2006 Willamette Riverkeeper Volunteer Monitoring Assessment

by: Monica Vogel, Water Quality Coordinator/NWSA Member 2006

David Russ and Megan McCoy using the "e-poli" to collect bacteria samples on the Willamette River at Kelly Point.

Shelley Mathews using a bucket to collect water samples from Johnson Creek.

Water Quality Training in Corvallis.

Water Quality training in the field with Lynnae Sutton and Jon Hill on Scappoose Creek.

Introduction
Many agencies and organizations recognize volunteer monitoring as an effective and worthwhile investment, a tool to help with local environmental issues. State and Federal agencies, as well as, non-profit groups devote a tremendous amount of time and money to keep volunteer monitoring programs active. On average, local monitoring programs have about 25 volunteers who generally monitor water quality in or near their town. The greatest impact of monitoring is at the local level, providing education, identifying water-related problems, and supplying information for decisions that affect a particular region. Many programs focus on the whole watershed and primarily monitor basic chemical parameters and macro invertebrates.

Willamette Riverkeeper's (WRK) Water Quality Monitoring Program was established in 2001 and has been growing strong since. During the past two years and this coming year (2005-2007) WRK has been fortunate in having dedicated AmeriCorps members to assist in establishing a legitimate and significant volunteer monitoring program. Now widespread and very creditable, WRK has volunteers from Portland to Eugene collecting monthly samples and observing the health of the Willamette River Watershed. Since the program's inception, the WRK staff has witnessed the positive outcomes of the volunteer program, as well as the difficult issues involved with developing such a program. A few challenging issues that have come up include, the extensive training that volunteers need to become monitors, the inconsistency with data collected among a large range of volunteers, and the significant time commitment (1 year) for volunteers. Due to a cooperative staff and dedicated volunteers, WRK's monitoring program is not inhibited by these challenges. The program has given positive exposure to and has resulted in broader outreach for WRK. WRK's volunteer positions are very well defined and offer great leadership opportunities for community members. Volunteers also generate quality and useful data that is available through the Department of Environmental Quality's (DEQ) statewide database.

Current Program
WRK's Volunteer Monitoring Program offered five trainings in 2006 during the spring and scheduled one-on-one trainings throughout the year. These trainings kept volunteers involved and up to date on procedures and sampling methods. The program is divided into two separate monitoring groups, Water Quality Monitoring and Bacteria Monitoring, which are outlined below.

Water Quality Monitoring
Currently, water quality is monitored at 38 different sites by approximately 60 volunteers throughout the Willamette Valley. Six sites are monitored on the mainstem of the Willamette River and another 32 sites are monitored on the major tributaries. The program is divided into five monitoring areas: Portland, Newberg, Salem, Corvallis, and Eugene. Each area has a monitoring kit that is shared between all the volunteers, who coordinate with each other to figure out kit usage each month. (See Table 1 to view site location.) To ensure that all sites are monitored WRK is beginning to assign two or more volunteers to each site.

The sampling plan emphasizes watershed scale monitoring because the water quality of a given body of water is a reflection of the activities in the surrounding land and tributaries. Therefore, monitoring sites are located on the mainstem and on the tributaries into the

Willamette River. WRK is only monitoring the major tributaries that flow perennially because these bodies of water have a greater impact on the Willamette Valley Watershed. The specific monitoring site locations are first and foremost based on safe accessibility for volunteers. These sites are chosen in attempt to collect water samples from the middle of the channel; all monitoring sites on tributaries are as close to the mouth as possible. WRK does not monitor at the confluence because that specific area is considered a mixing zone and the samples represent two separate bodies of water. In order to meet these criteria – to have safe access to a site close to the mouth of the river where a volunteer can gather a sample from the middle of the stream/river – WRK monitors from bridges and docks. This allows volunteers and substitute volunteers to access the site consistently year-round. Between the 10th - 20th of every month at their site, volunteers make visual observations and measure chemical characteristics of water – dissolved oxygen, pH, conductivity, temperature, and turbidity.

- Dissolved Oxygen (DO), is the amount of oxygen that is dissolved in water at a given temperature. Water at a lower temperature has a greater capacity to hold dissolved oxygen, and vice versa. Since access to oxygen is essential for virtually all aquatic organisms, DO is one of the principal parameters used to test water quality. WRK tests DO in the surface water of the water using the Winkler Titration method.
- Conductivity, is a measure of water's ability to pass an electrical current. Conductivity in water is affected by the presence of inorganic compounds from minerals as opposed to organic compounds derived from organisms. Changes in a river's conductivity can alter and disturb the biological systems within, significant changes in conductivity can then indicate a discharge or some other form of pollution that has entered the stream. WRK tests conductivity with the use of a digital probe
- Temperature, probably the most easily measured parameter, is a critical factor influencing several biological and chemical variables within the water. Temperature has an effect on both chemical and biological activities in water. WRK measures temperature using the same probe that measures conductivity.
- Turbidity, is defined as the optical property of a sample that causes light to be scattered and absorbed. In theory, the more suspended material exists, the more light scattering (i.e. turbid) and hence, the less transparent. Sediment removal, transportation, and deposition are key features that effect turbidity. As a result turbidity levels can support or impair foraging, shelter, and breeding for certain organisms. WRK uses a "bench" turbidimeter which is essentially a portable photometer.
- pH, is the measure of the hydrogen ion concentration in water. pH is important because it determines the solubility of nutrients and chemicals in the water. WRK uses a calibrated meter with pH probe to measure pH.

Bacteria Monitoring

In addition, there are 10 sites in the Portland area that monitor bacteria using *Escherichia coli* as an indicator. These sites are monitored twice a month (the 2nd and 4th week of each month) and only during the summer months when physical contact with the water through recreation is highest and when people are most likely to be exposed. The sites were chosen based on the amount of public exposure to the water (i.e. common swimming holes and water sport activity sites). The majority of the sites are located on the mainstem of the Willamette River. (See Table 2 for site information.)

The Water Quality Monitoring and the Bacteria Monitoring programs are separate because they are sampled and analyzed in a different manner. Water Quality Monitors are responsible for monitoring one site once a month. At these sites the samples and results are collected the same day. Bacteria Monitors sample up to four sites twice a month, due to the fact they are only collecting samples, rather than testing the water at their sites. The bacteria samples must be analyzed promptly at the WRK office and incubated for 24 hours.

Goals

The goal of the Volunteer Monitoring Program is to monitor, assess, and report on water quality while engaging the public in watershed stewardship and education. WRK hopes to improve the understanding of local water resources, encourage active citizen participation, and help communities make informed decisions that improve and restore water quality.

WRK's program is associated with the Department of Environmental Quality (DEQ) Volunteer Monitoring Program. The DEQ program provides support, including equipment use, data management and analysis support. In return, volunteers provide WRK and DEQ with quality data. These data are ensured with a strong quality assurance project plan (QAPP), that directs volunteer training protocol, sample collection procedures, and quality control guidelines. The DEQ checks and grades volunteer data. When data are confirmed, they are given a designated quality level (A, B, E, or C). The A and B data are used for watershed assessments and reporting, (303(d) list development and TMDL documentation); E data do not follow all quality control guidelines and are used for educational purposes; and C data are flawed and not used at all.

Future Development

In the future, the WRK Volunteer Monitoring Program will be more sustainable and have the capacity to be influential in providing the public and local and state agencies with useful information. But first there is still some work that needs to be done. Now that WRK has established its program down the Willamette Valley, a few factors must be addressed. Since the volunteer coordinator is stationed in Portland, there is a serious need for lead volunteers within each city that has a kit. The lead volunteer assists the coordinator, provides strong communication regarding sample collection and equipment condition, and supports volunteers in his/her area.

Substitute volunteer monitors collect samples that are missed each month; however, there are not enough of these substitute volunteers. Although a majority of the sties have partners, there are still a few sites that get missed each month. With one or more substitute monitors in each city, these dataset gaps will be consistently filled. Also, throughout the Willamette Valley there are many monitoring groups for example, watershed councils, soil and water conservation districts, and agencies. These groups, including WRK, need to work collaboratively to ensure the most precise and useful data. Communication between multiple groups can detect where unnecessary replication may occur and where information can be shared and compared.

To make sure each body of water is represented appropriately more quality control measures need to be taken. Although WRK makes sure each volunteer is trained properly, it should be more efficient in checking equipment (accuracy and calibration tests) and requiring volunteer consistency by taking duplicates. WRK also needs to start collecting split samples with volunteers. This would require the water quality coordinator to collect a water sample at the same place and time as volunteers. Not only does split sampling build better communication between the coordinator and volunteers, but it ensures that everyone is sampling using the same procedures.

2006 Data

Although samples are only taken once a month this data provides excellent baseline information about the watershed and quality data to compare with other monitoring groups. During the 2006 sampling year, more then half of WRK's monitoring sites were newly established. Therefore, there is not a sufficient amount of data to compare and contrast over the years. But WRK is able to perform monthly analyses using figures and charts to evaluate and compare seasonal trends, different tributaries, different parameters, and data quality (Figure 1). Contrary to water quality, the bacteria monitoring results can be more informative in a short period of time. This simple analysis can be very informative to the public. The bacteria data is displayed on WRK's website and is updated each month (Figure 2). Although currently there is little data in relation to WRK's large sample area, there is a consistent collection of information. Within the next few years WRK will have substantial amount of data to analyze yearly trends and point out major outliers.

Since the program is relatively new it is important to not only analyze raw data, but also evaluate the program's quality and usefulness of the data that is gathered. By examining the data from this year it is clear that volunteer monitoring data is as effective almost no different than data from other agencies. Table 3 breaks down the number of samples and duplicates by each parameter and reveals the date quality level (DQL) based on the DEQ standards. In order to meet quality control standards two criteria must be met which are: 10% of all the samples from each parameter must be duplicates and successful accuracy tests must be performed. Overall, WRK has met most quality control guidelines and as a result the majority of the data is A or B level, meaning it is credible and useful.

When looking at the numbers, it is clear that WRK is very fortunate to have such dedicated volunteers. There are a total of 1281 recorded hours and 1705 samples collected and recorded from January to November 2006! With more volunteer time and dedication, as well as devoted staff this program will only become a more significant tool in protecting and restoring the Willamette River. Thanks to everyone who have helped!

Table 1: Water Quality Monitoring locations, number of volunteers, and number of sampling days at each site (sampling day entails collecting 1 sample of each parameter).

Portland--19 volunteers	# Sampling days	River/stream mile
Scappoose Creek @ West Lane Road	3	4.7
Multnomah Channel @ Gilbert River Dock	9	11.5
Multnomah Channel @ Sauvie Island Ramp	9	18
Willamette River @ Cathedral Park	10	6
Willamette River @ Swan Island Ramp	10	9
Willamette River @ Sellwood Park Ramp	10	16.5
Johnson Creek @17th Ave Bridge	10	0.5
Kellogg Creek @ Wastewater Treatment Plant	9	0.22
Tryon Creek @ Stampher Rd.	8	0.3
Lake Oswego Creek @ George Rogers Park	8	0.16
Abernathy Creek @ Washington Street	6	0.32
Willamette River @ Willamette falls, Oregon City	7	26
Newberg--11 volunteers		
Mollala River @ Knights Bridge	8	3
Pudding River @ Arndt Rd. Bridge	8	4.37
Willamette River @ 1 mi D/S from French Prairie	9	39
Champoeg Creek @ Champoeg State Park	10	0.5
Mission Creek @ Champoeg Rd	6	1
Willamette River @ Smurfit Newsprint	4	50
Chehalem Creek @ Dayton Road	7	1.5
Yamhill River @ Dayton	9	5
Willamette River @ Mission Park	3	75
Salem---9 volunteers		
Willamette River @ Salem	2	84.2
Mill Creek @ Salem	4	0.15
Rickreall Creek @ HWY 51 and Oak Ridge Rd.	8	2
Willamette River @ Independence	7	96
Luckiamute River @ Buena Vista Rd	5	7
Santiam River @ Jefferson HWY bridge	4	10
Corvallis---8 volunteers		
Willamette River @ Bowman Park Dock	6	118
Calapooia River @ Bryant St. Bridge	7	119
Willamette River @ Corvallis bike bridge	9	131
Mary's River @ Mary's River bike Bridge	7	1.32
East Channel/Muddy Creek @ Stahlbush Island Road	5	2.56
Middle Channel @ Kiger Island Bridge	3	0.34
Long Tom River @ bridge on Old River Rd and Bundy Rd	2	1.9

Table 1: Continued

Eugene--8 volunteers		
McKenzie River @ Coburg Ped. Bridge	7	3
Willamette River @ Eugene Green Belt Bridge	3	180
Coast Fork Willamette River @ Seavy Loop Rd bridge/Buford park	7	2
Middle Fork Willamette Riverkeeper @ Parkway Rd near Jasper	8	7.5

Table 2: Bacteria Monitoring locations, number of volunteers, and number of sampling days at each site (sampling day entails collecting 1 sample of each parameter).

Bacteria Monitoring Sites---4 Volunteers	# Sampling days	River/stream mile
Willamette River @ Cedar Oak Dock	14	23
Willamette River @ Bernert Dock	14	25.5
Clackamas River @ Dahl Park	14	0.15
Lake Oswego Creek @ George Rogers Park	13	0.2
Multnomah Channel @ Sauvie Island Boat Ramp	8	18.5
Columbia River @ Sauvie Island Beach	2	90.1
Willamette River @ Kelly Point Beach	9	1
Willamette River @ Sellwood River Front Park	12	16.75
Willamette River @ Ross Island Slough	12	14
Willamette River @ Burnside Bridge	11	12.5

Table 3: Statistics of WRK's volunteer monitoring data separated by parameter

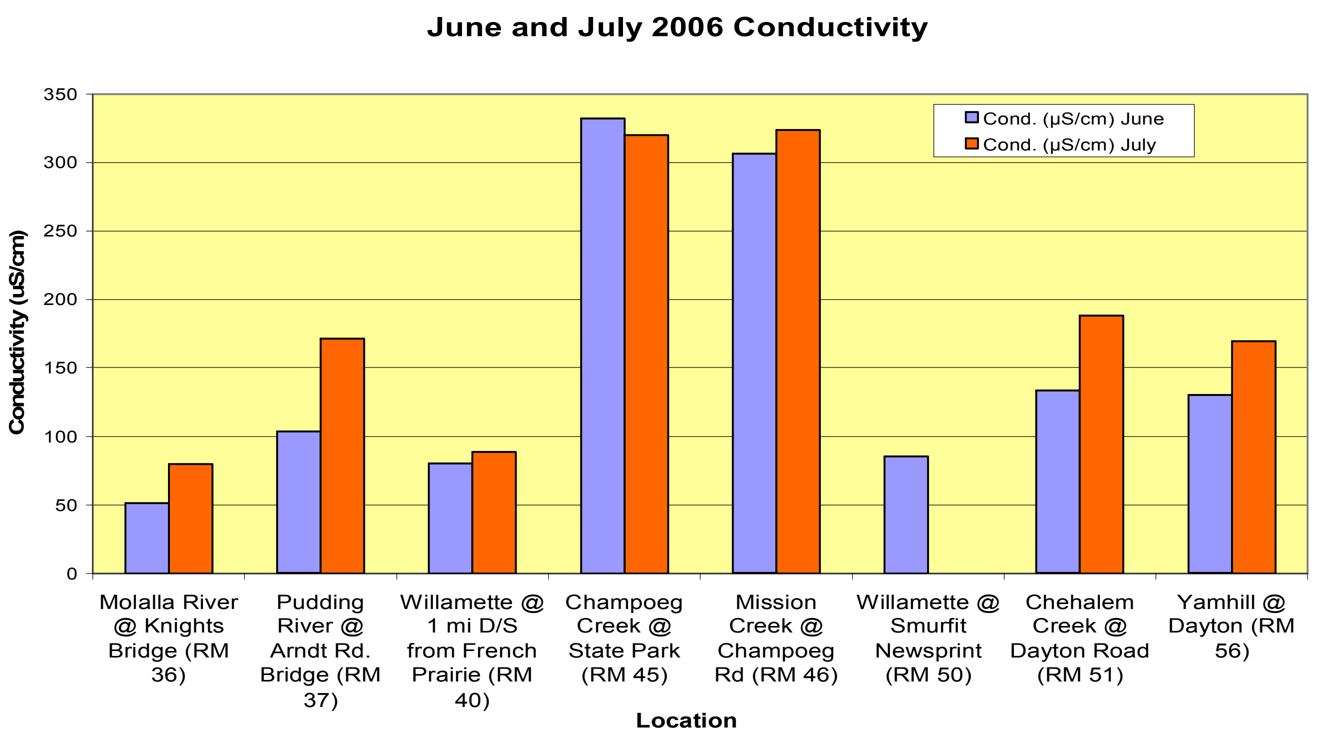
	Temperature	pH	Dissolved Oxygen	Conductivity	Turbidity	*E. coli*
Samples	248	155	239	239	246	101
Duplicates	117	51	62	118	119	10
% Data Quality Level A	86%	85%	85%	92%	94%	76%
% Data Quality Level B	2%	5%	3%	1%	2%	18%
% Data Quality Level C			7%	7%	3%	6%
% Data Quality Level E		11%	9%			
Total Sites: 48						
Total Samples (including all parameters and duplicates): 1705						
Total Volunteer Hours: 1281						

Figure 1: Example of a monthly analysis that was sent to the Wilsonville area volunteer monitors.

June/July 2006 Results for Wilsonville Area

		Temp (°C)	Temp (°C)	pH (su)	pH (su)	DO (mg/L)	DO (mg/L)	Cond (uS/cm)	Cond. (uS/cm)	Turbidity (NTU)	Turbidity (NTU)
Location	**rm**	**June**	**July**	**June**	**July**	**June**	**July**	**June**	**July**	**June**	**July**
Molalla River @ Knights Bridge	36	13	24			10	7.4	51	80	2.9	1.7
Pudding River @ Arndt Rd. Bridge	37	18	24	7.8	7.4	8	7.4	104	172	4	2.8
Willamette @ 1 mi D/S from French Prairie	40	18	22		7.6	8	8.7	80	89	4.4	3.4
Champoeg Creek @ State Park		14	20		7.9	7	6.3	332	320	6.3	4.5
Mission Creek @ Champoeg Rd	46	18	18	7.6	7.6	7	5.5	306	324	5.6	3.8
Chehalem Creek @ Dayton Road	51	16	22	7.8	7.3	8	6.7	133	188	9.5	4
Yamhill @ Dayton	56	19	26	7.4	8.5	8	10	130	169	4.9	6.2

Colored background indicates that result exceeded water quality standards -OR- contrasted strongly with historical results



This graph shows an increase of conductivity from June to July. Due to the increase in temperature resulting in drier streams between the months of June and July there is an obvious increase in conductivity. With less flow and rain runoff the streams are not being diluted, thus the minerals are more concentrated in the water. Also during the summer months ground water is still seeping into the streams, depending on the geology and what minerals are present in the area the ground water can have dramatic effects on conductivity. On the other hand, conductivity can also be increasing from the surrounding agricultural fields and nutrient runoff. But it is difficult to tell the exact source. The easiest way is to look at past years data (which is why we are still collecting data!) and/or test for specific nutrients or bacteria.

Figure 2: Example of *E. coli* data from Sellwood Park from 2003-2006. All *E. coli* data can be viewed on WRK's website (willamette-riverkeeper.org)