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2007 Annual Overview of Greater Victoria's Drinking Water Quality

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Executive Summary

This report is the annual overview of water quality testing that was conducted in 2007 in 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*. The full report is posted on the Capital Regional District (CRD) website at <http://www.crd.bc.ca/water/waterquality/annualreports.htm?mb>

Samples and Tests. In 2007, the Water Quality Division collected 7,933 samples from the Greater Victoria Drinking Water System and analyzed those samples for 45,526 individual tests. Approximately 300 different types of tests were conducted on these samples. The data collected in 2007 is reported in the data tables posted on the CRD website at <http://www.crd.bc.ca/water/waterquality/datatables.htm?mb>

Bacteria in Source Water. In 2007, 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 elevated 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 their regulations (**Figure 3B**). The level of 20 per 100 mL was only exceeded during early December due to a major rain-on-snow event. In 2007, *E. coli* positive samples contained concentrations below 20 CFU/100mL more than 99% of the time.

Treatment. The treatment process used at the Japan Gulch Treatment Plant 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 mg/L throughout the year. This dosage level resulted in a monthly median total chlorine residual ranging from 1.08 to 1.26 mg/L at the entry point to the distribution system (**Figure 4**).

Bacteria at First Customer. While five total coliform positive samples were found from the 248 samples taken at the first customer sampling location below the Japan Gulch Treatment Plant during 2007, the 10% monthly limit was never exceeded (**Figure 4**). The annual total coliform positive sample rate of 2.0% was similar to the previous five 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 2007 and was therefore in compliance with the *BC Drinking Water Protection Regulation*. Over a 16 year period of time, a broad reduction in total coliform bacteria detection (see inset in **Figure 5**) has been observed and hence, an improvement in the bacteriological water quality.

Parasites. In 2007, no viable (living) *Giardia* cysts were detected (**Figure 6**). While one non-viable *Giardia* cyst was detected in one sample collected in March (**Figure 6 inset**), this may be of little consequence since non-viable cysts are incapable of causing disease. The average annual percentage of samples containing non-viable *Giardia* cysts was 7.7% (median 0/100 L). None of the 2007 samples contained *Cryptosporidium* oocysts (**Figure 7**). The long term average (1992-2007) *Cryptosporidium* oocyst concentration was 0.032 oocysts per 100 L (**Figure 8**). 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 temperature (aesthetic limit of 15°C) and one high turbidity sample in early December. In 2007, 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 and 2006 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 a deeper, cooler strata. The high turbidity occurred in early December when a 'pineapple express' dumped heavy rains on melting snow resulting in extremely heavy flows into Sooke Reservoir from its tributary streams.

All inorganic chemicals including metals and non-metals were within Guideline values at the entry point to the Greater Victoria 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 8.7-19.1 µg/L) the Canadian Guideline limit of 100 µg/L in the chloraminated portion of the distribution system but were higher in the portion of the distribution system in North Saanich where additional free chlorine was being added to the water to prevent the regrowth of bacteria (**Figure 9**). Early in the year when the additional chlorine was being added in that section of the distribution system, the total trihalomethane concentration ranged from 55-72 µg/L. Once rechlorination stopped, the level dropped dramatically to those found in the rest of the system (14.9-21.6 µg/L). Similarly, in that same portion of the distribution system, 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 elevated, ranging from 146-177 µg/L and then dropping to much lower levels (9.0-27 µg/L) once rechlorination was stopped (**Figure 9B**). The World Health Organization limit for HAA5s is 100 µg/L. A Canadian Guideline limit for HAA5s is in preparation.

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 2007, the concentration of chlorophyll-a in the south basin continued to remain broadly elevated as in past years following the raising of the water level in Sooke Reservoir (**Figure 10**). The median increase in chlorophyll-a for the 5 years following the initial raising of the water level in Sooke Reservoir was 65% (**Figure 10A**) and is now showing a declining trend.

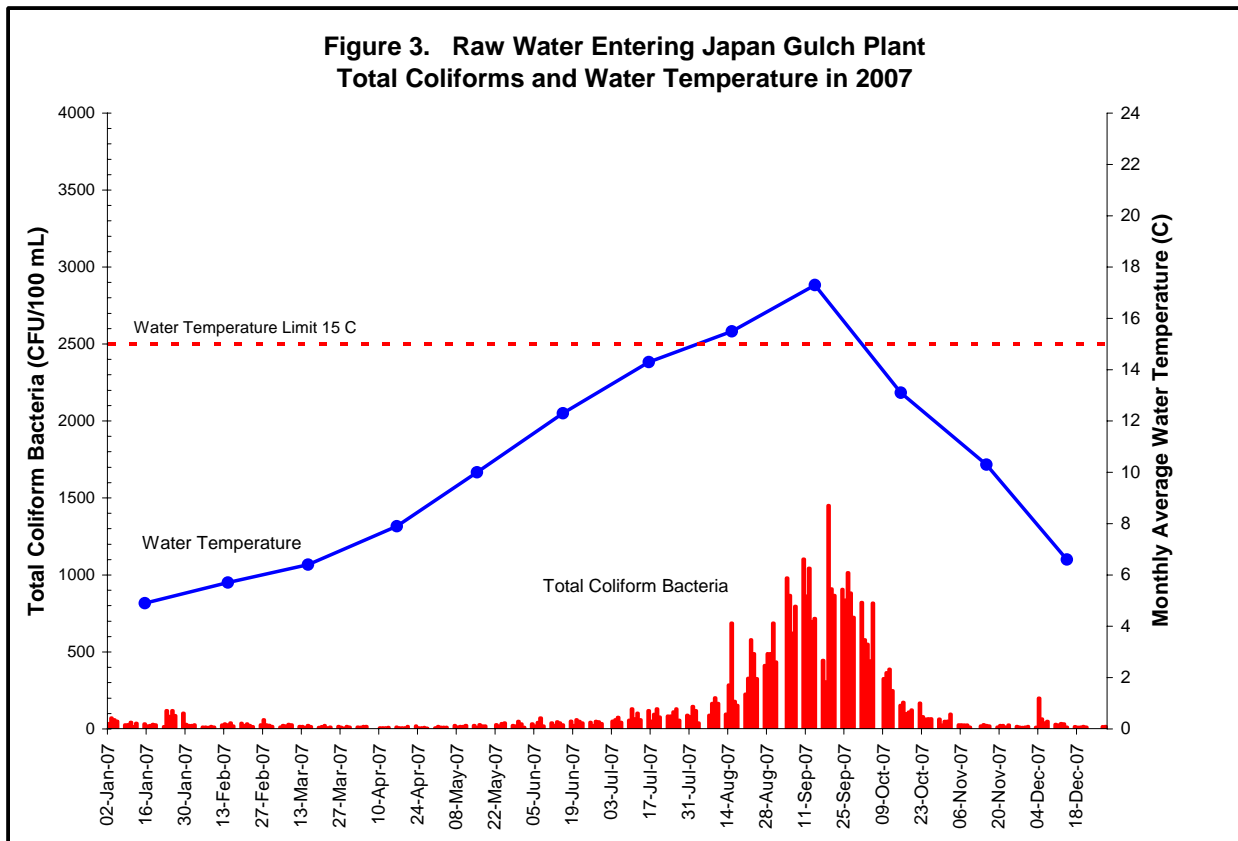
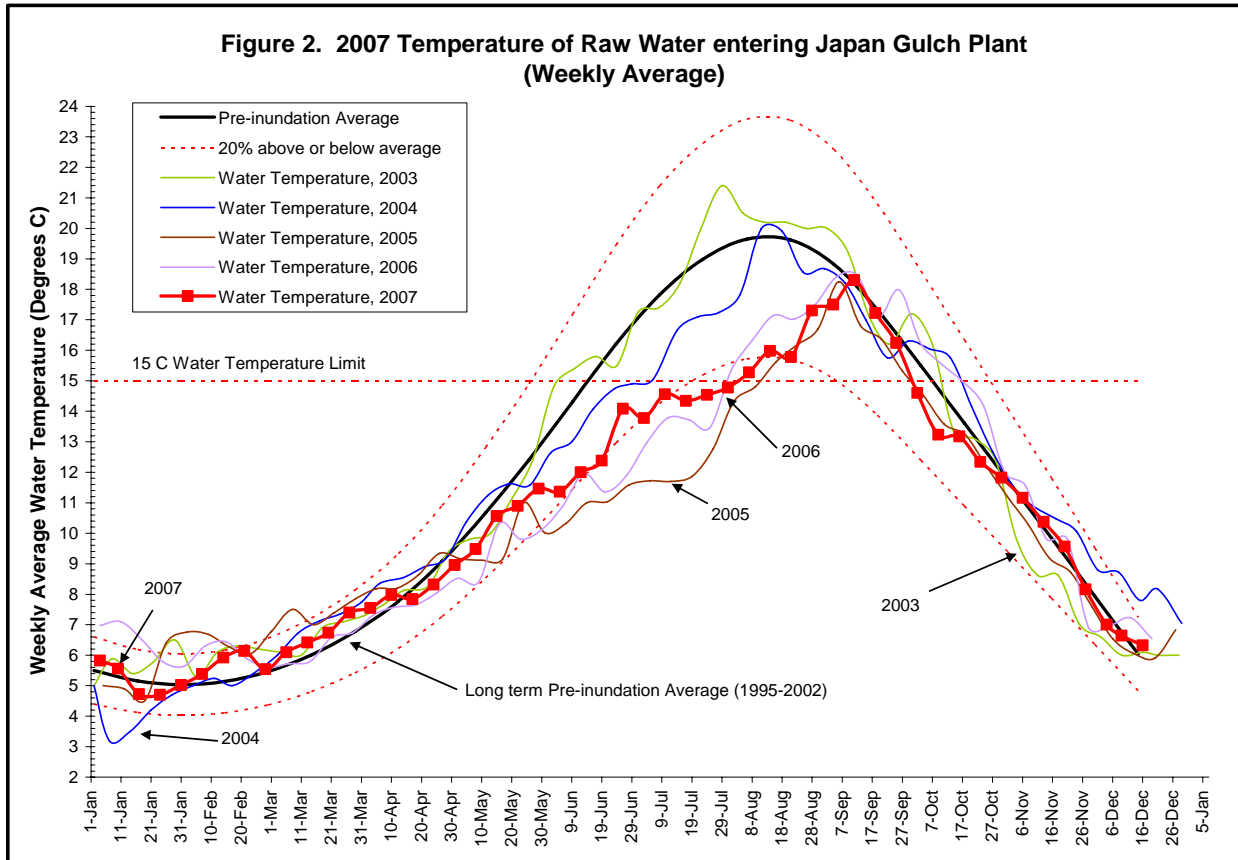
The primary contributor to the higher levels of chlorophyll-a observed in Sooke Reservoir in 2003 through 2007 was higher levels of total phosphorus, a nutrient that is needed for the algae to grow. **Figure 11** shows that the median concentration of total phosphorus was approximately 70% higher than in the years prior to raising the water level in both the north and south basins of Sooke Reservoir and does not appear to be declining. The highest phosphorus levels coincided with flooding of the newly cleared lands around the margin of Sooke Reservoir when the reservoir was expanded.

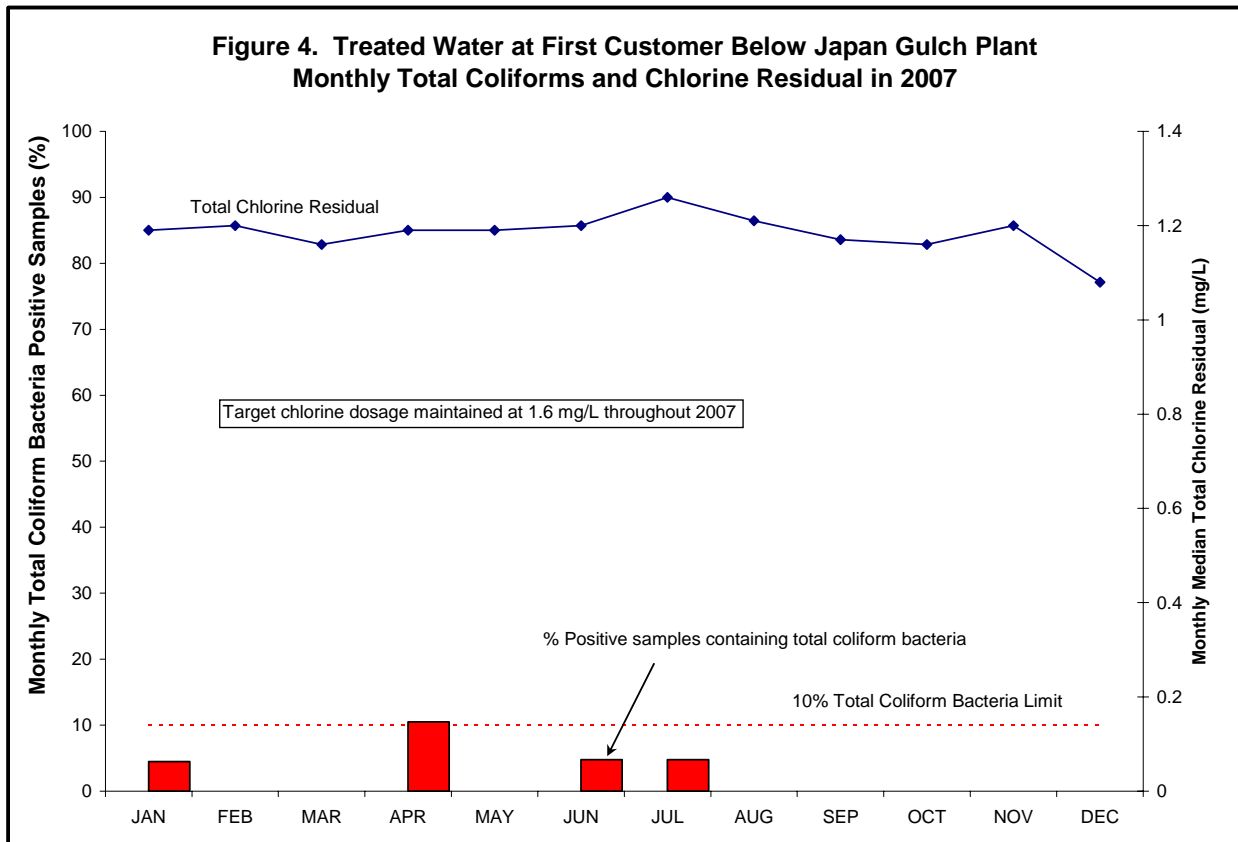
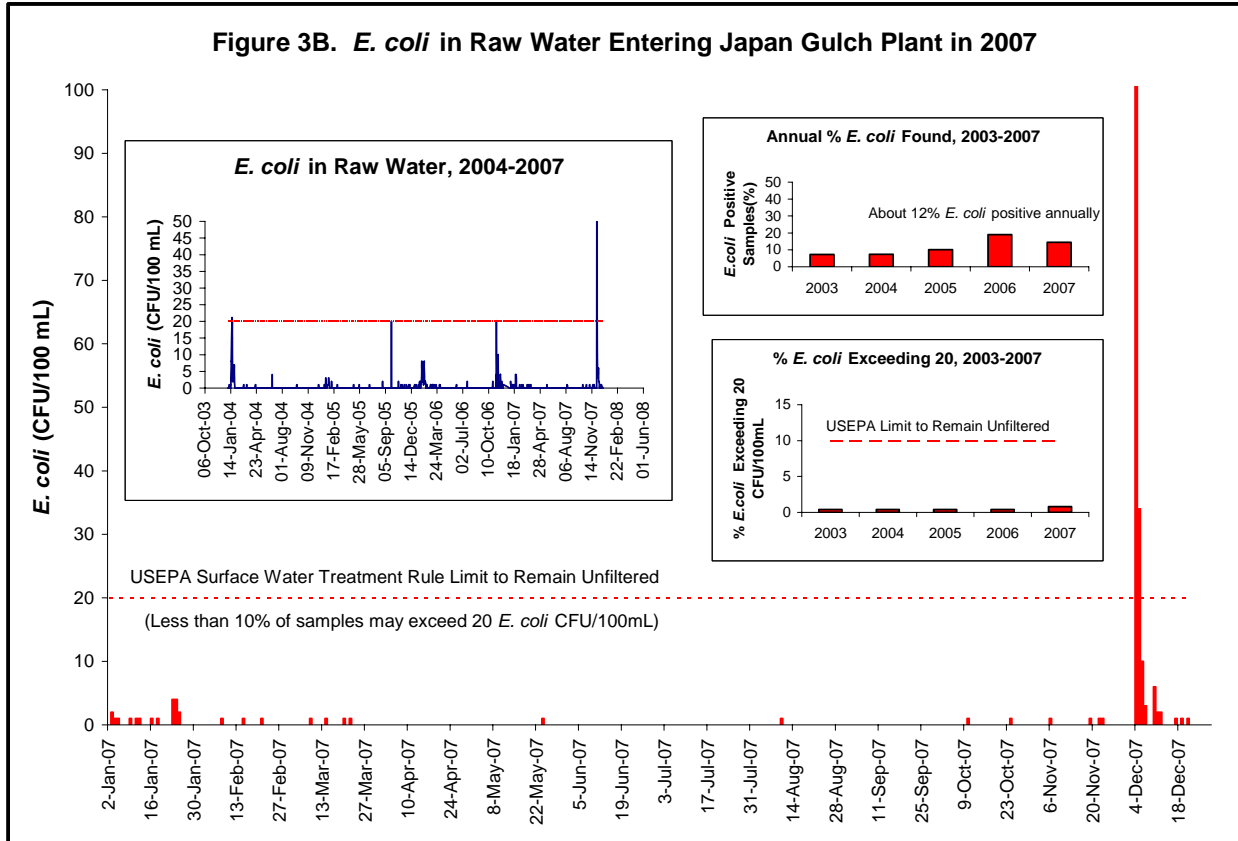
In 2007, two distinct, but not particularly significant algal bloom events occurred in Sooke Reservoir. One algal species (the diatom, *Asterionella formosa v. formosa*) was responsible for both blooms (**Figure 12**) and was a contributor to the overall chlorophyll-a concentrations (**Figure 10**). *Asterionella* is commonly present in Sooke Reservoir but has only been forming blooms since the raising of the reservoir water level in 2003. The highest concentrations of this alga were observed near the intake tower (**Figure 12**).

Water Quality Complaints. In 2007, the number of water quality complaints received by the Water Services Department was similar to other years that lacked significant algal blooms (**Figure 15**) and was substantively less than in those years when major taste and odour blooms occurred (2003 and 2006).

RECOMMENDATIONS

1. It is recommended that the rechlorination process at the Deep Cove Pumphouse on the Saanich Peninsula not be reactivated. This will reduce the levels of disinfection by-products in that portion of the North Saanich distribution system. No bacterial regrowth problems were noted during this period.





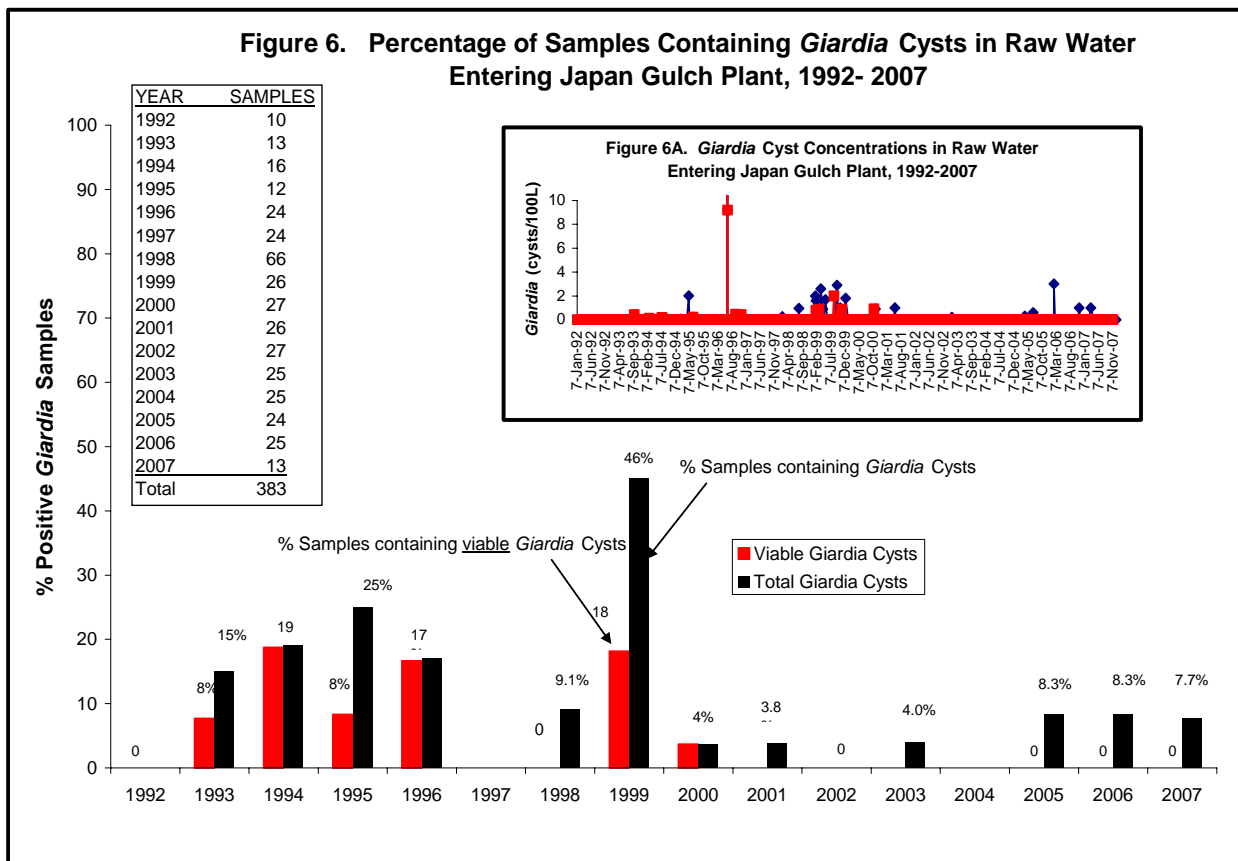
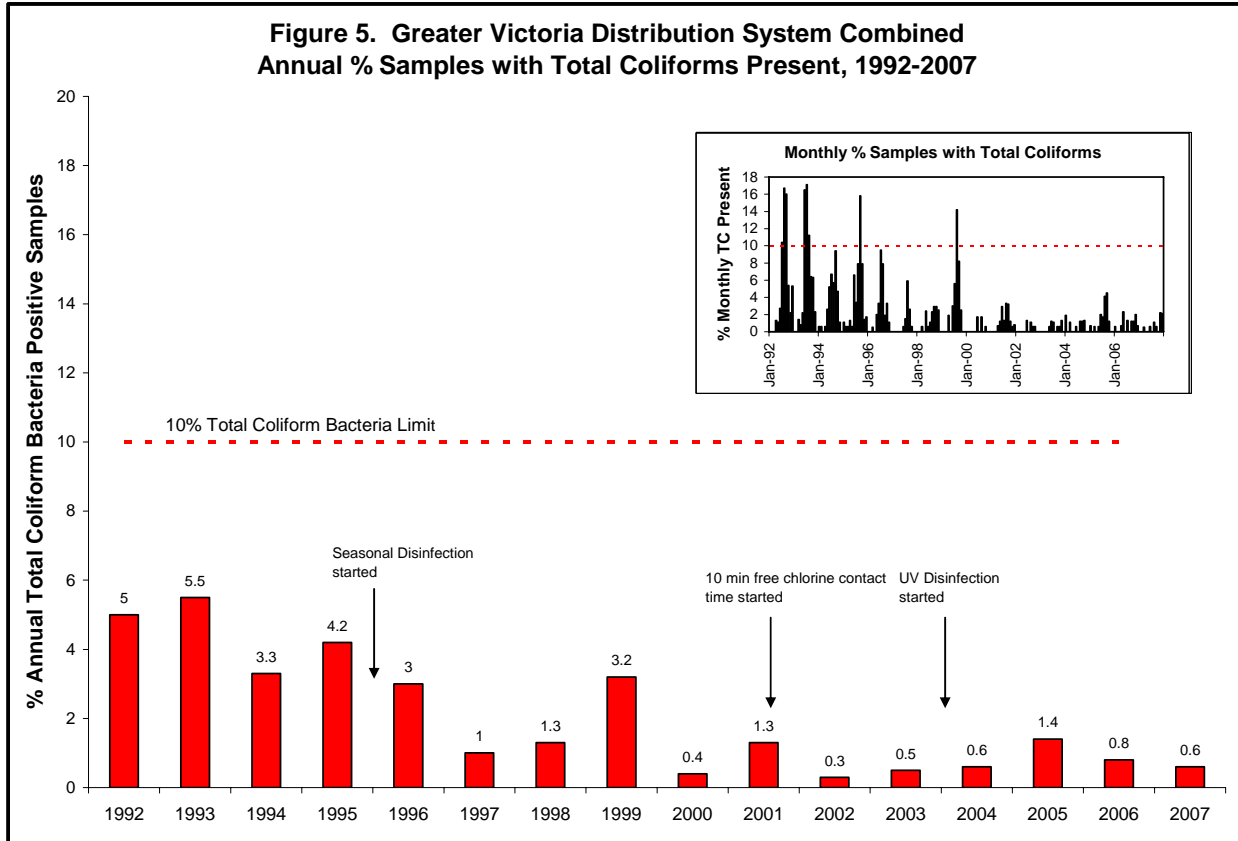


Figure 7. Percentage of Samples Containing *Cryptosporidium* Oocysts in Raw Water Entering Japan Gulch Plant, 1992- 2007

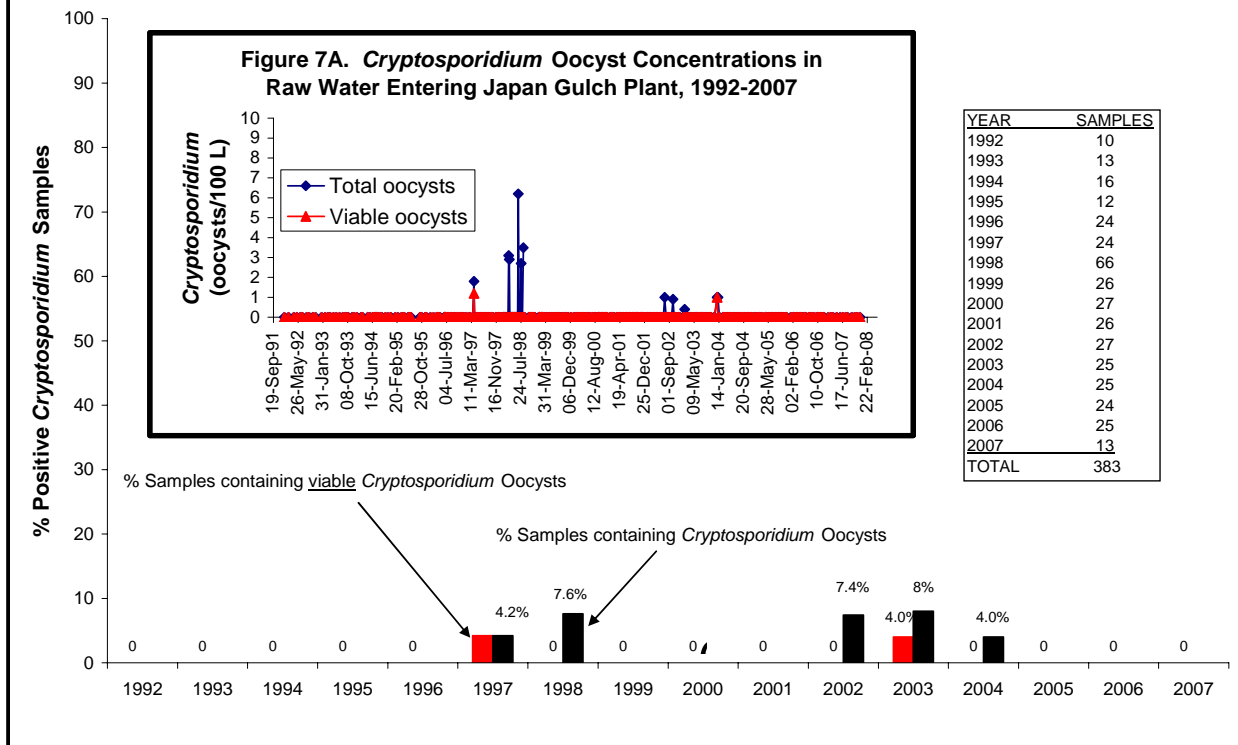
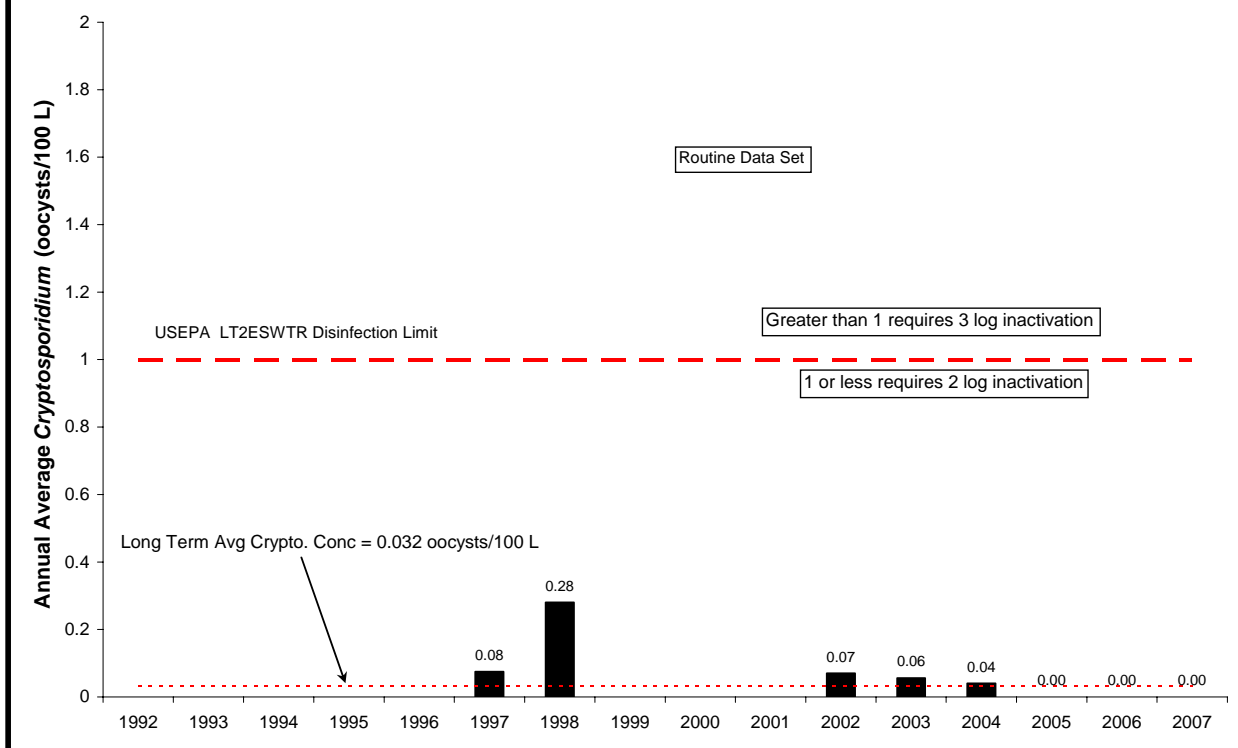
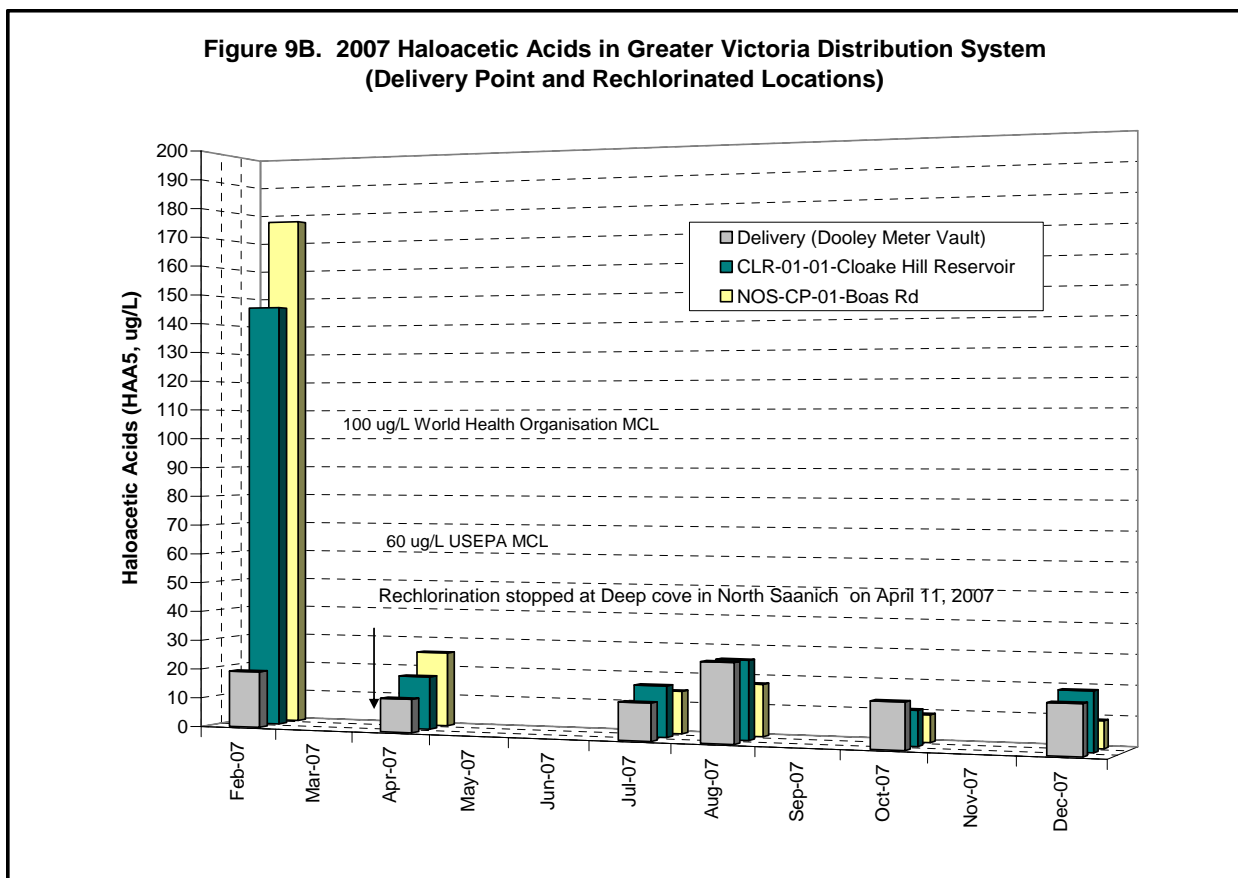
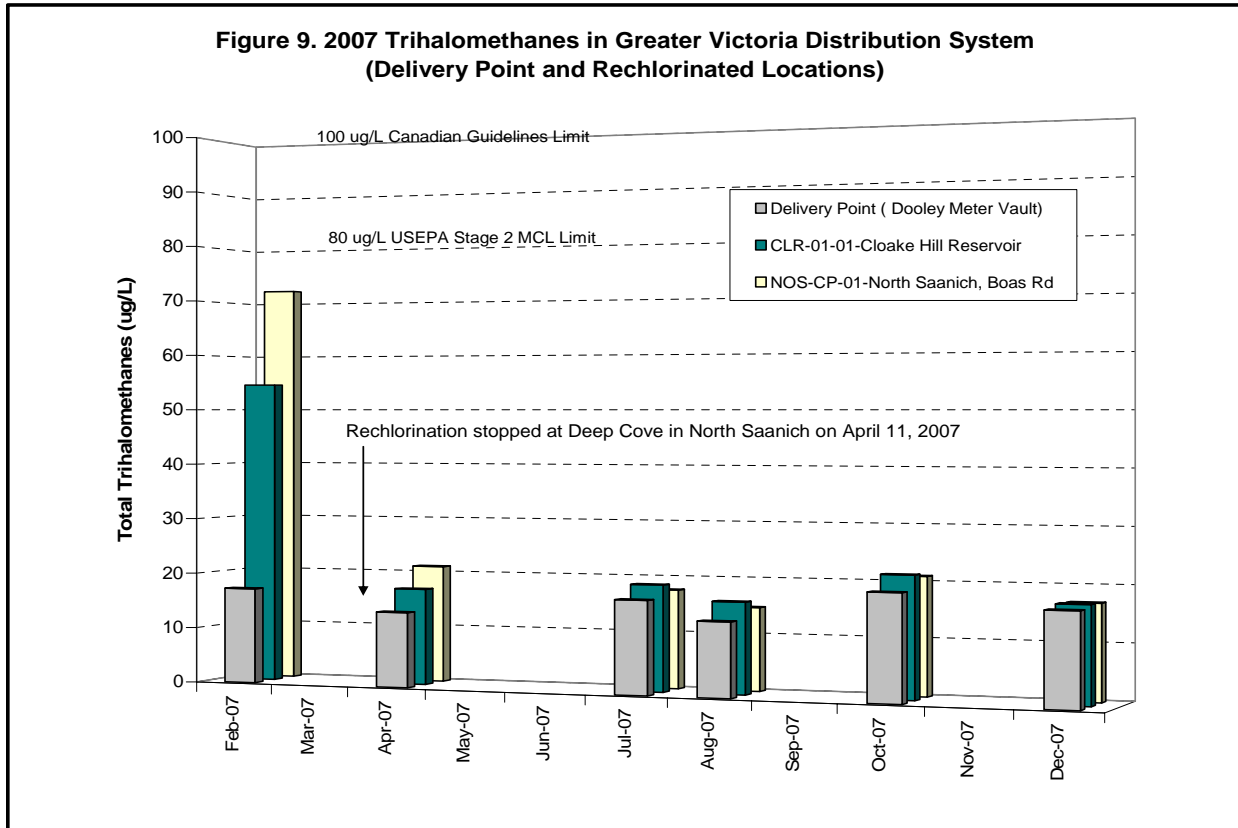
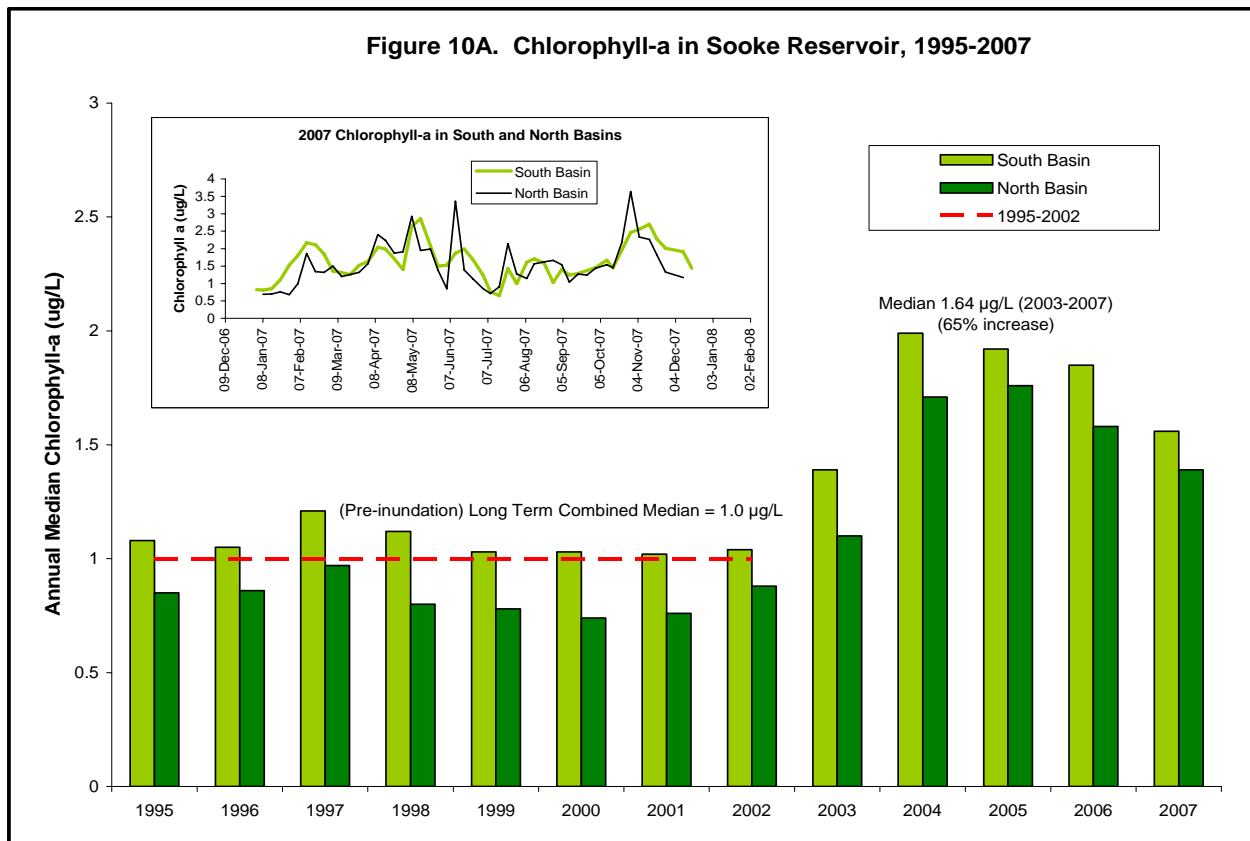
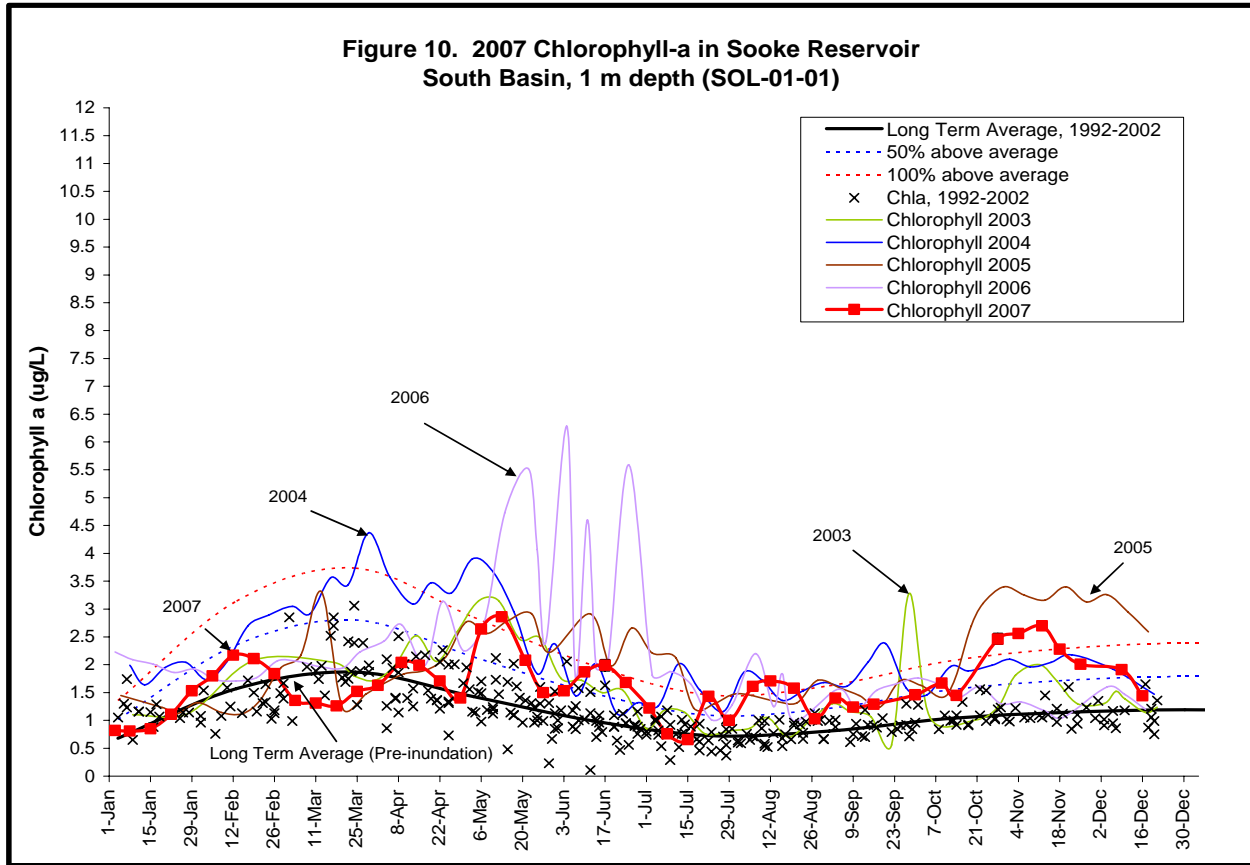
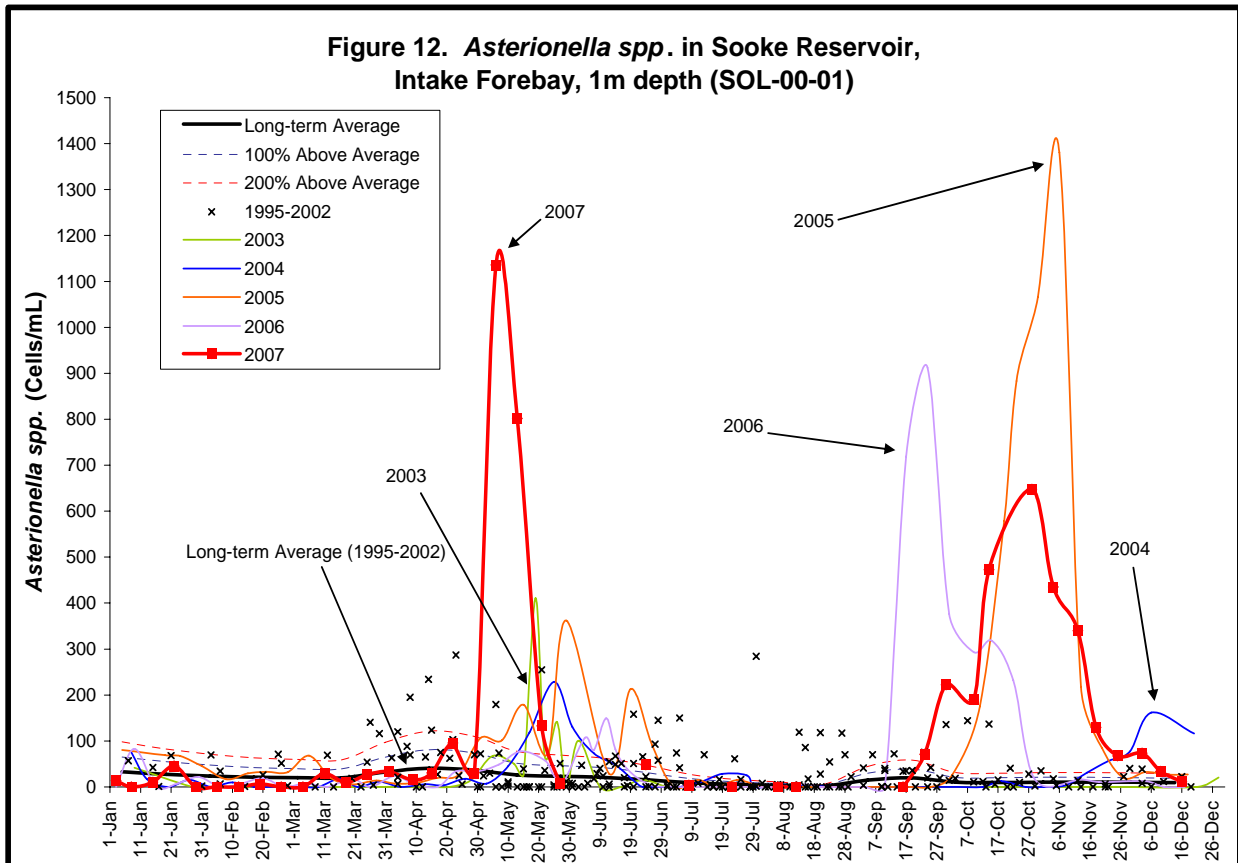
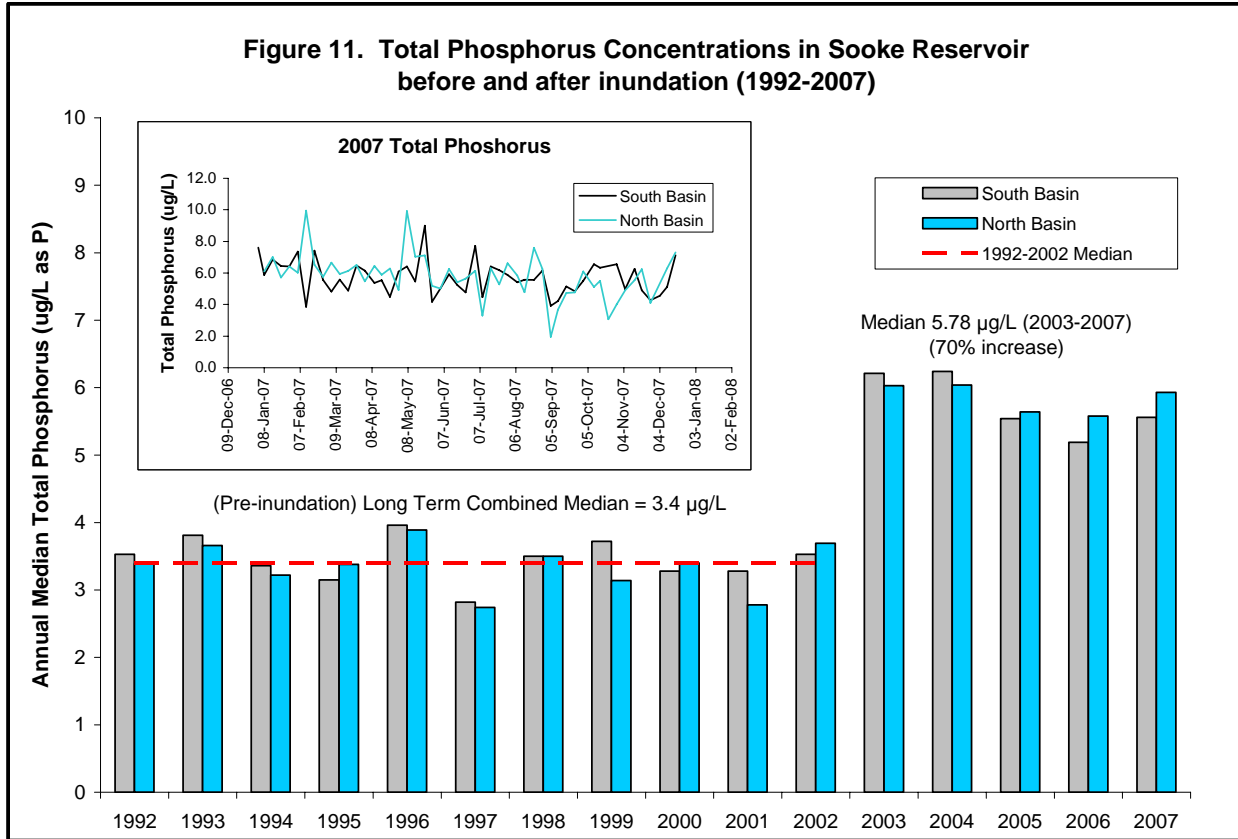


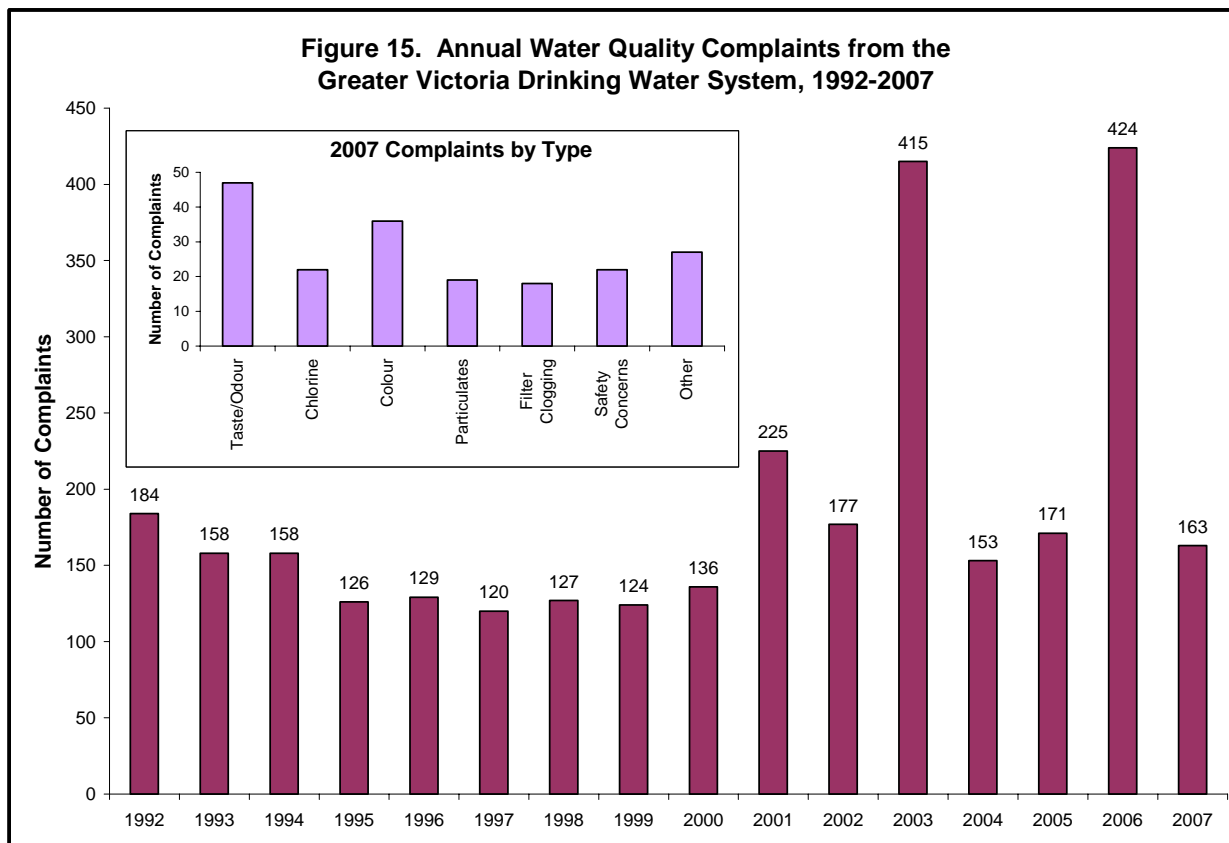
Figure 8. Annual Average Total *Cryptosporidium* Oocysts Levels in Raw Water Entering Japan Gulch Plant, 1992-2007











Water Quality Complaints by Type in 2007

Month	Total Number of Complaints ¹	Taste and/or Odour	Chlorine ²	Colour	Particulates	Safety Concerns	Filter Clogging	Customer's Plumbing	Sensitivity	Other
January	14	3	0	9	1	1	0	0	0	1
February	13	3	0	6	2	0	0	3	0	0
March	12	5	3	0	1	3	0	0	0	2
April	11	3	1	4	1	4	0	0	0	1
May	9	1	3	1	2	0	1	0	1	3
June	20	0	1	6	3	2	5	0	0	6
July	27	8	3	1	4	3	6	2	0	3
August	12	7	0	0	1	2	3	0	0	0
September	4	0	1	0	1	1	1	0	0	0
October	14	9	1	4	1	0	0	0	0	1
November	16	7	3	4	1	4	2	0	0	2
December	11	1	6	1	1	2	0	0	0	2
Total	163	47	22	36	19	22	18	5	1	21

¹Totals don't always reflect the numbers to the right, as some complaints fall into more than one category.
²Chlorine taste and odour are separated out from other taste and odour complaints.