Lower Coast Fork Willamette River

Watershed Assessment

Chapter 8 Water Quality

8.1 Introduction and Background

The term "water quality" has many aspects. It is reflected in the chemical and physical characteristics of water, and by the organisms living in the water. Physical and chemical measures of water quality include temperature, dissolved oxygen, turbidity, chlorophyll, nutrients, and toxins such as heavy metals, pesticides and other chemicals. Biological measures of water quality include the type and amount of bacteria, algae, macroinvertebrates and fish. Chemical and physical measurements of water quality provide a useful momentary snapshot. However, the organisms that live in the water often provide a good indicator of what water quality has been over the past several months or even years.

Each of these water quality characteristics has a different significance to the organisms living in the water. Below is a brief summary of the primary characteristics that are commonly measured in a water-monitoring program. This should help the reader interpret any monitoring data that is available.

- Dissolved oxygen: Obviously humans can't breathe in water, but we all know that fish do. Just like humans are sensitive to the amount of oxygen in the air, fish and other aquatic species experience some degree of stress or death at dissolved oxygen levels below 8 to 10 mg/l. One factor affecting the amount of dissolved oxygen in water is temperature. The higher the temperature, the less oxygen water can hold. Another factor is the amount of biological activity. If a lake or stream has a lot of algae and bacteria this results in large amounts of oxygen being generated and consumed. Both low levels of dissolved oxygen and large fluctuations in daily oxygen levels are stressful and sometimes deadly to fish and other aquatic life.
- pH: This measurement reflects the relative acidity and alkalinity of a solution that is a number on a scale of 1 to 14 on which a value of 7 represents neutrality and lower numbers indicate increasing acidity and higher numbers increasing alkalinity (1 = highly acid, 7 = neutral, 14 = Highly alkaline). The pH of rainwater in the pacific Northwest is between pH 5 and 6. The pH of rainwater increases once it hits the ground and intercepts soil particles and other substances. Most aquatic organisms can tolerate a range from pH 6.5 to 8.5. The pH in a river or lake can be influenced by human activity (e.g. industry, automobile exhaust, etc.), the soil and rock types in the watershed, and even the amount of photosynthesis of algae in the water.

- Heavy metals: In some contexts, the definition of a metal is based on physical properties such as high thermal and electrical conductivity, high reflectivity and metallic luster, strength, and ductility. From a biological perspective it is more common to use a broader definition that says a metal is an element that will give up one or more electrons to form a cation in an aqueous solution. With this latter definition, there are about 80 elements that can be called metals. The term heavy metal is less precisely defined. In chemical terms it is more often simply used to denote metals that are toxic. The list of toxic metals includes aluminum, arsenic, beryllium, bismuth, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, strontium, thallium, tin, titanium, and zinc. Some of these metals, such as chromium and iron, are essential nutrients in our diets, but in higher doses are extremely toxic.
- Nutrients: The most significant nutrients impacting water quality are nitrogen and phosphorus, because they are the ones that tend to limit plant growth. High levels of either of these nutrients can lead to large blooms of algae, which in turn leads to lower dissolved oxygen levels. Sources of nutrients include; decaying plants or animals in the water; discharge from wastewater treatment plants; leaking septic systems; fecal matter/manure from wild animals and livestock that wash into the water during storms; and fertilizers or detergents that runoff from urban, rural and agricultural land.
- Fecal coliform bacteria: A well known example of this kind of bacteria is E. coli., the culprit that has caused sickness in humans, and in some cases death, from the ingestion of poorly stored meat or unpasteurized apple juice. As the name implies, this type of bacterium often originates from fecal matter. Common sources that can contaminate surface waters include runoff carrying livestock manure, fecal matter from wildlife or domestic pets, and human sewage from leaking septic systems.
- Macroinvertebrates: Technically this word means animals with no vertebrae (i.e. backbone) that are not microscopic. Typical macroinvertebrate indicators of water quality include the aquatic larval stage of insects like Caddisflies, Mayflies and Stoneflies, as well as various aquatic worms. A large diversity and abundance of macroinvertebrates generally indicate good water quality and habitat conditions.
- Temperature: In addition to affecting the amount of oxygen water can hold (the higher the temperature, the lower the amount of dissolved oxygen it can hold), elevated temperatures can also weaken or kill fish, especially salmonids, which include both trout and salmon. Salmonids are especially sensitive to temperature before they hatch and during their early stages of life.
- Sediment: This includes dissolved and suspended soil particles in the water column and is commonly measured as total suspended solids, total dissolved solids and/or turbidity. High levels of suspended sediment are detrimental to fish because it can damage their gills, fill in spawning gravels, and impair the ability of sight-feeding fish to see their prey. The same processes that introduce sediment into the water also brings nutrients, pesticides and metals into the water. Therefore, reducing the amount of sediment that enters the stream from overland runoff can reduce the amounts of other pollutants entering the stream.

- Pesticides: This includes any chemical used to prevent the growth of unwanted insects, plants or plant diseases like fungus or bacteria. The terms herbicide, insecticide and fungicide are all included in the term pesticide. When these chemicals get into surface waters they can cause weakness, deformities or death of both plants and animals inhabiting the water or riparian zone.

In Oregon the Department of Environmental Quality (ODEQ) and the Department of Agriculture regulate water quality and are required to implement and enforce the guidelines set out in the Federal Clean Water Act. Part of this enforcement includes setting criteria or standards for water quality that protect freshwater-aquatic life and human health. This assessment uses the evaluation criteria created for the protection of freshwater-aquatic life because the data presented are from surface waters. Criteria developed for the protection of human health generally apply to drinking water and is beyond the scope of this discussion.

Criteria that protect freshwater aquatic life have been established for only some of the conventional measures of water quality, including water temperature, dissolved oxygen, nitrates, total dissolved solids and pH. Many other water quality measurements do not have established criteria. This is particularly true for pesticides. There are also no guidelines for the combined or cumulative effects of pesticides.

In order to evaluate the significance of individual characteristics of water quality it is important to consider the multiple benefits surface waters provide. The designated beneficial uses of the Coast Fork are identified in Oregon's Administrative Rules (OAR Chapter 340). Part of the challenge we face is to address the multiple demands for water in the basin. Including:

Water Supply
Irrigation
Livestock Watering
Salmonid Fish Spawning and Rearing
Resident Fish & Aquatic Life
Recreation and Aesthetics

Salmonid fish rearing and spawning is considered the most sensitive beneficial. This does not mean that it is the most important, rather it means that salmonids are more sensitive to poor water quality and instream habitat degradation than other beneficial uses. Because of this the standards for water quality and instream conditions are geared towards assuring adequate quality for salmonids, which will also assure adequate quality for other beneficial uses.

8.2 Water Quality Monitoring in the Basin

According to the October, 1995 Water Quality Report, Total Maximum Daily Load Program published by DEQ, monthly water quality monitoring data has been available at river mile 6.4 for the period 1979 through 1987, and at river mile 3.0 since 1987. More recent water quality data is available at a total of eight (8) locations in the Coast Fork and Row River since 1988.

The LCFW assessment area sampling sites have been categorized into three main categories based on the nearest point source or non-point source to the sampling site. The categories include: Sewage Treatment Plant (STP) sampling sites, Short Mountain Landfill (LF) sampling sites, and Miscellaneous (Misc) sampling sites. There are six STP sampling sites, two LF sampling sites, and nine Misc sampling sites. **Table 8-1** provides a detailed listing of monitoring sites.

Table 8-1 LCFW Monitoring Sites

Station ID	Location	Category	Sample Start Date	Sample End Date	Number of Samples
10379	Coast Fork Willamette at Hwy 58	misc	7/13/1950	9/12/1989	4169
10380	Coast Fork Willamette at Creswell	misc	7/26/1950	10/15/1991	1831
10381	Coast Fork Willamette at Saginaw Bridge	misc	7/13/1950	10/10/1989	660
11275	coast Fork Willamette at Mt. Pisgah Park	misc	2/20/1973	4/7/2003	6363
11282	Camas Swale at Hwy 99	misc	2/20/1973	10/12/1976	71
11284	Hills Creek at Cloverdale Rd	misc	7/17/1973	10/12/1976	60
18315	Delight School (Saginaw)	misc	10/2/1991	3/28/2003	4944
18317	Creswell High School	misc	9/3/1976	5/14/1980	227
18891	Camas Swale Unnamed near mouth	misc	12/17/1998	12/17/1998	12
10910	Gettings Creek at Mouth	NA			
11280	Russel Creek at Franklin Blvd (Eugene)	NA			
11281	Wild Hog Creek at Seavy Loop Rd	NA			
11283	Camas Swale at Sher Kahn Rd	NA			
14058	Camas Swale U/S Short Mt Landfill	NA			
14059	Camas Swale D/S Short Mt Landfill	NA			
18890	Camas Swale Unnamed Trib 100' D/S Creswell STP	STP	12/17/1998	12/17/1998	15
18892	Creswell STP Final Effluent	STP	12/17/1998	12/17/1998	13
18893	Camas Swale Above Creswell STP	STP	12/17/1998	12/17/1998	12
18894	Camas Swale Unnamed Trib U/S Creswell STP	STP	12/17/1998	12/17/1998	15
18895	Camas Swale Below Creswell STP	STP	12/17/1998	12/17/1998	29
18896	Creswell StTP Outfall	STP	12/17/1998	12/17/1998	15
15774	Short Mtn LF MW 1	Landfill	4/26/1984	11/21/1988	257
15775	Short Mtn LF MW 2	Landfill	4/26/1984	11/17/1993	614
15780	Short Mtn LF MW 3	Landfill	4/26/1984	6/19/1996	837
15781	Short Mtn LF MW 4	Landfill	4/26/1984	11/17/1993	554
15782	Short Mtn LF MW 5	Landfill	4/26/1984	4/25/1990	380
15783	Short Mtn LF MW 6	Landfill	4/26/1984	11/26/1991	532
15784	Short Mtn Leachate Lagoon	Landfill	3/13/1978	2/28/1995	1347
15787	Monitoring Well No. 1N	Landfill	5/10/1988	3/23/1999	660
15788	Short Mtn LF MW 7	Landfill	5/10/1988	11/17/1993	506
15789	Short Mtn LF MW 8	Landfill	5/16/1991	6/19/1996	848
15790	Short Mtn LF MW 9	Landfill	5/14/1991	11/17/1993	396
15791	Short Mtn LF MW 10	Landfill	5/14/1991	6/18/1996	706

15792	Short Mtn LF MW 11	Landfill	5/14/1991	11/17/1993	396
15793	Short Mtn LF MW 12	Landfill	5/13/1991	5/18/1993	335
15794	Short Mtn LF MW 13	Landfill	5/14/1991	5/18/1993	335
15795	Short Mtn LF MW 12A	Landfill	11/17/1993	11/17/1993	61
15796	Short Mtn LF MW 12B	Landfill	11/17/1993	11/17/1993	61
15797	Short Mtn LF MW 7B Part of Short 11 Cluster	Landfill	11/17/1993	6/18/1996	249

Table 8-1 LCFW Monitoring Sites Cont'd

Station ID	Location	Category	Sample Start Date	Sample End Date	Number of Samples
15798	Short Mtn LF MW 13A	Landfill	12/28/1993	6/19/1996	258
15799	Short Mtn LF MW 13B	Landfill	12/28/1993	12/28/1993	67
15800	Short Mtn LF MW 14	Landfill	12/28/1993	12/28/1993	120
15801	Short Mtn LF Cs 3	Landfill	2/28/1995	6/18/1996	197
15802	Short Mtn LF Cs 2	Landfill	2/28/1995	3/23/1999	318
15803	Short Mtn Lc 2 Lagoon	Landfill	2/28/1995	2/28/1995	70
15804	Short Mtn Lc 3 Sump	Landfill	2/28/1995	2/28/1995	71
22707	MW 12C	Landfill	3/24/1999	3/24/1999	73
22708	MW 10A	Landfill	3/24/1999	3/24/1999	73
22709	MW 15B	Landfill	3/22/1999	3/22/1999	73
22710	MW 8A	Landfill	3/22/1999	3/22/1999	73
22711	Mw 15A	Landfill	3/23/1999	3/23/1999	77
22712	CS 1A	Landfill	3/23/1999	3/23/1999	77
23646	Mw 15B	Landfill	6/28/2000	6/28/2000	5
15778	Short Mtn LF Lagoon Lc 2	Landfill NA			
15779	Short Mtn LF Lc 3 Sump East of Lagoon	Landfill NA			
46771	Short Mtn Lf Secondary Leachate Sump	Landfill NA			
15776	Short Mtn Cs 3 Camas Swale Cr Dwn Stream	Stream NA			
15777	Short Mtn Cs 2 Camas Swale Adjacent LF	Stream NA			
15785	Short Mtn LF U/S On Camas Swale	LF Stream	11/14/1979	3/22/1999	1146
15786	Short Mtn LF D/S On Camas Swale	LF Stream	3/19/1979	11/16/1993	783

Stream discharge data is available below the confluence of the Row River near Saginaw and near Goshen at Highway 58.

Limited data is available describing diurnal cycles, algal biomass, biomass accumulation, and periphyton community production and respiration.

The Cottage Grove Sewage Treatment Plant is the only major point source that discharges to the Coast Fork during summer low flow conditions. Although this source is outside of the assessment area it has a direct impact on water quality in the assessment area.

Nonpoint sources have not been extensively assessed. Concentrations of nutrient upstream of the major point source are high enough to support significant periphyton growth. However, point source discharge provides the dominant source of nutrients to the Lower Coast Fork during low flow periods when standards violations have been observed.

Most water quality data collection since 1950 has either been discontinued or was conducted for a limited period of time. The most complete and up to date data available comes from station # 11275, Coast Fork Willamette at Mt. Pisgah Park. This station continues to be monitored.

8.3 Water Quality Conditions

Overall water quality conditions in the LCFW Watershed can be interpreted in a number of ways. A regulatory perspective might focus on the percentage of water samples not meeting criteria or recommendations set by the DEQ for a particular characteristic (e.g. dissolved oxygen, temperature, etc.). A second perspective is the degree to which beneficial uses are being impacted. For example, how does water quality in the various tributaries and main stem of the LCFW impact cutthroat Trout (salmonids), which are considered the most sensitive of the beneficial uses in the watershed? A third perspective, and one that is most difficult to address, is the degree to which water quality has changed from human activities. In addition to humans, soil types, riparian vegetation, stream gradients, and amount of rainfall also influence water quality. Because no historical data on water quality is available it is difficult to judge the relative contribution of humans or determine how water quality has changed.

The ODEQ collects information used to determine whether water quality standards are being violated and consequently, whether the beneficial uses of the waters are being threatened. The term "water quality limited" is applied to waterbodies where water quality standards violations occur. The State establishes a "Total Maximum Daily Load or TMDL" for any water body designated as water quality limited. A TMDL is the total amount of a pollutant that can enter a specific waterbody without violating the water quality standards.

The October 1995 Coast Fork Water Quality Report found the Coast Fork Willamette River to be water quality limited. The parameters of concern were pH, DO saturation, nutrients, periphyton growth, temperature, and aquatic life. The known source was identified as the Cottage Grove Sewage Treatment Plant (STP), and the condition was contributed to by flow regulations by upstream impoundments (CG Dam).

Dissolved oxygen is a critical parameter for protection of salmonid rearing and spawning. The applicable standards in the basin are:

- Salmonid Rearing: 90 percent of saturation;
- Salmonid Spawning: 95 percent of saturation; and
- Non Salmonid producing: 6 mg/L.

The pH standard in the Coast Fork is a minimum of 6.5 with a maximum of 8.5.

The pH and dissolved oxygen saturation criteria violations were the result of periphyton photosynthesis and respiration (algae growth). Excessive algae growth can interfere with recreation and can produce chemicals that are toxic to livestock and wildlife. Algae growth is influenced by many factors including stream flow, temperature, grazing by invertebrates (bugs), and nutrient supply. Phosphorus and nitrogen are the major growth-limiting nutrients in water and are the focus of water quality evaluation. Although aquatic scientists measure nutrients in many forms, these are two primary chemical forms that limit plant growth.

Four specific TMDLs were approved in March 1995 for the Coast Fork Willamette River from the mouth to the Cottage Grove Reservoir. There was a specific TMDL for phosphorus during the summer season and three TMDLs for aquatic weeds or algae (summer season), dissolved oxygen (year around), and pH (summer season). The 1998 303(d) list shows that these TMDLs were being implemented. To date no TMDLs have been established for nitrogen in the watershed. The City of Cottage Grove has also planned and implemented wastewater treatment upgrades to address discharge problems.

Table 8.2 lists the names and location of current CF listed waterbodies from 2002.

Table 8.2 Water Quality 303(d) Listed Waterbodies In CFW

Waterbody Name	Listed River Mile	Parameter	Season
Camas Swale Creek	0 to 9.4	Dissolved Oxygen	October 1 - May 31
Coast Fork Willamette River	0 to 31.3	Fecal Coliform	Winter/Spring/Fall
Coast Fork Willamette River	0 to 31.3	Fecal Coliform	Summer
Coast Fork Willamette River	0 to 31.3	Mercury	Year Round
Coast Fork Willamette River	0 to 31.3	Temperature	Summer

The dissolved oxygen listing for Camas Swale Creek occurred in 2002 and sufficient data was not available for TMDL analysis. The fecal coliform listing is from the Willamette Basin TMDL project that began in 2000 and was designed to address the 1998 303(d) listed waterbodies that exceeded water quality criteria. In addition the CFWR remains water quality limited for temperature.

The bioaccumulation of mercury in fish is a recognized environmental problem throughout much of the United States. The number of states that have issued fish consumption advisories pertaining to mercury has risen steadily from 27 in 1993 to 45 in 2002 (USEPA, 2003). The Oregon Department of Human Services (DHS) has issued fish consumption advisories for mercury in the Willamette Basin advising consumers of fish of the health risks associated with eating fish caught from the Willamette River and the Dorena and Cottage Grove Reservoirs. These consumption advisories represent an impairment of the beneficial use of fishing in the Willamette Basin and demonstrate that mercury is bioaccumulating in fish tissue to levels that adversely affect public health. The ODEQ is in the process of developing a TMDL for mercury.

It is important to keep in mind that these conclusions are based on limited data. Most streams in the watershed have had little or no monitoring, so conclusions cannot be made for these areas. Pesticides are used across the basin for road maintenance, agricultural, and residential purposes. However, relatively little data has been collected on pesticides or other chemical pollutants.

The impacts of these water quality problems on the beneficial uses of surface water in the CFW Watershed are summarized in **Table 8.3**.

Table 8.3 Potential Human Impacts on Water Quality

Water Quality Characteristics Influenced by Humans	**Effect**
High Water Temperature	Primarily impacts the rearing and spawning of trout, other resident fish and aquatic life, which in turn negatively effects fishing. Trout and salmonids are the most sensitive fish in the watershed and require cooler temperatures and higher dissolved oxygen levels than other types of fish, especially while spawning.
Low Dissolved Oxygen	Same As Above
High Phosphorus Levels	Stimulates the growth of algae. This can decrease the aesthetic value of a stream or lake, and also lead to lower dissolved oxygen in the water, which impacts rearing and spawning of trout, other salmonids and other fish species.
Fecal Coliform	Mainly impacts humans who are in contact with the water, although other types of bacteria that are associated with fecal matter may cause sickness to livestock that are watered from local streams.
Heavy Metals	Can be toxic to humans who ingest contaminated fish, resident fish and aquatic life.

It is often difficult to distinguish between natural background levels and human effects on water quality. For example, warmer water temperatures and low dissolved oxygen levels result in part from warmer air temperatures and summer low flows. Turbid, silty water results in part from the large portion of sedimentary soils found in the lower elevations of the watershed. . Natural features and conditions in the watershed should be taken into account when setting goals for water quality and planning restoration or enhancement projects in the watershed.

8.4 Conclusions

Given the nature of pollutant sources in the watershed there are many possible solutions or strategies to protect and improve water quality. The following list is only a beginning to actions the council may want to consider.

- Expand water quality monitoring in the watershed.
- Implement temperature monitoring in the watershed.
- Implement a macroinvertebrate monitoring program.
- Investigate sources of fecal coliform contamination.
- Consider working groups to help facilitate the implementation of successful management practices for rural homeowners.
- Consider an Agriculture working group to facilitate the implementation of successful management practices identified by the Extension Service, Soil and Water Conservation District and from local knowledge.
- Identify pesticides currently being used in the watershed for agriculture, transportation and residential uses.
- Educate citizens in the watershed about the water quality problems the council has identified