Appendix R
Willamette Basin Report

1 Basin Description

The mainstem Willamette River begins where the Coast Fork and Middle Fork Willamette meet. It flows north to the Columbia River, adding stream flows of 12 subbasins that together comprise the Willamette Basin. The basin encompasses the Willamette Valley, the west slope of the Cascades Range, and the east slope of the Coast Range. There are about 187 river miles on the mainstem Willamette, 193 additional miles of side channels, and 21,317 miles of perennial tributaries, on which there are 13 major water storage reservoirs. These streams support the richest native fish fauna in the state as well as federally listed threatened or endangered species including spring Chinook salmon and summer steelhead trout.

The predominant land use surrounding Willamette streams and rivers is forest with about 60 percent of stream length. Roughly 30 percent of stream miles are in agricultural land use and about 10 percent are in urban areas. The upper reaches of the watershed are mostly federal lands in national forests or the checkerboard ownership of the Bureau of Land Management. While forestry use is active from the higher elevations to the foothills, agriculture represents the largest category of land use in the lowlands. About 66 percent of Oregon's population lives in the Willamette Basin.

Lower Wilamette Subbasin The Lower Willamette Subbasin (Hydrologic Unit Code 17090012) is in the northernmost portion of the Willamette Basin and is drained by the Willamette River, Multnomah Channel and tributaries. The subbasin's 408 square miles extend from the divides shared with the Sandy and Clackamas subbasins in the Cascade foothills on the east, across the Willamette River to the Tualatin divide on the west, north to the town of St. Helens and south to Willamette Falls at river mile 26.6. The southeastern portion of the subbasin drains directly to the Willamette River and contains the majority of the Portland metropolitan area, while the northwestern portion generally drains rural and agricultural lands through tributaries that discharge to the Multnomah Channel.

The Lower Willamette Subbasin includes the Columbia Slough, which is a 19-mile long complex of channels on the floodplain of the Columbia River between Fairview Lake on the east and the Willamette River at Kelley Point Park on the west. The Columbia Slough Watershed drains approximately 51 square miles of land. Fairview Creek, which drains to Fairview Lake, also lies within the geographic boundary of the Columbia Slough Watershed.

Most of the subbasin is privately owned, with scattered parcels in the northwest portion owned by the U.S. Forest Service and state wildlife refuge lands in the lowlands surrounding Sturgeon Lake. Land use is primarily urban, forestry and agriculture. Waterbodies within the Lower Willamette foster salmon and trout rearing, and several reaches of the Lower Willamette watershed, such as Scappoose and Milton Creek watersheds in the northwestern part of the Lower Willamette and Johnson and Crystal Springs creeks in the southeastern part of the watershed have active salmon and steelhead spawning.

Clackamas Subbasin The Clackamas River and tributaries drain the Clackamas Subbasin (Hydrologic Unit Code 17090011), in the Willamette Basin. The subbasin's 940 square miles extend from the Mt. Hood National Forest northwest to the Willamette River and include portions of Clackamas and Marion Counties, a small portion of the Confederated Tribes of the Warm Springs Reservation, and the cities of Oregon City, Gladstone, Sandy and Estacada. The subbasin also contains the smaller communities of Damascus and Boring. The Clackamas River provides drinking water for approximately 175,000 people in Clackamas County, the metropolitan area and Estacada. The U.S. Forest Service manages most of the 72 percent of the subbasin that is publicly owned; the Bureau of Land Management manages about 2 percent of land in the subbasin, usually in portions smaller than one square mile.

Approximately 25 percent of land in the Clackamas Subbasin, mostly in the lower watershed, is privately owned. Timber companies own private land within and outside of the Mt. Hood National Forest boundaries, and Pacific Gas and Electric owns land associated with its hydropower facilities. Individual, commercial and industrial land owners operate in the lower watershed.
Forestry is the dominant land use by area, although much of the land in the upper watershed is protected to varying degrees from timber harvest. The Clackamas Subbasin contains two wilderness areas; the Bull of the Woods Wilderness Area protects 34,900 acres in the Collawash and Hot Springs Fork of the Collawash drainages, and the Salmon Huckleberry Wilderness Area protects 44,600 acres, including a portion of the Eagle Creek drainage. Approximately 50 miles of the Clackamas River, and 14 miles of the Roaring River, are designated Federal Wild and Scenic Rivers. The Clackamas River designation extends from Big Spring, in the Olallie Lake Scenic Area, to Big Cliff, just upstream of North Fork Reservoir. Commercial and industrial land use is concentrated near the mouth of the Clackamas River, as well as in and around smaller urban areas and along major transportation corridors. Agricultural production consumes much of the lower third of the watershed.

Tualatin The Tualatin River drains an area of 712 square miles of the Tualatin Subbasin. The headwaters are in the Coast Range and flow in a generally easterly direction to the confluence with the Willamette River. The subbasin lies almost entirely within Washington County. There are also small portions of the sub-basin in Multnomah, Clackamas, and Yamhill, Tillamook and Columbia counties. The Tualatin River is approximately 83 miles in length and has a very flat gradient for most of its length. There is a reservoir-like section between river mile 24 and 3.4. Major tributaries to the Tualatin River include: Scoggins, Gales, Dairy (including East Fork, West Fork, and McKay Creeks), Rock (including Beaverton Creek), and Fanno Creeks. Summer flow is supplemented with releases of water from Hagg Lake (Scoggins Reservoir) on Scoggins Creek and from Barney Reservoir, located on the Trask River, which diverts water into the upper Tualatin River.

The subbasin supports a wide range of forest, agriculture and urban related activities The urban area, which makes up approximately 26% of the basin, is rapidly growing and includes the cities of Banks, Beaverton, Cornelius, Durham, Forest Grove, Gaston, Hillsboro, King City, Lake Oswego, North Plains, Sherwood, Tigard, Tualatin, West Linn and portions of Portland. Agricultural land use makes up approximately 35% of the basin with forestry land use making up the remaining 39%. Approximately 92% of the basin is in private ownership with state and federal lands making up the remaining eight percent.

Molalla-Pudding Subbasin The Molalla-Pudding subbasin is in the northeastern portion of the middle Willamette Basin. The Molalla River flows into the Willamette River between river miles 35 and 36. The Molalla River drains approximately 878 square miles of which the Pudding River drains approximately 530 square miles. The Pudding River flows into the Molalla River at approximately 0.7 miles upstream of the Molalla River's confluence with the Willamette River. The topography, surficial geology, stream channel characteristics, and land use are distinct between the Molalla River and Pudding River portions of the subbasin. The Molalla-Pudding subbasin is within Clackamas and Marion Counties, and includes the cities of Woodburn, Mt. Angel, Silverton, Canby, Molalla, Hubbard, Gervais, Aurora, Brooks, Barlow, Colton, Scotts Mills and portions of Salem, Keizer, Donald and Wilsonville. Most land in the Molalla-Pudding Subbasin is privately owned. The Bureau of Land Management administers the largest portion of public land in the subbasin, including Oregon and California railroad lands. The U.S. Forest Service manages comparatively little land in the far eastern and southeastern portions of the subbasin. The largest portion of state-managed land is Silver Falls State Park, in the south central portion of the subbasin.

Agriculture and forestry land uses predominate in the subbasin. Agriculture is most common in the lower elevation and western portions of the subbasin. Forestry land use occurs mainly in the eastern portion of the subbasin. Urban land use is concentrated around the cities of Woodburn, Silverton, Mt. Angel, Canby

and Molalla. Urban land use associated with the larger cities of Salem and Keizer occurs in the southwestern corner of the subbasin. In general, agricultural watersheds with the highest crop diversity are those in the northern part of the basin. In the northern part of the basin row crops, berries, orchards, nurseries, and vineyards are common, whereas in the southern part of the basin grass seed and other seed crops predominate.

Yamhill Subbasin The Yamhill Subbasin (Hydrologic Unit Code 17090008)is located in the Western portion of the Willamette Basin and drains portions of the Coast Range. The Yamhill River flows into the Willamette River just upstream of the City of Newberg. The Subbasin's 772 square miles (493,762 acres) include the following eight watersheds:

- Willamina Creek Watershed
- Agency Creek-South Yamhill River Watershed
- Mill Creek Watershed
- Deep Creek-South Yamhill River Watershed
- Salt Creek Watershed
- North Yamhill River Watershed
- Yamhill River Watershed

The subbasin is within portions of Yamhill and Polk counties, and includes the Cities of Amity, Carlton, Dayton, Lafayette, McMinnville, Sheridan, Willamina, and Yamhill. The subbasin is primarily owned by private landowners, however federal and state ownership accounts for 14% of the total land use in the subbasin. There are scattered landholdings by the U.S. Forest Service and Bureau of Land Management. The subbasin consists of forestry, agriculture and urban land uses.

Middle Willamette Subbasin The Middle Willamette Subbasin, Hydrologic Unit Code (HUC) 17090007, includes the Willamette River from Willamette Falls at river mile 26.6 to river mile 108, near the Santiam River. It is located in the northwest portion of the Willamette Basin and drains parts of the Cascade foothills from the east and the Coast Range from the west. The Willamette River longitudinally divides the subbasin with several medium to large tributaries and many smaller tributaries throughout its length. The 698 square miles (446,718 acres) of the subbasin have been divided among the following four watersheds:

- Rickreall Creek Watershed
- Mill Creek Watershed
- Chehalem Creek-Willamette River tributaries Watershed
- Abernethy Creek-Willamette River tributaries Watershed

The political jurisdictions within the subbasin include portions of Marion, Polk, Yamhill, Clackamas, and Washington Counties. There are fifteen incorporated cities: Stayton, Turner, Oregon City, Wilsonville, Newberg, Canby, Dundee, Donald, Saint Paul, Keizer, Salem, Dallas, Independence, Monmouth, Aumsville, Sublimity, and a portion of West Linn. The subbasin is almost entirely in private land ownership. Land uses are primarily agriculture, forestry, and urban. However there are small, scattered areas of public land managed by the Bureau of Land Management and the State of Oregon.

South Santiam Subbasin The South Santiam Subbasin (Hydrologic Unit Code 17090006) is located in the eastern portion of the Willamette Basin and drains the Cascade foothills. The South Santiam River flows into the Santiam River just upstream of the City of Jefferson. The Subbasin's 1,041 square miles (666,237 acres) include the following eight watersheds:

- Headwaters Middle Santiam River Watershed
- South Santiam River Watershed, downstream of Canyon Creek
- Quartzville Creek Watershed
- South Santiam River-Foster Reservoir Watershed
- Wiley Creek Watershed
- Crabtree Creek Watershed
- Thomas Creek Watershed
- Hamilton Creek-South Santiam River Watershed

The subbasin includes portions of Linn County, and the Cities of Scio, Sweet Home, Waterloo, and portions of Lebanon and Sodaville. The subbasin is primarily owned by private landowners, however federal and state ownership accounts for 30 to 40% of the total land use in the subbasin. There are scattered landholdings by the U.S. Forest Service and Bureau of Land Management. The subbasin consists of forestry, agriculture and urban land uses.

North Santiam Subbasin The North Santiam Subbasin (Hydrologic Unit Code 17090005) is located in the eastern portion of the Willamette Basin and drains the Cascade Range. The North Santiam River flows into the Santiam River just upstream of the city of Jefferson. The Santiam River drains into the Willamette River at river mile 109. The Subbasin's 764 square miles (488,958 acres) includes the following six watersheds:

- Breitenbush River Watershed
- Headwaters North Santiam River Watershed
- Upper North Santiam River Watershed
- Middle North Santiam River Watershed
- Little North Santiam River Watershed
- Lower North Santiam River Watershed

The subbasin's political jurisdiction is within Linn and Marion County, and includes the Cities of Jefferson, Marion, Stayton, Sublimity, Lyons, Mehama, Mill City, Gates, Detroit, and Idanaha. A small portion of the upper subbasin is located within the Confederated Tribes of Warm Springs Reservation. Land ownership in the subbasin is almost equally shared by both private and public landowners. The United States Forest Service dominates public ownership, but there are also scattered parcels of lands managed by the Bureau of Land Management and the U.S. Army Corps of Engineers throughout the subbasin. The subbasin is primarily forest land, with agricultural land use mainly occurring downstream of the Little North Santiam River Watershed.

Upper Willamette Subbasin The Upper Willamette Subbasin (Hydrologic Unit Code 17090003) is located in the southwest portion of the Willamette Basin with tributaries that flow to the Willamette River. The subbasin's 1,861 square miles (1,190,770 acres) extend from the foothills of the Cascade Mountains on the east to the Coast Range foothills on the west. The subbasin includes the following six watersheds:

- Long Tom River Watershed
- Marys River Watershed
- Upper Calapooia River Watershed
- Lower Calapooia River Watershed
- Luckiamute River Watershed

- Muddy Creek-Willamette River Watershed

The subbasin includes portions of Lane, Linn, Benton, and Polk Counties. The following cities are within the Upper Willamette Subbasin: Adair Village, Albany, Brownsville, Coburg, Corvallis, Eugene, Falls City, Halsey, Harrisburg, Junction City, Lebanon, Millersburg, Monroe, Philomath, Sodaville, Springfield, Tangent, and Veneta. The subbasin is owned almost entirely by private land owners. However, the U.S. Bureau of Land Management, United States Forest Service and the State of Oregon own a small portion of the subbasin, Map 10.2. The land use is primarily agriculture in the low-land valley, scattered urban developments in the valley, and forestry in the upper subbasin.

McKenzie Subbasin The McKenzie Subbasin (Hydrologic Unit Code 17090004) is located in the southeast portion of the Willamette Basin with tributaries that flow to the Willamette River at river mile 171.8. The subbasin's 1,338 square miles (856,466 acres) extend from the Cascade Mountains on the east to the Willamette River. The subbasin includes the following seven watersheds:

- Horse Creek Watershed
- Headwaters McKenzie River Watershed
- South Fork McKenzie River Watershed
- Blue River Watershed
- Quartz Creek-McKenzie River Watershed
- Mohawk River Watershed
- Lower McKenzie River Watershed

The subbasin boundaries includes portions of Lane and Linn counties. The city of Springfield is the largest city in the subbasin, however there are many smaller communities within the McKenzie Subbasin: Thurston, Walterville, Deerhorn, Nimrod, Leaburg, Rainbow, Marcola, Leaburg, Vida, and McKenzie Bridge. The subbasin is owned by numerous private land owners, however the Bureau of Land Management owns a small portion of the land downstream of Cougar and Blue River reservoirs, and the United States Forest Service primarily owns the land upstream of Cougar Reservoir and Blue River Reservoir. The land use is primarily forestry. The lower watershed valley floodplain is owned by private landowners, and agricultural, commercial and residential development is dominant.

Coast Fork Willamette Subbasin The Coast Fork Willamette Subbasin (Hydrologic Unit Code 17090002) is located in the southern most portion of the Willamette Basin. The Coast Fork Willamette River flows into the Willamette River at the confluence of the Middle Fork Willamette River. The subbasin's 666 square miles (426,238 acres) include the following four watersheds:

- Mosby Creek Watershed
- Row River Watershed
- Upper Coast Fork Willamette River Watershed
- Lower Coast Fork Willamette River Watershed

The subbasin is located within portions of Lane and Douglas Counties, and includes the cities of Cottage Grove and Creswell. The U.S. Forest Service and Bureau of Land Management administer much of the upland area, but most of the land in the subbasin is privately owned. The land use is primarily forestry, with agriculture and urban land uses near the mainstem Coast Fork Willamette River. The Coast Fork Willamette River and the Row River are a source of drinking water for the City of Cottage Grove.

Middle Fork Willamette Subbasin The Middle Fork Willamette Subbasin (Hydrologic Unit Code 17090001) is located in the south eastern portion of the Willamette Basin and drains the Cascade Range. The Middle Fork Willamette River flows into the Willamette River at its mouth at river mile 186. The Subbasin's 1,355 square miles (867,110 acres) include the following 10 watersheds:

- Headwaters Middle Fork Willamette River Watershed
- Hills Creek Watershed
- Salt Creek Watershed
- Salmon Creek Watershed
- Hills Creek Reservoir Watershed
- North Fork of Middle Fork Willamette Watershed
- Lookout Point Reservoir Watershed
- Little Fall Creek Watershed
- Fall Creek Watershed
- Pudding Creek Watershed

The subbasin is located within Lane and Douglas Counties, and includes the cities of Lowell, Hemlock, Oakridge, and a portion of Springfield. The subbasin is dominated by forested land use with some agriculture and residential land use near the mouth of the subbasin. Ownership is about 85% Federal, most of that managed by the Willamette National Forest (USFS) and the Bureau of Land Management Eugene District. Small, private landholders and industrial timber companies operate throughout the remainder of the subbasin.

The Middle Fork Willamette Subbasin has four man-made reservoirs, Fall Creek Reservoir, Dexter Reservoir, Lookout Point Lake, and Hills Creek Lake. Waldo Lake, located in the North Fork of the Middle Fork Willamette watershed, is the only large natural lake in the subbasin. The subbasin provides habitat for bull trout, spring Chinook, summer steelhead and winter steelhead. There are two real-time USGS flow monitoring stations in the subbasin, Middle Fork Willamette River near Dexter and Middle Fork Willamette River at Jasper.

Table R-1: 2011 Land use and land cover for each subbasin in the Willamette.

Subbasin	Watershed Area (km2)	% Urban/Roads	% Forest	% Cultivated	% Range/Forest Disturbance	%Other
Clackamas	2441682	3.6	75.2	6.7	13.7	0.7
Coast Fork Willamette	1726141	3.4	64.6	7.9	23.2	0.9
Lower Willamette	1060847	45.3	27.7	10.8	9.4	6.9
McKenzie	3468167	1.3	75.5	2.1	17.1	3.9
Middle Fork Willamette	3540459	1.0	78.6	2.0	15.4	3.0
Middle Willamette	1841474	19.9	17.3	53.3	6.7	2.9
Molalla-Pudding	2267505	6.6	39.2	37.2	16.5	0.6

Subbasin	Watershed Area (km2)	% Urban/Roads	% Forest	% Cultivated	% Range/Forest Disturbance	%Other
North Santiam	1979340	2.2	70.3	9.2	15.8	2.5
South Santiam	2696156	1.9	59.1	14.0	23.9	1.2
Tualatin	1835950	22.1	32.9	26.6	17.2	1.1
Upper Willamette	4850165	11.1	31.1	39.3	16.3	2.2
Yamhill	1998608	6.6	38.8	34.3	19.4	1.0

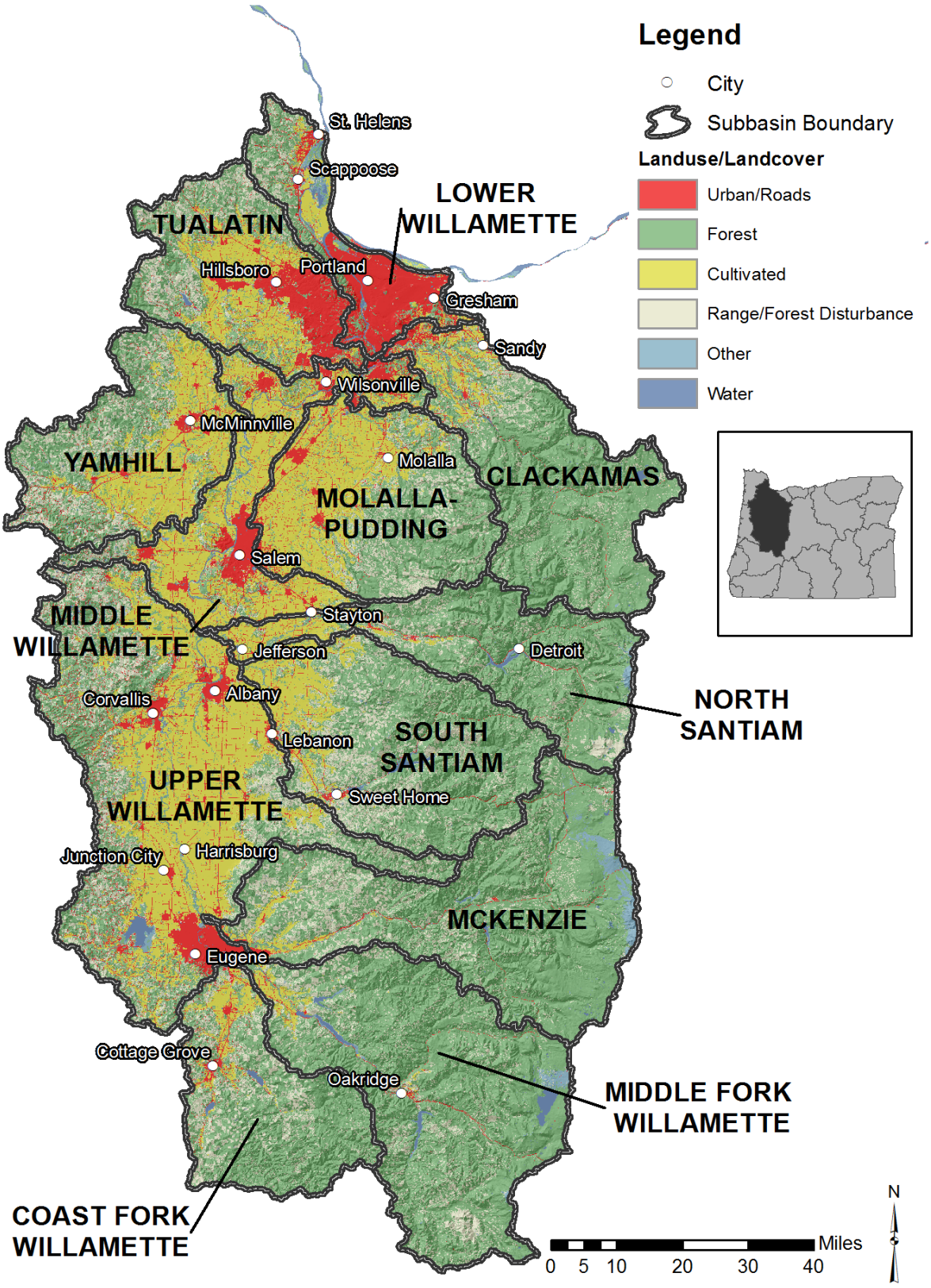

Figure R-1: Landuse in the the Willamette administrative basin.

1.1 Basin Contacts

Table R-2: Oregon DEQ basin contact.

Administrative Area	DEQ Basin Coordinator
Lower Willamette Subbasin	Andrea Matzke: 503-229-5350: matzke.andrea@deq.state.or.us
Clackamas and Molalla Subbasins	Kristi Asplund: 503-229-6254: asplund.kristi@deq.state.or.us
Middle Willamette Mainstem River, North Santiam, Pudding, and Yamhill Subbasins	Nancy Gramlich: 503-378-5073: gramlich.nancy@deq.state.or.us
McKenzie, Coast Fork Willamette, Middle Fork Willamette, and South Santiam Subbasins	Priscilla Woolverton: 541-687-7347: woolverton.priscilla@deq.state.or.us
Tualatin Subbasin	Wade Peerman: 503-229-5046: peerman.wade@deq.state.or.us

2 Water Quality Impairments and TMDLs

2.1 Water Quality Impaired Stream Segments

Under section 303(d) of the Clean Water Act, states, territories and authorized tribes must submit lists of impaired waters. Impaired waters are those that do not attain water quality standards or support all designated uses. The law requires that states establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDLs) for these waters. Table R-3 identifies the number of Willamette Basin waterbody segments impaired by parameter from the 2012 Integrated Report and and the number of segments with approved TMDLs. Sources: ODEQ, USEPA

Table R-3: Number of impaired stream segments with and without a TMDL as identified in Oregon's 2012 Integrated Report and Assessment database

Parameter	Segments without a TMDL	Segments with a TMDL
Aldrin	3	0
Ammonia	3	5
Aquatic Weeds Or Algae	27	5
Arsenic	9	0
Biological Criteria	92	3
Chlordane	1	1
Chlorophyll a	4	11
Chlorpyrifos	6	1
Chromium	1	1
Copper	12	0
Cyanide	1	0

Parameter	Segments without a TMDL	Segments with a TMDL
DDE 4,4	5	2
DDT 4,4	4	4
Dichloroethylenes	2	0
Dieldrin	9	3
Dioxin (2,3,7,8-TCDD)	0	8
Dissolved Oxygen	127	39
E. Coli	12	98
Endosulfan	2	0
Endrin aldehyde	1	0
Enterococcus	0	2
Fecal Coliform	10	30
Guthion	3	0
Heptachlor	1	0
Hexachlorobenzene	1	0
Iron	28	2
Lead	24	1
Malathion	0	1
Mercury	17	0
Nitrates	0	2
Pentachlorophenol	0	1
pH	12	10
Phosphorus	0	44
Polychlorinated Biphenyls (PCBs)	4	1
Polynuclear Aromatic Hydrocarbons	2	0
Sedimentation	3	0
Temperature	29	209
Tetrachloroethylene	3	0
Thallium	1	0
Trichloroethylene	1	0
Turbidity	2	2
Zinc	3	0

2.2 Total Maximum Daily Load Watershed Plans

The federal Clean Water Act requires that water pollutant reduction plans, called Total Maximum Daily Loads (TMDLs), be developed for water bodies that are listed in Category 5 of the Integrated Report (303(d) List). TMDLs describe the maximum amount of pollutants that can enter the river or stream and still meet water quality standards.

TMDLs take into account the pollution from major sources including discharges from industry and sewage treatment facilities, runoff from farms, forests and urban areas, and natural sources. TMDLs include a margin of safety to account for uncertainty, and may include a reserve capacity that allows for future discharges to a river or stream. DEQ typically develops TMDLs on a watershed, subbasin, or basin level and occasionally at the reach level depending on the type and extent of impairments.

The Water Quality Management Plan (WQMP) is the framework for TMDL implementation that is issued by Oregon along with the TMDL (Oregon Administrative Rules 340-042-0040(l)). The TMDL and WQMP serve as a multi-sector plan and provides the blueprint for TMDL related implementation activities. Table R-4 lists the TMDLs that have been approved in the Willamette Basin.

Table R-4: Approved TMDLs in the Willamette Basin and the impairments addressed by those TMDLs.

TMDL Document Name	Impairments Addressed
Coast Fork TMDL	Dissolved Oxygen, Nutrients, Periphyton, pH, Temperature
Columbia Slough TMDL	Algae, Bacteria (water contact recreation), DDT/DDE, dieldrin, dioxin, Dissolved Oxygen, Lead, PCBs, pH
Molalla-Pudding Subbasin TMDL and WQMP	Bacteria (water contact recreation), chlordane, DDT, dieldrin, Iron, Nitrate, Temperature
Pudding River TMDL	Dissolved Oxygen
Rickreall Creek TMDL	Dissolved Oxygen
Tualatin Subbasin TMDL and WQMP	Algae, Bacteria (water contact recreation), Chlorophyll a, Dissolved Oxygen, pH, Temperature
Willamette Basin TMDL and WQMP	Bacteria (water contact recreation), DDT, dieldrin, Dissolved Oxygen, Mercury, Temperature, Turbidity
Yamhill River TMDL	Algae, pH

3 Implementation Highlights

3.1 Section 319 Grants

Federal Section 319(h) funds are provided annually through the EPA to states for the development and implementation of each state's Nonpoint Source Management Program. In Oregon a portion of 319 grant funding is "passed through" to support community or partner projects that address Oregon's nonpoint source program priorities. Generally, DEQ requires grantees to report annually on the progress made implementing their grant project. This section highlights those outputs and accomplishments reported to DEQ in 2017. Note this section does not identify or include projects proposed and awarded a grant in 2017. Outputs and accomplishments for those projects will be reported to DEQ in future years once they have been implemented. For a listing of projects proposed and awarded a grant in 2017 see Section 3.6.2 of the main report.

In 2017, there were seven 319 projects active that reported project outputs and accomplishments to DEQ. Combined the projects have a total grant budget of $152,630. Table R-5 describes the projects and the reported outputs.

Table R-5: Project outputs reported in 2017 for Section 319 pass through grants.

Project Name	Grantee	Project Description	Reported Outputs
Milton Creek Riparian Enhancement	Scappoose Bay Watershed Council	Clear non-native vegetation along approximately 1600 linear feet of creek and replant area w/ native vegetation	Completed restoration project
Columbia Co.Watershed Scale WQ Monitoring Project	Columbia Co. SWCD	Establish a sustainable monitoring program for streams in Columbia Co. (Clatskanie River, Beaver Creek, and Scappoose River watersheds)	Established monitoring sites and conducted monitoring
Scappoose Bay Watershed Action Plan	Scappoose Bay Watershed Council	Develop a sub-basin strategy by focusing multiple party efforts to increase the impact of watershed restoration activities.	Drafted first half of action plan and provided to restoration team for input
Lower Milk Creek Stream and Riparian Restoration Project	Clackamas Soil and Water Conservation District	Riparian restoration	permitting, construction, planting
Expanding the Benefit: Riparian Revegetation Luckiamute Basin	Luckiamute Watershed Council	Increase canopy cover in Luckimaute watershed riparian areas	Knoxious weed removal, plant and monitor riparian plantings
Prioritizing Areas for Action Plan Implementation	Lane Council of Governments	This project assisted the Southern Willamette Valley Groundwater Management Area (GWMA) in reaching out to residents and agricultural operators and motivating them to act. It helped the committee and staff better understand the problem areas in the GWMA and find appropriate ways to communicate key messages, and prompt changes in behavior to reduce nitrate contributions.	Updated maps, which show nitate data levels and trends gepgraphically; targeted outreach materials; facte sheets; GWMA community mailing lists
Storm and Drinking Water Improvements for Cities Big and Small in the Upper Willamette Watershed	Long Tom Watershed Council	The goals of this project are to: 1) conduct outreach to the business community in order to identify business owners interested in voluntary stormwater treatment improvements; and 2) develop site specific feasibility study recommendations that business owners can implement for installing and maintaining stormwater treatment facilities.	GIS maps, which show geographical relationship between water quality, drinking water resource areas, stormwater basins, and commercial activities.

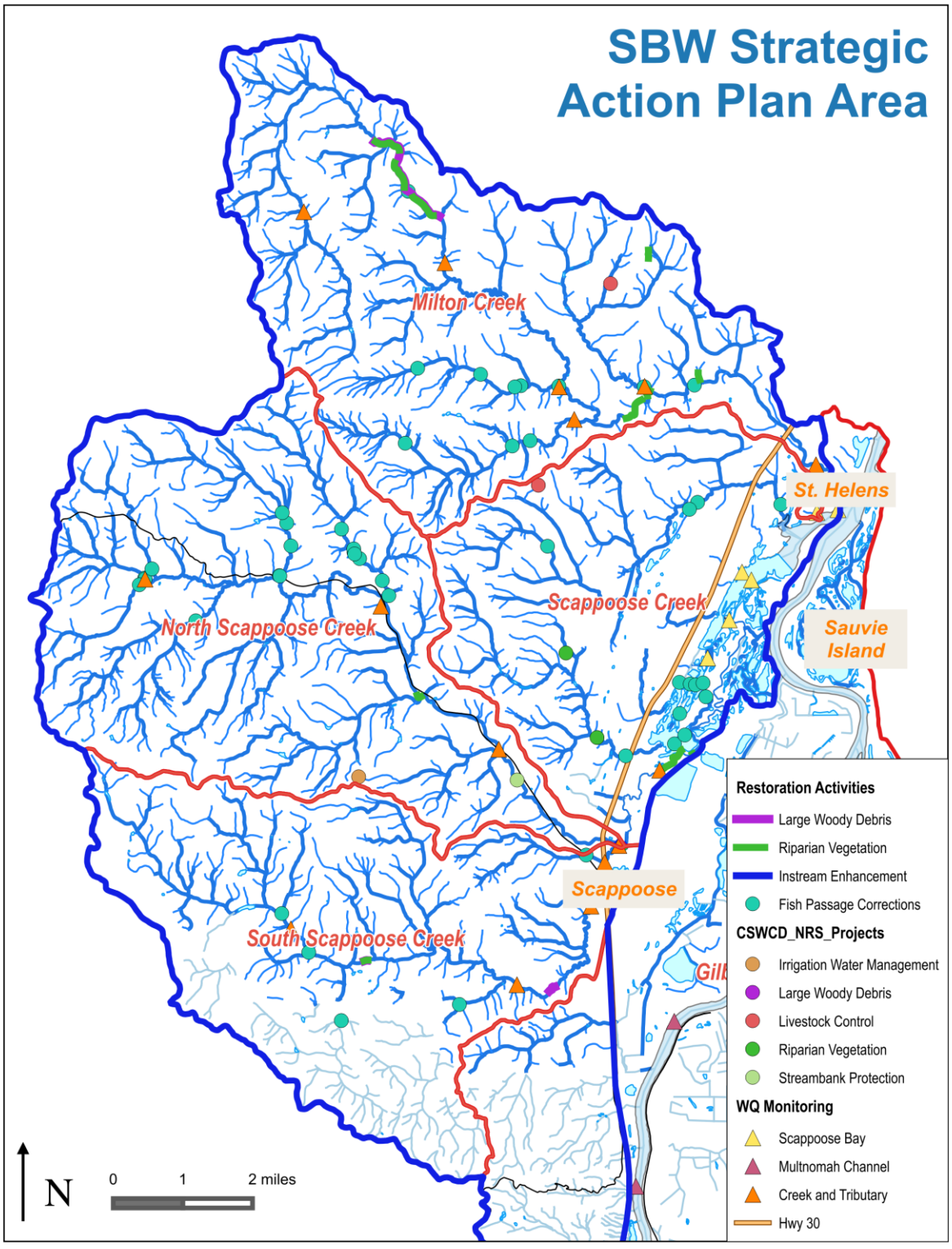

Figure R-2: Draft Action Plan for Scappoose Watershed

3.2 Clean Water State Revolving Fund (CWSRF)

The Clean Water State Revolving Fund loan program provides below market rate loans to public agencies for the planning, design and construction of various projects that prevent or mitigate water pollution. Eligible agencies include federally recognized Indian tribal governments, cities, counties, sanitary districts, soil and water conservation districts, irrigation districts, various special districts and intergovernmental entities. DEQ partners with Oregon communities to implement projects that attain and maintain water quality standards, and are necessary to protect beneficial uses. This section highlights the ongoing projects and the outputs and accomplishments reported to DEQ in 2017.

In 2017 there was one nonpoint source related Clean Water State Revolving Fund project active that reported project outputs and accomplishments to DEQ. Combined the projects have a total budget of $250,000. Table R-6 describes the project and the reported outputs.

Table R-6: Nonpoint source related Clean Water State Revolving Fund project outputs reported in 2017.

Project Name	Grantee	Project Description	Reported Outputs
Septic System Loan Program	Clackamas Soil and Water Conservation District	The Clackamas Soil and Water Conservation District received a local community loan to develop a pilot program to repair/replace failing onsite systems within its service area. The project will initially focus on previously identified hotspots; however, all private landowners will be eligible to participate in the program. The applicant will work with Clackamas County Water Environment Services to verify failing systems and recommend remediation options.	In 2017, CSWCD generated a list of qualified septic system installers that could be used by homeowners utilizing the program.

3.3 Source Water Protection Grants

The Oregon Health Authority regulates drinking water under state law and the Safe Drinking Water Act and works cooperatively with DEQ on source water protection efforts. Using the Drinking Water Revolving Loan Fund, OHA funds Source Water Protection Grants (up to $30,000 per public water system) for source water protection activities, monitoring, and planning in Drinking Water Source Areas. In addition, loans are available for improving drinking water treatment, source water protection activities, or land acquisition in source areas. Oregon's Infrastructure Finance Authority is responsible for administering these projects. The loan fund set-asides also fund five Drinking Water Protection positions at DEQ that provide technical assistance to public water systems and communities while they develop and implement strategies that reduce the risk within the delineated source water areas. This section highlights the ongoing projects and the outputs and accomplishments reported to DEQ in 2017.

In 2017 there were eight nonpoint source related Safe Drinking Water State Revolving Fund projects active that reported project outputs and accomplishments to DEQ. Combined the projects have a total budget of $177,889. Table R-7 describes the projects and the reported outputs.

Table R-7: Nonpoint source Safe Drinking Water State Revolving Fund projects and outputs for 2017.

Project Name	Grantee	Project Description	Reported Outputs
South Santiam Source Water Protection Through Riparian Restoration	City of Lebanon	Riparian zone invasive removal, repair/revegetation.	Completed riparian zone invasive removal, repair/revegetation focusing on continued restoration on McDowell and Hamilton Creeks just above their confluence with the South Santiam River.
Rivergrove Water - Septic and Private Well Abandonment Assistance	Rivergrove Water District	Septic system / private well education & risk reduction program. Develop Source Protection & Contingency Plan.	This is an ongoing program started in 2014. In 2017, the partners continued public outreach for private well and septic system owners within groundwater source area and maintained a cost share/rebate program for septic system repairs and inspections.
Implementation project - Decommission dry wells near city wellheads and redirect stormwater to a lower risk location	Columbia City (GW)	Implementation project - Decommission dry wells near city wellheads and redirect stormwater to a lower risk location.	City completed UIC closure plan, survey work, storm water improvements site plan, and the contract to bid documents. Project work is going out to bid for a second time (no bids on first attempt).
Secondary Containment and Spill Prevention in the Clackamas Industrial Area	North Clackamas Water Commission on behalf of Clackamas River Water Providers	Implementation project: Public education program focused on spill prevention, stormwater risk reduction and response within commercial/industrial area just upstream of CRWP intakes	Clackamas River Water Providers in conjunction with local partners developed and distributed outreach materials, established cost share/rebate program to incentivize BMPs for businesses, marked storm drains, provided on-site assistance and training to businesses regarding hazardous materials storage and stormwater risks. There was extensive coordination with County stormwater and Sustainability agencies and Clackamas Fire Marshall.
Septic System Education and Awareness	Mobilife Water Company	Addressed septic system impacts to groundwater and nearby streams in the Coast Fork Willamette River watershed	Pumped out on-site system and services drainfields that occur within 80 ft of their wells as a demonstration project for surrounding property owners. Provided education and outreach regarding ongoing maintenance and operation to broader community.

Project Name	Grantee	Project Description	Reported Outputs
Prioritize areas for septic system risk reduction efforts, outreach, repair and education	Canby Utility Board	Adressed septic system impacts to groundwater and nearby streams in the Molalla River watershed.	Prioritized areas for outreach and prepared mailing lists.
Develop social marketing approach to encourage local protection efforts	City of Coburg	Identifying and overcoming barriers to nitrate reducing practices in the Southern Willamette Valley GWMA.	The city contracted with Lane Council of Governments to complete the project. Lane Council of Governments identified neighborhood focus areas for outreach; compiled soil sensitivity data; engaged student researchers to develop, distribute, and analyze survey of attitudes/behaviors/perceptions/actions of rural Coburg residents in relation to drinking water; presented results to Southern Willamette Valley Groundwater Management Area Steering Committee; configured a social marketing approach for groundwater protection and prepared a draft marketing strategy.
Drinking water source area public education display	Joint Water Commission	Develop a drinking water source area public education display for the Tualatin River watershed.	Completed display, initiated outreach with display as a tool.

Figure R-3: McDowell Creek Restoration Site Before (left) and After (right)

3.4 Drinking Water Provider Partnership Grants

Oregon DEQ participates in the Drinking Water Providers Partnership (DWPP) with USDA Forest Service Region 6, EPA Region 10, the U.S. Bureau of Land Management OR/WA Office, the Washington Department of Health, Geos Institute and WildEarth Guardians. Together, these partners coordinate a competitive grant solicitation and award program for environmental conservation and restoration projects in municipal watersheds across the Northwest. The Drinking Water Providers Partnership made the first of the annual awards in 2016 and most projects have a focus on nonpoint sources of pollution. The goal of the Partnership and the funding is to develop and support local partnerships to restore and protect the health of watersheds which communities depend upon for drinking water while also benefiting aquatic and riparian ecosystems, including the native fish that inhabit them. This section highlights the ongoing projects and the outputs and accomplishments reported to the DWPP in 2017.

In 2017 there were six Drinking Water Providers Partnership projects active that reported project outputs and accomplishments to te DWPP. Combined the projects have a total budget of $232,100. Table R-8 describes the projects and the reported outputs.

Table R-8: Drinking Water Providers Partnership projects and outputs for 2017

Project Name	Grantee	Project Description	Reported Outputs
Lower South Fork McKenzie River Floodplain Enhancement Project	McKenzie River Ranger District	This multi-year, large-scale project will protect and improve water quality for the City of Eugene by removing levees and adding large wood to the river and its floodplain.	Partners completed wood source planning and revegetation plan development in 2016 through 2017.
South Fork Aerial LWD Enhancement	Polk Soil and Water Conservation District	The drinking water of the City of Dallas and salmonid habitat will be protected through the implementation of this project. Large wood will be added to the river and its floodplain to dissipate stream energy, catch gravels for salmon spawning, and provide fish habitat.	Project partnership between Hancock, BLM, City of Dallas, and Polk SWCD to place large wood in South Fork and mainstem of Rickreall Creek. Constructed large wood structures including placement of 522 logs for 34 new instream structures.
Lower South Fork McKenzie River Floodplain Enhancement Project	USFS Willamette National Forest, McKenzie River Ranger District	The Willamette National Forest, with the Eugene Water & Electric Board and several other groups, is coordinating planning and preparing for the Lower South Fork McKenzie River Floodplain project, a large scale, multi-year endeavor. In 2017, the project partners will finalize engineering designs and collect and grow out a native plant collection to be used for replanting the restoration site after earthwork is completed in the coming years.	In 2017 the project partners started project planning and obtaining required permits and approvals.
Milk Creek Stream and Riparian Restoration Project	Clackamas Soil and Water Conservation District	The Clackamas Soil and Water Conservation District will stabilize and restore 275 feet of eroding stream bank along Milk Creek, including replanting the area with native trees and shrubs, so as to improve infiltration, reduce erosion, and provider cooler and cleaner water for Canby Utility.	Project partners completed initial project planning.

Project Name	Grantee	Project Description	Reported Outputs
North Fork Clackamas River Restoration Project - Phase II	Clackamas River Basin Council	The Clackamas River Basin Council and Bureau of Land Management are working with the Clackamas River Water Providers — a coalition of seven drinking water providers — to improve habitat in the North Fork Clackamas River. This project will restore historic side channels, place large wood in the stream channel, control nonnative vegetation, and plant native trees and shrubs.	Project partners completed initial project planning.
North Santiam Basin Resiliency Action Plan	Cascade Pacific Resource Conservation & Development	The North Santiam Watershed Council and Cascade Pacific Resource Conservation and Development, on behalf of the Partners for the North Santiam, are leading the development of a climate informed Resiliency Action Plan. Having a coordinated and integrated strategic implementation plan for improving ecological, economic, and community health in the North Santiam will help every town and group to be more effective and benefit drinking water supplies for the cites of Salem, Albany, Idanha, Detroit, Breitenbush, Gates, Lyons, Mehama, Stayton, and Jefferson	Project partners completed initial project planning.

Figure R-4: Instream structures in the drinking water source area for the City of Dallas (upper Rickreall Creek watershed)

3.5 OWEB Grant Funded Projects

The Oregon Watershed Enhancement Board (OWEB) is a state agency that provides grants to help Oregonians take care of local streams, rivers, wetlands, and natural areas. These grant projects often address nonpoint sources of pollution and are thus included in this report.

Based on the most recent data available in OWEB's Oregon Watershed Restoration Inventory (OWRI) database, there were 53 OWEB funded projects completed in 2016 with a total cash and inkind budget of $5,787,820. The bar graph in Figure R-5 shows the total cash and inkind budget for the different project types in each Willamette subbasin. Table R-9 describes the projects and the reported outputs.

Learn more about OWEB grant programs at https://www.oregon.gov/OWEB/grants/Pages/grant-programs.aspx.

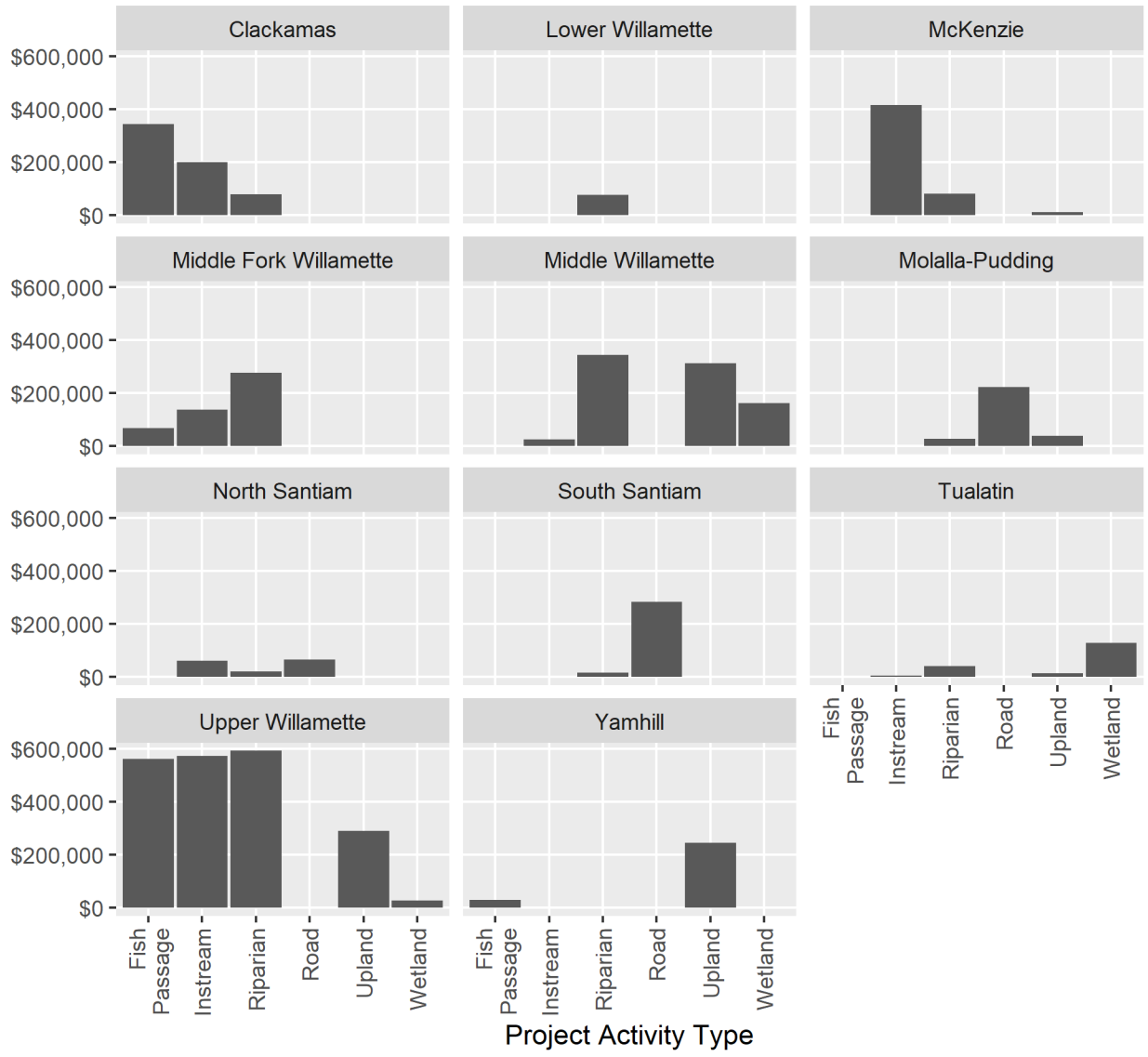

Figure R-5: Cash and inkind dollars spent in each subbasin for different project types completed in 2016, the most recent year data is available in OWEB's OWRI database.

Table R-9: OWEB grant funded projects completed in 2016, the most recent year data is available in the OWEB OWRI database.

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Clackamas	Fisher's Bend Phase I Alcove	Instream, Riparian	Anchored habitat structures placed; Side channels reconnected to stream or access improved; Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood	Chrysalis Farms, Clackamas County Parks, Clackamas River Basin Council, ODFW, OWEB, Portland State University, USFS, Volunteers: Clackamas River Basin Council	6 pools expected to be created by channel structure placement treatments, 0.18 miles of stream treated (instream activities), 6 habitat structures placed in channel, 0.7 linear stream miles treated (riparian activities), 32 acres treated (riparian activities)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Clackamas	Suter Creek Fish Passage & Habitat Restoration Project	Instream, Riparian, Fish Passage	Boulders placed; Large wood placed; Spawning gravel placed; Riparian trees planted: conifer and hardwood; Culverts/structures/fords replaced with bridges	Clackamas County, Clackamas River Basin Council, David Bugni & Associates, Portland General Electric	3 pools expected to be created by channel structure placement treatments, 0.2 miles of stream treated (instream activities), 3 habitat structures placed in channel, 2 acres treated (riparian activities), 0.24 linear stream miles treated (riparian activities), 5.2 miles of fish habitat made accessible due to road/stream crossing improvements (e.g. improvement or removal of culverts and other structures), 5.2 miles of habitat opened-previously inaccessible for both adults and juveniles, 1 road/stream crossing improved for fish passage
Lower Willamette	Council Office/Mill End Restoration	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded	Johnson Creek Watershed Council, Oregon Worsted Company, OWEB	0.12 linear stream miles treated (riparian activities), 0.54 acres treated (riparian activities)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Lower Willamette	Rusk/Lake Roads Neighborhood Restoration	Riparian	Riparian treated for non-native or noxious plant species; Riparian shrubs or herbaceous vegetation planted/reseeded	Clackamas County, Clackamas SWCD, North Clackamas Parks & Recreation District, North Clackamas Urban Watersheds Council, OWEB, Private Landowners, Turning Point Church, Unified Grocers	0.35 linear stream miles treated (riparian activities), 2.9 acres treated (riparian activities)
Lower Willamette	Stephens Creek and Tributary Project	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer	OWEB, River View Cemetery, West Multnomah SWCD	12.1 acres treated (riparian activities), 0.46 linear stream miles treated (riparian activities)
Lower Willamette	Tacoma MAX riparian reforestation	Riparian	Riparian treated for non-native or noxious plant species; Riparian shrubs or herbaceous vegetation planted/reseeded	East Side Plating, Johnson Creek Watershed Council, OWEB	0.48 acres treated (riparian activities), 0.07 linear stream miles treated (riparian activities)
McKenzie	Deer Creek Floodplain Enhancement Project	Instream	Large wood placed; Main stream channel modified / created; Side channels reconnected to stream or access improved	EWEB, McKenzie Watershed Council, National Fish and Wildlife Foundation , OWEB, USFS	50 habitat structures placed in channel, 30 pools expected to be created by channel structure placement treatments, 1.5 miles of stream treated (instream activities)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
McKenzie	BWCA Riparian Enhancement Phase II Project	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded	EWEB, McKenzie River Trust, McKenzie Watershed Council, OWEB	17 acres treated (riparian activities), 0.54 linear stream miles treated (riparian activities)
McKenzie	Pattle Oak Savanna Enhancement Project	Upland	Upland treated for non-native or noxious plant species; Upland trees planted; Other upland vegetation management	OWEB, Private Landowners, Upper Willamette SWCD	8 acres treated (upland activities)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Middle Fork Willamette	Willamette Confluence Restoration and Design Ph2	Instream, Riparian, Fish Passage	Anchored habitat structures placed; Large wood placed; Side channels reconnected to stream or access improved; Riparian treated for non-native or noxious plant species; Riparian shrubs or herbaceous vegetation planted/reseeded; Culverts/structures/fords replaced with ford	Friends of Buford Park & Mt. Pisgah, NOAA, OWEB, The Nature Conservancy	10 habitat structures placed in channel, 1 pool expected to be created by channel structure placement treatments, 1 mile of stream treated (instream activities), 159 acres treated (riparian activities), 1 linear stream mile treated (riparian activities), 1.5 miles of fish habitat made accessible due to road/stream crossing improvements (e.g. improvement or removal of culverts and other structures), 1.5 miles of habitat opened-previously inaccessible for both adults and juveniles, 6 road/stream crossings improved for fish passage

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Middle Fork Willamette	Lost Creek Riparian Enhancement Project Phase II-North Project Area	Riparian	Riparian treated for non-native or noxious plant species; Riparian fencing; Riparian shrubs or herbaceous vegetation planted/reseeded	Meyer Memorial Trust, Middle Fork Willamette Watershed Council, National Fish and Wildlife Foundation, Oregon Parks & Recreation Department, OWEB, Private Landowners	1.9 linear stream miles treated (riparian activities), 34.23 acres treated (riparian activities)
Middle Fork Willamette	Lost Creek Riparian Enhancement Project Phase II-South Project Area #1	Riparian	Riparian fencing	Meyer Memorial Trust, Middle Fork Willamette Watershed Council, National Fish and Wildlife Foundation, OWEB, Private Landowners	0.12 acres treated (riparian activities), 0.03 linear stream miles treated (riparian activities)
Middle Fork Willamette	Lost Creek Riparian Enhancement Project Phase II-South Project Area #2	Riparian	Riparian treated for non-native or noxious plant species; Riparian shrubs or herbaceous vegetation planted/reseeded	Meyer Memorial Trust, Middle Fork Willamette Watershed Council, National Fish and Wildlife Foundation, OWEB, Private Landowners	0.22 linear stream miles treated (riparian activities), 1.3 acres treated (riparian activities)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Middle Willamette	South Fork Aerial LWD Enhancement	Instream	Large wood placed	BLM, Hancock Forest Management, OWEB, Polk SWCD	3 pools expected to be created by channel structure placement treatments, 3 habitat structures placed in channel, 0.1 miles of stream treated (instream activities)
Middle Willamette	Willamette Mission Floodplain Forest Restoration-Phase 1	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded	Arbor Day Foundation, Ash Creek Forest Management, LLC, Bonneville Environmental Foundation, Oregon Parks & Recreation Department, OWEB, Willamette Riverkeeper	200 acres treated (riparian activities), 1.5 linear stream miles treated (riparian activities)
Middle Willamette	Herbert Farm - Plants for People 2014-16	Riparian, Upland	Riparian treated for non-native or noxious plant species; Riparian trees planted: hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded; Upland shrubs or herbaceous vegetation planted/reseeded; Upland treated for non-native or noxious plant species	AmeriCorps, City of Corvallis, Institute for Applied Ecology, ODF, ODFW, OWEB, USFWS	2 linear stream miles treated (riparian activities), 29 acres treated (riparian activities), 39 acres treated (upland activities)
Middle Willamette	2110-138 Relief Culvert	Road	Permanent cross-drains added above stream crossings	Seneca Jones Timber Company	1 non-stream crossing improved for surface drainage

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Middle Willamette	Coleman Ranch Hops Micro-Drip	Upland	Other irrigation system improvement	Coleman Ranch Inc., Marion SWCD, OWEB	146 acres treated (upland activities)
Middle Willamette	Smithfield Oak Restoration	Upland	Upland shrubs or herbaceous vegetation planted/reseeded; Upland treated for non-native or noxious plant species	NRCS, OWEB, Polk SWCD, Private Landowners, USFWS, Yamhill SWCD	41 acres treated (upland activities)
Middle Willamette	Canemah Bluff Natural Area - Brar Property	Upland, Wetland	Road obliterated, decommissioned, or vacated; Upland shrubs or herbaceous vegetation planted/reseeded; Upland trees planted; Previously filled or drained wetland returned to grass/herb meadow wetland; Existing grass/herb meadow wetland improved	Metro	0.87 acres treated (upland activities), 0.72 acres treated (wetland activities)
Middle Willamette	Canemah Bluff Natural Area - Lewis Property	Wetland	Existing grass/herb meadow wetland improved; Previously filled or drained wetland returned to shrub/scrub wetland	Metro	0.13 acres treated (wetland activities)
Molalla-Pudding	Molalla River Corridor Campsite Restoration	Riparian	Riparian trees planted: conifer and hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded	BLM, Canby Utility Board, Clackamas SWCD, DEQ, Molalla River Watch, Inc.	2.4 acres treated (riparian activities), 0.25 linear stream miles treated (riparian activities)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Molalla-Pudding	Around Panther Timber Sale #341-16-61 (Road Project)	Road	Existing culverts with outlet erosion protection added; Road durable rocking or quality hard road rocking prior to haul	ODF	172.13 stations improved by rocking for surface drainage, 20 non-stream crossings improved for surface drainage
Molalla-Pudding	Zip Up Timber Sale #341-15-85 (Road Project)	Road	Culverts added at locations other than above stream crossings; Road durable rocking or quality hard road rocking prior to haul; Structures replaced to meet 50+ year flow requirements	ODF	66.53 stations improved by rocking for surface drainage, 7 non-stream crossings improved for surface drainage, 4 stream crossings improved for peak flow passage
Molalla-Pudding	Bluegrass Farms Hazelnut Micro-Drip Project	Upland	Other irrigation system improvement	Bluegrass Farms, Marion SWCD, OWEB	16 acres treated (upland activities)
North Santiam	Snake Deford Confluence	Instream, Riparian	Stream bank stabilized: log and rock revetment installed; Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded	BLM, North Santiam Watershed Council, OWEB, Private Landowners, River Design Group, USFS	0.03 miles of stream treated (instream activities), 0.14 linear stream miles treated (riparian activities), 3 acres treated (riparian activities)
North Santiam	3rd and 15th Timber Sale #341-16-99 (Road Project)	Road	Road durable rocking or quality hard road rocking prior to haul; Structures replaced to meet 50+ year flow requirements	ODF	2.08 stations improved by rocking for surface drainage, 1 stream crossing improved for peak flow passage

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
North Santiam	Camp Six Timber Sale #341-16-68 (Road Project Point F to Point G)	Road	Road durable rocking or quality hard road rocking prior to haul	ODF	32 stations improved by rocking for surface drainage
North Santiam	Shepherd's Pie Timber Sale #341-14-23 (road project)	Road	Road durable rocking or quality hard road rocking prior to haul; Road obliterated, decommissioned, or vacated; Stream crossings with log fills/culverts removed and not replaced	ODF	1 stream crossing improved for peak flow passage, 45.55 stations improved by rocking for surface drainage
South Santiam	CAMCO, Inc. Youth Restoration Project	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded	CAMCO, Inc., OWEB, South Santiam Watershed Council, volunteers: Youth Watershed Council	0.25 linear stream miles treated (riparian activities), 3 acres treated (riparian activities)
South Santiam	Camp Creek North Timber Sale #341-16-001 (Road Project)	Road	Road durable rocking or quality hard road rocking prior to haul	ODF	32.1 stations improved by rocking for surface drainage
South Santiam	Double Arch Timber Sale #341-16-09 (Road Project)	Road	Culverts added at locations other than above stream crossings; Road durable rocking or quality hard road rocking prior to haul; Structures replaced to meet 50+ year flow requirements	ODF	7 non-stream crossings improved for surface drainage, 133.05 stations improved by rocking for surface drainage, 1 stream crossing improved for peak flow passage

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Tualatin	Gales Creek Campground Stream Enhancement	Instream	Large wood placed	ODF, ODFW, Scott Land and Timber	0.07 miles of stream treated (instream activities), 3 pools expected to be created by channel structure placement treatments, 3 habitat structures placed in channel
Tualatin	Gales Creek - Tualatin River Confluence Project - Phase I	Riparian, Upland, Wetland	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded; Upland shrubs or herbaceous vegetation planted/reseeded; Upland shrubs or herbaceous vegetation planted/reseeded; Upland treated for non-native or noxious plant species; Upland trees planted; Wetland vegetation planted; Wetland treated for non-native or noxious plant species	Clean Water Services, Metro, OWEB, Tualatin SWCD	26 acres treated (riparian activities), 1 linear stream mile treated (riparian activities), 4 acres treated (upland activities), 19 acres treated (wetland activities)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Upper Willamette	Bear Creek Fish Passage Enhancement Phase 1: Bennett Site	Fish Passage	Culverts/structures/fords replaced with bridges	Bennett Vineyards, Long Tom Watershed Council, Mowat Construction, ODOT, OWEB	0.5 miles of habitat opened-previously inaccessible for both adults and juveniles, 0.5 miles of fish habitat made accessible due to road/stream crossing improvements (e.g. improvement or removal of culverts and other structures), 1 road/stream crossing improved for fish passage
Upper Willamette	Bear Creek Fish Passage Enhancement Phase 1: Goracke Site	Fish Passage	Culverts/structures/fords replaced with bridges	Goracke Seed Farms, Long Tom Watershed Council, Mowat Construction, ODOT, OWEB	3.5 miles of fish habitat made accessible due to road/stream crossing improvements (e.g. improvement or removal of culverts and other structures), 3.5 miles of habitat opened-previously inaccessible for both adults and juveniles, 1 road/stream crossing improved for fish passage

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Upper Willamette	Sodom Ditch-Calapooia River Fish Passage	Instream, Riparian, Fish Passage	Flow deflector installed: log and rock/boulder; Stream bank stabilized: bioengineering; Riparian trees planted: conifer and hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded; Dam removed	American Rivers, BCI Contracting Inc, Calapooia Watershed Council, Confluence Consulting, DSL, Habitat Concepts, Heritage Research Associates, Linn County, Native Grounds Nursery, NOAA Fisheries, ODFW, Oregon Parks & Recreation Department, Oregon State University, OWEB, OWRD, Private Landowners, R Franco Restoration, Inc., River Design Group, Sevenoaks Native Nursery LLC, Staton Company, US Army Corps of Engineers, USFWS	5 pools expected to be created by channel structure placement treatments, 5 habitat structures placed in channel, 0.3 miles of stream treated (instream activities), 0.28 linear stream miles treated (riparian activities), 28 acres treated (riparian activities), 5.3 miles of habitat opened-previously inaccessible for juveniles, accessible for adults, 5.3 miles of fish habitat made accessible by the removal of barriers other than at road/stream crossings, 1 non-road crossing barriers improved for fish passage

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Upper Willamette	Harkens Lake Restoration, Phase 2	Instream, Riparian, Fish Passage, Wetland	Side channels reconnected to stream or access improved; Riparian treated for non-native or noxious plant species; Culverts/structures/fords removed and not replaced; Culverts/structures/fords replaced with culverts placed embedded or flat; Culverts/structures/fords replaced with open bottom arch culverts; Culverts/structures/fords replaced with ford; Existing grass/herb meadow wetland improved	BPA, Greenbelt Land Trust, Merritt Holdings, LLC., Meyer Memorial Trust, OWEB, River Design Group, USFWS	0.94 miles of stream treated (instream activities), 0.37 linear stream miles treated (riparian activities), 123 acres treated (riparian activities), 4 road/stream crossings improved for fish passage, 2.5 miles of habitat opened-previously inaccessible for both adults and juveniles, 2.5 miles of fish habitat made accessible due to road/stream crossing improvements (e.g. improvement or removal of culverts and other structures), 7 acres treated (wetland activities)
Upper Willamette	Garets Riverbank Riparian Project	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: hardwood; Riparian shrubs or herbaceous vegetation planted/reseeded	Linn SWCD, OWEB, Private Landowners	0.01 linear stream miles treated (riparian activities), 0.26 acres treated (riparian activities)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Upper Willamette	Long Tom Model Sub-WS Riparian Restoration Phase 3: Giustina land and Timber Site	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood	Giustina Land & Timber Co., Long Tom Watershed Council, OWEB	6.15 acres treated (riparian activities), 0.6 linear stream miles treated (riparian activities)
Upper Willamette	Long Tom Model Sub-WS Riparian Restoration Phase 3: Goracke site	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood	Goracke Brothers, Long Tom Watershed Council, OWEB	7.15 acres treated (riparian activities), 1 linear stream mile treated (riparian activities)
Upper Willamette	Long Tom Model Sub-WS Riparian Restoration Phase 3: Hrynyshyn Site	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood	Farm Service Agency, Long Tom Watershed Council, ODFW, OWEB, Private Landowners	10.19 acres treated (riparian activities), 0.3 linear stream miles treated (riparian activities)
Upper Willamette	Long Tom Model Sub-WS Riparian Restoration Phase 3: Kingzett Site	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood	Long Tom Watershed Council, OWEB, Private Landowners	0.5 linear stream miles treated (riparian activities), 6.01 acres treated (riparian activities)
Upper Willamette	Upper Luckiamute River Enhancement - Phase II	Riparian	Riparian treated for non-native or noxious plant species; Riparian trees planted: conifer and hardwood; Other riparian vegetation management; Riparian shrubs or herbaceous vegetation planted/reseeded	Greenbelt Land Trust, Luckiamute Watershed Council, Meyer Memorial Trust, OWEB, Private Landowners	281 acres treated (riparian activities), 25 linear stream miles treated (riparian activities)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Upper Willamette	Upper Luckiamute Willow Staking	Riparian	Riparian shrubs or herbaceous vegetation planted/reseeded	Bonneville Environmental Foundation, Luckiamute Watershed Council, Meyer Memorial Trust, OWEB, Private Landowners	2.9 acres treated (riparian activities), 0.44 linear stream miles treated (riparian activities)
Upper Willamette	Gimple Culvert Removal	Road	Stream crossings with log fills/culverts removed and not replaced	Seneca Jones Timber Company	1 stream crossing improved for peak flow passage
Upper Willamette	Chip Ross Area Oak Habitat Restoration	Upland	Upland shrubs or herbaceous vegetation planted/reseeded; Upland treated for non-native or noxious plant species; Other upland vegetation management	City of Corvallis, Oregon State University, OWEB, Volunteers	82.9 acres treated (upland activities)
Yamhill	1 Road Bridge - 2016	Fish Passage	Culverts/structures/fords replaced with bridges	Miami Corporation	2 miles of habitat opened-previously inaccessible for juveniles, accessible for adults, 1 road/stream crossing improved for fish passage, 2 miles of fish habitat made accessible due to road/stream crossing improvements (e.g. improvement or removal of culverts and other structures)

Subbasin	Project Name	Project Type	Project Description	Participants	Reported Outputs
Yamhill	Abbey Oak Restoration	Upland	Upland treated for non-native or noxious plant species; Other upland vegetation management	OWEB, Trappist Monks of Guadalupe, Inc., Trout Mountain Forestry, USFWS, Yamhill SWCD	55 acres treated (upland activities)
Yamhill	Champoeg State Park	Upland	Upland shrubs or herbaceous vegetation planted/reseeded; Upland treated for non-native or noxious plant species	Institute for Applied Ecology, Oregon Parks & Recreation Department, OWEB	45 acres treated (upland activities)
Yamhill	Supernatural Farms Irrigation Efficiency Upgrade	Upland	Other irrigation system improvement	OWEB, Private Landowners, Yamhill SWCD	9 acres treated (upland activities)
Yamhill	Van Duzer Corridor Oak Restoration	Upland	Upland shrubs or herbaceous vegetation planted/reseeded; Upland treated for non-native or noxious plant species; Other upland vegetation management	Landowner - Allan Saul Family Trust, OWEB, Polk SWCD, USFWS	6.1 acres treated (upland activities)
Yamhill	Verdant Hills Manure Storage	Upland	Livestock manure management	OWEB, Private Landowners, Yamhill SWCD	80 acres treated (upland activities)

3.6 TMDL Implementation Highlights

TMDL implementation actions taken by Designated Management Agencies (DMAs) or third parties are described in the table below. Most of these actions were summarized from annual reports submitted by DMAs to DEQ in calendar year 2017.

Table R-10: TMDL implementation activities reported in 2017 by Designated Management Agencies or third parties.

TMDL	DMA or Third Party	Reported Actions
Molalla-Pudding Subbasin TMDLs	City Canby	The city enhanced construction site erosion monitoring and compliance system; published quarterly information about seasonal stormwater impacts; reviewed the Cities Stormwater Master Plan, Capital Improvement Plan and System Development Charges; implemented new connection charges.
Molalla-Pudding Subbasin TMDLs	City of Woodburn, Pudding Watershed Council, and Clackamas SWCD	TMDL Pesticide Reduction Efforts: City of Woodburn provides GIS support and office space for Pudding Watershed Council. Nov 18, 2017 Clackamas Soil and Water Conservation District is partnering with Pudding River Watershed Council and the Pesticide Stewardship Partnership to offer this event. This collection event is for waste agricultural pesticides and pesticide containers. While the event's intent is to focus on the Pudding River Watershed, all producers in the county are eligible and encouraged to participate. Pudding Watershed Council also works jointly with ODA and DEQ for pesticide monitoring.
Molalla-Pudding Subbasin TMDLs	City Molalla	Submitted five year review report to DEQ.
Tualatin Subbasin TMDLs	Clean Water Services	Clean Water Services and the United States Geological Survey (USGS) partnered in a cooperative study in which the USGS maintains continuous monitoring stations throughout the Tualatin subbasin.
Tualatin Subbasin TMDLs	City of Rivergrove and Surface Water Management Agency of Clackamas County	Provided in kind support for Tualatin River Discovery Day paddle event in June.
Tualatin Subbasin TMDLs	City of Portland	Daylighted a portion of Restoration Creek, a tributary to Fanno Creek in Albert Kelly Park.
Tualatin Subbasin TMDLs	Lake Oswego	Through the Backyard Habitat Certification program, the city provided 1) training to one volunteer, 2) public education materials to the watershed community, and 3) two native plant sales to encourage restoration on private lands.
Tualatin Subbasin TMDLs	West Linn	The city participated in the Tualatin Basin Public Awareness Committee activities and sponsored their work using $900 of city funds.
Tualatin Subbasin TMDLs	Washington County	Built 32 water quality facilities in association with major road or bridge construction projects within the county.

TMDL	DMA or Third Party	Reported Actions
Tualatin Subbasin TMDLs	Metro	Acquired 180 acres of natural area in the Tualatin under a 2006 bond measure.
Tualatin Subbasin TMDLs	Tualatin Valley Irrigation District	Partnered with Clean Water Services to implement flow restoration efforts in two tributaries of the Tualatin River.
Tualatin Subbasin TMDLs	US Fish & Wildlife Service	Developed and implemented a pumping plan for Wapato Lake wildlife refuge and coordinated with partners in the basin to address downstream water quality concerns.
Willamette Basin and Mollalla-Pudding Temperature TMDLs	Marion County, City of Salem, North Santiam Watershed Council	Marion County and Salem key partners with North Santiam Watershed Council. Marion County Free Tree Program and Salem funding for North Santiam Watershed council to work in priority areas for attenuation temperature in support of their TMDL implementation plan.
Willamette Basin Bacteria TMDLs	City of Dallas, Independence and Monmouth, Luckiamute Watershed Council, OSU Graduate Student; and Ash Creek Water Control District	The Luckiamute Watershed Council, sponsored an OSU graduate student to develop the "Low Impact Development Findings and Recommendations, October 2017" for the Ash Creek Watershed through funding from the Cities of Independence and Monmouth and the Ash Creek Water Control District. The report is an excellent resource when considering options to address the impacts of urban development in the Ash Creek Watershed. A low impact development approach to stormwater management is recommend in the Willamette TMDL and MS4 Permits. This report is a proactive planning steps in the direction of an LID approach to storm water management.
Willamette Basin Temperature and Bacteria TMDLs	Marion County, ODA, Marion SWCD and Yamhill SWCD	Mill Creek - "Bringing It Back to Life" workshop to recruit landowners for conservation efforts in the Mill Creek Watershed. DEQ Drinking Water and TMDL Staff were assisting guests, along with OSU Extension & Pacific Birds Habitat Joint Venture, to promote BMPs for surface and groundwater quality protection and the streaked horned lark, a ground-dwelling bird.
Willamette Basin TMDL	Clackamas County Water Environment Services	Clackamas County Water Environment Services (WES) implements lower Clackamas watershed action plans through private landowner partnerships and a grant program called the RiverHealth Stewardship Program. In 2017, RiverHealth and WES completed 52 in-stream projects, restored 141 acres, planted 3,900 trees and removed 102 acres of invasive plants.

TMDL	DMA or Third Party	Reported Actions
Willamette Basin TMDLs	Portland General Electric and Clackamas River Basin Council	Portland General Electric implements part of its TMDL responsibilities by funding a restoration planting program contracted to the Clackamas River Basin Council, called Shade our Streams. In six years, the Shade our Streams program has enrolled 30 miles of riparian habitat and has restored approximately five miles of riparian area per year, most on private land. In 2018, they will reach 30 miles planted and complete the final maintenance year in 2020. The program relies on outreach to landowners who voluntarily enroll in the program, thanks to the credibility of the watershed council and the program's free planting and maintenance.
Willamette Basin TMDLs	North Santiam Corridor DMAs and North Santiam Watershed Council	The North Santiam Watershed Council was the host and facilitator for the development of the Partners for the North Santiam working group 2015 & 2017. Final Draft of North Santiam Watershed Resiliency Action Plan produced Dec 2017. This document will be used for funding requests. It describes the vision and scope of the partnership, how it will work, and key issues, such as water quality and quantity, for addressing watershed health while supporting social and economic interests of stakeholders and partners.
Willamette Basin TMDLs	United States Army Corps of Engineers and Bonneville Power Administration	Preliminary scoping meetings held in Dec 2017 for Detroit Reservoir Fish Passage and temperature control tower. Efforts are underway to incorporate measures to assess and mitigate Total Dissolved Gas. Timeline (2017-2026). This project is documented in the NMFS/DEQ joint annual water quality report, which meets the TMDL annual reporting requirement.
Willamette Basin TMDLs	Clackamas County	Completion of 52 riparian restoration projects, covering 141 acres, with 380 volunteers and 102 acres of removed invasive vegetation; Enhancing 21% of inventoried riparian reaches since 213.
Willamette Basin TMDLs	City Estacada	Co-sponsored a hazardous waste collection event in which 300 people participated; partnered with Clackamas River Water Providers to promote water conservation; partnered with local non-profit to clean up 400 pounds of trash along the Clackamas River.
Willamette Basin TMDLs	City of Springfield	Stormwater treatment park along north bank of Mill Race completed; provides pre-treatment and cooling of industrial and stormwater runoff before it enters the Mill Race, tributary to Willamette River.

TMDL	DMA or Third Party	Reported Actions
Willamette Basin TMDLs	City of Gladstone	MS4 Phase I permittee: The city updated their standard operation procedures for illicit discharge detection and elimination (IDDE) and conducted detailed mapping of outfall locations; adopted its own stormwater design and construction standards; and worked with a consultant to restore Rinearson Creek, which is a tributary to the Willamette River. Restoration work included weed management, a re-meander project, and protection of cold water refuges.
Willamette Basin TMDLs	City of Lake Oswego	There were 490 Erosion and Sediment Control inspections of construction sites from July 1, 2016 to June 30, 2017. Of those, there were 112 initial inspections and 177 final inspections. The City completed an update to the Storm Water Management Manual. Private development applications must utilize green infrastructure and infiltration before considering other methods of stormwater treatment. The City used $324,600 in funds on 286 acres to control invasive species, plant native species, and clear brush/debris. After invasive species were removed, the City planted 71,600 bareroot plants; 6,500 plant plugs; and 19,400 ferns. Volunteer work parties at the sites planted an additional 2,200 plants. The City provided $308,000 in funds in FY16-17 to control invasive species and plant native species on approximately 9.5 acres.
Willamette Basin TMDLs	City of Milwaukie	There was a total of 206 erosion control inspections conducted during the 2016-2017 reporting year. During fiscal year 2016-2017 our Streets maintenance department swept 559 miles of curbed streets and removed 1672 cubic yards of debris. The City engaged the GIS Coordinator to initiate an effort to track and prioritize shade opportunity areas. From year to year the City will look at infrared imagery and perform remote sensing techniques to classify vegetation in order to evaluate changes in vegetative concentrations in the vegetative buffer along streambanks. The City is anticipating using this data to provide a targeted mailing of information to streamside property owners encouraging them to plant trees along their respective stream in order to reduce stream warming.
Willamette Basin TMDLs	Multnomah County	Continued to enforce stream buffer protection. No code violations were reported this year.

TMDL	DMA or Third Party	Reported Actions
Willamette Basin TMDLs	Oak Lodge Water Services District	Summer intern from Clackamas Community College Water Education Technology program applied 28 medallions stating: "Don't Pollute, Flows to Waterways" to district catch basins. OLWS completed a merger of the Water District and the Sewer District, and as part of that merger provided a training for all field staff with a comprehensive overview on the MS4 Stormwater Permit with a focus on sediment control.
Willamette Basin TMDLs	City of Oregon City	A total of 583 erosion control inspections were conducted this permit year. Due to the time frames with which construction occurs, some sites had all three required inspections, and some sites have only had one or two inspections at this time (construction is still ongoing). Four public treatment/detention facilities were constructed, one public existing regional treatment/detention facility was reconstructed and enlarged; one private infiltration swale; several public street-side vegetated swales; four private soaker trench infiltrators; two private StormTech Chambers; two rain garden treatment facilities (one public); two private treatment/detention facilities; one private Contech water quality manhole; one private Contech Filter System; and 10 Trap and Siphon Catch Basins were constructed during the reporting period of 7/1/2016 through 6/30/2017: Total drainage area = 40.8 acres
Willamette Basin TMDLs	City of Wilsonville	During the 2016-17 reporting year, a total of 51 structural water quality and quantity facilities were installed. During the 2016-17 reporting year, street sweeping resulted in removal of 1,030 cubic yards of debris. During the 2016-17 reporting year, the City cleaned 562 catch basins, reflecting 21 percent of all public catch basins in the City. The City is working collaboratively with the U.S. Geological Survey (USGS) to research cold-water refuges in Wilsonville's tributaries (i.e., Boeckman Creek and Coffee Lake Creek) to the Willamette River.
Willamette Basin TMDLs	City of Junction City	Increased street sweeping from quarterly to monthly.
Willamette Basin TMDLs	City of Junction City	Installed five new pet waste stations.

TMDL	DMA or Third Party	Reported Actions
Willamette Basin and Columbia Slough TMDLs	City of Gresham	MS4 Phase I permittee: Staff continued to work on the Stormwater Manual update and coordinate with other jurisdictions on policy direction. The City is also planning to undertake a systemwide stormwater master plan effort over the next three years. Numerous riparian restoration activities were completed last year.
Willamette Basin and Columbia Slough TMDLs	Port of Portland	These efforts included maintaining over 439 catch basins, inspecting and maintaining Port-owned water quality treatment facilities, cleaning 6,852 feet of storm line, and conducting 4,172 hours of street sweeping. Together these tasks diverted 495 tons of potential pollutants from Port receiving waters. Dry-weather field screening inspections were conducted at 73 outfalls Port-wide. No potential illicit discharges were observed. In partnership with Friends of Trees the Port funded the following planting projects: Planting of 330 native trees and shrubs January 21, 2017 at the Columbia; Children's Arboretum located at 10040 NE 6th Drive. This project helped revegetate the site increasing infiltration to enhance summer base flows in the lower reach of the Columbia Slough. Planting of 142 street and yard trees on January 28, 2017 in Piedmont and Woodlawn neighborhoods. Planting of 125 street and yard trees on March 11, 2017 in Concordia and Vernon neighborhoods.

TMDL	DMA or Third Party	Reported Actions
Willamette Basin and Columbia Slough TMDLs	City of Portland	Conducted ongoing assessment, inspection, repair and maintenance activities of MS4 components including the cleaning of 4,990 green street facilities, 10,599 catch basins and inlets, 49,412 lineal feet of ditch, and 12,771 lineal feet of pipes and culverts. Also swept major arterials four to six times during the year and continued to sweep residential streets approximately once per year. Conducted 9,236 stormwater management permit reviews reflecting 1,272 projects with private stormwater management facilities and an additional 1,251 pollution source control measures at commercial and industrial properties. Conducted operations and maintenance inspections at 788 properties (containing 1,443 associated private stormwater management facilities) for compliance with operations and maintenance requirements. Acquired 73 acres of land and planted 6,728 trees and 23,820 shrubs along 10,381 linear feet of streambank covering 37 acres. Also, in partnership with Friends of Trees and other community planting partners, planted 3,431 street trees and yard trees in City of Portland rights-of-way, on school properties, and in private yards. Completing or finalizing a number of stream restoration projects, including replacing culverts and daylighting streams. In 2016, Portland became the first city to become Salmon Safe Certified. A number of conditions of certification will benefit temperature including stormwater management, restoration and coordinated monitoring.
Willamette Basin and Columbia Slough TMDLs	City of Wood Village	Streets were cleaned four times last year to reduce bacteria and other pollutants coming from streets. Ongoing planting and vegetation management along streambanks to maintain stream shade and bank stability.
Willamette Basin and Columbia Slough TMDLs	City of Salem, City of Keizer, and Marion County	Annual host for Erosion Control Summit targeting Municipalities, Contractors, and Builders statewide. In addition to DEQ 1200C permit, workshop includes component for < 1 acre for erosion control. Less than 1 Acres focus is a key strategy for reducing bacteria and mercury.
Willamette Temperature TMDLs	City of Eugene	Two planting projects completed along A-2 channel, tributary to Amazon Creek: 200 native broadleaf and conifer trees planted; and 4,000 lineal feet of willow planted in second location.

TMDL	DMA or Third Party	Reported Actions
Willamette Basin and Columbia Slough TMDLs	City of Fairview	MS4 Phase I permittee: Three IDDE investigations conducted, which resulted in enforcement actions. Inspected four regulated industrial/commercial facilities. Resolution 49-2013 approved compliance order agreement with EPA to implement reporting requirements and standards associated with the NPDES stormwater permit which includes adoption of the Erosion Prevention and Sediment Control (EPSC) Manual from the City of Gresham (Ordinance 2-2014).
Yamhill River TMDLs	City of McMinnville, Yamhill County, ODA, Yamhill Watershed Council, Yamhill SWCD, and Polk SWCD	11 nonpoint source complaints were logged for Yamhill County. All 11 complaints were referred and accepted by either ODA, McMinnville, or Yamhill County. Two of the complaints were addressed by PARC (Pesticide Analytical Response Center) under ODA jurisdiction. DMAs are not required to develop formal TMDL Implementation Plans in the Yamhill Basin. However, DMAs in this basin are responsive to complaint referrals from DEQ for resolution in support of TMDLS for phosphorus and surrogates as well as 303(d)listings. Third party partners are active in drinking water programs and PSP. All DEQ PARC complaints link electronically to ODA PARC for response.

Figure R-6: Lower Clear Creek site in 2013 before restoration (left photo) and in 2017, four years after planting (right photo); photo: Clackamas River Basin Council