4 – Aquatic Habitat and Biological Communities

Overview

This section summarizes aquatic habitat and biological communities in the lower Tualatin River watershed within the limits of the SWMACC District based on an evaluation of existing environmental monitoring data and reports of watershed conditions. This chapter describes how key biological indicators are being used to characterize the present level of biological and aquatic habitat conditions and impairment in selected tributaries to the Tualatin River.

Data Reviewed

- Metro RLIS GIS Data including – NWI, Soils, Slope, Aerial photos, Land Cover, and Vegetation
- Oregon Department of Fish and Wildlife Habitat Assessment Surveys & GIS data
- Macro Invertebrate Data (WES 1999 and ABR 2000, 2007 and 2010 reports and 2007 and 2009(10) GIS data)
- Geomorphic survey and GIS data (Waterways Consulting 2010)
- Clackamas County Culvert Inventory Data

Watershed Conditions

Wetlands

The National Wetland Inventory mapping identifies about 22 wetlands and waters in the SWMACC District (**Figure 5**). The largest is the main stem Tualatin River. Other smaller wetlands tend to be associated with agricultural impoundments. These impoundments are located either in the headwaters of subwatersheds or adjacent to streams. These are found in the subwatersheds of Wilson, Saum, Athey, and S. Rock Creeks. There are also wetlands associated with the S. Rock Creek floodplain.

NWI mapping is based on 1:24,000 scale mapping and often under represents wetland resources in forested and agricultural areas. Hydric soils were reviewed (**Figure 5**) to provide potential additional wetland locations in the District.

Stream Reach Characterization

Historic Setting

The Tualatin River, a tributary to the Willamette River, historically supported cold-water fish and benthic macroinvertebrate communities. Anadromous Steelhead trout, Coho salmon, and sea-run Cutthroat trout have spawned and reared in the upper Tualatin River basin. Resident cutthroat trout however are thought to have used the entire length of the Tualatin River and its tributaries.

Biological Characterization

The Tualatin River provides aquatic ecosystems that support a food web that extends up to anadromous and resident fish. These aquatic ecosystems have been altered as land use changes have occurred throughout the watershed. As part of this subwatershed characterization, existing data describing these

aquatic ecosystems is summarized to investigate how past hydromodifications have changed existing populations, and to assist in the development of priorities for management.

Indicator Species

The Tualatin River basin is used by both anadromous and resident fish. Anadromous fish include steelhead trout (*Oncorhynchus mykiss*), cutthroat trout (*O. clarki clarki*) and coho salmon (*O. kisutch*). These fish use the Lower Tualatin River to migrate to the upper watershed to spawn from January to May. Steelhead trout, within the Upper Willamette River Evolutionarily Significant Unit (ESU), which includes the Tualatin Basin, are listed as threatened under the federal Endangered Species Act (ESA). This species and coastal cutthroat trout are also on the ODFW sensitive species lists. These species have similar requirements for reproduction, rearing, and migration. They all require cool, clean, well oxygenated water; appropriate substrate with low levels of fines for spawning; areas of refuge from high winter flow events; adequate cover (deep pools, root wads, undercut banks, etc.); and adequate food production areas (e.g., shallow, clean riffle habitat). Therefore, the presence of expected life stages of these species in a given reach indicates that at least minimal requirements for these sensitive species are being met. The Lower Tualatin Watershed Analysis (Hawksworth 2001) mapped fish habitat in the lower watershed (**Appendix A**).

Resident fish include cutthroat trout, sculpin, lamprey, dace, coarsescale sucker, threespine stickleback, northern pikeminnow, and redside shiner (Hawksworth 2001 and ODFW 2008). They are present in many of the tributaries in the lower watershed.

Biological Indices

The scientific literature contains a number of biological indices for use with fish and benthic macroinvertebrate sampling data. Each index includes a number of metrics calculated from sample data. Each metric describes a specific aspect or sensitivities of the target community. The upper limits of these biological indices are based on an unimpaired reference condition. Index values are used to categorize impairment into levels (e.g., severe impairment, moderate impairment and slight impairment). Biological indices are useful because they integrate a lot of information about habitat conditions into one value.

Specific surveys of both fish and invertebrate species populations have occurred in a number of tributaries within the SWMACC District. These surveys have been synthesized into Indices of Biotic Integrity (IBI), where sampling results are expressed on a relative scale. Ranges within the scale are selected to denote properly functioning to impaired conditions for the population. These IBI scores are generally accepted as a good proxy for aquatic ecosystem functioning.

A survey of fish abundance distribution in the SWMACC District occurred in ten lower Tualatin River tributaries (ODFW 2008). **Figure 6** shows the ODFW reaches and sample locations. Fish distribution based on multi-pass removal sampling is illustrated in **Table 4-1**.

Table 4-1. Fish Distribution (ODFW 2008)

Species	FC	UT2	AC	SaC	UT4	PC	ShC	WC	UT5	UT6	TC
Brook lamprey	0	0	0	**10**	0	**1**	**2**	0	0	0	**2**
Unidentified ammocoete	0	0	**1**	**2**	0	0	0	0	**1**	0	0
Unidentified lamprey	0	0	**1**	0	0	0	0	0	0	0	0
Fathead minnow	0	0	**5**	0	0	0	0	0	0	0	0
Yellow bullhead	0	0	**2**	0	0	0	0	0	0	0	0
Cutthroat trout	**2**	**5**	0	0	0	**1**	0	**1**	0	0	**1**
Chinook salmon	0	0	0	0	0	0	0	0	0	0	**3**
Three-spined stickleback	0	0	0	**1**	0	0	0	0	0	0	0
Prickly sculpin	0	0	**8**	0	0	**5**	**2**	0	**1**	**1**	**9**
Riffle sculpin	0	0	**19**	**14**	0	**5**	0	**1**	**3**	**4**	**5**
Reticulate sculpin	0	0	**45**	**34**	**2**	**13**	0	**9**	**20**	**23**	**10**
Unidentified Sculpin	**3**	--	0	**2**	--	**15**	0	--	--	--	--
Unidentified cottid	--	**2**	--	--	0	--	--	0	**13**	**18**	0

FC = Fields Creek, UT#=Unnamed Tributary #, AC=Athey Creek, SaC=Saum Creek, PC=Pecan Creek, ShC=Shipley Crek, WC=Wilson Creek, TC=Tate Creek

The results of this sampling were used to develop Fish Index of Biotic Integrity (F-IBI) scores (**Table 4-2**). The 2008 work replicated previous sampling that occurred in 2003. Where results were available for both years, scores generally were generally lower in 2008. The exceptions were Saum Creek and Unnamed Tributary 2 which both went from impaired to marginally impaired.

The F-IBI results suggest a systemic reduction in fish population size and diversity throughout these streams. Athey Creek was the only stream where alien species were observed. The ODFW report used these results to suggest restoration and protection priorities, including fish passage assessment to determine how existing infrastructure is impacting fish usage. Focusing restoration and protection measures on the streams where anadromous and/or residence salmonids were encountered (Tate, Pecan, Wilson, Saum, and Fields Creeks and Unnamed Tributary 2) was recommended.

Table 4-2. Fish Index of Biotic Integrity (F-IBI) (ODFW 2008)

Subwatershed	Stream	F-IBI Score 2008 by reach
Fields	Fields Creek	0.0, 57
Tualatin	Unnamed Tributary 2	57, 57
Athey	Athey Creek	47, 44, 0.0
Saum	Saum Creek	54, 61
Tualatin	Unnamed Tributary 4	30
Pecan	Pecan Creek	59
Shipley	Shipley Creek	42
Wilson	Wilson Creek	45
Tualatin	Unnamed Tributary 5	61
	Unnamed Tributary 6	48, 0.0
Tate	Tate Creek	64

Acceptable (≥75), Marginally impaired (51-74), Severely impaired (≤50), No fish (0.0)

A baseline survey of benthic invertebrate assemblages in the lower Tualatin River Basin that covered some of the tributary streams in the SWMACC District area was conducted in 1999 (WES 1999). Sampling locations are shown on **Figure 6**. The report concluded that aquatic invertebrate diversity was good in most streams. Those streams without invertebrates appeared to naturally lack substrate conditions to support them.

More recently, benthic macroinvertebrate communities, physical habitat, and water chemistry were sampled within the SWMACC District in fall 2002, 2007, and 2009 (ABR Inc. 2010). Streams within SWMACC were resurveyed in 2009 to determine the current condition and to compare these conditions to those measured in 2002 and 2007. Looking at benthic macroinvertebrate populations is especially useful when considering overall hydromodifications in a watershed, since these species are highly dependent on both channel substrates and water chemistry. As changes to water quantity and quality occur due to changing land cover, benthic communities provide a useful metric to assess if and/or how hydromodifications have impacted the aquatic food web.

Multimetric scores were developed for streams using the Oregon Department of Environmental Quality (DEQ) methodology. This methodology uses metrics including species richness and relating species to their tolerance to sediment and water quality impairments (ABR Inc. 2010). Differences of eight or more points between data results in different years suggest a real temporal change to the benthic community (ABR Inc. 2010).

There appears to be a pattern of multimetric scores for high gradient streams where the 2002 and 2009 scores are similar, and 2007 scores are typically better (**Table 4-3**). This pattern suggests that hydrologic conditions in 2007 may have been more favorable than the other sampling years (ABR Inc. 2010).

Table 4-3. Multimetric Analysis of Macroinvertebrate Taxonomic Data for High Gradient Streams

Subwatershed	Stream	Multimetric Score		
		2002	2007	2009
Fields	Fields Creek	30	42	32
Athey	Athey Creek	22	32	22
Tualatin	Unnamed Tributary 4	16	32	28
Pecan	Pecan Creek	18	20	24
Wilson	Wilson Creek	--	34	--

Source: ABR Inc. 2010
Not impaired (>39), Slightly impaired (30–39), Moderately impaired (20–29), Severely impaired (<20)

Overall, the degree of alteration to the benthic macroinvertebrate community appeared to vary with physical stream conditions, with higher gradient streams having more intact communities and greater dominance of species that are tolerant of disturbance in low-gradient stream reaches. Correlations were also made between water quality parameters and benthic macroinvertebrate community, notably afternoon water temperature (ABR Inc. 2010).

The results of both the fish and benthic macroinvertebrate sampling suggest that impairments have occurred throughout the District, but that the level of impairment varies. In general, it appears that fish populations have been impacted to a greater degree than macroinvertebrates, with several stream reaches where no fish were encountered, and 9 out of 17 reaches ranked as severely impaired. Further, the pattern of greater dominance of benthic macroinvertebrates that are tolerant to impairment in lower gradient streams signals that changes to the macroinvertebrate community have also occurred.

Physical Habitat Characterization

Many tributary streams to the lower Tualatin have already been impacted by land use changes and hydromodification. Along most stream channels, hydromodification has resulted in moderately incised stream channels that are inset into wider valley bottoms. The incision restricts access to historic floodplain areas, which in turn confines higher flows to the primary channel, resulting in more energy being concentrated on the bed and banks of the channel. Because historic floodplain deposits in the lower Tualatin River Drainage Basin are composed primarily of fine material, bank erosion and a lack of instream structure (e.g. – large wood) results in sedimentation of the bed of the channel and a muted pool and riffle bed morphology.

The Washington County Soil and Water Conservation District prepared an analysis of the Lower Tualatin Basin (Hocksworth 2001). Their report includes a map of the Channel Habitat Types (CHT) of the Tualatin River and its tributaries in the lower basin (**Appendix A**). CHTs characterize channel structure using a typing methodology outlined by the Oregon Watershed Enhancement Board. The assessment was an office-based exercise and did not include field verification. It is included here because it covers all mapped streams in the SWMACC District.

CHT by stream are summarized in **Table 4-4**. Stream names follow naming conventions put forward by ODFW. Streams are listed clockwise from the south east end of the watershed. All streams within the District are included. Very steep headwaters and steep narrow valleys dominate the channels types in the upper reaches of most of the streams. However, some streams have moderate or low gradient areas in the headwaters which are mostly used for agriculture and may include on-line ponds. Middle reaches are generally moderate gradient. Lower reaches include both moderate and low gradient areas with few connected floodplains.

Table 4-4. SWMACC Channel Habitat Types (CHT)

Subwatershed	Stream	CHT
Fields	Fields Creek – 3 trib. *	VH, SV, MV
Tualatin	Unnamed Tributary 1	VH, SV, FP3
	Unnamed Tributary 2 *	VH, SV, MV, MH
	Unnamed Tributary 3 (Ek Creek)	SV, MH, LM
Athey	Athey Creek *	MV, LM, MH, Pond, FP3
Saum	Saum Creek – 5 tribs. *	MH, FP3, MM, MV, Pond, LC
S. Rock	S. Rock Creek – 5 tribs.	SV, MV, MH, FP3, Pond, MM, FP2
Tualatin	Unnamed Tributary 4 *	SV, VH, MV, MH
Pecan	Pecan Creek – 3 tribs. *	LC, SV, LM, MH, MV, VH, MM
Shipley	Shipley Creek *	SV, MH
Wilson	Wilson Creek – 5 tribs. *	Pond, MH, SV, MV, MM, MC, VH, FP3, LM
Tualatin	Unnamed Tributary 5 *	MV, SV, FP3, MH
	Unnamed Tributary 6 – 1 trib. *	SV, MV, MC, LC
Tate	Tate Creek *	MH, SV, VH, FP3

VH	Very steep headwaters	MC	Moderate gradient, confined
SV	Steep narrow valleys	LM	Low gradient, moderately confined
MV	Moderate gradient, narrow valley	LC	Low gradient, confined
MM	Moderate gradient, moderately confined	FP3	Floodplain, small stream
MH	Moderate gradient, headwaters	FP2	Floodplain, large and medium stream

* Portions surveyed by ODFW (ODFW 2008)

ODFW surveyed aquatic habitat as well as fish abundance and distribution in portions of ten tributary drainages in the District (ODFW 2008). Surveyed tributaries are listed in **Table 4-2** and are marked with an asterisk in **Table 4-4**. Sample locations correspond to the fish sampling locations in **Figure 6**. Data collected included channel width, depth and substrate as well as measurements of shading, large wood, riparian vegetation and erosion. Surveys were often limited to the lower reaches of the tributary drainage. Habitat survey reaches are different than the fish survey reaches and are not available in GIS. A summary of key habitat findings are included in **Table 4-5**. Generally large wood, especially "key"pieces, were scarce in the surveyed areas. Only Saum, Tate and Wilson Creeks contained wood qualifying as "key" pieces. Invasive plants such as bamboo, English ivy and Himalayan blackberry were pervasive. The surveyed areas were dominated by rural residential land use. Grazing was the dominant land use on Athey Creek. Wetlands were noted on both Athey Creek and Unnamed Tributary 5. Second growth timber was noted on Unnamed Tributary 6.

Table 4-5. ODFW Habitat Reach Summaries

Stream	Reach 1	Reach 2	Reach 3	Reach 4
	% Eroding bank, % Undercut bank, % Shade, No. of Wood Pieces			
Fields Creek	1, 1, 73, -	7, 2, 83, -		
Unnamed Tributary 2	2, 0, 65, 1	4, 1, 75, 26		
Athey Creek	4, 8, 26, 3	5, 1, 34, 8	0, 1, 35, 1	
Saum Creek	28, - , 50, 1	8, 7, 49, 86	-, -, 80, -	
Unnamed Tributary 4	5, 7, 62, 2	3, 3, 81, 1		
Pecan Creek	36, 13, 88, -	5, 3, 70, 5	1, 4, 87, 15	
Shipley Creek	2, 2, 41, -			
Wilson Creek	18, 15, 14, 6	4, 15, 50, 25	1, 4, 65, 22	-, 0, 41, 43
Unnamed Tributary 5	3, 1, 73, 6			
Unnamed Tributary 6	2, 3, 63, 17	3, 5, 35, 8	-, -, 32, 1	
Tate Creek	4, 19, 70, 10			

Note: Reaches are illustrated in Figure 6.

In 2009, Clackamas County WES established a baseline and a potential network network of long-term geomorphic monitoring stations in the SWMACC District (Waterways Consulting 2010). The geomorphic monitoring sites (**Figure 6**) were established to define baseline conditions and to supplement past assessment and monitoring efforts, including benthic macroinvertebrate surveys. The baseline geomorphic data could be compared to future surveys to evaluate changes in channel morphology and bed conditions, gage the effects of changing land use, and monitor the effectiveness of stormwater management practices and treatments designed to mitigate for the impacts of hydromodification.

A total of ten monitoring stations were established on tributaries to the lower Tualatin River. At each of the monitoring stations the following information was collected:

- Longitudinal and cross-section profile survey,
- Measurement of surficial substrate conditions,
- Collection of a bulk sample of bed conditions,
- Measurement of pool characteristics,
- Assessment of bank conditions, and
- Establishment of photo points.

Although the data collected at the geomorphic monitoring stations are meant to establish baseline conditions and will be most useful when compared to data collected in the future, a qualitative analysis of the data was conducted to assess current channel conditions within the surveyed reaches. The parameters used to evaluate channel conditions included floodplain connectivity, bed morphology, stream bank condition, and degree of fine sediment intrusion in the stream bed. Qualitative measures derived for each of these parameters was determined directly from the field data. The results, along with a final assessment of overall channel condition, are presented in **Table 4-5**.

Table 4-5. Qualitative Assessment of Channel Conditions

Site ID	Floodplain Connectivity	Bed Morphology	Bank Conditions	Sediment Intrusion	Channel Condition
Fields Creek	Low-Moderate	Pool-Riffle	**At Risk-Unstable**	Low	**At Risk**
Unnamed Tributary 2	High-Moderate	Plane Bed	**At Risk**	High-Moderate	**At Risk**
Athey Creek	Moderate-Low	Plane Bed	Stable	Low	Stable
Lower Saum Creek	High	Backwatered	Stable-At Risk	Moderate-High	Stable-At Risk
Middle Saum Creek	High	Plane Bed	Stable	**High**	Stable
Pecan Creek	Moderate-Low	Plane Bed	**At Risk-Unstable**	Moderate-High	**At Risk**
Upper Wilson Creek	Moderate-High	Pool-Riffle	**Unstable**	Low	**At Risk**
Unnamed Tributary 6	High	Plane Bed	**At Risk-Unstable**	**High**	**At Risk**
Tate Creek	High	Plane Bed	Stable-At Risk	**High**	**At Risk**

Over half of the monitoring sites exhibit significant bank erosion exceeding 15 percent of the total bank length. In addition, 6 of the 9 sites where bulk samples were collected exhibit a bed condition where greater than 30 percent of the sample was less than 0.85mm mean particle diameter. Although these results can be partially attributed to the geology of the lower Tualatin River Basin, the results suggest that coarse bedload within these systems is either being buried by fine sediment or is flushed through to the Tualatin due to channel incision. Efforts to reverse incisional trends and the impacts of hydromodification would greatly benefit channel morphology, substrate, and higher quality physical habitat.

Identification of Limiting Factors

Limiting Factors will be completed in the next draft and will incorporate, hydrology, water quality and habitat elements.

Riparian Vegetation

Riparian vegetation plays an important role in maintaining salmonid habitat. Adequate riparian buffers help maintain water temperatures by providing shade during warm months. They can provide a source of large wood to the stream channel that promotes channel complexity and assist with the preventiona of bank erosion. Riparian buffers act as filters to remove contaminants and absorb runoff from surrounding areas. High summer water temperatures in streams are typically related to low summer flows, aspect of the stream channel to incident solar radiation and amount of canopy cover (shade).

Riparian vegetation was characterized qualitatively using Metro Vegetation GIS data digitized form 2002 orthophotos (**Figure 7**). Generally steep headwater drainages that were not easily converted to other uses have wide closed canopy forest riparian buffers. Narrower or non existent buffers occur in areas where pasture or other agriculture uses abut streams. This is especially evident in the S. Rock Creek and Saum Creek subwatersheds. Athey, Pecan, Wilson and Shipley Creeks as well as Unnamed Tributaries 1, 2, and 3 have both flatter headwaters and valley bottom areas that lack cover. A majority of the streams in the District have reaches that include both wide – closed-canopy riparian buffer and no buffer.

Fish Passage Barriers

Adult anadromous and resident salmonids require access to suitable spawning and rearing habitat. It is also likely that unobstructed access to tributaries is important to allow access to refuge habitat during winter high flow events. Limited data on the presence of human-made and natural barriers to fish

passage was found in the Clackamas County culvert inventory that does not identify culverts as partial or complete barriers.

The *Lake Oswego Corporation (LOC) Diversion Dam* is located in the SWMACC District between SW Tualatin Loop Road and SW Borland Road. This push up weir dam, when installed, raises the water surface elevation of the Tualatin River so water can be diverted into the Oswego Canal 3.2 miles upstream. The dam and canal headgate was reconstructed following the 1996 floods and has a fish ladder. Anecdotal accounts question the dams passability.

There are several *smaller private dams* on tributaries to the Tualatin River in the SWMACC District. The largest creates Schaber Reservoir on Athey creek. Other agricultural ponds are found on Wilson, Saum and Rock Creek tributaries. It is assumed that these smaller dams are not designed to accommodate fish passage.

Other potential fish passage barriers are associated with *culverts* where roads cross creeks. The County has a culvert inventory in GIS (**Figure 8**). This inventory identifies culverts on creeks as "Fish Related." No culvert barrier inventory has been performed to identify fish passage barriers or prioritize culvert replacement to improve fish passage. The County has a culvert replacement program in place. Completed projects are indicated on **Figure 8**. It is not known if these projects were related to fish passage.

Potential Future Risk

The SWMACC District is located at the edge of the Portland metropolitan UGB. Development pressures in the next several decades will likely result in portions of the District becoming urbanized. This presents a risk to aquatic habitat, biological communities, and overall watershed health. Many of the issues described in other sections of this environmental characterization relate to potential changes in hydrology and water quality could affect aquatic habitat and biological communities. These elements of watershed health (hydrology, water quality, aquatic habitat, and biological communities) often contain interrelated problems and integrated opportunities for improvement.

Data Gaps

- Benthic macroinvertebrate data collection should be expanded to cover all stream reaches in the SWMACC District
- Geomorphic data collection should be expanded to cover all stream reaches in the SWMACC District
- Review of dams and other partial barriers (culverts, in-line ponds, etc.) for fish passage
- Continuous water temperature data

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