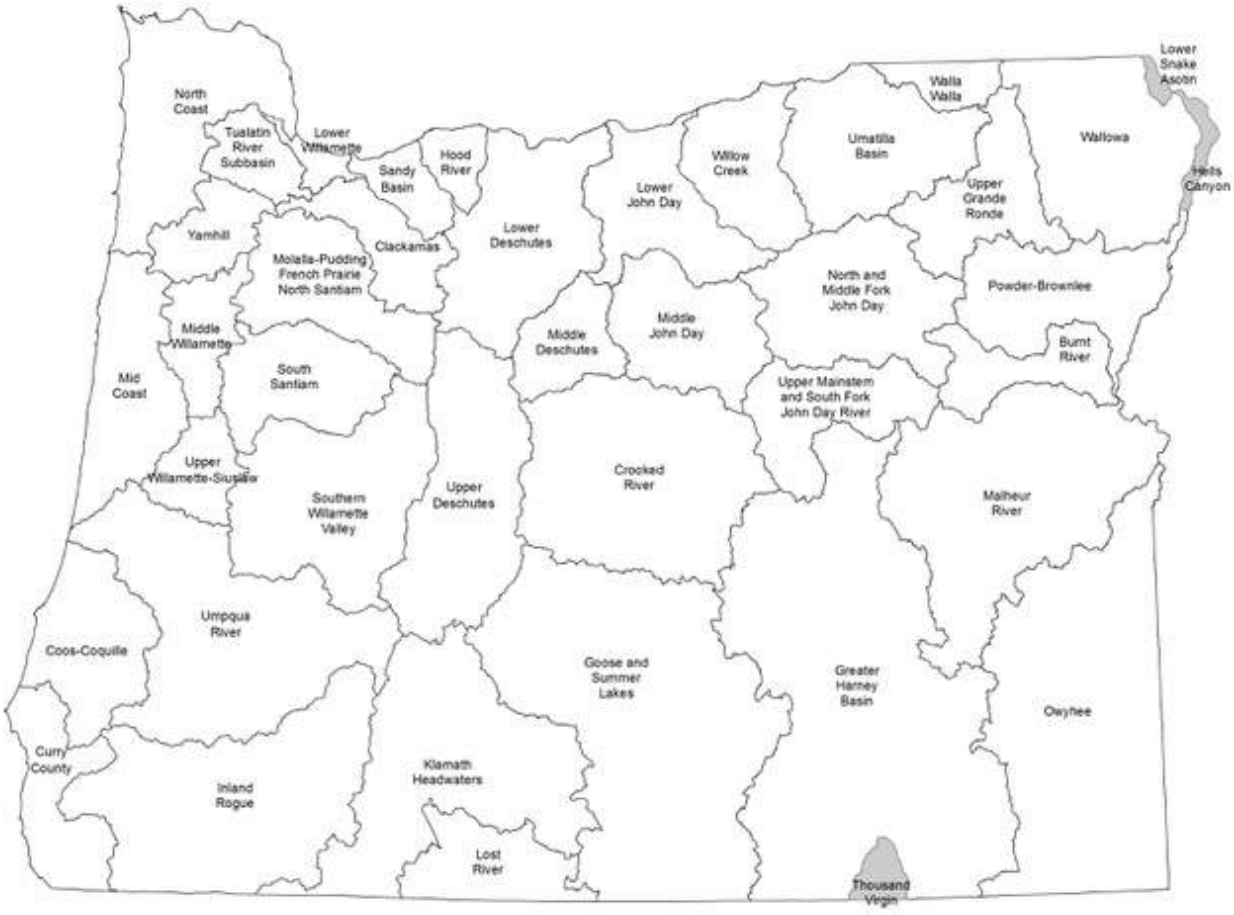
1.2 History of the Ag Water Quality Program

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, to 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). 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: Map of 38 Agricultural Water Quality Management Areas
Grey areas are not incorporated into Ag Water Quality Management Areas



1.3 Roles and Responsibilities

1.3.1 Oregon Department of Agriculture

The Oregon Department of Agriculture 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 carry out a water quality management plan 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),

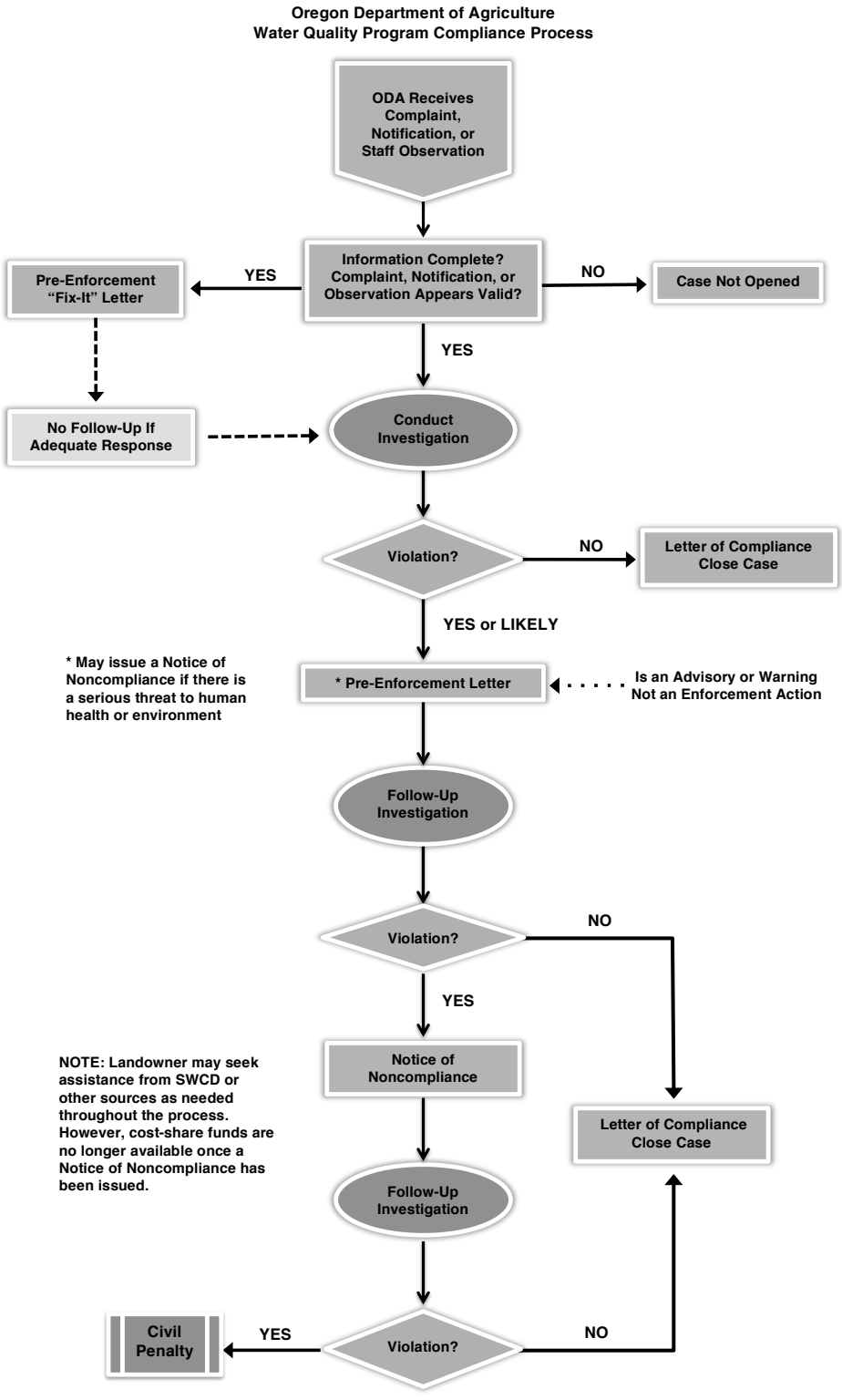
- Approved management measures for Coastal Zone Act Reauthorization Amendments (CZARA),
- Agricultural activities detailed in a Groundwater Management Area (GWMA) Action Plan (if DEQ has established a GWMA and an Action Plan has been developed).

The Oregon Department of Agriculture has the legal authority to develop and implement Area Plans and Area Rules for the prevention and control of water pollution from agricultural activities and soil erosion, where such plans are required by state or federal law (ORS 568.909 and ORS 568.912). 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. 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 gain compliance with Area Rules. Figure 2 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 the condition through required corrective actions (RCAs) 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 RCAs, ODA may assess civil penalties for continued violation of the 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.

Any member of the public may file a complaint, and any public agency may file a notification of a violation of an Area Rule. As a result, ODA may initiate an investigation (See Figure 2).

Figure 2: Compliance Flow Chart



1.3.2 Local Management Agency

A Local Management Agency (LMA) is an organization that ODA designated to assist with the implementation of an Area Plan (OAR 603-090-0010). The Oregon Legislature's intent is for SWCDs to 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 as many as 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 provide advice and direction to 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 their responsibilities, which include but are not limited to:

- Participate in the development and subsequent revisions of the Area Plan,
- Participate in the development and subsequent revisions of the 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. However, 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 a suite of measures to protect water quality. 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 also may 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:

- Conditions resulting from unusual weather events,

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

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

1.3.5 Public Participation

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.

The Oregon Department of Agriculture, the LACs, and the SWCDs 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 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. Significant 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 many are regulated under ODA's CAFO Program. Pesticide applications in, over, or within three feet of water also are regulated as point sources. Irrigation water flows from agricultural fields may be at a defined outlet but they do not currently require a permit.

Nonpoint 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 in OARs for each basin. They may include: public and private domestic water supply, industrial water supply, irrigation, livestock watering, fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, aesthetic quality,

hydropower, and commercial navigation and transportation. The most sensitive beneficial uses usually are fish and aquatic life, water contact recreation, and public and private domestic water supply. These uses generally are the first to be impaired because they are affected at lower levels of pollution. While there may not be severe impacts on water quality from a single source or sector, the combined effects from all sources can contribute to the impairment of beneficial uses in the Management Area. Beneficial uses that have the potential to be impaired in this Management Area are summarized in Chapter 2.

Many waterbodies throughout Oregon do not meet state water quality standards. Many of these waterbodies have established water quality management plans that document needed pollutant reductions. The most common water quality concerns related to agricultural activities are temperature, bacteria, biological criteria, sediment and turbidity, phosphorous, algae, pH, dissolved oxygen, harmful algal blooms (HABs), nitrates, pesticides, and mercury. Water quality impairments vary by Management Area and are summarized in Chapter 2.

1.4.3 Impaired Waterbodies and Total Maximum Daily Loads

Every two years, DEQ is required by the CWA to assess water quality in Oregon. CWA Section 303(d) requires DEQ to identify a list of waters that do not meet water quality standards. The resulting list is commonly referred to as the 303(d) list. In accordance with the CWA, DEQ must establish TMDLs for pollutants that led to the placement of a waterbody on the 303(d) list.

A TMDL includes an assessment of water quality data and current conditions and describes a plan to achieve conditions so that water bodies will meet water quality standards. TMDLs specify the daily amount of pollution a waterbody can receive and still meet water quality standards. In the TMDL, point sources are allocated pollution limits as "waste load allocations" that are then incorporated in National Pollutant Discharge Elimination System (NPDES) waste discharge permits, while a "load allocation" is established for nonpoint sources (agriculture, forestry, and urban). The agricultural sector is responsible for helping achieve the pollution limit by achieving the load allocation assigned to agriculture specifically, or to nonpoint sources in general, depending on how the TMDL was written.

Total Maximum Daily Loads generally apply to an entire basin or subbasin, not just to an individual waterbody on the 303(d) list. Water bodies will be listed as achieving water quality standards when data show the standards have been attained.

As part of the TMDL process, DEQ identifies the Designated Management Agency (DMA) or parties responsible for submitting TMDL implementation plans. TMDLs designate the local Area Plan 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.

For more general and specific information about Oregon's TMDLs, see: www.oregon.gov/deq/wq/tmdls/Pages/default.aspx. The list of impaired water bodies (303(d) list), the TMDLs, and the agricultural load allocations for the TMDLs that apply to this Management Area are summarized in Chapter 2.

1.4.4 Oregon Water Pollution Control Law – ORS 468B.025 and ORS 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 of the 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 to prevent and control water pollution from agriculture activities and to prevent and control soil erosion. Streamside vegetation can provide three primary water quality functions: shade for cool stream temperatures, 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.

Additional reasons for the Ag Water Quality Program's emphasis on streamside vegetation include:

- Streamside vegetation can improve water quality related to multiple pollutants, including: temperature (heat), sediment, bacteria, nutrients, and toxics (e.g., pesticides, heavy metals, etc.).
- Streamside vegetation provides fish and wildlife habitat.
- Landowners can improve streamside vegetation in ways that are compatible with their operation.
- Streamside vegetation condition is measurable and can be used to track progress in achieving desired site conditions.

Site-Capable Vegetation

The Ag Water Quality Program uses the concept of "site-capable vegetation" to describe the vegetation that agricultural streams can provide to protect water quality. Site-capable vegetation is the 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 vegetation consistent with site capability 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 for 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 recognizes removal as a good conservation activity and encourages landowners to remove these plants. Voluntary programs through SWCDs and watershed councils provide technical assistance and financial incentives for weed control and restoration projects. In addition, the Oregon State Weed Board identifies invasive plants that can negatively impact watersheds. Public and private landowners are responsible for eliminating or intensively controlling noxious weeds as may be provided by state and local law enacted for that purpose. For further information, visit www.oregon.gov/ODA/programs/weeds.

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

The Oregon Department of Agriculture is the lead state agency for the CAFO Program. The CAFO Program was developed to ensure that operators do not contaminate ground or surface water with animal manure or process wastewater. Since the early 1980s, CAFOs in Oregon have been registered to a general Water Pollution Control Facility (WPCF) permit designed to protect water quality. A properly maintained CAFO must implement a site-specific suite of structural and management practices to protect ground and surface water. To assure continued protection of ground and surface water, the 2001 Oregon State Legislature directed ODA to convert the CAFO Program from a WPCF permit program to a federal NPDES program. ODA and DEQ jointly issue the NPDES CAFO permit, which complies with all CWA requirements for CAFOs. In 2015, ODA and DEQ jointly issued a WPCF general CAFO permit as an alternative for CAFOs that are not subject to the federal NPDES CAFO permit requirements. Currently, ODA can register CAFOs to either the WPCF or NPDES CAFO permit.

Both of the Oregon CAFO 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 about the CAFO program, go to www.oregon.gov/ODA/programs/NaturalResources/Pages/CAFO.aspx.

1.5.2 Groundwater Management Areas

Groundwater Management Areas are designated by DEQ where groundwater has elevated contaminant concentrations resulting, at least in part, from nonpoint sources. After the GWMA is declared, a local groundwater management committee comprised of affected and interested parties is formed. The committee works with and advises the state agencies that are required to develop an action plan that will reduce groundwater contamination in the area.

Oregon 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.

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

The ODA 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, the interagency Water Quality Pesticide Management Team (WQPMT) was formed to expand efforts to improve water quality in Oregon related to pesticide use. The WQPMT includes representation from ODA, Oregon Department of Forestry (ODF), DEQ, and Oregon Health Authority (OHA). The

WQPMT facilitates and coordinates activities such as monitoring, analysis and interpretation of data, effective response measures, and management solutions. The WQPMT relies on monitoring data from the Pesticides Stewardship Partnership (PSP) program and other 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 (https://www.oregon.gov/deq/wq/programs/Pages/Pesticide.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.

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

1.5.5 Drinking Water Source Protection

Oregon implements its drinking water protection program through a partnership between DEQ and 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 see: https://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 Oregon to implement the federal CWA in our state. DEQ is the lead state agency with overall authority to implement the CWA in Oregon. DEQ coordinates with other state agencies, including ODA and ODF, to meet the requirements of the CWA. DEQ sets water quality standards and develops TMDLs for impaired waterbodies, which ultimately are approved or disapproved by the US EPA. In addition, DEQ develops and coordinates programs to address water quality including NPDES permits for point sources, the CWA Section 319 grant program, Source Water Protection, the CWA Section 401 Water Quality Certification, and GWMAs. DEQ also coordinates with ODA to help ensure successful implementation of Area Plans.

A Memorandum of Agreement (MOA) between DEQ and ODA recognizes that ODA is the state agency responsible for implementing the Ag Water Quality Program. ODA and DEQ updated the MOA in 2012.

The MOA includes the following commitments:

- ODA will develop and implement a monitoring strategy, as resources allow, in consultation with DEQ.
- ODA will evaluate the effectiveness of Area Plans and Area Rules in collaboration with DEQ:

    - ODA will determine the percentage of lands achieving compliance with Area Rules.
    - ODA will determine whether the target percentages of lands meeting the desired land conditions, as outlined in the goals and objectives of the Area Plans, are being achieved.
- ODA and DEQ will review and evaluate existing information to determine:
    - Whether additional data are needed to conduct an adequate evaluation.
    - Whether existing strategies have been effective in achieving the goals and objectives of the Area Plans.
    - Whether the rate of progress is adequate to achieve the goals of the Area Plans.

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

Oregon Department of Agriculture and SWCDs work in close partnership with local, state, and federal agencies and organizations, including: DEQ (as indicated above), the United States Department of Agriculture (USDA) NRCS and Farm Service Agency, watershed councils, Oregon State University Agricultural Experiment Stations and Extension Service, tribes, livestock and commodity organizations, conservation organizations, and local businesses. As resources allow, SWCDs and local partners provide technical, financial, and educational assistance to individual landowners for the design, installation, and maintenance of effective management strategies to prevent and control agricultural water pollution and to achieve water quality goals.

1.7 Measuring Progress

Agricultural landowners have been implementing 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 needed to achieve the measurable objective.

The AgWQ 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 implemented through focused work in small geographic areas (section 1.7.3), with a long-term goal of developing measurable objectives and monitoring methods at the Management Area scale.

The State of Oregon continues to improve its ability to use technology to measure current streamside vegetation conditions and compare it to the vegetation needed to meet stream shade targets to keep surface waters cooler. 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 incentive programs.

At each biennial review, ODA and its partners will evaluate progress toward the most recent 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 achieving the measurable objective(s) and will revise strategies to address obstacles and challenges.

The measurable objectives and associated milestones for the Area Plan are in Chapter 3 and progress toward achieving the measurable objectives and milestones is summarized in Chapter 4.

1.7.2 Land Conditions and Water Quality

Land conditions can serve as useful surrogates (indicators) for water quality parameters. For example, streamside vegetation generally is used as a surrogate for water temperature, because shade blocks solar radiation from warming the stream. In addition, sediment can be used as a surrogate for pesticides and phosphorus because they 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,
- Reductions in water quality 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 cost-prohibitive and could fail to 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 less likely to document the short-term effects of changing land conditions on water quality parameters such as temperature, bacteria, nutrients, sediment, and pesticides.

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 in the Focus Area. A key component of this approach 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 and is supported by a large body of scientific research (e.g. Council for Agricultural Science and Technology, 2012. Assessing the Health of Streams in Agricultural Landscapes: The Impacts of Land Management Change on Water Quality. Special Publication No. 31. Ames, Iowa).

Systematic implementation in Focus Areas provides the following advantages:

- Measuring progress is easier in a small watershed than across an entire Management Area.
- Water quality improvement may be faster since small watersheds generally respond more rapidly.

- A proactive approach can address the most significant water quality concerns.
- Partners can coordinate and align technical and financial resources.
- Partners can coordinate and identify appropriate conservation practices and demonstrate their effectiveness.
- A higher density of projects allows neighbors to learn from neighbors.
- A higher density of projects leads to opportunities for increasing the connectivity of projects.
- Limited resources can be used more effectively and efficiently.
- Work in one Focus Area, followed by other Focus Areas; will eventually cover the entire Management Area.

Soil and Water Conservation Districts select a Focus Area in cooperation with ODA and other partners. The scale of the Focus Area matches the SWCD's capacity to deliver concentrated outreach, technical assistance, and to complete projects. The current Focus Area for this Management Area is described in Chapter 3. The SWCD 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 cooperation 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. 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 made in the watershed. Chapter 3 describes any SIAs in this Management Area.

1.8 Monitoring, Evaluation, and Adaptive Management

The Oregon Department of Agriculture, the LAC, and the LMA will assess the effectiveness of the Area Plan and Area Rules by evaluating the status and trends in agricultural land conditions and water quality (Chapter 4). This assessment will include an evaluation of progress toward measurable objectives. ODA will utilize other agencies' and organizations' local monitoring data when available. ODA, DEQ, SWCDs, and LACs will examine these results during the biennial review and will revise the goal(s), measurable objectives, and strategies in Chapter 3 as needed.

1.8.1 Agricultural Water Quality Monitoring

As part of monitoring water quality status and trends, DEQ regularly collects water samples 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). DEQ collects water quality samples every other month throughout the year to represent a snapshot of water quality conditions. Parameters consistently measured include alkalinity, biochemical oxygen demand (BOD), chlorophyll a, specific conductance, dissolved oxygen (DO), DO percent saturation, *E. coli*, ammonia, nitrate and nitrite, pH, total phosphorus, total solids, temperature, and turbidity.

At each biennial review, DEQ assesses the status and trends of water quality in relation to water quality standards. Parameters included in the analysis are temperature, pH, and bacteria. DEQ will add additional parameters as the data become available, depending on the water quality concerns of each Management Area. ODA will continue to work with DEQ to cooperatively summarize the data results and how they apply to agricultural activities.

Water quality monitoring is described in Chapter 3, and the data are presented in Chapter 4.

1.8.2 Biennial Reviews and Adaptive Management

All Area Plans and Area Rules around the state undergo biennial reviews by ODA and the LAC. As part of each biennial review, ODA, DEQ, SWCDs, and the LAC discuss and evaluate the progress on implementation of the Area Plan and Area Rules. This evaluation includes discussion of enforcement actions, land condition, water quality monitoring, strategic initiatives, and outreach efforts over the past biennium. ODA and partners evaluate progress toward achieving measurable objectives and milestones, and revise implementation strategies as needed. The LAC submits a report to the Board of Agriculture and the director of ODA describing progress and impediments to implementation, and recommendations for modifications to the Area Plan or Area Rules necessary to achieve the goal of the Area Plan. ODA and partners will use the results of this evaluation to update the measurable objectives and implementation strategies in Chapter 3.

Chapter 2: Local Background

The Molalla/Pudding/French Prairie/North Santiam Subbasins include the drainage areas of the Molalla, Pudding, North Santiam, and Santiam rivers (Figure 3). In the area known as French Prairie, all the creeks and drainages between the towns of St. Paul and Donald that flow directly into the Willamette River are also part of this management area. The Willamette River is the western boundary. Operational boundaries for the land base under the purview of these rules include all lands within the Molalla/Pudding/French Prairie/North Santiam Subbasins in agricultural use, agricultural and rural lands which are lying idle or on which management has been deferred, and forested lands with agricultural activities, with the exception of public lands managed by federal agencies and activities which are subject to the Forest Practices Act.

Figure 3. Map of the Molalla, Pudding, French Prairie, North Santiam Agricultural Water Quality Management Area

2.1 Local Roles

2.1.1 Local Advisory Committee

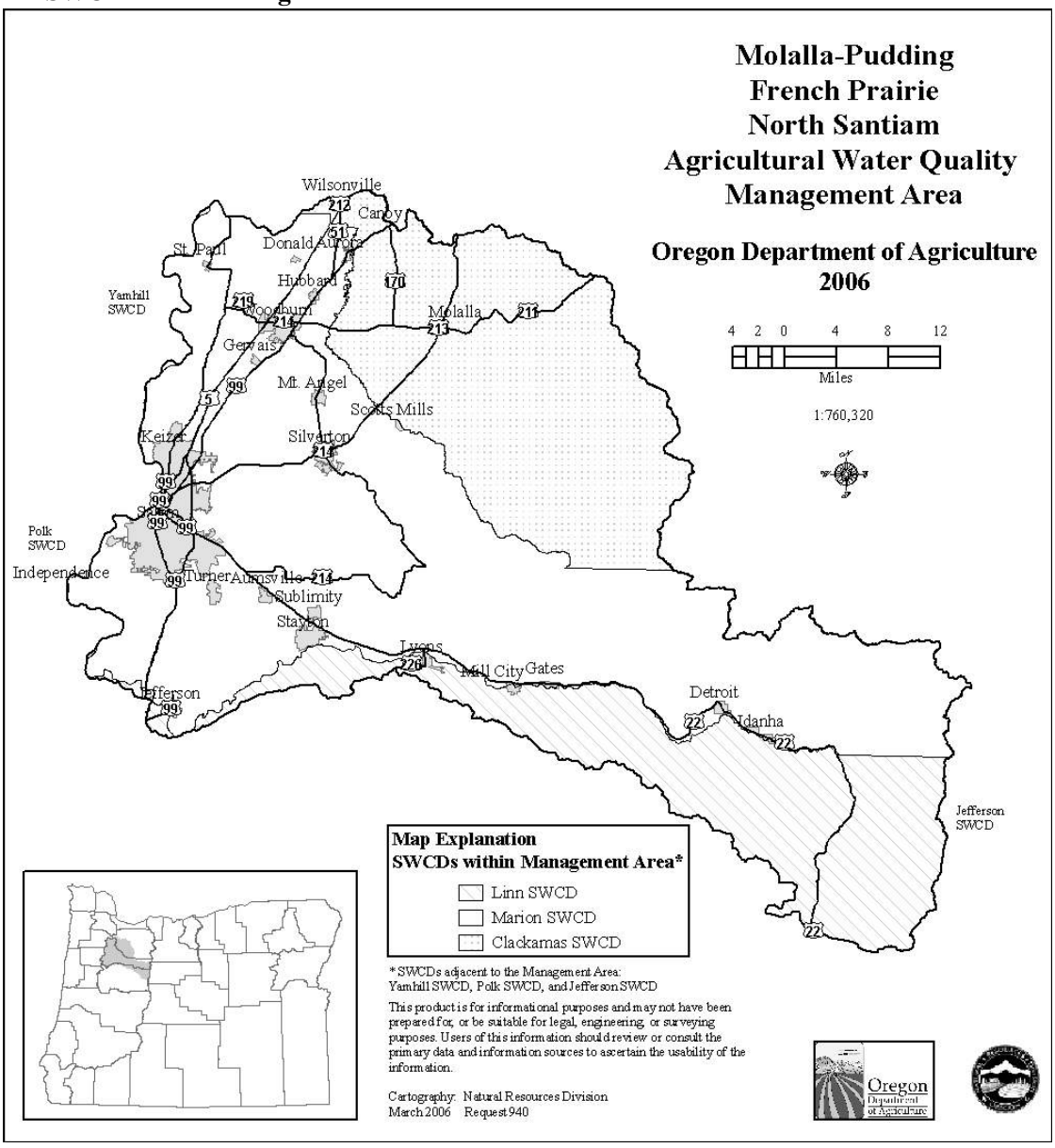
The Area Plan was developed with the assistance of the LAC. The LAC was formed in 2000 to assist with the development of the Area Plan and associated regulations and with subsequent biennial reviews.

Current LAC members are:

Name	Location	Representing
Daniel Goffin, Chair	Aumsville/ Mill Creek	Farmer, Livestock
Bob Dettwyler	Silverton/ Pudding	Grass Seed, Wheat, Bush Beans, Beef
Matt Knudsen	Marion County	County Government
Alan Kraemer	Mt. Angel/ Pudding	Ornamental Nursery Stock
Jerome Rosa	Gervais/ Pudding	Dairy
Joan Zuber	Molalla	Local Management Agency
Ed Beitel	Stayton	Grass Seed/Wheat/Corn/Beans
Gayle Goschie	Silverton	Hops/Grapes/Other Crops
Gayla Hansen	Molalla	Christmas Trees
Brent Stevenson	Stayton	Santiam Water Control District
Charlotte Smith	St. Paul	Raw Milk Dairy/Pastured Meats

2.1.2 Local Management Agency

Figure 4. SWCDs in the Management Area



Implementation of the Area Plan is accomplished through an Intergovernmental Grant Agreement(s) between ODA and the Marion, Clackamas, and Linn SWCDs. This Intergovernmental Grant Agreement defines the SWCD(s) as the LMA(s) for implementation of the Ag Water Quality Program in this Management Area. The SWCD(s) was/were 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. Figure 4 shows the boundaries for each SWCD within the Management Area.

2.2 Area Plan and Area Rules: Development and History

The director of ODA approved the Area Plan and Area Rules in 2000. Since approval, the LAC met in 2004, 2006, 2008, 2010, 2014, and 2016 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

History: Farming In Marion County: A Glimpse At Now And Then[1]

Introduction

In this section, the LAC describes the rich history of agriculture in this area and how agriculture is an important endeavor, providing a vital economic stimulus to the area (Table 1). However, it is a difficult and chancy enterprise, with an increasingly older farm population taking great financial risks forever decreasing returns (Table 2). Yet this area's farmers continue to persevere, following tradition while experimenting with new farming methods in the hope that things will get better. Within this context, farmers are facing new water quality demands.

Table 1: Agricultural Commodity Sales ($) Marion County, 2009*

Commodity	Sales ($)
Crops Spec. Prod.	220,088,000
Grass & Legume Seeds	81,473,000
Not Disclosed	63,895,000
Dairy Products	71,148,000
Small Fruits	49,572,000
Eggs & Produce	47,836,000
Field Crops	9,575,000
Hays & Forage	12,822,000
Tree Fruits & Nuts	15,178,000
Cattle & Calves	14,468,000
Misc. Animals	15,961,000
Grains	19,752,000
TOTAL	**$493,025,000**

*Compiled from Oregon County and State Agricultural Estimates: Oregon State University Extension Service, Special Report 790-09, February.

The Oregon County and State Agricultural Estimates: Oregon State University Extension Service, Special Report 790-09 provides data regarding agricultural commodity sales which can be found at http://library.state.or.us/repository/2010/201002091432162/2009.pdf . Demographics for Marion County can be found at http://www.city-data.com/county/Marion_County-OR.html.

[1] Most of this subsection was written by Barbara Lucas when she served as a Local Advisory Committee member. Please see Acknowledgements and Bibliography section for information sources. Data in tables is updated as new information becomes available.

Table 2: Bits and Pieces

- Population of Marion County: 2012: 319,985 (87% urban, 13% rural); it was 284,834 in 2000
- Average size of farms: 106 acres
- Average value of agricultural products sold per farm: $134,457
- Average value of crops sold per acre for harvested cropland: $1,708.44
- The value of nursery, greenhouse, floriculture, and sod as a percentage of the total market value of agricultural products sold: 43.91%
- The value of livestock, poultry, and their products as a percentage of the total market value of agricultural products sold: 15.42%
- Average total farm production expenses per farm: $114,750
- Harvested cropland as a percentage of land in farms: 62.52%
- Irrigated harvested cropland as a percentage of land in farms: 44.75%
- Average market value of all machinery and equipment per farm: $87,306
- The percentage of farms operated by a family or individual: 84.89%
- Average age of principal farm operators: 54 years
- Average number of cattle and calves per 100 acres of all land in farms: 11.34
- Milk cows as a percentage of all cattle and calves: 37.50%
- Corn for grain: 51 harvested acres
- All wheat for grain: 9,573 harvested acres
- Vegetables: 31,410 harvested acres
- Land in orchards: 9,907 acres

http://www.city-data.com/county/Marion_County-OR.html, as of 2012

The Land

The destination of early settlers in the Oregon Country was the land east of the Willamette River and south to present-day Salem in Marion County. This prairie land was fringed with wide forests, bordering rivers and streams but the prairies themselves had few trees and little brush due to periodic burning by the indigenous people. Dr. John McLoughlin, and one of his Hudson Bay Company employees, pronounced this prairie land the Northwest's most desirable region for Euro-American settlement. According to an early day traveler, Rev. Samuel Parker, the soil was alluvial river bottom; rich, easy to cultivate, sufficiently dry for cultivation, yet well-watered by small streams and springs. French Prairie is the largest of these prairies.

At the south end of French Prairie, north of Salem and east of Keizer, are the Lake Labish bottomlands, a one-time swamp left over from an old bed of the Willamette River. It is about 10 miles long and one-half mile at its widest, 1,270 acres of peat created by decayed vegetation. The peat is four feet to eight feet deep. Surrounding the swamp were woodlands of fir, pine, and oak, but the swamp itself contained willow, ash, vine maple, cattails, skunk cabbage, cottonwoods, and many beaver dams. Because of its swampiness, no one filed a donation land claim, and the state of Oregon later sold the property for $1 an acre.

Anecdotes. *Early stagecoaches avoided the swamp, bypassing the lake about a half-mile northwest of the Chemawa Indian School.... A Marion County engineer reportedly shoved a 2"x 6" sixteen feet into the peat with his bare hands and never touched bottom.... According to one resident, Lake Labish soil is even more fertile than French Prairie.*

The highlands southwest of Silver Creek Falls Park is a stretch of land described by historian Mark Schmid as a fairyland of majestic timber, white water and wild flowers, a primeval forest with Indian trails and mountain streams abounding in fish. These highlands and the lowlands around neighboring Mill

Creek provide the setting for farms and the small towns of Turner, Aumsville, Sublimity, and Stayton. Besides providing many of the Christmas trees sold here and abroad, this area is the home of the famed Kentucky Wonder Santiam Green Bean, and the home of the world's largest grass seed farm. A particularly productive tract, north of the North Santiam River, is a 13-mile flatland between Parrish Gap and Stayton.

Other land is farmed along the Willamette, the Pudding, and the lower North Santiam - very fertile land, which in winter and spring is under water. Come back in the summer and you see crops growing and cattle grazing. The situation is different up the North Santiam. As you climb higher and the gorge narrows, the main agricultural activity along the river is pastureland.

The People

The Kalapuya Indians were the earliest known inhabitants of the prairies. They fished salmon at Willamette Falls and trout and eel throughout the upper tributaries, hunted waterfowl and game, and gathered nuts, berries, camas bulbs, tarweed seeds (wild oats), basketry materials, and various herbs. Each fall they burned the prairies to harvest tarweed, renew fertility, and eliminate brush while maintaining widely spaced Oregon white oak trees. There was an Indian trail from the Willamette Falls to Silverton, Sublimity, across the Santiam River, and on to the Klamath basin, with another Indian trail through the North Santiam gorge across the Cascades into the Deschutes valley.

The first recorded European visitors to French Prairie were trappers from the Pacific Fur Company in 1812. Then in 1829, a retired Hudson Bay Company French-Canadian trapper settled on French Prairie near what is now St. Paul. Eventually, about 75 former trappers, with the Company's financial assistance, located in the area. Many of the French Canadians settled here to start new lives with their Indian families and they were followed by Methodist missionaries looking for converts. Beginning in the 1840's, the Eden-seekers began arriving by wagon train, or by ship from across the Isthmus of Panama, or around the tip of South America. Among later immigrants were families not only from eastern states but also from Ireland, Germany, Switzerland, and Austria. Many of their descendants are still farming here.

***Anecdotes*.** *In 1879, a missionary from Minnesota came to Sublimity and convinced his previous flock to follow him.... One immigrant, armed with California gold, came to French Prairie amassed 10,000 acres, divided it among his 11 children, and returned to the East.... An entire family, including aunts and uncles, arrived in Oregon in two rail cars, one car with family and furniture, and another car with cattle and equipment.... A now-retired farm wife came west with her family before World War II, 14 people in two model Ts, "just like the Grapes of Wrath" she says.*

Crops

The first settlers were subsistence farmers, raising what was needed to support a family: gardens, fruit trees, cows, pigs, and chickens. "Old white winter wheat" was the mainstay cash crop and was the medium of exchange until the 1850s: $1 = 1 bushel of wheat. The yield was fifteen to twenty bushels an acre. Besides wheat, early Hudson Bay records show that trading items of beaver skins, buckskins, salt salmon, shingles, and saw logs. By 1843, trade included cattle, horses, sheep, swine, oats, potatoes, bacon, and sides of beef. At that time, the market was the Sandwich Islands, China, and the Russian settlements in Alaska. As improved transportation brought markets closer to Willamette Valley farmers, the list of crops expanded to include beef cattle, hops, berries, chickens, and turkeys and by the end of the century, many farmers were growing apples, prunes, cherries, peaches, and nuts as well.

The rush for gold in California and southern Oregon had a great effect on the Willamette Valley. Two-thirds of the men left to search for gold, together with some women. Farms and mills were run by old men, boys, and women. Some gold seekers never returned to the Valley, some returned with nothing. Others brought back gold, which they invested in more land or became storeowners. There was a great

demand for flour and lumber in the gold fields, not only in California, but also in Jacksonville, eastern Oregon, and Idaho. Prices soared. To take advantage of the heightened demand to get more land into production, forested land was cleared using Chinese labor and horses. Horses were used not only to pull stumps but also to propel threshing machines, plow, take logs to mills, and crops to market.

Moving Crops to Market
Wagons in the early days were either up to their hubs in mud or dust. The settlers' connection with the civilized world was the Willamette River, which they used for transportation of passengers and crops. They tried to locate within a day's round trip of the river.

The River - The first settlers located along the Willamette from Oregon City south to Salem. There were about 100 landings on the river. Farmers brought their grain to these river landings, stacked it under trees to protect it from weather and theft, then waited for canoes, flatboats, or keel boats to take their grain down to Oregon City.

Regular steamboat service began in 1851, calling landings at Butteville, Champoeg, Fairfield, Wheatland, and Lincoln. Warehouses were built where grain and other perishables could be stored. Cattle and swine were kept in pens near the river. The two-month period following harvest was the busy time at the landings, teams and wagons waiting their turns to unload. Steamboats moved wheat downriver during the high-water season, and by spring, most warehouses had been emptied.

The river was a mixed blessing. Many times, flood waters carried away livestock, landings, docks, warehouses, shops, hotels, and stores. The 1861 flood, the biggest in memory, is just one of the many which afflicted Willamette Valley residents. Repeated floods in 1843, 1849, 1853, 1860, 1861, 1888, 1890, and 1894 convinced early day settlers that it was wise to build and farm at a safe distance from the river.

Rails - The railroad, supplanting the steamboat, changed the future for many communities along the river. No longer was it necessary for a farmer to live within a day's round trip to the river. No longer was it necessary to wait for high water so boats could navigate. The landings along the river disappeared. The railroad became the artery of trade. In 1869, a north-south railroad from Portland via Aurora-Woodburn to Waconda was established. An east-west railroad from Ray's Landing (across the Willamette from Dayton), through St. Paul and Woodburn to Silverton never materialized. With the advent of the railroad, wheat production and cattle grazing moved across the mountains to central Oregon but the railroad brought markets and processors closer to Willamette Valley farmers.

Roads - The paved road finally got the farmer out of the mud. In 1919, acting as agent for the state of Oregon, Marion County paved the first 7.39 miles of road. This active partnership lasted until the Depression, and by 1932, there were 94 market roads in Marion County, 187 miles paved and 264 miles graded. Today Marion County has 990 miles of rural county roads, 780 miles of which are paved, and 210 miles graveled. But water still causes road problems in bottomlands. A Marion County report lists four pages of roads where water accumulates during heavy rains.

Anecdote. *One old-timer claims that the early market road was paved on the side where the heavily laden wagon went to market but graveled on the side where the wagon returned home empty.*

The number of warehouses on today's farms is increasing. These warehouses provide a place where produce can either be stored or containerized for eventual transfer by truck to a rail yard or port. A question, which needs to be addressed, is the adequacy of local roads being used by trucks. The County reports that 71 percent of its roads don't meet pavement width standards, and 81 percent don't meet shoulder width standards.

Unfortunately, Marion County does not have funds to correct all the deficiencies in its rural road system. Its 1998 study lists major repairs and replacements needed for seven bridges and possible weight limitations if these improvements cannot be made. The study also cites the growth in Marion, Polk, and Yamhill counties as a reason for looking at the need for another bridge across the Willamette, perhaps linked with a study for a second interchange at Woodburn.

Back to the River - Marion County still operates two ferries across the Willamette, serving rural areas. The Wheatland Ferry, at the end of Matheny Road about five miles north of Keizer, operates daily (except Christmas and Thanksgiving). Annual ridership is 125,000 vehicles. The Buena Vista Ferry, operating between an area south of Independence to Buena Vista Road on the other side of the river, carries only 6,000 vehicles a year. Operation of both ferries depends on weather conditions, river levels, and maintenance requirements. The shutdown of the Wheatland Ferry is an inconvenience for many because the ferry is the only way to cross the Willamette between Newberg and Salem.

Increasing Production
Because of the Willamette Valley's long growing season, local farmers can pick and choose among 200 potential crops. Whereas wheat, oats, barley, flax, and grass can survive without irrigation, other crops need well-drained soil and water during the summer months.

Drainage
While benefiting from the long growing season, Marion County farmers are plagued with wet springs. Drainage is a means to provide a 4' depth for optimal plant root development. It also allows the farmer to get out to his fields earlier in the spring and to raise a greater variety of crops.

According to local memory, installing drainage tile in the Willamette Valley began about 1892. In those days, clay was fired into foot-long red drainage tiles; the tiles were laid in trenches, butted up against each other, and pointed to some low spot. The problem with these tiles was soil that entered the cracks blocking the flow of water. A new kind of tiling is now being used: high-density polyethylene flexible tubing, which can be attached to additional tubing with plastic couplets. Cost is about $1,000 to $1,500 an acre to install the tubing.

Flood Control
Local drainage is not enough to protect against floods. Some major twentieth century floods along the Willamette occurred in 1923, 1927, 1945, 1955, in 1964, and 1996. These last two floods were 100-year events, caused by heavy rainfall that saturated the ground, by low temperatures that froze the ground, by heavy wet snowfall, and by sudden melt-off of the snow pack. These floods brought logs, brush, trees and structures down the rivers. Topsoil was eroded, livestock drowned, riverbanks destroyed, orchards and specialty crop fields were washed out or silted under. The damage caused by these last two floods was great, but it was reduced by the flood control projects built by the U. S. Army Corps of Engineers since 1940 on the Willamette, the McKenzie, the Long Tom, and the Santiam rivers. Detroit Dam and its regulating dam Big Cliff are the projects that provide flood control downstream along the North Santiam River.

Anecdotes. *My neighbor lost 700 acres to the '64 flood. Corrective measures since then have cost me 120 acres.... These heavy rains the last three or four years remind me of what we had 25 years ago. My stream was always over its banks then, and we even ice skated down there in the winter....*

Irrigation
Although the Willamette Valley receives 40" to 60" of rain a year, most of it falls at the wrong time for crops. To get the maximum return for his efforts and investment, the farmer needs to raise diverse crops,

and to do that, he needs 6" to 10" of water during the three summer months when almost no rain falls. Irrigation became commonplace after World War II. Marion County farmers use several irrigation methods: lines which must be moved by hand, lines which are moved on wheels, big guns which spray water and fertilizer, and the micro, or drip, system. Cost for the drip system is $800 to $1,000 an acre. About 70,000 acres in Marion County are irrigated, with an additional 15,000 acres irrigated sometimes.

Irrigators in the French Prairie and Lake Labish areas use water from wells or the rivers. Farmers in the North Santiam area can contract for irrigation water from Detroit reservoir. Three irrigation districts have been organized to take advantage of this stored water through water rights permits issued by the State Water Resources Department. These districts include: Sidney, Kingston, and the Santiam Water Control. The most extensive irrigation project, the Santiam Water Control District, serves the thirteen miles of fertile land west of Stayton where 17,000 acres are irrigated from March to October.

Irrigation water in Detroit Reservoir is available through the Bureau of Reclamation. There are 281,630 acre-feet of water that can be used for conservation storage, including irrigation, during the period from March to October. However, the Bureau has not entered into any permanent contracts since March of 1999, waiting for a Biological Opinion.

Fertility
Chemicals have wrought the biggest change in agriculture. In the old days before World War II, farmers would maintain soil fertility by rotating crops. A four-year rotation was clover or alfalfa and manure the first two years, wheat the third year, with corn or a row crop the fourth year. This rotation guaranteed a certain level of fertility and weed control and, with a cover crop, controlled soil erosion. Since the advent of chemicals, crop rotation has given way to chemical fertilizers, herbicides, and pesticides. New hybrids and chemical fertilizers have vastly increased production. Chemical herbicides have eliminated the need for hand weeding. However, chemical runoff to streams may reduce water quality and can be harmful to aquatic life.

Correcting Mistakes
Trying to increase production has brought problems; riverbanks have been eroded by cultivation and cattle grazing; soil erodes during winter storms for lack of cover crops. Draining hastens storm runoff creating bigger floods downstream, and irrigation competes with other uses for water. The run-off of nitrogen-rich fertilizers creates oxygen-robbing conditions in streams. Herbicides and pesticides do not always kill only their targets.

Some Marion County farmers are changing their practices to correct these problems and together with federal, state, and county governments are drawing up voluntary management plans to reduce erosion and pollution in creeks and rivers.

Harvest Headache
Labor has always been a problem for the farmer. When wheat was the major crop, the harvest had to be completed within 20 days. Family and neighbors, and sometimes, local Indians, or even Chinese immigrants, supplied the manpower. Before long, the horse provided help and later on came mechanization, but there has always been the need for willing hands.

Local farmers who remember the last fifty and sixty years recall how neighbors would help each other with the harvests. Then, as farms grew bigger and families grew smaller, the number of neighbors diminished, and farmers began to recruit platoons of mothers and children from the cities. These volunteers would be picked up by a bus in the morning and delivered back in the evening. When this source of labor ended, farmers recruited homeless men either from Salem or Portland, bused them back

and forth, providing lunch and liquid refreshment. Another limited source of farm labor were Russian and Vietnamese immigrants.

There was another labor source - migrant families who returned year after year to the same farms, bringing relatives and even friends. Some migrants followed a crop, moving from California to Oregon, to Washington and Montana before returning home to Oklahoma, Texas, and Arkansas. Others came to the Valley for the May to October harvest season and then they returned home.

An increasingly important source of labor is contractors. Working with several farmers whose harvest times differ, the contractor can arrange that laborers from Mexico and Central America are available when they are needed and where they are needed.

Encroachment Pressures
Urban encroachment on farmland is a worry for Marion County farmers as people flee from Portland and Salem to find a better life and cheaper housing in small towns. Two towns advertise that there are several new subdivisions in the rolling hills and farmland of their charming communities. Before long, these subdivision dwellers will complain about the dust, noise, and odors emanating from the farm next door, and the farmer will notice the faster runoff from the new subdivision.

Another urban encroachment is the commercial development at interchanges along the I-5 corridor at Wilsonville, Donald, Brooks, and especially at Woodburn where land which was farmed just ten years ago is now covered with gas stations, fast food outlets, motels, car dealerships, two regional distribution centers, and a huge factory outlet shopping mall.

The encroachment on farmland from urbanization can be tracked in population increases over the past 46 years as shown on Table 3.

Encroachment by a Big Neighbor
The city of Keizer, non-existent until 1982, was involved in a dispute with neighboring Lake Labish Irrigation District over 1996 flood damages to a city park next to Labish Ditch. The city said the problem was the way the Parkersville Dike was operated. The District claimed it was operating legally to protect its members' onion fields. The city ultimately dismissed its case against the District.

This case brings back memories of dynamiting and armed opposition in 1905 when Lake Labish property owners wanted to farm their swampland and property owners in the Parkersville area wanted to protect their mill. The matter went to court. Eventually the mill owners were bought out but it was not until 1914 that the lake bottom was under cultivation.

Big City Water Needs
The city of Salem, with a water right dating back to 1856, gets its municipal water supply from the North Santiam River. The intake for Salem's water supply is located at Geren Island near Stayton. Prolonged high turbidity water in the North Santiam River below Detroit Reservoir following the floods of 1996 and 1997 destroyed one of Salem's slow sand filters and forced Salem to improve its filtration system. Salem needs clean water for its 155,000 residents and its food processors and opposes activities in the North Santiam canyon which might adversely affects its drinking water source. Upriver towns in the canyon want jobs to replace those lost when timber harvest was reduced. Occasionally, Salem's interests run counter to those of canyon residents and property owners.

In the future, farmers above Stayton may find their activities further regulated by the Three Basin Rule, Safe Drinking Water Act, and other water quality laws that prohibit direct discharges of wastewater and potential runoff of specific pesticides and fertilizers into the North Santiam above major drinking water

intakes. This would also be true of agriculture activities above the municipal water intakes of the cities of Canby and Molalla on the Molalla River. The Molalla River is not covered by the Three Basin Rule.

Small Town Water Needs
Several cities have wells in Marion County exclusive farm use areas: Monmouth, Independence, Mt. Angel, and Jefferson. Newberg has five or six wells. After its application for another well permit was turned down several years ago by Marion County, Newberg, together with the League of Oregon Cities, convinced the Oregon Legislature to ease rules for siting utilities in exclusive farm use zones.

Another concern for farmers and water quality: If cities continue to drill wells for drinking water in county exclusive farm use zones, the County or state Health Department may be forced to establish rules or enforce existing rules for well head protection which may limit the use of some pesticides or fertilizers within the wellhead protection zone.

Conversion of Farm Land to Other Uses
Farmers are concerned about the conversion of farmland for residential, commercial, and industrial use, for roads and for cell phone towers. Increasingly they're troubled about the use of farmland for the disposal of treated wastewater by cities. For example, in Marion County, Woodburn is using poplars on farmland to help clean up its wastewater; Silverton is using the Oregon Gardens, formerly a farm, as a wastewater disposal site; and Salem has embarked on a wastewater study, which might eventually result in creating a wetland on farmland. Though these activities convert farmland, the reduction in waste to the rivers can benefit farmers. Four state agencies are discussing rules to define farm use and possibly restrict utilities to less valuable farmland.

Present Day Economics and a New Generation
Marion County's 1998 commodity sales, representing 87 different crops, were the biggest in history, but the makeup of sales is changing. Bad weather has taken its toll on fruit crops. Growers are taking out peach and cherry orchards. Walnut orchards are dying out and hazelnuts are suffering from blight. Berry fields are disappearing because labor costs are so high. There are no vines in some hop fields. The reorganization of processing firms has dried up the market for bush beans and sweet corn, for broccoli and cauliflower, for berries. Dairy herds are half of what they were 25 years ago and there is little demand for mint.

Anecdote. *That place up the road had the biggest dairy around here, 500 acres. Now it's all grass. A ninety-year old lady still lives up there in a house hidden by all the shrubbery that's grown up but the barns are all tumbling down.*

Farmers complain that they have lost parity; the prices of things they must buy have risen while the prices they receive for their crops have actually decreased. Wheat costs $4.00 a bushel to raise but sells for less than $3.00. It costs more to pick a crop than it can be sold for. Farmers in 1998 earned only 2.83 percent on their investment in land and equipment. They can earn more than that in a bank or on the stock market without the worry of weather and the hassle of government reports.

But there are winners in Marion County agriculture nowadays: ornamental nursery and greenhouse crops and grass seed; together with Christmas trees - these are the moneymakers. The market for grass seed is created by the need to seed and reseed golf courses and home lawns. The market for ornamentals is created by the need to landscape the explosive growth in residential, commercial, and industrial developments. A contributing factor is the continued bad weather in other parts of the country.

Today's average farmer is 54. At that age, he isn't planning to expand, or buy more land or new equipment - he is making plans for retirement. If he has children, he will leave his land to them. If there are no

children, he will sell. But who will buy? The original settlers in Oregon got 640 acres for nothing (per married couple). In 1878, land near Woodburn sold for $25-$50 an acre. Today land with a water source and drainage can sell for $7,500 or more an acre. The likely prospects to buy this land are not young people but large corporations or land developers.

With the high cost of land and equipment, people can't get into farming now without help from their families, and even then, they may have to work at jobs off the farm until their farms produce enough to pay principal, interest, and expenses. The most vexing problem is repaying loans to the bank every year. A farmer must choose very carefully which crop he is going to raise. There's little room for error anymore. The margin is too slim. A farmer may be able to survive one bad year, but not several in a row.

Despite unpredictable weather, diminished financial returns, labor problems, and governmental regulations, young people in Marion County are still choosing to follow in their parents' and grandparents' and even great-grandparents' footsteps and be farmers. They gamble every spring that they will choose the right crop. Some are opting to specialize, to find a niche for themselves, perhaps raising specialty items for foreign markets, or raising food and even flowers strictly for a direct-to-customer market. Whatever the adversity, they enjoy having their lives in tune with the seasons, experimenting with crops, and gambling that this year will be better than last.

Anecdote. *This house was built 100 years ago. We added on. This is a family farm. My sons and daughter live here so do my daughter-in-law and my grandchildren. I'm 56 years old. My boy is 30. He's taking over. We're acting like we have 20 years more....*

Location, Water Resources, Land Use, Land Ownership, Agriculture

The Molalla River, Pudding River, Santiam River, North Santiam River, Mill Creek, and French Prairie Area Subbasins are in the northwest quadrant of the state of Oregon, 70 miles west of the Pacific Ocean. All of these watersheds are tributaries of the Willamette River. The Willamette River runs from south to north between the Coast Range and the Cascade Range of Oregon. All of these Subbasins drain from the Cascade Range west to the Willamette River. The watersheds have developed geographically and geologically from tectonic plate movement, basalt flows from east of the Cascades, and silt deposited by the Missoula Floods at the end of the last ice age.

Oregon sits in an area known informally as the Pacific Rim of Fire, which is the name given to the region of volcanic activity around the Pacific Ocean. In the case of Western Oregon, the Juan De Fuca Plate is moving under (subducting) the North American Plate. Among many things, this process has scraped off the sea floor to produce foothills. Fossils from sea creatures are found in the basin above Scotts Mills at 300-foot elevation. The process of subduction produced the volcanic activity that created the Western Cascade Range and High Cascades. The volcanic activity of the Western Cascade Range has produced the headwaters of the Molalla at approximately 5,000 feet and the headwaters of tributary streams of the Pudding River at 4,000 feet, flowing to an elevation of 60 feet. The High Cascades are east of the Western Cascade Range and younger in geologic time. The High Cascades are the headwaters of the North Santiam River with Mt. Jefferson being the highest point in the watershed at 10,495 feet.

The crops grown from the land are varied but consistent throughout the planning area. The soil types vary throughout the area as the geology changes. The region has unique characteristics that over time shaped the geography and meteorology. These characteristics are the reason why the watersheds of these streams encompass one of the highest producing agricultural areas in the United States of America.

Much of the agricultural area in the Molalla River, Pudding River, and French Prairie Area Subbasins is a fault-block basin that filled with sand and gravel washed in several thousand years ago. The Subbasins were covered to an elevation of about 400 feet by water-laden sediment during the last Ice Age from the

Missoula Flood. The sediment created the present soils of today. Granitic rocks, known as glacial erratic rocks, are found throughout the valley that were brought in with chunks of ice during the Missoula Flood. During the construction of a pond near Mount Angel, an erratic rock was found in the glacial-lacustrine sediment seven feet below the ground surface.

The North Santiam River, Santiam River, and Mill Creek Subbasins have unique geologic characteristics that relate to agriculture production and water quality. As previously mentioned, the Missoula Floods that occurred over the thousands of years as each Ice Age warmed, provides the Northern Willamette Valley with many of the soils farmed today. During this same time, Alpine Glaciers occurred in the Cascade Mountains. A 1939 report by Department of Geology and Mineral Industries identifies three glaciers: Mill City, Detroit, and Tunnel Creek. All three glaciers were in relatively the same areas over different periods of time. The significance is the gravelly soils that make up most of the farming area from Stayton to Jefferson. The gravel and alluvium reflect the glacier erosion and outwash deposition. Farmers say that corn will ripen two weeks earlier on gravel soils due to the heat that is built up during the day and released at night, providing for warmer night time temperatures. Many of these soils are well drained with low water holding capacity. This requires more frequent irrigation and longer irrigation. These main geologic features have provided agriculture with soil to produce crops. In addition, ground water is supplied from wells in the sand and gravel sediment or fractured volcanic rock created millions of years ago, and from mountains that collect snow and rain in the winter, providing summer runoff for irrigation and groundwater recharge of the aquifers.

The mountains of Molalla and Pudding Subbasins are considered part of the Cascade Range. This area ridge is 25 miles west of the Cascade Range crest. The watersheds are bordered on the north and east by the Clackamas River Subbasin and on the south by the North Santiam River Subbasin. These watersheds are bordered on the east by the Cascade Range crest. During the year, the mountains of the Molalla and Pudding Subbasins historically go through periods of snow accumulation followed by warm rain and rapid snowmelt. The runoff causes flooding over agricultural lands, causing erosion of croplands, pastures, and streambanks. In February of 1996, the runoff caused flooding that affected homes, roads, and power lines.

The meteorology of the region is unique to only a few areas of the world, with a Mediterranean, modified marine climate. The area has wet winters and dry summers. This is the reason agriculture areas here can receive up to 80 inches of rainfall but still require irrigation to sustain some crops in the summer. The heavy winter rains saturate soils, causing erosion that contributes to water quality problems. The lack of precipitation in the summer, along with no high elevation mountains for snow accumulation, creates extremely low stream flows this time of year. This makes the area vulnerable to water quality problems in late summer, such as low dissolved oxygen.

The Molalla, Pudding, and French Prairie area make up Subbasins of the Willamette Basin, which is a basin within the Columbia River Region. The Molalla, Pudding, and French Prairie area Subbasins drain approximately 900 square miles. The Pudding River is 62 miles long and originates in the low elevation Waldo Hills located east of Salem. The Molalla River is 49 miles long and originates on the west slope of the Cascade Range. The Pudding River flows in to the Molalla River 0.75 miles upstream from the point the Molalla River flows into the Willamette River.

LAND USE

The Molalla-Pudding-French Prairie-North Santiam agricultural water quality management area is the eastern half of the North Willamette River Valley. Settlers came to this area for the rich farmland and mild climate. Today the major land use is still agriculture. However, many farms of yesterday have given way to land division and homes in the country.

The land has been divided into farm parcels of one to 200 acres. In Marion County, there are 25,425 parcels in the exclusive farm use zone. There are 3,518 parcels in special agriculture zone, and 8,429 parcels in acreage residential zone. Over 30 percent of the parcels outside of the cities are not exclusive farm use, although many of these parcels do produce farm products. The USDA Natural Resource Conservation Service has estimated the average acreage field size to be 17 acres.

Land use changes in the management area are based on elevation and the characteristics for vegetation growth. Milk Creek, tributary to the Molalla River, is in the north end of the Plan Area. The stream begins at 1,700 feet elevation flowing to 500 feet of elevation by the time it reaches the city of Colton. This watershed is mostly forest and pastures, Christmas tree parcels, and timber parcels managed by commercial timber companies. With many farmed parcels ranging from two to 100 acres, there are few full-time farmers here, many of whom work as far away as Portland.

Most of this area's agriculture is contained along the narrow Molalla Subbasin. This area has a full range of agriculture use. The parcels are mixed with clusters of one to five acres and large tracks of over 100 acres; the area does have full time farmers. At 500 feet in elevation near Dikey Prairie, agriculture gives way to forestlands and timber operations.

The largest Subbasin in this plan area is the Pudding River. The broad plain of the Pudding River Subbasin is high production agriculture, with a mix of full-time and hobby farmers. Small landowners and hobby farmers commute to various cities for work including Salem and Portland. The area extends from Donald and Aurora on the northwest to MacLeay on the south and Silver Falls State Park on the east.

The Silverton Hills area of the Pudding River Subbasin has extensive Christmas tree and grass seed farms. They include both full-time and part-time farmers. Mixed in are row crops, nursery production, and occasional vineyards and pastures. Many of the canyons in the area are too steep to farm and are used for livestock production and timber.

The valley floor of the Pudding River Subbasin produces over 200 different agricultural crops that utilize small and large parcels. They constitute scattered areas of one to 10-acre tracts where landowners have landscaping but not agriculture production. Whether or not a farmer can make a living on a small land holding depends on their crop - some nurseries and livestock operations operate on less than 10 acres.

The North Santiam River, Santiam River, and Mill Creek are similar to the Pudding River Subbasin. The upper watershed, still below the timber production area, is mainly grass seed and Christmas trees. The lower watershed consists of row crops and a variety of other agricultural production. Thousands of acres are irrigated from the North Santiam River by diversion ditches of the Santiam Water Control District. Downstream, the Sidney Irrigation Cooperative diversion ditch provides irrigation water from the North Santiam near the village of Marion to the Willamette River.

Of all the streams in this management area, only Mill Creek, which flows through Salem and Silver Creek, which flows through Silverton, flow through any city. The Willamette River also flows through Salem, but this Plan focuses on the tributaries to the Willamette River, not the Willamette itself.

The French Prairie area consists of predominately full-time farming operations. Named for the French settlers, this was the first area within the management area to be put into agricultural production. The area is prime agricultural soil, producing a variety of agriculture products. The area extends from Donald on the east to the Willamette River on the west, the Willamette River on the north and Salem on the south. The area includes the Claggett Creek watershed. The number and expanse of the large agricultural tracts

are dominating the area. The number of small parcels does not exceed the large parcels except in an area north of Keizer.

BIOLOGICAL RESOURCES

The streams, wetlands, and riparian zones within the management area contain a wide-range of biological values. The riparian zones vary significantly. Streams range from very slow moving to very fast moving. Riparian zones extend from a few yards to thousands of feet wide. Most riparian areas and wetlands have been manipulated to some extent. The area includes a broad spectrum of species and for that reason it is difficult to develop an all-encompassing description of the area. There is a core group of species that are found with equal abundance throughout the area, complemented by those species whose presence is variable depending upon the specific location within the plan area.

Riparian zones within the management area contain a variety of plant species. Numerous rushes, pond weeds, and sedges inhabit the waterways and marshy areas. Ferns such as northern maidenhair, sword fern, and bracken fern are common in shaded areas. Horsetails are abundant along stream banks in the area. Timothy grass, meadow foxtail, spike bentgrass, and tufted hairgrass are just a few species of grass found in the riparian zone. Reed canary grass is a non-native, invasive species that is found throughout, especially in wet lower elevations. Providing a spectrum of color in the spring is a number of native wildflowers, which include: iris, camas, asters, buttercups, and larkspur. Rare species include golden Indian paintbrush, which is federally-listed as threatened. Some trees and shrubs of the riparian zones include red alder, several species of willow, and Oregon ash. Found in higher altitude locations is the Pacific rhododendron. Other shrubs that are commonly found are salal, ocean spray creambush, Indian plum, and Oregon grape. Introduced species that have thrived in the area are Scotch broom and the Himalayan blackberry.

Tree species include Douglas fir, grand fir, Western red cedar, Ponderosa pine, and Western hemlock, which are encountered throughout the area, especially in the upper reaches of the Molalla and North Santiam rivers and their tributaries. Pacific yew is also found in parts of the watershed area. Deciduous species include big-leaf maple, vine maple, black hawthorne, black cottonwood, and dogwood. Throughout the planning area is Oregon white oak, which is found mostly in groves of varying sizes. These groves contain a unique grouping of species that depend upon the oaks for survival. A common shrub associated with the drier oak zones in the area is Pacific poison oak. California hazel can be found on moist Oregon white oak sites. Contained in the riparian zones of this area are numerous species of amphibians and reptiles. Pacific tree frogs, rough-skinned newts, and introduced bullfrogs are common amphibians of the area. Some reptiles found in the area include the common garter snake, the western fence lizard, and the painted turtle. The Oregon spotted frog is a species found in the area and is currently a candidate on the federal endangered species list. Species whose existence in the area is of concern are the tailed frog, western pond turtle, the red-legged frog, the yellow-legged frog, and the Cascades frog.

A broad-range of bird species inhabit the management area. Those species encountered in and around water include increasing numbers of Canadian geese, of which the Aleutian subspecies is federally-listed as endangered. A variety of ducks are also found; such as the common mallard, wood duck, pintail, and the green-winged teal. Blue herons are a common site in the watershed and the smaller green-backed heron is also present. Upland game birds that are found in the planning area include the ring-necked pheasant and California quail. Turkey vultures, American kestrels, and barn owls are a few of the birds of prey commonly found in the area. Red-tailed hawks can be seen perched on telephone poles or soaring above open fields. The bald eagle has been sighted in areas contained within the plan. The northern spotted owl is a species of occurrence that is listed as threatened by the federal government. A colorful mix of other birds can also be found throughout the watershed. Lewis' woodpecker and the pileated woodpecker can be found in wooded areas particularly among the Oregon white oak groves. Sparrows are

common, particularly the English sparrow and the white-crowned sparrow. Starlings, originally from Europe, are found in abundance and considered a nuisance by many fruit growers and livestock owners. Redwing blackbirds frequent the area as well. Violet-green swallows are seasonal visitors arriving in the early spring and staying through the summer. Other species of interest are the Rufous hummingbird, the western bluebird, the Pacific nighthawk, and the western belted kingfisher. Species of songbird that are of concern are the olive-sided flycatcher and the little willow flycatcher.

The species and numbers of fish found in the streams and rivers of the management area depend greatly on the characteristics of the stream in question. Those species found in the slow-moving Little Pudding River differs from those found in the faster, colder Abiqua Creek and, of those species found in both types of streams, the abundance or availability differs greatly. The Oregon chub is a fish species that, at one time, was common to waters of the area but is now listed as endangered on the federal list. Several populations of steelhead (*Oncorhynchus mykiss*) and Chinook salmon (*Oncorhynchus tshawytscha*) inhabit rivers within the area and are listed as threatened. The populations include upper Willamette steelhead, lower Columbia steelhead, lower Columbia Chinook salmon, and upper-Willamette Chinook salmon. Coastal cutthroat trout (*Oncorhyncus clarki*) is a candidate for the endangered species list and lower Columbia Coho salmon (*Oncorhynchus kisutch*) has been listed as a threatened species. A species of concern found in the area is the Pacific lamprey. In faster, colder waters the rainbow trout is found. Other common natives are speckled dace, redside shiner, and assorted sculpins. Non-native residents include largemouth bass, carp, bullhead catfish, bluegill, and crappie. Bull trout historically inhabited the North Santiam River but are now possibly extinct in that particular river (ODF, 2000).

A large assortment of mammals is present in the management area. The smaller mammals consist of a number of bats, which include the big brown bat and the silver-haired bat. Several species of squirrel are found, such as the California ground squirrel and the western grey squirrel as well as chipmunks. Various voles, shrews, and mice inhabit the area. These include, among others, the deer mouse, the bushy-tailed woodrat, and the Pacific shrew. Burrowing in the soil of the area are gophers and moles, which include the common mole and the western pocket gopher. Other native small mammals closely connected to the riparian zone include the mountain beaver, beaver, river otters, raccoon, striped skunks, mink, and nutria. Additional mammals of interest are red fox, gray fox, coyote, porcupine, and bobcat. Small mammals present in the area and listed as species of concern are the Pacific big-eared bat, the California wolverine, the Pacific fisher, the long-eared myotis (bat), the fringed myotis, the long-legged myotis, and the Yuma myotis. Several large mammals occur within the bounds of the area. The black bear is found in the forested, less-populated parts of the area. Encountering humans with increasing frequency is the cougar. Blacktail deer are very common throughout the area and Roosevelt elk are found in selective areas at higher elevations.

DEMOGRAPHICS

The total population of Marion County was 341,286 as of 2017. This is a 49 percent increase from a 1980 total population of 204,692. The Hispanic community plays a very important role in area agriculture in part by satisfying the large demand for farm labor. People of Hispanic origin live throughout the county but have concentrated in towns like Woodburn and Gervais that have high agricultural employment opportunities.

Table 3 provides the cities and towns of the management area along with their population history. Population changes over time can be found at http://bluebook.state.or.us/local/cities/sy/index.htm. Salem, the largest city in the area, is also the state capital. The population of all these towns has increased significantly in the past 40 years, illustrating the general trend of urbanization taking place across the entire management area.

These towns contribute greatly to agriculture in the management area. They serve as collection points for crops and distribution centers for fertilizers, chemicals, and other agriculture supplies. There are a number of small, unincorporated communities within the management area. Many of these communities are strongly dependent upon local agriculture. Pratum, for example, is home to a farmers' cooperative that serves an area east of Salem. A small sawmill operates in the community of Yoder and serves local customers.

The town of Woodburn, and the area surrounding it, contains a significant population of Orthodox Russians. A large percentage of these people are farmers, raising many different crops, particularly berries.

Table 3: Population Changes for Marion and Clackamas counties, 1960-2016.

City	1960 Pop.	2011 Pop.	% Change 1960 to 2011	2016 Pop.
Salem	49,142	155,710	217	162,060
Keizer	?	36,715	N/A	37,505
Woodburn	3,120	24,090	672	24,795
Canby	2,168	15,830	630	16,420
Silverton	3,081	9,265	201	9,725
Stayton	2,108	7,660	263	7,745
Molalla	1,501	8,110	440	9,085
Mt. Angel	1,428	3,285	130	3,375
Aumsville	3,000	3,680	23	3,965
Sublimity	490	2,680	447	2,775
Jefferson	716	3,135	338	3,195
Mill City	1,289	1,865	45	1,860
Gervais	438	2,520	476	2,565
Turner	770	1,860	142	1,945
Lyons (Linn Co.)	463	1,160	150	1,160
Donald	201	980	388	985
Aurora	274	920	236	970
Gates	189	475	151	485
Detroit	206	205	-0.5	210
Idanha	295	135	-54	140
St. Paul	254	420	65	430
Scotts Mills	155	360	132	365

http://bluebook.state.or.us/local/cities/sy/index.htm

Water Quantity

Marion County covers an area approximately 1,194 square miles and is bordered on the south by the North Santiam and Santiam rivers, on the west and north by the Willamette River and much of the east by the Pudding River and Butte Creek. Detroit and Big Cliff reservoirs, located on the North Santiam River, about 55 miles east of Salem, are part of the US Army Corps of Engineers Willamette Basin Project, and are operated for flood control, irrigation, navigation, water quality, recreation, fish and wildlife, and hydropower production purposes. A portion of the Little North Santiam River is included within the State Scenic Waterway System. The Army Corps of Engineers must balance between competing authorized purposes. Water management decisions include collaboration with agency partners.

The county has been divided into four drainage areas. In all drainage areas, unregulated stream flows are inadequate to meet the total current needs during the low-flow season. In some cases, unregulated stream flows are not adequate to meet requirements of existing consumptive water rights. In all cases, unregulated stream flows are inadequate to meet instream requirements.

There are three Groundwater Limited Areas established by the Oregon Water Resources Department in Marion County that extend over 158 square miles: Mt. Angel, Stayton-Sublimity, and South Salem Hills. Also, within in the management area there is the Gladtidings Groundwater Limited Area in Clackamas County, along with the Kingston Ground Water Limited Area in Linn County (Figure 5). These areas are identified in Oregon Administrative Rules, Department of Water Resources, Chapter 690, Division 502, Willamette Basin Program. The designation includes limitation of future groundwater use in these areas to uses related to meeting individual family needs.

Clackamas County has two major watersheds within this management area, Rock Creek and the Molalla River. Rock Creek is a tributary of the Pudding River. Rock Creek has limited flow to no flow depending on stream reach during summer months. The headwaters are in the foothills south of Molalla. The watershed is entirely agricultural and rural residential. The headwaters of Molalla River are located 5,000 feet in the National Forest. The largest part of this watershed consists of public and private forest. There are no major reservoirs in Molalla River watershed. The low flows in the summer have reached as little as 20 cubic feet per second at the Canby gage and the August flow is normally below 100 cubic feet per second. These low flows contribute to the water quality limited factors.

Present Water Use

Supplies to urban areas from surface water, while supplying over half the present population of Marion County but only three municipalities, generally are secure because of the seniority of rights that most cities hold. For example, Salem diverts from the North Santiam under priorities dating from 1856, 1866, and 1923. The city of Silverton has one of the most senior rights of Abiqua Creek and a reservoir on Silver Creek. Eleven cities in Marion County rely on groundwater for their supplies. Mt. Angel and Sublimity, both located within Groundwater Limited Areas, have reached the production capability of their wells. Most industrial use that is not supplied from municipal systems acquires their water supplies from groundwater. Nearly all the rural residential population in the county, amounting to nearly 73,000 persons, and all the rural schools rely on groundwater to meet their needs.

Over 49,500 acres are irrigated from surface water sources in Marion County. Lands in the Santiam Water Control District and the Sidney Irrigation Cooperative both have reliable supplies from the North Santiam River, as the rights they operate under have priorities that predate establishment of minimum flows for fish and other aquatic life, and in some cases predate the 1909 water code. The combined acreage of these two districts totals about 23,500 acres, nearly one half the county total. Water is diverted from the Willamette River for irrigation of about 6,900 acres. About half of these lands have water rights that predate the instream rights and minimum flows. Nearly 15,000 acres have irrigation rights from streams in the Pudding Drainage Area. Many rights predate instream water rights set for aquatic life, however, stream flow amounts during the irrigation season are such that less than 20 percent of these lands have full-season supplies and significant acreage obtain supplemental supplies from groundwater. About 78,250 acres rely on groundwater sources for full-season irrigation supplies in Marion County. Along the North Santiam, Santiam, and Willamette rivers, a relatively small acreage relies on water purchased from US Army Corps of Engineers storage, although Sidney Irrigation Cooperative is adding about 2,500 acres to its service area supplied by water purchased from Detroit Reservoir.

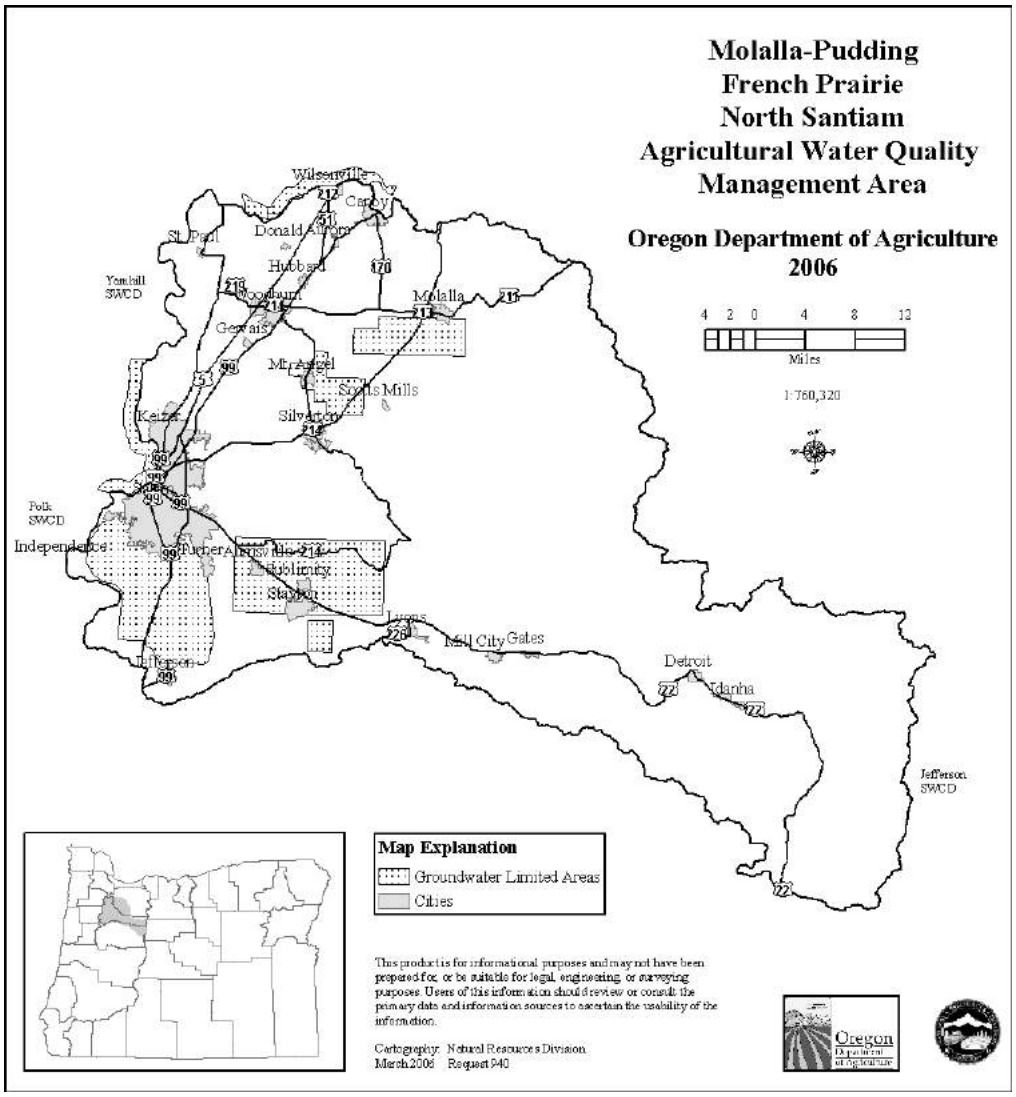
Average recreation use at Detroit Reservoir is the largest over the entire Willamette Basin Project. Other than the Detroit Reservoir with a full-pool surface of 3,500 acres, and Silverton Reservoir with a surface area at full pool of 65 acres, there are no slack-water recreation sites in Marion County. Kayaking,

canoeing, and drift boating are popular seasonal recreation uses of the North Santiam, Little North Santiam, Santiam, and Willamette rivers.

Instream rights for aquatic life exist for many streams in Marion County. In the North Santiam, Santiam, and Willamette, minimum flows are established for a portion of "natural flows" and a portion of reservoir releases. The level of releases present in these streams tends to "mask" shortages occurring from the lack of "natural flows." Flow amounts present in the Willamette at Salem meet "target" amounts during all but the driest years. Tributaries of the Pudding River, and the Pudding itself, have inadequate flows to satisfy instream rights for much of the late summer and early fall every year.

The Molalla River provides water for the city of Molalla and the city of Canby. Water is also used for irrigation of agricultural lands adjacent to the River. In the past, industrial use was related to timber and lumber manufacturing. Today, a major use of the Molalla River is recreation. This includes bank and drift boat fishing, canoeing, kayaking, rafting, and swimming. There are three public parks on the River, and during warm summer days, residents go to the parks to swim. There are many private swimming and recreation areas including a golf course and religious retreat.

Figure 5: Groundwater Limited Areas



2.4 Agricultural Water Quality

2.4.1 Water Quality Issues

The DEQ evaluated monitoring program data to determine the listing status of stream segments in the Management Area. Common parameters of concern identified in the Molalla-Pudding, French Prairie portion of the Middle Willamette and North Santiam include temperature, bacteria, biological criteria and Dissolved oxygen. Temperature and bacteria counts commonly exceed state criteria in the Molalla-Pudding and French Prairie portion of the Middle Willamette mainstems as well as in some tributaries during the fall and spring. Dissolved oxygen may fall below state criteria in the Santiam River during fall, winter, and spring. Data collection also revealed current use pesticides and legacy pesticides, no longer in use in the United States, in the Pudding River, Little Pudding River and Zollner Creek water columns. Nitrate concentrations in Zollner Creek frequently exceed the human health standard, which, itself, is orders of magnitude greater than typical aquatic concentrations. Fish tissue collected from the mainstem middle Willamette River contained toxics, including current pesticides, legacy pesticides, metals such as copper, lead and mercury. Nearly all streams where water quality is tested consistently exhibit high water temperatures above the state biological criteria in July and August.

Harmful algae blooms are becoming more common across Oregon. Outbreaks contaminate drinking water, pose recreational health risks, and impacts fish and wildlife. A harmful algae bloom in Detroit Reservoir (May-June 2018) resulted in an drinking water advisory for at risk populations.

The U.S. Geological Survey and DEQ measured Pudding River water quality during 1994 and 1995. These studies highlighted some important concerns about water quality within the watershed. Nitrate content in the stream greatly increased after the first storm event of the year. Levels of potassium and organic nitrogen peaked after the first storm as well. The Pudding River is a naturally turbid stream due to its flat gradient and to the soil types found in the area. The level of total phosphorous (TP) closely corresponded to the amount of total suspended solids. Suspended solids are generally low throughout the summer months while levels of TP vary. Water quality criteria values for the Willamette River Basin, set by DEQ in 1994, such as fecal coliforms (max#/100ml=400), were routinely violated during storm events in the Pudding River and its tributaries.

Zollner Creek, which is a tributary to the Pudding River, is a high-intensity agricultural watershed. The monitoring done by U.S. Geological Survey and DEQ showed water quality in Zollner Creek to be very poor. Erosion is high, nutrient transport is increased, fecal contamination is elevated, and ion chemistry is altered. The Marion SWCD Board of Director's identified Zollner Creek in 2009 as a priority area to focus conservation efforts to improve water quality.

The water quality of streams and groundwater directly impacts drinking water users. Nitrate above the Oregon Health Authority alert level of 5 ppm, has been detected in both public and private drinking water sources in the Management Area.

2.4.1.1 Beneficial Uses

The beneficial uses impacted by these water quality concerns include fish and aquatic life, water contract recreation, fish consumption, and human health concerns for drinking water.

Temperature
DEQ developed the temperature TMDL to protect salmon spawning in the fall, and migration and rearing year-round as the most sensitive beneficial uses in the Molalla-Pudding, Middle Willamette and North Santiam subbasins. On agricultural lands, absence of streamside vegetation, water withdrawals, and land

management that leads to widened stream channels contribute to elevated stream temperatures. DEQ has identified the existing nonpoint source pollution sources as solar heating of the Area's waterways due to a lack of riparian vegetation from forestry, agriculture, rural-residential, and urban activities.

EPA disapproved the "natural conditions criterion," a key provision of Oregon's temperature standard, on August 8, 2013. DEQ can no longer use the natural conditions criterion to account for naturally warmer temperatures in Oregon's rivers, lakes, and streams. Until the pending litigation on the temperature TMDL is resolved, the future status of existing TMDLs based on the natural conditions criteria is uncertain. At present, nonpoint source temperature reduction targets from existing approved TMDLs continue to apply and should be implemented. Management practices and stream restoration to reduce temperatures in impaired waters are needed whether the ultimate regulatory goal is natural conditions or the numeric criteria. Also, the cold water protection criterion has not changed and is still effective.

Bacteria
DEQ has set the bacteria TMDL to protect human water contact recreation (risk of infection and disease to people who come in contact with fresh water while fishing, swimming, or boating) as the most sensitive beneficial use. On agricultural lands, *E. coli* generally comes from livestock waste, either deposited directly into waterways or carried to waterways via runoff and soil erosion. Runoff and soil erosion from agricultural lands may also carry bacteria from other sources. There are numerous sources of bacteria in streams, including humans (from recreation or failing septic systems) and wildlife.

Mercury
Human fish consumption is the most sensitive beneficial use for which DEQ has set the Willamette mercury TMDL. Primary sources of mercury include air deposition from national and international sources, discharge from specific legacy mining sites, and erosion of soils containing mercury. In addition, some fertilizers have minimal amounts of mercury in them. Mercury contributions from agricultural lands originate primarily through soil erosion and transport.

Following a Court decision, the Willamette mercury TMDL was suspended and is being re-developed by DEQ (https://law.lclark.edu/live/files/23881-hernandez-ruling-april-13-2017). DEQ and EPA are revising the TMDL to meet Oregon's current water quality criterion for methylmercury, which is eight times more stringent than the criterion in effect in 2006. EPA approved Oregon's revisions to its methylmercury fish tissue concentration criterion for the protection of human health in October 2011. In April 2017, the US District Court issued a ruling requiring EPA to revise the TMDL by April 2019 and allowing the 2006 TMDL to remain in effect until EPA issues or approves the revised TMDL. In April 2017, the US District Court issued a ruling requiring EPA to revise the TMDL by April 2019 and allowing the 2006 TMDL to remain in effect until EPA issues or approves the revised TMDL. Mercury Category 4 TMDL listings, however, have been revised to reflect Category 5 303(d) water quality limited. For additional information see http://www.oregon.gov/deq/wq/tmdls/Pages/willhgtmdlac2018.aspx.

2.4.1.2 WQ Parameters and 303(d) list

Every two years, DEQ is required to assess water quality and report to the U.S. EPA on the condition of Oregon's waters. DEQ prepares an Integrated Report that meets the requirements of the federal CWA. The Integrated Report includes an assessment of each waterbody where data are available, and the list of waters identified under Section 303(d) as water quality limited and needing a TMDL and waters with established TMDLs that are expected to improve water quality (Table 4). The current 303(d) list can be found at http://www.oregon.gov/deq/wq/Pages/WQ-Assessment.aspx. The 2012 report identified approximately 67 stream segments in the Management Area as water quality limited and needing TMDLs. The Management Area watershed has approximately 83 streams with established TMDLs.

Table 4: 2012 Number of Streams Listed

Status	Molalla-Pudding	French Prairie/ Middle Willamette	North Santiam	Total
303(d) Listings	33(17 streams)	49(15 streams)	9 (6 streams)	91 (38)
TMDLs	47(15 streams)	26(15 streams)	15 (10 streams)	88 (39)
				179 (77)

2.4.2 Basin TMDLs and Agricultural Load Allocations

DEQ completed the Willamette Basin TMDLs for temperature, bacteria, and mercury and the US EPA approved the TMDLs in September 2006. These TMDLs included the Middle Willamette, French Prairie and North Santiam Subbasins. In addition, DEQ defined a TMDL for temperature, bacteria, mercury, pesticides (DDT, Dieldrin, chlordane), nitrate, and metals for the Molalla-Pudding Subbasin in December 2010. The load allocations and reductions needed to meet water quality standards and protect beneficial uses are summarized in Table 5.

Table 5: TMDL Agricultural Load Allocations

Subbasin	Parameter Reductions
North Santiam **Middle Willamette** **Molalla-Pudding**	**Mercury:** 27% Willamette Basin-wide - All Subbasins **Temperature:** Attainment and preservation of effective shade levels on smaller tributaries associated with system potential vegetation will eliminate most anthropogenic nonpoint source heat loads. Surrogate measure is percent effective shade targets and a heat load equivalent of 0.05 ºC of the Human Use Allowance. Other important measures— preserving and restoring cool water refuges where salmonids rear and migrate to when the river warms up in the summer; restore instream flow quantity.
Middle Willamette	**Bacteria:** 88% summer 75% fall-winter-spring Middle Willamette Specific Tributaries 81% Mill Creek Turner Road 79% Pringle Creek at Pringle Park/Church Street 89% Clark Creek at Mouth Bush Park
Molalla-Pudding	**Bacteria:** Agricultural land use, unless otherwise specified: 87% (summer), 92% (winter) 70-92% Pudding R., Zollner Cr., Silver Cr., W. Fork Little Pudding, Molalla R. (October 1 – May 31) 75 – 86% Pudding R., Zollner Cr., Silver Cr. (June 1 – September 30)
North Santiam	**Bacteria:** 60-83%
Pudding	**Dissolved Oxygen: Not less than 6.0 mg/L** **Iron:** 3-6 mg/l total suspended target to meet 19% to 96% based on stream flow Pudding River and Zollner Creek Watersheds. **Legacy Pesticides:** Surrogate Load Allocation Total Suspended Solids (96 hr average) Pudding River: 15 mg/L Zollner Creek: 15 mg/L Little Pudding River: 7 mg/L -90% Dieldrin Pudding River and Tributaries 95% Dieldrin Zollner Creek DDT congeners Little Pudding River: 95 – 99% Pudding River and tributaries: 61 – 97% Zollner Creek: 71 – 99% **Nitrate:** 48% Reduction Zollner Creek and tributaries

2.4.3 Sources of Impairment

The sources of water pollution can be divided into two general categories: point sources and non-point sources. Point sources of pollution within this management area consist mainly of municipal wastewater discharge and Confined Animal Feeding Operations (CAFOs). Also of significance is a food processing plant. These point sources are required to obtain a permit from DEQ in order to discharge waste.

Point source water pollution can be easy to identify and is often associated with a factory discharge or local sewage treatment overflow pipe. Non-point source pollution can be difficult to pinpoint to a single source. Non-point pollution can consist of the many vehicles on our roadways that leak oil and gas, whereas the surface drainpipe that drains this oil and gas into the local waterway may be considered a point source of water pollution. Lack of shade along agricultural, rural, and urban streams may contribute to non-point pollution. However, a single 500-acre cultivated field leaching excess nitrogen could be considered a point source of water pollution. Non-point source pollution is normally considered the result of various activities throughout a watershed. Non-point sources of pollution can include:

- Eroding agricultural and forest lands;
- Eroding stream banks and roadsides;
- Erosion from developing urban areas;
- Lack of riparian shade producing vegetation;
- Reduced water quality;
- Contaminated runoff from livestock and other agricultural operations;
- Contaminated runoff from established urban areas; and
- Septic systems.

The pollutants from these sources are carried to the surface water or groundwater through the action of rainfall, irrigation runoff, and seepage. While there may not be severe impacts on water quality from a single non-point source or activity, the combined effects from all sources contribute, along with impacts from other land uses and activities, to the impairment of the beneficial uses of the water in the area.

Most of the management area is considered moderate to high intensity agriculture land. Agricultural factors that affect water quality include:

- Crop type,
- Fertilization practices,
- Hydrologic modifications,
- Livestock management,
- Riparian alternation.

Hydrologic modifications include farm ponds, ditches, and drain tile. Ponds can have a positive effect on water quality by collecting and retaining sediment and phosphorous and providing conditions favoring increased uptake of nitrogen and de-nitrification under anaerobic conditions.

Higher in the management area there is a greater percentage of forested streams and decreasing agricultural and urban use. Water quality monitoring data for common water quality parameters in this Area Plan indicates that the water entering the watershed at these upper levels is overall of better quality.

2.5 Voluntary and Regulatory Measures

The emphasis of this Area Plan is on voluntary action by landowners and operators to control the factors affecting water quality in the Molalla River, Pudding River, North Santiam River, Mill Creek, and French

Prairie subbasins. Prevention and control measures provide guidance to help landowners and operators reduce water pollution from all agricultural and rural lands. These form the basis for the OARs developed for this management area. Landowners and/or operators who fail to address the applicable OARs either with or without an individual voluntary conservation plan may be subject to enforcement procedures based upon the administrative rules. Enforcement procedures are outlined in Section 1.3.1.

2.5.1 Nutrients and Manure Management

Nutrients are important for crop and pasture production. It is a goal of this measure to minimize discharge of agricultural nutrients into waters of the state. Appropriate timing and rates of nutrient application use can save operators money through efficient utilization of nutrients, minimizing leaching from the plant root zone and losses from surface runoff and tile drainage. Reducing leaching and surface runoff will also reduce ground water and surface water pollution from agricultural activities.

Examples of Management Practices
Nutrient management, waste utilization to agronomic levels, and nutrient/manure application equipment calibration and maintenance.

Landowners/operators can get information about nutrient management and crop nutrient needs from consultants, USDA NRCS local field office, local SWCD, and/or the OSU Extension Service.

The Oregon Administrative Rule

OAR 603-095-1940
(7) Nutrients. Effective upon rule adoption.
(a) Landowners or operators shall use and apply crop nutrients in a manner that prevents transport into the waters of the state.

TMDL parameters may be affected by this measure:
- Bacteria
- Nitrate

2.5.2 Waste: Livestock and Other

The goal of this measure is to ensure that potentially concentrated nutrients and pathogens associated with higher livestock density areas are not readily transported to waters of the state. It is encouraged that livestock waste and/or storage feeds be collected, safely spread on land, treated, or stored until it can be safely disposed. Runoff and leaching of pollutants into the waters of the state from livestock lots, pasture areas, corrals, paddocks, barnyards, arenas, and other livestock areas should be minimized so that water quality standards are not violated.

Producers should be aware that in addition to this Prevention and Control Measure, other laws regulate the management of animal waste. Many livestock operations are required to have a CAFO permit. Also, ORS 468B.025 prohibits activity that causes pollution of any waters of the state, or places or causes 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.

Examples of Management Practices
Waste storage structure, waste utilization, nutrient management, irrigation management, water diversion, underground outlets, roof gutters, prescribed grazing, filter strips, riparian buffers, fencing, off stream watering, and stream crossing.

Landowners/operators can get information on livestock resource management from consultants, agriculture engineers, USDA NRCS local field office, local SWCD, OSU Extension Service, and/or the the ODA – Natural Resources Program Areas.

The Oregon Administrative Rule

OAR 603-095-1940
(6) Waste: Livestock and Other. Effective upon rule adoption.
(a) No person subject to these rules shall violate any provision of ORS 468B.025 or ORS 468B.050.
(b) Landowners and operators shall prevent the runoff or leaching of contaminated water from feed and manure storage piles into waters of the state, including but not limited to groundwater.

TMDL parameters may be affected by this measure:
- Bacteria
- Nitrate

2.5.3 Riparian/Streamside Management Area (RMA)

The goal of this measure is to encourage landowners/operators to manage their riparian areas to establish and maintain riparian vegetation such as grasses, sedges, shrubs, and trees appropriate to the site. In the normal course of time, this vegetation is expected to provide shade and protect streamside stability during high stream flows at or below those that occur during or following a 25-year, 24-hour storm event (i.e. a four percent chance of occurrence).

A functional RMA also provides adequate vegetation to trap sediment, prevent flood debris from depositing on fields, and protect pasture and cropland from bank erosion. Protecting vegetation along smaller streams helps reduce solar radiation reaching the water and provides wildlife habitat.

In general, a functional RMA provides:
- Shade to reduce solar radiation with the objective of minimizing heating of the water,
- Filtering of sediment, organic material, nutrients, and pesticides in surface runoff,
- Streambank stability,
- Large wood and other naturally occurring vegetative contributions to the stream.

In areas where riparian vegetation has been degraded, landowners and operators are encouraged to use either passive or active management to restore vegetation and to thereby restore riparian function. Passive management could include adjustments in grazing systems, altering cropping regimes, or other adjustments to management. Active management includes planting site appropriate plant species or other restoration techniques.

When considering active management, it is recommended that native plant species be used to provide a variety of riparian functions. Non-native species in the riparian management area, however, may also provide important functions including shade, streambank stabilization, and wildlife cover.

Regardless of the approach taken, management and water quality goals should be clearly outlined. For further information about riparian areas, please refer to section 1.4.5.

Examples of Management Practices
Forest buffer, stream crossing, filter strip, riparian buffer, and exclusion zone, or limited use area.

Landowners/operators may use Conservation Reserve Enhancement Program (CREP) to restore riparian areas. CREP provides materials and labor cost-share as well as rental payments in exchange for a commitment to protect the riparian area. See Appendix A for more information.

Landowners/operators can get information about riparian areas from consultants, USDA NRCS local field office, local SWCD, the OSU Extension Service, and/or the ODA - Natural Resources Program Areas.

TMDL parameters may be affected by this measure:

- Temperature,
- Bacteria,
- Mercury from soil erosion and runoff,
- Bacteria from soil erosion and runoff,
- Nitrate,
- Turbidity
- Phosphorous
- Current use pesticides,
- Legacy pesticides (surrogate total suspended solids).

The Oregon Administrative Rule

OAR 603-095-1940
(8) Riparian Management Area. Effective upon rule adoption.
(a) A Riparian Management Area (RMA) that allows for the natural or managed development of riparian vegetation and riparian function over time shall be provided along all streams. This shall include the natural or managed establishment and maintenance of riparian vegetation, such as grasses, sedges, shrubs, and trees, appropriate to site capability, and that in the normal course of time will provide shade and protect streambank stability from flows at or below those expected to occur during or following a 25-year, 24 hour storm event.
(b) Sufficient RMA width will be site specific, and may vary by, for example, soil type, size of stream, and agricultural use.

2.5.4 Soil Erosion Prevention and Control

The goal of this Prevention and Control Measure (PCM) is to control soil erosion and minimize eroded soil access to waterways. Erosion occurs when soil particles detach and move due to the impacts of wind and water on soil without vegetative cover. Eroded soil particles can carry contaminants along with them. These particles, either with or without attached contaminants, can move to waterways and create water quality problems. Soil erosion reduces the long-term productivity of farmland.

Example of Management Practices
Annual and permanent cover crops, crop residue management, subsurface drainage, sedimentation basins, filter strips, cross slope farming, and riparian buffers.

Visual on-site indicators for erosion to surface water include sheet and rill erosion that combines to a concentrated flow that runs into a waterway or road ditch, or any waters of the state. Other visual indicators include sediment deposition from overland flow in channels that are carrying or connected to waters of the state. Field measurements may include depth of sheet and rill erosion on the field and by inspection of exposed roots from soil erosion. See Appendix C for on-site visual indicators of erosion. Landowners/operators may get additional information about erosion and soil management from the USDA NRCS local field office, local SWCD, and/or the OSU Extension Service.

The Oregon Administrative Rule

OAR 603-095-1940
(4) Erosion Prevention and Sediment Control. Effective upon rule adoption.
(a) Soil erosion rate shall not exceed five tons per acre per year between October 1 and September 30 if the resulting sediment has access to and enters the waters of the state. The erosion rate will be determined using standard scientific methods.

TMDL parameters may be affected by this measure:

- Mecury from soil erosion and runoff,
- Bacteria from soil erosion and runoff,
- Current use pesticides,
- Legacy pesticides (surrogate total suspended solids).

2.5.5 Upland Management, Irrigation Management, Livestock Management

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

Healthy upland areas provide several important ecological functions, including:

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

2.5.6 Chemigated Irrigation Water

The goal of this measure is to encourage the application of crop nutrient applications through irrigation systems at a time and in a manner that does not adversely impact the waters of the state. Fertilizers should be applied in accordance with nutrient budgets developed for each crop, incorporating current yield estimates, water analysis, soil tests, tissue tests, and/or other appropriate tests and information. All pesticides should be used in accordance with the label.

Examples of Management Practices
Waste storage structure, pond, pond sealing or lining, irrigation water management, nutrient management, pest management, filter strips, and riparian buffers.

For most commercial crops, information is available at OSU Extension Service, USDA NRCS Field Office, and/or the local SWCD.

The Oregon Administrative Rule

OAR 603-095-1940
(2) Chemigated Irrigation Water. Effective upon rule adoption.
(a) Landowners or operators shall use the application of chemicals in combination with irrigation water in a manner that does not adversely impact waters of the state.

TMDL parameters may be affected by this measure:

- Current use pesticides

2.5.7 Surface Drainage and Irrigation Ditches

Ditches provide important drainage and irrigation functions for agricultural lands. It is the goal of this measure to minimize impacts on fish and water quality from agricultural ditches while preserving landowner/operator ability to effectively construct, maintain, and use their ditches. The environmental benefits of proper drainage and irrigation ditch operation include a reduction in pollutants conveyed to the waters of the state.

For ditches to function over time, maintenance will be required. Excavation may be required to return a ditch to its original design function. Ditch bank vegetation may be damaged during maintenance. Care should be taken to minimize this damage and provide for re-vegetation. Ditch vegetation should be maintained in a manner that does not restrict water flow or prohibit ditch maintenance. Special Districts for drainage, irrigation, and/or water control may require specifically designed vegetation to meet the maintenance needs.

Landowners/operators are encouraged to refer to Oregon Department of Fish and Wildlife (ODFW) fish screening laws to determine requirements and cost share availability.

When required, either a joint permit from the U.S. Army Corps of Engineers and the Department of State Lands (DSL), or a General Authorization permit from DSL, must be obtained to clean or dig new ditches.

Examples of Management Practices

Streambank stabilization, critical area planting, filter strips, riparian buffers, grassed waterway, and lined waterway or outlet.

Information about surface drainage and irrigation ditches is available at the USDA NRCS local field office, local SWCD, and/or OSU Extension Service.

The Oregon Administrative Rule

OAR 603-095-1940
(3) Surface Drainage and Irrigation Ditches. Effective upon rule adoption.
(a) Construction, maintenance, and use of surface drainage field ditches or surface irrigation field ditches shall cause no pollutant delivery to waters of the state from soil erosion induced by excessive channel slope, unstable channel cross section, or placement of disposed spoils.

TMDL parameters may be affected by this measure:

- Temperature (surrogate shade),
- Mecury from soil erosion and runoff,
- Bacteria from soil erosion and runoff,
- Current use pesticides,
- Legacy pesticides (surrogate total suspended solids).

2.5.8 Irrigation

Appropriate irrigation and water use benefits the environment by reducing irrigation water run-off and leaching, and total pollutant discharge from an irrigation system. Landowners/operators benefit from appropriate irrigation and water use by maximizing water use efficiency and minimizing waste.

The efficacy of irrigation water application is generally enhanced by assuring the quantity and timing of application is based on the needs of the crop, as determined by soil moisture levels, crop water use budgets, or other monitoring tools.

Every farm or ranch has its own characteristics, its own soil conditions, climate, topography, and crops to consider when designing an irrigation system.

Examples of Management Practices
Irrigation water management, nutrient management, pest management, filter strips, riparian buffers, and equipment calibration and timely maintenance.

Landowners/operators can get information about crop needs, soil moisture levels, crop water use budgets, irrigation, and monitoring tools from consultants, local irrigation sales, USDA NRCS local field office, local SWCD, and/or the OSU Extension Service.

The Oregon Administrative Rule

OAR 603-095-1940
(5) Irrigation. Effective upon rule adoption.
(a) Irrigation systems shall be designed and operated to minimize runoff of potential pollutants. Irrigation scheduling shall be appropriate to each site and consideration shall be given to water use efficiency, off-target minimization, soil conditions, crop, climate, and topography.

TMDL parameters may be affected by this measure:

- Temperature,
- Mercury from soil erosion and runoff,
- Bacterial from soil erosion and runoff,
- Current use pesticides,
- Legacy pesticides (surrogate total suspended solids).

2.5.9 Pesticides

The goal of this measure is to encourage the appropriate management of pesticides, while maintaining their availability for beneficial uses while reducing the risk of surface or groundwater contamination.

Pesticide handling and application practices should be adopted that prevent off-target application and that limit off-site transport.

Current state law requires that landowners/operators follow labeling instructions for transport, storage, mixing, and application of pesticides.

Examples of Management Practices

- Use of integrated pest management strategies,
- Equipment calibration and maintenance,
- Use of anti-backflow devices.

Landowners/operators are encouraged to store, mix, and handle pesticides correctly. One way to accomplish this is by providing secure containment facilities including a leak proof pad with curbing for mixing and loading. An alternative is to load and mix pesticides at the application site carefully, avoiding spillage.

Several routines for disposal of empty containers are suggested:

(1) Triple rinsing of liquid pesticide containers, then puncturing the containers and disposing in an approved manner;
(2) Emptying dry chemical bags, then bundling and storing them until they can be disposed of in an approved manner.

Landowners/operators can get information about pesticide use from consultants, the USDA NRCS local field office, the local SWCD, the OSU Extension Service, and the ODA – Natural Resources Program Areas.

Landowners/operators shall use pesticides in accordance with the label as required under ORS Chapter 634, as administered and enforced by the ODA Natural Resources Program Areas.

TMDL parameters may be affected by this measure:

- Current use pesticides

2.5.10 Road and Staging Areas

The goal of this measure is to minimize water pollution from agriculture activities from the use and maintenance of farmstead, farm roads, and related areas. Farm roads, staging areas, barn lots, stream crossings, bridge abutments, and right of ways should be managed to reduce the impact of runoff from agriculture activities into waterways. This includes activities, similar to agricultural activities, including: nutrient management, pest management, well head protection, erosion control, grass seeding of rights of way, rock placement in ditches, stream crossings, bridges, sediment basins, proper culvert placement, sizing, and management, and weed control. Similarly, agricultural lands shall be managed to reduce the impacts of runoff onto public rights of way.

Examples of Management Practices

Critical area vegetation, heavy use protection, water bars on dirt or gravel roads, appropriate culvert placement-construction-design, appropriate road construction grade-crown, bio-swales for runoff, all measures that apply to crops apply to roads, staging areas, and farmsteads.

Landowners/operators can get information about farm roads and associated areas from consultants, USDA NRCS local field office, local SWCD, and/or the OSU Extension Service.

The Oregon Administrative Rule

OAR 603-095-1940

(9) Roads and Staging Areas. Effective upon rule adoption.

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

(A) Exemptions: Public roads and roads subject to the Oregon Forest Practices Act.

TMDL parameters that may be affected by this measure:

- Mercury from soil erosion and runoff,
- Bacteria from soil erosion and runoff,
- Legacy pesticides (surrogate total suspended solids).

Chapter 3: Implementation Strategies

Goal

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

LAC Mission

The mission of the Plan is to promote agricultural management practices that protect and improve water quality in the Molalla River, Pudding River, North Santiam River, Santiam River, Mill Creek and French Prairie Area Subbasins while maintaining agricultural viability.

The primary strategies to reduce water pollution from agricultural and rural lands lie in the adoption of practices that reduce pollutants entering surface or groundwater. These strategies are carried out at the local level by the Marion SWCD in cooperation with landowners, operators, OSU Extension, NRCS and other agencies, and volunteer organizations such as watershed councils.

3.1 Measurable Objectives

3.1.1 Management Area

ODA is working with SWCDs and LACs throughout Oregon towards establishing long-term Measurable Objectives to achieve desired conditions. At the current time, ODA and the SWCDs are using Focus Area milestones and Abiqua SIA to serve as a means to show progress.

ODA and SWCDs are working on several strategic initiatives. These include three currently active Focus Areas, a closed Focus Area and a completed Strategic Implementation Area. These are described below.

3.1.2 Focus Area(s)

There are three active Focus Areas and one completed Focus Area in the Management Area (Figure 6). Clackamas SWCD, in partnership with the Pudding Watershed Council, began working in the Pudding River Focus Area in June 2015. Marion SWCD completed work in the Silver Creek Focus Area (2013 to 2015) and began work in the Upper Mill Creek Focus Area in July 2015. Linn SWCD began work in the Bear Branch Focus Area in July 2017.

Streamside conditions for each Focus Area are assessed using ODA's Streamside Vegetation Assessment method which measures streamside vegetation before, during, and after project implementation to show progress towards meeting water quality and land condition objectives. The objective is to increase desirable vegetation such as trees and shrubs and to decrease undesirable conditions such as bare ground and invasive species. A brief description and milestones chosen to show progress is provided below for each Focus Area. The Silver Creek Focus Area is discussed in previous Plan versions. Chapter 4 provides a summary of accomplishments and lessons we are learning from implementing these Focus Areas.

Bear Branch Focus Area

The Bear Branch Focus Area is about 8,320 acres in size with approximately 39 percent of the acres in agricultural use (Figure 6). There are roughly 9.7 perennial stream miles and 11.7 intermittent stream miles within the Focus Area. The primary types of agriculture in the Focus Area include grass seed,

grazing, hay, filberts, and Christmas trees. The selection of Bear Branch Creek was based on a high percentage of ag land (39%), condition of streamside vegetation, and strong landowner contacts. The TMDL identifies temperature and bacteria to address. The Focus Area aligns with the NRCS area eligible for EQIP. This area has recent monitoring (2012), has been part of the Meyer Memorial Trust model watershed (which is ending), and strong partner interest. There has been good traction in the area; therefore, landowners may more readily adopt conservation practices.

This Focus Area is in the beginning stages of development and a pre-assessment is underway. Milestones for the 2017-2019 biennium will be chosen once the pre-assessment has been completed.

Pudding River Focus Area

The Pudding River Focus Area is about 45,721 acres in size with approximately 82 percent of the acres in an agricultural use (Figure 6). There are roughly 420 miles of intermittent and perennial streams which takes in all of the Lower Rock Creek HUC (16,265 ac), Garret Creek HUC (9,991 ac), Upper Rock Creek HUC (14.415 ac) and the Clackamas County portion of the Lower Butte Creek HUC (5,050 ac). The primary crops gown in the Focus Area include row crops, Christmas trees, orchards and nurseries. The Clackamas SWCD chose this Focus Area because it has been under-served by the District in the past and there is need for riparian restoration in this extensively agricultural area. In addition, the Pudding Watershed Council is an enthusiastic partner that will be instrumental in the success of this project.

Current Streamside Conditions from 2017 Pre-assessment:

Ag Buildings	Bare	Bare Ag	Grass	Grass Ag	Not Ag	Shrub	Shrub Ag	Tree	Tree Ag	Water	Total Ag Acres
7.55	21.61	171.35	70.18	389.44	55.39	389.24	27.85	876.47	52.68	156.87	2,163.2

Focus Area Milestone for 2017-2019:

- By 2019, increase trees and shrubs by 15 acres.

Upper Mill Creek Focus Area

The Upper Mill Creek Focus Area is about 13,831 acres in size with approximately 54 percent of the acres in agricultural use (Figure 6). There are roughly 16 perennial and 12 intermittent streams that flow through the Focus Area, which begin in the uplands and flows westward through the towns of Sublimity and Stayton and just past the town of Aumsville. Crops grown in the Focus Area include ryegrass and other small grass seed crops, as well as hazelnuts, dairy, horses, pasture, and timber. The Focus Area was chosen due to the amount of land in a farm use, 303(d) listings for temperature and bacteria, and the potential to partner with other organizations to improve water quality.

Upon completion of the pre-assessment of the Mill Creek Focus Area, Marion SWCD found that most of the streamside areas are already well forested, but that three acres could benefit from streamside vegetation improvements. Therefore, the milestone for this Focus Area is to improve the trees and shrubs along these three acres of stream over the next biennium. The SWCD recognized that other watershed work such as improved irrigation efficiency is needed in the uplands that could also contribute to improving water quality. Conducting upland improvements may foster interest with farmers to take on streamside planting projects as well. The SWCD is using this Focus Area to test a variety of media and outreach approaches to explore what works best to engage local farmers to take on water quality improvement projects.

Current Streamside Conditions from the 2017 Pre-assessment:

Ag Buildings	Bare	Bare Ag	Grass	Grass Ag	Not Ag	Shrub	Shrub Ag	Tree	Tree Ag	Water	Total Ag Acres
2.06	0.11	14.56	4.33	33.05	57.68	13.83	0.39	165.49	2.15	15.67	251.64

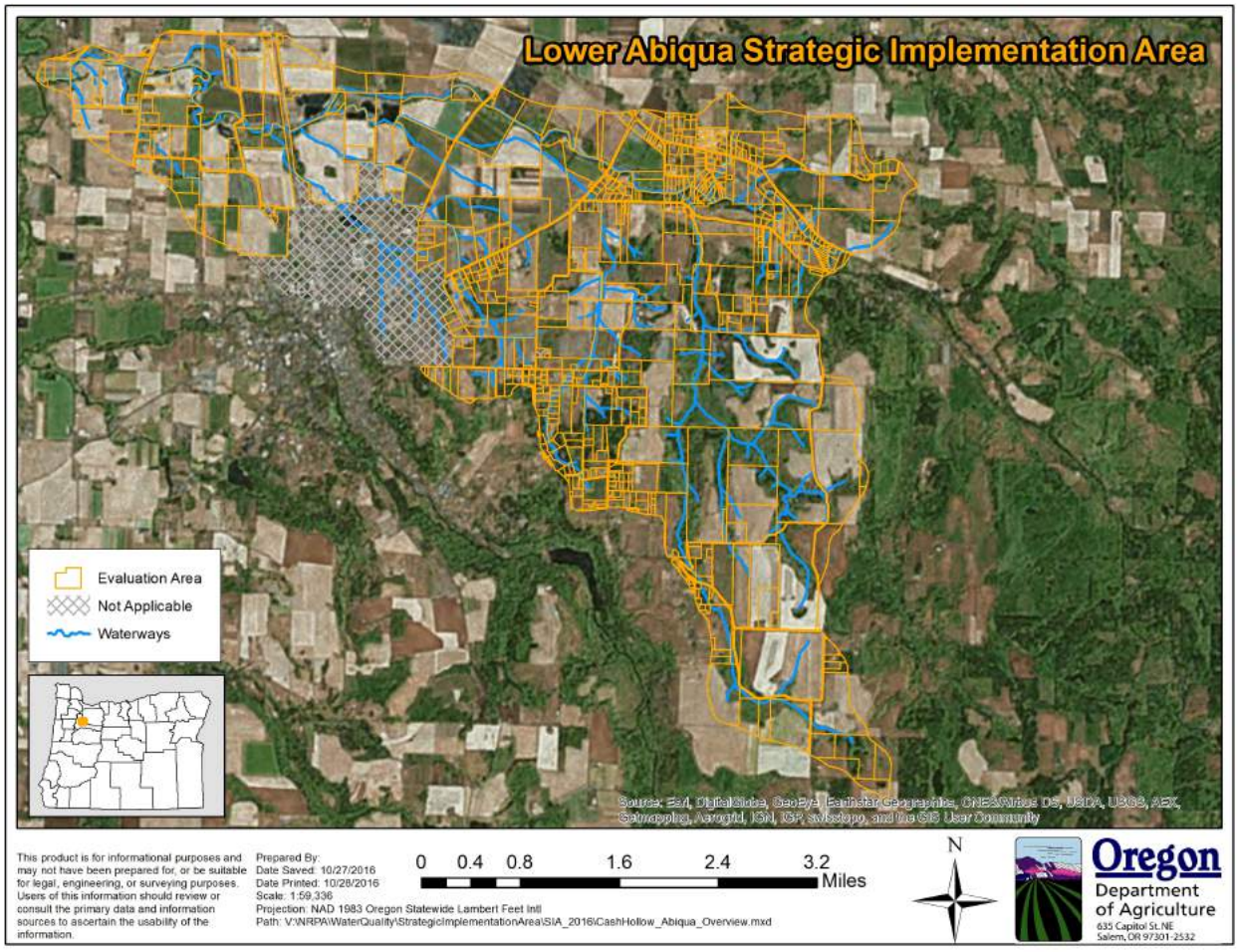
Focus Area Milestone for 2017-2019:

- By the end of the 2017-2019 biennium, increase streamside trees and shrubs by three acres.

3.1.3 Abiqua SIA

In 2016, the Abiqua watershed was selected as a SIA. As part of the Abiqua Creek watershed in Marion County, the SIA area contains approximately 9,300 total agricultural acres (Figure 7). Agricultural areas in the watershed consist of primarily of grass seed, row crops, and vineyards. Water quality concerns in the watershed include: nutrients, pesticides, and dissolved oxygen. The objective within SIAs is to achieve compliance with the agricultural water quality rules.

Figure 6. Lower Abiqua Strategic Implementation Area



3.1.4 Molalla-Pudding Pesticide Stewardship Partnership

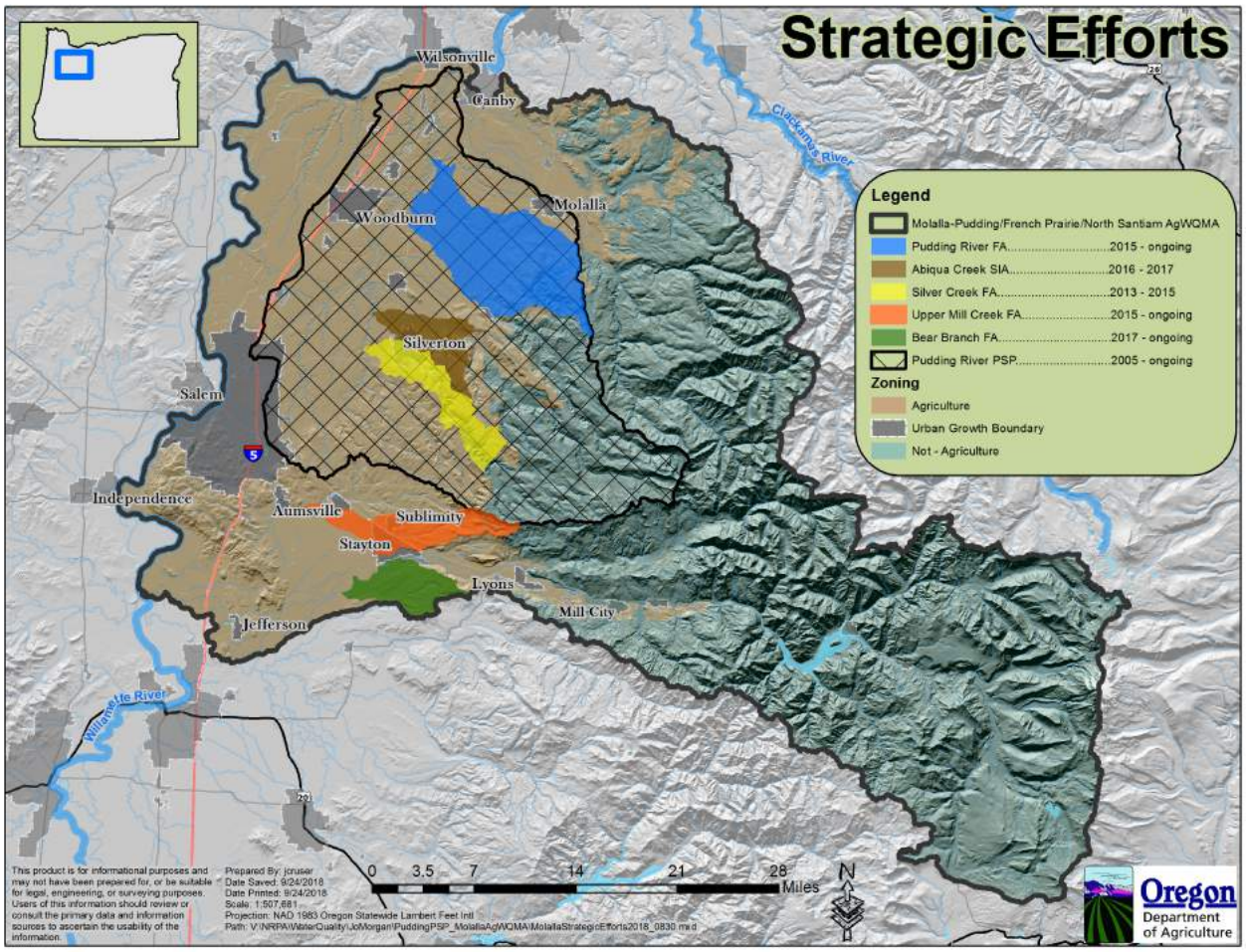
The Molalla-Pudding Pesticide Stewardship Partnership began in 2005, after a review of water quality impairment listings indicated that streams in the Molalla-Pudding were water quality limited for current use pesticides. At that time, a Total Maximum Daily Load (TMDL) was being developed for the Pudding River, which created an opportunity to pursue voluntary stewardship actions through a PSP in lieu of short-term Clean Water Act measures through the TMDL. In addition, USGS was conducting regular monitoring of Zollner Creek as part of its National Water Quality Assessment program, and these monitoring results underscored the need for engagement with pesticide applicators in the watershed. Local partners, including Marion Soil and Water Conservation District (SWCD), Oregon State University Extension (OSU), US Geological Survey (USGS)S and Wilco, expressed a strong interest in establishing a PSP in the watershed. Beginning in 2015 partners began a renewed effort to assess and address pesticide residues within the watershed.

The Molalla-Pudding PSP encompasses 529 sq.-mi. and is dominated by agricultural land use. The largest city within the watershed is Woodburn with a population of 26,000 (2017 Portland State University estimates). Based on 2011 National Land Coverage Data (NLCD), the land use in the watershed is 52% agriculture, 23% forest, 16% other, and 9% urban. Agricultural activities include tree fruit, grains, grass seed, and row crops.

As part of the PSP program, water quality is monitored for pesticide residues beginning in March and continuing through June and again in September and continuing through November. During the timeframe July 1, 2015 through June 30, 2017 water quality samples were collected from three locations.

Details about the PSP can be found at https://www.oregon.gov/ODA/programs/Pesticides/Water/Pages/PesticideStewardship.aspx. PSP accomplishments are in Chapter 4.

Figure 7. Strategic Initiatives and the Pesticide Stewardship Partnership in the Management Area



3.2 Strategies and Activities

SWCDs implement a number of strategies and activities over the biennium that are intended to help reach the water quality goal of the Area Plan. Table 6 provides an indication of what each District has generally planned to accomplish over a biennium. Strategies and activities are unique to each SWCD. For one it may make sense to focus on community and landowner engagement, while for another it may make sense to focus on implementing projects. A discussion of strategy and action effectiveness is provided in Chapter 4.

Table 6. SWCD Strategies

Strategy	Activity
Community and Landowner Engagement	• Technical assistance & outreach to individual farmers • Presentations to community groups and local partners • Tours of multiple prior or completed restoration sites • Information provided via FaceBook, Twitter, TV and Movie Ads • Information booths at local events • Publish outreach (newsletters, brochures, native plant guide, rural living handbook, etc.) • Water quality monitoring reports • Newspaper articles (sediment sources, water quality) • Native Plant Sales • Website development and launch • Multi-stakeholder meetings and technical work groups
Land Stewardship and Water Quality Projects	• Technical assistance provided to landowners for a range of management practices • Agricultural water quality projects developed (streambank erosion, riparian improvements, livestock exclusion, off-stream livestock water sources, manure storage facilities & livestock crossings) • Agricultural water quality projects implemented (streamside plantings, maintenance, livestock exclusion, manure storage facility and off-channel livestock water) • Site visits conducted (water quality technical assistance, project development, management & follow-up) • Invasive species control projects # sites
Monitoring	• Water quality sampling events conducted each quarter: # sites • Effectiveness monitoring of restoration sites: • Assisted DEQ with coordination and installation of continuous turbidity and Total Suspended Solids sampling • Conducted ODA Temperature monitoring • Focus Area streamside vegetation assessments • Provide summary of water quality monitoring, Focus Area and compliance results for LAC
Funding and Grants	• Water quality grant applications submitted • Cost-share program information provided • Cost-share enrollment assistance (CREP, EQUIP, etc.)

3.3 Monitoring and Evaluation

Water quality in the Management Area is currently monitored by DEQ, USEPA and USGS. Many other organizations also provide data. DEQ summarizes monitoring results in a report called the *Oregon DEQ Water Quality Status and Trends report for the Molalla-Pudding French Prairie North Santiam AgWQ Management Area,* March 2018 report. The full report can be found at https://www.oregon.gov/deq/wq/programs/Pages/wqstatustrends.aspx. This report will be updated for future biennial reviews.

Data collected between January 01, 2000 to March 01, 2018 within the Management Area are described in this report. These groups primarily measure surface water temperature, pH, dissolved oxygen, total suspended solids, total phosphorus, and bacteria (*E coli,* fecal coliform, and *Enterococcus*). DEQ determined status for the last two consecutive years of recent data and trends for stations with at least eight years of data. For a description of monitoring and evaluation results, see Chapter 4.

Chapter 4: Implementation, Monitoring, and Adaptive Management

4.1 Progress Toward Measurable Objectives

4.1.1 Management Area

The SWCDs conduct many activities throughout the Management Area. Subsection 4.2 below provides an indication of what they and their partners accomplishments to engage landowners, complete projects in partnership with Management Area growers and their work to obtain grants and funding to facilitate projects.

In addition to their work throughout the Management Area, each SWCD is conducting work in Focus Areas. ODA has partnered with the Marion SWCD to complete a Strategic Implementation Area in the Abiqua Watershed. The North Santiam WC, working with Marion SWCD and other partners, has applied for an OWEB Focused Investment Partnership grant, in the southern portion of the Management Area. Complementing these efforts, the Pudding Pesticide Partnership encompasses a large swath of farmland. We look forward to seeing what we can accomplish together with this mosaic of implementation strategies and partnerships that nearly cover the entire Management Area (Figure 6). A snapshot of our progress to date is provided below.

4.1.2 Focus Area(s)

In each of the Focus Areas the SWCD is assessing improvements in streamside vegetation over time using the ODA Streamside Vegetation Assessment methodology. Generally, this reflects a change from bare ground and lack of streamside vegetation to an increase in the categories of "Tree" and "Shrub."

Bear Branch Focus Area:

Milestone Progress
Linn SWCD is working on the pre-assessment and will choose a milestone for this biennium once the pre-assessment has been completed.

Accomplishments
- Conducting a pre-assessment,
- Conducted site visits,
- Writing small grants applications for two nutrient management projects.

Adaptive Management
Linn SWCD strategically chose this watershed to capitalize on momentum underway with other partners (NRCS, FSA, USFWS, ODF and the NSWC). The Focus Area aligns with the NRCS area eligible for EQIP. The watershed is also within a Meyer Memorial Trust Model Watershed. Even though the Model Watershed program is ending, this Focus Area will gain from background monitoring and traction with landowners that was begun under that program.

Pudding River Focus Area:

Milestone Progress

Assessment at the beginning of the 2017-2019 biennium:

Ag Bldgs	Bare	Bare Ag	Grass	Grass Ag	Not Ag	Shrub	Shrub Ag	Tree	Tree Ag	Water	Total Ag Acres
7.55	21.61	171.35	70.18	389.44	55.39	389.24	27.85	876.47	52.68	156.87	2,163.20

- By June 30, 2019 increase desirable streamside vegetation ("Tree" and "Shrub") on 15-acres.

During the last biennium, the SWCD and WC had the goal of increasing desirable streamside vegetation by 15-acres. They succeeded in increasing 4.03 acres of desirable ground cover, trees, and shrubs. Because there are no cities within the Clackamas County portion of this agricultural water quality management area, the SWCD chose to use nearby cities as a means to launch outreach strategies. They noted that more outreach was needed; there is a large Russian community farm in the watershed and communications needed to be tailored to that group as well as to horse owners. Over the past biennium, Clackamas SWCD and Pudding River WC have reached out to these communities. The SWCD is also focusing efforts to engage landowners in cover crop topics. The accomplishment list below highlights their progress.

Accomplishments

The Pudding Watershed Council and Clackamas SWCD:

- Conducted outreach by:
  - Promoted soil health through the popular Cotton Brief Challenge. More on that topic can be found at: https://conservationdistrict.org/2018/soil-health-and-the-cotton-brief-challenge-part-3-html.html. The "Soiling Your Undies" initiative has caught the imagination of many and the partners have brought it to the Clackamas County Fair, local newspapers and KOIN TV.
  - Visited two Farmer's Markets using cities near the Focus Area.
  - Published the Pudding River Press newsletter reaching 425 riparian landowners in the Focus Area on a range of topics (managing mud and manure during the rainy season, advertising the PSP event, and encouraging folks to volunteer for riparian plantings. A second newsletter reached 395 Focus Area farmers on topics related to shading streams, avoiding overgrazed pasture, and results of the pesticide collection event.
  - Submitted articles for the Oregon Horse Country newsletter.
  - Provided an online Tips Brochure for Small Acreages.
  - The partners hosted a booth at the Garden Palooza event (50+ landowner contacts were made).
  - Held Pudding River WC annual meeting (20 landowner contacts made).
  - Hosted a Spring 2018 Horse Workshop with flyers distributed at local feed stores and vet offices in addition to electronic messaging.
  - Hosted a Pasture Management Workshop
  - Sent out 395 PSP post cards to Focus Area landowners; 24,953 pounds of agricultural pesticides were collected at the November 2017 event. Another 110 farmers in the Focus Area were sent post cards for a second PSP collection event. The second event in Molalla brought in 19,500 pounds of unusable, expired, or restricted pesticides. Another 110 farmers in the Focus Area were sent post cards for a second PSP collection event.
  - Reached out to the Russian community in the Focus Area via a Russian radio station in Portland that provided public service announcements for the pesticide collection event. An interview was also conducted on a Spanish-speaking radio station.

- Installed 116 acres of irrigation conversion from big gun to drip irrigation for water savings (two projects 32 acres and 84 acres).
- Site prepared (invasive weed control) and planted 14 acres of riparian forest buffer (two seven-acre areas).
- Conducted brush management on 90 acres to assist a recently planted area.

Adaptive Management

The Clackamas SWCD and Pudding River WC partnership is enjoying successful momentum, having adapted their approach from the last biennium. We look forward to hearing more about progress at the next biennial review.

Upper Mill Creek Focus Area:

Milestone Progress

Assessment at the beginning of the 2017-2019 biennium:

Ag Buildings	Bare	Bare Ag	Grass	Grass Ag	Not Ag	Shrub	Shrub Ag	Tree	Tree Ag	Water	Total Ag Acres
2.06	0.11	14.56	4.33	33.05	57.68	18.83	0.39	165.49	2.15	14.67	251.64

- By the end of the 2017-2019 biennium increase streamside trees and shrubs by 3-acres.

During the last biennium, Marion SWCD had initially set the goal of reaching 15-acres of desirable streamside vegetation. However, upon conducting a thorough assessment, the SWCD learned that the majority of the Focus Area streamside areas are well-shaded with trees and shrubs. Therefore, they changed their milestone to improve streamside vegetation on the 3-acres that could benefit from shading. This is also allowing the SWCD to focus on other water quality projects such as irrigation water conservation projects that will also serve as a means to build relationships.

Accomplishments

- Completed an in-depth assessment of the watershed.
- Developed a multi-faceted stakeholder engagement approach that includes a variety of media outreach.
- Conducted outreach by:
  - Providing educational information at Saturday Farmers' Markets,
  - Distributed flyers at the Aumsville Corn Festival (1,000 flyers),
  - Hosted an irrigation meeting (including three Focus Area landowners),
  - Applied for Landowner Assistance Program funds for producers (2),
  - Displayed Mill Creek Focus Area information at the SWCD's annual meeting,
  - Planned a Water Rights Boot Camp for November 6, 2018,
  - Attended Santiam Water Control District Board meeting, WILCO, and Hops Commission meetings to build relationships with Mill Creek producers,
  - Published articles in the Aumsville Newspaper (2) and ran an ad for a month in the Star Cinema in Stayton and Northern Lights in Salem.
- Provided onsite technical assistance; discussed potential projects with landowners (10).
- Conducted site visits with producers (11).
- Planned an irrigation system for a Focus Area farm for which funding was awarded.
- Planned and funded a riparian restoration project along Mill Creek with the City of Aumsville which is located on 80-acres of farmland. The first year a 35-foot by 750-foot streamside setback will be created and an additional 35-feet by 750-feet the second year. Area Public

Works Department will tour and learn how to use off-site effluent re-use sites to enhance water quality.

- Developed farm plans (5) with two awarded funding. The two projects were drip irrigation on hazelnut fields with a total of 44-acres.
- Conducted invasive surveys along Mill Creek in partnership with North Santiam WC and the Marion Weed District, funded by the Oregon State Weed Board Grant. Weed treatments are planned along with a landowner workshop to communicate results.

Adaptive Management

Following the pre-assessment, Marion SWCD learned that most of the streamside areas are already well-shaded with trees and shrubs. Therefore, they changed their milestone from 15- to 3-acres to specifically target where additional vegetation could help cool stream temperatures. The SWCD is reaching out to landowners to build relationships with an intensive stakeholder engagement campaign. They are finding that it is challenging to keep a 'firewall' between the ODA regulatory program and the SWCD's voluntary approach and that the perception that a regulatory entity is involved at any level results in landowners not wanting to participate.

The SWCD will be doing two workshops in the watershed to educate landowners and build trust. The irrigation workshop will feature a landowner that has been a recipient of two grants explaining the benefits of his water monitoring system. The horse workshop will be on a horse farm in the watershed to show the benefit of their planned Waste Management Facility.

The SWCD is reaching out with upland projects such as irrigation efficiency and cover crops to control erosion which will contribute to water quality as well as build trust. Because there is only 3-acres where streamside vegetation might be improved, building trust with other types of projects at this juncture will help to build trust.

Marion SWCD has found that old school methods of engaging with stakeholders such as sending out newsletters is costly and provides no feedback data. The SWCD has embarked on a marketing approach that makes use of web page hits, Facebook posts on the SWCD and partners' pages and Twitter. They are also reaching out to stakeholders using TV for Public Service Announcements, big screen movie ads and placemats used in restaurants in the watershed.

4.1.3 Abiqua SIA Results

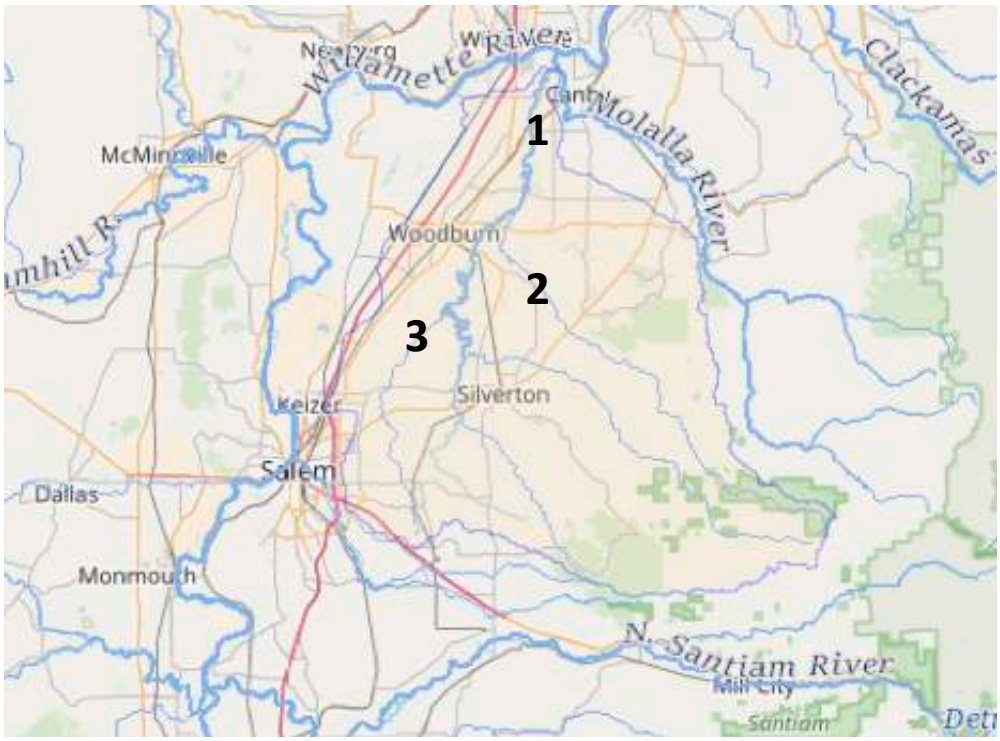
In 2016, the Abiqua watershed was selected as a SIA. A total of 2,223 parcels were evaluated for potential compliance. Of those 1,536 were not applicable (e.g. federal land, not agriculture, or less than 1-acre). 687 parcels were evaluated for compliance with the Area Rules. Of those 644 were of no concern for compliance with the agricultural water quality rules. Seven cases were opened and all growers were able to achieve compliance. In addition to gaining compliance several growers were able to capitalize on incentives through NRCS programs to install irrigation conservation measures and implement cover crops to control erosion. The objective of achieving compliance was achieved and documented in a final report in September, 2017.

4.1.4 Pudding PSP

As part of the PSP program, water quality is monitored for pesticide residues beginning in March and continuing through June and again in September and continuing through November. During the timeframe July 1, 2015 through June 30, 2017 water quality samples were collected from three locations.

(Figure 8). The biennial report can be found at
https://www.oregon.gov/ODA/shared/Documents/Publications/PesticidesPARC/MolallaPuddingSummary.pdf

Figure 8. Molalla-Pudding PSP Monitoring Locations



Water Quality Monitoring Locations 2015-17

Table 7: Water Quality Monitoring Stations 2015-17 Biennium

Station ID	Map Number	Description	Land Use	Number of Detections	BM* Exceedances
10917	1	Pudding R @ Hwy 99E	Ag, Urban	106	0
11516	2	Zollner Cr @ Dominic Rd	Ag	232	6
31875	3	Little Pudding R @ Rambler Rd	Ag	209	5

**BM= US EPA Aquatic Life Benchmark for pesticides*

A majority of pesticide detections occurred in predominately agricultural areas monitored at stations 11516 and 31875. These sites are also responsible for all U.S. Environmental Protection Agency (EPA) pesticide aquatic life benchmark exceedances.

Water quality monitoring conducted from July 1, 2015 through June 30, 2017 indicated the presence of 48 pesticides or pesticide metabolites, five of which were found at concentrations and frequencies that are of high concern and four of which are of moderate concern. Based on the sampling results the areas of greatest concern are the Zoller Creek sub-watershed and the mid-Little Pudding River. Pesticide residue concentrations in the Pudding River are of low concern at this time.

Progress in reducing the frequency of pesticide residues in stream has been limited; however, significant progress has been made in reducing the magnitude of detections as evidenced by the decline in the benchmark exceedances from the 2013-15 biennium to the 2015-17 biennium. A five-year trend analysis indicates a downward trend in concentrations for the following pesticides or pesticide metabolites: deisopropylatrazine, simazine, carbaryl, chlorpyrifos, dimethoate, diuron, ethoprop, and oxyfluorfen. Trends have remained steady for atrazine and desethylatrazine. Trends for dimethenamid, glyphosate, AMPA, imidacloprid, metolachlor, and propiconazole are up indicating the need for more focused education and outreach and/or management measures. Additional efforts are needed to reduce the overall number of pesticides detected at the three monitoring stations. Future monitoring will be expanded to include stream flow data which will allow for determinations of pesticide loading in addition to concentrations determinations.

During the 2015-17 biennium, local efforts have been focused on engaging the watersheds diverse communities through conversations at local events, such as the Woodburn Public Works Field Day and by presenting information via local Spanish language radio. The PRWC has also been engaged in filling gaps in local school programs by sharing the stewardship message through hands on educational programs and conducting field day streamside demonstrations about aquatic macroinvertebrates and water quality.

Initially in 2015, early partnership development focused on identifying and acquiring academic and conservation district support. Focus has been directed towards gaining the public's attention in relaying the need for clean streams to be a critical part of a healthy community. Substantial efforts have made to promote partnerships between businesses and the community. This has resulted in partnerships with nursery businesses donating trees to improve impaired riparian corridors on private agricultural property thus reducing he potential for pesticide movement from fields to waterbodies.

Through a combination of cold-calling and emailing, the PRWC communicated with people on a list of licensed nursery operators and Christmas tree growers. As credibility of the organization has evolved, so has its potential to make inroads with streamside landowners. The PRWC is collaborating with both Clackamas and Marion SWCDs to enhance riparian buffers on private lands.

4.2 Activities and Accomplishments

Table 8 below provides information from each District on the types of strategies and activities they accomplished over the fiscal biennium. Each District brings a focus that reflects the needs within their unique portion of the Management Area.

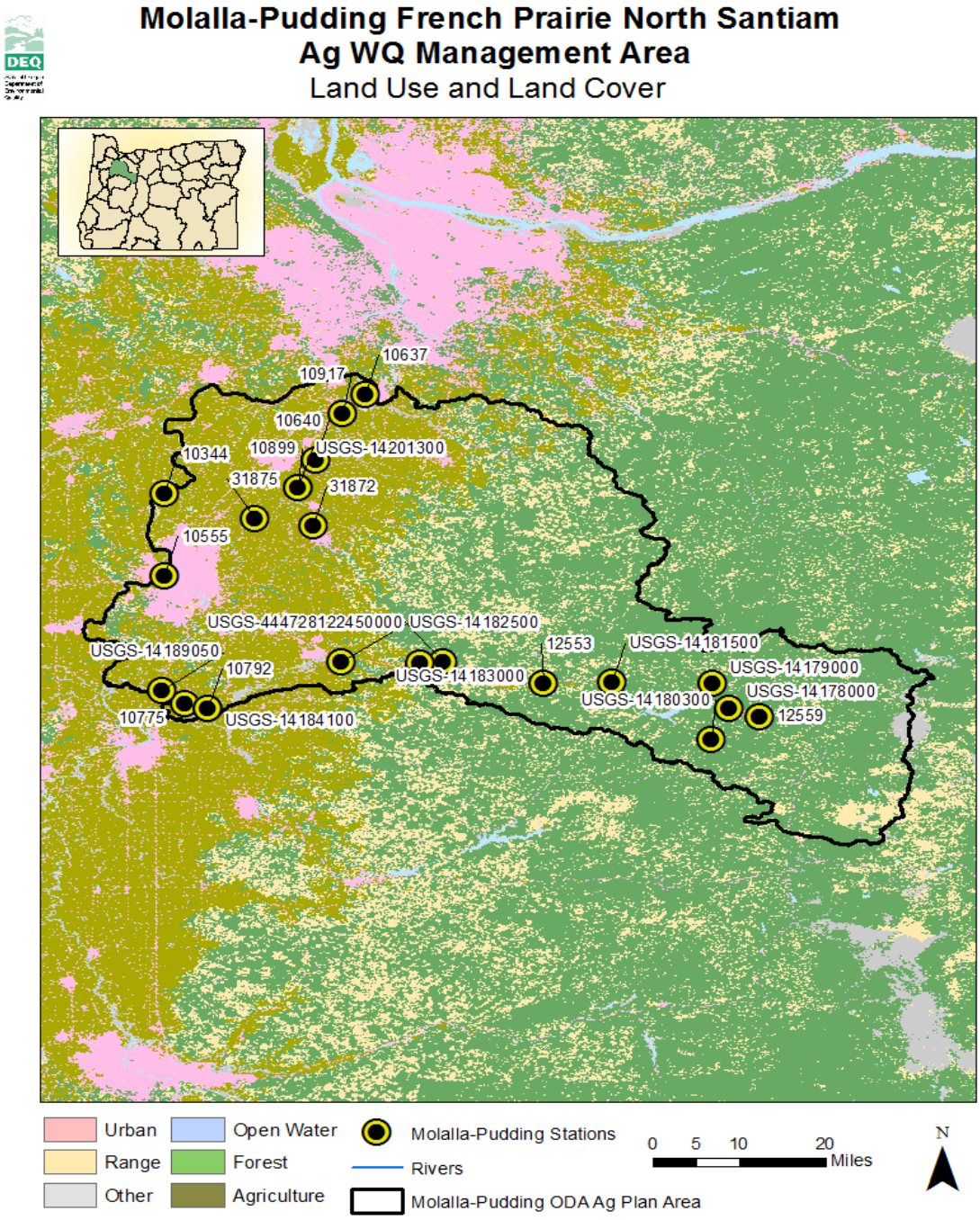
Table 8. SWCD Cumulative Reporting of Activities and Accomplishments

Progress Toward Work Plan Activities and Measurable Objectives This table is a combined total of accomplishments completed by Marion, Clackamas, and Linn SWCDs July 1, 2016 – June 30, 2018. Note that Focus Area accomplishments are provided in 4.1 above.		
Community and Landowner Engagement	# of landowners provided with brochures, fact sheets, mailings, etc.	12,553
	# of landowner engagement events sponsored by the SWCD (info booths, workshops, tours, etc.)	13
	# of landowners that attended these events	655
	# of Electronic Media 'Hits' (FaceBook, Twitter, TV and Movie Ads)	
	# of landowners provided technical assistance	638
	# of on-site evaluations/on-site visits	170
	# funded applications for landowners projects	49
	# conservation plans written	27
	# acres in conservation plans	1,131
	# Ag WQ projects implemented	49
	Total acres in Ag WQ projects implemented	688
Land Stewardship and Water Quality Projects	**Project Types**	Units
	Streamside planting (trees, shrubs, filter strips)	40
	Wetland enhancement	33 ac
	Stream habitat enhancement	1 ac
	Streambank protection	860 ft
	Upland	
	▪ Tiling	710 ft
	▪ Grass waterway	6 ac/ 1,100 ft
	▪ Erosion control	201 ft
	▪ Sediment pond	22 ac
	Invasive species control	23 ac
	Water conservation (irrigation)	479 ac
	Livestock management	
	▪ Exclusion fencing	.8 ac/1,100 ft
	▪ Heavy use area	6 ac
	▪ Grazing management	18 ac
	Access road	1,100 ft
Monitoring	The SWCDs are not currently conducting monitoring in this Management Area.	
Funding and Grants	▪ OWEB Grants ▪ Marion Landowner Assistance Program (LAP) Funding ▪ NRCS Funds (CREP, EQIP, etc.)	$32,600 + $184,734

4.3 Monitoring—Status and Trends

For this biennial review, DEQ reviewed data from 307 monitoring stations, of which 22 had sufficient data for this status and trends analysis (*Oregon DEQ Water Quality Status and Trends report for the Molalla-Pudding French Prairie North Santiam AgWQ Management Area,* March 2018 report). Of these 22, approximately five are potentially influenced by agriculture based on location and percent of land in an agricultural use (Figure 7 and Table 8).

Figure 9. Monitoring Station



The main agricultural water quality concerns are highlighted in grey and discussed below. See the DEQ report for all graphs (https://www.oregon.gov/deq/wq/programs/Pages/wqstatustrends.aspx).

Table 9. Status for Agriculturally Influenced Stations

Site ID	Site Description	*E. coli (mpn/100mL)*	pH	Dissolved Oxygen (mg/L)	Temperature (deg C)	Total Phosphorus (mg/L)	Total Suspended Solids (mg/L)
		# exceeding standard/N[1]				median[2]/N[1]	median[3]/N[1]
Likely influenced by agriculture in the Management Area							
10640	**Pudding R @ Hwy 211 (Woodburn)**	7/107	0/115	4/115	-	0.11/108	19/110[4,]
10899	**Zollner Cr @ McKee Rd**	-	0/107	18/101	-	-	-
10917	**Pudding R @ Hwy 99E (Aurora)**	11/116	0/179	0/174[5]	-	0.1/115	31/162
31875	**Little Pudding R @ Rambler Rd**	-	0/107	17/103	-	-	-
UGSG 14201300	**Zollner Cr Near Mt Angel**	-	3/272	-	-	0.23/261	-

[1] N = total # of observations

[2] DEQ benchmark for potential water quality concerns = 0.05 mg/L ("*Methodology for Oregon's 2012 Water Quality Report and List of Water Quality Limited Waters"*)

[3] Instream TSS concentrations of 6 mg/L and 3 mg/L are necessary to meet the iron criterion in the Pudding River and Zollner Creek, respectively. The pesticides TMDL established instream TSS concentration targets of 15 mg/L for the Pudding River, 15 mg/L for Zollner Creek, and 7 mg/L for the Little Pudding River.

[4] Statistically significant degrading trend

[5] Statistically significant improving trend

[6] Statistically significant seasonal patterns

E. coli: Of the stations with the highest percentage of agricultural land use, Station 10640 exceeded the water quality standard for 6.5 percent of the samples and Station 10917 exceeded the water quality standard for 9.5 percent of the samples.

pH

Zollner Creek near Mt Angel—there were only two exceedances in 20-years with most values meeting the standard. The slightly decreasing trend falls entirely within an acceptable pH.

Dissolved Oxygen

Stations 10640 and 10917 all showed a significant improving trend. No significant trend was shown in the available data at stations 10899 and 31875.

Temperature

There are nine stations with sufficient data to assess temperature status and/or trends for the Molalla-Pudding French Prairie North Santiam AgWQ Management Area. None of these stations are located in areas with the highest percentage of agricultural use.

Total Suspended Solids (TSS)

Nine stations in the AgWQ Management Area had enough data to assess TSS trends with six having significant results. Two stations had sufficient data for a status result. Status was based on a comparison to the instream TSS concentration targets established in the Molalla-Pudding Subbasin iron and pesticides TMDLs. Instream TSS concentrations of 6 mg/L and 3 mg/L are necessary to meet the iron criterion in the Pudding River and Zollner Creek, respectively. The pesticides TMDL established instream TSS concentration targets of 15 mg/L for the Pudding River, 15 mg/L for Zollner Creek, and 7 mg/L for the Little Pudding River. Stations 10640 and 10917, both in the Pudding River, exceeded the TSS TMDL target within the last two years. Both stations show significant increasing TSS trends indicating a degradation in water quality.

Additional Conclusions

DEQ provides the following additional conclusions:

- *Available Data*: No monitoring station had sufficient status or trend data for all parameters assessed in this report. Stations with sufficient data for the most parameters included DEQ ambient monitoring stations 12559 and 10792 in the North Santiam / Santiam, and stations 10555, 10640, and 10917 on the Pudding River. USGS stations tend to have multiple years of available data but are primarily limited to temperature data.
- *TSS:* Additional TSS data should be collected in the Pudding River tributaries, Abiqua Creek, Zollner Creek and the Little Pudding River in order to evaluate the status and trend of achieving the Molalla-Pudding Subbasin Pesticides TMDL TSS targets. TSS data in the Pudding River should continue to be collected at stations 10640 and 10917. Aligning TSS monitoring on the tributaries with current Pesticide Stewardship Partnership monitoring stations should also be reviewed for feasibility.
- *Continuous Data*: Grab samples may not provide a complete characterization of water quality for parameters that fluctuate on a daily basis (e.g., temperature, DO, pH). For this reason continuous data are preferred and should be considered when monitoring these parameters in the future.
- *Land use*: When interpreting results for biennial reviews and planning the location of future monitoring stations where there are data gaps, the land use in the watersheds should be considered. Pudding River stations 10899, USGS-14201300, 31875, 10640, and 10917 are located in watersheds with the highest percentage (50% - 88%) of agriculture land use. Other stations typically have <20% agricultural land use with nine out of the 11 stations in the North Santiam having less than three percent agricultural land use.

4.4 Biennial Reviews and Adaptive Management

4.4.1 LAC Discussion and Recommendations

Which strategies have been most effective and why?

Focus Area implementation is underway with an emphasis on outreach beginning to yield multiple on the ground projects. ODA's SIA resulted in achieving compliance at a point in time. Projects are also being implemented within the Pudding PSP that include tree plantings and successful pesticide collection events. We believe these strategies are successful, but it remains difficult to link project implementation with water quality monitoring results.

Are there cultural, economic, or environmental factors that are limiting the effectiveness of our strategies?

The LAC indicated that grant funding processes can be cumbersome and do not mesh well with the timeframe that growers need to get work done in. They also pointed out a need to know more comprehensively how much restoration is done by growers. Many do projects simply because it is the right thing to do but do not report these actions. Cultural perceptions of distrust of government and/or a desire to keep it simple and not involve agencies can result in under-counting all that growers are doing.

Conflicts exist between restoration efforts and the need to control water for irrigation and flood control. For example, trees have been planted along streams where there is a need to limit woody vegetation where the irrigation district manages these reaches for other purposes.

4.4.2 ODA Compliance

As typical throughout Oregon, the approach of identifying issues and working with growers through primarily providing information, engaging with the SWCDs, NRCS, and WCs to provide technical

assistance and sometimes financial assistance has proven successful in achieving compliance with the rules without a need to resort to punitive measures such as civil penalties (Table 10).

Table 10. Resulting Compliance Actions

Letter of Compliance	16	Compliance Achieved
Letter of Warning	2	Required Actions Possible
Water Quality Advisory	17	ODA Recommends Actions
Fix It Letter	1	Site Visit Not Warranted
Notice of Non-Compliance	0	ODA Requires Actions
Civil Penalty	0	Penalty Fee Assessed

During the biennium, 23 compliance cases were initiated; of these ODA initiated nine cases. Seven of these were within the Abiqua SIA. Five cases were initiated via public written complaint and nine via another agency notification. Issues encountered during compliance actions were primarily related to riparian (10) and sediment (11) with some related to manure management (6) and nutrients (1). All seven SIA cases resulted in compliance. More details about the Abiqua SIA results can be found in 4.2.1.

Acknowledgements

For Farming in Marion County: A Glimpse at Then and Now

The author of this section, Barbara Lucas, wishes to thank the pioneers' descendants and other farming devotees who helped her catch a glimpse of farming in Marion County: Dave Adams, Barbara Bauman, Bob Dettwyler, Lois Egan, Myron and Jane Harper, Fred Kaser, Alan Kraemer, Edgar Lucht, Judy McClaughry, Mark McKay, Rob Miller, Harold Morgan, Don Nusom, Jr., Don Nuson, Sr., Swede Pavlicek, Ken Perkey, Hazel Smith, Betty Stuchlik, Ron Vandecouvring, and Butch Van Veldhuizen. Her thanks also go to:

Paul Eckley, city of Salem
Gail Gingrich, Marion County Extension Service
Jim Johnson, Oregon Department of Agriculture
Dan Keeley, Marion County Public Works
Rob Kissler, city of Keizer
Ed Magner, Portland District, U. S. Army Corps of Engineers
Larry Parsons, Bureau of Reclamation
Bruce Pokarney, Oregon Department of Agriculture
Richard Schmid, Mid-Willamette Valley Council of Governments
Tina Schweikert, city of Salem
Larry Trosi, Santiam Water Control District
Sterling Anderson, Marion County Planning Department

Bibliography

Clark, Malcolm Jr., *Eden Seekers: The Settlement of Oregon 1818-1862;* published by Houghton Mifflin Company, Boston 1981

Corning, Howard McKinley, *Willamette Landings: Ghost Towns of the River,* published by the Oregon Historical Society, 1973

Ecosystem Research Consortium, *Willamette Basin Planning Atlas*, published by University of Oregon, 1999

MacColl, E. Kimbark, *Merchants, Money and Power: The Portland Establishment, 1843-1913,* published by The Georgian Press 1988

McKay, Harvey J., *St. Paul, Oregon 1830-1890*, published by Binford & Mort, 1980

O'Donnell, Terence, *Oregon History*, published in Oregon Blue Book 1995-96

Richmond, Henry III, *The History of the Portland District Corps of Engineers, 1871-1969,* published by U. S. Army Engineers District, Portland 1970

Schmid, Mark, *Sublimity; the Story of an Oregon Countryside, 1850-1950,* the Library Bookstore, St. Benedict, OR, 1951

Snyder, Eugene E., *1851 Early Portland: Stump Town Triumphant*, published by Binford and Mort, Portland, 1970

Strozut, Jr., George, *Black Gold: The Story of Lake Labish,* the Marion County Historical Society, Salem, Oregon 1959

A Century of Memories: City of Stayton, Oregon 1891-1991; published by the Stayton Mail, August 28, 1991

Marion County Rural Transportation System Plan, prepared by Marion County Public Works, December 1998

Stayton and Sublimity: Community Guide and Business Directory, l999-2000, published by the Stayton/Sublimity Chamber of Commerce.

Watershed Work Plan: Little Pudding River Watershed, Marion County, Oregon, prepared by the Soil Conservation Districts of Mt. Angel, Silver Creek, and Santiam, plus the Lake Labish Water Control District, December 1957.

Willamette River Basin Reservoir System Operation, published by US Army Corps of Engineers, Portland District, May 1989

References

Alt, David D. (1978). *Roadside Geology of Oregon*. Mountain Press Publishing Co., Missoula, MT

Bailey, V. (1936). *The Mammals and Life Zones of Oregon*. In "North American Fauna" 55:1-416

Baldwin, Ewart M. (1964). *Geology of Oregon*. Kendall/Hunt Publishing Co.

Behler, John L. and King, F. Wayne. (1998). *National Audubon Society Field Guide to North American Reptiles and Amphibians*. Alfred A. Knopf Inc.

Brown, Herbert A., et al. (1993). *Amphibians of Washington and Oregon*. Seattle Audubon Society.

Council for Agricultural Science and Technology. (2012). Assessing the Health of Streams in Agricultural Landscapes: The Impacts of Land Management Change on Water Quality. Special Publication No. 31. Ames, Iowa.

Evanich Jr., Joseph E. (1990). *The Birder's Guide to Oregon*. Portland Audubon Society.

Friedman, Ralph. (1983). *This Side of Oregon*. The Caxton Printers, Ltd. Caldwell, ID

Gabrielson, Ira N. and Jewett, Stanley G. (1970). *Birds of the Pacific Northwest*. Dover Publications Inc., New York

Ingles, Loyd G. (1965). *Mammals of the Pacific States*. Stanford University Press. Stanford, CA.

Marshall, David B. (1992). *Sensitive Vertebrates of Oregon*. Oregon Department of Fish and Wildlife. 1st Edition.

Marshall, David B. and Puchy, Claire A. (1993). *Oregon Wildlife Diversity Plan*. Oregon Department of Fish and Wildlife. 2nd Edition.

National Geographic. (1999). *Field Guide to the Birds of North America*. Washington D.C. 3rd Edition.

Natural Resources Conservation Service (1986). Field Office Technical Guide, Section 1. NRCS Field Office, Salem, Oregon.

Oregon Department of Forestry. (2000). ODF - Bull Trout Distribution Map. http://www.odf.state.or.us/atlas/maps/bul.

Sullivan, Walter. (1974). *Continents in Motion*. McGraw-Hill Book Company
www.city-data.com (basin on estimated 2006 populations)

Whitaker Jr., John O. (1996). *National Audubon Society Field Guide to North American Mammals*. Chanticleer Press Inc., New York.

Williams, James D., et al. (1983). *The Audubon Society Field Guide to North American Fishes, Whales, and Dolphins*. Alfred A. Knopf Inc.

Thayer, Thomas P. (1939). *Geology of the Salem Hills and the North Santiam River Basin, Oregon*. Oregon Department of Geology and Mineral Industries. Bulletin No. 15.

Tuscon Myers & Associates. (1994). *Marion County Water Management Plan*. Marion County Planning Department.

USDA National Agricultural Statistics Service. (1999). *Census of Agriculture, 1997*. Portland, Oregon.

Appendix A: Public Funding Sources for Landowner Assistance

What is the Conservation Reserve Enhancement Program?
The CREP was created in 1998 through a unique partnership between the USDA and the state of Oregon. Its purpose is to establish riparian vegetation on agricultural land along streams, protecting water quality and restoring fish and wildlife habitat.

Agricultural landowners can enroll eligible riparian lands into a 10 to 15-year CREP contract and receive an annual conservation payment for the 10 to 15-year contract period, reimbursement for 75 percent of the costs of riparian restoration practices, and other financial incentives.

What is the Oregon CREP?
The Oregon CREP is a State and Federal partnership developed to assist in the restoration of freshwater streams along agricultural lands. Riparian habitat along salmon and trout streams throughout the State will be restored under this program. CREP is implemented in partnership with landowners, by the NRCS, FSA, ODF, and local SWCDs.

What are the goals of the Oregon CREP?
Oregon and the USDA have jointly developed several goals for the program. They include:

- Provide riparian buffers to restore stream conditions for salmonid habitat requirements,
- Reduce sediment and nutrient pollution from agricultural lands adjacent to streams,
- Ensure vegetation establishment adequate to stabilize stream banks under non-flood conditions,
- Ensure vegetation establishment adequate to reduce water temperature to natural ambient conditions,
- Ensure acreage enrolled for riparian buffer practice is restored to properly functioning riparian conditions,
- Provide a mechanism for landowners to meet water quality requirements.

What are some of the environmental benefits of the Oregon CREP?

- Establishment of forested riparian buffers will help restructure streams and increase the availability of insects and other salmon and trout food,
- Trees along streams will reduce the rate of solar water heating which is the most important water quality limiting factor in salmonid streams,
- Establishment of wetlands will provide important rearing habitat for trout and salmon,
- Riparian buffers will reduce non-point source pollution and improve stream water quality.

Who is eligible for the Oregon CREP? When can I signup?
You can enroll in CREP at any time. In addition to offering acreage along agricultural lands, the applicant must satisfy the basic eligibility criteria for CRP. Land must be cropland that has been cropped two out of the last five years that is physically and legally capable of being cropped. Marginal pasture is also eligible to be enrolled provided it is suitable for use as a riparian buffer planted to trees. Land for which there is an existing CRP contract or an approved offer with a contract pending is not eligible for CREP until that contract expires.

What land is eligible for CREP?
Local agency employees will work with landowners in determining if the land is eligible.
What types of land are eligible?

- Cropland planted to annual or certain perennial crops
- Marginal pasture

- Cropped wetlands

What must I do with land enrolled in the program?
Three conservation practices are included in the program: riparian forest buffers, wetland restoration, and filter strips. Most CREP land will be planted to riparian buffers, consisting primarily of native trees and shrubs. Landowners will receive annual rental payments from the USDA.

How will I know what to plant in the riparian zones?
Technical assistance is available to all CREP producers at no charge. You will have access to staff members from several agencies including the FSA, NRCS, ODF, Cooperative Extension Service, and U.S. and ODFW. Agency staff will develop a Conservation Plan specifically tailored to your site. (There may be a minimal measurement service charge for determining field sizes.)

How wide are the riparian habitats? Is the riparian habitat width flexible?
The width is site specific and flexible. It is based on landscape features such as soil type, vegetation, stream type, and site history. The width can range from 35 to 180 feet AVERAGE. The widths specified in the riparian forest buffer standard are averages, over the length of the enrolled acreage. Landowners may move the RIPARIAN boundary toward or away from the stream at different locations to meet management objectives as long as the overall average width meets the contract specifications.

Must I enroll all eligible land?
No. The program is voluntary and the decision on how much land is enrolled is up to the landowner. The length of riparian area to enroll, and whether to enroll land on both sides of the stream, is the landowner's choice.

Can I hay, harvest, or graze my CREP land?
Haying, harvesting, and grazing would not be permitted during the CREP contract period unless the Secretary of Agriculture permits it for emergency purposes.

What are the payments under CREP?
There are seven types of payments that participants in the Oregon CREP may receive: annual soil rental payments, annual practice incentives, annual maintenance payments, cost-share assistance in the installation of the conservation practices, and a one-time cumulative impact incentive.

Annual payments:
- Soil rental: Land enrolled will earn an annual payment based on the county's dryland soil rental rates for specific soils on agriculture land. The rate for a producer's land will be based on an average of the three predominant soil types. Additionally, for the first time, producers may be eligible for a rental payment based on the rental value of irrigated land if the water used to irrigate that land is left in the stream and landowners get an “instream lease” from Oregon Water Resources Department.
- Practice incentives: Annual incentive payments above the basic annual per acre rental rate will be made based on the conservation practice installed. Incentive rates will be 25 percent for filter strips, 50 percent for riparian buffers, and 50 percent for wetland restoration.
- Maintenance: Participants will receive $5 to $10 per acre for annual maintenance based upon the conservation practice installed.

Installation compensation:
- Cost-Share: Landowners will receive 50 percent cost sharing from USDA, plus 25 percent cost sharing from Oregon State to establish trees, shrubs, and other components necessary for CREP

practices. This 75 percent cost-sharing potentially limits a participating landowner's out-of-pocket expenses in establishing the habitat.

Cumulative Impact Bonus:

- Landowners can earn a one-time bonus incentive of four times their average annual soil rental rate if they enroll at least 50 percent of a five-mile stretch of stream. Neighbors along a stream can join together to be eligible for this bonus.

Signup Incentive Payments:

- Signup Incentive Payment **(Not applicable to CP-23 Wetland Restoration)**
  $10 per acre per each full year of contract
  Example: ($10 X 15 years X 1 acre = $150)
  This is a one-time payment and became available June 21, 2000.

Practice Incentive Payment:

- Practice Incentive Payment (PIP)
  (Not applicable to CP-23 Wetland Restoration)
  40 percent of eligible costs.
  Example: (Total eligible cost of putting in practice per acre is $800 X .40 = $320) If cost of installation is zero, Practice Incentive Payment is zero.
  This is a one-time payment and became available June 21, 2000.

What types of items can I receive cost sharing assistance on?
Cost sharing is available for riparian plantings, fencing and providing livestock water through the habitat (such as with nose pumps). There are not-to-exceed cost share amount guidelines in place.

What will happen to the land in 10-15 years when the contract expires?

- CREP lands *might* be eligible for re-enrollment, if the program is extended, but you may enroll CREP lands into a permanent easement in the original contract.
- The CREP buffer may be retained and good stewardship of your land may be continued.
- Portions of the CREP buffer may be commercially harvested (following proper Forest Practices Act requirements).
- Portions of the CREP buffer may be converted back into agricultural use (following proper regulations such as the Endangered Species Act and Agricultural Water Quality Management Act).

Permission to Access Property - When an applicant enters into a CREP contract, does that give permission for any agency to enter their property? If not, other than NRCS and FSA, who else can enter the property without the owner's authorization?
No, by signing a contract this does not give the right for any agency to enter the property. Participating agencies would be the Oregon Department Forestry, to develop the Tree Plan, or a SWCD employee who helps the producer develop the Conservation Plan of Operation, and/or the Oregon Water Resources Department to perfect the Water Right Lease if a producer is applying for the irrigated rental rate. In no case, should an employee be on the property without calling first and setting up an appointment and/or stopping by the headquarters to facilitate the visit to the producer's property.

Other than the NRCS-038 form that is used for receiving authorized access when a "Yes" is entered on the AD-1026, is there any other provision that automatically allows others to access the property?
No

How does the CREP gel with the Agricultural Water Quality Management Act **process in regard to purposes, legal protection, etc.?**
Agricultural Water Quality Management Act establishes a process for agriculture to address watershed conservation efforts and identify the condition, problems, priorities, and solutions to maintain or enhance the watershed conditions. CREP is one of the programs available for a producer to enhance the stream corridor on his property.

How can I get more information and sign up?
Check out the website at www.or.usda.gov/edso/or/or.htm, or contact your local SWCD, USDA NRCS office, or Farm Service Agency office. The contact information is located in Appendix B.

Appendix B: Educational and Technical Services

Soil and Water Conservation Districts (SWCDs)
Prepares management plans and helps implement them by coordinating with other technical experts in natural resources. Helps landowners obtain financial assistance for conservation projects.

Clackamas County:	503-655-3144
Marion County:	503-399-9927
Linn County:	541-926-2483

USDA – Natural Resources Conservation Service (NRCS)
Provides information on soil types, soils mapping, and interpretation. Administers and provides assistance in developing plans for Conservation Reserve Program (CRP), Environmental Quality Incentive Plan (EQIP), Wetland Reserve Program (WRP), and other cost share programs. Makes technical determinations on wetlands and highly erodible land.

Clackamas County:	503-655-3144
Marion County:	503-391-5741
Linn County:	541-967-5925

Oregon State University Extension Service
Offers educational programs, seminars, classes, tours, and publications to guide landowners in managing their resources.

Clackamas County:	503-655-8631
Marion County:	503-588-5301
Linn County:	541-967-3871

Oregon Department of Agriculture (ODA)
Oversees the Agricultural Water Quality Management program, issues permits and helps producers comply with confined animal feeding water management programs, provides support to Soil and Water Conservation Districts.

Natural Resources Division (Salem):	503-986-4700

Department of Environmental Quality (DEQ)
Responsible for protecting and enhancing Oregon's water and air quality, cleaning up spills and releases of hazardous materials, and managing the proper disposal of solid and hazardous wastes. Maintains a list of water quality limited streams, sets total maximum daily load (TMDL) allocations. Provides technical assistance and grants to assist with non-point source pollution issues (319 grant program).

Portland:	800-452-4011

USDA – Farm Service Agency (FSA)
Maintains agricultural program records and administers various cost share programs. Their offices also provide up-to-date aerial photography of farm and forestland.

Clackamas County:	503-655-3144
Marion County:	503-399-5741
Linn County:	541-967-5925

Department of State Lands (DSL)
Administers state removal/fill law and provides technical assistance.

Salem:	503-378-3805

Oregon Water Resources Department (WRD)
Provides technical and educational assistance and water rights permits and information.
Salem: 503-986-0900

Local Advisory Committee (LAC)
Voluntary committee composed of twelve agricultural producers in the plan area. Charged with developing the agricultural water quality management Area Plan in accordance with Senate Bill 1010.
Marion SWCD Technical Manager: 503-399-5741 ext. 130
ODA Natural Resources Division: 503-986-4700

Oregon Department of Fish and Wildlife (ODFW)
Works with landowners to balance protection of fish and wildlife with economic, social, and recreational needs. Advises on habitat protection. Offers technical and educational assistance for habitat and restoration projects. Provides plan review for special property tax assessment for wildlife habitat projects.
North Willamette Watershed District: 971-673-6000

Oregon Department of Forestry (ODF)
Technical assistance with State and Federal cost sharing, Oregon property tax programs, Forest Resource Trust, forestry practices, and forest management plans.
Salem: 503-945-7200

Appendix C: Erosion Visual Indicators and Measurement

The goal of the Erosion Prevention and Sediment Control Measure referred to in this plan is to control soil erosion and minimize eroded soil access to waterways. A landowner/operator can determine the amount of potential soil that has access to a waterway using the visual indicators of sheet and rill erosion together with the deposition of the sediment of the eroded soil. The landowner/operator can measure the visual erosion in tons per acre. Sediment deposition from this erosion can also be measured. Subtracting this from the total erosion gives an approximation of how much sediment left the field and potentially entered a nearby waterway.

Sheet Erosion rate can be measured in the field by pedestal measurement or root measurement. Pedestals represent the soil particles protected from raindrops by rock, straw, roots, or other material that can withstand the impact of raindrops. Measure the depth of the pedestal from the top of the pedestal, where erosion did not take place, to the soil level immediately around it where soil was eroded away. Root measurement can be performed by inspecting plants in a field to determine how much of the plant roots had been previously covered with soil. The white portion of the roots represents the area previously covered by soil. Measure the depth of the white area, from the top of the white area to the soil level. In each case, the depth is determined and then multiplied by 43,460 square feet (1 acre) to determine cubic feet of soil eroded. The cubic feet is multiplied by 90 pounds per cubic foot and then divided by 2,000 pounds to provide the erosion rate in tons per acre (Table 1).

Rill Erosion rate can be measured in the field by using 20-foot transects across the field, and measuring the width and depth of each rill within the transect to get a field average cross-section of soil lost by rill erosion. The cross-section is the width and depth of the rills. The width multiplied by the depth multiplied by the length of the rills will give the volume. To avoid conversion of cubic inches to cubic feet, measure the rills in feet and tenths of feet. The volume will be converted to tons per acre as in sheet erosion (Table 1).

Sediment deposition can be measured by the average end area method. This method is difficult to explain here. Generally, it is a scientifically accepted way to measure how much soil has been deposited at the base or low point of some area, such as a farm field. Consult a Civil Engineering reference book or textbook for methodology of computing average end area, or contact a local expert. Subtracting the result from the pedestal, white root, or sheet soil erosion estimates will provide an estimate of how much soil left the field and potentially entered into any nearby waterway.

Anyone wishing assistance in erosion measurement and estimation can contact the local SWCD, NRCS or OSU Extension Service.

Table 1: Soil Erosion Estimation Methods

Example of Pedestal or Root Method to Estimate Sheet Erosion

Average pedestal or white root depth in a field _ 0.50 inches _ 0.04 feet
0.04 ft x 43,460 ft^2 = 1,738.40 ft^3 of soil lost per acre
1,738.40 ft^3 x 90 lbs/ft^3 = 156,456 lbs of soil/acre
156,456 ÷ 2,000 lbs/ton _ 78.05 tons of soil lost per acre

For a 10-acre field, this would equal 780.5 tons of eroded soil
For a 100-acre field, this would equal 7,805 tons of eroded soil
(assuming a constant soil erosion rate over the entire field)

Example of Method to Estimate Rill Erosion

Average rill depth _ .75 inches _ 0.06 feet
Average rill width _ .50 inches _ 0.04 feet
Total rill length _ 10,000 feet
0.06 ft x 0.04 ft x 10,000 ft _ 24 ft^3
24 ft^3 x 90 lbs/ft^3 = 2,160 lbs soil/acre
2,160 lbs soil/acre ÷ 2,000 lbs/ton _ 1.08 tons of soil lost per acre

Key:

≈ means "approximately equals"
ft^2 means "square feet"
ft^3 means "cubic feet"
lbs means "pounds"

Appendix D: The Conservation Planning Process

The USDA - NRCS has developed, and the Local Management Agency may choose to use the following nine-step process to develop a voluntary plan.

1. Identify Problems -- Identify resource problems, opportunities, and concerns in the planning area.

2. Determine Objectives -- Identify, agree on, and document the client's objectives.

3. Inventory Resources -- Inventory the natural resources and their condition, and the economic and social considerations. This includes on-site and related off-site conditions.

4. Analyze Resource Data -- Analyze the resource information gathered in planning step 3 to clearly define the natural resource conditions, along with economic and social issues. This includes problems and opportunities.

5. Formulate Alternatives -- Formulate alternatives that will achieve the client's objectives, solve natural resource problems, and take advantage of opportunities to improve or protect resource conditions.

6. Evaluate Alternatives -- Evaluate the alternatives to determine their effects in addressing the client's objectives and the natural resource problems and opportunities. Evaluate the projected effects on social, economic, and ecological concerns. Special attention must be given to those ecological values protected by law or Executive Order.

7. Make Decisions -- The client selects the alternative(s) and works with the planner to schedule conservation system and practice implementation. The planner prepares the necessary documentation.

8. Implement the Plan -- Implement the selected alternative(s). The planner provides encouragement to the client for continued implementation.

9. Evaluate Plan -- Evaluate the effectiveness of the plan as it is implemented and make adjustments as needed.

Appendix E: 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: http://www.deq.state.or.us/wq/assessment/assessment.htm or by calling (503) 229-6099.

Parameters

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 depends on a waterbody's designation as fish spawning habitat. Streams designated as salmon rearing and migration are assumed to have resident trout spawning from January 1 – May 15, and those streams designated core cold water are assumed to have resident trout spawning January 1 – June 15. During non-spawning periods, the dissolved oxygen criteria depends 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 waterbody 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.

Mercury: Mercury occurs naturally and is used in many products. It enters the environment through human activities and from volcanoes, and can be carried long distances by atmospheric air currents. Mercury passes through the food chain readily, and has significant public health and wildlife impacts from consumption of contaminated fish. Mercury in water comes from erosion of soil that carries naturally occurring mercury (including erosion from agricultural lands and streambanks) and from deposition on land or water from local or global atmospheric sources. Mercury bio-accumulates in fish, and if ingested can cause health problems.

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 at: http://www.deq.state.or.us/wq/standards/toxics.htm

Phosphorous/Algae/pH/Chlorophyll a: 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 F: Definitions

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

Chemigation – The method of applying nutrients, pesticides, or both in irrigation water. (Natural Association of Wheat Growers Foundation, 1994).

Drainage or Irrigation Ditch – As defined in ORS 196.600 to 196.900 and its associated administrative rules.

Erosion Rate, Sheet and Rill – The annualized amount of soil material lost from a field or parcel of land due to sheet and rill erosion, expressed in tons of soil eroded per acre per year, and calculated according to the Universal Soil Loss Equation or the Revised Universal Soil Loss Equation. (OAR 603-095-0010(13)).

Erosion, Rill – An 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 603-095-0010(14).

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

Farmstead – The farmstead is the cluster of buildings associated with operation of the farm. This may include homes. It does include barns, shops, machinery storage, and other outbuildings. In the case of a dairy it includes all barns, hay and feed storage, livestock housing, and milk parlor. In relation to this Area Plan and water quality the farmstead includes livestock manure handling facilities in pesticide storage and handling areas, well head protection and well location areas, farm vehicle wash down and cleaning areas, and from staging areas used for equipment or commodity handling and loading for shipment.

Fertilizer – Any substance, or any combination or mixture of substances, designed for use principally as a source of plant food, in inducing increased crop yields or plant growth, or producing any physical or chemical change in the soil and shall contain five percent or more of available nitrogen, phosphorus pentoxide (phosphoric acid) or potassium oxide (potash), singly, collectively or in combination, except hays, straws, peat and leaf mold, and unfortified animal manure. (ORS 633.310(5)).

Filter Strip – A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff and wastewater. (USDA – Natural Resources Conservation Service, 1997).

Gullies. See Active Channel Erosion.

Hydrology - The science concerned with understanding, describing, and predicting the movement of water on and under the earth's land surface, and the physical, chemical, and biological interactions of water with the earth's terrestrial environment. (Dingman, S. Lawrence. (1984). Fluvial Hydrology. W.H. Freeman and Company)

Intermittent Stream - Means any stream which flows during a portion of every year and which provides spawning, rearing or food-producing areas for food and game fish. (OAR 141-085-0010(20)).

Livestock - The animals described or listed in ORS 596.010 and 596.020 and includes, but is not limited to, horses, mules, jennies, jack-asses, cattle, bison, sheep, dogs, cats, hogs, goats, poultry, domesticated fur-bearing animals, and any other vertebrate in captivity, except fish.

Maintenance - The repair, rehabilitation or reconstruction of a structure pursuant to the provisions of ORS 196.905. (OAR 141-085-0010(22)).

Natural Waterways - As used in ORS 196.800(14), means waterways created naturally by geological and hydrological processes, waterways that would be natural but for human-caused disturbances (e.g. channelized or culverted streams, impounded waters, partially drained wetlands or ponds created in wetlands) and that otherwise meet the definition of waters of the state, and certain artificially created waterways included under the definition of "Other Bodies of Water." (OAR 141-085-0010(27)).

Oregon Forest Practices Act - Provides for economically efficient forest practices that assure the continuous growing and harvesting of forest tree species and the maintenance of forestland for such purposes as the leading use on privately owned land, consistent with sound management of soil, air water, fish and wildlife, as well as scenic resources within visually sensitive corridors, that assures the continuous benefits of those resources for future generations of Oregonians. The Oregon Department of Forestry implements and enforces the Oregon Forest Practices Act. (ORS 527.610 – 527.992).

Perennial Stream - A natural channel in which water flows continuously and which is shown on a United States Geological Survey quadrangle map. (OAR 603-095-0010(32)).

Pesticide - Any substance or mixture of substances intended to be used for defoliating plants or for preventing, destroying, repelling or mitigating all insects, plant fungi, weeds, rodents, predatory animals or any other form of plant or animal life which is, or which the Oregon State Department of Agriculture may declare, to be a pest, which may infest or be detrimental to vegetation, humans, or be present in any environment thereof. (ORS 634.006(8)(h)).

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 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(3))

Riparian Area - At its simplest, it is a zone adjacent to water where the soil is wet around springs, ponds, and streams. The term includes three components:
Aquatic area, which includes the stream, side channels, and depressions in the flood plain away from the stream
Wet terrestrial zone, the area near the stream where vegetation is strongly influenced by water, and either has wet soils or often is flooded
Zone of influence, includes the plants that hang over the stream as well as trees growing farther away that might shade or fall into the stream.

-- (OSU Extension Service, 2000. Watershed Stewardship: A Learning Guide. p. II-5.2.)

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

Site Capability - The ability of a site to provide for the development of potential structural and functional properties. Structural properties include, among other things, vegetation and soil characteristics.

Functional properties include processes such as energy and nutrient flow. Capabilities to produce and sustain these properties are not the same for all sites, but are site specific.

Wastes - 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(7)).

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 effect 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(8)).

Wetlands - Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. (OAR 141-085-0010(40)).