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Agenda Item #08
REPORT #RWSC 2009-09

REPORT TO THE REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, 15 APRIL 2009

SUBJECT 2008 ANNUAL OVERVIEW OF GREATER VICTORIA'S DRINKING WATER QUALITY

PURPOSE

Provide information on the quality of drinking water in the Greater Victoria Drinking Water System in 2008.

BACKGROUND

Each year, as part of the formal data reporting structure currently in place, Water Quality Division staff prepare annual summaries of the data collected on the quality of Greater Victoria's drinking water. These reports are sent to individual Water Suppliers, the Chief Medical Health Officer and, by regulation, are made available to the public. The annual reports are posted on the CRD Website at http://www.crd.bc.ca/water/waterquality/annualreports.htm?mb. The executive summary and selected charts from the full report are attached.

The water quality data that was collected in 2008 is summarized in three data tables that are posted on the CRD Website at http://www.crd.bc.ca/water/waterquality/datatables.htm?mb .

RECOMMENDATION

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

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2008 Annual Overview of Greater Victoria's Drinking Water Quality

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February 15, 2009

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EXECUTIVE SUMMARY

This report is the annual overview of water quality testing that was conducted in 2008 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?mb on the Capital Regional District (CRD) website.

Samples and Tests. In 2008, the Water Quality Division collected 6,323 samples from the Greater Victoria Drinking Water System and analyzed those samples for 51,926 individual tests. Approximately 300 different types of analyses were conducted on these samples. The data collected in 2008 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?mb

Bacteria in Source Water. In 2008, as in the past few years, the level of total coliform bacteria in the raw (untreated) source water entering the Japan Gulch Treatment Plant continued to be higher during the late summer and peaked in mid to late September (**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 2008, 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 maintained at 1.6 – 1.7 mg/L throughout the year. This dosage level resulted in a monthly median total chlorine residual ranging from 1.09 to 1.24 mg/L at the entry point to the distribution system (**Figure 4**).

Bacteria at First Customer. Only one total coliform positive sample was found from the samples taken at the first customer sampling location below the Japan Gulch Treatment Plant during 2008 and the 10% monthly limit was never exceeded (**Figure 4**). The annual total coliform positive sample rate of 0.4% was similar to the previous six 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 of the bacterial safety of Greater Victoria's drinking water.

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 2008 and was therefore in compliance with the BC *Drinking Water Protection Regulation*. Over a 17 year period of time, 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.

Parasites. In 2008, no viable (living) or non-viable (dead) *Giardia* cysts were detected in the raw source water entering Japan Gulch Treatment Plant **(Figure 6)**. In addition, none of the 2008 samples contained viable *Cryptosporidium* oocysts (**Figure 7**). While one non-viable *Cryptosporidium* oocyst was detected in one sample collected in December, this may be of little consequence as non-viable oocysts are incapable of causing disease. The 10-year average total *Cryptosporidium* oocyst concentration was only 0.044 oocysts per 100 L (**Figure 7**). While this is an extremely low value for a surface water supply, the addition of UV disinfection provides assurance that no infective *Cryptosporidium* oocysts (or other parasites) can enter Greater Victoria's 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) and a turbidity spike in late June. In 2008, the water temperature was above the 15°C limit for a period of two months between early August to early October (**Figure 3**). This is similar to 2005, 2006 and 2007 and an improvement from previous 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. The turbidity spike occurred in late June when the high early morning water demand caused sediment in the supply mains to mix into the water.

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 7.8-21.9 μg/L) the Canadian Guideline limit of 100 μg/L in the chloraminated distribution system (**Figure 8**). 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 also very low, ranging from 9.13-19.82 μg/L (**Figure 9**). A new 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 2008, 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**). The median increase in chlorophyll-a for the 6 years following the initial raising of the water level in Sooke Reservoir was 63% **(Figure 10A)** but is showing a declining trend.

The primary contributor to the higher levels of chlorophyll-a observed in Sooke Reservoir in 2003 through 2008 was higher levels of total phosphorus, a nutrient that is needed for the algae to grow. The median concentration of total phosphorus was approximately 65% higher than in the years prior to inundation in both the north and south basins of Sooke Reservoir (**Figure 11**). The highest phosphorus levels coincided with flooding of the newly cleared lands around the margin of Sooke Reservoir when the reservoir was expanded. In 2008, the phosphorus levels were the lowest of the past few years.

In 2008, one distinct, but not particularly significant algal bloom occurred in Sooke Reservoir. Two algal species (the diatoms, *Asterionella formosa v. formosa and Tabellaria fenestrata*) were responsible for the spring bloom (**Figures 12-13)** and were the main contributors to the higher levels of chlorophyll-a (**Figure 10**). Both *Asterionella* and *Tabellaria* are commonly present in Sooke Reservoir but have only been reaching bloom conditions since the raising of the Sooke Reservoir water level in 2003. The highest concentrations of both organisms were observed at the south basin.

Water Quality Complaints. In 2008, the number of water quality complaints received by CRD Water Services was the lowest recorded in the past 17 years (**Figure 14**).

Figure 1. Water Level Elevation in Sooke Reservoir, 2003-2008

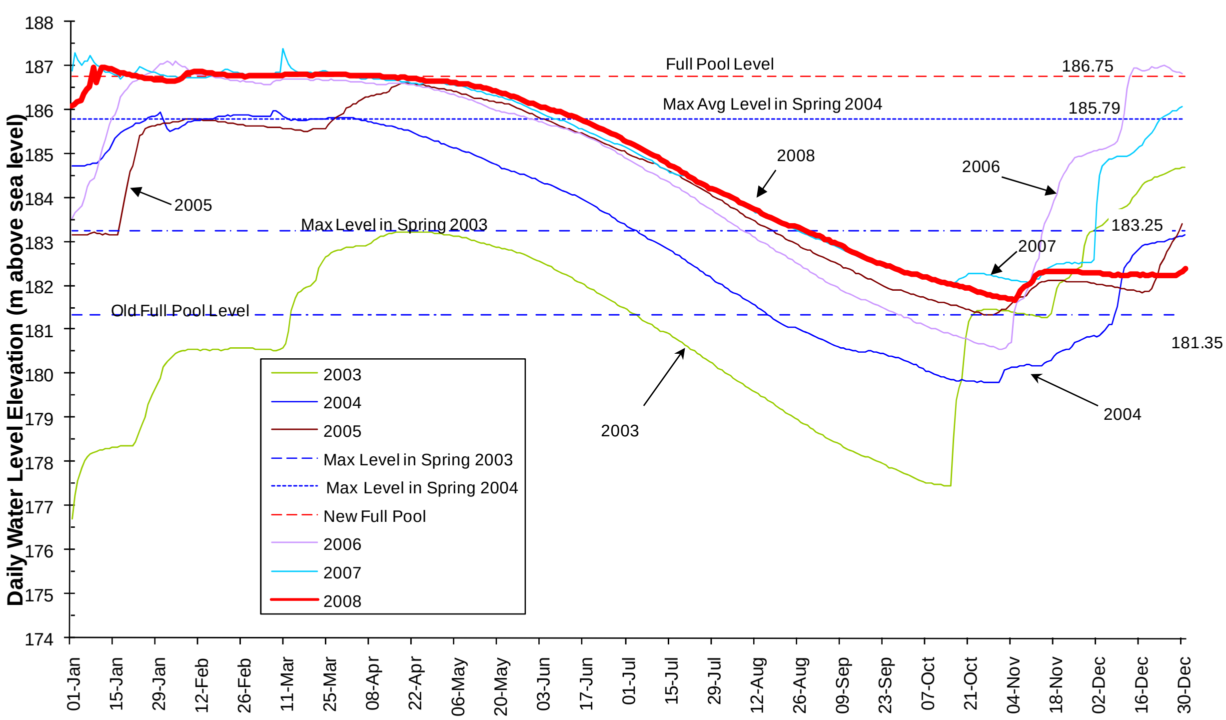
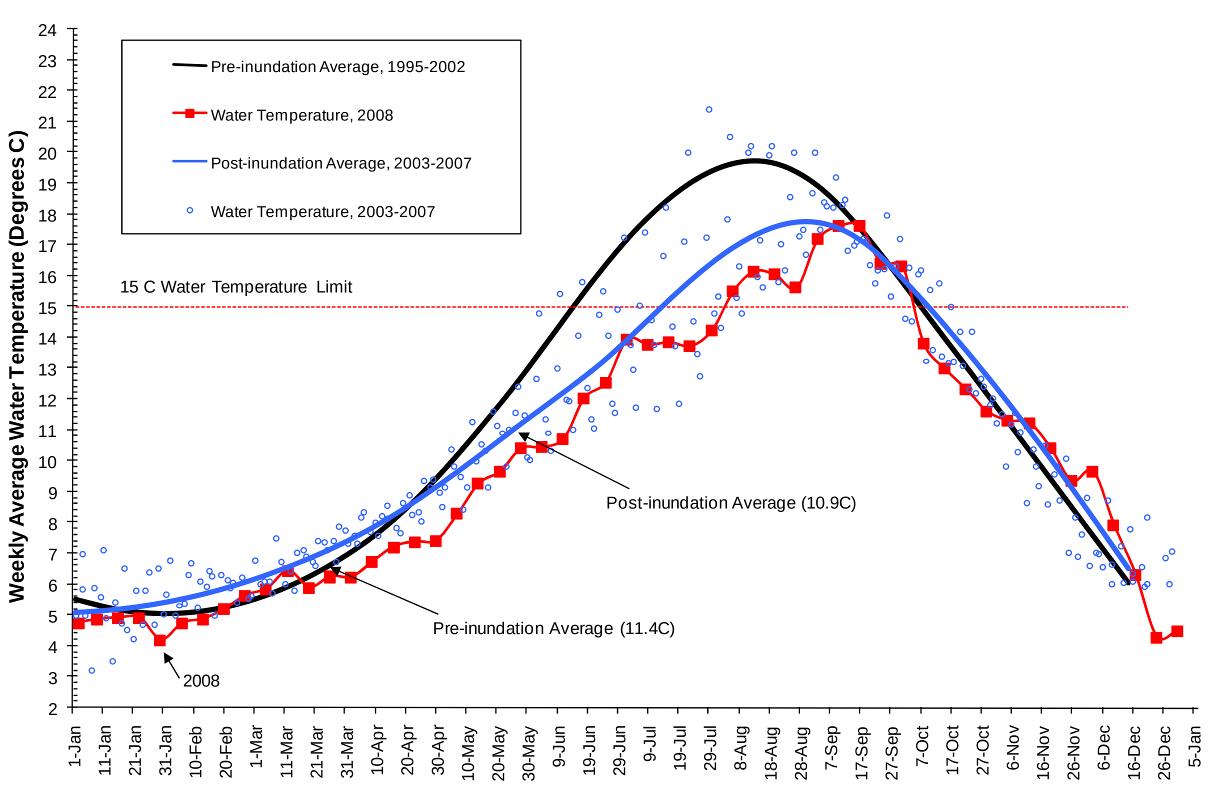


Figure 2. 2008 Temperature of Raw Water entering Japan Gulch Plant (Weekly Average)



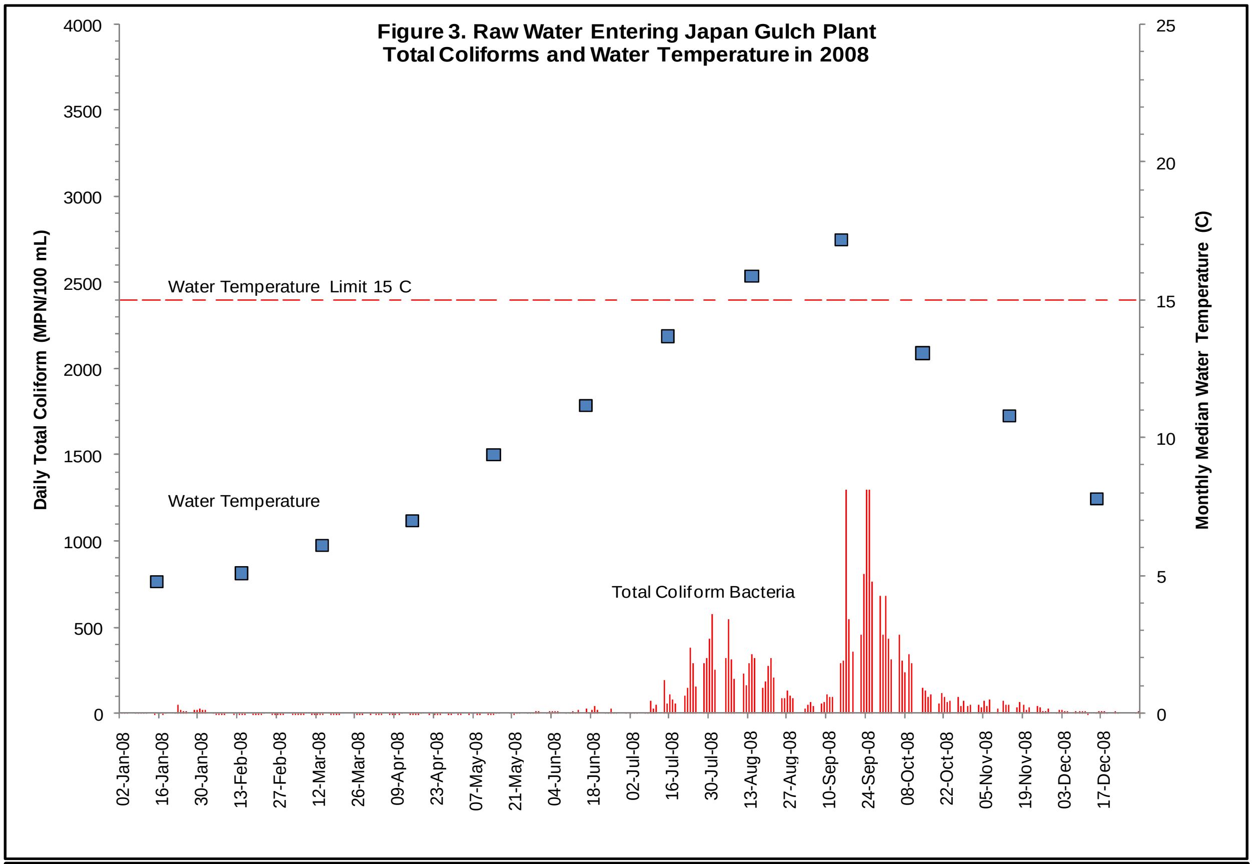


Figure 3. Raw Water Entering Japan Gulch Plant
Total Coliforms and Water Temperature in 2008

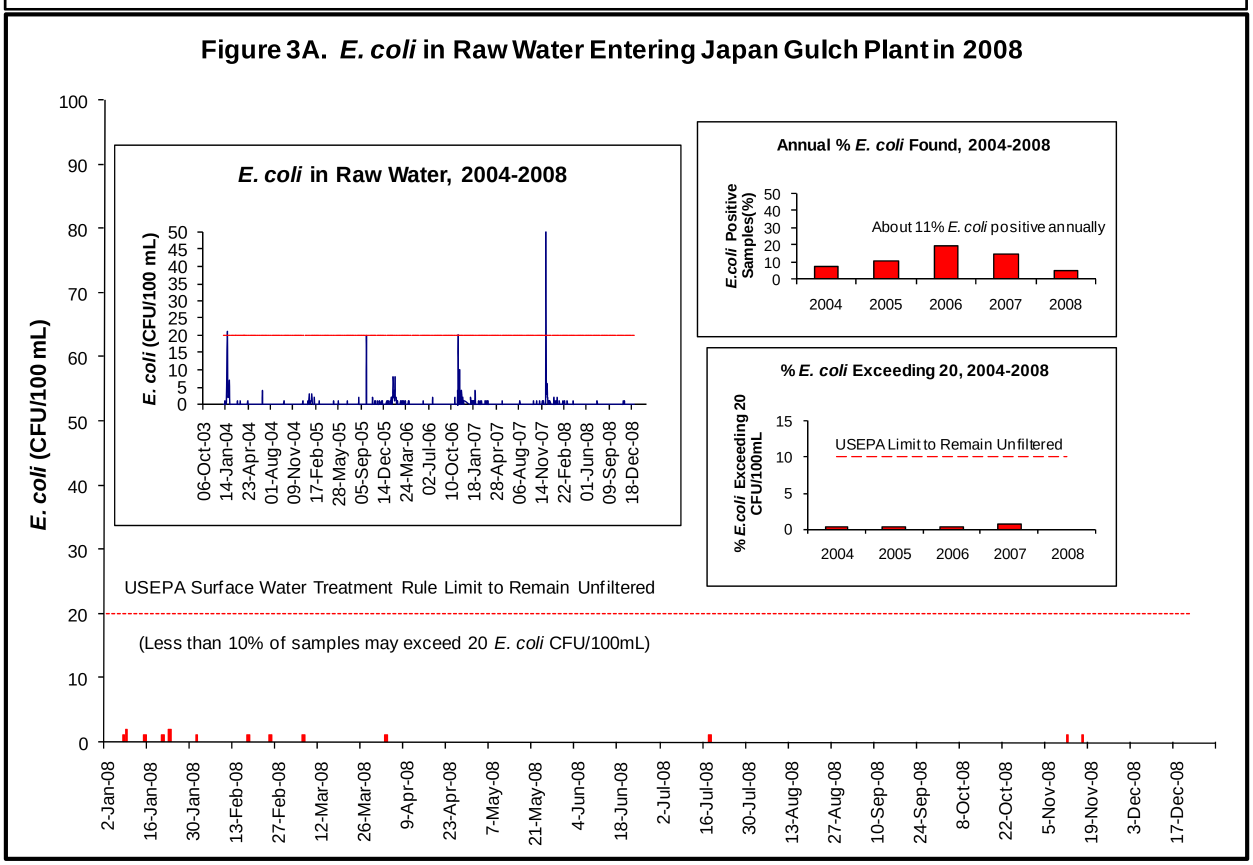


Figure 3A. *E. coli* in Raw Water Entering Japan Gulch Plant in 2008

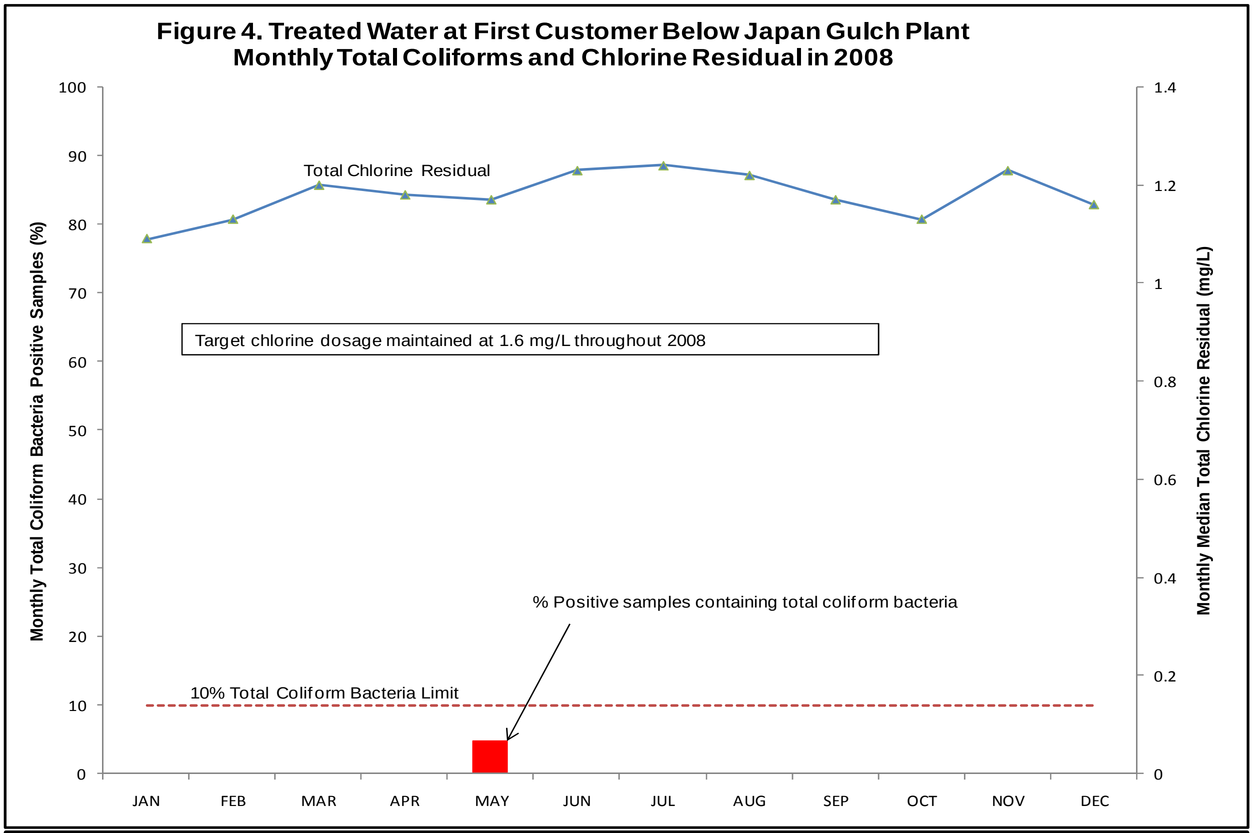


Figure 4. Treated Water at First Customer Below Japan Gulch Plant
Monthly Total Coliforms and Chlorine Residual in 2008
Total Chlorine Residual
Target chlorine dosage maintained at 1.6 mg/L throughout 2008
% Positive samples containing total coliform bacteria
10% Total Coliform Bacteria Limit
Monthly Total Coliform Bacteria Positive Samples (%)
Monthly Median Total Chlorine Residual (mg/L)
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

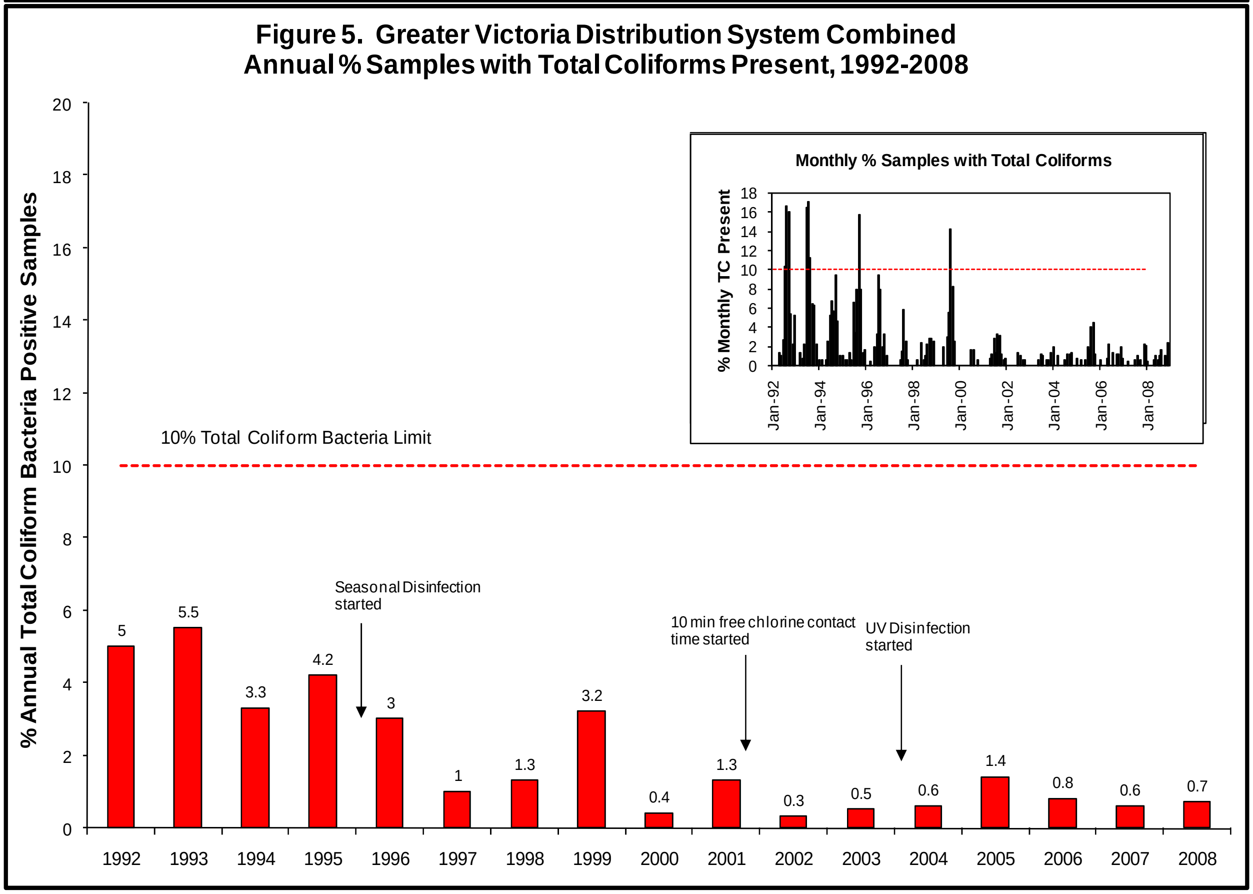


Figure 5. Greater Victoria Distribution System Combined
Annual % Samples with Total Coliforms Present, 1992-2008
% Annual Total Coliform Bacteria Positive Samples
10% Total Coliform Bacteria Limit
Seasonal Disinfection started
10 min free chlorine contact time started
UV Disinfection started
Monthly % Samples with Total Coliforms
% Monthly TC Present
5
5.5
3.3
4.2
3
1
1.3
3.2
0.4
1.3
0.3
0.5
0.6
1.4
0.8
0.6
0.7
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008

Figure 6. Annual Average Viable and Total *Giardia* Cysts Levels in Raw Water Entering Japan Gulch Plant, 1999-2008

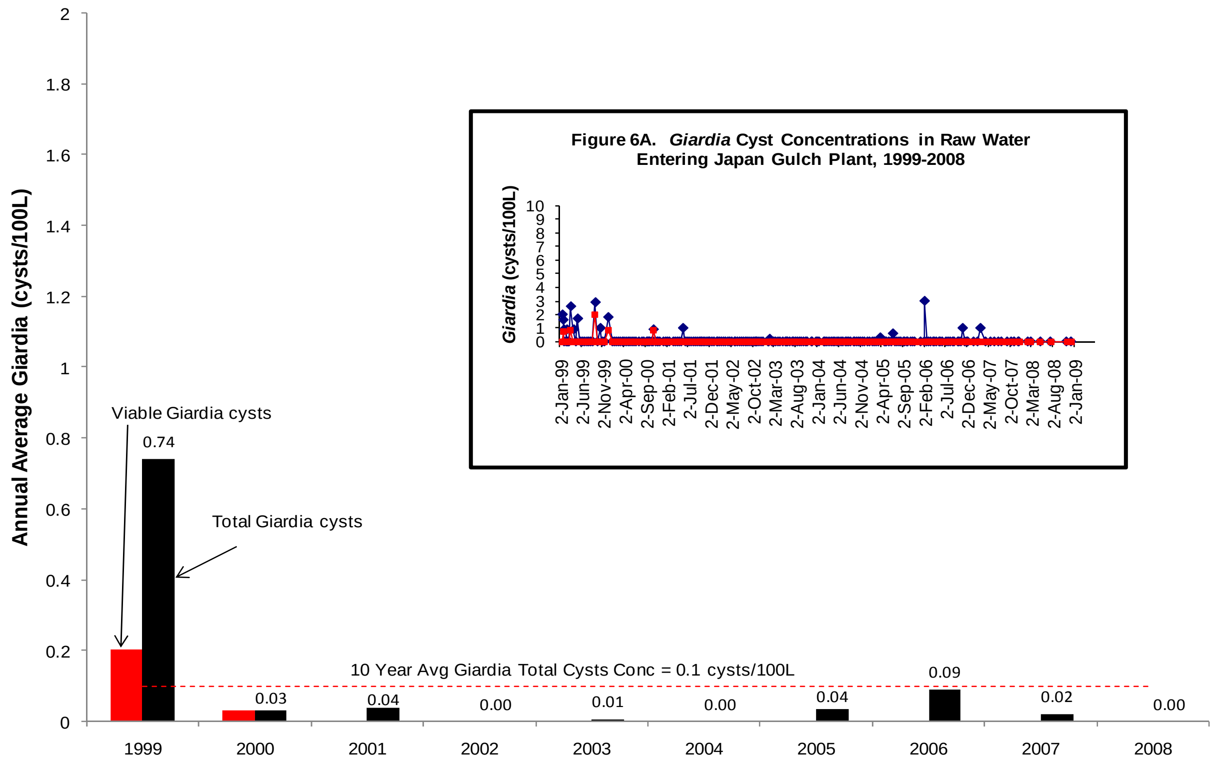


Figure 7. Annual Average Total *Cryptosporidium* Oocysts Levels in Raw Water Entering Japan Gulch Plant, 1999-2008

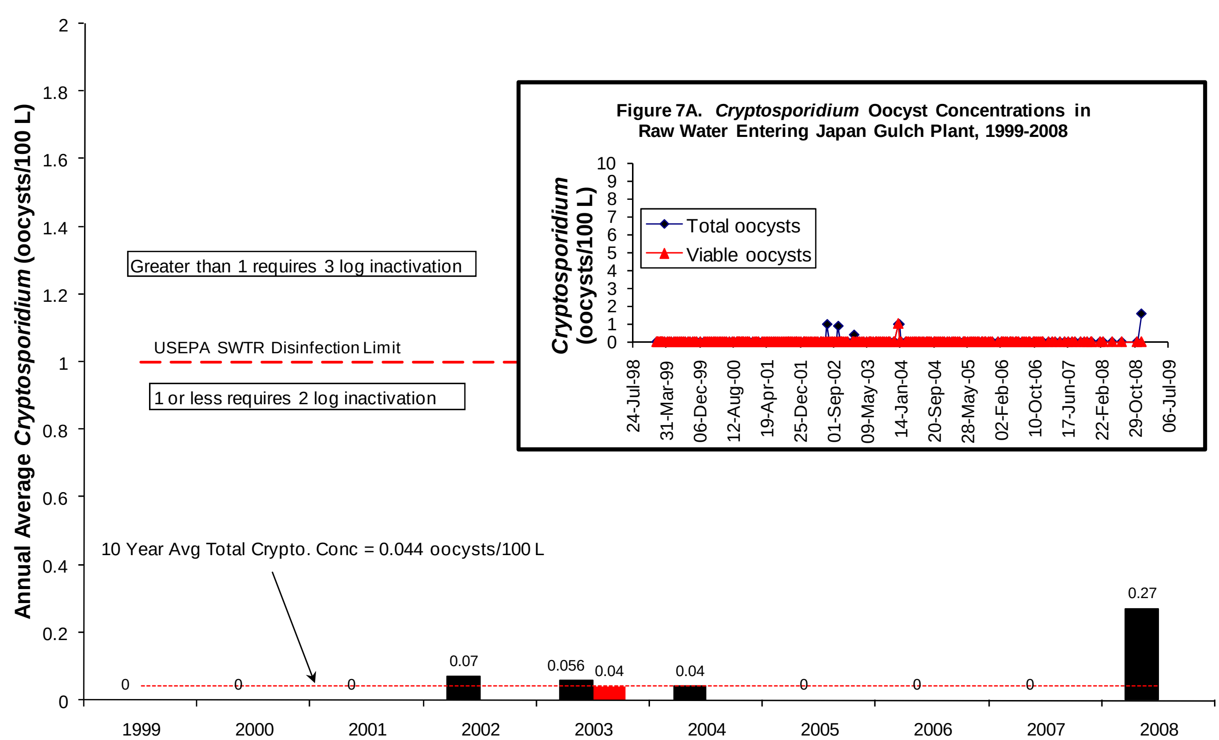


Figure 8. 2008 Trihalomethanes in Greater Victoria Distribution System

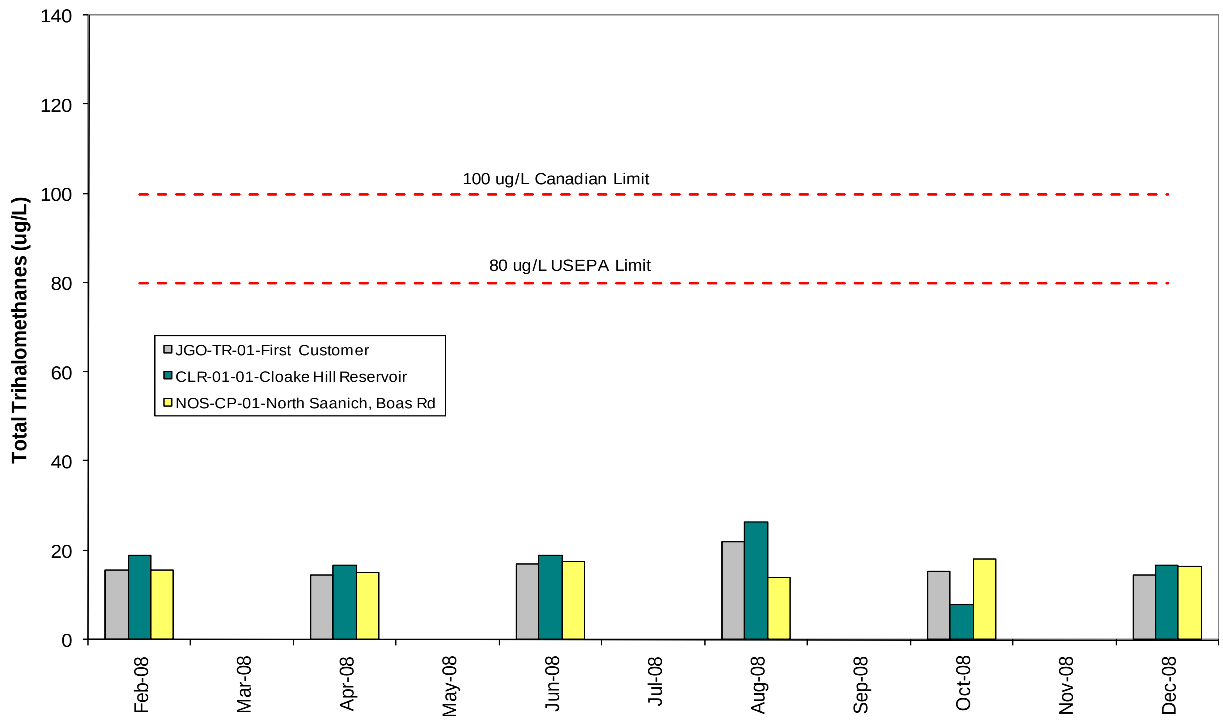


Figure 9. 2008 Haloacetic Acids in Greater Victoria Distribution System

Figure 10. 2008 Chlorophyll-a in Sooke Reservoir South Basin, 1 m depth (SOL-01-01)

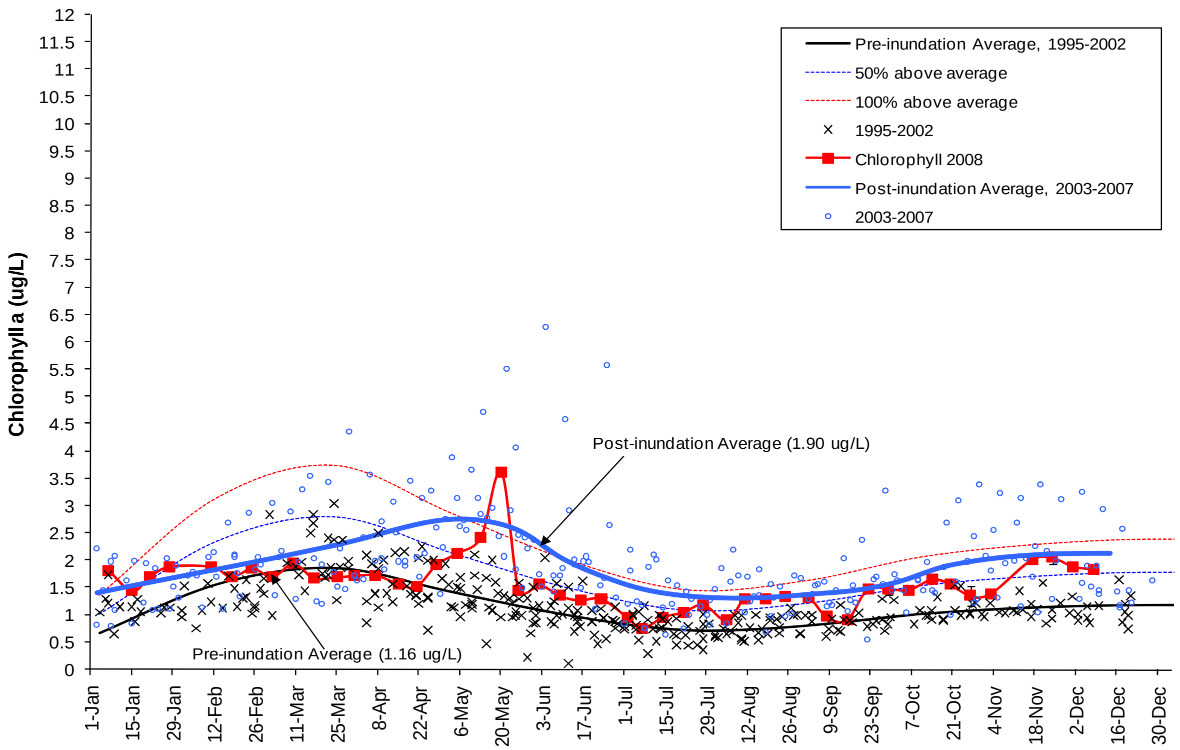


Figure 10A. Chlorophyll-a in Sooke Reservoir, 1995-2008

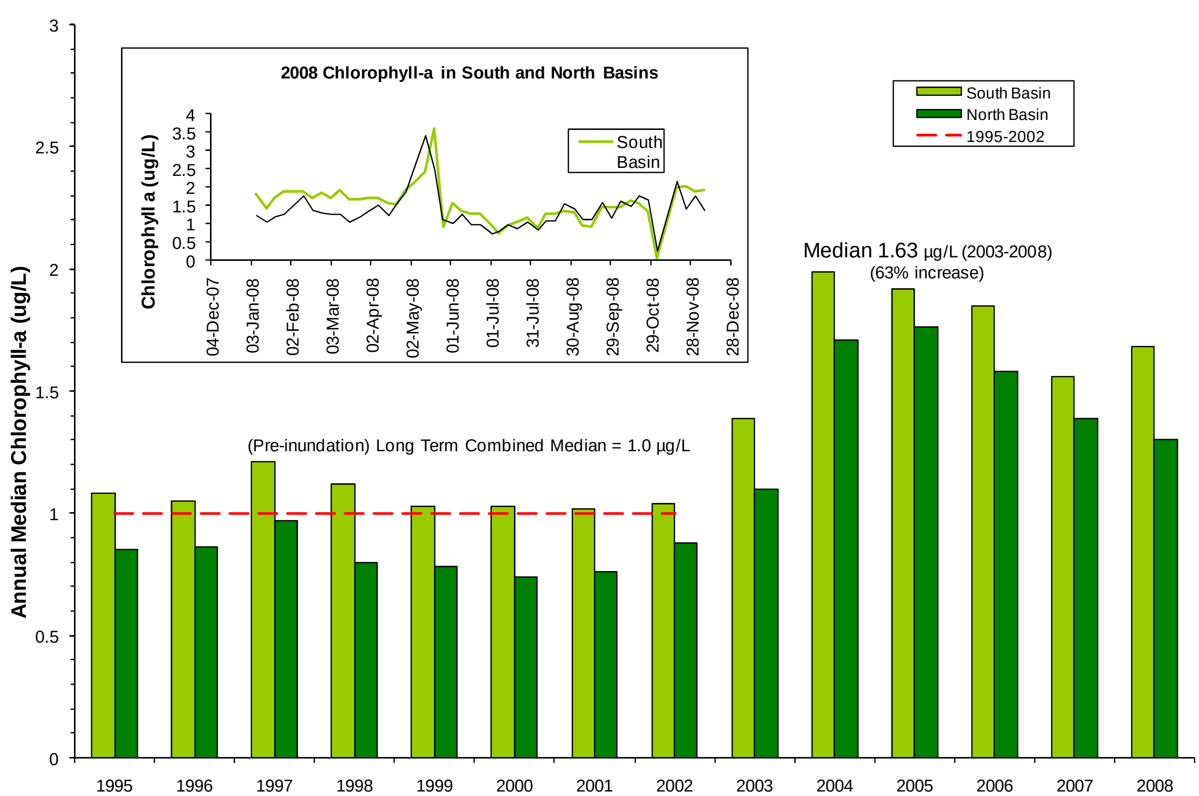


Figure 11. Total Phosphorus Concentrations in Sooke Reservoir before and after inundation (1992-2008)

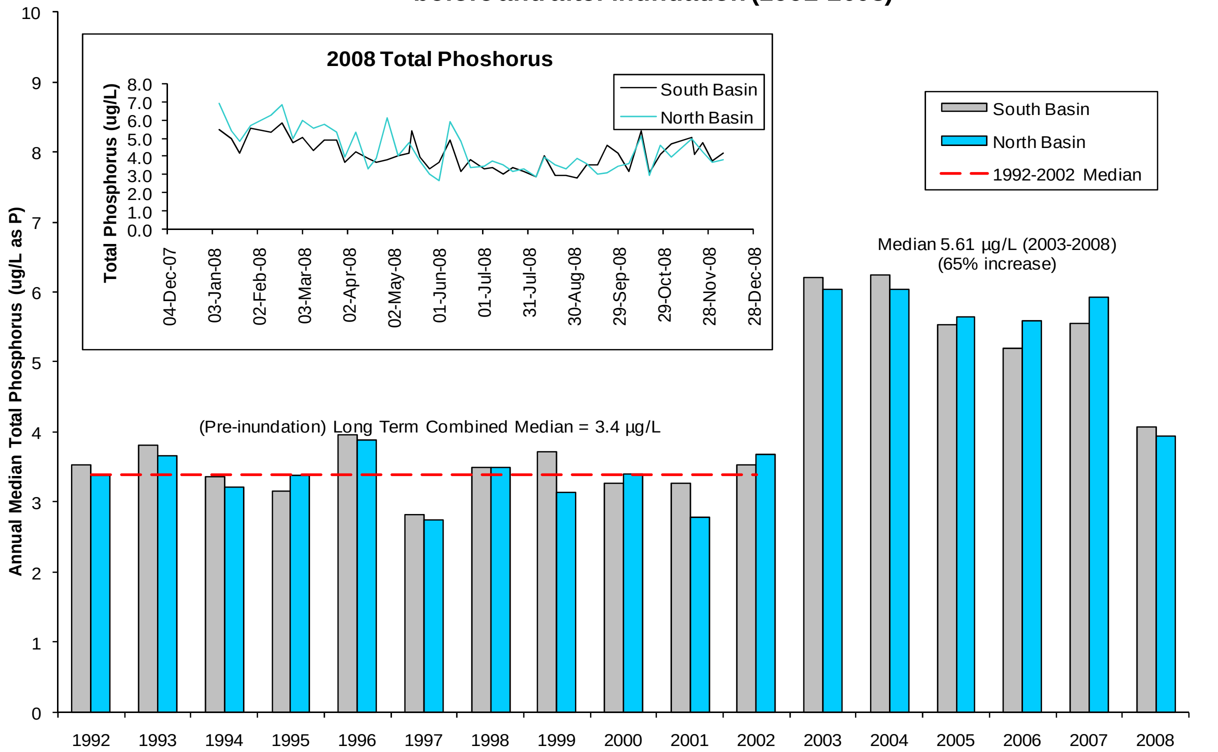


Figure 12. *Asterionella spp.* in Sooke Reservoir, South basin, 1m depth (SOL-01-01)

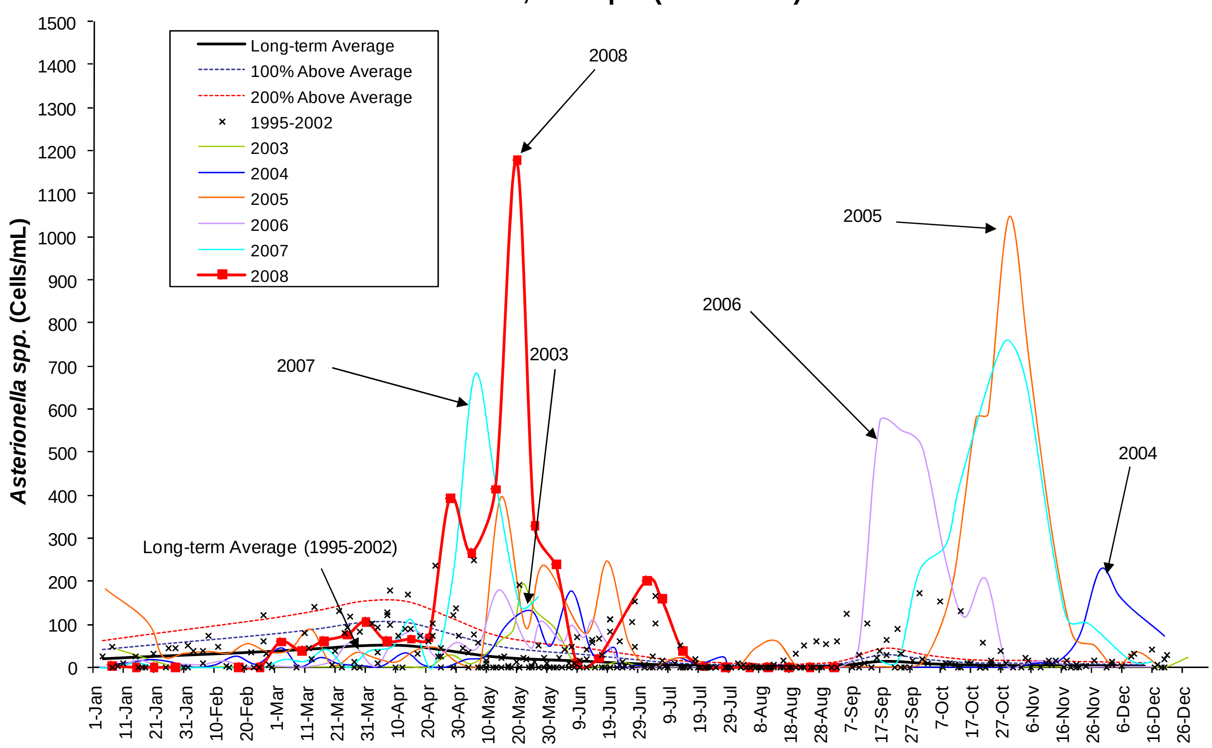


Figure 13. *Tabellaria spp.* in Sooke Reservoir, South basin, 1m depth (SOL-01-01)

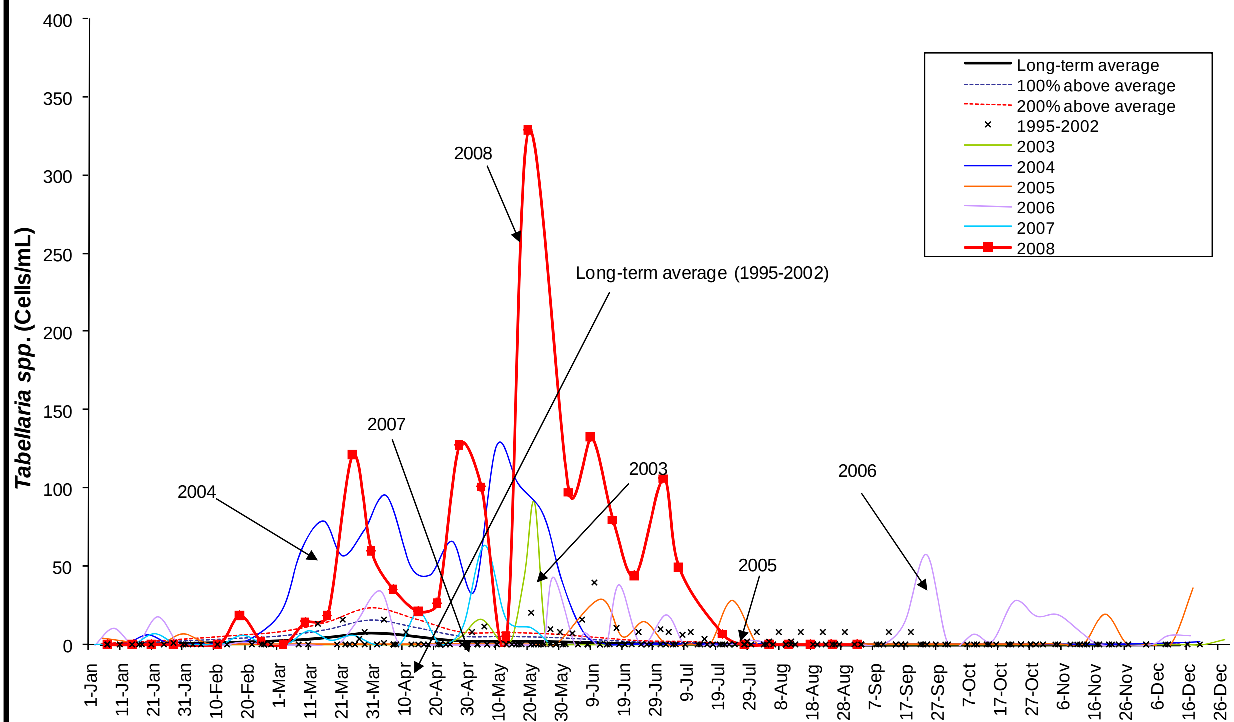


Figure 14. Annual Water Quality Complaints from the Greater Victoria Drinking Water System, 1992-2008