Thurston County Water Resources Monitoring Report
2007-2008 Water Year
2008-2009 Water Year

Report Includes:
Water Quality of Streams and Lakes

July 2010

Prepared by:
Thurston County Public Health and Social Services Department, Environmental Health Division and Thurston County Resource Stewardship Department, Water Resources Division

In Cooperation With:
City of Olympia Public Works, Water Resources Program
City of Lacey Public Works, Water Resources Program
City of Tumwater Public Works Department
# Table of Contents

## Introduction

- Report Organization ............................................................................................................. 1
- Monitoring Methods ........................................................................................................... 2
- Water Quality Standards .................................................................................................... 7

## Black River Watershed

- Beaver Creek .................................................................................................................... 9
- Black River ....................................................................................................................... 15
- Blooms Ditch ................................................................................................................... 25
- Deep Lake ....................................................................................................................... 31
- Salmon Creek .................................................................................................................. 41

## Budd Inlet / Deschutes River Watershed

- Black Lake ....................................................................................................................... 47
- Black Lake Ditch ............................................................................................................... 57
- Capitol Lake .................................................................................................................... 63
- Chambers Creek ............................................................................................................. 81
- Deschutes River ............................................................................................................... 87
- Ellis Creek ..................................................................................................................... 99
- Indian Creek .................................................................................................................. 105
- Lawrence Lake .............................................................................................................. 111
- Mission Creek ............................................................................................................... 129
- Moxlie Creek .................................................................................................................. 135
- Percival Creek .............................................................................................................. 139
- Schneider Creek (Budd) ............................................................................................... 145
- Spurgeon Creek ............................................................................................................ 151
- Ward Lake ..................................................................................................................... 157

## Chehalis River Watershed

- Chehalis River ................................................................................................................. 167
- Prairie Creek ................................................................................................................... 173
- Scatter Creek ................................................................................................................... 179
- Skookumchuck River .................................................................................................... 191

## Eld Inlet Watershed

- Green Cove Creek ........................................................................................................... 197
- McLane Creek ................................................................................................................. 203
- Perry Creek ..................................................................................................................... 209

## Henderson Inlet Watershed

- Hicks Lake ....................................................................................................................... 215
- Long lake ......................................................................................................................... 225
- Pattison Lake .................................................................................................................. 247
- Tanglewilde Stormwater Outfall ................................................................................... 257
- Woodard Creek ............................................................................................................. 263
Woodland Creek ..............................................................................................................269

Nisqually River Watershed
   Eaton Creek..................................................................................................................275
   Lake St. Clair ...............................................................................................................281
   McAllister Creek...........................................................................................................299
   Thompson Creek...........................................................................................................305
   Yelm Creek...................................................................................................................311

Totten / Little Skookum Inlet Watershed
   Kennedy Creek.............................................................................................................319
   Schneider Creek (Totten)............................................................................................325
   Summit Lake..................................................................................................................335

Volunteer Monitoring Activities .......................................................................................345

Benthic Macroinvertebrates Monitoring...........................................................................353

References.........................................................................................................................389
Introduction

This report contains water quality data collected by Thurston County Environmental Health Division during the 2007/08 and 2008/09 water years (Note: A water year is October 1 through September 30). The surface water monitoring is part of an ambient monitoring program funded by the local storm and surface water utilities of Thurston County and the Cities of Lacey, Olympia, and Tumwater. The report contains a chapter of student volunteer-collected water quality data collected through two education projects called South Sound GREEN and Nisqually River Education Project. This report is prepared every two years. The water quality data produced by the program is posted annually on the website below:

www.co.thurston.wa.us/health/ehswat/swater.html

The objectives of the surface water monitoring program are to:

- Collect baseline information about the water quantity and water quality condition of streams and lakes in Thurston County;
- Identify problem areas and;
- Track trends in stream flow and water quality over time.

The county map on page three shows currently monitored and historically monitored sites.

Report Organization

Surface Water Report Organization

The surface water report is divided into sections by watershed or drainage basin. The eight major drainage basins within Thurston County are as follows:

Puget Sound:  Chehalis Drainage to Pacific:
Nisqually River  Skookumchuck River
Budd Inlet/Deschutes River  Chehalis River
Henderson Inlet  Black River
Eld Inlet
Totten Inlet

The first item at the beginning of each watershed section is a map highlighting the watershed area. Following the watershed maps are descriptive summaries and data for each stream and lake monitored within the watershed. These summaries appear alphabetically by the most common name for that stream, river, or lake. In some cases there is no official name for a stream, so it has been assigned a name by County staff for reference.
Introduction

On the first page of each stream summary is the name of the stream and its stream catalog number assigned to it by the Washington Department of Fisheries, November 1975, in A Catalog of Washington Streams and Salmon Utilization. On the top half of the page is a map of the stream or lake. If water quality sampling was conducted, the sampling site is identified.

Below the map is a general description of the stream or lake: the watershed it is located in, length of the stream or lake shoreline, and basin size in acres or square miles. Stream order, which is a number from 1 to 6 ranked from headwaters to river mouth that designates the relative position of a stream in the drainage basin system, is listed. U.S. Geological Survey 7.5 minute quadrant maps were used to determine the stream order for this report. Fisheries resources are listed using A Catalog of Washington Streams and Salmon Utilization, November 1975, unless otherwise noted.

A brief description of the area topography is included followed by a general water quality description of "excellent," "good," "fair," or "poor" for the stream. The description is based on the water quality data collected in the water year reported, the number and degree of excursions outside the water quality standards, as well as other water quality indicators. A definition of these categories can be found on page 8. Following the “General Water Quality” category is a listing of sources for additional information.

The remainder of the summary includes summary tables and comparisons of water quality data to water quality standards, with a narrative discussion of water quality and quantity conditions and issues, as well as volunteer data, if any is available. Each summary ends with water quality data and stream flow or lake level records.

Monitoring Methods

Surface Water Quality Monitoring Methods

Streams

In water year 2007/08, water quality information was collected on thirty two streams. In water year 2008/09, water quality information was collected on thirty seven streams. Sampling sites for streams are generally located close to the mouths of the streams before they discharge into the larger river or marine water body. The stream monitoring was done monthly.

The following parameters were measured at all stream sites:

- total phosphorus
- nitrate-nitrite nitrogen
- turbidity
- fecal coliform
- temperature
- pH
- specific conductivity
- dissolved oxygen

Ammonia was measured at Moxlie Creek throughout water year 2008/09 and at Tanglewilde throughout both water years.
Field parameters were measured using a YSI multi-parameter field instrument. Stream discharges, measured during water quality monitoring events, were measured using a Swoffer flow meter and by wading the stream.

Lakes

In 2009, water quality information was collected at thirteen sites on nine lakes. For lake monitoring, field parameters were measured at one or two meter increments from the surface to the bottom of the lake using the YSI multiparameter field instrument. The nutrients (total phosphorus and total nitrogen) were sampled near the surface and near the bottom. The bottom samples were collected using a Kemmerer sampler. Chlorophyll $a$ and algae identification samples were taken as composite samples from the epilimnion (warm surface layer) or the photic zone (the surface area where sunlight can penetrate). Secchi disk visibility (or water clarity) was measured using a standard black and white quadrant disk. Sampling sites in the lakes were located in the deepest area of each lake as determined by available bathymetric maps. Four lakes had two sampling sites on them. Changes in the program for 2009 included addition of sampling at two sites on Lawrence Lake and discontinued on Hicks Lake and North Pattison.

The average summer total phosphorus and chlorophyll $a$ concentrations and secchi disk measurements are used to calculate the Carlson trophic state indices. The Carlson trophic state indices (TSI) are used to express the degree of productivity, or plant and algae growth, in a lake. Average summer total phosphorus concentrations, chlorophyll $a$ concentrations, and secchi disk transparency are each used to calculate a TSI for the lake. A TSI of 0 to 40 indicates an oligotrophic, or low productivity, lake. A TSI of 41 to 50 indicates a mesotrophic, or moderately productive lake. A TSI of greater than 50 indicates a eutrophic, or highly productive lake.

The three graphs on the following pages show the 2009 lake sample sites in order of their trophic state by parameter. Lakes toward the bottom of the graph have the clearest water, lowest algae production and low total phosphorus levels. Low productivities lakes are ones that people like to swim and recreate in and associate with “good” water quality. Those lakes toward the top of the graphs have poor water clarity and tend to have frequent and/or prolonged algae blooms. The plant and algae growth on these lakes can interfere with recreational uses at times.
2009 Thurston County Lakes
Chlorophyll Trophic State Indices

<table>
<thead>
<tr>
<th>Lake</th>
<th>Oligotrophic</th>
<th>Mesotrophic</th>
<th>Eutrophic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capitol_North</td>
<td>50</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Pattison_South</td>
<td>60</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Black</td>
<td>60</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>St Clair_SW</td>
<td>50</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Lawrence_West</td>
<td>60</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Lawrence_East</td>
<td>60</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Long_North</td>
<td>60</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Long_South</td>
<td>60</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Capitol_Middle</td>
<td>60</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Ward</td>
<td>50</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>St Clair_East</td>
<td>60</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Deep</td>
<td>50</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Summit</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
</tbody>
</table>

Total Phosphorus Trophic State Indices

<table>
<thead>
<tr>
<th>Lake</th>
<th>Oligotrophic</th>
<th>Mesotrophic</th>
<th>Eutrophic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capitol_North</td>
<td>50</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Capitol_Middle</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Pattison_South</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Lawrence_West</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Black</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Lawrence_East</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Long_North</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Long_South</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>St Clair_SW</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>St Clair_East</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Ward</td>
<td>50</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Deep</td>
<td>50</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Summit</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
</tbody>
</table>
Water Resources Atmospheric and Water Quantity Monitoring

Thurston County’s Department of Resource Stewardship, Water Resources Division performs stream flow and stream temperature, lake level, ground water level and atmospheric monitoring. There are currently eleven active stream gauging stations, nineteen multi-parameter rainfall gauging stations, dozens of ground water level recorders, and six lake level gages in the program in 2010.

The data are used for a variety of purposes including calibration of stormwater flow models to micro-scale hydrologic interpretation models. Much of the data is used to validate hydrologic and hydraulic models used to predict and track changes in stream flow resulting from changes in land use and changes in stormwater management activities. More recently, the precipitation data collected now for over ten years is being used for site-specific drainage design using the WWHM 3 runoff modeling software. This allows developers to model stormwater according to actual site conditions and size facilities appropriately, as required the newly adopted Drainage and Erosion Control Manual (2009-10). The river and precipitation data also serves as an early warning of possible flooding, especially the ground water level data and urban streams. There are five real-time weather and river flow stations that can be accessed by the public through the Water Resources Monitoring Data Website, along with all of the other data resources that we manage, at www.co.thurston.wa.us/monitoring

Information regarding all of the data locations, maps, and links to external sites can also be accessed from the website address listed above.
# Water Quality Standards

The Washington State water quality standards for all surface water bodies are established in Chapter 173-201A of the Washington Administrative Code (WAC) which was amended November 20, 2006. Water quality standards for surface waters were established consistent with public health and public enjoyment of the waters and the propagation and protection of fish, shellfish, and wildlife. The standards for the parameters that are monitored by Thurston County are shown in Table 1. Refer to WAC 173-201A for a complete description of the water quality standards.

## Table 1. Water Quality Standards for Surface Waters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Extraordinary Primary Contact Recreation (includes lakes)</th>
<th>Primary Contact Recreation</th>
<th>Secondary Contact Recreation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater Fecal Coliform (colonies/100 L) Part 1 – geometric mean ≤ X</td>
<td>50</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Freshwater Fecal Coliform (colonies/100 L) Part 2 - not more than 10% of the samples &gt;XX</td>
<td>100</td>
<td>200</td>
<td>400</td>
</tr>
</tbody>
</table>

### Freshwater Contact Recreation Criteria

<table>
<thead>
<tr>
<th>Dissolved Oxygen (mg/l) Lowest 1-Day Minimum</th>
<th>Char</th>
<th>Salmon &amp; Trout Spawning, Core Rearing, and Migration</th>
<th>Salmon &amp; Trout Spawning, Non-core Rearing, and Migration</th>
<th>Salmon &amp; Trout Rearing and Migration Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5</td>
<td>9.5</td>
<td>8.0</td>
<td>6.5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature (degrees C) Highest 7-DAD* Maximum</th>
<th>12°C (53.6°F)</th>
<th>16°C (60.8°F)</th>
<th>17.5°C (63.5°F)</th>
<th>17.5°C (63.5°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5 – 8.5; 0.2</td>
<td>6.5 – 8.5; 0.2</td>
<td>6.5 – 8.5; 0.5</td>
<td>6.5 – 8.5; 0.5</td>
<td>6.5 – 8.5; 0.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>pH Within range shown with human-caused variation within the range of less than XX units.</th>
<th>6.5 – 8.5; 0.2</th>
<th>6.5 – 8.5; 0.2</th>
<th>6.5 – 8.5; 0.5</th>
<th>6.5 – 8.5; 0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbidity (NTUs) Not exceed X over background when background is 50 NTU or less; or a XX% increase in turbidity when background is &gt; 50 NTU.</td>
<td>5; 10%</td>
<td>5; 10%</td>
<td>5; 10%</td>
<td>10; 20%</td>
</tr>
</tbody>
</table>

*7 day average of the daily maximum temperatures
The “General Water Quality” condition stated in the descriptive summary for each stream and lake in this report is made on the basis of the guidelines below.

**Stream Water Quality Categories**

“Excellent” - No water quality standard violations, and very low fecal coliform and nutrient concentrations.

“Good” - Usually meets water quality standards; OR violates only one part of the two part fecal coliform standard; OR the violation is most likely the result of natural conditions rather than pollution.

“Fair” - Frequently fails one or more water quality standards and other parameters such as nutrients indicate water quality is being impacted by pollution.

“Poor” - Routinely fails water quality standards by a large margin; other parameters such as nutrients are at elevated concentrations.

**Lake Water Quality Categories**

“Excellent” - Very low nutrient and chlorophyll $a$ concentrations, and very high water clarity; Classified as Oligotrophic; Uses not impaired.

“Good” - Low to moderate nutrient and chlorophyll $a$ concentrations, and moderate to high water clarity; Classified as Mesotrophic; Uses not impaired.

“Fair” - Moderate to high nutrient and chlorophyll $a$ concentrations, and low to moderate water clarity; Classified as Eutrophic; Uses sometimes impaired.

“Poor” - High nutrient and chlorophyll $a$ concentrations, and low water clarity; Classified as Eutrophic; Uses impaired during most of the summer season by excess algae and/or aquatic macrophyte (plant) growth.