Thurston County
Water Resources Monitoring Report
2003-2004 Water Year
2004-2005 Water Year

Report Includes:
Water Quality of Streams and Lakes

August 2006

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In Cooperation With:
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City of Lacey Public Works, Water Resources Program
City of Tumwater Public Works Department
Washington State Department of Ecology
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Introduction

This report contains water quality data, continuous stream flow records, lake level data, and precipitation records collected by the Thurston County Storm and Surface Water Utility and the Thurston County Environmental Health Division during the 2003/04 and 2004/05 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 stormwater utilities and County funds. This is the eleventh annual water resources report.

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 maps on pages 3 and 4 show 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 shown on the map on page three and are as follows:

Puget Sound:
- Nisqually River
- Budd Inlet/Deschutes River
- Henderson Inlet
- Eld Inlet
- Totten Inlet

Chehalis Drainage to Pacific:
- Skookumchuck River
- Chehalis River
- Black River

The first item at the beginning of each watershed section is a map highlighting the watershed area. The next information is the precipitation data graphs from each precipitation gage within the watershed.

Following the precipitation data 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*. Following this is a map showing the stream or lake and the sampling site, if water quality sampling was conducted.

Following the map is a general description of the stream or lake, including in what watershed it is located, 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 also 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.

Following a brief description of the area topography is a general water quality description of "excellent," "good," "fair," or "poor" for the stream, which is based on the water quality data collected in the water year reported and 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 10. Following the “General Water Quality” category is a listing of sources for additional information.

The remainder of the summary presents water quality data summary tables and comparisons to water quality standards, followed by a narrative discussion of water quality and quantity conditions and issues and volunteer data, if available. Last are the water quality data and stream flow or lake level records.

**Monitoring Methods**

**Surface Water Quality Monitoring Methods**

**Streams**

In 2003-2004, water quality information was collected on eighteen streams. In 2004-2005, water quality information was collected on twenty-six 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

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.
THURSTON COUNTY
Department of Water & Waste Management
Monitoring Sites

Introduction

Miles

Map Created on 07/13/06 abc

0 1 2 4

Ground Water Wells
Precipitation Station
Stream Flow Site
Surface Water Gage
Lakes

In 2004 and 2005, water quality information was collected at fourteen sites on nine different 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 $a$ 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. Three lakes had two sampling sites on them and Capitol Lake had three sites, because these lakes have separate basins.

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 page show the 2005 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.
Introduction

2005 Thurston County Lakes
Chlorophyll Trophic State Indices

Oligotrophic  Mesotrophic  Eutrophic

Secchi Trophic State Indices

Oligotrophic  Mesotrophic  Eutrophic

Total Phosphorus Trophic State Indices

Oligotrophic  Mesotrophic  Eutrophic
Surface Water Quantity Monitoring

Thurston County’s Department of Water and Waste Management, Surface and Storm Water Utility performs stream flow and stream temperature, lake level, ground water level and precipitation monitoring. There were eight stream gaging stations, nine rainfall gaging stations, ground water level recorders in four areas, and sixteen lake level gages. The data are used for a variety of purposes including to calibrate and 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. The data also serves as an early warning of possible flooding, especially the ground water level data.

Continuous Stream Flow and Stream Temperature Data

Stream flow data is collected using a Geokon LC-1 measurement and control module utilizing a vibrating wire pressure transducer. Stream temperatures and ambient air temperatures are also recorded concurrently. Stage measurements are recorded every 60 minutes. The stage is then converted to a flow value (cubic feet per second) by the use of a rating curve. Historical 15-minute data is available for most of the stream flow collection sites listed below. Stream flow and temperature data are available on the Thurston County website at http://www.co.thurston.wa.us/monitoring/index.htm.

Stream flow data for the following creeks and rivers are available:

- Black Lk Ditch @ Jones Quarry Bridge  Start date: 2003 - present
- Chambers Creek at Rich Road  Start date: 8/28/89 - present
- Green Cove Creek at 36th Avenue NW  Start date: 6/20/89 - present
- McLane Creek at Delphi Road  Start date: 9/21/94 - present
- Percival Ck @ Black Lk Ditch Confluence  Start Date: 2003 - present
- Percival Creek at Mottman Road  Start date: 2/26/88 - 3/7/96
- Woodland Creek at Pleasant Glade Road  Start date: 2/26/88 - 2/5/96, 2003 - present
- Woodard Creek at 36th Avenue NE  Start date: 3/1/88 - present

Precipitation

Thurston County’s Storm and Surface Water Utility measures precipitation at nine locations throughout Thurston County. Data is collected using a Campbell Scientific CR-205, CR-510 or CR-10X rain gage recorder with a tipping bucket that registers every 1/100 of an inch of rainfall. Precipitation data is collected from the field every month or by radio telemetry and downloaded to a database. The data is then posted on Thurston County’s website for access to the public or other agencies. The data can be downloaded at http://www.co.thurston.wa.us/monitoring/index.htm. The water year begins on October 1 and ends on September 30. Rainfall statistics for the water year and period of record are available.
Introduction

In addition to County-maintained precipitation stations, the National Oceanic and Atmospheric Administration (NOAA) measures precipitation at the Olympia Airport. That information is also available at the above website.

Rainfall data is available for the following areas.

- Upper Deschutes River  Start Date: October 1990 to present
- Eaton Creek/Lake St. Clair  Start Date: March 1992 to 2000, 2002 to present
- Green Cove Creek Basin  Start Date: October 1990 to 2000, 2002 to present
- Nisqually/McAllister Basin  Start Date: 2002 to present
- Olympia Airport  Start Date: 1955 to present
- Percival Creek Basin  Start Date: October 1989 to 2000, 2001 to present
- Summit Lake  Start Date: November 1993 to 2000, 2003 to present
- Tenino  Start Date: October 1994 to 2001, 2003 to present
- Woodard Creek Basin  Start Date: October 1988 to present
- Woodland Creek Basin  Start Date: October 1988 to present

Lake Levels

Thurston County Department of Water and Waste Management, Surface and Storm Water Utility has volunteer lake level gage readers for sixteen lake sites. Graphs of each lake’s water surface elevation over time can be seen by going to http://www.co.thurston.wa.us/monitoring/index.htm. The following is a listing of the lakes monitored.

- Black Lake  Offutt Lake
- East and West Chambers Lake  Pattison Lake
- Deep Lake  Scott Lake
- Hewitt Lake  Smith Lake
- Hicks Lake  Summit Lake
- Lake Lawrence  St. Clair
- Long Lake  Ward Lake
- McIntosh Lake

Ground Water Level Monitoring

Continuous ground water elevations are monitored in the following areas of the County:

- Salmon Creek Basin
- Hidden Forest Subdivision
- Hawksridge Subdivision
- The Meadows Subdivision

That data can be viewed by going to http://www.co.thurston.wa.us/monitoring/index.htm
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 July 1, 2003. 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

| Parameter | Water Contact Recreation Criteria | | | |
|---|---|---|---|
| | Extraordinary Primary Contact Recreation (includes lakes) | Primary Contact Recreation | Secondary Contact Recreation |
| Fecal Coliform (colonies/100 mL) | 50; 100 | 100; 200 | 200; 400 |
| Freshwater – geometric mean and not more than 10% of the samples >XXX |

| Parameter | Water Contact Recreation Criteria | | | |
|---|---|---|---|
| | | Freshwater Aquatic Life Uses Criteria |
| | Char | Salmon & Trout Spawning, Core Rearing, and Migration | Salmon & Trout Spawning, Non-core Rearing, and Migration | Salmon & Trout Rearing and Migration Only |
| Dissolved Oxygen (mg/l) Lowest 1-Day Minimum | 9.5 | 9.5 | 8.0 | 6.5 |
| Temperature (degrees C) Highest 7-DAD* Maximum | 12°C (53.6°F) | 16°C (60.8°F) | 17.5°C (63.5°F) | 17.5°C (63.5°F) |
| pH Within range shown with human-caused variation within the range of less than XX units. | 6.5 – 8.5; 0.2 | 6.5 – 8.5; 0.2 | 6.5 – 8.5; 0.5 | 6.5 – 8.5; 0.5 |
| Turbidity (NTUs) Not exceed X over background when background is 50 NTU or less; or a XX% increase in turbidity when background is > 50 NTU. | 5; 10% | 5; 10% | 5; 10% | 10; 20% |

*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.