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Agenda Item 8
REPORT #RWSC 2011 - 08

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, 18 MAY 2011

SUBJECT **2010 ANNUAL OVERVIEW OF GREATER VICTORIA'S DRINKING WATER QUALITY**

ISSUE

To provide information on the quality of drinking water in the Greater Victoria Drinking Water System in 2010.

BACKGROUND

Each year, as part of the legislated reporting requirements for all Water Suppliers, CRD Water Quality (WQ) Division staff prepare summaries of water quality data collected in 2010 from Greater Victoria's Drinking Water System. These reports are provided to individual Water Suppliers, the Chief Medical Health Officer and the public.

WQ division staff post the annual reports and water quality data tables at the following CRD website locations:

- http://www.crd.bc.ca/water/waterquality/annualreports.htm
- http://www.crd.bc.ca/water/waterquality/datatables.htm

Please find the executive summary and selected charts from the *2010 Annual Overview of Greater Victoria's Drinking Water Quality* attached.

RECOMMENDATION

That the Regional Water Supply Commission receive the staff report for information.

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2010 Annual Overview of Greater Victoria's Drinking Water Quality

(Executive Summary and Selected Charts Only)

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May 10, 2011

ENVIRONMENTAL SUSTAINABILITY
CAPITAL REGIONAL DISTRICT
479 Island Highway
Victoria, BC

Executive Summary

This report is the annual overview of water quality testing that was conducted in 2010 for the Greater Victoria Drinking Water System. The test results show that Greater Victoria's drinking water continues to be good quality and is safe to drink. With a few minor exceptions, all the results were within the limits of both the *Guidelines for Canadian Drinking Water Quality* and the BC *Drinking Water Protection Regulation.* This report is posted at http://www.crd.bc.ca/water/waterquality/annualreports.htm on the Capital Regional District (CRD) website.

Samples and Tests. In 2010, the Water Quality Division collected 7,675 samples from the Greater Victoria Drinking Water System and analyzed those samples for 47,743 individual tests. Approximately 300 different types of analyses were conducted on these samples. The data collected in 2010 are reported in the water quality data tables (**Tables 1, 2 and 3**) that are posted in the Water Quality section of the CRD website at http://www.crd.bc.ca/water/waterquality/datatables.htm

Bacteria in Source Water. In 2010, as in the past few years, the level of total coliform bacteria in the raw (untreated) source water entering the Japan Gulch Disinfection Plant continued to be higher during the late summer and peaked in late August (**Figure 3**). Nevertheless, the quality of the raw water entering the treatment plant continued to easily meet the fecal coliform bacteria (*E. coli*) limit of 20 colony forming units per 100 mL at least 90% of the time as stipulated in the USEPA Surface Water Treatment Rule and therefore continued to qualify to remain an unfiltered surface water supply under this portion of the USEPA regulations (**Figure 3A**). In 2010, all of the *E. coli* positive samples contained *E. coli* concentrations below 20 CFU/100mL.

Treatment. The treatment process used to disinfect the raw source water entering the distribution system continued to be ultraviolet (UV) disinfection followed by free chlorine and then ammonia (to produce chloramines). The chlorine dosage level was increased four times during the year to keep the chlorine residual in the distribution system relatively constant in response to a significant nitrification event. These changes resulted in monthly median total chlorine residuals ranging from 0.73 to 1.52 mg/L at the entry point to the distribution system (**Figure 4**).

Bacteria at First Customer. While five total coliform positive samples were found in samples taken at the first customer sampling location below the Japan Gulch Disinfection Plant during 2010, the 10% monthly limit was never exceeded (**Figure 4**). The annual total coliform positive sample rate of 2.0% was similar to the previous eight years and much better than earlier years before the use of UV and free chlorine as primary disinfectants. No *E. coli* bacteria were found in any of the samples collected at the entry point to the distribution system. This provides assurance that Greater Victoria's primary disinfection process is working in a satisfactory manner.

Bacteria in Distribution System. When all of the results from the various municipal distribution systems are grouped together (**Figure 5**), the percentage of total coliform positive samples in the Greater Victoria distribution system did not exceed the 10% Guideline limit during any month in 2010 and was therefore in compliance with the BC *Drinking Water Protection Regulation*. Over the last 19 years, a broad reduction in total coliform bacteria detection (see inset in **Figure 5**) has been observed and hence, an overall improvement in the bacteriological quality of the water. The relatively low level of total coliform positive samples (under 1%) reflects the balance maintained between reasonable concentrations of chlorine in the distribution system and acceptable levels of positive bacterial samples.

Parasites. In 2010, no *Giardia* cysts were detected in the raw source water entering Japan Gulch Treatment Plant **(Figure 6)**. In addition, none of the 2010 samples contained *Cryptosporidium* oocysts (**Figure 7**). The 10-year average total *Giardia* cyst and total *Cryptosporidium* oocyst concentrations were only 0.02 cysts and 0.04 oocysts per 100 L, respectively (**Figures 6 and 7**). While these are extremely low values for a surface water supply, the addition of UV disinfection provides assurance that no infective parasites can enter the Greater Victoria Drinking Water System.

Physical-Chemical-Radiological. All the physical, chemical and radiological parameters were well within the Canadian Guideline limits except for summer water temperatures (aesthetic limit of 15ºC). In 2010, the water temperature was above the 15°C limit for a period of about three months from mid-July to mid-October (**Figure 3**). This is similar to the previous five years and an improvement from earlier years when the water temperature was above the 15°C limit for about 4 months of the year (**Figure 2**). This cooler water is one of the benefits of raising the water level in Sooke Reservoir and the ability to draw from deeper and cooler strata.

Inorganic and Organic Chemicals. All inorganic chemicals including metals and non-metals were within Guideline values at the entry point to the distribution system. No synthetic organic chemicals including pesticides and herbicides were detected in the raw water entering the treatment plant.

Disinfection By-Products. Disinfection by-products such as total trihalomethanes (TTHMs) were well below (range of 11.0-23.9 μg/L) the Canadian Guideline limit of 100 μg/L in the chloraminated distribution system (**Figure 8**). The TTHMs were higher in a small section of the distribution system in North Saanich that is subject to rechlorination (Upper Dean Park Reservoir) but were still below Guideline values, ranging from 15.4 to 46 µg/L. Similarly, a second group of disinfection by-products, haloacetic acids (referred to as HAA5 because the limit is based on the concentration of a group of five HAAs) were low in the chloraminated distribution system, ranging from 8.45-32.6 μg/L (**Figure 9**) but were unusually elevated at the plant in the summer. The Canadian Guideline limit for HAAs of 80 μg/L was introduced in 2008.

Sooke Reservoir Biological Activity. The overall level of algal activity in Sooke Reservoir is measured using chlorophyll-a, a component of all algal cells. In 2010, the concentration of chlorophyll-a in the south and north basins continued to be elevated (as was observed in past years) following the raising of the water level in Sooke Reservoir (**Figure 10**). In the past 4 years, chlorophyll-a concentrations appear to have reached a steady state (with some variation).

Phosphorus. The primary contributor to the higher levels of chlorophyll-a observed in Sooke Reservoir in 2003 through 2010 was higher levels of total phosphorus, a nutrient that is needed for the algae to grow. The median concentration of total phosphorus was approximately 53% higher than in the years prior to inundation in both the north and south basins of Sooke Reservoir (**Figure 11**). However, the levels of total phosphorus are declining as the median concentration in 2008 through 2010 was only 16% higher than in the years prior to inundation. The highest phosphorus levels coincided with flooding of the newly cleared lands around the margin of Sooke Reservoir when the reservoir was expanded. In 2010, the phosphorus levels were similar, albeit slightly lower, than 2009 and substantially lower than during the inundation.

Algae. In 2010, one distinct, but not particularly significant algal bloom occurred in Sooke Reservoir in spring. The diatom, *Asterionella formosa* (**Figure 12**) was the main contributor to the higher levels of chlorophyll-a during this time (**Figure 10**). *Tabellaria fenestrata* (a diatom) also contributed to the overall increase in algal abundance (**Figure 13**).

Water Quality Complaints. In 2010, the number of water quality complaints received by CRD Water Services was very low (lowest in nineteen years) (**Figure 14**).

Figure 1. Water Level Elevation in Sooke Reservoir, 2007-2010

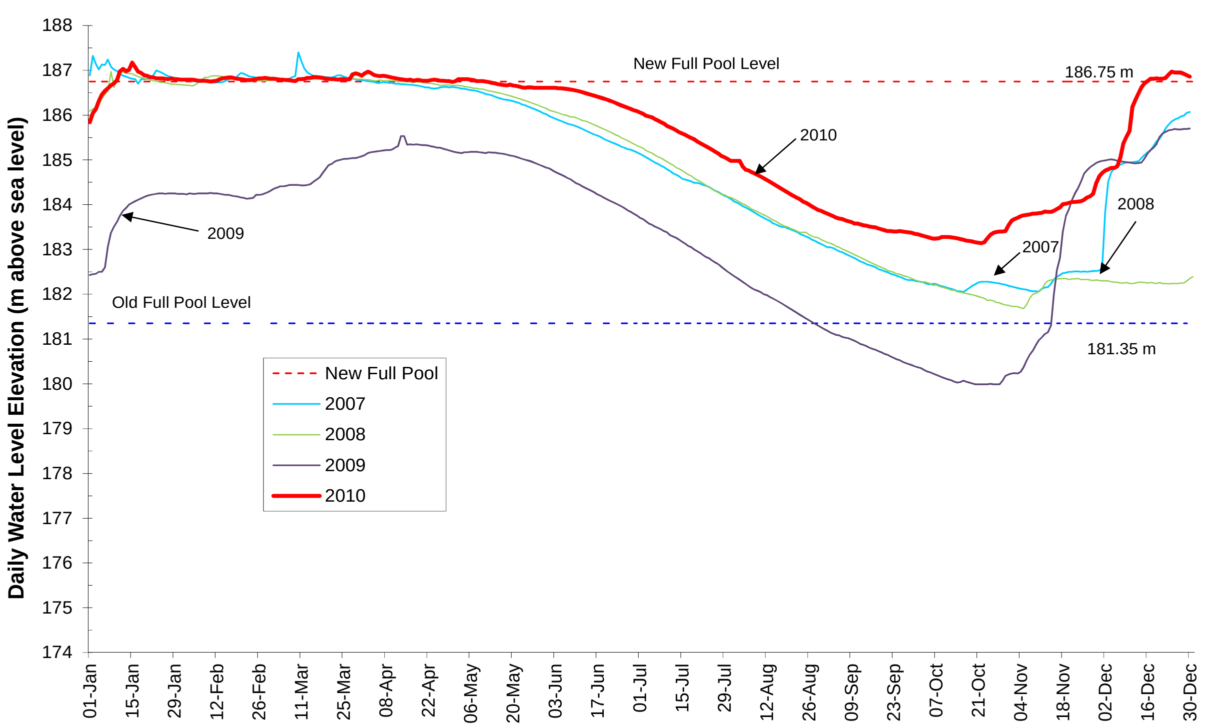
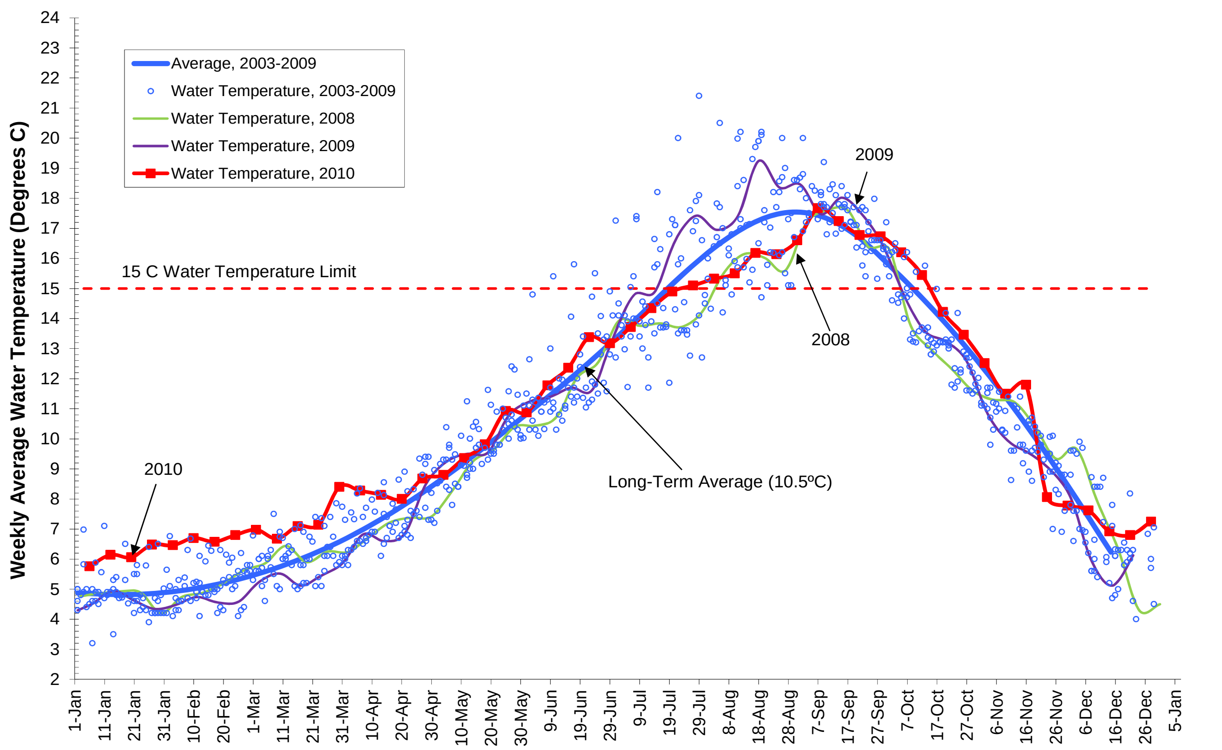


Figure 2. 2010 Temperature of Raw Water entering Japan Gulch Plant (Weekly Average)



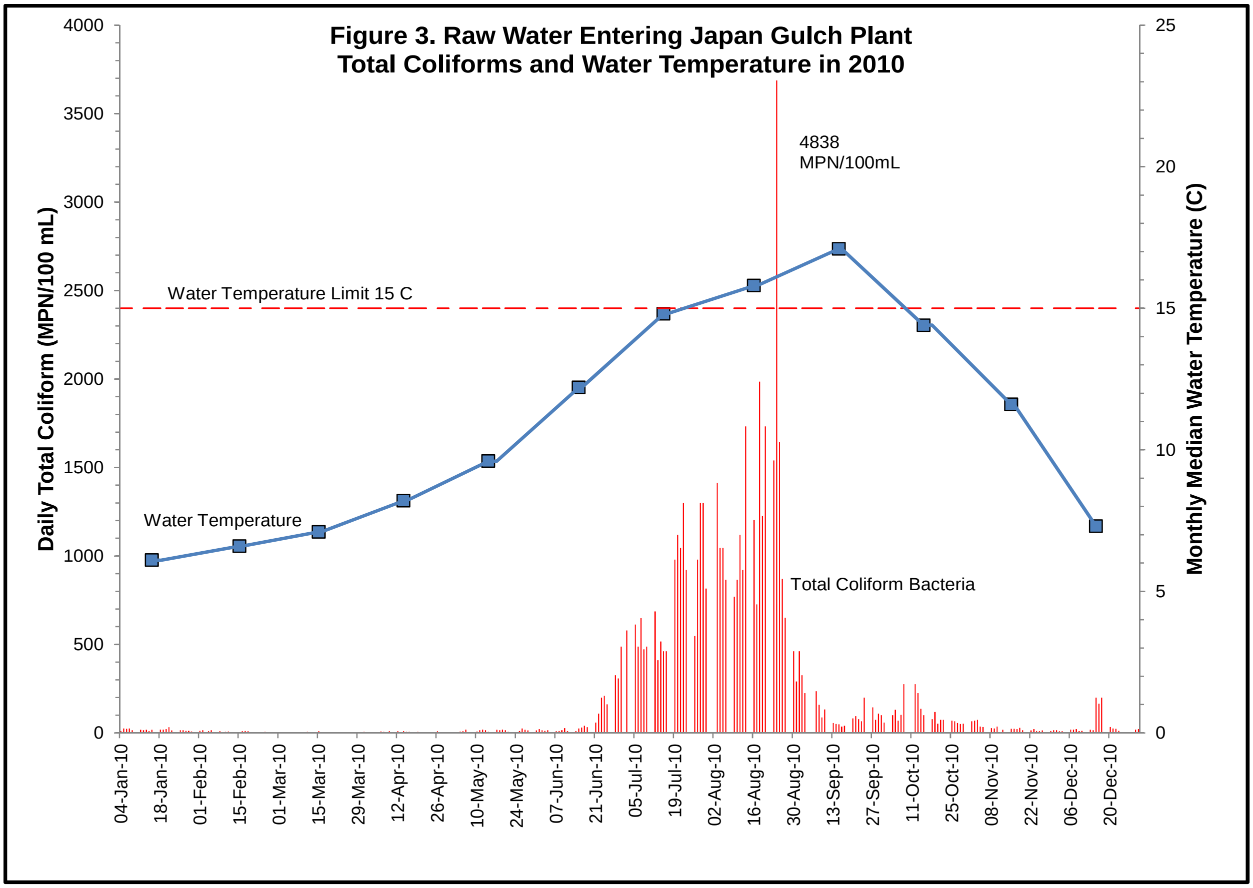


Figure 3. Raw Water Entering Japan Gulch Plant
Total Coliforms and Water Temperature in 2010
Daily Total Coliform (MPN/100 mL)
Monthly Median Water Temperature (C)
4838
MPN/100mL
Water Temperature Limit 15 C
Water Temperature
Total Coliform Bacteria

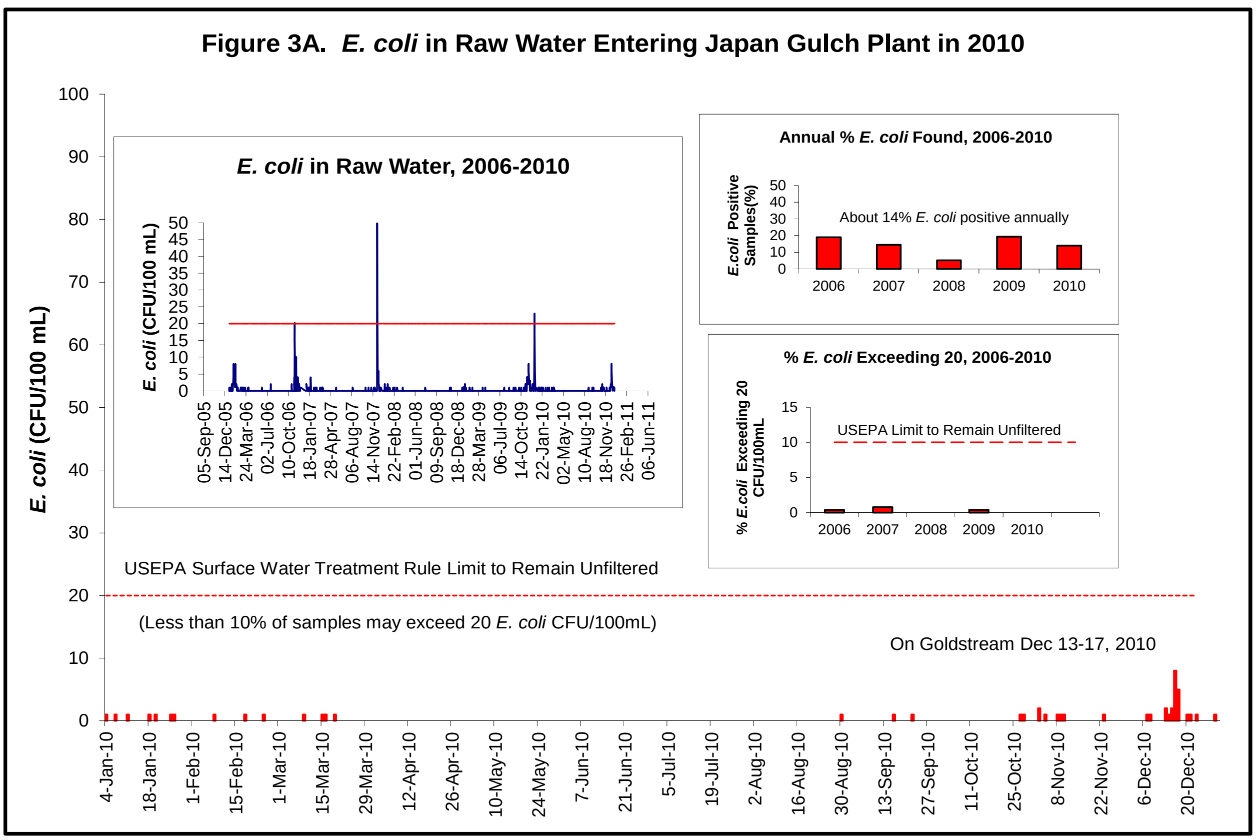


Figure 3A. E. coli in Raw Water Entering Japan Gulch Plant in 2010
E. coli (CFU/100 mL)
E. coli in Raw Water, 2006-2010
Annual % E. coli Found, 2006-2010
E.coli Positive Samples(%)
About 14% E. coli positive annually
% E. coli Exceeding 20, 2006-2010
% E.coli Exceeding 20 CFU/100mL
USEPA Limit to Remain Unfiltered
USEPA Surface Water Treatment Rule Limit to Remain Unfiltered
(Less than 10% of samples may exceed 20 E. coli CFU/100mL)
On Goldstream Dec 13-17, 2010

Figure 4. Treated Water at First Customer Below Japan Gulch Plant Monthly Total Coliforms and Chlorine Residual in 2010

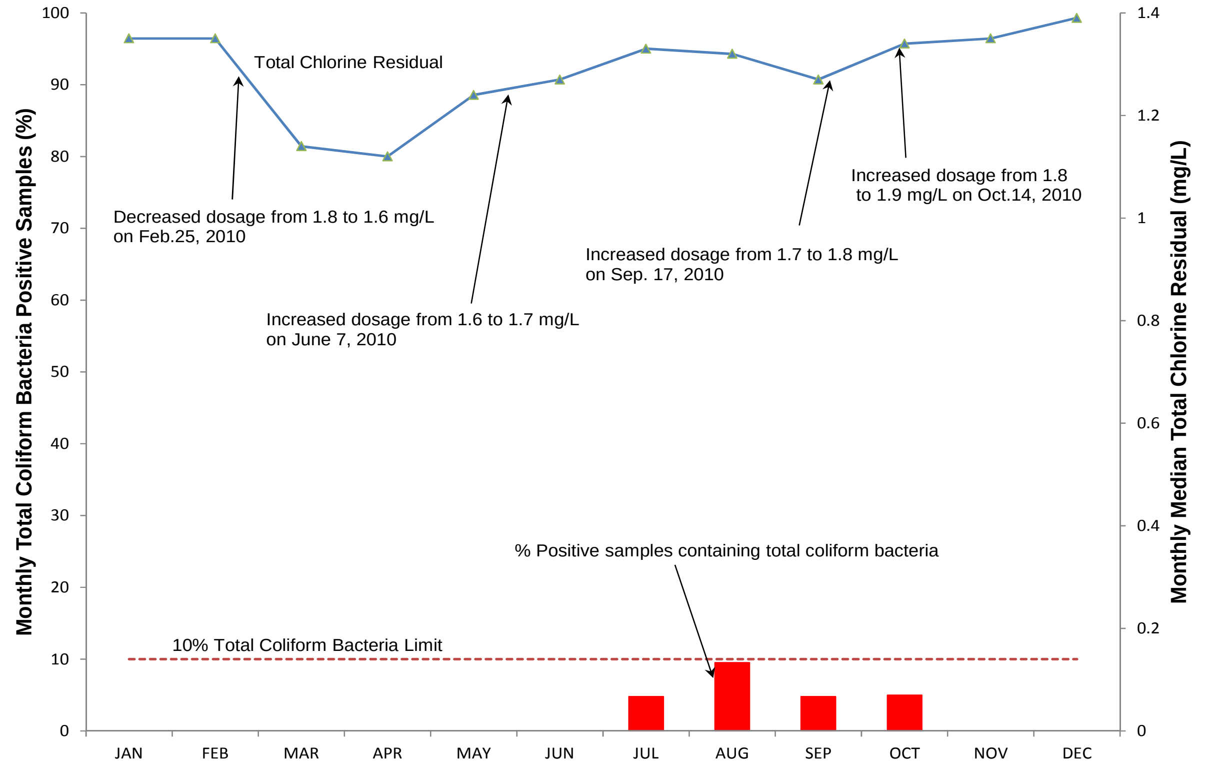
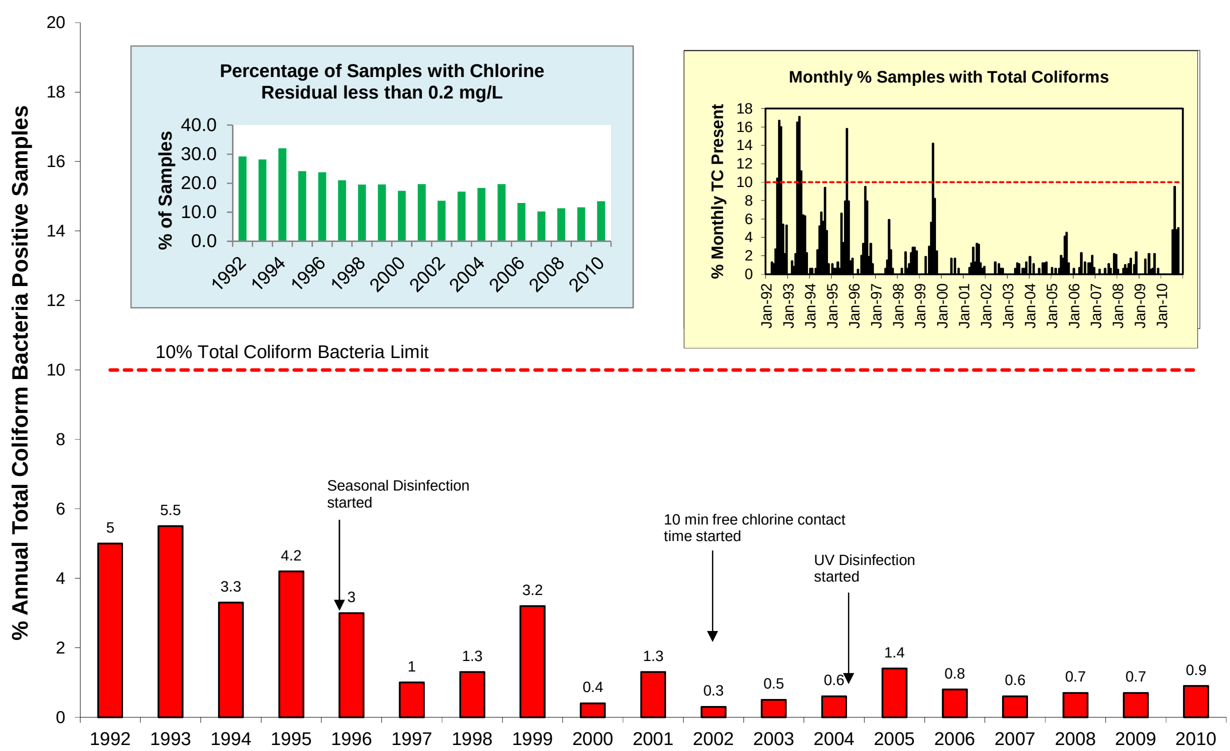


Figure 5. Greater Victoria Distribution System Combined Annual % Samples with Total Coliforms Present, 1992-2010



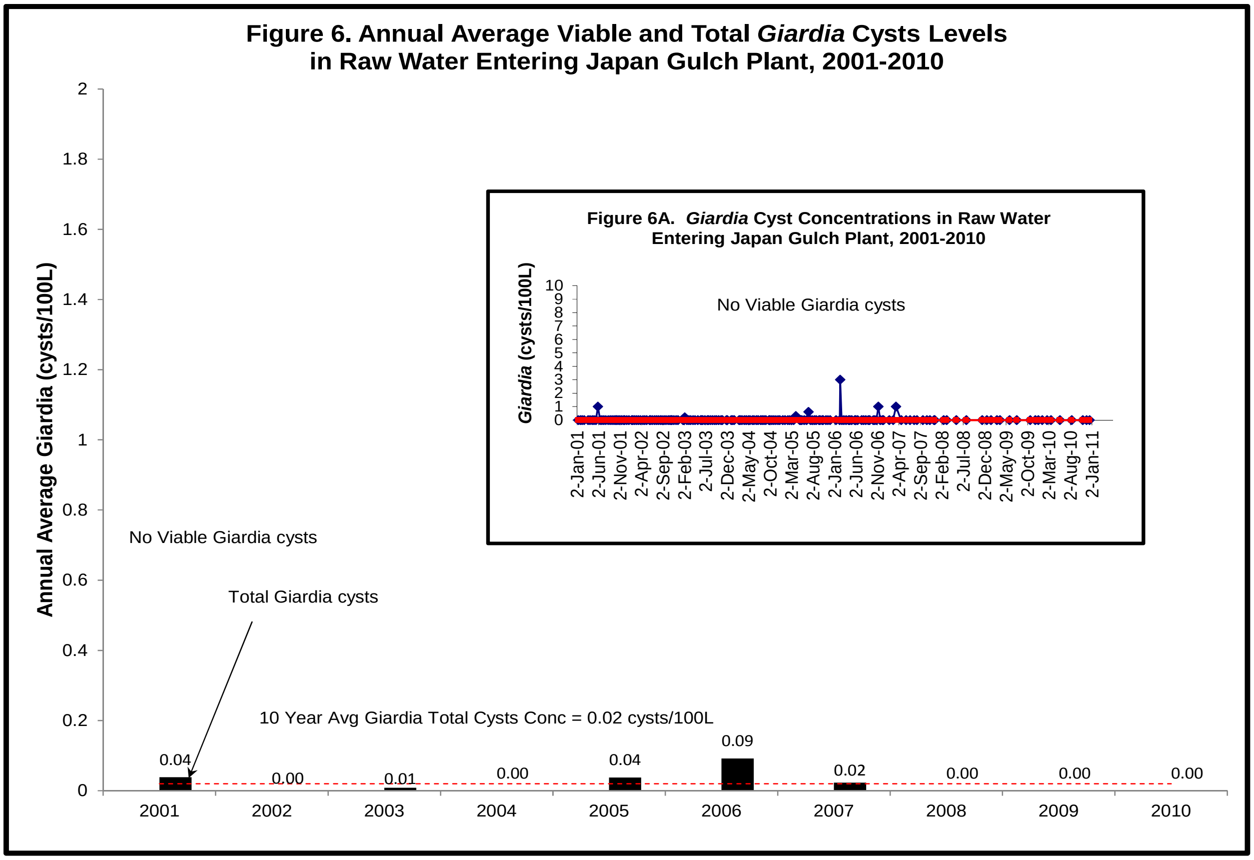


Figure 6. Annual Average Viable and Total *Giardia* Cysts Levels in Raw Water Entering Japan Gulch Plant, 2001-2010
Annual Average Giardia (cysts/100L)
No Viable Giardia cysts
Total Giardia cysts
10 Year Avg Giardia Total Cysts Conc = 0.02 cysts/100L
0.04
0.00
0.01
0.00
0.04
0.09
0.02
0.00
0.00
0.00
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Figure 6A. *Giardia* Cyst Concentrations in Raw Water Entering Japan Gulch Plant, 2001-2010
Giardia (cysts/100L)
No Viable Giardia cysts

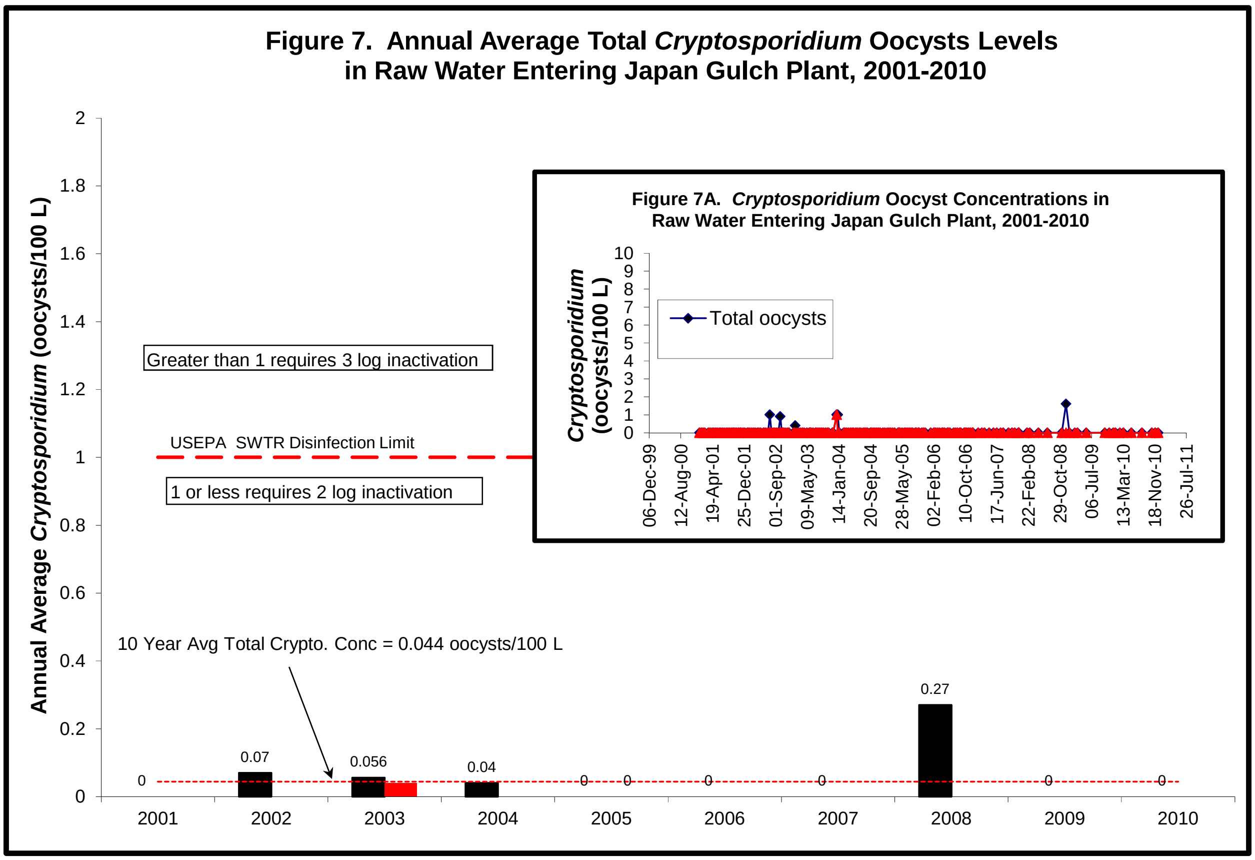


Figure 7. Annual Average Total *Cryptosporidium* Oocysts Levels in Raw Water Entering Japan Gulch Plant, 2001-2010
Annual Average *Cryptosporidium* (oocysts/100 L)
Greater than 1 requires 3 log inactivation
USEPA SWTR Disinfection Limit
1 or less requires 2 log inactivation
10 Year Avg Total Crypto. Conc = 0.044 oocysts/100 L
0
0.07
0.056
0.04
0.27
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Figure 7A. *Cryptosporidium* Oocyst Concentrations in Raw Water Entering Japan Gulch Plant, 2001-2010
Cryptosporidium (oocysts/100 L)
Total oocysts

Figure 8. 2010 Trihalomethanes in Greater Victoria Distribution System

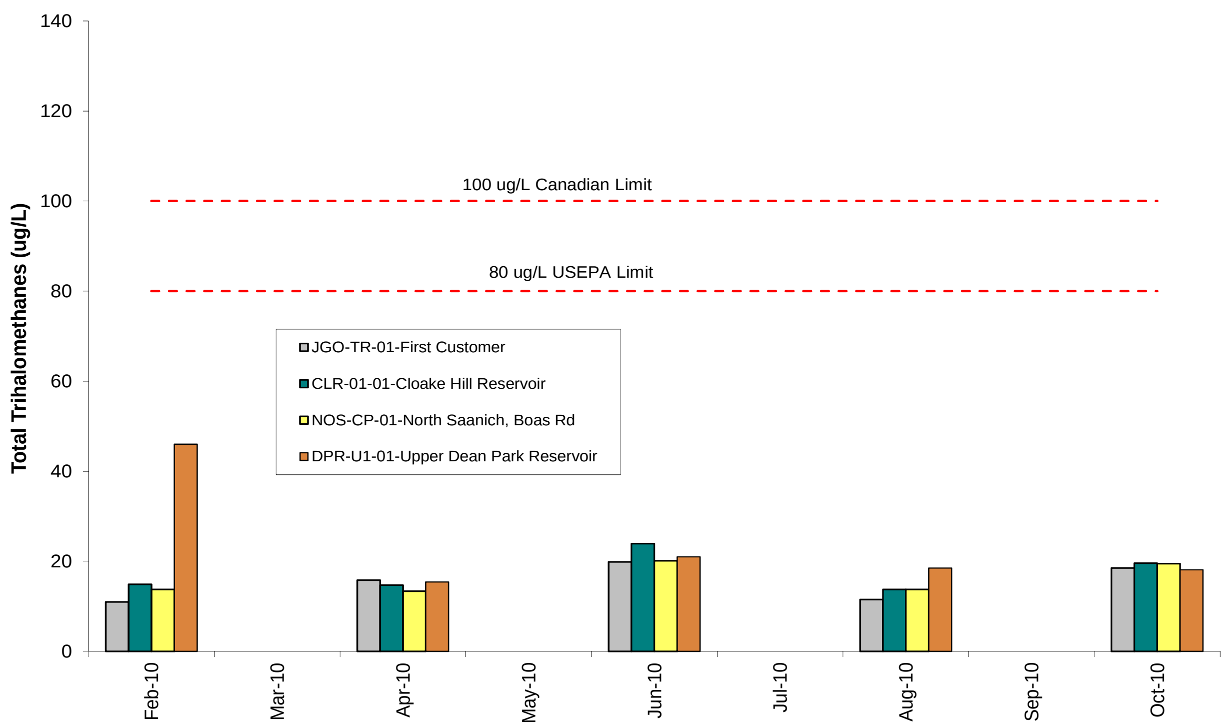


Figure 9. 2010 Haloacetic Acids in Greater Victoria Distribution System

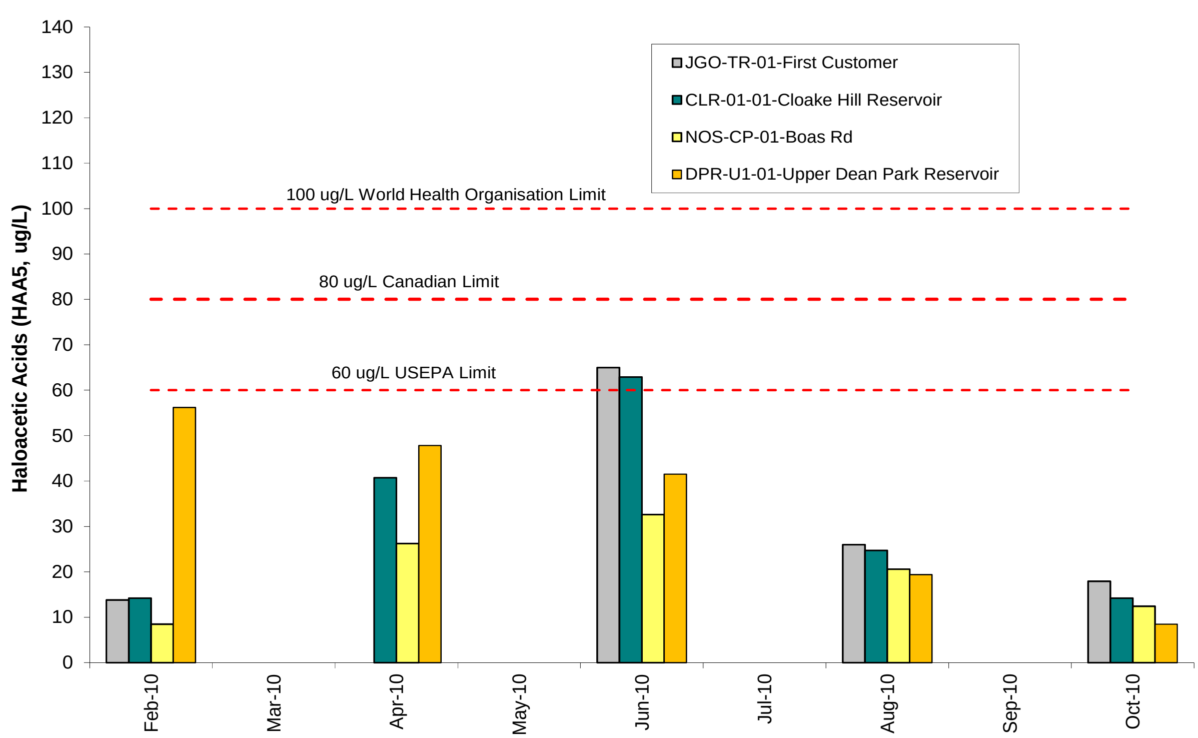


Figure 10. Chlorophyll-a Concentrations in Sooke Reservoir before and after inundation (1995-2010)

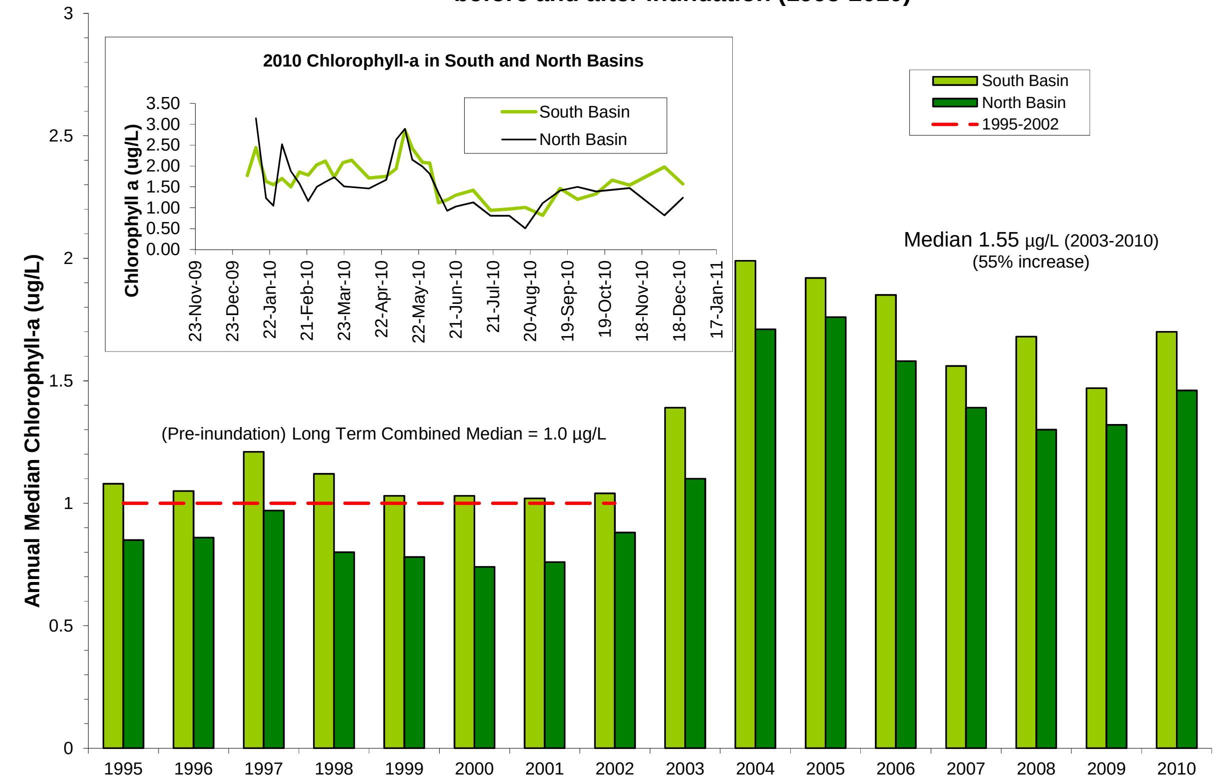


Figure 11. Total Phosphorus Concentrations in Sooke Reservoir before and after inundation (1992-2010)

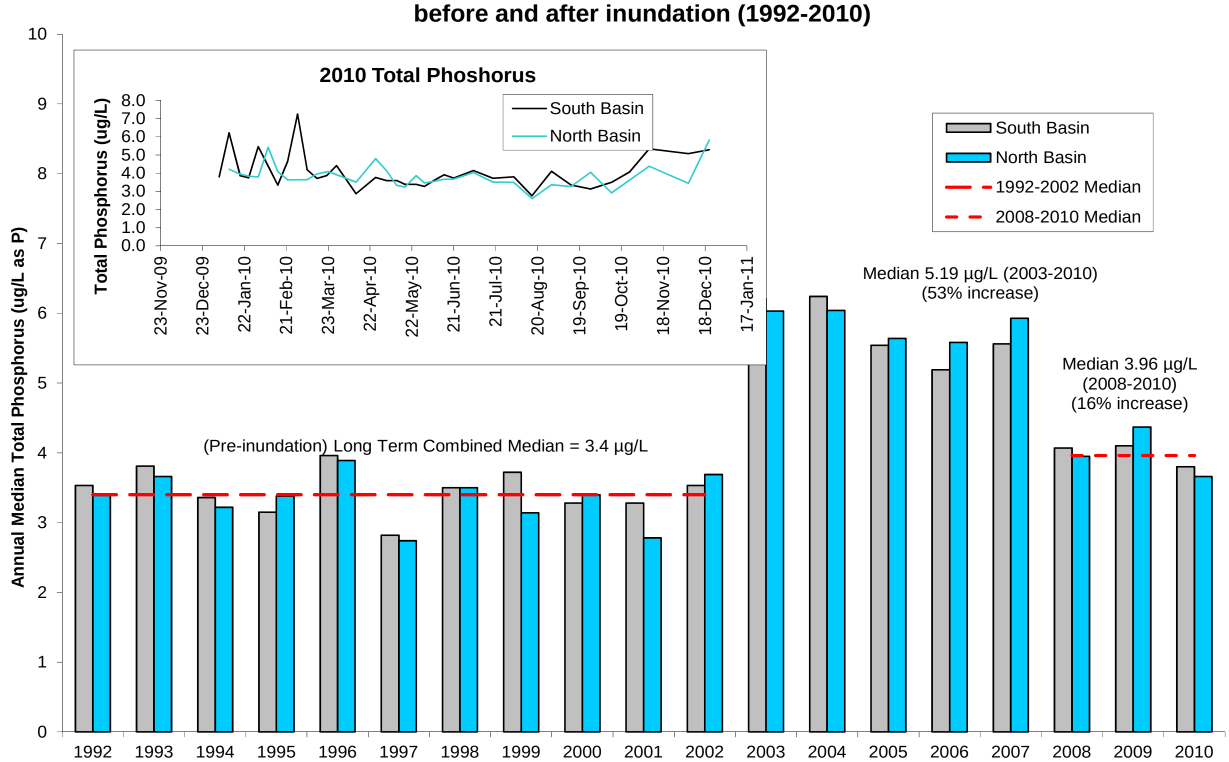


Figure 12. *Asterionella spp*. in Sooke Reservoir, South basin, 1m depth (SOL-01-01)

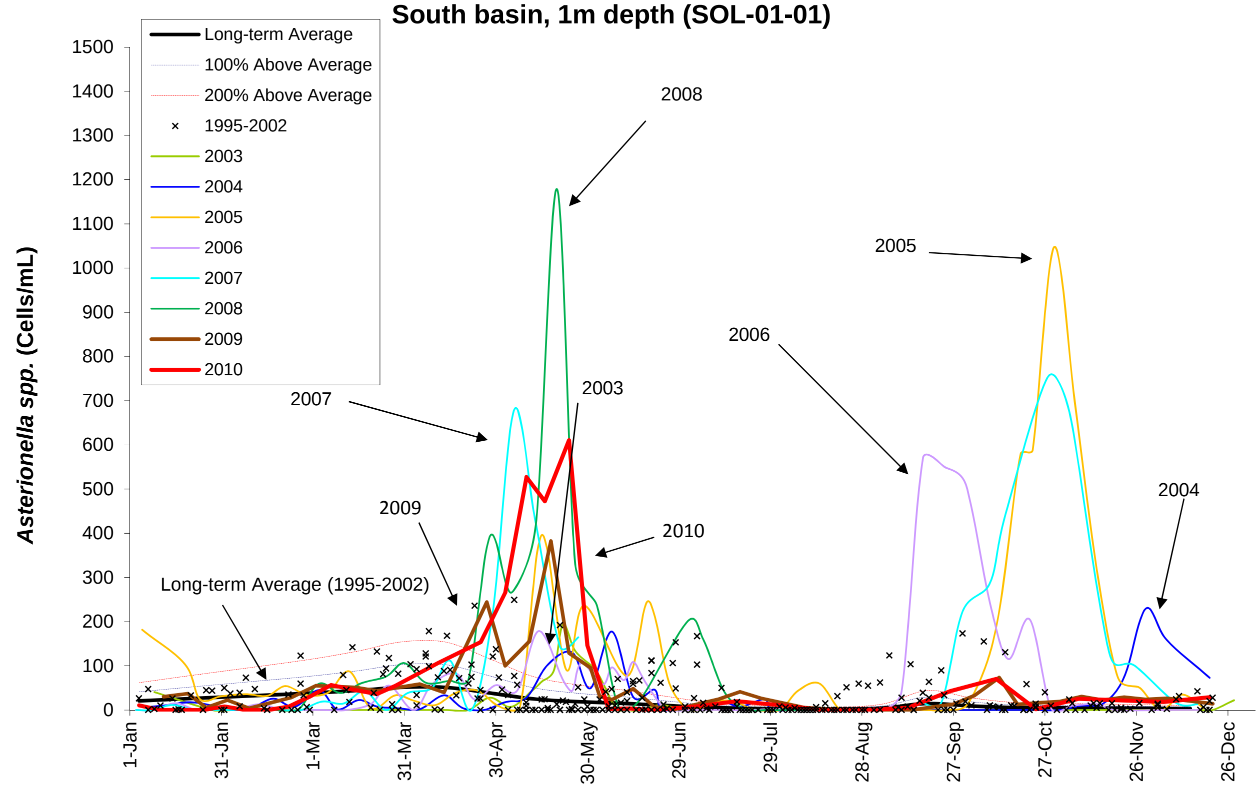


Figure 13. *Tabellaria spp*. in Sooke Reservoir, South basin, 1m depth (SOL-01-01)

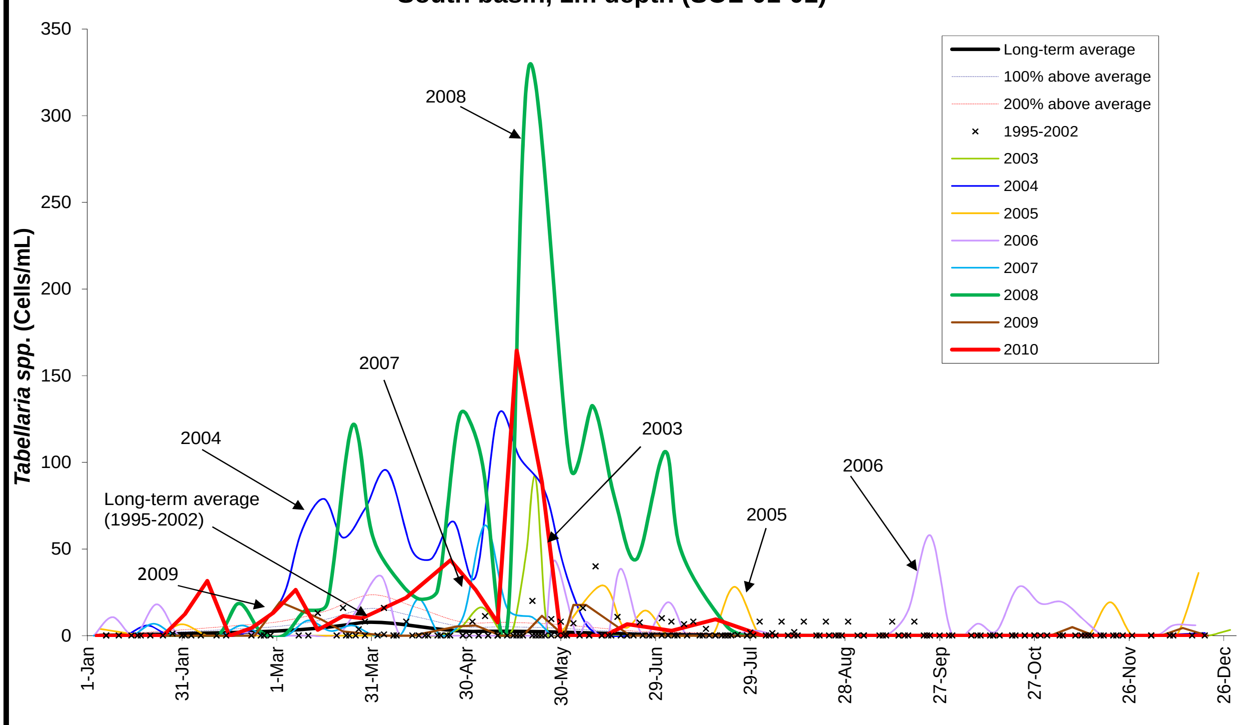


Figure 14. Annual Water Quality Complaints from the Greater Victoria Drinking Water System, 1992-2010