MOLALLA-PUDDING WATERSHED TOTAL MAXIMUM DAILY LOAD IMPLEMENTATION PLAN

Clackamas County

February 2012

MOLALLA-PUDDING SUBBASIN TOTAL MAXIMUM DAILY LOAD IMPLEMENTATION PLAN

Prepared for

Clackamas County

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This is a draft report that may be updated prior to finalization.

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1. Introduction

The federal Clean Water Act, section 303, requires states to develop water quality standards to support beneficial uses of public water bodies. Where water quality standards are not being met, the water body or the appropriate reach is listed on the 303(d) list of water quality limited water bodies for that parameter. The State of Oregon, through the Oregon Department of Environmental Quality (DEQ), is required to develop Total Maximum Daily Loads (TMDLs) to determine how to meet water quality standards for that parameter.

The TMDL process begins when a stream, lake, or river does not meet water quality standards and is classified as water quality-limited on the state's 303(d) list. TMDLs identify the maximum amount of a specific pollutant that can be present in a water body without violating water quality standards. This is known as the loading capacity. After extensive water quality monitoring and modeling efforts, TMDLs establish the difference between the loading capacity and the current pollutant load. TMDLs are expressed as numeric standards or percent pollutant reductions that need to be met to bring water bodies into compliance with water quality standards. The difference between the current load and the loading capacity is known as excess load (DEQ, 2004). The excess load is split up between the different sources of pollution according to their contribution to the overall pollution load. Any difference between the waterway's loading capacity and the current pollutant load must be mitigated by pollution reduction activities. The DEQ develops wasteload allocations for point sources such as wastewater treatment plants and industrial discharges, and load allocations for non-point pollution from agricultural, urban, and forestry lands such as erosion, animal wastes, and stormwater.

The Oregon Administrative Rule (OAR) 340-042-0025 that addresses TMDLs requires local governments and other agencies to develop TMDL Implementation Plans.

Responsible parties that are able to implement pollution reduction strategies are classified as Designated Management Agencies (DMAs). In the Molalla-Pudding Subbasin, DMAs include federal agencies such as the Bureau of Land Management, state agencies such as the Oregon Department of Forestry and the Oregon Department of Agriculture, counties, cities, and others. According to OAR 340-042-0025, TMDL Implementation Plans must include the following five elements:

1. Management strategies that will be used to achieve load allocations
2. A timeline and schedule to achieve measurable milestones
3. A plan for periodic review and revision of the implementation plan
4. Evidence of compliance with applicable statewide land use requirements
5. Any other analyses or information as specified in the Water Quality Management Plan

The Molalla-Pudding Subbasin TMDL was issued as an order from DEQ on December 8, 2008, and approved by the U.S. Environmental Protection Agency (EPA) on December 31, 2008. A portion of the Molalla-Pudding Subbasin lies within Clackamas County, so Clackamas County is identified as a DMA in the

Molalla-Pudding TMDL. The TMDL obligates certain DMAs to take measures to assess, and (if applicable) reduce their loading of pollutants regulated by the TMDL.

This TMDL Implementation Plan is for Clackamas County and summarizes the management strategies for protecting and improving water quality. The particular focus of this Implementation Plan is on strategies for reducing TMDL pollutants from non-point sources to achieve load allocations. Strategies for reducing TMDL pollutants from point sources to achieve waste load allocations are addressed comprehensively in point source permits for storm water and wastewater discharges.

To comply with DEQ requirements for TMDL Implementation Plans (provided in OAR 340-042-0080(3)), the management strategies and information provided herein address each parameter within the Molalla-Pudding Subbasin TMDL over which Clackamas County has jurisdiction (in-stream heat, *E. coli*, dichlorodiphenyltrichloroethane [DDT], dieldrin, and iron). In addition, we believe that this Implementation Plan demonstrates commitment and reasonable assurance of implementation and maintenance of effort over time. Many of the elements of this TMDL Implementation Plan are also summarized in the Matrices of Management Strategies in Chapters 8 through 11.

2. Clackamas County Surface Water Overview

2.1 Watersheds

The major watersheds of Clackamas County are shown on Figure 1. A large portion of Clackamas County is drained by the Willamette River and its tributaries including the Clackamas, Molalla, Pudding, and Tualatin Rivers (Table 1). The remaining lands are drained by the Sandy River, which enters the Columbia River in the City of Troutdale. Figure 2 illustrates the Molalla-Pudding subbasin.

Table 1. Clackamas County Watersheds

Clackamas County watersheds	Total acres in watershed	Watershed in Clackamas County, acres	Percent of watershed in Clackamas County
Clackamas	602,634	540,456	90
Molalla-Pudding	560,037	305,785	55
Tualatin	453,849	12,587	3
Lower Columbia-Sandy	560,566	235,361	42
Middle Willamette	455,502	73,906	16
Lower Willamette	411,905	33,797	8
Total	*3,044,494*	*1,201,890*	

Separate TMDL Implementation Plans outline Clackamas County's efforts to comply with the Willamette, Clackamas, Sandy and Tualatin River TMDLs.

2.2 Organizational Summary

Clackamas County, including the Departments of Transportation and Development (DTD), Water Environment Services (WES), and Business & Community Services (BCS) are playing a role in implementing portions of this Implementation Plan. No single department within Clackamas County is solely responsible for water quality within the Molalla-Pudding Watershed. Tables 5 through 9 identify the responsible County Department for each identified management strategy (Section10). In many cases, partnership opportunities and agreements with non-county agencies will need to be established to accomplish the milestones identified for the Molalla-Pudding watershed. General responsibilities of each County Department are outlined below in Table 2.

Table 2. County Department Responsibilities

DMA name	Jurisdictional area	TMDL Implementation Plan responsibility
Clackamas County DTD	County-wide	Riparian area use and other land uses and roads[1]; illegal dumping and solid waste nuisances on private property
Clackamas County BCS	County-wide	Parks, management of surplus real estate, and Dump Stoppers (an illegal solid waste dumping prevention program)
Clackamas County WES	Limited to CCSD #1 and TCSD (except for septic system, grading, and 1200C programs, which are county-wide)	Administers CCSD #1 and TCSD. Also administers septic system, grading, and 1200C programs on a county-wide basis

1. Figure 3 Shows County Maintained Roads

The cities of Barlow, Canby, and Molalla are within Clackamas County and are DMA's for the Molalla-Pudding TMDL. These Cities are responsible for completing their own implementation plan.

2.3 Surface Water Responsibilities

As stated above, Clackamas County has responsibility as a DMA and has cooperated in the development of this Implementation Plan. Each County Department has ongoing programs that provide for overall management of surface water, and water quality, that contribute to watershed health in the Molalla-Pudding subbasin.

2.3.1 Wastewater

There are no discharges of treated wastewater effluent within the Molalla-Pudding subbasin that Clackamas County is responsible for.

2.3.2 Stormwater

There are no Clackamas County owned NPDES Municipal Separate Storm Sewer System (MS4) permitted storm sewer outfalls within the Molalla-Pudding subbasin.

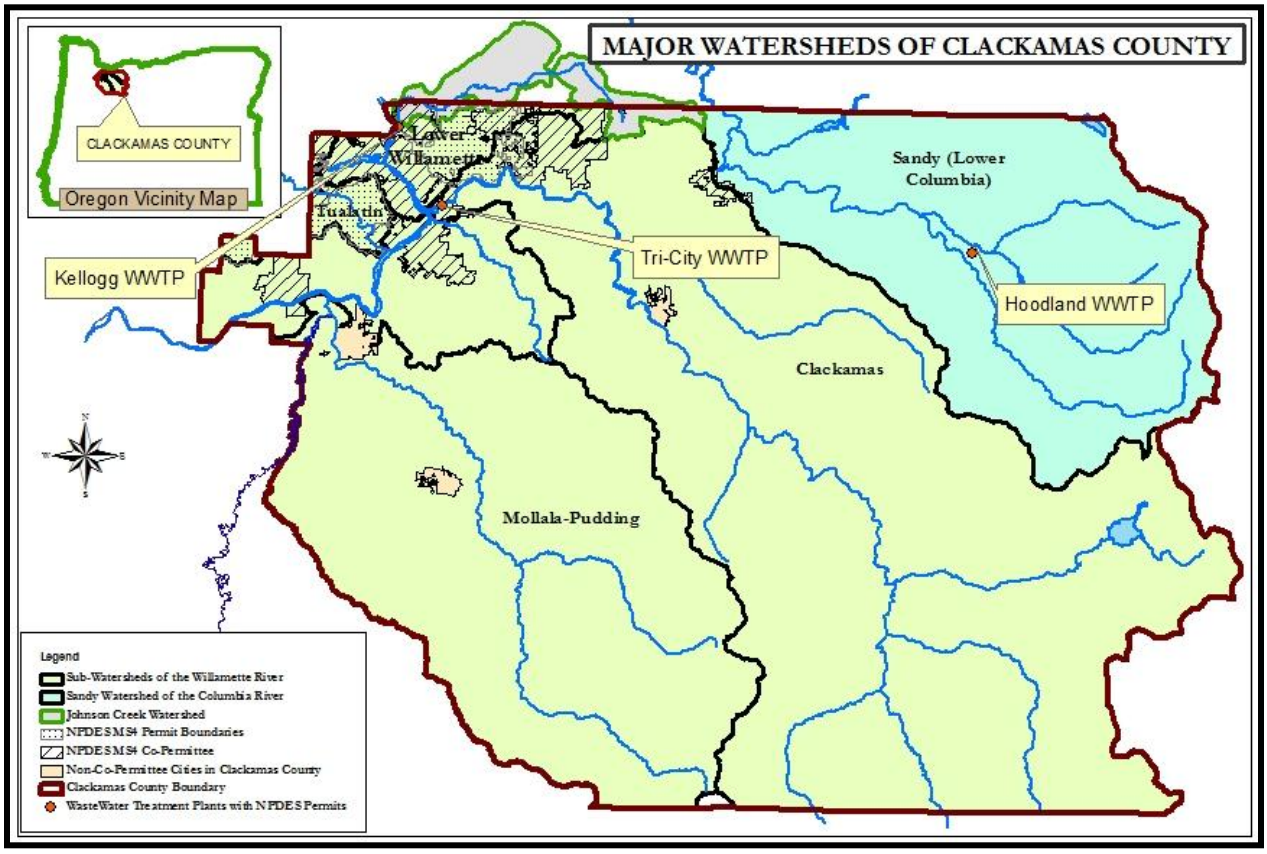

Figure 1. Major Watersheds of Clackamas County

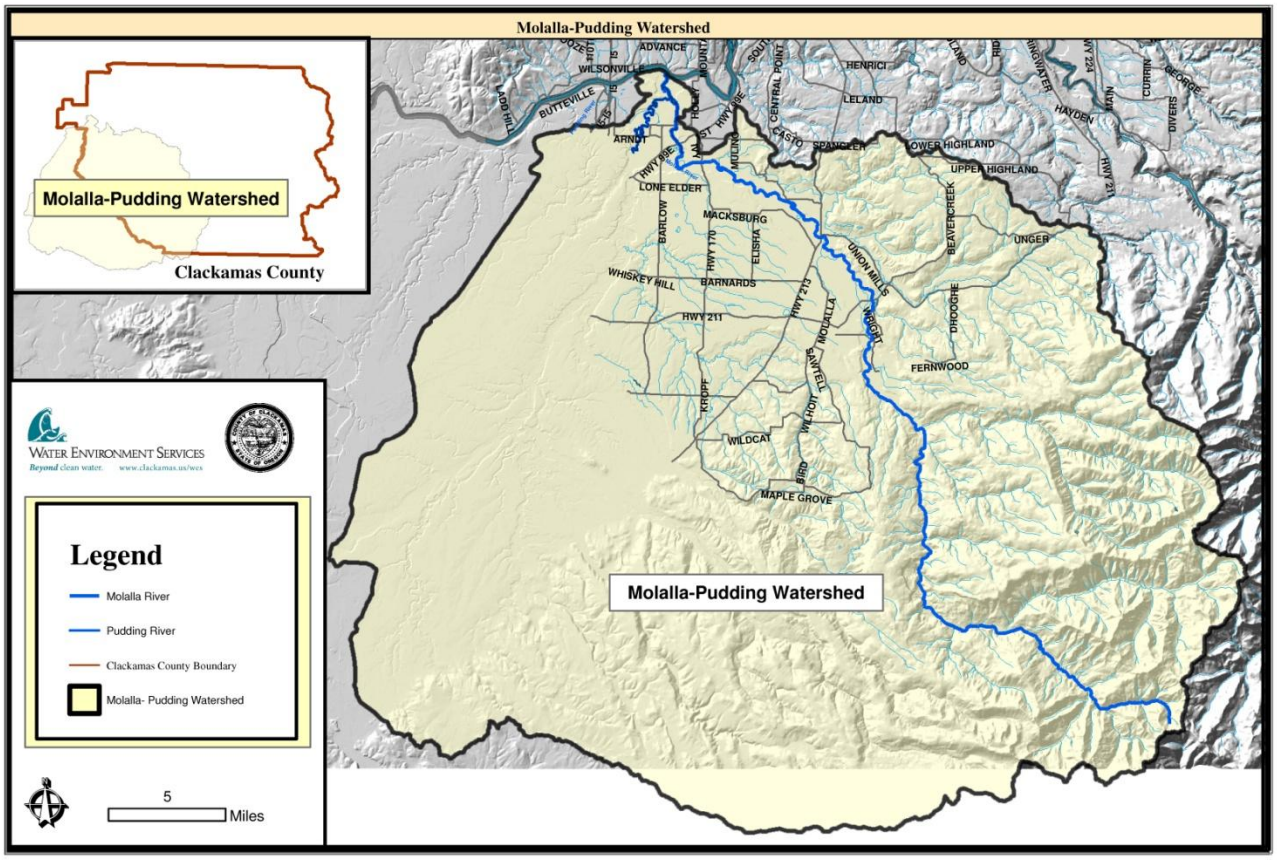

Figure 2. Molalla-Pudding Subbasin

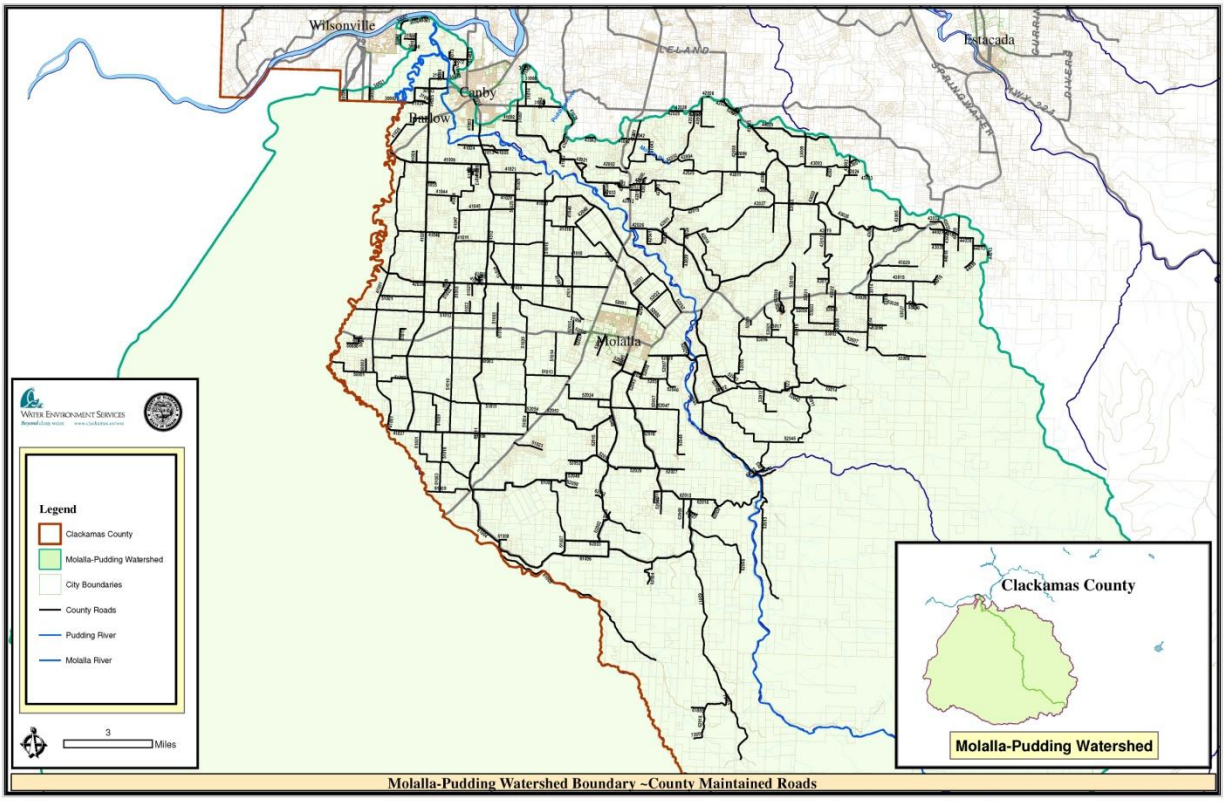

Figure 3. Molalla-Pudding County Maintained Roads

3. TMDL Parameters and Allocations

TMDLs have been developed in the Molalla-Pudding watershed for temperature, *E. coli*, pesticides (DDT/dieldrin/chlordane), nitrate, and iron. Table 3 summarizes each TMDL parameter, load allocation, measurement, and DMA.

Table 3. TMDL Parameters and Load Allocations

Parameter	Affected waters in CC's part of Molalla-Pudding watershed	Measurement method	Allocation type (and NPDES permit type)	LA	DMA
In-stream temperature	Beaver Creek, Butte Creek, Drift Creek, Molalla River, Pine Creek, Pudding River, Silver Creek, S. Fork Silver Creek, Table Rock Fork Creek, Teasel Creek, Zollner Creek	Surrogate: shade	LA	Attaining "system potential vegetation" conditions	CC
E. coli	Molalla, Pudding, W. Fork Little Pudding River	Direct	LA	Variable[1]	CC
DDT	Little Pudding River, Pudding River, Zollner Creek	Surrogate: TSS	LA	TSS < 15 mg/L (Pudding & Zollner); TSS < 7 mg/L (Little Pudding)	CC
Diledrin	Pudding River, Zollner Creek,	Surrogate: TSS	LA	TSS < 15 mg/L (Pudding & Zollner)	CC
Chlordane	Little Pudding, Zollner Creek,	Surrogate: TSS	LA	TSS < 15 mg/L (Pudding & Zollner); TSS < 7 mg/L (Little Pudding)	CC
Nitrates	Zollner Creek	Direct	LA	Loading capacity minus 10% for margin of safety	CC
Mercury	Willamette River			27% reduction	CC
Iron	Pudding River, Zollner Creek	Surrogate	LA	79% reduction for Iron (Pudding); 96% reduction for Iron (Zollner)	CC

1 Percent reductions vary for each compliance point and/or land use.

3.1 Temperature

Several stream and river reaches in Clackamas County are part of the Molalla-Pudding Subbasin temperature TMDL including: the Molalla River, Pine Creek, Table Rock Fork Creek, Beaver Creek, Butte Creek, and

Teasel Creek. DEQ has established Percent Effective Shade (PES), a measurement of the shade-yielding capacity of a riparian area, as the TMDL's surrogate for in-stream heat load. "System potential vegetation" conditions represent areas with a high PES value. "System potential vegetation" conditions are considered by DEQ to be necessary to achieve "system potential effective shade," which is defined by DEQ as "the potential near-stream vegetation that can grow and reproduce on a site, given the climate, elevation, soil properties, plant biology, and hydrologic processes." The Molalla-Pudding Subbasin TMDL establishes site-specific shade targets for the Molalla and Pudding River, and basin-wide "shade curves" that can be used to establish shade targets for all other streams in the basin.

3.2 *E. coli*

Stream specific percent load reductions were determined for each 303 (d) listed stream in the Molalla-Pudding Subbasin, which apply to their tributaries as well. Table 4 summarizes the percent reduction requirements for streams within Clackamas County.

Table 4. Compliance Point and Percent Reduction Requirements for Clackamas County Streams

Compliance Point	Percent Reduction
Pudding River at Hwy. 211 (river mile 21)	75
Pudding River at 99E (river mile 7.3)	70
Molalla River at Knights Bridge Road (river mile 2.8)	81

3.3 Pesticides (DDT, Dieldrin, Chlordane)

The DDT and dieldrin TMDL is specific to the Pudding River and Zollner Creek. The chlordane TMDL applies only to Zollner Creek. Approximately 20 miles of the Pudding River are located within Clackamas County, and approximately 7 miles of the Pudding are located along the County Boundary (Figure 1). None of Zollner Creek, nor any portion of the contributing area to Zollner Creek, is within the Clackamas County boundary. Therefore, chlordane will not be addressed as part of this TMDL implementation plan.

The Molalla-Pudding Subbasin TMDL has assigned a 30 percent reduction in long-term average Total DDT (t-DDT) concentrations for all non-point sources in the Pudding River watershed to meet target. This reduction is based on attaining the fish tissue criteria, but does not meet water column criteria. The reductions of DDT metabolite long term average concentrations are 61% and 97% to meet human health water column criteria.

Dieldrin and DDT, when they are present in stormwater or creek water, may be attached to or associated with small, suspended solid particles. As part of the TMDL development, DEQ has established reduction of total suspended solids (TSS) as a surrogate measurement of overall DDT and dieldrin reduction. The TMDL's TSS target is 15 milligrams per liter (mg/L) for non-point sources. The 15 mg/L TSS target in the Pudding River is sufficient to meet t-DDT water column targets and prevent exceedances of fish tissue action

levels in the Pudding River. However, meeting the TSS allocations may not be enough to ensure that the very low human health criteria for 4-4'-DDT is met. Meeting the TSS allocations also will not be adequate to meet all dieldrin criteria in the Pudding River. Therefore, the TSS allocations will be augmented by further research on potential hot spots and source reductions (ODEQ 2008).

3.4 Mercury

The Willamette TMDL has established a 27 percent reduction over time from all sources (point and non-point sources) of mercury compared to current loading levels.

Although the water quality criteria for mercury in the Willamette River's water column is currently being met at all times or nearly all times, excessive levels of mercury have accumulated in certain species of the watershed's fish.

The stated objective of the mercury TMDL is to reduce average fish tissue mercury concentrations in the Willamette River so that all fish species are safe for human consumption. The multiple fish consumption advisories for mercury in the Willamette Basin and the numerous 303(d) listings indicate that this beneficial use is not currently being met. DEQ acknowledges that it may take many years, perhaps even decades, to ultimately achieve the desired reduction in fish tissue concentrations of mercury. In establishing interim water quality guidance values, DEQ considered the criteria and thresholds utilized when fish consumption advisories are issued.

3.5 Nitrate

The nitrate TMDL applies only to Zollner Creek. None of Zollner Creek, nor any portion of the contributing area, is within the Clackamas County boundary. Therefore, nitrate will not be addressed as part of this TMDL implementation plan.

3.6 Metals (Iron, Manganese, Arsenic)

The iron and manganese TMDL is specific to the Pudding River and Zollner Creek. The arsenic TMDL applies only to Zollner Creek. As previously mentioned, none of Zollner Creek is within the Clackamas County boundary. Therefore, arsenic will not be addressed as part of this TMDL implementation plan. As indicated in the Molalla-Pudding TMDL report, based on the manganese analyses, DEQ concluded that a TMDL for manganese is not necessary and recommended delisting. Therefore, manganese will not be addressed as part of this TMDL implementation plan.

4. Goals and Objectives of Plan

The goal of this Implementation Plan is to identify the ongoing and planned management strategies to improve the watershed and address requirements of the Molalla-Pudding Subbasin TMDL related to reductions in in-stream heat, bacteria (*E. coli*), DDT, dieldrin, and iron loading.

The objectives of this Implementation Plan include applying adequate management strategies for pollution prevention (e.g., erosion control, riparian protection strategies, and stormwater management strategies), evaluating strategies annually for effectiveness and level of service, and implementing adaptive management as necessary.

To achieve this goal and these objectives, this Implementation Plan's DMA (Clackamas County) will be implementing the portions of this Plan that they are responsible for in a coordinated fashion. A single annual report to DEQ is expected to be submitted by Clackamas County each year. Clackamas County will submit one single annual report to DEQ for each of the Willamette Subbasins for which Clackamas County is listed as a DMA. Included in this report will be a general description of issues related to all subbasins followed by a specific implementation matrix for each subbasin.

SECTION B

POLLUTANT REDUCTION AND MANAGEMENT STRATEGIES

5. Potential Sources of Pollutants

According to the Oregon Department of Environmental Quality (DEQ) specific known or suspected sources of TMDL parameters should be noted in this Implementation Plan. The potential sources of TMDL parameters in the Clackamas County watersheds are discussed below.

5.1 Temperature

Stream temperature is determined by many factors. Heat energy is transferred to and from streams by the following processes:

- Short-wave radiation (primarily direct solar radiation, also known as radiant heat)
- Long-wave radiation (thermal radiation emitted from the Earth's surface)
- Convective mixing with the air
- Evaporation
- Conduction with the stream bed
- Advective mixing with inflow from groundwater and tributary streams
- Advective mixing with point source inputs such as wastewater effluent

There are varying scientific opinions about the relative importance of the above listed processes as a source for temperature increases in streams. While it is known that all of the above processes interact to produce the temperature regimes observed in streams and rivers and it is also known that the relative importance of each process differs among locations, there is disagreement as to what are the dominant processes.

Some scientific literature indicates that in small- to intermediate-sized streams of forested regions, incoming solar radiation represents the dominant form of energy input to streams during summer. Groundwater inputs may be important in small streams where they constitute a large percentage of the overall discharge, particularly during periods of the year when flows are low. As streams become larger and wider, riparian vegetation shades a progressively smaller proportion of the water surface, diminishing the effects of riparian shading and advective mixing on water temperature and increasing the importance of evaporative heat-loss.

Other recent scientific literature considers air temperature over the stream to be the most influential factor in stream temperature. Alteration of the riparian canopy, even well back from the stream, can open air flow and change the microclimate over the stream. Increasing airflow, particularly in areas with high summer air temperatures, can increase heat exchange with the stream and thereby elevate water temperatures. Thus, even where direct shade is retained over streams, alteration of riparian stands and adjacent upland areas may result in increased stream warming due to changes in the microclimate over the stream.

Riparian vegetation modifies convective and evaporative heat-exchange losses by creating a microclimate of relatively high humidity, moderate temperatures, and low wind speed compared with surrounding uplands. These microclimate conditions tend to reduce both convective and evaporative energy exchange by minimizing temperature and vapor-pressure gradients.

Potential or actual types of non-point source in-stream heat loading include:

- Alteration of the riparian and upland canopy; and removal of streambank vegetation
- Filling and drying of wetlands
- Interception and rerouting of groundwater inputs
- Withdrawal and return of water for agricultural irrigation
- Release of water from ponds and reservoirs
- Changes in channel or water body size
- Suspended sediment/turbidity in streams
- Low stream flow

Although scientific studies indicate that water temperature is affected by a variety of processes, DEQ's analysis of temperature sources in the TMDL contains a simplified assessment of non-point temperature sources. The TMDL states that elevated summertime stream temperatures attributed to non-point sources result from increased solar radiation heat loading. The TMDL attributes non-point source temperature increases to the disturbance/removal of near stream vegetation that has reduced levels of stream shading and exposed streams to higher levels of solar radiation (i.e., reduction in stream surface shading via decreased riparian vegetation height, width, and/or density increases the amount of solar radiation reaching the stream surface). DEQ modeling of the mainstem Molalla River indicates that about half of the excess temperature is from lack of shade, and the other half is from reduced stream flow. DEQ also found that channel width of the Molalla River contributed to increased stream temperatures; a widened channel reduces even mature vegetation's shading effectiveness. As a result, management strategies to address elevated water temperature in this Implementation Plan are focused on increasing the percent effective shade in the watershed and other reasonable steps to reduce elevated stream temperatures.

As discussed further in Chapter 6, the impacts to stream temperature in the Molalla-Pudding subbasin from agricultural and forestry lands regulated by ODA and ODF are not addressed in this Implementation Plan. The matrix of management strategies Clackamas County is employing to address potential sources of elevated stream temperatures is included in Chapter 8. Additional information on the Clackamas County management strategies which control potential sources is provided in Chapter 7.

5.2 *E. coli*

E. coli bacteria can enter surface water bodies from many sources, including the feces of wild mammals, tame and wild waterfowl, wild songbirds, pets, and livestock, and from improperly functioning (i.e., failed) septic systems. *E. coli* can enter the waters while the host animal is in, sitting above, or flying above the creek. It can also be washed in from riparian and upland areas during storm events. In unusual instances, it can be discharged into the creek during dry weather from a "point source" such as a failing septic system.

Recent scientific evidence from studies in the Puyallup River watershed in Washington State and the Tualatin River watershed in Oregon indicates that approximately 80 percent of the *E. coli* in stormwater that was discharged from urbanized land does not originate in the gut of humans. A relatively small percentage also appears to be coming from dog and cat wastes. The Tualatin River watershed study shows that the percent-

age of *E. coli* that is present in stormwater which originated from dog feces is less than 20 percent and often is far lower. According to these studies and to anecdotal evidence available to WES and Clackamas County, stormwater washing over fecal matter that had been deposited by a range of wild animals, including birds and rodents, appears to be the source of most *E. coli* contamination in urban stormwater in many instances. Less data is available on the specific sources of *E. coli* in rural portions of watersheds in the Pacific Northwest region. Livestock can be major sources in rural watersheds.

At this time, Clackamas County is not aware of any specific known sources of *E. coli* in the waters that are regulated by the Molalla-Pudding Subbasin TMDL, although suspected or general (i.e. non-specific) sources include:

- Livestock waste
- Wild bird and mammal feces
- Pet waste
- Failed septic systems
- Illegal dumping of solid waste
- Dead animals
- Spills and illicit discharges
- Stormwater runoff

5.3 Pesticides (DDT and Dieldrin)

DDT and dieldrin are organochlorine insecticides that have been banned for at least 20 years. Historically, DDT and dieldrin were both used extensively. Examples of typical usage included killing mosquitoes in urban areas and killing insects in farmed lands. Both compounds are long-lived in soils and can be toxic to animals. They are also highly hydrophobic, which means they tend to bind to soil particles and the fatty tissues of animals and do not readily dissolve in water. Due to the extensive past use and the long-lived nature of these compounds, these materials are ubiquitous in the environment and have been detected in virtually all media (i.e., water, soil, and animal tissue).

The use of dieldrin in the United States was restricted in 1970 and all uses of products containing dieldrin were banned in 1983. In addition to being an insecticide, dieldrin is also a long-lived oxidation breakdown product of aldrin, another organochlorine pesticide. Aldrin is known to quickly break down—typically within a matter of days—into dieldrin in an animal's body or in the environment. Thus, the concentration of dieldrin in the environment is often a cumulative result of the historic use of both aldrin and dieldrin. Dieldrin is very stable in the environment and, unfortunately, does not easily break down into harmless by-products. Since dieldrin and aldrin are no longer being used, the transport of dieldrin to surface water bodies is believed to be due, in large part, to stormwater runoff. It is believed that dieldrin is also able to be dispersed in the environment by wind and volatilization as well. In upland areas, these molecules preferentially bind to soil.

DDT was banned from use in the United States in 1972. Over time, DDT breaks down to form the metabolites DDE and DDD, which are also associated with toxicological effects in animals. Transport of these molecules (DDD, DDT, and DDE) to surface water bodies is believed to be due, in part, to stormwater runoff. They can also be dispersed in the environment by wind and volatilization. In upland areas, these molecules preferentially bind to soil. In water, they tend to bind to sediment, volatilize, photodegrade, or be taken up into the food chain.

At this time, Clackamas County is not aware of any specific known sources of DDT and dieldrin in the Molalla Pudding subbasin, although suspected or general (i.e., non-specific) sources include:

- Stormwater runoff from agricultural, forest, and urban lands
- Soil erosion from new development and redevelopment
- Soil disturbance related to road maintenance
- Illegal dumping of solid waste
- Spills and illicit discharges

5.4 Mercury

Mercury is a naturally occurring element found in high concentrations in cinnabar deposits. In Oregon, mercury was mined commercially and used extensively in gold and silver amalgamation (Brooks, 1971; Park and Curtis, 1997). Mercury is present in other rock types and soil types in Clackamas County, given the role that volcanoes have played in our geologic history. Mercury is also naturally present in geothermal areas and in many types of native vegetation; significant amounts can be released into the atmosphere during wild/forest fires.

Mercury has been used historically in fungicide formulations and can still be found in many commercial products, including fluorescent lights, thermometers, automobile switches and dental amalgam. Illegal dumping of solid waste containing mercury can also be a source.

Mercury is in fossil fuels such as coal, natural gas, diesel fuel, and heating oil. The mercury present in these fuel sources is often released into the atmosphere upon combustion. Atmospheric mercury can be transported great distances and is known to be deposited on the landscape via either wet or dry deposition (Sweet et al., 1999, 2003). Research has shown that much of the mercury which enters the Willamette River had been deposited in the watershed by the atmosphere.

Mercury can be present in various physical and chemical forms in the environment (Ullrich et al., 2001; USEPA, 2001b). The majority of the mercury found in the environment is in the form of inorganic or elemental mercury, but these forms of mercury can be converted to organic or methyl mercury by sulfate reducing bacteria. Methyl mercury production is affected by a host of physical and chemical factors including temperature, redox potential, dissolved oxygen levels, organic carbon, sediment particle size, alkalinity, sulfate concentration, and pH. Methyl mercury, once formed, represents the most bioaccumulative form of mercury in fish tissue and the most toxic form of mercury for human consumers (USEPA, 2001a). The primary route of human exposure to mercury is via the consumption of freshwater fish, saltwater fish, and other seafood containing mercury (USEPA, 2001a).

Mercury can enter surface water bodies in many ways. One way that mercury can be transported to surface waters is through stormwater runoff. Some of the mercury in stormwater runoff may be washed from impervious surfaces after having been deposited on the surface from the atmosphere. Stormwater runoff can also carry mercury if it erodes mercury-containing soils.

At this time, Clackamas County is not aware of any specific known sources of mercury, although suspected or general (i.e. non-specific) sources include:

- Erosion of soils from agricultural, forest, urban and commercial/industrial areas and lands
- Runoff and soil erosion from new development and redevelopment and commercial and industrial areas
- Soil disturbance related to road maintenance
- Illegal dumping of solid waste
- Spills and illicit discharges of certain materials

5.5 Iron

Iron is a naturally occurring substance and particularly prevalent in soils deriving from eroded volcanic rocks. Iron enters surface water bodies primarily through stormwater runoff and eroding stream banks. Although a naturally occurring material, iron concentrations in groundwater and surface water, stream flow, and precipitation may be contributed in unnatural concentrations through runoff and erosion (ODEQ2008).

At this time, Clackamas County is not aware of any specific known sources of iron in the Molalla-Pudding subbasin, although suspected or general (i.e., non-specific) sources include:

- Stormwater runoff from agricultural, forest, and urban lands
- Soil erosion from new development and redevelopment
- Soil disturbance related to road maintenance

6. TMDL Implementation Responsibilities

Responsibility for implementing the TMDLs has been distributed among a variety of designated management agencies (DMAs). TMDLs are being implemented by appropriate state and federal agencies for state and federally-owned and managed lands. TMDLs for private lands in timber management areas are being implemented through the Oregon Department of Forestry (ODF), and the TMDLs for private lands in agricultural areas are being implemented through the Oregon Department of Agriculture (ODA). TMDLs are being implemented through the NPDES permitting process for point sources of pollutants such as wastewater treatment plant discharges and NPDES Municipal Separate Storm Sewer System (MS4)-permitted stormwater discharges.

This Implementation Plan focuses on management strategies that address non-point sources of pollution in Clackamas County, including surface discharges of stormwater runoff from areas that are not regulated by the NPDES MS4 program. Stormwater runoff directed to subsurface discharge through injection systems and infiltration systems is not addressed through this Implementation Plan. Lands subject to ODF and ODA jurisdiction are also not the focus of this Implementation Plan. In addition, this Implementation Plan does not address runoff from lands owned by the state or federal government. See Chapters 1 and 2 for previous discussion on jurisdictional authority and responsibility coverage.

This Implementation Plan addresses TMDL parameters that are discharged by these types of stormwater drainage systems:

- Clackamas County storm sewer outfalls that are not subject to the NPDES MS4 permit requirements. (See the areas outside the NPDES MS4 permit boundaries in Figures 2 and 3.)
- Privately-owned storm sewer outfalls if they do not drain agricultural and timber management areas. These outfalls, unless they are permitted by an NPDES permit such as a 1200Z, are non-point sources of pollution. (See the jurisdiction and land use maps in Figures 3 and 4)
- Overland sheet flow or channelized flows that do not flow through MS4-permitted or privately owned storm sewer outfalls. These drainage systems are non-point sources of pollution. They are found on lands with every type of land use. Those drainage systems that are not in agricultural and timber management areas are addressed in this Implementation Plan. (See the jurisdiction and land use maps in Figures 3 and 4)
- Drainage and runoff in County Rights of Way

It is important to note that Clackamas County's authority to control sources of pollution from privately owned storm sewer outfalls, overland sheet flow and channelized flows is quite limited. If Clackamas County is aware of a privately owned conveyance system that is either a significant or known source of pollution, the matter will be referred to DEQ if public education and/or mediation fail to yield the necessary water quality improvement.

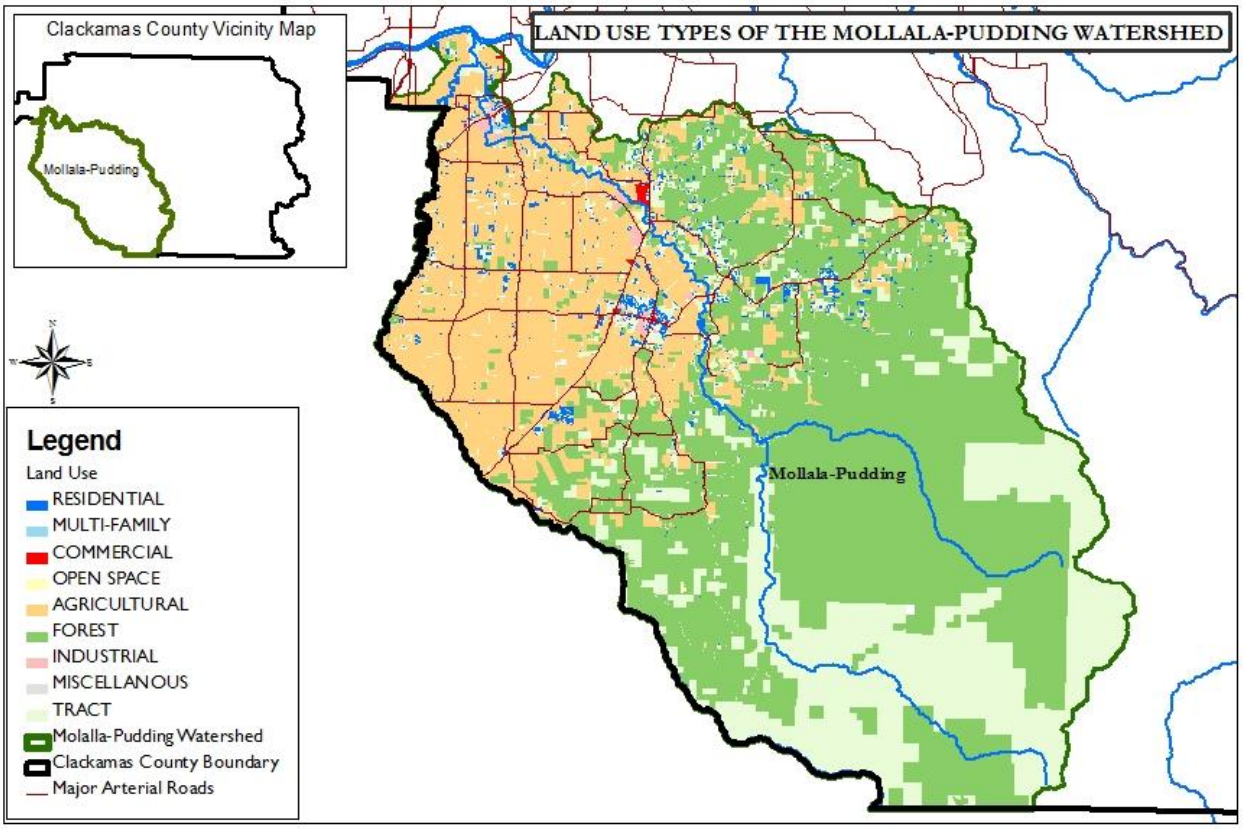

Figure 4. Land Use Types of the Molalla-Pudding Subbasin

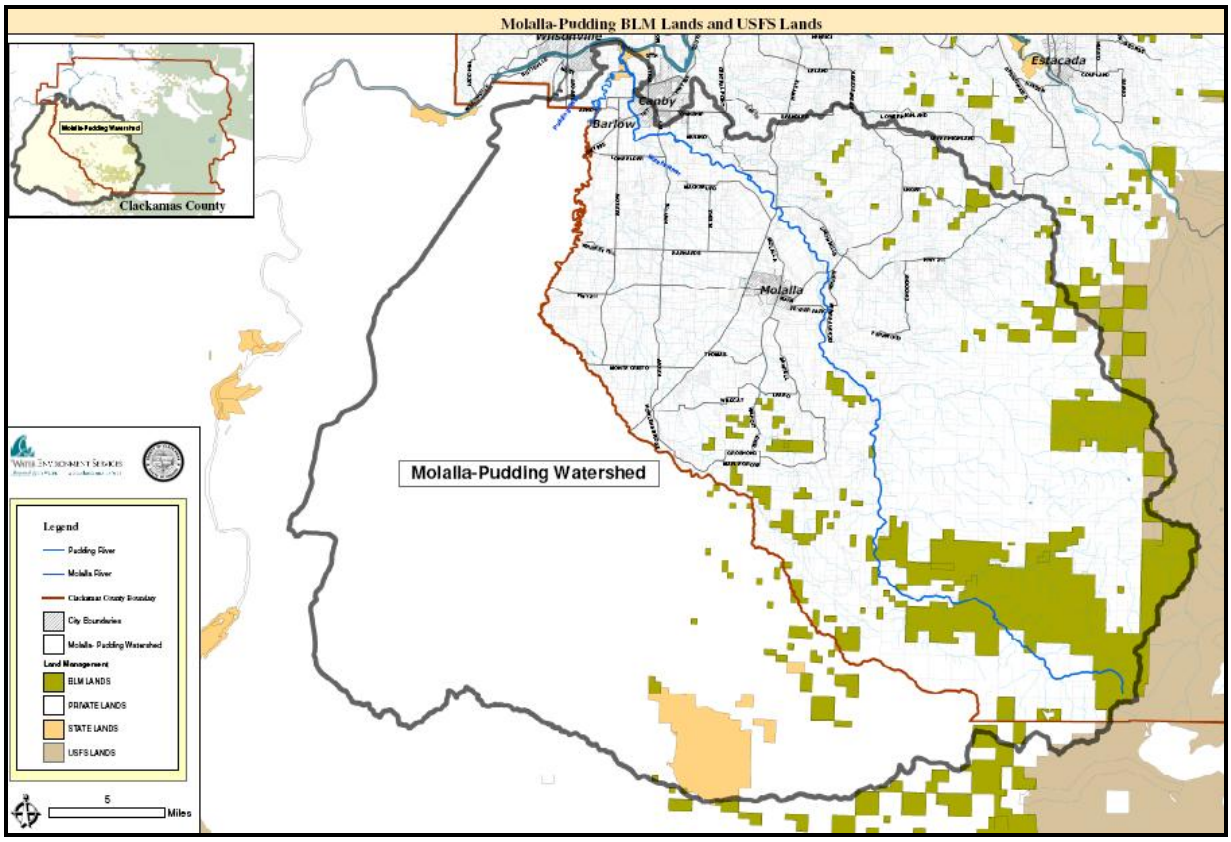

Figure 5. Jurisdictional Areas of the Molalla-Pudding Subbasin

7. Clackamas County Water Quality Programs and Activities

A variety of management programs, activities, and strategies are employed by Clackamas County to improve and protect water quality and overall watershed health. The strategies that are implemented or planned for implementation to address non-point sources of TMDL parameters in the area covered by this Plan include:

7.1 Development-Related and watershed protection regulations
7.2 Erosion prevention and sediment control
7.3 Public involvement and education
7.4 Pet waste management
7.5 Septic system management
7.6 Illegal dumping management
7.7 Dead animal management
7.8 Spill response and Illicit Discharge, Detection, and Elimination Program (IDDE)
7.9 Riparian Assessment and Management

These management strategies are described in detail in the sections below. Applicable management strategies for each TMDL parameter are also summarized in the matrices in Section C: Implementation.

7.1 Development-Related & Watershed Protection Regulations

TMDL parameters addressed: Temperature

Description of the potential sources: Removal or disturbance of vegetation reduces stream shading, exposing streams to higher levels of solar radiation. Solar radiation (sunlight) falling directly on streams can cause water temperature to increase. Alteration of the riparian canopy can also change the microclimate near streams, increasing air flow and heat exchange with the stream and thereby elevating water temperatures.

Description of the Management Strategy: Protection of system potential vegetation and effective shade in riparian areas is one of the primary mechanisms for achieving load allocations for temperature. The following watershed protection regulations that protect streamside vegetation are implemented in Clackamas County.

Streamside Buffer Areas

Many lands that include even a portion of riparian area are subjected to "streamside buffer regulations" when these lands are developed or re-developed under Clackamas County's land use and building permitting processes. Areas with streamside setbacks are illustrated in Figure 5. These streamside buffer regulations come in three forms:

- *Wetlands.* Clackamas County's Zoning and Development Ordinance (ZDO) 1002 applies in unincorporated, urban areas in the watershed and also applies outside the urban areas. The "wetland provisions" of ZDO Sections 1002 regulates disturbances, often pursuant to state and federal standards, and specify setback distances and buffers for wetlands. Disturbances and setbacks to these wetlands are reviewed in accordance with applicable provisions of the ZDO, and are dependent upon several factors that are determined on a case-by-case basis. ZDO 1002 is administered by Clackamas County's

DTD. Wetlands are noted here in this Implementation Plan, for many wetlands in the Molalla-Pudding River's watershed discharge their waters directly to creeks and rivers in the watershed.

- *River and Stream Conservation Area, ZDO 704.* This ordinance, administered by DTD pursuant to the applicable provisions of the ZDO, applies to land within unincorporated Clackamas County that is located outside of the Portland Metropolitan UGB and / or outside of the Metro Service District Boundary. Development that is regulated by Clackamas County that occurs on land lots near rivers and qualifying creeks must provide a largely undisturbed setback area varying in width from 50 feet to 100 feet (ZDO 704.07 requires that no less than 75 percent of the setback's area be preserved with native vegetation). For a river's riparian area, a setback area wider than 100 feet can be required in certain circumstances. The setback distance for creeks is based on whether a creek has been determined to be "small" (50 feet), "medium" (75 feet), or "large" (100 feet). Smaller (non-fish-bearing) streams and all wetlands are unprotected by ZDO 704's provisions, although are still protected in the course of land-use actions under ZDO Section 1002. All riparian areas around creeks and rivers that are eligible for protection under ZDO 704 are on Water Protection Rule Classification maps that were compiled pursuant to OAR 629-635-000.

- *Floodplain Management District, ZDO 703.* This ordinance, administered by Clackamas County DTD, applies to the unincorporated lands that are addressed by this Implementation Plan. This ZDO restricts the types, and in some instances, the magnitude of development that can occur in floodplains, and implements and exceeds the standards set by FEMA's National Flood Insurance Program (NFIP). This ordinance tends to direct development away from areas that are directly adjacent to a creek or river's low and high flow channels, making it more likely that native vegetation will be allowed to provide shade to the water body (see the previous four bullets for regulations which formally establish riparian area setback areas).

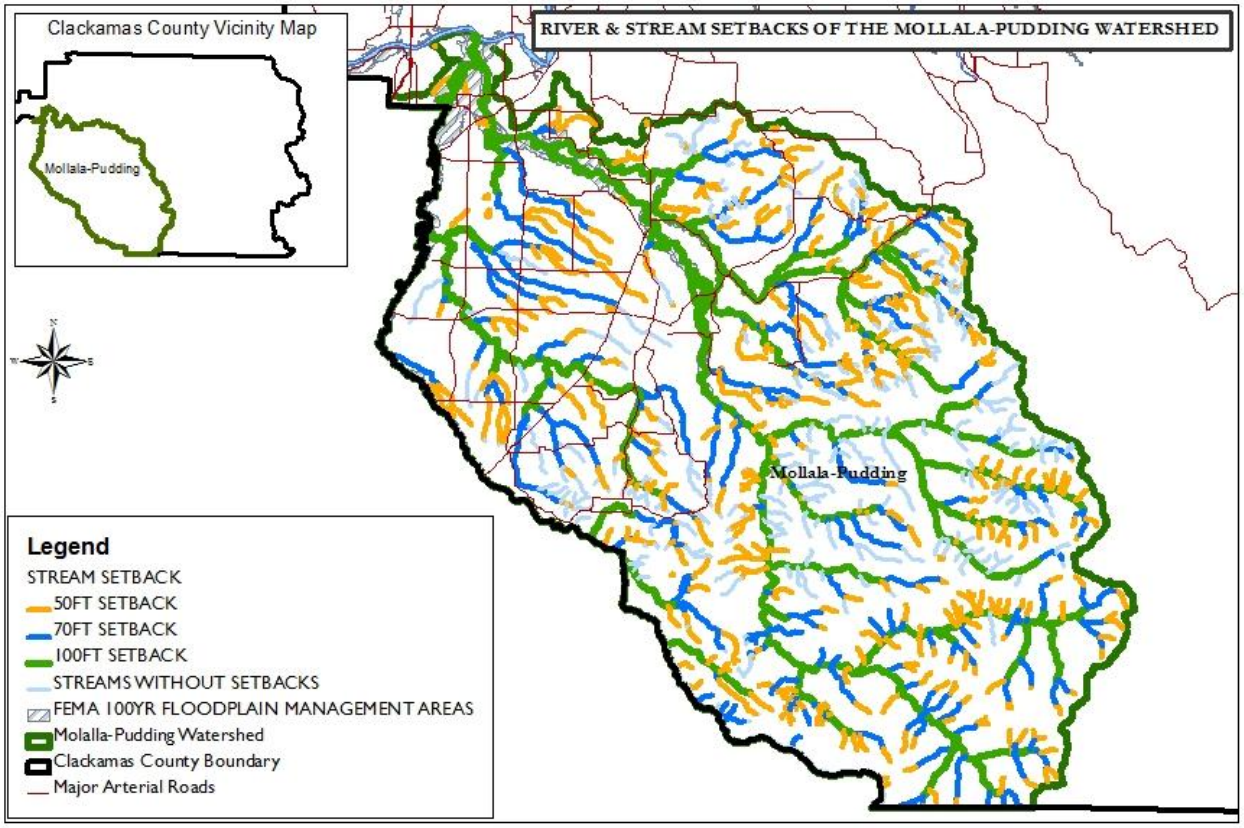

Figure 6. Molalla-Pudding Stream Setbacks

Sustainability Resolution

Clackamas County established an Office of Sustainability in 2007 and he Board of County Commissioner's adopted a resolution regarding sustainability on February, 28, 2008. A portion of that resolution is listed below. Some of the elements of this resolution will aid in the implementation of management measures to control and reduce TMDL parameters:

The County is committed to meeting or exceeding global targets for mitigating climate change by taking actions in the County's operations and communities, including the following:

a. Create an action plan for reducing global warming emissions in County operations;

b. Increase the average fuel efficiency of County fleet vehicles;

c. Increase recycling rates in County operations and in the community;

d. Make County procurement decisions that minimize negative environmental and social impacts;

e. Continue to practice and promote sustainable building practices using the U.S. Green Building Council's LEED™ program;

f. Adopt and enforce land-use policies that reduce sprawl; preserve open space; create compact, walkable urban communities, and

g. Protect and foster productive and healthy agriculture and natural resource lands;

h. Make energy efficiency a priority, and increase the use of clean, alternative energy;

i. Promote transportation options;

j. Preserve water resources through education, planning and water supply coordination;

k. Help educate the public, schools, other jurisdictions, professional associations, businesses, and industry about reducing the negative impacts of climate change.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include:

- Tracking the number of approved building and development permits per year with riparian area buffers or setbacks.
- Tracking the number of approved building permits per year which receive a ZDO 703 review.
- Qualitative assessment through interviews with staff.

Fiscal analysis: Implementation of river and stream conservation areas (ZDO 704), the floodplain management district (ZDO 703), and wetland provisions of ZDO 1002 is currently funded.

Timeline for implementation: Management strategies are currently being implemented. Implementation will continue.

7.2 Erosion Prevention and Sediment Control

TMDL parameters addressed: DDT, dieldrin, mercury and iron

Description of the potential sources: Erosion of disturbed soil at construction sites can result in stormwater being contaminated with sediment and other pollutants, which can then be transmitted to waterways. DDT and dieldrin may be present in some soils due to spills or improper storage. Iron is naturally occurring. Mercury is naturally present in some soils and also reaches soil through air deposition.

Description of the Management Strategy: Erosion control is addressed through County development review and the issuance of erosion control permits for sites undergoing significant development or redevelopment, reducing the amount of soil leaving the site and subsequent TSS in stormwater washing from the property. By reducing TSS in stormwater, it is presumed that the concentration in stormwater of TMDL parameters adhered to soil, if present (such as DDT, dieldrin, mercury, and iron) is also reduced.

The implementation of the erosion control program varies depending on the location of the property being developed. The erosion control methods employed for the Molalla-Pudding Subbasin is summarized below.

- *Unincorporated Clackamas County.* The County is provided the authority to require erosion control through ZDO Section 1008, *Storm Drainage.*
    - Development within the UGB that disturbs more than 800 square feet and less than one acre is reviewed by the Development Services Division of DTD to assess the need for erosion control.
    - Development that disturbs one acre or more but less than five acres requires a 1200-C permit from WES, acting as the County-wide Agent for DEQ.
    - Development that disturbs five acres or more requires a 1200-C permit with Public Notice.

  The Clackamas County Transportation Maintenance Division of DTD performs routine road maintenance and repair work within the County road rights-of-way, which may involve disturbing soils. The Division follows the Oregon Department of Transportation's *Routine Road Maintenance, Water Quality and Habitat Guide, Best Management Practices*, which was revised in 2009 (ODOT Guide). Proper erosion prevention and sediment control methods are addressed under several activities within the ODOT Guide, including but not limited to Activity #120 (Ditch Shaping and Cleaning), Activity 112 (Shoulder Rebuilding), and Activity 081 (Stockpiling). The County is working through the final stages with National Marine Fisher-

ies Service (NMFS) to have this subset of activities described in Limit 10(i) under section 4(d) of the Endangered Species Act (ESA) as exempt from ESA take provisions for activities that have the potential to cause take when its best management practices (BMPs) are used.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include tracking erosion control permits issued, inspections performed, enforcement actions taken, and education and outreach activities implemented.

Fiscal analysis: This management strategy is currently funded. Additional resources may be needed to fully implement this management strategy.

7.3 Public Involvement and Education

TMDL parameters addressed: *E. coli*, DDT, dieldrin, iron, mercury, and temperature

Description of the potential sources: Land management decisions on private lands and activities conducted by the public throughout the watershed affect overall watershed health and may contribute to the release of TMDL parameters into waterways. Educating the public about the way their practices can negatively or positively impact the health of the watershed is an important component in managing these potential sources.

Description of the Management Strategy: Public involvement and education is targeted by Clackamas County DTD and WES to encourage citizens to work and live in ways that protect and improve water quality. Public involvement and education is a part of many water quality management strategies implemented in Clackamas County including pet waste education and management, septic system education and management, responding to and preventing illegal solid waste dumping, addressing dead animals on County roads, spill response, industrial/commercial stormwater maintenance, erosion prevention and sediment control, and design/construction standards for new/redevelopment management strategies. Specific activities and strategies employed by Clackamas County to reduce potential sources of *E. coli*, DDT, dieldrin, mercury, iron, and temperature are described below.

E. coli

Public involvement and educational activities intended to reduce E. *coli* load contributions to waterways include the following:

- Educating the public about how to prevent septic system failures and how to report failures when they occur. This information is provided in brochures, on WES' website, and on request when citizens contact WES in person, by phone, e-mail, or U.S. mail.
  - Clackamas County's newsletter. The summer 2007 issue's page 6 contained a large (3/4 page) article on the proper way to care for a home's septic system. Proper care of septic systems prevent the discharge of sewage (and thus bacteria) into surface water bodies.

The spring 2006 issue contained an article titled "Buffer Zones: Protecting Sensitive Creeks and Streams", which as the title suggests, encouraged citizens to maintain their healthy—and enhance their degraded—riparian areas. Healthy riparian areas infiltrate, transpire, and filter non-point source stormwater runoff, and can reduce or assist in eliminating *E. coli* loading to streams and creeks, and may contribute to reducing water temperatures in receiving waterbodies.

One or more future newsletters may possibly include an article on one or more of the following topics that have the potential to further reduce in-stream *E. coli* loading levels:

- "Reasons why you should not feed ducks and geese"
- "Proper management of dog and cat wastes"
- "Please take your RV to an approved dump site after your vacation"

- Clackamas County Fair. In 2009, WES employees staffed the County's booth at the Fair during about one-quarter of the time that the Fair was open, and WES literature was available and distributed to the public from the booth during all hours that the Fair was open. Clackamas County employees distributed the literature during the times when WES employees were not in the booth. It is expected that WES employees will continue to staff the County's booth about one-quarter of the time during Fairs in future years. When citizens visit the booth during the Fair, WES literature provides information to the public on various bacteria-related subjects, including proper pet waste management and the value of proper maintenance of septic systems, and if WES staff are present in the booth at the time, additional information, advice, and guidance is provided on water quality and watershed health related issues.

- Clackamas County's Dog Services in parternship with Clackamas County Parks provide information about proper dog waste management (including dog waste bag dispensers and signs) to the general public at all County Parks. The Clackamas County Soil & Water Conservation District (CCSWCD). The CCSWCD provides assistance to landowners who are interested in conservation and watershed enhancement. While the CCSWCD is not a department of Clackamas County, it is noted here for Clackamas County and the CCSWCD work closely together. The CCSWCD helps landowners identify, plan for, and implement conservation measures that reduce pollutants coming off their lands including *E. coli* contamination through wise management of livestock manure, pet waste (this can include horses), and by installing vegetated buffer areas that allow stormwater to infiltrate into, be evaporated by, or filtered through the vegetated area. In November 2006, Clackamas County voters elected to increase their taxes and provide a stable funding source for the CCSWCD, allowing the CCSWCD to increase the level and quality of the services it provides.

DDT,Dieldrin, and Mercury

Public involvement and educational activities intended to reduce DDT, dieldrin, and mercury concentrations and pollutant loadings to waterways. The following provide examples of past County activities:

- Clackamas County's newsletter. The summer 2005 issue contained an article titled "Keeping the dirt where it belongs." This large (1/2 page) article addressed the fact that excessive

human-caused soil erosion can be harmful to aquatic life, then provided information on ways to control erosion at construction sites. The spring 2006 issue contained an article titled "Buffer Zones: Protecting Sensitive Creeks and Streams", which as the title suggests, encouraged citizens to maintain their healthy—and enhance their degraded—riparian areas. The spring 2006 article specifically stated that healthy riparian areas "minimize erosion." One or more future *Citizen News* newsletters may possibly carry other articles that encourage citizens to reduce or prevent soil erosion on property that they own or rent.

- *Clackamas County Fair.* In August 2009, WES employees staffed the County's booth at the Fair during about one-fourth of the time that the Fair was open, and WES literature was available and distributed to the public from the booth during all hours that the Fair was open. Clackamas County employees distributed the literature during the times when WES employees were not in the booth. It is expected that WES employees will continue to staff the County's booth about one-fourth of the time during Fairs in future years. When citizens visit the booth during the Fair, WES literature provides information to the public on the benefits of (and recommended way to) prevent and minimize soil erosion. If WES staff are present in the booth at the time citizens visit, additional information, advice, and guidance on this subject is provided.

- Metro's Household Hazardous Waste Facility in the City of Oregon City was also mentioned in the discussion of Illegal Disposal of Solid Waste Management Strategies. Metro's public involvement program encourages citizens to take unused amounts of hazardous wastes including insecticide products there for disposal. When inquiries from the public about the proper disposal method for potentially harmful substances (such as empty containers that once held pesticide/herbicide, unwanted quantities of pesticides/herbicides, and mercury-containing products) are received by Clackamas County, citizens are promptly forwarded to Metro's informational phone number (503-234-3000).

- CCSWCD. The CCSWCD provides assistance to landowners who are interested in conservation and watershed enhancement. While the CCSWCD is not a department of Clackamas County, it is noted here because Clackamas County and the CCSWCD work closely together. CCSWCD helps landowners identify, plan for, and implement conservation measures that reduce soil erosion in many ways (for example, by installing vegetated buffer areas that allow stormwater to infiltrate into, be evaporated by, or filtered by the vegetated area). In November 2006, Clackamas County voters elected to increase their taxes and provide a stable funding source to CCSWCD, allowing CCSWCD to increase the level and quality of the services it provides to landowners.

Iron

Public involvement and educational activities intended to reduce iron concentrations and pollutant loadings to waterways. The following provide examples of past County activities:

- Clackamas County's *Citizen News* newsletter. The summer 2005 issue contained an article titled "Keeping the dirt where it belongs." This large (1/2 page) article addressed the fact that excessive human-caused soil erosion can be harmful to aquatic life, then provided information on ways to control erosion at construction sites. The spring 2006 issue contained an article titled "Buffer Zones: Protecting Sensitive Creeks and Streams", which as the title suggests, encouraged citizens to maintain their healthy—and enhance their degraded—riparian

areas. The spring 2006 article specifically stated that healthy riparian areas "minimize erosion." One or more future newsletters may possibly carry other articles that encourage citizens to reduce or prevent soil erosion on property that they own or rent.

- CCSWCD. The CCSWCD provides assistance to landowners who are interested in conservation and watershed enhancement. While the CCSWCD is not a department of Clackamas County, it is noted here because Clackamas County and the CCSWCD work closely together. CCSWCD helps landowners identify, plan for, and implement conservation measures that reduce soil erosion in many ways (for example, by installing vegetated buffer areas that allow stormwater to infiltrate into, be evaporated by, or filtered by the vegetated area). In November 2006, Clackamas County voters elected to increase their taxes and provide a stable funding source to CCSWCD, allowing CCSWCD to increase the level and quality of the services it provides to landowners.

Temperature

Public involvement and education is targeted by Clackamas County to encourage citizens to maintain their existing healthy riparian areas, and to encourage them to enhance degraded riparian areas that are on their property. Riparian area-related public involvement and educational opportunities available to the citizens and property owners in the area regulated by the Molalla-Pudding Subbasin temperature TMDL are present in many forms. The following provide examples of past County activities:

- Clackamas County's *Citizen News* newsletter. The spring 2006 issue, for example, contained an article titled "Buffer Zones: Protecting Sensitive Creeks and Streams", which as the title suggests, encourages citizens to maintain their healthy—and enhance their degraded—riparian areas.

- *Clackamas County Fair.* In August 2009, WES employees staffed the County's booth at the Fair during about one-fourth of the time that the Fair was open, and WES literature was available and distributed to the public from the booth during all hours that the Fair was open. Clackamas County employees distributed the literature during the times when WES employees were not in the booth. It is expected that WES employees will continue to staff the County's booth about one-fourth of the time during Fairs in future years. When citizens visit the booth during the Fair, WES literature provides information to the public on the benefits of (and recommended way to perform) riparian restoration or protection. If WES staff are present in the booth at the time citizens visit, additional information, advice, and guidance on this subject is provided.

- *CCSWCD.* CCSWCD provides assistance to landowners who are interested in conservation and watershed enhancement. While the CCSWCD is not a department of Clackamas County, they are noted here because Clackamas County and the CCSWCD work closely together. They routinely assist landowners with identifying, planning, and undertaking riparian area protection and enhancement projects.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include performing qualitative assessments through interviews with staff and our customers as well as tracking public education and outreach metrics such as:

- The number of website "hits" per year.
- The number of brochures printed and distributed per year.
- The number of requests for speakers or surveys taken, give-away requests, or for more information.
- The number of pet waste bags taken from dispensers each year.
- The number of attendees at various WES sponsored or project related events.
- Erosion control education and outreach activities implemented each year.

Fiscal analysis: This management strategy is currently funded, although additional resources may be needed in the future.

7.4 Pet Waste Management

TMDL parameters addressed: *E. coli*

Description of the potential sources: When pet waste is left in uncovered areas stormwater can transport *E. coli* from the land surface into the waters of the Molalla-Pudding subbasin.

Description of the Management Strategy: There are two main elements to the pet waste management strategy:

- *Public involvement and education:* Chapter 7.3, Public Involvement and Education, provides more information on this element.
- *Technical assistance and enforcement:* This management strategy is implemented when reports of improper pet waste management are submitted to Clackamas County's DTD Code Compliance Section (CCS). The CCS staff is the County's solid waste management experts, and they can interface with complainants and pet owners to find solutions which prevent or greatly minimize the discharge of pet waste to the waterways.

  Not all types of solid waste generated by animals are addressed by CCSs program (e.g., agricultural activities that generate manure).

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address lim-

iting factors for watershed health. Assessment of this strategy will include performing qualitative assessments through interviews with staff and our customers and by tracking public education and outreach metrics such as:

- The number of website "hits" per year.
- The number of brochures printed and distributed per year.
- The number of pet waste bags taken from dispensers each year.

Fiscal analysis: This management strategy is currently funded.

7.5 Septic System Management

TMDL parameters addressed: *E. coli.*

Description of the potential sources: A potential source of bacteria in the waters regulated by the Molalla-Pudding subbasin TMDL is failing septic systems. A septic system that is failing or has failed can discharge improperly treated or untreated wastewater into a surface water body. A properly functioning septic system discharges all of its wastewater into the earth's uppermost, unsaturated soil layers after treatment; the water then percolates down into groundwater.

Description of the Management Strategy: WES administers the Onsite Sewage Treatment and Disposal (Onsite) Program as an agent of DEQ throughout Clackamas County. The goals of the program are to have no septic system failures and for all septic systems to be in a properly functioning condition. To achieve these goals, WES implements:

- A process to address suspected failed or failing systems, and
- A process to educate the public about how to prevent septic system failures and how to report failures when they occur. This process is discussed in Chapter 7.3, Public Involvement and Education.

When septic systems fail, WES is most often notified by the owner or renter of the property with the system, by an adjacent property owner/renter, by other County departments, or by other governmental agencies. Failing and failed septic systems are potential environmental and health hazards and they are a high priority for WES to address. The Onsite Program makes every effort to investigate a reported problem or complaint the same day that it has been received.

Once a site visit has been performed and a failed septic system is identified during the visit, steps for needed correction are identified and a process for implementation is established. Time frames for repair are discussed with the property owners and the length of time allotted to repair is determined based on the severity of the problem. Discharges to the ground surface and into waterways are not allowed and are given the shortest time that is feasible for construction of repairs or implementation of alternatives. Alternatives vary from limiting the usage of the septic system (timing of laundry, for example) to vacating the premises until the problem is resolved. To address failing septic systems Clackamas County funds the Safety Net Program, which provides low interest loans for low income property owners to repair failing septic systems.

WES has an agreement with Clackamas County's DTD CCS to bring violators into compliance if initial efforts are unsuccessful. All failing septic systems are an enforcement priority for CCS. Initial efforts made by CCS encourage voluntary compliance. In the event this is unsuccessful, CCS has the ability to levy both fines and fees for code violations. A citation with forfeiture up to $500 can be issued for a high priority violation. If a violation case is referred to the Compliance Hearings Officer, he/she can issue civil penalties up to $3,500 on priority one violations. Additionally, all costs incurred by CCS while administering the enforcement action, or a $75 monthly administrative fee, can also be assessed.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include tracking the number of reports of failing septic systems, the outcome of inspections (failing or not), the date of follow-up that confirmed repairs were made, and the number of Safety Net loans provided.

Fiscal analysis: This management strategy is currently funded.

7.6 Illegal Dumping Management

TMDL parameters addressed: *E. coli*, DDT, dieldrin, and mercury

Description of the potential sources: Illegal dumping of solid waste can allow stormwater to move pollutants from the waste and into the waterways regulated by the Molalla-Pudding subbasin TMDL. Solid waste that may contain *E. coli* includes but is not limited to diapers and other waste containing fecal matter. Solid waste that may contain DDT and dieldrin includes unused quantities of these insecticides and equipment or other items contaminated with residuals of these insecticides. Solid waste that may contain mercury includes but is not limited to fluorescent light bulbs, batteries, thermometers, and electronics.

Description of the Management Strategy: Illegal dumping of solid waste is addressed by three separate programs, each of which serves their own geographic area within the area that is regulated by the Molalla-Pudding Subbasin TMDL. Each program is described separately below:

- *Developed, unincorporated, primarily urban areas: County Ordinance:* Illegal dumping in developed, unincorporated, primarily urban areas is addressed by Clackamas County's DTD Code Compliance Section. The CCS administers a solid waste nuisance ordinance which pertains to illegal dumping on public and private property. This ordinance is administered on a priority-rated basis, and illegal dumping that involves household garbage is a high priority for enforcement and resolution. Mediation is an additional tool that CCS uses to resolve certain types of solid waste issues that cause a condition of unsightliness on private property.

- *Rural areas: Clackamas County's Dump Stoppers Program:* Illegal dumping of solid waste in rural areas, including the edges of roadways in these areas, is addressed by Clackamas County's Dump Stoppers Program. County employees respond to reports of illegally dumped waste and coordinate the removal of the waste. Crews of people who have been ordered to per-

form community service remove the garbage and properly dispose of or recycle it. County employees install "no dumping" signs, with the program's hotline prominently displayed, in places where dumping has occurred. County employees aggressively sift through the trash in search of clues that can identify the persons who illegally dumped the waste. A Sheriff Deputy who is assigned to this program uses these clues to confirm identities of dumpers, and then tracks down, and if appropriate, cites those persons. The Clackamas County District Attorney's office has assigned a prosecutor to this program, and it pursues the most egregious cases.

This program's success is largely due to effective partnerships between several County departments, residents, schools, recreationalists, and large landowners in the watershed like the U.S. Forest Service and the Bureau of Land Management.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include tracking waste removed through the Dump Stoppers Program, tracking the number of persons per year who complete the mediation process for solid waste dumping, and tracking the number of enforcement actions taken per year for solid waste dumping.

Fiscal analysis: This management strategy is currently funded.

7.7 Dead Animal Management

TMDL parameters addressed: *E. coli.*

Description of the potential sources: Warm-blooded animals carry *E. coli* in their gastrointestinal tract. Stormwater runoff could carry *E. coli* from a dead, warm-blooded animals (deer, for example) gastrointestinal tract into surface water bodies if its carcass was lying on or adjacent to a roadway or drainageway.

Description of the Management Strategy: Clackamas County's DTD Transportation Maintenance Division Strategies are as follows:

- Large, dead animals on County roads with "full County maintenance" are removed and properly disposed of by Clackamas County's Transportation Maintenance Division. The Division follows the Oregon Department of Transportation's *Routine Road Maintenance, Water Quality and Habitat Guide, Best Management Practices*, which was revised in 2009 (ODOT Guide). Removal of dead animals from the road is addressed in the ODOT Guide under "Accident Cleanup (Activity 149)"

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include tracking the number of dead animal removals performed annually.

Fiscal analysis: This management strategy is currently funded.

7.8 Spill Response and Illicit Discharge Elimination Programs

TMDL parameters addressed: *E. coli*, mercury, DDT and dieldrin

Description of the potential sources: The spill or illicit discharge of certain substances containing TMDL parameters such as *E. coli*, mercury, DDT and dieldrin can cause watershed health impairment.

Potential sources of *E. coli* include untreated sewage releases from a privately owned sanitary sewer line due to pipe failures or improper connections.

If unused quantities of DDT or dieldrin are spilled or illicitly discharged, these insecticides could flow directly (or indirectly via stormwater) into the waters of the Pudding River. Spills and illicit discharges of DDT and dieldrin are unlikely given that their use has been banned for many years.

If liquid or sludge-like materials that contain mercury are spilled or illicitly discharged, mercury could flow directly (or indirectly via stormwater) into a creek that discharges to or is a tributary of the Willamette River.

Description of the Management Strategy: Spill response and illicit discharge detection and elimination (IDDE) programs are addressed by several management strategies depending on location. Clackamas County's Management Strategies are as follows:

- *Clackamas County Roads:* If materials that potentially contain harmful substances (such as TMDL parameters including *E. coli*, mercury, DDT and dieldrin) are spilled or illicitly discharged onto a Clackamas County road's right-of-way in non-MS4-permitted areas and the impacted road segment is eligible for "full County maintenance," personnel from Clackamas County's Transportation Maintenance Division will respond if they discover the incident or if they are notified about the incident and it is determined that a response is appropriate.

  Crews will ensure that the release of the material is halted and that the material is subsequently cleaned up in a manner that prevents harmful substances from entering waters, if possible, or minimizes the amount of harmful substances that enters waterways if that is not possible. If a response by a government agency is required for a spill involving agricultural materials that contain TMDL parameters (i.e., *E. coli* from animal manure), ODA will provide oversight for the incident, in coordination with the Road Department. As was noted previously, the Clackamas County Transportation Maintenance Division adheres to the ODOT Guide. Roadway spill response work is addressed in "Accident Cleanup" (Activity 149) and "Spill Prevention and Cleanup" of the ODOT Guide.

- *Other geographic areas:* If Clackamas County DTD or WES staff are made aware of non-septic system related material containing TMDL parameters that is spilled or illicitly discharged in the following areas, DEQ will be contacted and the case will be referred to them:
  - Unincorporated, non-ODA/ODF areas regulated by the Molalla-Pudding Subbasin *E. coli* TMDL in Clackamas County
  - Areas that are state or federal lands
  - Clackamas County roads without "full County maintenance"

DEQ has the authority to do the applicable source control work on these lands and, if need be, can compel most responsible parties to halt or modify their discharge if spilled or illicitly discharged material contains a significant concentration of TMDL parameters and is likely to flow directly to Waters of the State.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include tracking the number of illicit discharges and spills per year.

Fiscal analysis: This management strategy is currently funded.

7.9 Riparian Assessment and Management

TMDL parameters addressed: Temperature

Description of the potential sources: Removal or disturbance of riparian vegetation reduces stream shading, exposing streams to higher levels of solar radiation. Solar radiation (sunlight) falling directly on streams can cause water temperature to increase. Alteration of the riparian canopy can also change the microclimate near streams, increasing air flow and heat exchange with the stream and thereby elevating water temperatures.

Description of the Management Strategy: Protection and restoration of system potential vegetation and effective shade in riparian areas are the primary mechanisms for achieving load allocations for temperature.

Clackamas County Parks periodically completes watershed/riparian restoration projects that include native tree/shrub planting within riparian corridors that are located in Clackamas County Parks. Within the past several years projects were completed at Feyrer Park and Ivor Davies Park with the City of Molalla. On average, Clackamas County Parks has planted approximately 150 trees and 150 shrubs per year.

Timeline for implementation: As funding becomes available, NCPRD will identify high priority restoration projects within the County.

Measurable milestones (if any): Implementation of this strategy will include identifying and prioritizing riparian areas for restoration or protection actions; identifying partner agencies and alternative funding sources. As restoration projects are completed tracking will include summarizing number of trees and shrubs planted and length of riparian area restored.

Fiscal analysis: This strategy is currently unfunded.

SECTION C

IMPLEMENTATION

8. Temperature

8.1 Matrix of Management Strategies

Table 5 lists strategies for management and reduction of elevated water temperature.

8.2 Barriers to Implementation

Much of the privately owned land in Clackamas County's portion of the area regulated by the Molalla-Pudding temperature TMDL lies within timber management and agricultural areas. The TMDL for the privately owned lands in timber management and agricultural areas is being implemented through ODF and ODA. Management strategies for these lands are not contained within this Implementation Plan.

System Potential shade conditions likely cannot be attained within 100 percent of the watershed's riparian area in Clackamas County on Clackamas County and non-ODA/ODF privately owned lands due to private property rights, historic land use decisions, and other factors.

8.3 Implementation Monitoring, Annual Status Reports, and Evaluation Reports

Implementation monitoring will be conducted by Clackamas County to confirm that specific Management Strategies outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be submitted to DEQ in Annual Status Reports, as is required by the TMDL's "Water Quality Management Plan". Every fifth year, an Evaluation Report will also be submitted.

8.4 Effectiveness Monitoring

Effectiveness monitoring is conducted to determine if the selected management strategies are effectively reducing in-stream pollutant loading from sources that Clackamas County is responsible for. The resulting data will then, from time to time, be compared to:

- The non-point source temperature load allocation (LA)—or the LA surrogate, percent effective shade—to determine if the allocation or surrogate has been attained, and/or
- Current water quality standards and to historic data to determine if in-stream water quality has improved to the desired level or by the desired percentage.

Clackamas County does not perform environmental monitoring within the Molalla-Pudding watershed, and will therefore rely on monitoring results from other agencies through development of partnership agreements. It is expected that temperature monitoring will be conducted in the future in portions of Clackamas County through efforts by other agencies or entities. Temperature monitoring could be conducted by DEQ,

ODFW, the USFS, the BLM, and/or other DMA's. Clackamas County has not identified other agencies collecting environmental data in the Molalla-Pudding watershed. As these agencies are identified, Clackamas County will work to develop partnership agreements to utilize this data as it becomes available to asses program effectiveness.

8.5 Timeline

The goal of Clackamas County is to attain the load allocations for each TMDL parameter through an adaptive management process. Clackamas County is committed to investing in activities and programs that contribute to overall watershed health. Clackamas County is currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and tracking the effectiveness of these activities with monitoring as described in Chapter 8.4. It is unknown at this time whether the current and planned level of management activities will provide enough pollutant load reduction to meet the load allocation given the barriers to implementation described in Chapter 8.2. As monitoring demonstrates progress toward pollutant reduction, Clackamas County will adaptively manage its activities and programs in order to work toward attaining the load allocations.

Clackamas County will address the temperature TMDL by focusing on increasing riparian shading. It will take many years for sufficient numbers of new trees to be planted and many more decades for those trees to grow to full height to develop effective riparian shading where it is lacking. Even if every degraded riparian area in the portion of the watershed in Clackamas County were to be planted with native trees within ten years, which is exceedingly unlikely, it would take at least sixty more years for the trees in all of these areas to reach sufficient size to yield System Potential shade conditions.

As discussed in the Barriers section, System Potential shade conditions likely cannot be attained within 100 percent of the watershed's riparian area in Clackamas County on Clackamas County and non-ODA/ODF privately owned lands due to private property rights, historic land use decisions, and other factors.

It is expected that the eventual attainment of high system potential shade values in the Clackamas County portion of the Molalla-Pudding Subbasin temperature TMDL's watershed will be the product of a loose or structured partnership between Clackamas County and:

- Citizens
- Non-profit organizations (watershed councils, Friends of Trees, SOLV, etc.)
- Certain for-profit companies who own land in the watershed
- The Clackamas County SWCD

Table 5. Management Strategies Matrix for Elevated Water Temperature

Source	Strategy	How	Responsible Agency	Applicable Jurisdiction-al Area	Fiscal analysis	Measure	Timeline	Milestone
What sources of this pollutant are under your jurisdiction?	*What is being done, or what will you do, to reduce and/or control pollution from this source?**	*How will this be done?**	*County Agency Responsible for Implementation[1]*	*Areas within the Molalla Pudding Watershed where this strategy would apply*	*What is the expected resource need?**	*How will we demonstrate successful implementation or completion of this strategy?**	*When do you expect it to be completed?**	*What goals do you expect to achieve, and by when, to know progress is being made?**
1. Effective shade (radiant heat)		For roads with Full County Maint., apply ODOT Guide. As roads are maintained, repaired, and rebuilt, the ODOT Guide's BMPs will be used to address river/stream surface shade where appropriate over time.	DTD	Clackamas County	Currently funded	Qualitative assessment through interviews with staff.	June 2013	Establish tracking measures and milestones
	a. Implement Other Watershed Protection Regulations	i. River and Stream Conservation Area (ZDO 704). This is administered by Clackamas County.	DTD	Land within unincorporated CC that is located outside of the Portland Metro UGB and / or outside of the Metro Service District Boundary	Currently funded	Track the number of approved building permits per year with riparian area setbacks.	June 2013	Establish tracking measures and milestones
		ii. Floodplain Management District (ZDO 703). This is administered by Clackamas County.	DTD	Unincorporated Lands within Clackamas County	Currently funded	Track the number of approved building permits per year which receive a ZDO 703 review.	June 2013	Establish tracking measures and milestones
		iii.. Wetland Provisions of ZDO 1002. This ZDO, which only applies to wetlands, is administered by Clackamas County.	DTD	Clackamas County	Currently funded	Track the number of approved building permits per year with wetland riparian area setbacks.	June 2013	Establish tracking measures and milestones
	b. Public involvement and education	Encourage landowners to voluntarily protect/enhance their riparian areas through public education and involvement.	DTD BCS - Parks CCSWCD WES	Clackamas County County Parks Clackamas County CCSD #1 and SWMACC	Currently funded, additional resources may be needed.	Qualitative assessment through interviews with staff.	June 2013	Establish tracking measures and milestones and begin partnership discussions
2. Riparian Assessment and Management	a. Riparian Restoration and Tree Plantings	watershed/riparian restoration projects that include native tree/shrub planting within riparian corridors that are located in Clackamas County Parks.	DTD and Parks	Clackamas County Parks	Unfunded	Track number of plantings, number of plants/shrubs planted, volunteer hours, etc.,	June 2013	Establish tracking measures and milestones and begin partnership discussions

9. *E. coli*

9.1 Matrix of Management Strategies

Table 6 lists strategies for reduction and management of *E. coli* (bacteria).

9.2 Barriers to Implementation

This Implementation Plan addresses *E. coli* that are discharged by the following types of conveyance systems from lands under Clackamas County jurisdiction for the TMDL implementation (i.e., land not owned by the state or federal government, and land not in Oregon Department of Agriculture (ODA)/Oregon Department of Forestry (ODF) regulated areas):

- Clackamas County storm sewer outfalls that are not subject to the MS4 permit's requirements.
- Privately owned storm sewer outfalls.
- Overland sheet flow or channelized flows that do not flow through MS4-permitted or privately owned storm sewer outfalls.

Clackamas County's authority to control sources of bacteria in privately owned conveyance systems is usually quite limited. If Clackamas County is aware of a privately owned conveyance system that is a significant known source of *E. coli*, the matter will be referred to the Oregon Department of Environmental Quality (DEQ) if public education and/or mediation fail to yield the necessary water quality improvement.

The sources of in-stream *E. coli* loading are generally not well defined, and in most instances are likely to include significant contributions from the feces of wild birds and mammals. Clackamas County cannot and does not accept sole responsibility for reducing *E. coli* loading in any of the Molalla-Pudding subbasin water bodies.

Clackamas County does accept some of the responsibility for reducing the fraction of the *E. coli* loading:

- Which originates on those lands which Clackamas County has the authority to regulate, and
- Which is generated by the specific land uses that Clackamas County has the authority to regulate, but
- Only if the *E. coli* loading is not from the feces of wild birds and mammals.

Land ownership categories that are potential sources of in-stream *E. coli* loading which Clackamas County has very little or no authority to regulate or control include, but are not limited to:

- Privately owned timberlands
- Privately owned farm, ranch, and orchard lands
- BLM and Forest Service lands (U.S. government)
- Nearly all lands within the other cities in the TMDL's geographic area

- Highways and other State-owned lands

The bacteria load allocation may be exceedingly difficult and prohibitively expensive to attain in many of those water bodies where more than 22 percent of the in-stream *E. coli* loading is from the feces of wild birds and mammals.

It is understood that Clackamas County is legally responsible only for preventing and/or controlling the portion of the *E. coli* load that originated in the gut of humans or in fecal material from pets–and then only if the authority is provided to regulate the activity which caused the pollution–but not from other host species, including livestock, wild mammals, and wild birds.

9.3 Implementation Monitoring, Annual Status Reports, and Evaluation Reports

According to OAR 340-042-0080(3)(a)(C), Clackamas County shall "Provide for performance monitoring...". The definition of performance monitoring, as provided in OAR 340-042-0030(7) is "…monitoring implementation of management strategies, including sector-specific and source-specific implementation plans, and resulting water quality changes." The two types of performance monitoring that are required, "implementation" and "effectiveness" monitoring, are addressed.

Implementation monitoring will be conducted by Clackamas County to confirm that specific Management Strategies that are outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be submitted to DEQ in Annual Status Reports, as is required by the TMDL's "Water Quality Management Plan". An Evaluation Report will be submitted every fifth year.

9.4 Effectiveness Monitoring

Effectiveness monitoring is conducted to determine if the Management Strategies are effectively reducing in-stream pollutant loading from sources that Clackamas County are partially or completely responsible for. The resulting data will then, from time to time, be compared to:

- The *E. coli* LA to determine if the allocation has been attained, and/or
- Current *E. coli* water quality standards/criteria and to historic data to determine if in-stream water quality has improved to the desired level or by the desired percentage.

Clackamas County does not perform environmental monitoring within the Molalla-Pudding watershed, and will therefore rely on monitoring results from other agencies through development of partnership agreements. It is expected that environmental/water quality monitoring will be conducted in the future in portions of Clackamas County through efforts by other agencies or entities. Temperature monitoring could be conducted by DEQ, ODFW, the USFS, the BLM, and/or other DMA's. Clackamas County has not identified other agencies collecting environmental data in the Molalla-Pudding watershed. As these agencies are identified, Clackamas County will work to develop partnership agreements to utilize this data as it becomes available to asses program effectiveness.

9.5 Timeline

The goal of Clackamas County is to attain the load allocations for each TMDL parameter through an adaptive management process. Clackamas County is committed to investing in activities and programs that contribute to overall watershed health. Clackamas County is currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and tracking the effectiveness of these activities with monitoring as described in Chapter 9.4. It is unknown at this time whether the current and planned level of management activities will provide enough pollutant load reduction to meet the load allocation given the barriers to implementation described in Chapter 9.2. As monitoring demonstrates progress toward pollutant reduction, Clackamas County will adaptively manage its activities and programs in order to work toward attaining the load allocations.

It is expected to take longer to attain the load allocations in areas where a larger share of the in-stream *E. coli* loading is from the feces of wild birds and mammals. The load allocation may be exceedingly difficult and prohibitively expensive to attain in many of those water bodies where more than 22 percent of the in-stream *E. coli* loading is from the feces of wild birds and mammals.

Attaining the load allocation for *E. coli* in the Molalla-Pudding TMDL subbasin will likely require action by a variety of government agencies and private landowners. Clackamas County work toward reducing *E. coli* in surface water will likely be complemented by actions taken by the following three government agencies that provide additional regulatory authority and/or education and technical assistance:

- The Clackamas County Soil & Water Conservation District
- ODA
- ODF

Table 6. Management Strategies Matrix for Bacteria

Source	Strategy	How	Responsible Agency	Strategy Jurisdiction	Fiscal analysis	Measure	Timeline	Milestone
What sources of this pollutant are under your jurisdiction?	*What is being done, or what will you do, to reduce and/or control pollution from this source?**	*How will this be done?**	*County Agency Responsible for Implementation[1]*	*Areas within the Molalla Pudding Watershed where this strategy would apply*	*What is the expected resource need?**	*How will we demonstrate successful implementation or completion of this strategy?**	*When do you expect it to be completed?**	*What goals do you expect to achieve, and by when, to know progress is being made?**
1. Failing septic systems	a. Septic system management	Respond to reports of failing systems; work with homeowner to set a timeline for repair. County-funded Safety Net Program provides low interest loans for low income property owners to repair failing septic systems.	WES	Clackamas County	Partially Funded	Track number of reports, outcome of inspection (failing or not), date of follow-up that confirmed repairs were made, and # of Safety Net loans provided.	June 2012	Update safety net program, establish milestones, and identify alternative funding sources (grants)
	b. Public involvement and education	Provide information in brochures, on WES' website, and upon request about septic system maintenance and how to detect failures.	WES	Clackamas County	Currently funded	Track the number of website "hits" and the number of brochures printed/year	Ongoing	Establish milestones and tracking measures
2. Pet waste	a. Pet waste management and Public involvement and education	Public education to pet owners through a variety of sources. Maintain educational signs and provide dog waste bag dispensers in parks.	Clackamas County Parks; Dog Services	Clackamas County	Currently funded	Track number of bags taken from dispensers each year. Track the number of website "hits" and the number of brochures printed/year	June 2013	Establish partnership agreements, milestones and tracking measures.
3. Dead animals	a. Dead animal management	Personnel from Clackamas County Road Dept. collect and properly dispose of large dead animals on full-service roads.	DTD	Clackamas County	Currently funded	Track the number of removals performed annually.	Ongoing	Annually report number of removals. Establish tracking measures and milestones.
4. Illegal dumping of solid waste	a. Illegal dumping management and public education and involvement	Implement Clackamas County's Dump Stoppers Program. Provide public education related to illegal dumping, including publicizing Metro hazardous waste facilities.	BCS	Rural Clackamas County	Currently funded	Track waste removed through Dump Stoppers Program. Track number of persons who complete mediation process for solid waste dumping. Track public education materials distributed.	Ongoing	Annually report number of persons who complete mediation process. Annually report the number of public educational materials distributed.
						Track number of enforcement actions taken/year for solid waste dumping.		Annually report number of enforcement actions.
5. Illicit discharges and spills	a. Spill response and IDDE	Implement spill response and IDDE program on Clackamas County full service roads. Refer other cases to DEQ.	DTD	Urban Clackamas County	Currently funded	Track the number of discharg-es/spills.	Ongoing	Annually report the number of spills
6. Runoff and soil erosion from construction sites	a. Implement Erosion control programs and public and education and involvement	i. ZDO Section 108, Development that disturbs more than 800 sf and less than 1 acre	DTD	Areas within the UGB (Molalla, Canby, Barlow)	Currently funded.	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Annually report permits issued, inspections, enforcement actions, and educational outreach activities.
		ii. 1200-C permit: disturbs more than 1 acre but less than 5 acre. Requires public notice if disturbance is greater than 5 acres.	WES	Clackamas County	Currently funded	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Annually report permits issued, inspections, enforcement actions, and educational outreach activities.

10. DDT and Dieldrin

10.1 Matrix of Management Strategies

Table 7 lists strategies for reduction and management of DDT and dieldrin in the Molalla-Pudding subbasin.

10.2 Barriers to Implementation

The DDT and dieldrin TMDL is limited to the Pudding River and Zollner Creek. As previously mention, none of Zollner Creek, nor any portion of the contributing area is within the Clackamas County Boundary. Approximately 20 miles of the Pudding River are located within Clackamas County, and approximately 7 miles of the Pudding are located along the County Boundary (Figure 1).

The Molalla-Pudding watershed consists of a patchwork of land uses/owners, draining a large rural area, portions of 13 cities, some urbanized unincorporated lands, and portions of two counties. Numerous agencies provide jurisdiction over certain activities which may cause in-stream DDT contamination. However, many soil-disturbing activities, such as gardening and off-road vehicle use, are not regulated by any agency.

Clackamas County accepts some of the responsibility for reducing the fraction of the DDT loading:

- Which originates on those lands which Clackamas County has the authority to regulate, and
- Which is generated by the specific land uses that Clackamas County has the authority to regulate.

Land ownership categories that are potential sources of in-stream DDT loading via non-point sources which Clackamas County has very little or no authority to regulate or control include, but are not limited to:

- Privately owned timberlands
- Privately owned farm, ranch, nursery, and orchard lands
- U.S. government-owned lands
- Nearly all lands within the other cities
- Highways and other State-owned lands

10.3 Implementation Monitoring, Annual Status Reports, and Evaluation Reports

Implementation monitoring will be conducted by Clackamas County to confirm that specific Management Strategies that are outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be submitted to DEQ in Annual Status Reports, as is required by the TMDL's "Water Quality Management Plan". An Evaluation Report will be submitted every fifth year.

10.4 Effectiveness Monitoring

Effectiveness monitoring is conducted to determine if the Management Strategies are effectively reducing in-stream pollutant loading from sources that Clackamas County are completely or partially responsible for. The

resulting data will then, from time to time, be compared to:

- The DDT LA or the TSS target to determine if the allocation has been attained, and/or
- Current DDT and dieldrin water quality standards/criteria and to historic data to determine if in-stream water quality has improved to the desired level.

Clackamas County does not perform environmental monitoring within the Molalla-Pudding watershed, and will therefore rely on monitoring results from other agencies through development of partnership agreements. It is expected that environmental/water quality monitoring will be conducted in the future in portions of Clackamas County through efforts by other agencies or entities. Temperature monitoring could be conducted by DEQ, ODFW, the USFS, the BLM, and/or other DMA's. Clackamas County has not identified other agencies collecting environmental data in the Molalla-Pudding watershed. As these agencies are identified, Clackamas County will work to develop partnership agreements to utilize this data as it becomes available to asses program effectiveness

10.5 Timeline

The goal of Clackamas County is to attain the load allocations for each TMDL parameter through an adaptive management process. Clackamas County is committed to investing in activities and programs that contribute to overall watershed health. Clackamas County is currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and tracking the effectiveness of these activities with monitoring as described in Chapter 10.4. It is unknown at this time whether the current and planned level of management activities will provide enough pollutant load reduction to meet the load allocation given the barriers to implementation described in Chapter 10.2. As monitoring demonstrates progress toward pollutant reduction, Clackamas County will adaptively manage its activities and programs in order to work toward attaining the load allocations.

The attainment of the TMDL Load Allocation will likely be due to a loose or structured partnership with the cities and the landowners mentioned above, and in combination with the following three government agencies who provide additional regulatory authority and/or education & technical assistance:

- The Clackamas County Soil and Water Conservation District
- ODA
- ODF

Table 7. Management Strategies Matrix for DDT and dieldrin

Source	Strategy	How	Responsible Agency	Strategy Jurisdiction	Fiscal analysis	Measure	Timeline	Milestone
What sources of this pollutant are under your jurisdiction?	*What is being done, or what will you do, to reduce and/or control pollution from this source?**	*How will this be done?**	*County Agency Responsible for Implementation[1]*	*Areas within the Molalla Pudding Watershed where this strategy would apply*	*What is the expected resource need?**	*How will we demonstrate successful implementation or completion of this strategy?**	*When do you expect it to be completed?**	*What goals do you expect to achieve, and by when, to know progress is being made?**
1. Illegal dumping of solid waste	a. Illegal dumping management and public education and involvement	Implement Clackamas County's Dump Stoppers. Provide public education related to illegal dumping, including publicizing Metro hazardous waste facilities.	BCS	Rural Clackamas County	Currently funded	• Track waste removed through Dump Stoppers Program. Track # of persons/year who complete mediation process for solid waste dumping.	Ongoing	Annually report number of persons who complete mediation process. Annually report the number of public educational materials distributed.
						• Track # of enforcement actions taken/year for solid waste dumping.		Annually report number of enforcement actions.
2. Illicit discharges and spills	a. Spill response and IDDE	Implement spill response and IDDE program on Clackamas County full service. Refer other cases to DEQ.	DTD	Urban Clackamas County	Currently funded	Track the number of discharges/spills.	Ongoing	Annually report the number of spills.
3. Runoff and soil erosion from construction sites	a. Implement Erosion control programs and public and education and involvement	i. ZDO Section 108, Development that disturbs more than 800 sf and less than 1 acre	DTD	Areas within the UGB (Molalla, Canby, Barlow)	Currently funded.	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Annually report permits issued, inspections, enforcement actions, and educational outreach activities.
		ii. 1200-C permit: disturbs more than 1 acre but less than 5 acre. Requires public notice if disturbance is greater than 5 acres.	WES	Clackamas County	Currently funded	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Annually report permits issued, inspections, enforcement actions, and educational outreach activities.

11. Mercury

11.1 Matrix of Management Strategies

Table 8 lists strategies for reduction and management of mercury.

11.2 Barriers to Implementation

Research has shown that much of the mercury which enters the Willamette River had been deposited in the watershed by the atmosphere. It is Clackamas County's understanding that we are not legally responsible for preventing and/or controlling the portion of the River's mercury load that had been deposited on our service areas by the atmosphere. We will reduce mercury contributions to waterways to the extent possible where we have the authority to regulate stormwater discharges from the locations where mercury is deposited. In many instances, we will make "good faith" efforts to reduce the portion of the mercury load that is attributable to atmospheric sources.

The stated objective of the mercury TMDL is to reduce average fish tissue mercury concentrations in the Willamette River so that all fish species are safe for human consumption. The multiple fish consumption advisories for mercury in the Willamette Basin and the numerous 303(d) listings indicate that this beneficial use is not currently being met. DEQ acknowledges that it may take many years, perhaps even decades, to ultimately achieve the desired reduction in fish tissue concentrations of mercury. In establishing interim water quality guidance values, DEQ considered the criteria and thresholds utilized when fish consumption advisories are issued.

Given that Clackamas County's portion of the watershed possesses many land uses in large rural and urban areas, numerous agencies share jurisdiction over some of the activities which may cause in-stream mercury contamination. Other activities, such as those which cause the atmosphere to deposit mercury in the watershed, or certain ways to cause mercury-containing soil to be disturbed and eroded, such as through extensive off-road vehicle use on private property, are not regulated at all. Unfortunately, unregulated and thinly regulated sources of mercury appear to account for the vast majority of the River's annual mercury loading. Only a small amount of the River's annual mercury loading is being discharged by publicly owned wastewater treatment plants (estimated to be 2.72 percent of the Willamette River's total mercury load per year) or by industries (estimated to be 1.17 percent of the total/year).

Land ownership categories in Clackamas County that are potential sources of in-stream mercury loading via non-point source stormwater runoff which Clackamas County has very little or no authority to regulate or control include, but are not limited to:

- Privately owned timberlands
- Privately owned farm, ranch, nursery, and orchard lands
- U.S. government-owned lands
- Lands within cities
- Highways and other State-owned lands

For these reasons, Clackamas County cannot and does not accept sole responsibility for reducing in-stream mercury loads from non-point sources in Clackamas County. Clackamas County does accept some of the responsibility for reducing the fraction of the mercury loading:

- Which originates on those lands which Clackamas County has the authority to regulate, and
- Which is generated by the specific land uses that Clackamas County has the authority to regulate.

11.3 Implementation Monitoring, Annual Status Reports, and Evaluation Reports

Implementation monitoring will be conducted by Clackamas to confirm that specific Management Strategies that are outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be submitted to DEQ in Annual Status Reports, as is required by the TMDL's "Water Quality Management Plan". Every fifth year, an Evaluation Report will also need to be submitted.

11.4 Effectiveness Monitoring

Effectiveness monitoring is expected to be conducted to determine if our Management Strategies are effectively reducing in-stream mercury loading from sources that Clackamas County are completely or partially responsible for.

Clackamas County does not perform environmental monitoring within the Molalla-Pudding watershed, and will therefore rely on monitoring results from other agencies through development of partnership agreements. It is expected that environmental/water quality monitoring will be conducted in the future in portions of Clackamas County through efforts by other agencies or entities. Temperature monitoring could be conducted by DEQ, ODFW, the USFS, the BLM, and/or other DMA's. Clackamas County has not identified other agencies collecting environmental data in the Molalla-Pudding watershed. As these agencies are identified, Clackamas County will work to develop partnership agreements to utilize this data as it becomes available to asses program effectiveness.

11.5 Timeline

The goal of Clackamas County, WES, and Happy Valley is to attain the load allocations for each TMDL parameter through an adaptive management process. Clackamas County is committed to investing in activities and programs that contribute to overall watershed health. Clackamas County is currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and tracking the effectiveness of these activities with monitoring as described in Chapter 10.4. It is unknown at this time whether the current and planned level of management activities will provide enough pollutant load reduction to meet the load allocation given the barriers to implementation described in Chapter 10.2. As monitoring demonstrates progress toward pollutant reduction, Clackamas County will adaptively manage its activities and programs in order to work toward attaining the load allocations.

Quantifying Clackamas County's role in progressing towards meeting the entire Willamette River watershed's Interim Allocation Load (IAL) will be challenging due to the many potential sources of mercury and the barriers to implementation discussed above. The amount of mercury that is coming from Clackamas County stormwater runoff and other non-point sources has not yet been estimated closely. Only a small amount of the River's annual mercury loading is being discharged by publicly owned wastewater treatment plants (estimated to be 2.72 percent of the Willamette River's total mercury load per year) or by industries (estimated to be 1.17 percent of the total/year).

The attainment of the non-point source mercury IAL will likely be due to a loose or structured partnership

with cities and private landowners, in combination with the following three government agencies who provide additional regulatory authority and/or education & technical assistance:

- The Clackamas County Soil and Water Conservation District
- ODA
- ODF

Table 8. Management Strategies Matrix for Mercury

Source	Strategy	How	Responsible Agency	Strategy Jurisdiction	Fiscal analysis	Measure	Timeline	Milestone
What sources of this pollutant are under your jurisdiction?	*What is being done, or what will you do, to reduce and/or control pollution from this source?**	*How will this be done?**	*County Agency Responsible for Implementation[1]*	*Areas within the Molalla Pudding Watershed where this strategy would apply*	*What is the expected resource need?**	*How will we demonstrate successful implementation or completion of this strategy?**	*When do you expect it to be completed?**	*What goals do you expect to achieve, and by when, to know progress is being made?**
1. Illegal dumping of solid waste	a. Illegal dumping management and public education and involvement	Implement Clackamas County's Dump Stoppers. Provide public education related to illegal dumping, including publicizing Metro hazardous waste facilities.	BCS	Rural Clackamas County	Currently funded	• Track waste removed through Dump Stoppers Program. Track # of persons/year who complete mediation process for solid waste dumping.	Ongoing	Annually report number of persons who complete mediation process. Annually report the number of public educational materials distributed.
						• Track # of enforcement actions taken/year for solid waste dumping.		Annually report number of enforcement actions.
2. Illicit discharges and spills	a. Spill response and IDDE	Implement spill response and IDDE program on Clackamas County full service. Refer other cases to DEQ.	DTD	Urban Clackamas County	Currently funded	Track the number of discharges/spills.	Ongoing	Annually report the number of spills.
3. Runoff and soil erosion from construction sites	a. Implement Erosion control programs and public and education and involvement	i. ZDO Section 108, Development that disturbs more than 800 sf and less than 1 acre	DTD	Areas within the UGB (Molalla, Canby, Barlow)	Currently funded.	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Annually report permits issued, inspections, enforcement actions, and educational outreach activities.
		ii. 1200-C permit: disturbs more than 1 acre but less than 5 acre. Requires public notice if disturbance is greater than 5 acres.	WES	Clackamas County	Currently funded	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Annually report permits issued, inspections, enforcement actions, and educational outreach activities.

12. Iron

12.1 Matrix of Management Strategies

Table 7 lists strategies for reduction and management of Iron in the Molalla-Pudding subbasin.

12.2 Barriers to Implementation

The Molalla-Pudding watershed consists of a patchwork of land uses/owners, draining a large rural area, portions of 13 cities, some urbanized unincorporated lands, and portions of two counties. Numerous agencies provide jurisdiction over certain activities which may cause in-stream iron contamination. However, many soil-disturbing activities, such as gardening and off-road vehicle use, are not regulated by any agency.

Clackamas County accepts some of the responsibility for reducing the fraction of the iron loading:

- Which originates on those lands which Clackamas County has the authority to regulate, and
- Which is generated by the specific land uses that Clackamas County has the authority to regulate.

Land ownership categories that are potential sources of in-stream iron loading via non-point sources which Clackamas County has very little or no authority to regulate or control include, but are not limited to:

- Privately owned timberlands
- Privately owned farm, ranch, nursery, and orchard lands
- U.S. government-owned lands
- Nearly all lands within the other cities
- Highways and other State-owned lands

12.3 Implementation Monitoring, Annual Status Reports, and Evaluation Reports

Implementation monitoring will be conducted by Clackamas County to confirm that specific Management Strategies that are outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be submitted to DEQ in Annual Status Reports, as is required by the TMDL's "Water Quality Management Plan". An Evaluation Report will also be submitted every fifth year.

12.4 Effectiveness Monitoring

Effectiveness monitoring is conducted to determine if the Management Strategies are effectively reducing in-stream pollutant loading from sources that Clackamas County are completely or partially responsible for. The resulting data will then, from time to time, be compared to:

- The iron LA or the TSS target to determine if the allocation has been attained, and/or
- Current iron water quality standards/criteria and to historic data to determine if in-stream water quality has improved to the desired level.

It is expected that water quality monitoring will be conducted in the future in portions of Clackamas County through efforts by other agencies or entities. Water quality monitoring could be conducted by DEQ, ODFW, the USFS, the BLM, and/or other DMA's. Clackamas County plans to use data as it becomes available to perform effectiveness monitoring.

12.5 Timeline

The goal of Clackamas County is to attain the load allocations for each TMDL parameter through an adaptive management process. Clackamas County is committed to investing in activities and programs that contribute to overall watershed health. Clackamas County is currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and tracking the effectiveness of these activities with monitoring as described in Chapter 11.4. It is unknown at this time whether the current and planned level of management activities will provide enough pollutant load reduction to meet the load allocation given the barriers to implementation described in Chapter 11.2. As monitoring demonstrates progress toward pollutant reduction, Clackamas County will adaptively manage its activities and programs in order to work toward attaining the load allocations.

The attainment of the TMDL Load Allocation will likely be due to a loose or structured partnership with the cities and the landowners mentioned above, and in combination with the following three government agencies who provide additional regulatory authority and/or education & technical assistance:

- The Clackamas County Soil and Water Conservation District
- ODA
- ODF

Table 9. Management Strategies Matrix for Iron

Source	Strategy	How	Responsible Agency	Strategy Jurisdiction	Fiscal analysis	Measure	Timeline	Milestone
What sources of this pollutant are under your jurisdiction?	*What is being done, or what will you do, to reduce and/or control pollution from this source?**	*How will this be done?**	*County Agency Responsible for Implementation†*	*Areas within the Molalla Pudding Watershed where this strategy would apply*	*What is the expected resource need?**	*How will we demonstrate successful implementation or completion of this strategy?**	*When do you expect it to be completed?**	*What goals do you expect to achieve, and by when, to know progress is being made?**
3. Runoff and soil erosion from construction sites	a. Implement Erosion control programs and public and education and involvement	i. ZDO Section 108, Development that disturbs more than 800 sf and less than 1 acre	DTD	Areas within the UGB (Molalla, Canby, Barlow)	Currently funded.	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Annually report permits issued, inspections, enforcement actions, and educational outreach activities.
		ii. 1200-C permit: disturbs more than 1 acre but less than 5 acre. Requires public notice if disturbance is greater than 5 acres.	WES	Clackamas County	Currently funded	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Annually report permits issued, inspections, enforcement actions, and educational outreach activities.

13. Review and Revision of Plan

According to OAR 340-042-0080(3)(a)(C), Clackamas County shall "Provide for… periodic review and revision of the implementation plan." The County will review and revise the Implementation Plan on an as-needed basis. At minimum, we expect to review and, if deemed necessary, revise the Implementation Plan soon after the Molalla-Pudding Subbasin TMDL is revised in the future by the DEQ. We and the DEQ expect that the TMDL revision date will be in, five years from the date of acceptance of Implementation plan. This Implementation Plan may be reviewed and, if deemed necessary, revised at other times if we learn that one or more cost-effective modifications to the Implementation Plan can be made which, if implemented, will result in attainment, or significant progress towards attainment, of one or more LA.

14. Statewide Land Use Requirements

Oregon Administrative Rule 340-042-0080(3)(a)(D) states that—to the extent required by ORS 197.180 and OAR chapter 340, Division 18—evidence of this Implementation Plan's compliance with the applicable land use requirements shall be provided. Clackamas County is currently in compliance with all land use requirements which pertain to this Implementation Plan. This Implementation Plan is consistent with Clackamas County's Comprehensive Plan and land use regulations. These Comprehensive Plans have been acknowledged by Oregon's Land Conservation and Development Commission to be in compliance with the Statewide Planning Goals. This Implementation Plan is consistent with the County's Comprehensive Plan and the City's Comprehensive Plan to the extent required by law.

For example, within the Clackamas County Comprehensive Plan's "Natural Resources and Energy" Chapter, setback distances from streams/wetland/rivers are addressed with broad policies and in specific detail. These broad setback distance policies and details are then repeated and detailed further in Sections 704 and 1002 of the Zoning and Development Ordinance. While the Clackamas County Comprehensive Plan does not specifically mention TMDLs by name, overarching goals that are present in the TMDL—including the need to keep in-stream water temperatures down during the summer—are addressed in the Comprehensive Plan.

15. Citation of Legal Authority

- *Clackamas County Comprehensive Plan, ZDOs, and Other Board Orders.* The Clackamas County Comprehensive Plan was last updated on May 31, 2000. The Comprehensive Plan addresses planning goals and policies, including land use, transportation, community and design plans, stormwater drainage, natural resources, and open space/parks. Current policies regarding development, implementation, and enforcement of stormwater controls for new development or redevelopment are identified in the Public Facilities and Services element of the Comprehensive Plan. The Comprehensive Plan provides authority to adopt measures that protect surface/stormwater quality.

  Zoning and Development Ordinances (ZDO) provides the rules, regulations, and standards that implement the goals and policies of the Comprehensive Plan. The ZDOs that serve to protect surface/stormwater quality are:

  - Floodplain Management District (Section 703)
  - River and Stream Conservation Area (Section 704)

- Willamette River Greenway (Section 705)
- Protection of Natural Features (Section 1002)
- Utility Lines and Facilities (Section 1006)
- Storm Drainage (Section 1008). Includes stormwater quality control, such as detention and erosion control.
- Open Space and Parks (Section 1011)
- Density Standards, Transfers and Bonuses (Section 1012)
- Planned Unit Developments (Section 1013)
- Open Space Review (Section 1103).

Existing regulations that prohibit illicit connections to storm sewers are promulgated in ORS 447.140. Clackamas County Board Order 81-1-36 ("An Ordinance Pertaining to Enforcement of the Building Code, Excavation and Grading Standards, and Sewage Disposal System Standards"), as amended pursuant to Ordinance No. 05-2000 provides Clackamas County with the authority to enforce regulations which prevent and control illicit connections. This Order was amended by Board Order 88-179 to include grading and filling regulations.

The Comprehensive Plan, ZDOs, and Board Orders apply during new/redevelopment and during times when development is not proposed or occurring. If a property is not being developed or redeveloped, Clackamas County's DTD administer the applicable portions of the Comprehensive Plan, the applicable ZDOs, and many Board Orders. If a property has been proposed to be developed/redeveloped, all Plans are checked for conformance with the following:

- ZDOs (Clackamas County)
- Grading and Excavation Ordinances (Clackamas County)
- *Clackamas County Roadway Standards*. This document provides requirements for drainage standards, roadway standards, and site development, including a section on hydrology, hydraulics, and water quality. The manual was completed in January 1999 (Clackamas County) and revised January 1, 2010. The revisions adopted WES Design Standards for CCSD#1 and SWMACC with certain exceptions. Refer to Chapter 4 of the Roadway Standards for additional detail.

16. References

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