State Water Project

Organic Carbon Monitoring

August 21, 2002

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Drinking Water Regulations

And Organic Carbon

- **Total Trihalomethane Rule (1979) –** Sets MCL of 100 µg\L annual average of four disinfection byproduct compounds. Organic carbon is a precursor and indicator of formation potential.

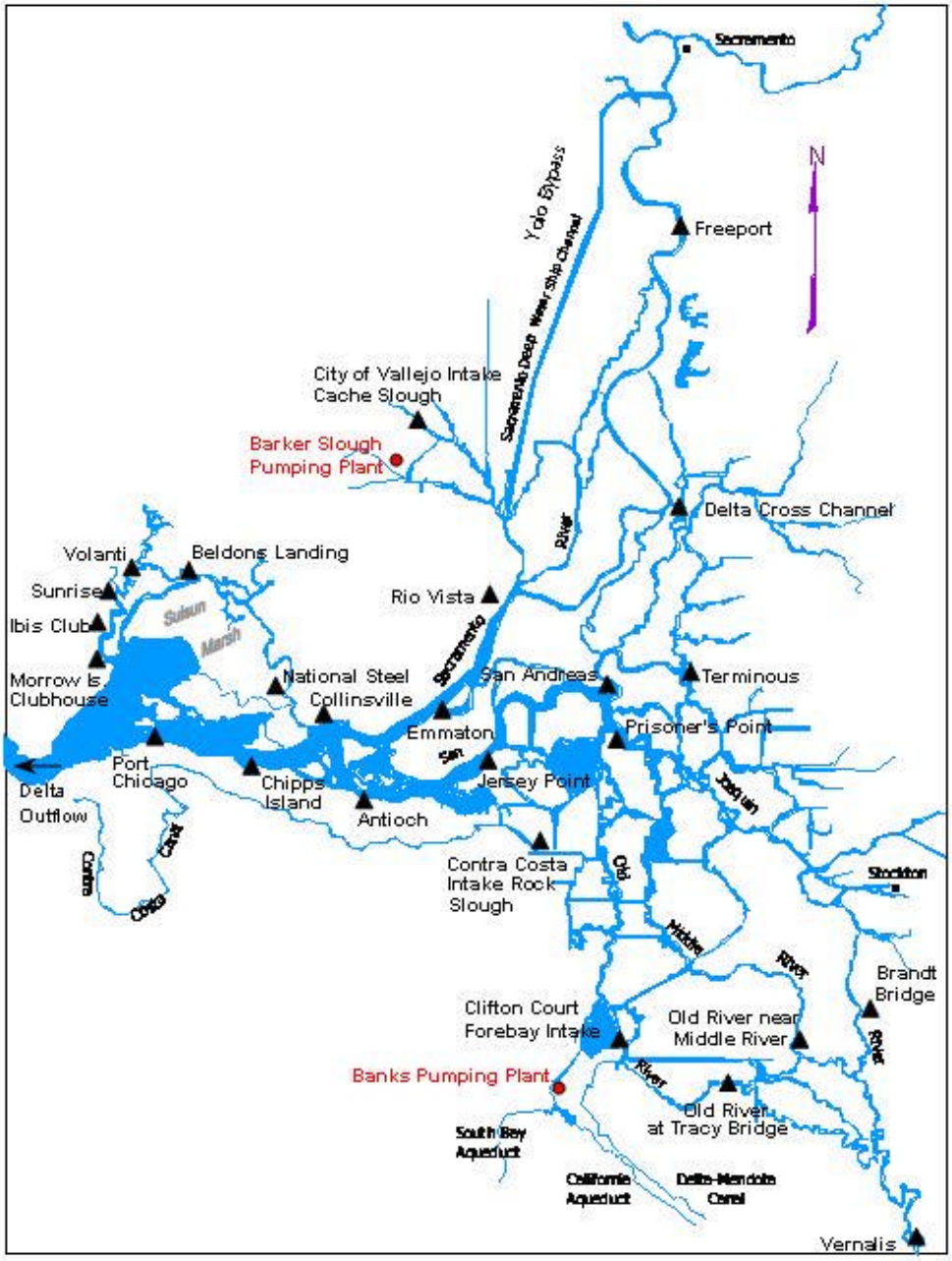
- **Surface Water Treatment Rule (1989) –** Requires 3-log removal of Giardia, 4-log removal of viruses and "multi-barrier" protection including disinfection of surface water.

- **Stage 1 Disinfectants & Disinfection Byproducts Rule (1998) –** Reduces the MCLs for THM to 80 µg\L, and Haloacetic Acid to 60 µg\L and requires removal of organic matter based upon raw water TOC and alkalinity.

- **CUWA\CALFED Targets (1998) –** CUWA expert panel recommends and CALFED adopts a target for "average concentrations at Clifton Court Forebay and other southern and central Delta drinking water intakes of 50 µg\L bromide and 3 mg\L TOC" or ELPH.

- **Stage 2 Disinfectants & Disinfection Byproducts Rule (Pending) -** Will most likely further reduce MCL for DBPs and source water organic matter (TOC).

State Water Project
Primary Water Quality Monitoring Stations



Water Quality Monitoring Stations in the Sacramento-San Joaquin Delta

SWP Organic Carbon Monitoring

Sampling Methods

- Samples are collected monthly or weekly from the circulation system in the Automated Monitoring Station pulling water from a depth of 3 meters.

- Samples are collected in 40 ml clear glass vials, refrigerated to 4 °C, delivered to Bryte laboratory and acidified.

- DOC samples are filtered to 0.45 micron in the field.

Analytical Methods

- **Wet Oxidation Infrared Method**, EPA 415.1, Standard Methods 5310 D; applicable to drinking water, surface water, groundwater, agricultural, municipal and industrial waste; analytical range of 0.1 mg\L – 100 mg\L; reporting limit of 0.1 mg\L.

- **High-Temperature Combustion Method**, EPA 415.1, Standard methods 5310 B; applicable to drinking water, surface water, groundwater, agricultural, municipal and industrial waste; analytical range of 0.5 mg\L – 1000 mg\L; reporting limit of 0.5 mg\L.

Sampling Frequency and Results

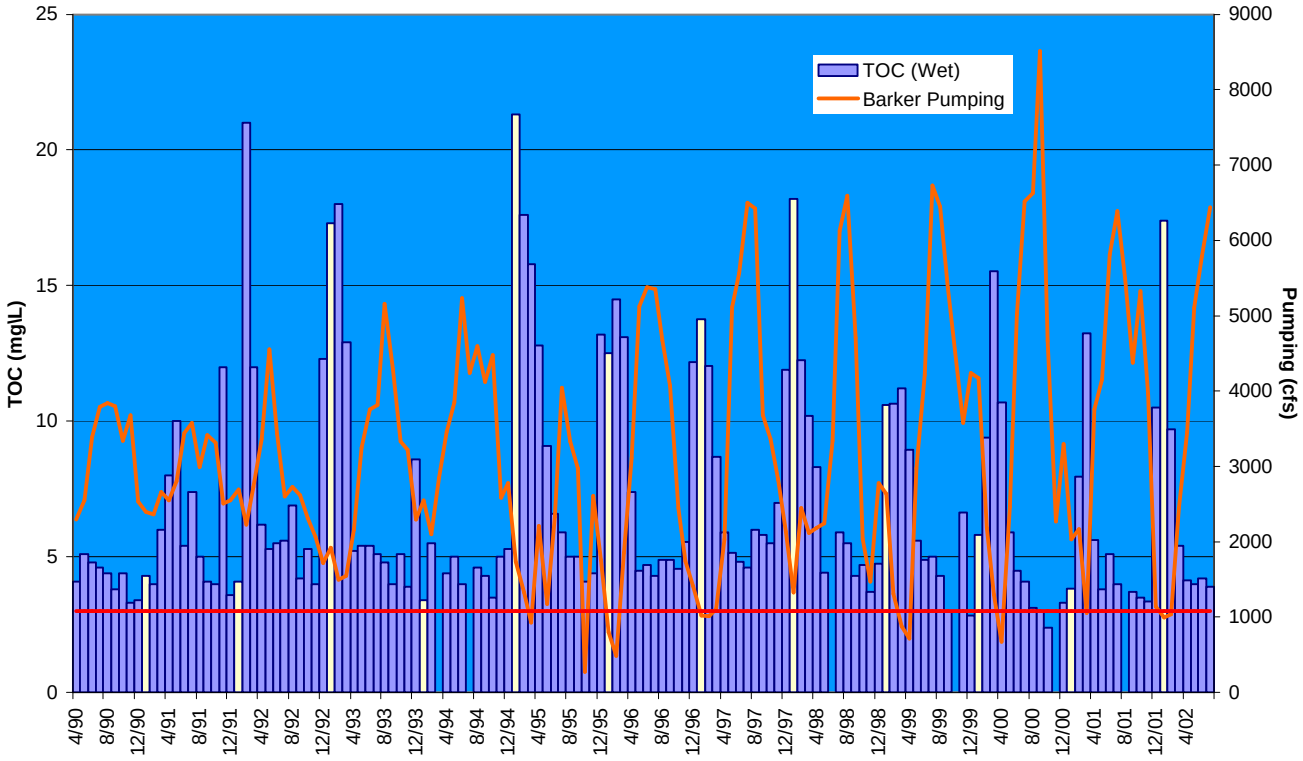
Banks Pumping Plant

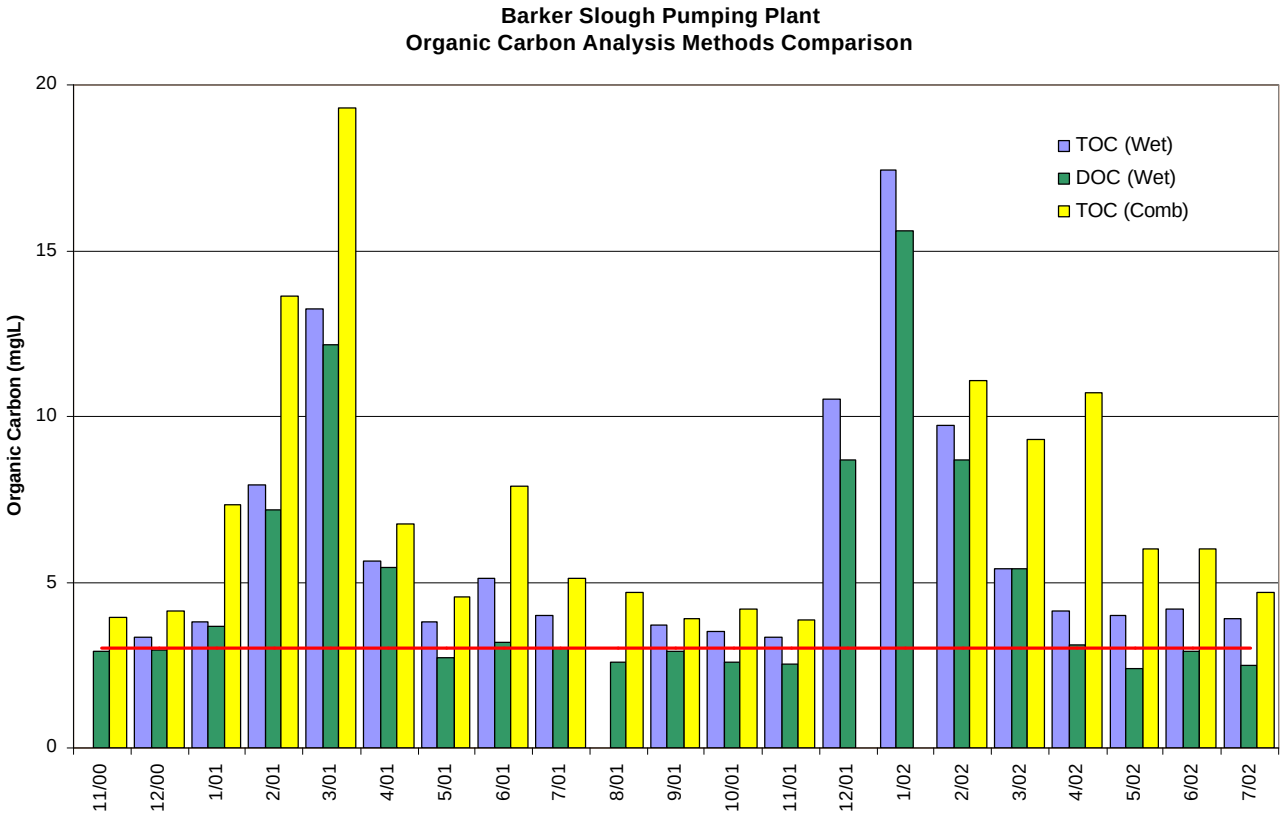
		mg\L				
	Months	Ave	Min	Max	Stdev	n
TOC (wet)	11/83-7/02	4.1	2.2	9.6	1.3	166
TOC (comb)	11/00-7/02	5.7	2.9	16.3	3.3	21
DOC (wet)	10/00-7/02	3.8	2.2	8.3	1.3	43

Barker Slough Pumping Plant

		mg\L				
	Months	Ave	Min	Max	Stdev	n
TOC (wet)	10/89-7/02	7.4	2.3	21.3	4.8	266
TOC (comb)	11/00-7/02	8.9	2.6	28.8	6.4	96
DOC (wet)	10/96-7/02	6.5	2.4	17.9	3.9	208

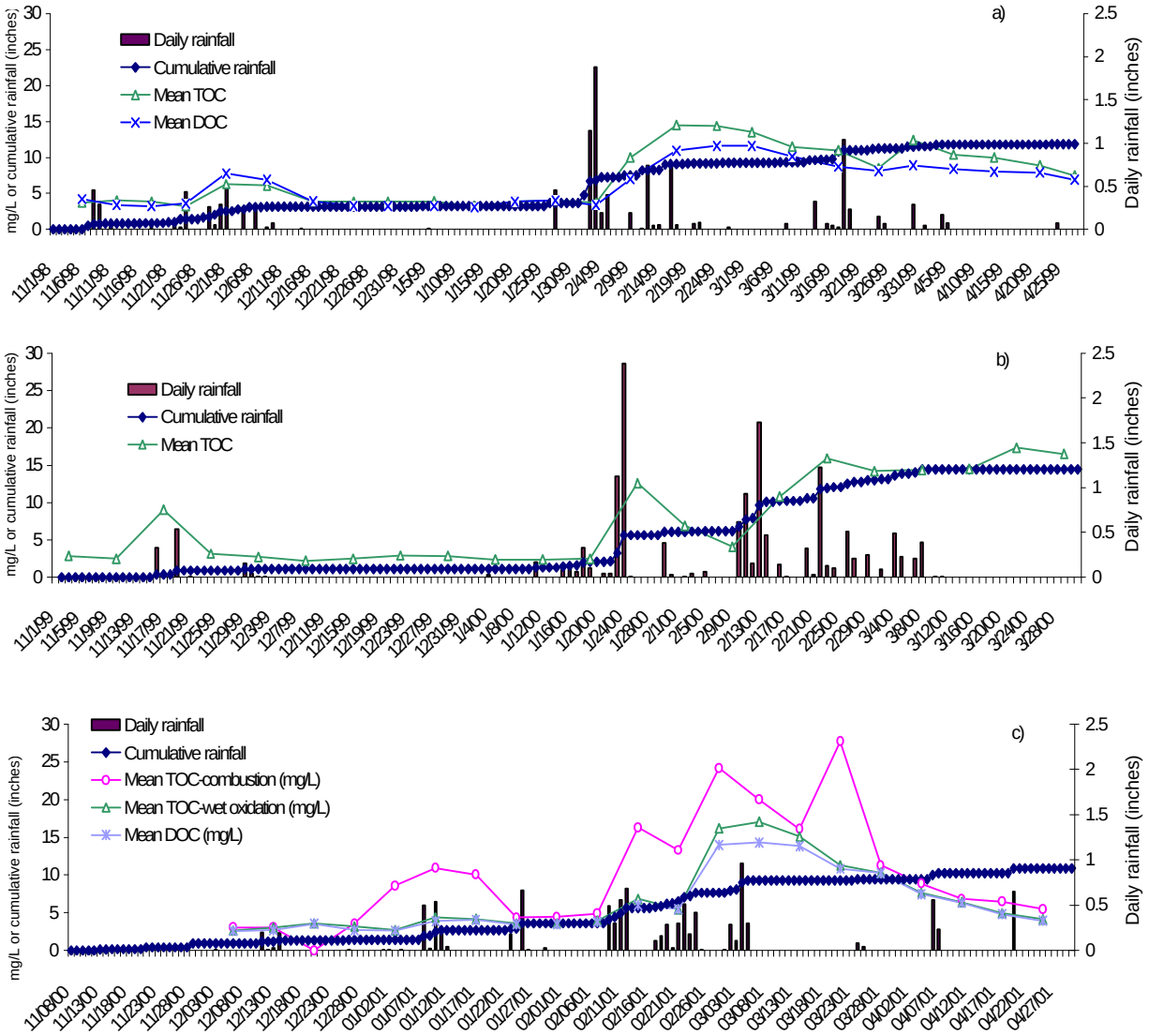
Barker Slough Pumping Plant
Monthly TOC (Wet Oxidation) and Pumping




Barker Slough Pumping Plant
Organic Carbon Analysis Methods Comparison
Organic Carbon (mg/L)
20
15
10
5
0
TOC (Wet)
DOC (Wet)
TOC (Comb)
11/00
12/00
1/01
2/01
3/01
4/01
5/01
6/01
7/01
8/01
9/01
10/01
11/01
12/01
1/02
2/02
3/02
4/02
5/02
6/02
7/02

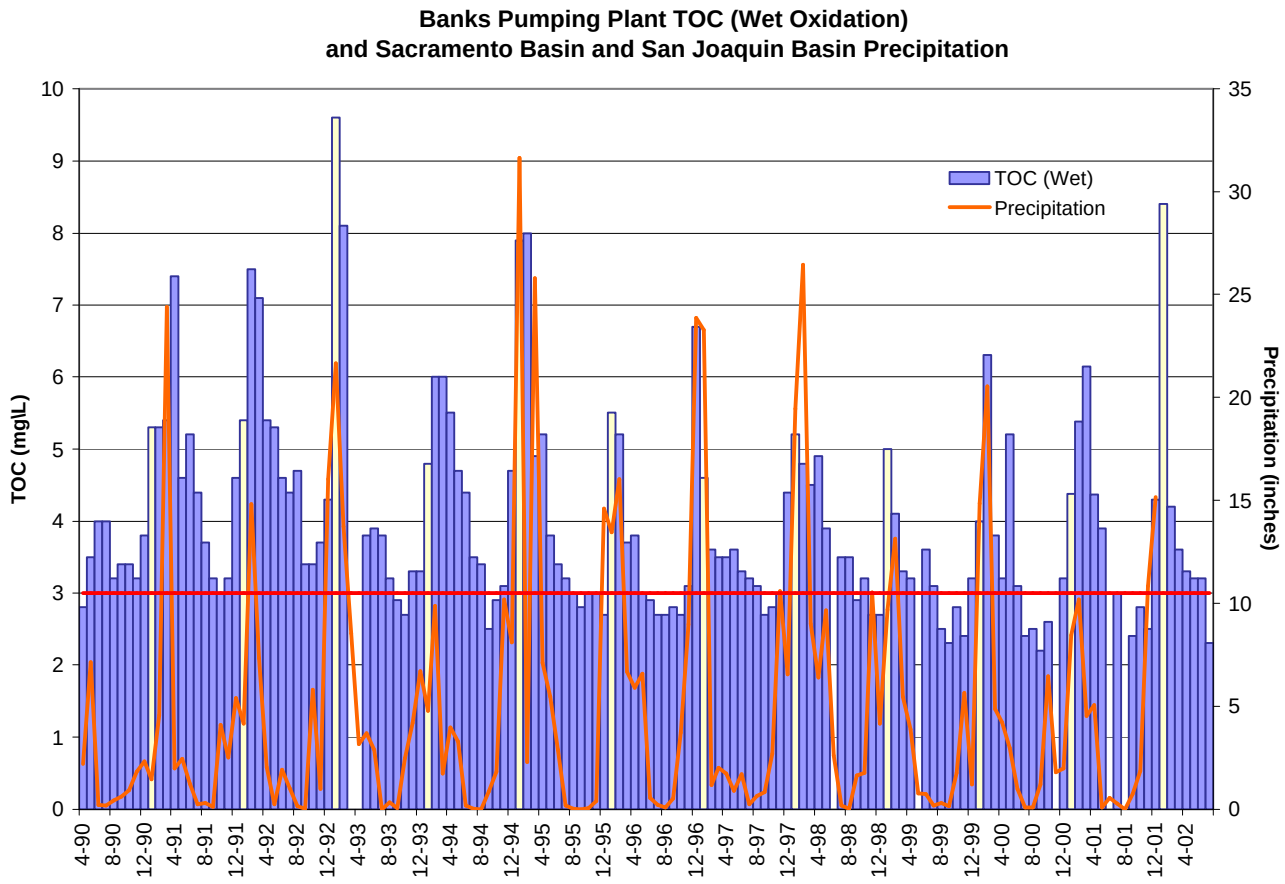
Comparison of TOC/DOC vs. Rainfall at the Barker Slough Pumping Plant

a) 11/98-4/99), b) 11/99-3/00 c) 12/00-4/01



From: ***Water Quality Investigations of the Barker Slough Watershed 1997- 2000, North Bay Aqueduct Summary, May 2002***

http://www.dpla.water.ca.gov/supply/sampling/mwq/second/publications/NBAfinal.pdf


Banks Pumping Plant TOC (Wet Oxidation)
and Sacramento Basin and San Joaquin Basin Precipitation
TOC (mg\L)
Precipitation (inches)
TOC (Wet)
Precipitation
0
1
2
3
4
5
6
7
8
9
10
0
5
10
15
20
25
30
35
4-90
8-90
12-90
4-91
8-91
12-91
4-92
8-92
12-92
4-93
8-93
12-93
4-94
8-94
12-94
4-95
8-95
12-95
4-96
8-96
12-96
4-97
8-97
12-97
4-98
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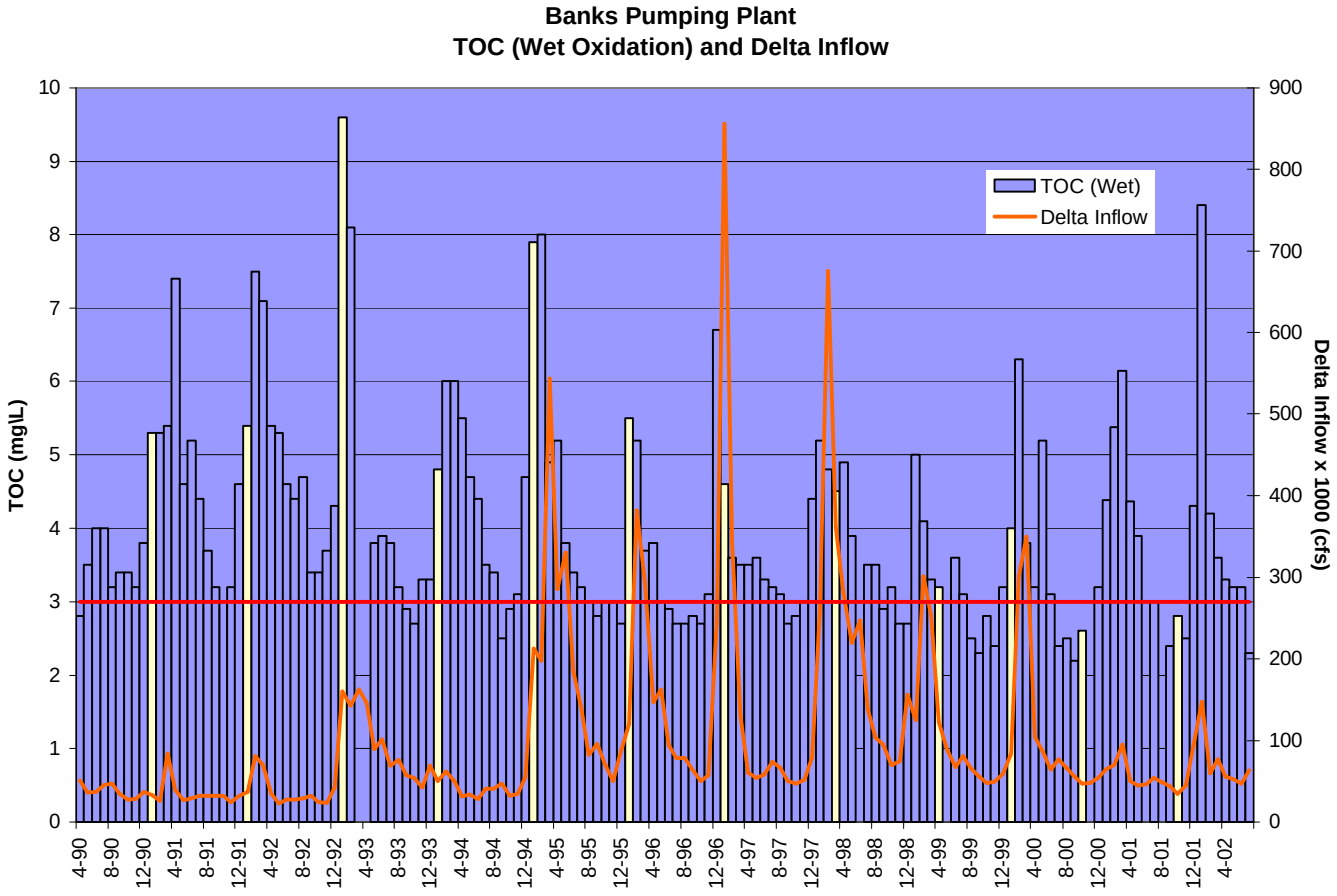
4-01
8-01
12-01
4-02


Banks Pumping Plant
TOC (Wet Oxidation) and Delta Inflow
TOC (mg/L)
Delta Inflow x 1000 (cfs)
TOC (Wet)
Delta Inflow
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
4-90
8-90
12-90
4-91
8-91
12-91
4-92
8-92
12-92
4-93
8-93
12-93
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4-97
8-97
12-97
4-98
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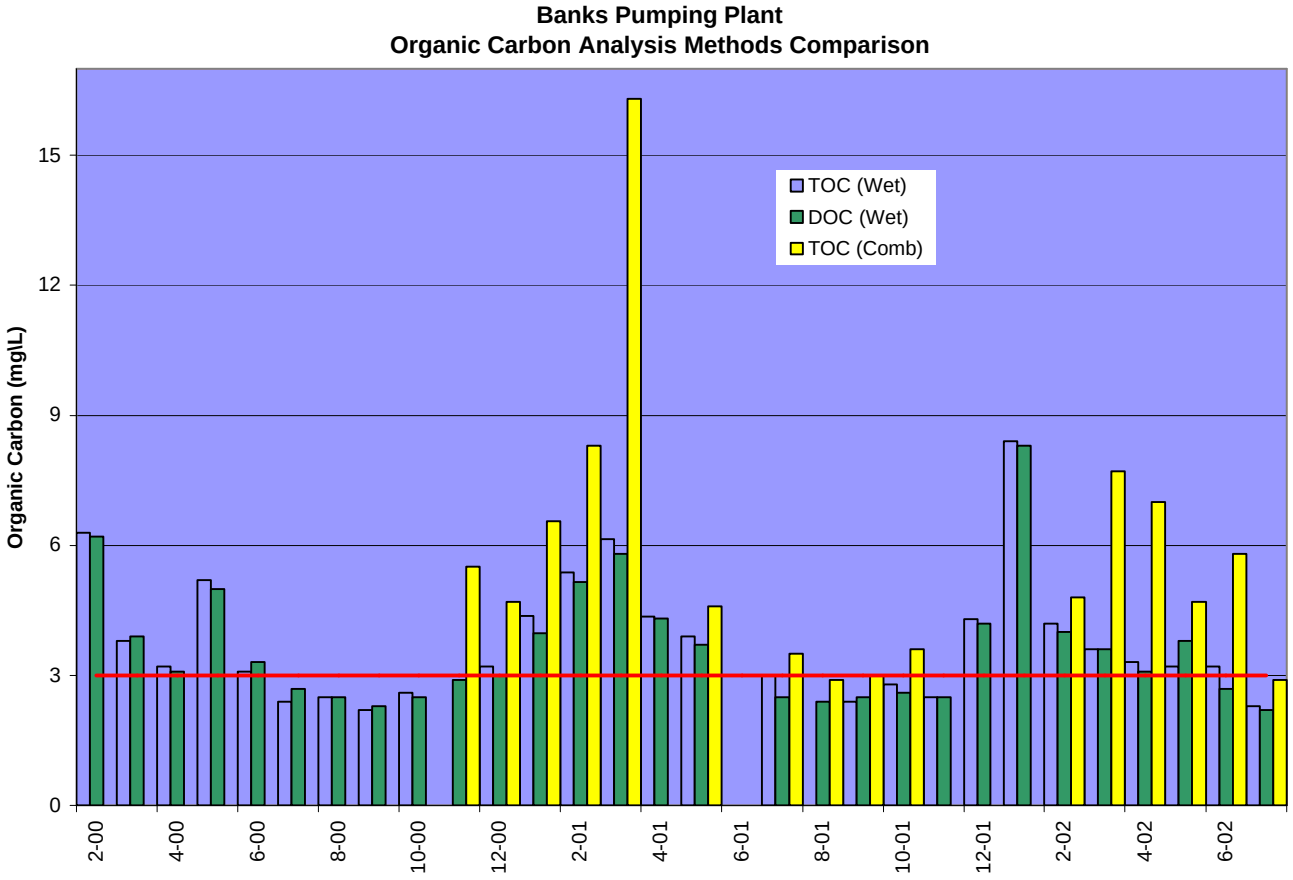
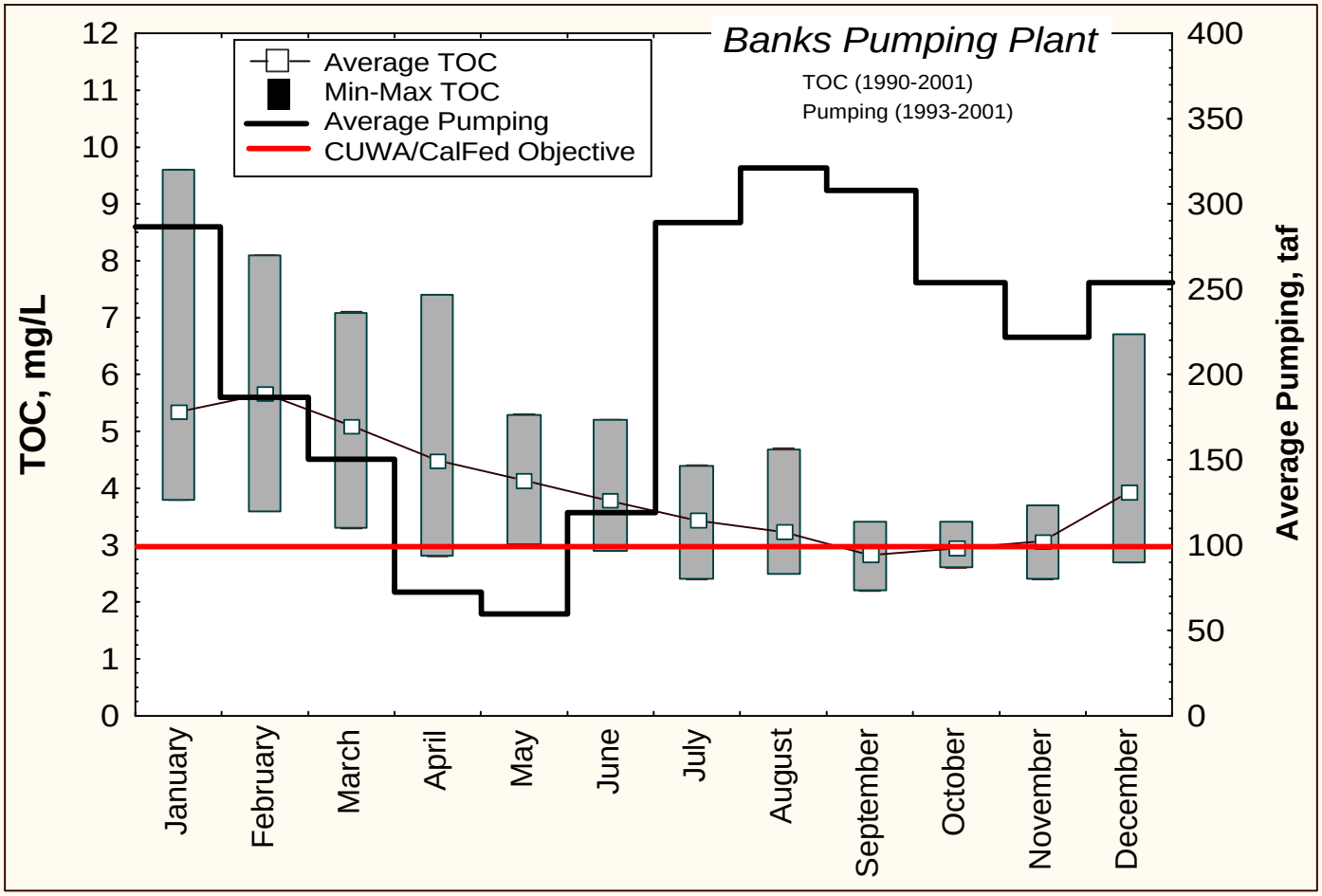
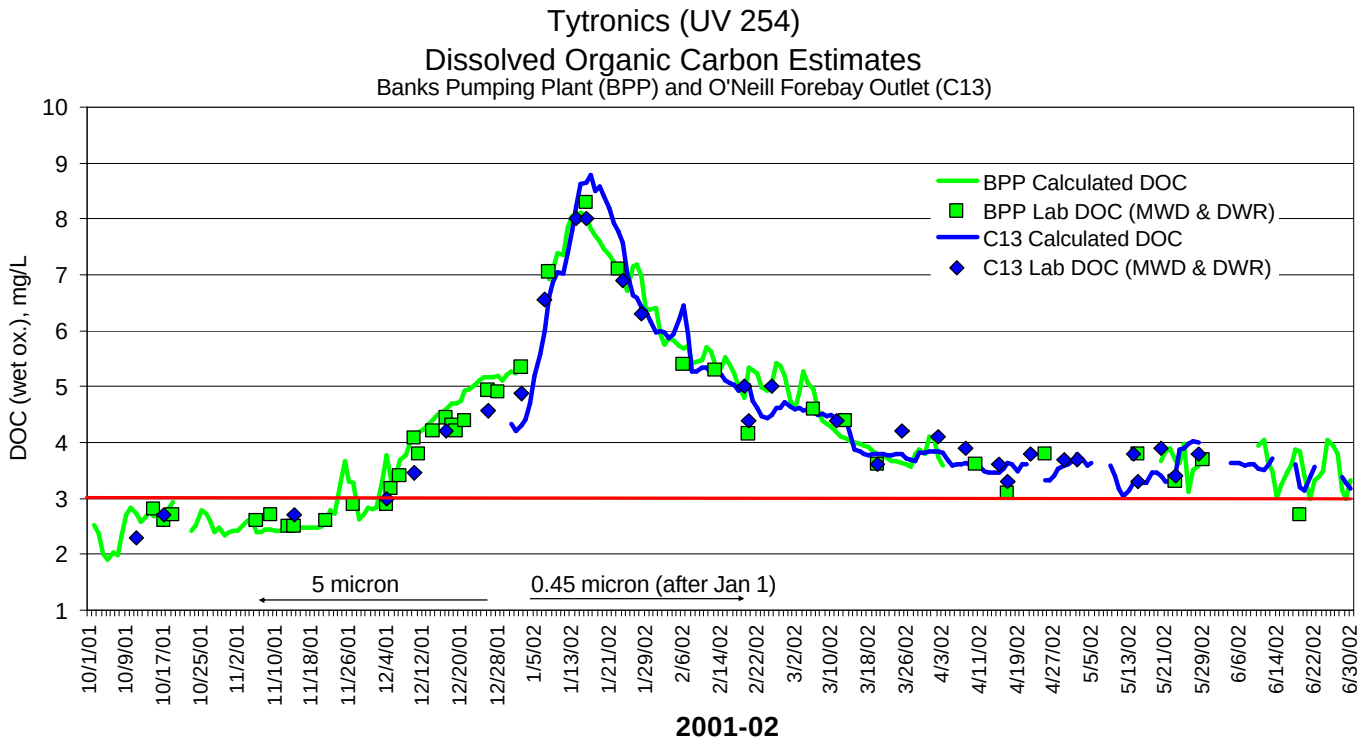
4-01
8-01
12-01
4-02


Banks Pumping Plant
Organic Carbon Analysis Methods Comparison
Organic Carbon (mg/L)
0
3
6
9
12
15
TOC (Wet)
DOC (Wet)
TOC (Comb)
2-00
4-00
6-00
8-00
10-00
12-00
2-01
4-01
6-01
8-01
10-01
12-01
2-02
4-02
6-02

Banks Pumping Plant
Average Monthly TOC Concentrations
And Pumping




Tytronics (UV 254)
Dissolved Organic Carbon Estimates
Banks Pumping Plant (BPP) and O'Neill Forebay Outlet (C13)
DOC (wet ox.), mg/L
10
9
8
7
6
5
4
3
2
1
BPP Calculated DOC
BPP Lab DOC (MWD & DWR)
C13 Calculated DOC
C13 Lab DOC (MWD & DWR)
5 micron
0.45 micron (after Jan 1)
10/1/01
10/9/01
10/17/01
10/25/01
11/2/01
11/10/01
11/18/01
11/26/01
12/4/01
12/12/01
12/20/01
12/28/01
1/5/02
1/13/02
1/21/02
1/29/02
2/6/02
2/14/02
2/22/02
3/2/02
3/10/02
3/18/02
3/26/02
4/3/02
4/11/02
4/19/02
4/27/02
5/5/02
5/13/02
5/21/02
5/29/02
6/6/02
6/14/02
6/22/02
6/30/02
2001-02

SWP Organic Carbon Monitoring

Observations

- Delta organic carbon varies seasonally with peak concentrations during the winter.

- Delta organic carbon dynamics seem to be largely driven by precipitation.

- Temporal trends of TOC (wet and comb) and DOC are similar.

- Maximum organic carbon concentrations at Barker Slough P. P. are more than double that of Banks P. P.

- To date watershed studies of Barker Slough have not found one predominant source of organic carbon.

- Even dry season TOC concentrations at SWP Delta export locations usually exceed the CUWA\CALFED target of 3 mg\L.

- Enhanced coagulation will most likely be necessary to remove TOC with conventional water treatments using Delta water.