NATURAL RESOURCES CONSERVATION SERVICE

NRCS Strategic Plan for Conservation
Washington County Oregon

In cooperation with the Tualatin Soil and Water Conservation District

Updated April 2019

With special thanks to the Tualatin River Watershed Council

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NRCS Long- Range Strategy for Washington Country

Who we are

The Natural Resources Conservation Service (NRCS) is an agency within the United States Department of Agriculture. The mission of NRCS is, "helping people help the land." Our vision is "productive land with a healthy environment." NRCS originated as the Soil Erosion Service in 1933, was renamed as the Soil Conservation Service in 1935, and was renamed again to NRCS in 1994. In Washington County, NRCS shares an office with the Farm Services Agency and the Tualatin Soil and Water Conservation District (SWCD). The office is located on the west side of Hillsboro at 1080 SW Baseline and is open Monday through Friday from 8:00am to 4:30pm.

The Washington County SWCD began in 1955 and changed its name to the Tualatin SWCD in 2003. In order to conserve, protect, and enhance natural resources in the Tualatin Basin, the mission of the Tualatin SWCD is to:

- Assess watershed conditions, identify resource concerns, and select strategies to help natural resources meet standards and all beneficial uses;
- Provide technical assistance to help private landowners install conservation practices to meet natural resource goals and their own objectives;
- Increase the public's knowledge of and involvement in natural resource issues and solutions; and
- Deliver conservation programs and services to individuals, groups, and other governments.

The SWCD is led by seven unpaid directors, chosen in general elections. SWCD directors and staff work closely with NRCS staff, based on our mutual goals and a series of formal agreements to help deliver conservation planning and application services to residents of Washington County.

Purposes of this document

This document describes the strategy that NRCS and the SWCD will implement to conserve natural resources in Washington County. This strategy is based on many years of experience, discussions with our partners, and analyses of data. We will use this document in the following ways:

- Focus our efforts to address the most important resource concerns with the most beneficial practices. This focus will include a strategic allocation of NRCS and SWCD funds and staff.
- Communicate our strategy to partners, clients, and the general public. Our partners include Clean Water Services, Metro Regional Government, the Tualatin River Watershed Council, Tualatin Valley Irrigation District, the United States Fish and Wildlife Service, the Tualatin Riverkeepers, and multiple state and federal agencies involved in natural resource conservation. Our clients, the farms and nonindustrial private forestland owners in Washington County, include units ranging from small "lifestyle" operations up through the largest commercial enterprises. We plan to use this document to develop projects with a high level of cooperation between the most appropriate public agencies, nongovernmental organizations and private farmers, and foresters.
- Provide a source of easily available information about natural resources in Washington County.

Washington County and the Tualatin River Watershed

The document is partially based on the process we use when helping farmers develop conservation plans for their operations: inventory and analyze resources, develop alternatives to identified resource problems and implement the most appropriate solutions.

As the base map illustrates, the boundaries of Washington County approximate the boundaries of the Tualatin River Watershed. The small areas of the county which lie outside the Tualatin River Watershed to the north and west are largely forestland and tend to be owned and managed by the state or federal government, large industrial forest owners who employ their own resource managers, or nonindustrial forest owners who are assisted by the Oregon Department of Forestry. The even smaller areas of the county that lie outside the Tualatin River Watershed to the north and east are largely suburban and receive conservation assistance from Clean Water Services and Metro Regional Government.

The base map also shows that the Tualatin River Watershed extends outside the political boundaries of Washington County, primarily to the south. The fractions of the watershed outside of Washington County are small, and the natural resource concerns in these outlying rural areas closely match concerns within the county. Because water naturally flows from these outlying areas into Washington County, we believe it makes sense to include them in our strategic planning document.

For these reasons, we will focus this document on the entire Tualatin River Watershed, including those areas outside of Washington County, but not including those parts of the county that lie outside of the watershed. Within the watershed, this document focuses on farms and nonindustrial private forestland.

Limitations to our funding prevent us from helping every farm or forest operator with every conservation project they undertake. Here again, the strategic focusing of our limited resources will provide the greatest environmental benefits per dollar expended.

Getting to Know the Watershed

What is a watershed?

A watershed is an area of land that drains into a lake or river. We all live in watersheds.

Why is the Tualatin Watershed important?

Healthy watersheds are vital for a robust environment, community and economy. The Tualatin River provides water for drinking, irrigation, industry and wildlife.

Everyone relies on water and other natural resources. What we do in the watershed impacts the water running into the river.

Understanding the watershed

The Tualatin River Watershed is a dynamic and unique place. It is a complex web of natural resources (soil, water, air, plants and animals) and has many features that separate it from other watersheds. Some important features are listed below.

Size

Since the Tualatin River flows into the Willamette River, it is a watershed of the Willamette Watershed. The Tualatin watershed itself has six main sub-watersheds. These are Dairy-McKay, Gales, Upper Tualatin-Scoggins, Middle Tualatin, Rock and Lower Tualatin. The Tualatin River Watershed is 712 square miles and approximately 42 miles long and 29 miles wide.

Watershed boundaries

The geographic boundaries of our watershed are formed by ridges or high areas from which water drains toward the Tualatin River. The Chehalem and Parrett Mountains form the southern rim of the watershed.

Terrain

The topography is another important feature. How flat, like in the floodplains, or how steep the land is impacts how fast water drains. Faster drainage increases the potential for flooding and soil erosion. The Tualatin Watershed is composed of a mixture of landscape types including uplands, wetlands, riparian areas, streams and lakes.

Soil Type

The watershed is composed mostly of fertile loam, silt loam and silty clay loam soils.

Vegetation

The riparian area near a stream has a great effect on quality of water within the stream. Riparian forest buffers, filter strips, field borders and wetland restoration are important practices that filter water runoff before it reaches a stream. Wetlands act as natural sponges to absorb peak flows of water and reduce flooding. Many fish and wildlife species rely on wetlands and riparian areas for rearing their young and for food and shelter.

Animals

One meaningful way to evaluate the health of an ecosystem is to directly observe the animals that live there. The animals can reflect the effects of various stressors, such as an increase in pollutants in the river. Animal studies can therefore show problems that otherwise would be missed or underestimated.

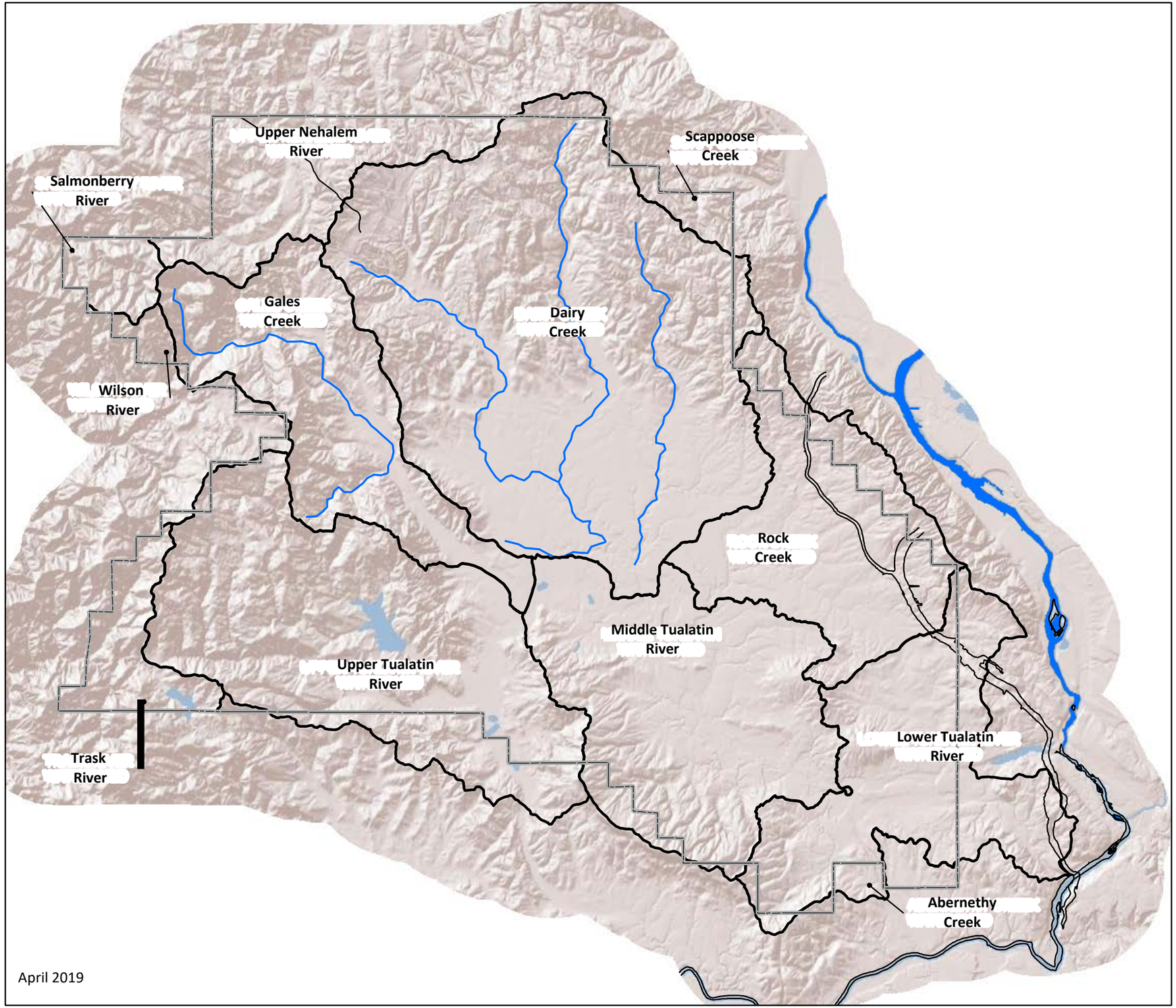
Natural resource uses

Natural resources are used in many different ways in the Tualatin. People use the Tualatin River for drinking water, industry, irrigation, livestock watering and recreation. At places like Hagg Lake, people enjoy water for recreational uses like fishing, swimming, and boating. The quality and quantity of water are very important to people who live here.

Water quality and pollutants

In the past, most water quality problems were traced to the most obvious cause, point source pollution. Since point source pollution is any pollution source that comes from a specific location such as a pipe discharging pollutions directly into the river, this means the problem can usually be traced back up the pipe to the source. Much progress has been made in preventing further water quality problems from point sources

Nonpoint source pollution problems are more difficult to control because the sources are often hard to identify and difficult to measure. This type of pollution results from a variety of activities. Nonpoint source pollution can be the water that runs off crop, forest, and urban landscapes. Nonpoint sources include failing septic systems, runoff from parking lots construction sites and irrigation and drainage systems. Even automobile exhaust getting in the atmosphere are falling back to earth in the rain can result in nonpoint source pollution.



Tualatin River Watershed Long Range Strategy

Washington County Watersheds

Tualatin Soil & Water Conservation District

USDA-Natural Resources Conservation Service

Legend

- Watershed
- County boundaries
- Streams
- Lakes

0 1 2 3 4 5 6 7 8 9 10 miles

Geography, Geology and Soils

Geography

The Tualatin River Watershed is a low elevation, low gradient drainage area that covers 712 square miles in the northwest corner of Oregon. The headwaters of the Tualatin and many of its tributaries originate in the Coast Range and the Tualatin Mountains, a spur of the Coast Range. These hills border the valley on the north and east. The Chehalem and Parrett Mountains (1630 and 1240 feet maximum elevation, respectively) form the southern rim of the watershed. The watershed is about 42 miles long when measured in a straight line from headwaters to mouth. After dropping about 2,700 feet over its first 14 miles, the river drops more gradually and meanders the rest of its 83 mile length.

Nearly half the watershed is a broad alluvial valley where elevations are between 100 and 200 feet. The Tualatin River drains into the Willamette River through a steep, walled canyon, falling about 50 feet over its last three miles beyond the dam at Lake Oswego.

During the Wisconsin stage of the last ice age, 12,800 to 15,000 years ago, numerous ice dams formed across the Upper Columbia River and then collapsed, resulting in catastrophic floods, called the Missoula or Bretz floods. The lake formed in the Willamette Valley by these floodwaters is referred to by geologists as Lake Allison. The floods punched their way into the Tualatin River Watershed, leaving behind rich alluvial soils which quickly became dominated by swamps and prairies.

Before European settlement, the Tualatin River frequently exceeded the channel capacity and spread over the valley floor, forming slow draining marshlands. Early trapper reports note the wet condition of the valley floor, and one such trapper, Peter Ogden, described the Tualatin valley as “mostly water connected by swamps.” The largest marshy areas were near the fork of Dairy Creek and in the old Wapato and Lousignont lake beds.

Geology

The oldest geologic units in the Tualatin Watershed are volcanic and sedimentary rocks formed during the Eocene and Oligocene ages of the Tertiary period. The volcanic rocks are mainly basaltic lavas and tuffs, and are overlain by the sedimentary rocks, which are mainly shale, clay stone, sandstone, and siltstone (Hart and Newcomb, 1965). The watershed has a bow-like shape, surrounded by mountains and underlain entirely by Columbia River basalt dating from the middle Tertiary period; this is the uppermost bedrock of the watershed. This basalt layer is dense and is composed of an aggregation of lava flows which varies in thickness from zero to more than 1,000 feet. This formation surfaces along many of the boundaries of the watershed, and is buried under nearly 1,500 feet of sediment in the center of the watershed, near Hillsboro. The “bowl” of the basalt is partially filled with unconsolidated sedimentary material which has been described in many ways. The deposits were grouped together by Hart and Newcomb (1965) as undifferentiated Tertiary and Quaternary basin fill. Trimble (1963) broke it into two basic layers: the lower or pre Quaternary sediments which he termed the Troutdale Formation and the Sandy River Mudstone equivalent, and the upper layer lacustrine deposits dating from the Missoula Floods during the Pleistocene. Madin (1990) described the older, deeper sediments simply as the Sandy River Mudstone equivalent and the upper as catastrophic flood deposits. Recently, Wilson (1997) identified the older sediments as Neogene sediments and the flood deposits as Willamette Silt.

Soils

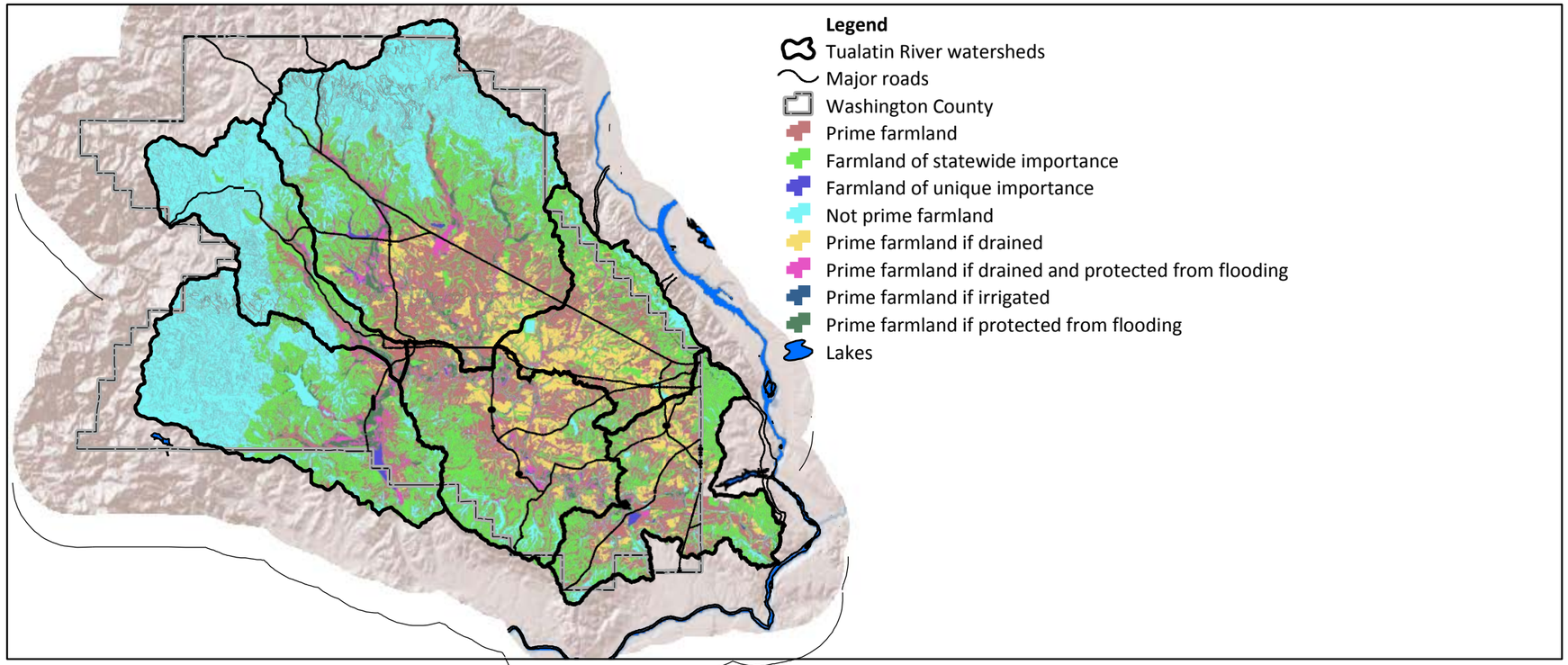
Soils of the watershed are very fertile in the flood plains of the Tualatin River and its tributary creeks, leading to a rich agricultural diversity. The soils of the watershed occur in eleven soil associations, as differentiated by the USDA Natural Resources Conservation Service. Soil on nearly level flood plains and bottomlands is well to poorly drained silty clay loam and clay. On the nearly level to moderately steep terraces, soil also varies, and is described as silt loam and silty clay loam. Soil in the Coast Range is well drained silt loam and cobbly loam.

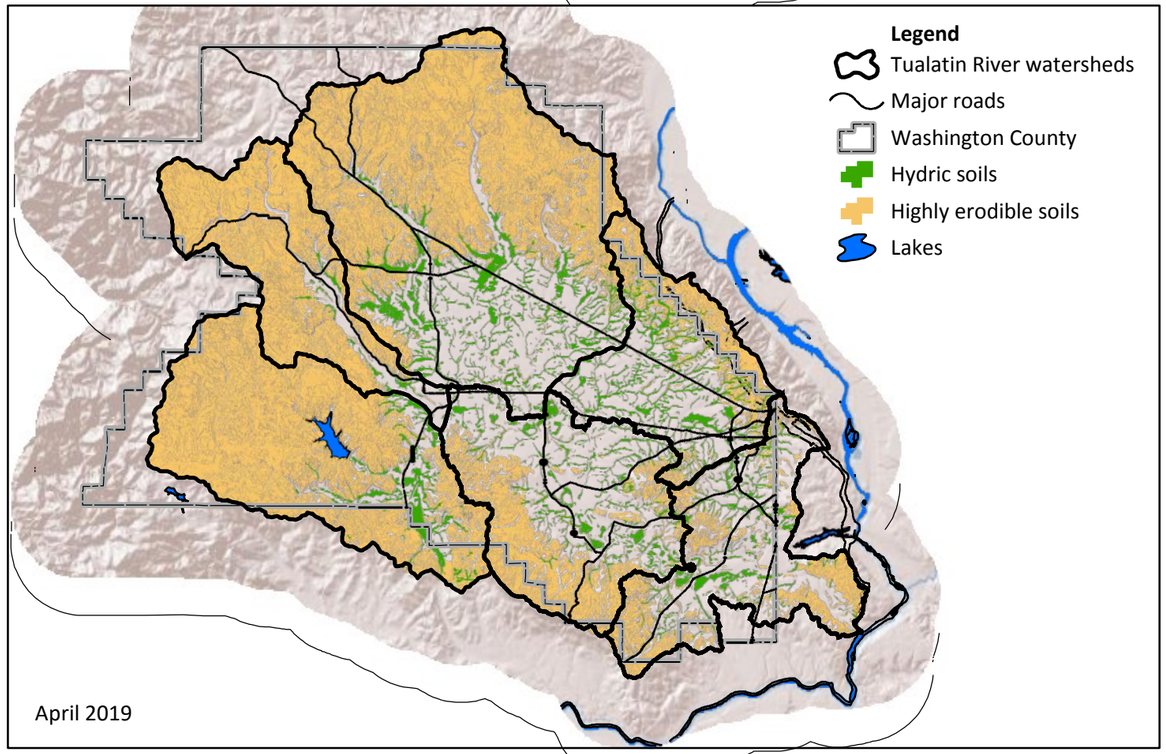
Tualatin River Watershed Long Range Strategy

Washington County Soils

Tualatin Soil & Water Conservation District

USDA-Natural Resources Conservation Service





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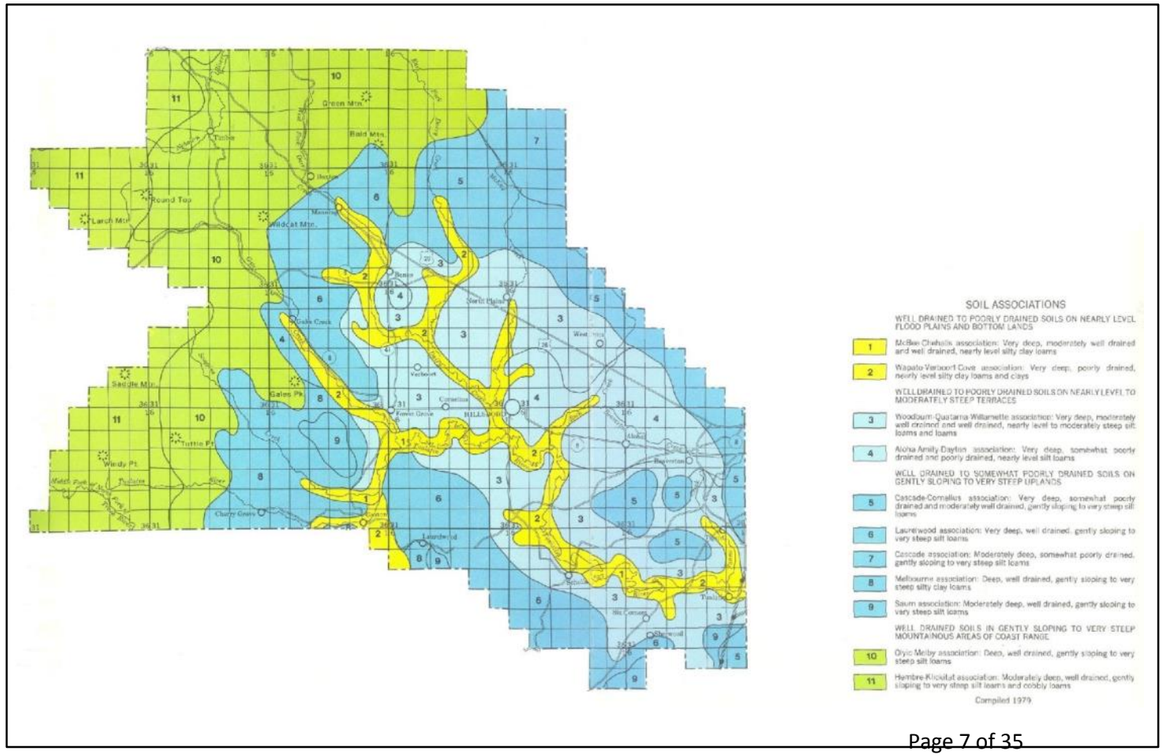


Climate and Air Quality

Climate

The Tualatin River Watershed, whose western edge is less than 40 miles from the Pacific Ocean, has a modified marine climate. The prevailing western airflow from the ocean moderates the colder temperatures of the winter and the heat of the summer. Occasional extreme temperatures are associated with outbreaks of dry continental pushing through the Columbia River Gorge and across the Cascade Mountains.

The watershed's winter climate consists of rainfall from November to April. Dry months are July, August, and September. Seasonal characteristics are well- defined. Changes between seasons are gradual. Average annual rainfall decreases from 110 inches along the crest of the Coast Range to 38 inches in the southeastern valley floor. Some 28% of the total annual rainfall is received in fall, 46% in winter, 20% in spring, and only 6% in summer. Extremes in rainfall for individual years have varied from 26 to 65 inches at Forest Grove and from 42 to 83 inches at Timber. Snowfall in the mountainous portion of the watershed can be significant but is normally quite light on the valley floor. However, Tualatin River flow does not typically receive snow melt after early spring.

Air Quality

The Tualatin River Watershed's air quality is also an important factor in the health of the watershed. Health concerns can be addressed by reducing air particulate, carbon monoxide, and ozone levels. The ability to view some of the region's majestic Cascade peaks, such as Mt. Hood and Mt. Saint Helens, is also important to residents, and requires good visibility be maintained.

Air quality in the Tualatin River Watershed is monitored and regulated as part of the entire Portland Air Quality Management Area. The air quality within the watershed cannot exceed National Ambient Air Quality Standards as defined by the Environmental Protection Agency.

Greenhouse gases

Climate change caused by greenhouse gas emission is arguably the most important natural resource problem that humans have ever faced. The secondary impacts of climate change are the subject of many scientific papers and include flooding of coastal areas, drought, species extinction, spread of disease and expanded ranges of disease vectors, and severe economic repercussions.

This issue truly affects the global population because the impacts listed above are global in extent. With respect to local agriculture, greenhouse gas emission is a critical issue for dry cropland farmers who may face yield losses due to changes in rainfall patterns and summer temperatures, irrigators who may experience water shortages due to decreased snowpack, and specialty crop growers (e.g., nurseries and wine grapes) whose crops are adapted to the current climate.

In a larger sense, this issue will affect local farmers and the suburban population due both to the impacts listed above and to the legislative remedies that will address the issue. By beginning to focus on this issue now, NRCS positions itself and our clients to be well-suited to adapt to proposed cap and trade legislation as well as demonstrating pro-active leadership in addressing this critical issue.

Watershed History

The ancient swamps, grass covered prairies, and forests of Douglas fir, Oregon oak, western hemlock, and western red cedar were once home to ice age elephants, camels, and giant beaver. In more recent times, native wildlife residents included cougar, bear, elk, deer, coyote, beaver, rabbit, muskrat, and fox. Grouse, herons, kingfishers, mallards, geese, swans, quail, owls, and hawks inhabited the watershed while trout, steelhead, and Chinook salmon lived in the Tualatin River and its tributaries. These animals were supported by a large array of smaller animals and forest understory vegetation including vine maple, hazel, dogwood, salal, and Oregon grape.

The Twality people

The Kalapuya people, emigrating from the Columbia River plateau, made the whole Willamette valley their home 10,000 years ago. The Tualatin River Watershed was the territory of a group of Kalapuya known as the Twality (also call Atafalati), who developed a unique dialect. The Kalapuya numbered approximately 10,000 when European immigrants arrived less than 200 years ago. The Twality burned some lowlands to open meadowlands and concentrate game for hunting.

In 1829, more than half the Kalapuya people died of fever brought by immigrants of European heritage. By 1851, when a treaty was negotiated, only 65 Twality were living in the watershed. Wild game had become scarce. Lowland roots such as camas and wapato, once used by the Twality as a nutritious food source, were nearly gone, consumed by imported swine. No Twality people are alive today.

European settlement

In the 1820s, a few retired fur traders began farming in the Tualatin River Watershed which was then about 80 percent forest. Missionaries came next, and they too began farming as the Twality population diminished. News of the fertile land in the watershed brought a larger wave of settlers from the east in the 1850s. By 1855, the last year of the Donation Lands Claim Act, about 350 farms had been claimed in the watershed, occupying land out to river mile 67.

Farmers drained much of the marshy lowlands to plant crops and develop pasture for cattle. Settlers built ditches, canals, dikes, and dams and installed sub-surface “tile” drains.

At first, surplus timber was felled and burned to clear the land. Later, sawmill owners built dams for power and to get logs to the mills. In the 1870s, timber was being exported to California, Hawaii, and China from the Durham mill on Fanno Creek.

Modernization

The first roads in the Tualatin River Watershed followed old Twality trails. Villages grew around low spots like Scholls and around mills, such as at Dilley. The first Tualatin River steamer began runs in 1858. Steamboats often had to stop during July through November due to low flow. In 1869 the steamboats could not negotiate the rapids at the mouth of the Tualatin. In 1871, Chinese laborers were hired to excavate the canal to Lake Oswego (then called Sucker Lake). One of the earliest water rights in Oregon occurred at the outlet of Lake Oswego when Alonzo Durham started a sawmill operation powered by a water wheel in 1850.

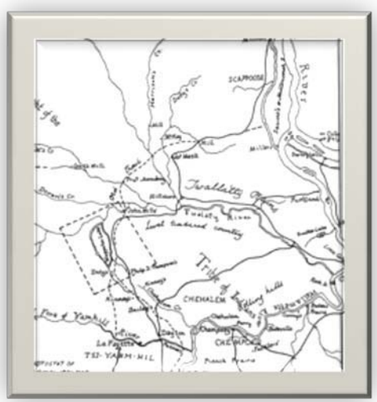
Steamboat traffic become much less important when the railroads were constructed beginning in 1887. By that time, 14 bridges crossed the Tualatin River. When the Southern Pacific Railroad was completed in 1911, eastern timber companies began to invest in the watershed’s timberlands and sawmills. They built side rails to forest sites and temporary mills in the forest to avoid bringing logs down to the lowlands.

Several dams were built in the watershed during the late 1800s and the early 1900s. These were used to power flour mills and sawmills and to generate electricity. Two dams were built above Cherry Grove across the mouth of the Tualatin River Canyon. In 1862, the Patton Mill dam was built to power a mill, but was removed at the turn of the century by Oregon’s fish commission. The Haines Falls dam was built in 1901 to generate electricity. The Lovengren Dam was then built at the same site to help harvest timber on the south side of the river. It was 200 feet long and created a 70- acre lake. Logs and debris broke the dam in 1913 after a heavy rain in the uplands. Wapato Lake was drained by a canal so the lake bed could be used for agriculture, and the Wapato Lake water right was established in 1928. A dike was built to drain Jackson Bottom.

In the 1930s, Oregon State University introduced sprinkler irrigation to farms in the watershed. Along with higher productivity, sprinklers brought additional loss of summer flows through greater water evaporation rates.

Historical Photographs of Washington County

Sketch of a Kalapuya man.



Map of the Willamette Valley

Five Oaks in the North Plains area was a meeting site for Native Americans and early settlers.

Loggers and a bunkhouse near Buxton.

Joe Meek was the Northwest's Davy Crockett who settled in North Plains and played a major role in helping Oregon become a state.

Homestead on the Tualatin Plains

Imbrie Octagonal barn. McMenamins complex now operates this on Cornelius Pass Rd. The Imbries were one of the first Euro-American families in Washington County.

Hillsboro's arrival of the electric train in 1908.

http://www.washingtoncountymuseum.org/localhistory/index.php

Tualatin River Watershed Population

Land use

Home to over 500,000 people, the watershed is approximately 15% urban, 35% farmland (includes natural areas) and 50% forestland. Major cities include Hillsboro, Beaverton, Forest Grove, Tigard and Tualatin. Five percent of the watershed is managed by the State of Oregon, and 2% is managed by the Bureau of Land Management. The rest is privately owned or municipal.

Most of the forested land lies in the mountains and foothills of the Coast Range, where the Tualatin River headwaters originate. Some forest remains in the Tualatin Mountains and the Chehalem Mountains to the south. Almost none of the forest is old growth.

The urban growth boundary

Urban growth boundaries (UGBs) were created as part of the statewide land use planning program in Oregon in the early 1970s. The boundaries mark the separation between rural and urban land. They are intended to encompass an adequate supply of buildable land that can be efficiently provided with urban services (such as roads, sewers, water lines, and street lights) to accommodate the expected growth during a 20- year period. By providing land for urban uses within the boundary, rural lands can be protected from urban sprawl.

Metro is required by state law to add land to the boundary if it is needed. Additions to the boundary must be based on a demonstrated need for more urban land. Once need has been demonstrated, the area selected for the addition must be shown to be superior to the other areas. The UGB for the Portland metropolitan area, defined by Metro, extends into eastern and southeastern portions of the watershed.

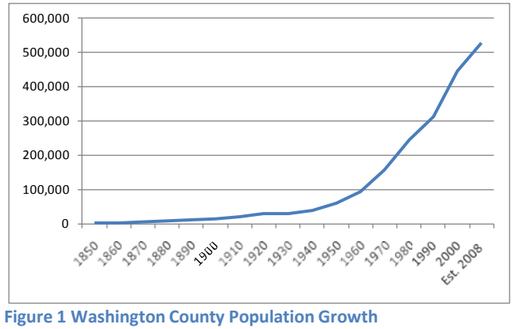


Figure 1 Washington County Population Growth

Farms in Washington County

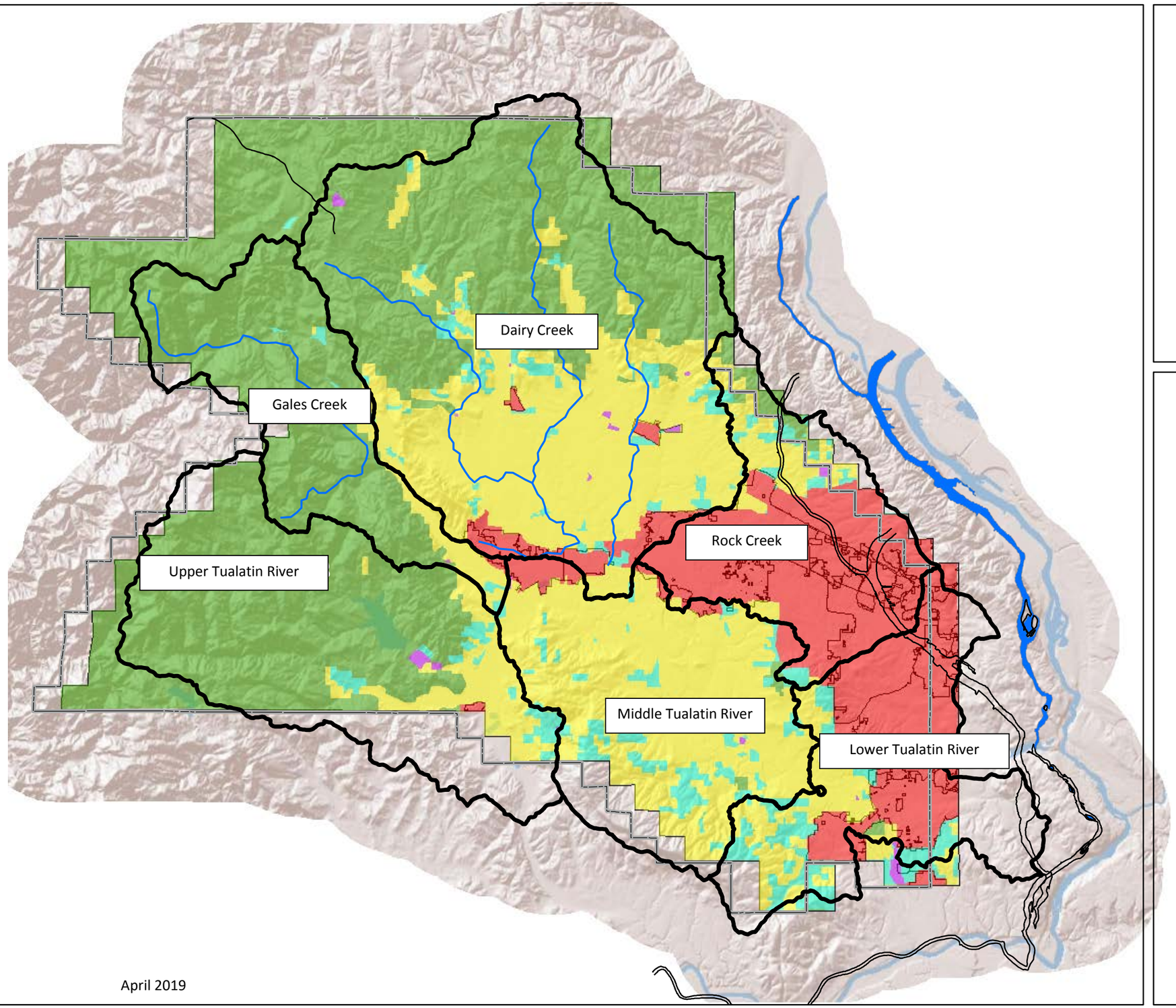
Agriculture is a significant land use within Washington County, with approximately 25% of the land area being used for production agriculture. In 2007, Washington County ranked third in the state for agricultural gross income. Top commodities, in order of sales, are nursery and greenhouse crops; fruits, tree nuts, and berries; and hay.

As of 2007, 127,984 acres of Washington County are in farm land. Of these acres, approximately 25% are in field and grass seed crops. This is followed by forage, wheat, hazelnuts, and nursery stock. In 2007, there were a total of 1,761 farms, with an average size of 73 acres. Almost three- fourths of the farms are less than 50 acres.

The Tualatin River Watershed includes a wealth of timber resources in the upland forests, some of the most productive agriculture land on earth and a thriving urban area with industry, commercial districts, and residential areas. Recently, there has been an increase in the amount of land devoted to wildlife habitat, including new United States Fish and Wildlife Service refuges, Metro "Greenspaces" purchases, and land enrolled in USDA's Wetland Restoration Program (WRP). Due to a growing population and economic pressures which are often global in scale, there have been growing tensions between proponents of the various land uses in the watershed.

Although land use changes often involve political decisions beyond the scope of NRCS or the SWCD, we certainly are sometimes involved in these changes. One example is the permanent easement that NRCS purchased for the Hutchinson wetland restoration (a WRP project the SWCD is helping to implement). It is important for NRCS and the SWCD to be strategic in these sorts of projects because they can result in significant conservation benefits but they also can be costly in terms of taxpayer funds and can significantly reduce the amount of farmland available for production.

More commonly, NRCS and SWCD efforts involve helping farmers and foresters implement conservation projects on their "working lands" that produce food and fiber. These conservation projects tend to help maintain rural land uses by making resource use more efficient (such as converting sprinkler irrigation systems to drip irrigation), by ensuring the long-term productivity of soil (such as helping farmers plant cover crops to improve soil tilth), or by helping farmers comply with environmental regulations (such as by helping dairy farmers manage manure). Although NRCS and the SWCD very much support the use of conservation systems on all



Tualatin River Watershed Long Range Strategy

Washington County Land Use

Tualatin Soil & Water Conservation District

USDA-Natural Resources Conservation Service

Legend

- Tualatin River watersheds
- Washington County
- Cities
- Agriculture
- Forestry
- Rural commercial
- Rural industrial
- Rural residential
- Urban
- Major roads
- Rivers and lakes

April 2019

Watershed Management

Responsible government agencies

More than 30 state, regional, and local agencies have varying levels of jurisdiction in the Tualatin River Watershed. These agencies include 15 cities, 6 counties, 2 urban regional agencies, 3 land use based agencies, and 11 state agencies. In addition, 12 federal agencies participate at different levels in watershed activities. Many of these jurisdictions overlap in their areas of responsibility as well as in geographic areas, making it difficult for coordinated watershed- wide management. The primary government agencies involved in managing the watershed's resources include:

Natural Resources Conservation Service (NRCS)
U.S.D.I. Bureau of Land Management (BLM)
Fish and Wildlife Service (USF&W)
Environmental Protection Agency (EPA)
Oregon Department of Forestry (ODF)
Oregon Department of Land Conservation and Development (DLCD)
Oregon Department of Geology and Mineral Industry (DOGAMI)
Oregon Water Resources Department (OWRD)
Oregon Department of Agriculture (ODA)
Oregon Department of Fish and Wildlife (ODFW)
Oregon Dept. of Environmental Quality (DEQ)
Oregon Watershed Enhancement Board (OWEB)
Tualatin Valley Irrigation District (TVID)
Washington and Multnomah Counties
Tualatin Soil and Water Conservation District (SWCD)
Clean Water Services (CWS)
Metropolitan Service District (Metro)
16 city governments, a park and recreation district and four water districts

State agencies

The Oregon Department of Fish and Wildlife, Oregon Department of Forestry, and Oregon Water Resources Department maintain branch offices to administer resource management programs in the watershed. In 1971, the Oregon Forest Practices Act was created. Administered by ODF this Act, regulates all forest activities on forest lands. OWRD appoints a water-master for the Tualatin and Lake Oswego Watersheds to coordinate reservoir resources, regulate water withdrawals, and arbitrate water supply disputes based on water right records. In 1993, the Oregon Department of Agriculture (ODA) was designated as the lead state agency, through Senate Bill 1010, to work with the agriculture industry to address nonpoint source water pollution. Through a Memorandum of Agreement, ODA has in turn delegated implementation of this task to the Soil and Water Conservation District (SWCD). Other agencies named by DEQ as "Designated Management Agencies" for the Tualatin River Watershed include ODF, Clean Water Services , Clackamas and Washington Counties, and the Cities of Portland, Lake Oswego, and West Linn.

DEQ is responsible for monitoring, permitting, and defining environment rules and ordinances for the region. Planning and road maintenance responsibilities of the Oregon Department of Transportation (ODOT) also affect current and future conditions in the watershed.

The Oregon Department of Land Conservation and Development has established 15 mandatory goals for planning that are applicable to the Tualatin River Watershed. The goals generally encourage preservation of existing agriculture and forest lands, open spaces, natural resources, and air and water quality, while allowing economic and urban development. These goals are incorporated in city, county, and Metro plans.

Local and regional agencies

The cities and counties in the watershed have comprehensive plans which regulate many aspects of development in their jurisdictions, such as storm water management and land use. The agencies with urban responsibility are the Clean Water Services and the Metropolitan Service District. The Tualatin SWCD helps farmers plan and implement conservation systems, working cooperatively with federal agencies and the Oregon State University Extension Service. The SWCD prepared a plan for reducing or eliminating "...all excessive nonpoint source pollution of the Tualatin River from the rural areas... contributing to the restoration of the Tualatin's waters to a level of quality that will preserve and protect their beneficial uses."

Washington County

Washington County covers a majority of the watershed. The county's Comprehensive Plan for growth and development is divided into two volumes—one for areas within the Urban Growth Boundary and another for areas outside it. Both contain many policies protective of the watershed ecosystem and some that may degrade it (for example, paved parking lots allowed in floodplains hinder water storage and infiltration). The plan includes policies on air quality, water resources, energy resources, biological resources, natural areas, growth (urbanization), noise, natural hazards, transportation, and recreation. The County also has a Community Development Code to guide planning for new housing and other development to meet projected population growth. The Code lists specific standards such as required landscape areas and topsoil conservation.

Clean Water Services

Clean Water Services is the sanitary sewer and surface water management utility for the homes and businesses in a 120- square mile area of Washington County. CWS cleans 56 million gallons of wastewater daily at four treatment facilities before releasing it to the Tualatin River. The cleaned wastewater meets some of the nation's highest treatment standards and is actually improving the water quality of the Tualatin River. CWS maintains more than 700 miles of sanitary sewer lines, the public storm water drainage systems, and is responsible for providing flood control in the Tualatin River and its urban tributaries. CWS is responsible for surface water management planning for about two- thirds of the watershed, while the remainder is managed by the cities of Portland and Lake Oswego. Several watershed plans have been prepared by CWS for the urban portions of some Tualatin River sub basins. These plans address surface water management issues and prioritize capital improvements.

Metropolitan Service District Portions of the watershed within the jurisdiction of Metro are subject to the Regional Urban Growth Goals and Objectives (RUGGOs) that the Metro Council adopted in 1991 (since amended) in accordance with state law. RUGGOs are designed to complement local watershed plans. One objective states that Metro will "manage watersheds to protect, restore and ensure to the maximum extent practicable the integrity of streams, wetlands and floodplains, and their multiple biological, physical and social values." The RUGGOs also address protection of natural areas and wildlife habitat, and agriculture and forest lands, and they require that Metro use performance measures for all goals and objectives.

Developed partly in response to significant flood damage that occurred in 1996, Metro's Title 3, Stream and Floodplain Protection Plan, addresses conflicts between growth, development, and resource protection. Title 3 also responds to degradation of water quality in urban streams caused by impervious surfaces, loss of riparian vegetation, and construction practices that allow sedimentation and erosion to occur.

Joint Water Commission

The Joint Water Commission (JWC) is the primary drinking water supplier in Washington County and is responsible for treating, transmitting, and storing potable water to more than 400,000 customers.

Four agencies share ownership in the JWC – the cities of Hillsboro, Forest Grove, Beaverton and the Tualatin Valley Water District. The JWC also wholesales water to the City of North Plains. The JWC procures most of its water from a pumping plant located on the Tualatin River just downstream of the confluence with Gales Creek and adjacent to the TVID irrigation water pumping plant.

Terrestrial Biota

Ecosystem

The Tualatin River Watershed encompasses portions of two ecoregions, the Coastal Range Ecoregion and the Willamette Watershed Ecoregion. Ecoregions divide landscapes into areas of similar land form, vegetation, and soils. The ecoregion concept helps managers assess the quality of the land and water resources relative to appropriate reference conditions. The western and northern sections of the watershed fall within the Coastal Range Ecoregion. The remainder of the watershed is within the Willamette Watershed Ecoregion. Steeper slopes and higher stream densities characterize the Coastal Range portions of the Tualatin River Watershed. The Willamette Watershed Ecoregion is flatter with landscape formations dominated by flood plain processes. Table 3 describes the characteristics of the two Ecoregions.

Scientific Resources Inc. (SRI) divided the Tualatin River into four "eco-reaches" in a 1990 report. The eco-reaches were based on gradient and other physical, chemical, and biological features of the river. These eco-reaches are

- Riffle, from river mile (RM) 0 to 3.4.
- Reservoir, from RM 3.4 to 33.0
- Meander, from RM 33.0 to 58.0
- Mountain, from RM 58.0 to 83.0

The Riffle eco-reach is dominated by a moderate to high gradient with fast water velocities, bedrock substrate, and a series of pools, riffles, and small falls passable by anadromous fish. The Reservoir eco-reach has very slow currents which permit occasional stratification and stagnation of pools during summer low flows. In stratified pools, the cooler water on the bottom of the pool is isolated from the atmosphere, causing oxygen levels to drop in the deeper water. These low oxygen levels in stratified pools may force fish to remain near the water surface where warm water temperatures and lack of cover can increase fish mortality. Fish may also move into tributaries.

The substrate of the Reservoir eco-reach is composed of sand, silt, and organic matter. Urban and agricultural encroachment limits riparian cover along the edges of the stream in this eco-reach. Stream velocities in the Meander eco-reach are slow. The substrate and riparian characteristics of the Meander eco-reach are similar to those found in the Reservoir eco-reach. The Mountain eco-reach has steep gradients causing faster water velocities with a rock, cobble substrate, and extensive riparian cover.

Vegetation

Vegetation within the watershed has changed dramatically since prehistoric time. Agriculture, fire suppression, and urban development have combined to remove much of the pre-settlement vegetation. Nearly all forests in the watershed are second growth stands within the Coastal Range Ecoregion.

In the Willamette Basin Ecoregion, much of the vegetation has been cleared. The soils have been hydrologically and chemically altered for agriculture or urban development. Over half of the agriculture land is devoted to cropland requiring seasonal tillage. The majority of the agriculture land not requiring seasonal tillage is used for tree crops, pasture, nurseries, or vineyards. Indigenous species in undisturbed or restored areas face competition from exotic species like reed canary grass (*Phalaris arundinacea*) and Himalayan blackberry (*Rubus discolor*), two of the most invasive non-native plant species in the watershed.

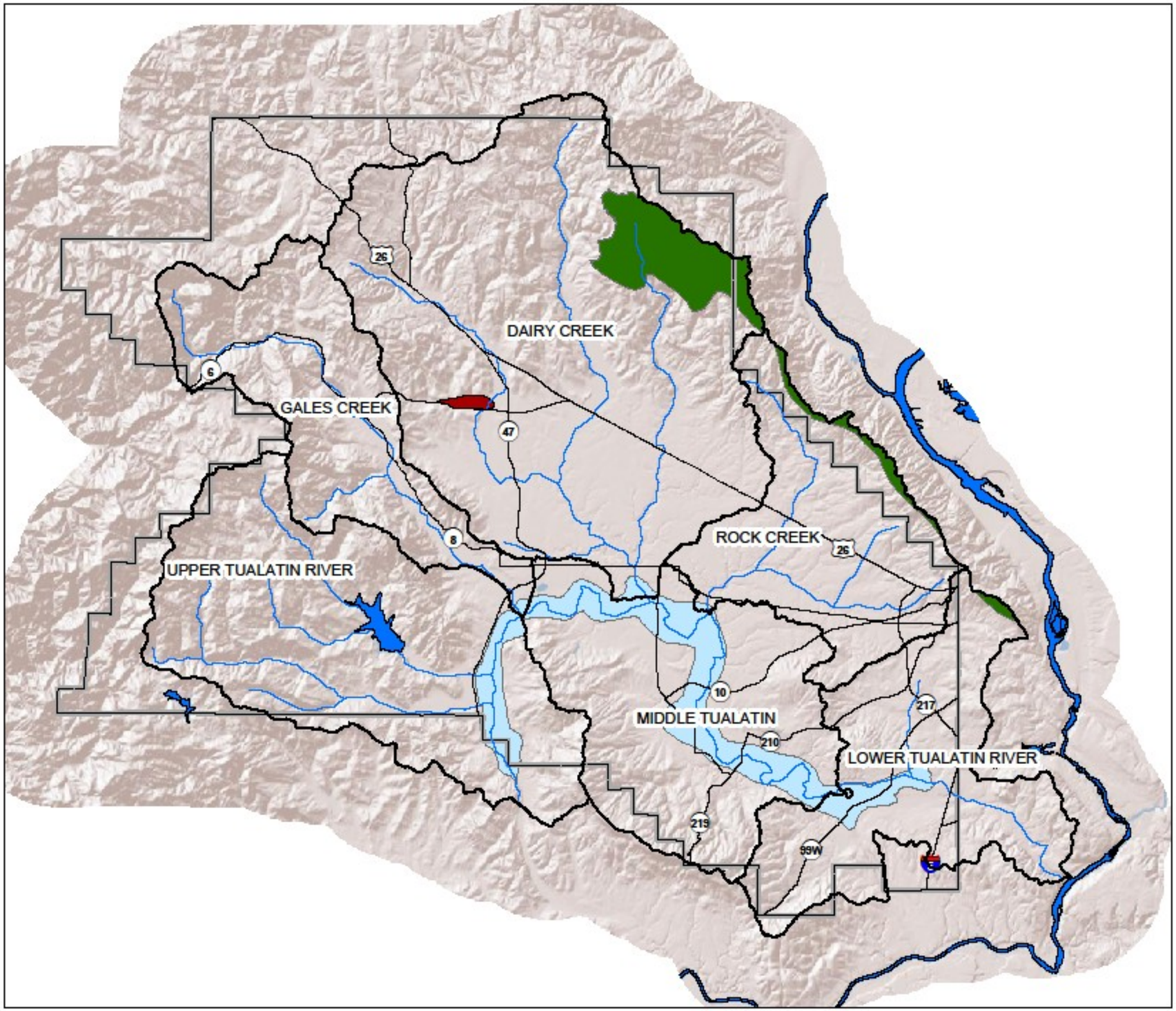
Riparian areas are important transitional areas which link water and land ecosystems. Vegetation in riparian areas is dependent on stream processes, such as flooding, and often is composed of plants which require large amounts of water, like willows and cottonwoods. Riparian areas are important for animals, provide shade and protection for aquatic organisms, and serve as corridors for terrestrial organism movement. Riparian areas also provide structure and diversity in the form of large woody debris. Vegetated riparian buffer strips of greater than 75 feet exist in many of the reaches within the Mountain eco-reach. The majority of the Tualatin River and many tributaries in the agricultural and urban areas, though, have riparian buffers less than 75 feet wide.

Riparian trees outside the Mountain eco-reach include Douglas fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), willows (*Salix spp.*), Oregon ash (*Fraxinus latifolia*), black cottonwood (*Populus balsamifera*), red alder (*Alnus rubra*), and big leaf maple (*Acer macrophyllum*). Understory is dominated by red-osier dogwood (*Cornus stolonifera*), snowberry (*Symphoricarpos albus*), oceanspray (*Holodiscus discolor*), hawthorn (*Crataegus douglasii*), Douglas spiraea (*Spiraea douglasii*), slough sedge (*Carex obnupta*), and reed canary grass (*Phalaris arundinaceae*).

Terrestrial wildlife

Terrestrial wildlife species in the Tualatin River Watershed are managed by the Oregon Department of Fish and Wildlife. The majority of large game, including Roosevelt elk, black-tailed deer, and black bear, is found in the Coastal Range Ecoregion. In the Willamette Watershed Ecoregion, where wetlands and agricultural areas provide the majority of habitat, birds are important game species. Concentrated human populations in the valleys produce extensive habitat alteration in the lower sections of the watershed.

Wetlands provide refuge for Canada geese and numerous duck species in the watershed. It has been estimated that 5,000 Canada geese and 65,000 ducks of various species winter in Washington County. Bird counts at Scoggins Dam conducted by the Audubon Society and the Northwest Ecological Research Institute have recorded large increases in starling numbers. Many small mammals, reptiles, and amphibians depend on riparian corridors and wooded areas throughout the watershed, but little specific data exist concerning populations of these species.



Tualatin River Watershed Long Range Strategy

Washington County Conservation Opportunity Area

Tualatin Soil & Water Conservation District

USDA-Natural Resources Conservation Service

Legend

- Tualatin River Watersheds
- Washington County
- Banks Swamp
- Portland's Forest Park
- Tualatin River
- Major Roads
- Rivers and Lakes

0 1 2 3 4 5 6 7 8 9 10 Miles

Aquatic Biota

Aquatic Flora

Aquatic flora in the Tualatin River Watershed includes duckweed, watercress, and algae. Algae are particularly important because extensive algal blooms lead to depletion of oxygen in the water. Algal blooms decrease the penetration of light which can cause a decline in rooted macro-vegetation. Algal blooms reduce water clarity, decrease the aesthetic value of streams, produce wide fluctuations in pH, and may produce foul tastes and odors in drinking water.

Macro-invertebrates

Some macro-invertebrates, like mayflies and caddis, are important sources of food for fish and indicate a healthy stream. Studies of aquatic macro-invertebrates in the upper reaches of the Tualatin River Watershed have found a high diversity of organisms including several genera of mayflies, caddis, and stoneflies. The absence of rocky substrates and moderate- to- high water velocities result in lower populations of these species in the lower reaches of streams. Substrate has been found to be the limiting factor in macro-invertebrate populations below the confluence of McKay and Dairy Creeks. The rocky substrates of the upper reaches of the McKay and Dairy Creeks support a diverse population of organisms relative to the lower reaches where substrate is dominated by sand, silt, and organic matter.

Fisheries

Resident salmonids in the Tualatin River Watershed include cutthroat trout (*Oncorhynchus clarki*) and rainbow trout (*O. mykiss*). Anadromous salmonids in the Tualatin River Watershed include fall Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*) and winter steelhead (*O. mykiss*). Chinook are generally found in the lowest reaches of the Tualatin River, near the Willamette River confluence, but were found in Scoggins Creek in the 1970s. However, none have been documented in recent years.

At present, salmonid fisheries in the Tualatin River Watershed are depressed as compared with historic diversity and run size. The factors that limiting salmonids in the watershed include:

- Low hydraulic diversity in the river and tributaries
- Degraded water quality, including turbidity and siltation
- Low summer flows
- High summer water temperatures
- Predation by warm water species
- Limited spawning and rearing areas
- The Lake Oswego Canal
- Predation by non-native species

In general, salmonids appear to be more abundant in the upper reaches of the watershed, where better physical habitat and water quality exist. The lower reaches are dominated by introduced warm water species, which are typically more tolerant to habitat degradation.

Warm-water fish species include largemouth and smallmouth bass, crappie, bluegill, catfish, dace, squawfish, suckers, sculpin, and three-spine sticklebacks.

Some parts of the watershed are stocked with cold water game species. ODFW released rainbow and cutthroat trout in Dairy Creek, Gales Creek, and the Tualatin main-stem but stopped such releases in 1986 to promote natural cutthroat runs. From 1975 to 1995, winter steelhead hatchery fish were released into Gales Creek. Hagg Lake and Dorman Pond are still stocked with hatchery trout. Coho salmon, a popular cold-water species, are not believed to have been present in the Tualatin River Watershed historically; however, construction of a fish ladder at Willamette Falls and stocking by ODFW since 1962 may have resulted in some natural production today.

Fifteen tributaries in or near the Urban Growth Boundary in Washington County were surveyed for fish and habitat conditions. ODFW and Clean Water Services conducted the surveys in 1995. The study used a modified index of biotic integrity (IBI) to measure the quality of the fish communities. The IBI ranks streams as excellent, good, fair, poor and very poor based on the abundance of fish, the diversity of species, feeding structure of fish, pollution and habitat tolerances of species, and the presence of physical anomalies. The study found only one of the 34 stream reaches sampled ranked “good.” No reaches achieved excellent scores, 20 ranked poor or very poor, and 13 ranked fair. Findings of the report include:

- 12 of 25 species collected were exotic to Oregon. Introduced species made up 6% of the total catch. 3% of the fish were intolerant to habitat degradation and pollution.
- Intolerant species were generally confined to the upper reaches of forested, free flowing, relatively undisturbed sites.
- Sculpin made up nearly 70% of the total catch.

Fish populations outside the Urban Growth Boundary are not well studied. Upper reaches of the Tualatin River and tributaries within the Mountain eco-reach support cold water species including resident and migratory cutthroat trout, which maintain a popular fishery. IBI scores would likely be higher in the upper reaches where the substrate is dominated by boulder and cobble, the landscape is not as developed, and water quality is typically better than in the lower reaches.

Surface Water Quality

The Tualatin River Watershed supports a growing population and a wide range of urban, agricultural, and forest- derived activities. The urban area is served by four wastewater treatment plants (WWTPs), all of which are operated by Clean Water Services (formerly the Unified Sewerage Agency of Washington County). Historically, these WWTPs discharged high concentrations of ammonia and phosphorus into the main- stem of the Tualatin River.

The high ammonia concentrations often caused significant in-river nitrification during the summer, resulting in a high oxygen demand and low dissolved oxygen concentrations downstream of the plants. In addition, large populations of phytoplankton thrived in the main stem during the summer. The algal blooms and subsequent population crashes contributed to violations of the State of Oregon minimum dissolved oxygen standard of 6.0 mg/L (now 6.5 mg/L) and the maximum pH standard of 8.5. Several sites on the main- stem also exceeded the State of Oregon action level for nuisance algal growth (15 µg/L of chlorophyll a).

In response to the Federal Clean Water Act (CWA) of 1972, the Oregon Department of Environmental Quality listed the Tualatin River as a "water quality limited" stream. The term "water quality limited" is used in the CWA to define stream reaches that do not meet established water quality standards even after the implementation of standard technology to control the point sources. In 1984 and 1986, DEQ again listed the Tualatin River as water quality limited because of low dissolved oxygen concentrations and nuisance levels of algae. The beneficial uses of the river, designated as "aesthetics" and "swimming", were listed as impaired by algal blooms. Once a river has been designated as water quality limited, the CWA requires that total maximum daily loads (TMDLs) be developed for that water body in order to meet the established water quality standards.

In December of 1986, the Northwest Environmental Defense Center filed suit against the U.S. Environmental Protection Agency to require that TMDLs be established for the Tualatin River. In September of 1988, DEQ established TMDLs for both ammonia nitrogen and total phosphorus for the main stem Tualatin River and its largest tributaries. The ammonia TMDL was designed to decrease in-river nitrification and its associated oxygen demand. The phosphorus TMDL was designed to limit algal growth and thereby restore the designated beneficial uses and minimize the number of violations of the dissolved oxygen and pH standards.

Establishing of TMDLs in the Tualatin River Basin prompted the various management agencies (CWS, many of the cities and counties in the basin, and the Oregon Departments of Forestry and Agriculture) to take action to meet the load allocations set by the TMDLs. Tertiary treatment to remove phosphorus was implemented at CWS's two largest WWTPs. In addition, those plants were reengineered to encourage bacterially mediated nitrification within the plant, thereby minimizing the discharge of ammonia to the river. USDA-NRCS, The Tualatin Soil and Water Conservation District (TSWCD) and the Oregon Department of Agriculture helped control phosphorus releases from many dairy and nursery operations. As of June 1993, the Tualatin River was in compliance with the ammonia nitrogen TMDL, and an extended implementation and compliance schedule had been developed and approved for the total phosphorus TMDL.

Year 2001 TMDLs

Since the 1986 TMDLs, water quality concerns have expanded from the main-stem Tualatin River to include the tributaries. In 1998, 274 out of 898 stream miles in the Tualatin River Watershed were listed as water quality limited for one or more of the following parameters: bacteria, dissolved oxygen, temperature, pH, biological criteria (fish communities), chlorophyll a, and toxics (iron, arsenic, and manganese). In 2001, four TMDLs were developed addressing dissolved oxygen, temperature, bacteria, and algae/phosphorous. DEQ plans to use the adaptive management approach to all TMDLs.

Dissolved Oxygen (DO)

Dissolved oxygen gets into water by diffusion from the surrounding air, by aeration (rapid movement), and as a byproduct of photosynthesis. Oxygen is necessary to all forms of life, but too much or too little oxygen in the system can be fatal to organisms. As dissolved oxygen levels in water drop below 5.0 mg/l, many aquatic species are stressed. Oxygen levels that remain below 12 mg/l for a few hours can result in large fish kills. Total dissolved gas concentrations in water should also not exceed 110 percent.

Twenty -one tributaries to the Tualatin River are listed on the 1988 water quality limited list for dissolved oxygen. According to the DEQ, the two factors that most affect dissolved oxygen concentrations in the tributaries are temperature and sediment oxygen demand (the decomposition of bottom sediments which consumes dissolved oxygen). Temperature will be addressed through the temperature TMDL. To address sediment oxygen demand, reductions in organic solids discharged to the streams will need to be reduced. In order to achieve this, reductions in point and nonpoint discharges will be necessary.

Temperature

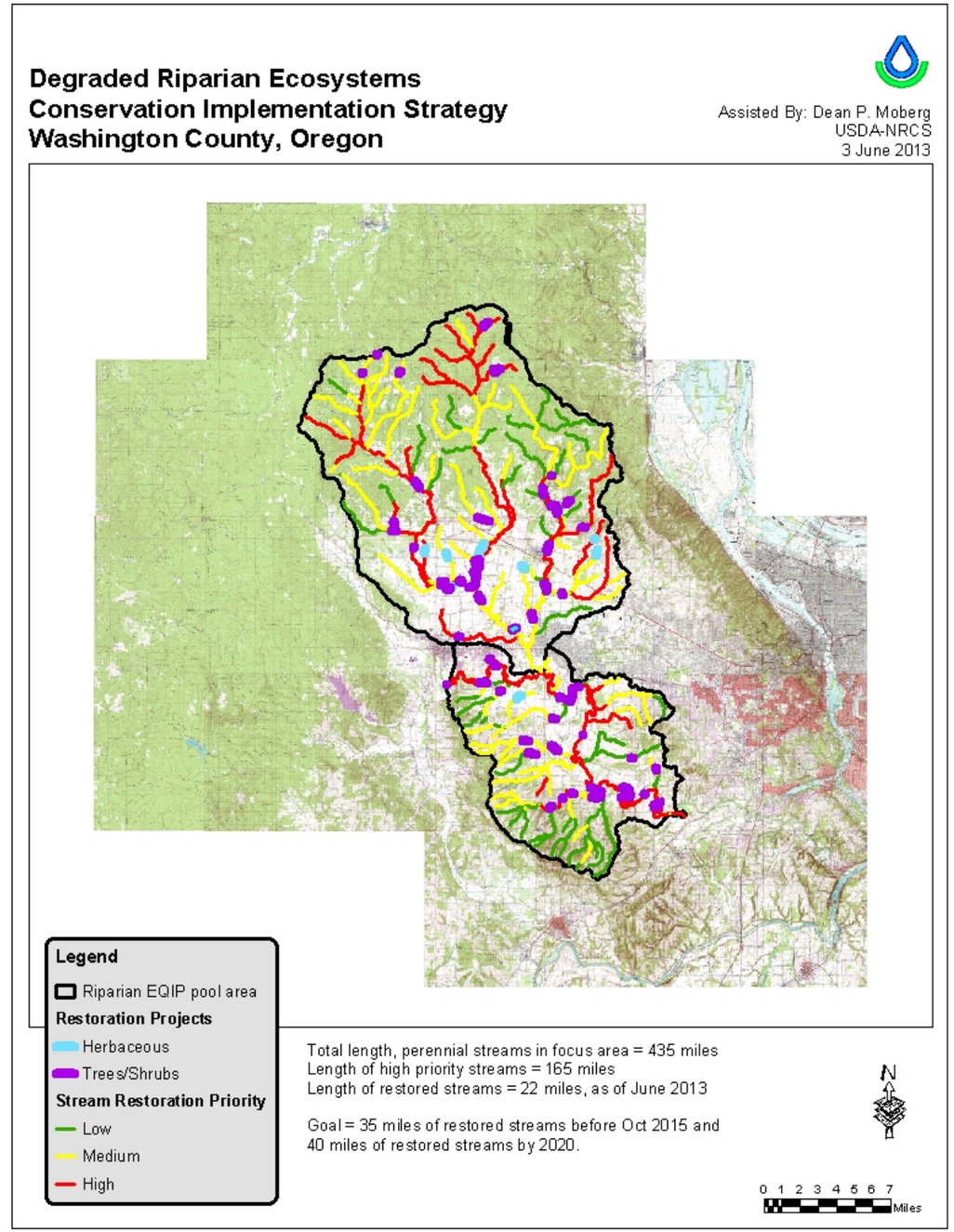
The Tualatin River is home to winter steelhead and resident cutthroat trout. The temperature standard for protecting these salmonid species is 64°F, and 55°F. Elevated temperatures can cause increased incidence of disease, an inability to spawn, reduced rates of growth and survival of eggs and juveniles, an increased competition for limited habitat and food, and others. Temperatures In the mid –to- upper 70's can be lethal to salmonids. The goal of the standard is to prevent or minimize warming caused by human activity. The Tualatin River and many tributaries exceed the standard in July and August with temperatures ranging up to the lower to mid-70s. Currently, approximately 76% of the stream network exceeds the 64 degree standard in midsummer.

Factors that affect stream temperatures include riparian vegetation, stream morphology, warm water discharges, hydrology, climate, and geographic location. Climate and geographic location are outside of human control. In the Tualatin, humans can affect vegetation, channel morphology, and hydrology. With removal of riparian vegetation, the amount of solar radiation reaching the water increases, as it does with widened channels. Impermeable surfaces, such as pavement, reduce summertime base flows and the volume of water. In the Tualatin, modeling by DEQ indicates that "increases in solar radiation loading due to riparian vegetation disturbance and discharge of warmer water from point sources were primary causes of increased stream temperature." (DEQ TMDL Fact Sheet) In order to address warmer temperatures, management plans will increase effective stream shading on most tributaries to a range between 82 and 100%.

Bacteria

The Tualatin River and tributaries are used for swimming, fishing, and boating. Bacterial contamination of these waters can affect the health of people recreating in the water. Bacteria can enter the waterways through several different routes. Untreated sewage can overflow from sewage treatment plants. Failing septic systems, runoff contaminated with animal wastes (such as livestock, and domestic pets), can elevate bacteria levels. The highest levels of bacteria in the Tualatin River Watershed generally occur during periods of storm water runoff due to rain events.

Potential sources of bacteria include failing septic systems, pet waste, other animal wastes, illegal dumping, and illicit connections.



Phosphorus/algae

Late summer and early fall algal blooms, resulting from a combination of high nutrient loads (nitrogen, phosphorus) and abundant sunshine, are the major controller of dissolved oxygen levels in the Tualatin.

Algal blooms, the extensive growth of algae, are not desirable because they lead to depletion of oxygen in the water. Algal blooms decrease the penetration of light which can cause a decline in rooted macro vegetation. Furthermore, algal blooms reduce water clarity, decrease the aesthetic value of streams, produce wide fluctuations in pH, and may produce foul tastes and odors in drinking water. Growth of suspended algae is stimulated by slow water velocities and high nutrient concentrations. Algal growth in Lake Oswego is monitored, and nuisance levels are treated with copper sulfate. Copper sulfate is toxic to fish and must be applied carefully.

Wapato Lake, located in the Upper Tualatin River Watershed, was drained by the Wapato Improvement District (WID) in the 1930's to create farmland. This drainage project includes an elongated U-shaped dike, roughly 3,000 feet in length that protects the lakebed from winter flooding by the surrounding creeks.

In December of 2007 the west side of the dike breached, allowing Wapato Creek to flood the lake bed to a depth of about eight feet. The breached dike delayed WID's annual pumping of water out of the lake until July 2008. Water quality problems were observed downstream of Wapato Lake that summer. The Joint Water Commission, the drinking water providers in the county, experienced significantly greater difficulty and increased cost to treat Tualatin River water during summer 2008. Monitoring the watershed above their intake demonstrated that much of the water treatment problem came from the Wapato area.

Also, a bloom of potentially toxic blue-green algae was observed in the lower Tualatin more than 40 river miles downstream of Wapato in mid- July. On July 31, the Tualatin Riverkeepers reported a fish kill in the canal below the Wapato pump house.

The WID developed a water quality management plan for Wapato Lake with help from DEQ, USDANRCS, the TSWCD, and ODA.

Toxics

No detailed examination of organic chemicals such as volatile organic compounds, organochlorine compounds and pesticides, has been performed in the Tualatin River Watershed. A USGS report (Anderson, 1996) which addresses the entire Willamette River Watershed detected levels of DDT/DDE/DDD and Dieldrin, which exceeded criteria at three sites.

Trace Elements

In the 1996 USGS report, measurements of trace elements at five sites within the watershed exceeded State of Oregon criteria for arsenic (2 sites), copper (1 site), lead (3 sites), and zinc (2 sites). No detailed analysis of these detections has been performed.

Hydrology

The meandering Tualatin River is about 80 miles long and the Tualatin River Watershed covers an area of 712 square miles. Annually, more than 1.1 million acre-feet of water flow out of the watershed into the Willamette River (including water imported from the Trask and Bull Run rivers). Nearly 85% of this flow is discharged during November through March, and less than 3% typically is discharged during June through October.

The Tualatin River has five major tributaries:

(1) Gales Creek flows through a mostly forested landscape in its upper reaches but flows through cropland in the lower reaches, skirting the city limits of Forest Grove.

(2) Dairy Creek flows through forested landscape in the uplands, and then through predominantly agriculture lands at lower elevations.

(3) Rock Creek has both agriculture and urban land uses.

(4) Fanno Creek is an almost exclusively urban area.

(5) Scoggins Creek, which receives water releases from Hagg Lake, is mainly forested above Hagg Lake and agricultural below the lake.

Scoggins Dam located near the town of Gaston, stores runoff from the Scoggins Creek watershed. This project, authorized by Congress in 1966, was the last Bureau of Reclamation (BOR) project authorized in the Pacific Northwest.

In the 1950s, only about 6,000 acres of the Tualatin River Watershed were irrigated. BOR began studies and held local meetings to formulate the type of irrigation development best suited to the area. A report in 1956 analyzed storage at the site of present- day Scoggins Reservoir. A feasibility report issued in 1963 identified a need for irrigation water on 17,000 acres of land, 14,000 acre-feet of municipal and industrial water, and water for fish and wildlife, recreation, quality control, and flood control benefits. On the basis of this plan, the Scoggins Dam project was authorized in 1966.

The principal features of the Tualatin Project include Scoggins Dam, Henry Hagg Lake, Patton Valley Pumping Plant, Spring Hill Pumping Plant, and more than 120 miles of a piped distribution system for irrigation.

The Tualatin Valley Irrigation District is now responsible for the operation and maintenance of Scoggins Dam and Patton Valley and Spring Hill pumping plants. The recreation facilities are operated and maintained by Washington County.

The Patton Valley Plant is located on Scoggins Creek and provides water for the Patton Valley area and upper Tualatin River. The Springhill Pump Plant has four 350 HP pumps and five 1500 HP pumps which withdraw water from the Tualatin River (just downstream of the confluence with Gales Creek and adjacent to the Joint Water Commission drinking water diversion) for distribution through the north, east, and west pipelines. Water is delivered via the Tualatin River for irrigators who pump directly from the river.

Seasonality of flow

Flows within the Tualatin River Watershed exhibit a seasonal pattern. The high winter flows generate high turbidity in the main-stem and many of the tributaries. Fall and winter flood events in 1995 and 1996 increased concern with flood management in the watershed. Increased development within the urbanized portion of the watershed has led to higher peak flows which have led to degradation of streams.

Low summer flows have historically resulted in high levels of phytoplankton growth and low dissolved oxygen (DO) concentrations during the low flow months of May through October. Both TMDL- focused water quality management practices and flow augmentation have been undertaken to improve water quality during the low flow period. The goal of flow augmentation is to maintain a minimum monthly mean flow of 120 cubic feet per second (cfs) from June to August and 150 cfs for September to November at the Farmington gauge, RM 33.3. During this summer period, flow in the Tualatin River is increased by as much as one- third of its natural flow through input to the Tualatin River from Henry Hagg Lake, Barney Reservoir, and the Rock Creek and Durham wastewater treatment plant effluent.

A shallow aquifer is near the surface of much of the valley floor and lies within alluvial fill. A separate aquifer that is as much as 1,200 feet below land surface lies within Columbia River Basalt. The alluvial aquifers are typically filled each winter from precipitation.

Oregon water law

Under Oregon law, all water is publicly owned. With some exceptions, cities, farmers, factory owners, and other users must obtain a permit or water right from the Oregon Water Resources Department (OWRD) to use water from any source whether it is underground or from lakes or streams. Landowners with water flowing past, through, or under their property do not automatically have the right to use that water.

Oregon's water laws are based on the principle of prior appropriation. This means the first person to obtain a water right on a stream is the last to be shut off in times of low stream flows. In water short times, the water right holder with the oldest date of priority can demand the water specified in their water right regardless of the needs of junior users. If there is a surplus beyond the needs of the senior right holder, the person with the next oldest priority date can take as much as necessary to satisfy needs under their right and so on down the line until there is no surplus. The date of application for a water use permit usually becomes the priority date of the right.

The prior appropriation doctrine is the basis of water law for most of the states west of the Mississippi River. In Oregon, the appropriation doctrine has been law since 1909.

Water diversions

As of 1992, the Oregon Department of Water Resources had issued rights to divert a total of approximately 1,194 cubic feet per second (cfs) from surface waters in the Tualatin River Watershed. Rights to 722 cfs are held by agriculture users, with 678 cfs specifically for irrigation. Municipalities hold rights to divert 330 cfs and industries hold rights to 37 cfs. Rights to 104 cfs are held for other uses. Full use of these rights could result in diversion of 508,300 acre- feet to out –of- stream uses. This would be 46 % of the total average annual discharge.

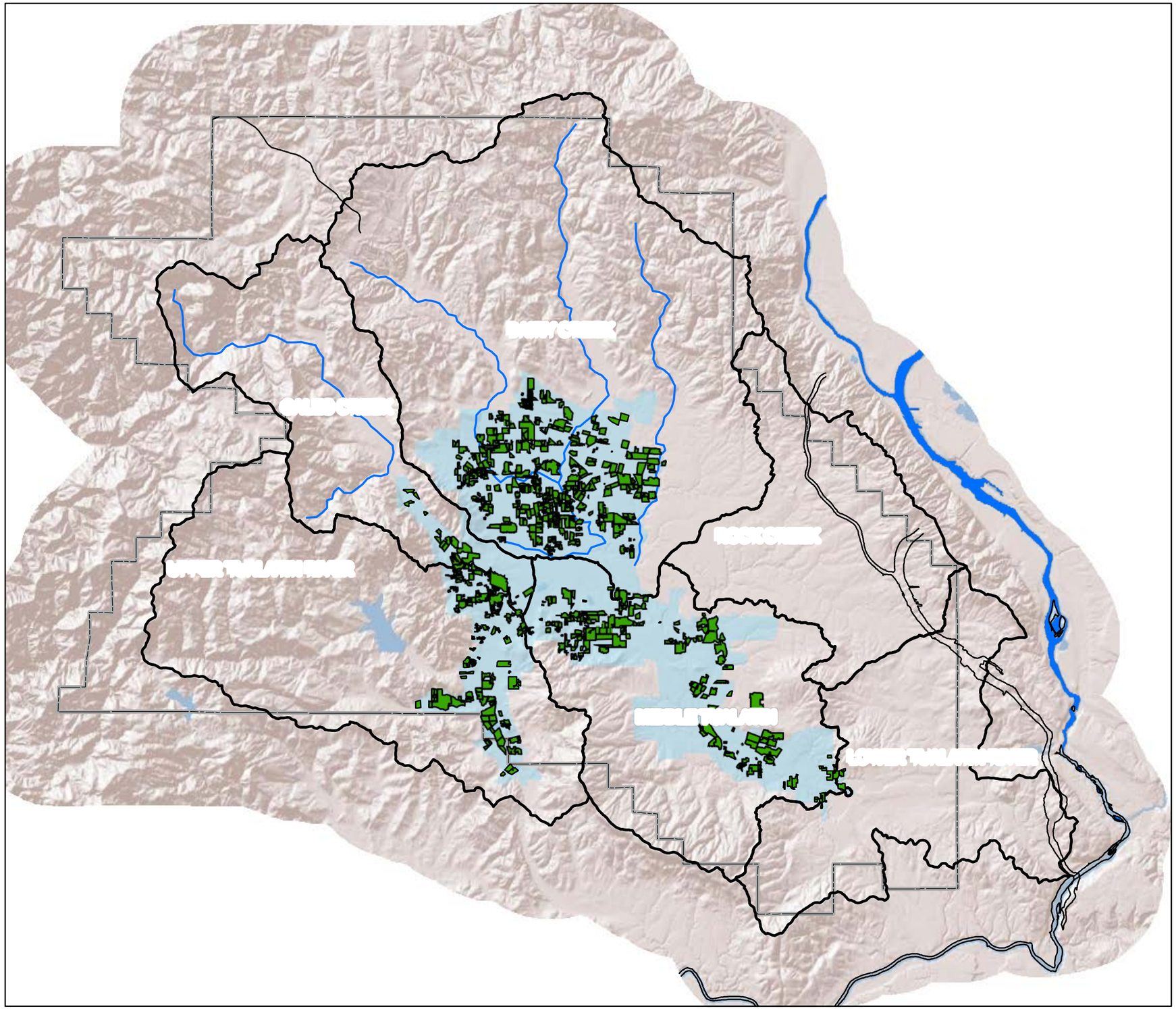
Since 1966, the State of Oregon has set year-round minimum stream flows, in-stream water rights, from natural sources, at various points along the Tualatin River and tributaries. The Tualatin River is managed to meet or exceed existing in-stream water rights. Flows are generally met on the river due to stored water releases and imported water. Minimum required flows in most of the larger tributaries of the Tualatin are also met, though many smaller streams are not protected by minimum required flows.

Concerns

Since the 19th Century, more than half of the Tualatin River Watershed has been converted from forest and wetland habitat to urban or agriculture use. The remaining forest is now intensively managed.

As development in the watershed continues, there may be more impacts to river morphology due to more direct delivery of runoff from impervious surfaces. This contributes to higher peak flow velocities and subsequent scouring and sediment movement, as well as lower summer flows. Increasing urbanization may decrease riparian buffers. Loss of riparian buffers can cause increased temperatures in streams and increased sediment, nutrients, and pollutants reaching the river. Agriculture and forestry activities can also lead to similar degradation due to vegetation removal and unmaintained roads and culverts.

Currently, Tualatin River Watershed communities are concerned about quantity of water available, especially because population growth in Washington County is expected to double water needs by 2050. In order to provide a reliable source of high quality water for drinking, agriculture, industry, recreation and wildlife, the Joint Water Commission is now considering raising Scoggins Dam by 2,540 ft. in order to store more winter runoff for use during summer months.



Tualatin River Watershed Long Range Strategy

Washington County Irrigation

Tualatin Soil & Water Conservation District

USDA-Natural Resources Conservation Service

Note: other lands in Washington County, not designated on this map, are also irrigated by withdrawal from streams and groundwater.

Legend

- Tualatin River watersheds
- Washington County
- TVID use 2009 (typical)
- TVID boundaries
- Major roads
- Lakes and rivers

Natural Resource Analysis

The Natural Resources Conservation Service (NRCS) has enjoyed a long partnership with the Tualatin Soil and Water Conservation District (SWCD). The seven- member SWCD Board of Directors is a volunteer group elected by the public. The Board meets on the second Tuesday of each month and currently employs a staff of two technical conservation professionals and an administrative specialist. SWCD staff share office space with NRCS and collaborate on conservation projects in Washington County.

On March 34, 2010, the Tualatin Soil and Water Conservation District met with local stakeholders to develop a long-term strategy for natural resource conservation. Participants in this meeting included representatives of the following groups:

- NRCS
- Farm Service Agency
- The Tualatin River Watershed Council
- Farm Bureau
- Small acreage farmers
- Berry farmers
- Nursery growers
- The environmental community
- Washington County
- The Joint Water Commission
- Clean Water Services
- Oregon Department of Environmental Quality
- Oregon Department of Agriculture

This meeting identified the following set of high priority natural resource conservation issues:

- Water Quality (TMDLs, sedimentation, temperature, riparian resource enhancement, etc.)
- Water Quantity
- Soil Health & Erosion
- Invasive & Noxious species
- Threatened Species and Upland Habitat Enhancement
- Energy Conservation & Green House Gas Reduction
- Air Quality
- Conservation Education (in all the above including urban and rural audiences)
- Maintain Ag Viability (in all the above)

As a result of this meeting, the SWCD also identified the following high priority geographic areas in Washington County:

- Upper Tualatin River Watershed area – source of drinking water for upper county, source of irrigation water, Wapato Lake condition, Metro, Clean Water Services and watershed council high priorities with many of the resource concerns identified)
- Gales Creek Watershed (as part of the Tualatin River Watershed)

Sites of highest priority within the above areas include those with heavy erosion, severely degraded riparian zones, and animal waste sites without modern waste storage facilities.

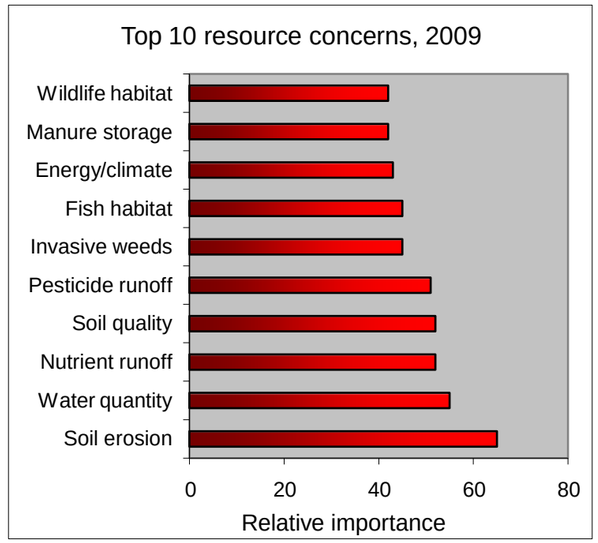
2002-2009 Local Work Groups

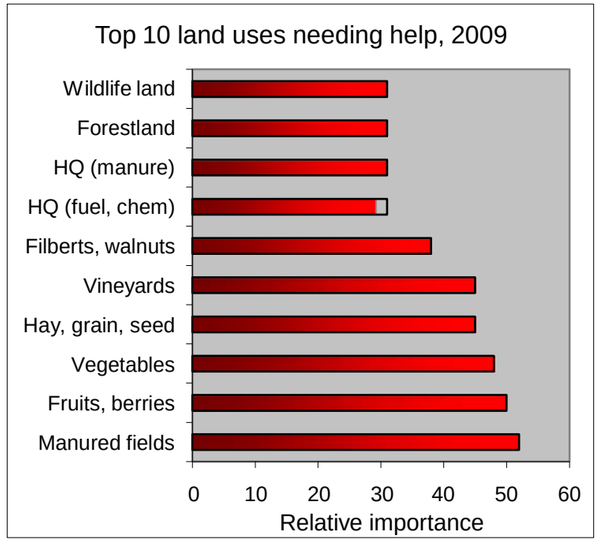
The 2002, 2008 and 2014 federal Farm Bills require NRCS to meet annually with a Local Work Group of individuals and organizations with an interest in natural resource conservation. For 2002-2009, we held Local Work Groups with partners from Washington County. Identified priorities were very much in agreement with the SWCD priorities shown above. The Local Work Group has also stated that NRCS and the SWCD should continue their efforts to expand programs to small acreage farms, nurseries, and vineyards.

Additional concerns the Local Work Groups have identified are:

- Reduce the goose problem in the county (There are many more geese than there used to be. They are eating crops)
- Reduce wildfire risk in woodlands
- Expand the use of programs by groups historically underserved by USDA

In 2009, NRCS surveyed 20 individuals in Washington County representing farmers, agency representatives, and environmental groups. The results of this survey are illustrated in the following charts.





Local Work Groups after 2009

Beginning in 2010, our Local Work Group has met in joint sessions combining Washington, Multnomah, and Clackamas Counties. These combined sessions are arranged because the natural resource issues affecting these counties are similar. Also, it's easier for partner agencies such as ODFW to attend one combined meeting rather than individual meetings for each county.

In these meetings, the Local Work Group has identified the following resource issues, which reiterate the issues identified by the SWCD and in previous work groups:

- Loss of riparian habitat: loss of riparian forests increases water temperature and sediment/chemical loading and hurts fish and wildlife. Wastewater treatment facilities and drinking water utilities then incur higher costs to return water quality to regulatory standards.
- Soil erosion on cropland: soil erosion and sedimentation from Christmas tree, nursery, winter vegetables, and new ryegrass seedings that lack cover crop and/or buffers hurt surface water quality, including an increased presence of pesticides and nutrients. Erosion and runoff from cropland can carry phosphorus and pesticides into streams.
- Invasive species: invasive plant and animal species reduce forest health, impact nursery markets, reduce crop yields, and hurt wildlife. Invasive weeds spread easily, especially downstream.
- Loss of farmland: ecological, social and economic pressures, and urbanization increase the likelihood producers will sell their land or convert it from farming. Fewer farmed acres results in reduced food production, less open space, and less wildlife habitat.
- Reduced stream flow due to inefficient irrigation: inefficient irrigation on water-intensive crops and urban water use in summer months (June-September) reduces the amount of water available for municipal water use, fish passage, habitat, irrigation, and recreation.
- Decreased soil quality on cropland: soil quality ("tilth") caused by compaction, tillage, lack of organic matter, and water-induced erosion result in decreases in long-term productivity in livestock operations, Christmas tree, perennial rye-grass, and irrigated row crops.
- Unhealthy forest stands: unhealthy young forests result in reduced productivity, increased soil erosion, and increased fire hazard. Unhealthy forests also harbor deleterious insects, diseases, and invasive weeds.
- Greenhouse gases, energy use, and climate change: some agricultural practices increase atmospheric concentrations of greenhouse gases (carbon dioxide, methane, and nitrous oxides). Greenhouse gas emission is often caused by inefficient energy use. Greenhouse gases cause climate change, which can lead to water shortages, crop failures, and loss of wildlife habitat.

Conservation accomplishments

NRCS and the SWCD have helped farmers in the Tualatin River Watershed develop and implement conservation plans for many years. In 1991, NRCS procured funding for a Hydrologic Unit Area (HUA) approach to conservation in the Dairy-McKay watershed. The purpose of this project was to provide funding to help farmers address water quality problems of phosphorus, turbidity, low dissolved oxygen, algae, pH, bacteria and temperature in the Tualatin River and its tributaries. In 1994, the HUA project was extended to the entire Tualatin River Watershed and project funding continued through 1998.

This HUA project was a collaborative effort between NRCS, the SWCD, and OSU Extension. HUA funding allowed NRCS to hire two additional staff, the SWCD to hire one staff person, and OSU Extension to hire one staff person to implement the project. Outreach efforts included a series of focus group meetings with farmer groups, a newsletter, mailings and numerous on-farm meetings.

The HUA helped 34 farms (18 of which were dairy farms) develop and implement resource management system plans including the following:

- 18,922 acres of nutrient management including reducing nitrogen application by up to 200 lbs/acre and phosphate application by up to 100 lbs/acre on some farms.
- 2,946 acres of irrigation water management, including the use of a neutron probe (managed by the Tualatin Valley Irrigation District) to monitor soil moisture to help farmers apply irrigation water more efficiently.
- 28 waste storage structures to store manure on Confined Animal Feeding Operations.
- Plus, streambank protection, underground outlets, cover crops, well testing and other conservation practices to protect or improve water quality.

After the HUA funding ended in 1998, NRCS and the SWCD continued helping farmers plan and implement conservation practices through the Environmental Quality Incentive Program. The location of many of these more recent projects are illustrated on the following map of Washington County Applied Conservation Practices, generated from the NRCS IDEA mapping system.

A vibrant partnership that is unique to the Tualatin River Watershed is the Enhanced CREP program. A collaboration of Farm Services Agency, the SWCD, NRCS and Clean Water Services, this program has helped 32 landowners establish 385,449 native trees and shrubs on 327 acres bordering 20.5 miles of streams in the watershed (progress is through 2009). These riparian forest buffers will reduce stream temperatures, filter runoff, and provide habitat for fish and wildlife.

NRCS, the SWCD, and Metro Regional Government have partnered on nine wetland restoration projects totaling 606 acres and funded in part by the Wetland Reserve Program (WRP). Three other WRP projects, totaling 403 acres were implemented without Metro's

involvement. These projects have restored riparian forest, oak savannah, wet prairie, and vernal pool plant communities. Two of the projects are currently supporting populations of the threatened Nelson's checker-mallow (*Sidalcea nelsoniana*). The US Fish & Wildlife Service has restored wetlands on the Tualatin River National Wildlife Refuge, located along the lower Tualatin River near Sherwood and is now beginning to develop its Wapato Lake Unit on the refuge in the upper Tualatin River near Gaston.

Future conservation needs

A more detailed list of future conservation needs appears in Sections IV and V of this document. However, in general terms, NRCS and the SWCD believe that the following represent the highest priority conservation needs in the Tualatin River Watershed:

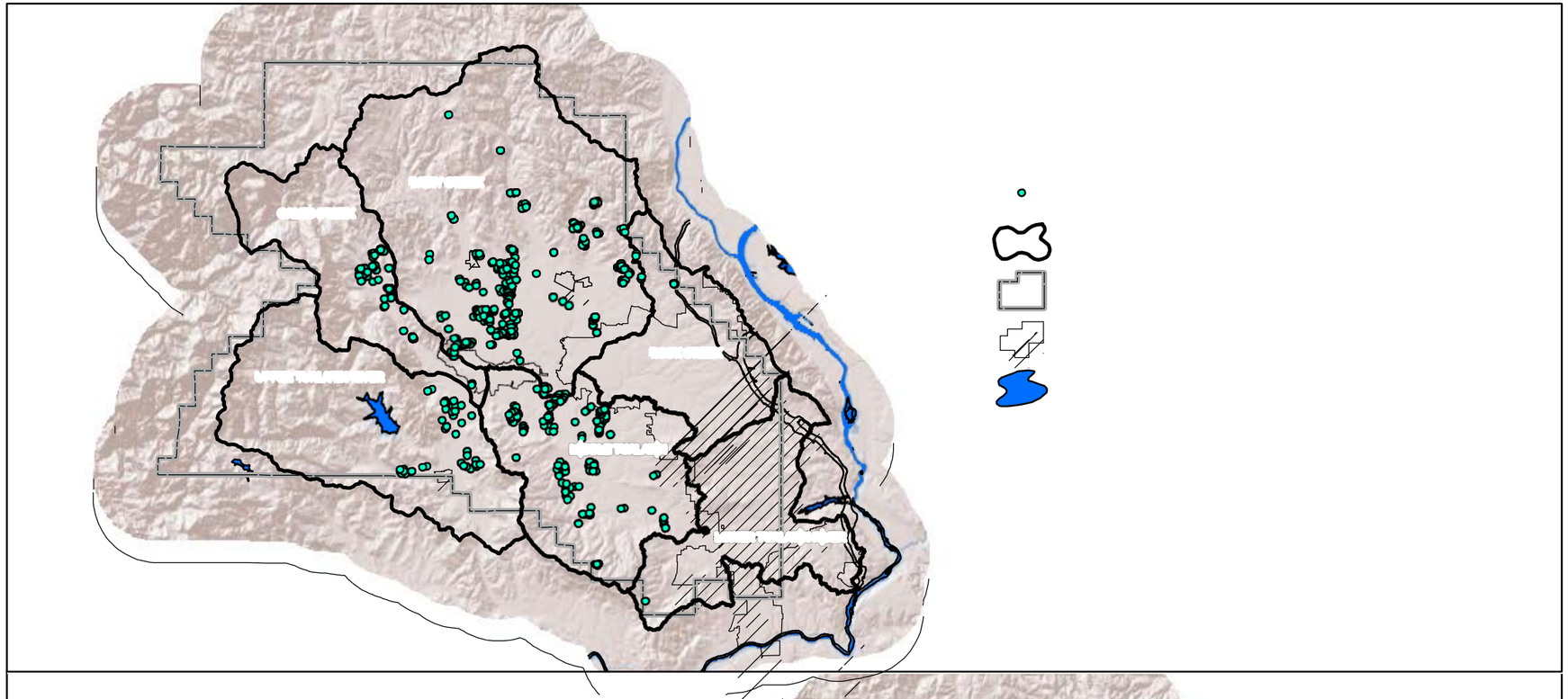
- Water quality, especially focusing on phosphorus runoff and stream temperature. The most critical areas in the watershed are agriculture lands upstream of the JWC drinking water take-out on the Tualatin River. This area includes the Upper Tualatin River, and Gales Creek. Conservation systems including the following practices are needed: micro-irrigation, riparian forest buffer, nutrient management.
- Greenhouse gases and energy conservation, especially focusing on farms that are large consumers of energy (e.g. intensely irrigated farms), farm enterprises where N fertilizer is often over-applied, and farms that have the potential to plant significant acreages of trees. Conservation systems including the following practices are needed: tree & shrub establishment, nutrient management, no-till.
- Degraded riparian areas on streams in agricultural areas, especially focusing on high priority streams (see Washington County Stream Restoration Rating map) and practices such as riparian forest buffer, pesticide management and filter strips.
- Reduced streamflow due to inefficient irrigation, especially focusing on the area served by the Tualatin Valley Irrigation District. Practices including drip irrigation, pipeline, pumping station, sprinkler irrigation (linear move and center pivots), fish screens, variable frequency devices and irrigation water management are needed.

Tualatin River Watershed Long Range Strategy

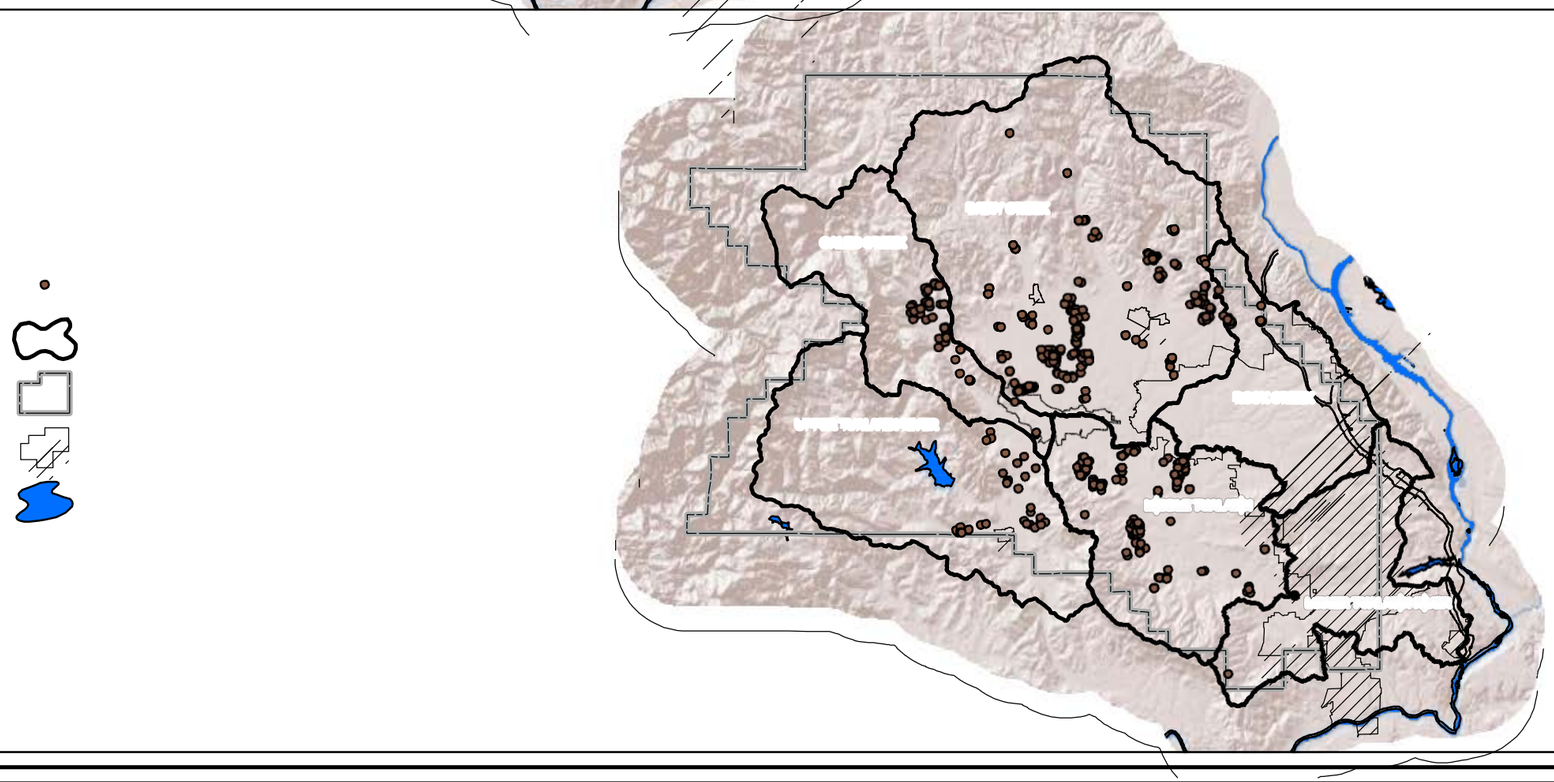
Conservation Practices

Tualatin Soil & Water Conservation District

USDA-Natural Resources Conservation Service



Water Quality Practices (green dots) include: Field Border, Filter Strip, Nutrient Management, Pest Management, Riparian Forest Buffer, and Tree and Shrub Establishment.



Erosion control practices (brown dots) include: Conservation Cover, Cover Crop, Critical Area Planting, Field Border, Filter Strip, Grassed Waterway, Heavy Use Protection, Microirrigation, Irrigation Water Management, Mulching, Residue Management, Riparian Forest Buffer, Roof Runoff Structure, Tree and Shrub Establishment, and Underground Outletand Tree and Shrub Establishment.

NRCS - SWCD Projects

A stream with severe cutting and a lack of riparian vegetation (ca. 1960?).

No-till winter wheat.

Data collection system to aid in irrigation water management.

Filter strip along a ditch.

The same site as above in 2010 after a re-vegetation project and exclusion of livestock.

Annual oat cover crop in rhubarb.

Drip irrigation in grapes.

Underground outlet to control erosion.

Prioritized Natural Resource Problems

Priority	Problem	Description	Trend	Impact to people
1	Degraded riparian areas	Highly- disturbed stream reaches result in stressed populations of native aquatic species (including threatened steelhead trout and native cutthroat trout) and declining populations of native plant and animal species that depend upon riparian areas (e.g., Nelson's checker-mallow and yellow-breasted chat).	Riparian areas have been degraded over 150 years of ecosystem impacts, including removal of trees, tillage, drainage, use of pesticides, and introduction of invasive species. High surface water temperatures and pesticide runoff degrade the water in which aquatic species live. This degradation has affected native populations of cutthroat trout, winter steelhead, Pacific lamprey, neo-tropical migrant birds, and native pollinators.	This issue consistently ranks high in local work groups and in a recent Tualatin SWCD strategic planning session (March 2010). Stakeholders include farmers and farm organizations (e.g. Farm Bureau), environmental groups (e.g., Tualatin Riverkeepers) and local government (e.g. Tualatin SWCD, Clean Water Services, and Metros Regional Government).
2	Reduced biodiversity	The spread of invasive weeds and the destruction of wet prairie and oak savannah communities have reduced biodiversity in the basin. "Strategy species" that are high priorities for restoration include Nelson's checker-mallow, northern red-legged frog, Fender's blue butterfly, steelhead trout, acorn woodpecker, western meadowlark, yellow-breasted chat, and willow flycatcher (ODFW, 2006).	Invasive weed populations continue to expand in Washington County. Recent new weeds include garlic mustard, Japanese knotweed, and giant knotweed. However, some strategy species are also increasing, which is good news. Wetland restoration projects (sponsored by Metro and NRCS) are helping to expand populations of Nelson's checker-mallow. American bald eagle populations are expanding, and this bird was taken off the endangered species list in 2007.	Invasive species are expensive to control, jeopardize farm profits (especially in the nursery industry), and reduce habitat for strategy species. When species are placed on the Endangered Species List, regulatory costs for both public and private development projects increase. Restoring populations of strategy species helps avoid these costs while also providing better recreation opportunities for the growing number of birdwatchers and others who enjoy nature.
3	Water quantity	The US Bureau of Reclamation built Scoggins Dam in 1972-75. Scoggins Dam is a 151-foot-high zoned earth-fill structure that is 2,700 feet long at the crest. Total capacity of Henry Hagg Lake is 59,910 acre-feet (active 53,600 acre-feet). Hagg Lake releases water into Scoggins Creek, a tributary of the Tualatin River. The Tualatin Valley Irrigation District (TVID) and the Joint Water Commission (JWC) withdraw water from the Tualatin River downstream of Scoggins Creek. TVID provides water for high value irrigated crops. The JWC provides water for high tech industry and the general population. Growing demands for this high quality water have raised local concerns for the future of adequate water supplies. The 2014 Local Work Group had enthusiastic participation from partners who agreed that developing a CIS to conserve water in the TVID boundaries was essential to maintain productive agriculture as competition for water increases.	Steady growth in the population of Washington County, along with the development of high value irrigated cropland has resulted in increased demand for irrigation water from the Tualatin Valley Irrigation District. Concurrently, high tech manufacturing has expanded in Washington County, due in part to plentiful supplies of high quality water. However, projections for population growth indicate that water supplies will run short in the near future.	Concerns for water shortages has lead TVID, the Joint Water Commission and US Bureau of Reclamation to complete feasibility studies for raising the Scoggins Dam (Hagg Lake) in order to store more water. Any changes to the dam, however, would need to meet new seismic upgrade standards, which would not be economically feasible. Thus, in order to provide continued high quality water supplies sufficient to meet the needs of agriculture, industry and residents, conservation of water has become critical.

Prioritized Natural Resource Problems, continued

Priority	Problem	Description	Trend	Impact to people
4	Threatened public drinking water supplies	High levels of phosphorus (P), high water temperatures, and reduced stream flows threaten public drinking water with harmful algae blooms. Also, algae blooms cause wide swings in stream water oxygen and pH levels, which hurt fish such as the Upper Willamette River steelhead (*Oncorhynchus mykiss*), a threatened species. Algae levels are measured by analyzing water samples for chlorophyll *a*, a pigment found in algae.	On the mainstem of the Tualatin from river mile (RM) 3.4 to 33.3, concentrations of chlorophyll *a* routinely exceed the action level that indicates when algae growth may create a nuisance condition (ODEQ, 2001). A blue-green algae bloom occurred in 2008 upstream of the drinking and irrigation water takeouts on the Tualatin River. The species of blue-green algae observed in that bloom (*Anabaena flos-aquae*) can produce liver and neuro-toxins. This incident was linked to a fish kill below Wapato Lake.	Most of the public drinking water for Washington County is provided by the Joint Water Commission from their Tualatin River pumping plant just downstream from Gales Creek. The 2008 blue-green algae bloom significantly increased JWC water treatment costs (approximately $300,000). The algae may have caused crop damage and endangered farm-worker health. Algae blooms also hurt recreational opportunities for fishing and canoeing in the river.
5	Greenhouse gas emission and inefficient energy use	Greenhouse gases, including CO_2 and N_2O, are contributing to climate change. Climate change caused by greenhouse gas emission is arguably the most important natural resource problem that the earth's population has ever faced. The secondary impacts of climate change include flooding of coastal areas, drought, species extinction, spread of disease, and severe economic repercussions (AAAS, 2010).	The upward trend in atmospheric concentrations of greenhouse gases for the past century has been well documented for decades. More recently, scientists have documented a clear trend toward increased temperatures on Earth and the resulting impact on natural resources. These impacts include the melting of glaciers and the reduction in polar ice caps. Due to population growth and increasing standards of living, greenhouse gas concentrations are expected to increase in coming years.	Greenhouse gas emission is a critical issue for local dryland farmers who may face yield losses due to changes in rainfall and temperature, irrigators who may experience water shortages and specialty crop growers (e.g., nurseries and vineyards) who depend on the current climate to produce superior quality crops. In a larger sense, this issue will affect local farmers and the suburban population due both to the impacts listed above and to the legislative remedies that will address the issue.

Desired outcomes

Priority	Problem	Products and services that are needed	Focus	Implementation strategies
1	Degraded riparian areas	Conservation planning and implementation on farm types with the greatest potential to protect the highest priority stream reaches. Systems include tree/shrub establishment, filter strips, pest management, upland wildlife habitat management, and drip irrigation.	The Tualatin SWCD, the Tualatin River Watershed Council, and NRCS field office staff developed a stream matrix GIS layer to identify the highest priority stream reaches for treatment in the Tualatin River Basin. This matrix is based on seven parameters, including anadromous salmonid spawning, resident salmonid spawning, water quality, stream temperature, erosion, riparian vegetation quality, barriers to salmonids, and wildlife corridors. We will focus on the Dairy-Mckay and Middle Tualatin Watersheds, which have a total of 145.3 miles of high- priority stream reaches.	We have developed a stream reach EQIP funding pool to address this problem. Key to this effort is a partnership with ODFW, local tree planting contractors, the SWCD, and Clean Water Services.
2	Reduced biodiversity	Conservation planning and implementation on both public and private lands. Systems include tree/shrub establishment, forest site preparation, forest stand improvement, brush management, and conservation cover.	Our focus will be on the Tualatin River floodplain "conservation opportunity area WV-05" as delineated by ODFW (2006), plus stream corridors that drain into this area. The area provides the best opportunities for restoring wet prairie and floodplain oak savannah communities. The upstream corridors are important focal points for controlling invasive weeds.	We will use WHIP and WRP to fund restoration projects in the conservation opportunity area. The Tualatin SWCD plans to become the Washington County Weed Board and will work on noxious weed control in the stream corridors upstream of the conservation opportunity area.
3	Water quantity	Water conservation practices (drip irrigation, irrigation water management, and associated practices) are needed to conserve valuable surface water supplies.	The focus will be on high value irrigated crops within the TVID service area. High value crops include berries, vegetables and berries.	We will use EQIP funding to fund irrigation efficiency projects on farms in the focus area.

Desired outcomes

Priority	Problem	Products and services that are needed	Focus	Implementation strategies
4	Threatened public drinking water supplies	Conservation planning and implementation on farmland and private forestland. Resource management systems include nutrient/pest/irrigation water management, tree and shrub establishment, filter strips and drip irrigation on farms, and erosion control on forest roads. Some landowners may find that selling conservation easements in riparian areas fits their business plan for maintaining profitable farming operations while protecting water supplies.	The Upper Tualatin and Gales Creek watersheds are the highest priorities for focus. These watersheds are located above the JWC drinking water take-out on the Tualatin River, just downstream from the confluence with Gales Creek. The Tualatin Valley Irrigation District (TVID) take-out is just downstream of the JWC takeout. TVID provides most of the irrigation water for cropland in the county. Gales Creek also supports the main run of threatened steelhead trout in the Tualatin watershed.	Our implementation strategy begins with a USDA – Agricultural Water Enhancement Program (AWEP) project that focuses on helping farmers implement resource management systems in the Upper Tualatin and Gales Creek watersheds. Beginning in 2011, we will also focus our Environmental Quality Program (EQIP) forestry pool for Washington county to help private non-industrial foresters in these watersheds develop and implement plans to control erosion on logging roads.
5	Greenhouse gas emission and inefficient energy use	Conservation planning and implementation on farm types with the greatest potential to conserve energy, sequester atmospheric carbon, and reduce nitrous oxide emissions. Resource management systems include tree/shrub establishment, perennial herbaceous plantings and no-till to sequester carbon, nutrient management to reduce nitrous oxide emissions, and drip irrigation and variable frequency drives to improve energy efficiency.	We will focus our efforts on: a. Intensely irrigated and fertilized farms. Approximately 10,000 acres of nurseries and berries. b. Dryland wheat farms. Approximately 10,000 acres. c. Farms with marginal land that could be planted to native trees. Approximately 5,000 acres.	We have developed a greenhouse gas and energy conservation EQIP pool to address this problem. Key to this effort is a partnership with Oregon Environmental Council and Oregon Energy Trust.

Conservation Strategies

Priority	Problem	Partnerships	Marketing and outreach	Technology transfer tools	Status
1	Degraded riparian areas	A partnership that has been successful for over five years, but that is expanding to new members includes: • Tualatin SWCD • Clean Water Services (CWS) • Oregon Department of Fish & Wildlife (ODFW) • Local tree planting contractors	We have developed a targeted mailing list to owners and operators of land that contains high priority stream reaches. Our marketing effort for owners appeals to their common desire to protect their property values and improve wildlife habitat. For operators, we appeal to their desire to get help with practices that benefit their farming operations (e.g. drip irrigation). The ranking criteria for this EQIP pool are arranged so that a drip irrigation system ranks low unless the plan also includes tree planting along streams.	For over five years, the Tualatin SWCD has honed a "turn-key" approach to planting riparian forests in the CREP program. With this approach, farmers only need to enroll and work with staff to develop the basic aspects of their plan (dimensions of the border, specific tree species they like, etc.). Then SWCD staff and contractors implement the project with little additional effort from the landowner. We are working with contractors, the SWCD, CWS, and ODFW to help make tree planting along streams via EQIP as easy as it has been under CREP.	EQIP contracting for this strategy began in 2011 and has been very successful. We anticipate modifying the CIS for this concern and continuing to fund this effort after the original CIS expires.
2	Reduced biodiversity	Our partnership addressing this problem has included: • Oregon Department of Forestry • Oregon State University Extension • Metro Regional Government. • Tualatin SWCD • Tualatin Riverkeepers • Clean Water Services • US Fish & Wildlife Service (USFWS) • Tualatin River Watershed Council	Currently, we are focusing our efforts on the first three priority problems. Although reduced biodiversity is addressed incidentally in those projects, we are not currently marketing a specific effort for this problem. One of the reasons for this is that, under the 2002 Farm Bill, we could partner with Metro on WRP projects, but that ability was not approved in the 2008 Farm Bill.	Because we are not currently marketing projects that address this problem, we have not developed technology transfer tools. If the SWCD succeeds in becoming the county Weed Board, we will work with the SWCD to develop tools and processes to address this problem.	We are currently collaborating with Multnomah and Clackamas County NRCS/SWCD offices to develop a CIS to plant sites overgrown with invasive weeds back to productive forest species.
3	Water quantity	Our partnership includes: • Tualatin Valley Irrigation District • Tualatin Soil and Water Conservation District • Clean Water Services • Oregon Water Resources Department • Joint Water Commission • US Bureau of Reclamation • Energy Trust of Oregon • Local irrigation vendors	Marketing and outreach will be via the Tualatin Valley Irrigation District, local vendors and the Tualatin Soil and Water Conservation District. NRCS has already received several requests for irrigation efficiency improvement projects in the TVID area.	Due to staffing considerations, this CIS will utilize local private expertise from irrigation vendors to help develop draft designs and plans for NRCS approval. Our main practices to implement are drip irrigation, pipeline, pumping plant, and irrigation water management.	We anticipate submitting a CIS proposal for this project in 2014.

Conservation Strategies

Priority	Problem	Partnerships	Marketing and outreach	Technology transfer tools	Status
4	Threatened public drinking water supplies	We have a strong partnership, as outlined in our AWEP project plan, that includes: • Tualatin SWCD • Clean Water Services • Metro Regional Government • The Freshwater Trust • The Willamette Partnership	Because we initially identified only 24 high -priority farms in this focus area, our marketing approach has been simple and direct. We have used and plan to continue to use post cards, phone calls, and farm visits. As more contracts are written, we may organize field days so farmers can view each other's projects.	A unique aspect of this program is we are working with the partners to develop and implement tools to quantify ecological benefits for each farm project. Specifically, we are focusing on shade credits for streams and nutrient credits for farms. After farmers implement projects, they will be able to sell some of the credits that those projects generate to Clean Water Services (or other organizations). The long range goal is to develop an ecological services marketplace where farmers are	AWEP contracting for this strategy was completed in 2012. Contracts for this strategy will be fully implemented before 2017.
5	Greenhouse gas emission and inefficient energy use	A partnership still in the early stages includes: • Oregon Environmental Council and their "Climate Friendly Nurseries" program, which is itself a partnership with the Oregon Association of Nurseries (OEC, 2010) • Oregon Department of Agriculture's renewable energy program • Energy Trust of Oregon • Tualatin SWCD	Local farmers request energy conservation projects regularly from our office. Thus, our marketing effort involves more narrowing the applications down to the best projects rather than trying to generate many new applications. We are working with OEC to choose nurseries with the best potential greenhouse gas / energy conservation projects.	In order to choose the best projects for funding, and to measure our success, we are working with the partnership to develop a simple tool to estimate net greenhouse gas reductions from various practices. This tool may employ existing tools such as COMET VR and the NRCS Energy Estimator.	EQIP contracting for this strategy will be completed in 2014. Contracts for this strategy will be fully implemented before 2019.

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Definitions:

Anadromous Fish: Fish that hatch in fresh water streams of rivers, migrate to the oceans as juveniles where they grow to maturity, and then return to fresh water.

Groundwater: Water that is underground in an area of porous material. Most wells tap ground water.

Nonpoint Source Pollution: Pollution occurring from widely dispersed land areas and is carried in runoff water from a field, forest, or urban area into a stream of lake.

Point Source Pollution: Pollution originating from the discharge of pollutants from a single, readily identifiable source such as an industrial or sewage discharge pipe.

Riparian Area: Vegetated areas located at the banks of rivers, lakes, and wetlands. These are particularly important for water quality and wildlife habitat since they remove sediment and pollution as well as provide a home for wildlife.

Stakeholders: Any individual or group who has an interest in or will in some way be affected by things that occur in the watershed. Farmers, environment organizations, and businesses are examples of stakeholders.

Stewardship: Exercising responsible care over the resources entrusted to us. Requires managing water and other resources in the most responsible way we can.

Tributary: A stream that flows into a larger body of water. For example, Fanno Creek is a tributary of the Tualatin River.

Macro invertebrates: Aquatic organisms used as indicators of good ecosystem health. They lack a backbone and are large enough to be seen with the naked eye. Crayfish and the mayfly are examples of macro-invertebrates.

Watershed: The area of land that drains into a lake or a river. As rainwater and melting snow run downhill, they carry sediment and other materials into our streams, wetlands, and groundwater.

Wetlands: Areas covered with water at least part of the year. They have certain distinctive types of soils, plants and drainage. They provide habitat for fish and wildlife, help filter pollutions, and control floods.