2006 data summary for volunteer stream sites in Clark County, Washington

Clark County Public Works
Water Resources Program

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Introduction

Clark County initiated the Clean Water Program in 2000 to protect water quality in our streams and lakes through stormwater management. Volunteer monitoring has been an integral part of the Clean Water Program since 2002. This report summarizes the results of data collected in 2006 by volunteers in Mill, Gibbons, Brezee, and Gee Creeks. This is meant to be a simple data summary for volunteers to see the results of the data they have collected. For background information on the sites or procedures used please reference last year's report, *2005 annual report for stream sites in Clark County*. Copies available by request or from our website at: http://www.clark.wa.gov/water-resources/documents.html#strmac

Biological Integrity

Benthic macroinvertebrates (bottom-dwelling invertebrates which are visible to the naked eye) were collected from all four stream sites to evaluate stream health. The populations of macroinvertebrates change with changing stream condition, and provide a means to determine stream health. Consistent macroinvertebrate data, collected annually, also provides a basis for future comparison. There are many criteria that can be used to measure the health of the macroinvertebrate population. Four of the most important criteria used to rate stream health are described below.

B-IBI Score:
Utilizing the Benthic Index of Biological Integrity (B-IBI) (Karr, 1999) streams are given an overall score based on ten different metrics: taxa richness, EPT taxa, number of long-lived taxa, number of intolerant taxa, % tolerant taxa, % predator taxa, number of clinger taxa, and % dominance of the top three taxa. The index ranges from 10 (very poor) to 50 (excellent)

In addition to the overall B-IBI score, several individual metrics are also useful indicators of stream health. These metrics, along with overall B-IBI score, are shown in figure 1.

Taxa Richness:
The total number of different types of macroinvertebrates. Streams with excellent water quality have 40 or more taxa represented in a typical sample.

EPT Taxa:
A variety of Mayfly (Order **E**phemeroptera), Stonefly (Order **P**lecoptera), and Caddisfly (Order **T**richoptera) species are represented in a healthy stream. Many of the taxa from these families are both important food for salmonids and are sensitive to pollution. Streams with excellent water quality have 25 or more combined taxa from these three orders.

Total Abundance (density per square meter):
Invertebrate densities of several thousand per square meter are normal for western mountainous streams. Densities below 500 per square meter are considered very low.

Results from volunteer sites:

Figure 1

Measure of Biological Integrity	Gee Creek at Abrams Park	Brezee Creek at La Center Bottoms	Gibbons Creek at Jemptegaard Middle School	Mill Creek at the WSU-Vancouver campus
BIBI Score	28	30	34	26
Taxa Richness	32	36	43	34
EPT Taxa	13	18	21	16
Total Abundance (per square meter)	514	1468	2940	1425

Comments:

In addition to the tallies compiled by the volunteers, samples from each stream were also sent to a professional laboratory for detailed analysis. Lab results (Figure 1) indicate the effects, to varying degrees, of warm water temperature, fine sediment load, low dissolved oxygen, and substrate disturbance (i.e. how drastically the stream bottom is scoured and resorted during winter high flows). B-IBI scores were essentially the same as 2005 for all four sites, suggesting that there has been no substantial decline or improvement in overall biological integrity. The bias of the B-IBI is that it is intended for use in streams that provide adequate riffle habitat for EPT taxa. In some cases, a low B-IBI score is not just as a result of poor water quality but also indicates poor substrate for EPT taxa such as sand or hard clay. The substrate of any given stream is determined by the geology, soil types, and land use within the watershed.

Across all sites in Clark County, including non-volunteer sites, invertebrate densities were significantly lower than previous years. Out of 15 total sites surveyed in Clark County in 2006, five samples (none of them volunteer sites) had an invertebrate density less than 500 per square meter. We can only guess at the reasons for the 2006 decline in invertebrate densities. One possible reason, according to a local macroinvertebrate expert, could be differences in the month of sampling (2005 sampling took place during August/September, and 2006 sampling during September/October). Peculiarities of the 2006 warm season in particular, and the effects of global warming in general, could also be part of the answer to the puzzle. The contracted lab noticed low densities widespread across both Oregon and Washington this year. This likely rules out sampling inconsistency by volunteers and staff as a factor in the low density results.

In addition to the samples sent to the contracted laboratory, volunteers were asked to identify a sample of macroinvertebrates from their stream to the best of their ability. Training was provided and volunteers put a concerted effort into the difficult job of noting tiny differences in bug morphology with field microscopes and hand lenses. Tallies of taxa richness and EPT taxa were made for each site. This was a pilot project and results were not robust enough to be reported as summary data (a minimum of 100 bugs must be identified for a sample to have statistical strength). However, volunteers proved that they can master the basics of macroinvertebrate identification in a very short time and hopefully the 2007 results will yield a larger body of data. Eventually, volunteers will be able to use their knowledge to test the biological integrity of any stream that they are interested in. There are many precedents for this type of citizen action as empowered volunteers across the country have been rating the biological integrity of streams for years based on their own macroinvertebrate tallies.

Chemical and Physical Water Quality

Volunteers collected samples for lab analysis and took water quality measurements quarterly at their sites. Standards are set by state agencies; in our case the State of Washington Department of Ecology (Ecology). In light of the importance of salmon in our region and the role salmon takes ecologically as a keystone species, many standards for a healthy stream are set in relation to the needs of salmon, trout and char.

Results from volunteer sites:

Figure 2

Parameter	Gee Creek	Brezee Creek	Gibbons Creek	Mill Creek
Dissolved oxygen (minimum value)	7.63 mg/L	9.32 mg/L	8.52 mg/L	7.43 mg/L
pH (average)	7.7	7	7.2	7
Turbidity (maximum value)	22 NTU	18 NTU	5 NTU	22 NTU

Comments:

Several parameters were measured by volunteers. Results of three are shown in Figure 2. Typical pH values for a healthy stream fall between 6.5-8.5 on the pH scale. All of the pH values were within the normal range. Dissolved oxygen concentration between 8-12 mg/L has been set by Ecology for streams with salmonids. Dissolved oxygen concentration is typically lower in the summer since warmer water holds less oxygen. Some of the readings were below 8.0 mg/L and these are a cause for concern, especially for rearing or migrating salmonids. Turbidity varies greatly under natural conditions. Impairments of fish health have been documented above 25 NTU. None of the turbidity values were higher than 25 NTU. However, monitoring dates were random and did not

attempt to document turbidity during or after a storm when turbidity values may increase significantly.

Fecal coliform in a stream indicates the potential presence of harmful pathogenic bacteria. Samples were collected at all sites quarterly and analyzed at a local laboratory. All volunteer sites show the presence of fecal coliform bacteria with a general trend for higher numbers during the rainy months. There are two methods for estimating fecal coliform, one gives an actual count of colonies (reported in 'colony forming units' or CFU), and the other gives a statistical probability (reported as 'Most Probable Number' or MPN of coliform present. The contracted lab reports in MPN, which is less precise than CFU. The lack of precision is a disadvantage, but the contracted lab is willing to analyze samples on the weekend, which is important for a volunteer-supported program. Hence, the lab results, reported in MPN, are only precise enough to give a general presence or absence for each stream, and the specific numbers are not reported here.

A more precise analysis of bacteria loading utilizing lab analysis in CFU has been done in the Gibbons Creek drainage and summarized in a report titled *Gibbons Creek Bacteria and Turbidity Monitoring Study* (July, 2006), which is available by request or from our website at: http://www.clark.wa.gov/water-resources/documents.html#strmac This has allowed the county to pinpoint the areas and causes of high bacteria loading to Gibbons Creek and recommend actions to the appropriate agencies. A similar study is planned in the Gee Creek watershed in 2007 utilizing volunteers.

Temperature:

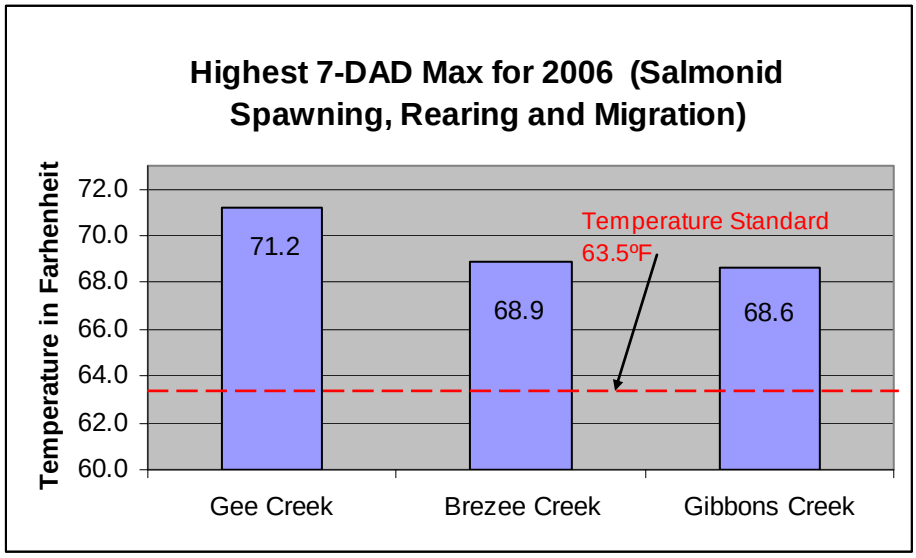
Continuous temperature data loggers were deployed at all volunteer sites taking hourly readings from May to October. Jones Creek, while not a volunteer site, has been included in this section as an example of water quality results from an uninhabited, forested watershed that lies within Clark County. Jones Creek is an example of how intact riparian shading along the stream corridor controls solar heating in a stream during the summer.

Temperature criteria have been developed by Ecology based on the needs of salmonids. Instead of an individual maximum value, Ecology utilizes a 7-day average of the daily maximum temperatures (7-DAD Max), which is the average of seven consecutive daily maximum temperatures. Any given 7-DAD Max value, then, is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date. For example, the maximum values for the days June 1-7 would be averaged and that number would be the 7-DAD Max for June 4th. The 7-DAD Max value for June 5th would be an average of the maximum values for June 2-8, and so on. The temperature criteria is based on the highest 7-DAD Max of the summer, which represents the warmest week of the summer.

According to Ecology's water quality standards the volunteer sites fall into two of the aquatic life temperature criteria. Gee, Brezee, and Gibbons Creek fall into the category "Salmonid Spawning, Rearing and Migration" and the highest acceptable 7-DAD Max is 63.5ºF (Figure 3). A stream in this category is defined by the use of salmon or trout

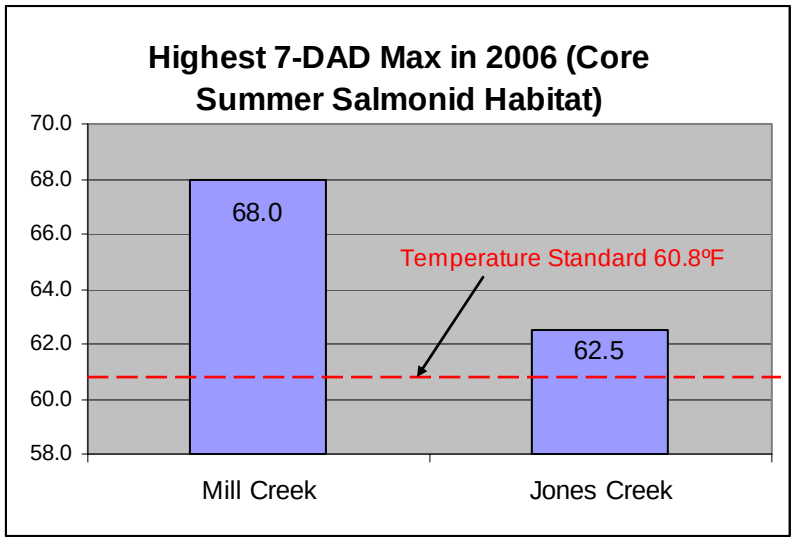
spawning and emergence *outside* of the summer season (Sept.16-June 14th), and includes rearing and migration by salmonids. (Ecology, page 9)

Figure 3



Mill Creek and Jones Creek are in the category "Core Summer Salmonid Habitat" and the highest acceptable 7-DAD Max is 60.8ºF (Figure 4). A stream in this category is defined by the use of salmon or trout spawning and emergence *during* the summer season (June 15th- September 15th), and includes use as rearing habitat by one or more salmonids. (Ecology, page 9).

Figure 4



Comments:

In all previous years where data is available these creeks have exceeded the temperature standard. 2006 was no exception. Increasing the density of shade trees and shrubs in the riparian zone would benefit all the stream sites as well as protection of intact forested portions in each watershed. Increasing summer baseflow, by limiting water withdrawals or through stormwater management, is another important factor in lessening the impact of solar exposure. Also, it may be beneficial to study the influence of ponds on stream temperatures in these watersheds.

Temperatures above the standard may begin to effect the salmonid life cycle in negative ways. Water temperature controls the rate of metabolic and reproductive activities, and therefore, life cycles. Cold-blooded organisms like salmonids are adapted to a specific temperature range for their life cycle. If stream temperatures increase, or fluctuate too widely, metabolic activities may slow down, malfunction, or stop altogether. Studies have shown salmonids may become more vulnerable to parasites and diseases, and more sensitive to toxic chemicals, when water temperatures exceed their normal range.

It is also useful to know for how many days the standard was exceeded. (Figure 5).

Figure 5

Site	Days>63.5ºF	Days>60.8ºF
Gee Creek	60	N/A
Brezee Creek	39	N/A
Gibbons Creek	38	N/A
Mill Creek	35	72
Jones Creek	2	7

Conclusion

All four volunteer stream sites have been significantly impacted by land use, increased impervious area and deforestation. Gee, Mill and Brezee Creeks seem to be more adversely effected than Gibbons Creek. The ability of a watershed to absorb the effects of human activities is based, in part, on the underlying geology and soil types. More conclusions could be made if these factors, as well as primary land uses in each watershed, were researched. On-going data collection at these sites in 2007 will provide more data on background condition and track changes in water quality.

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