Chlorophyll *a* Non-Attainment Diagnostics

WQGIT 7 June 2010

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Chlorophyll *a* Attainment at 180TN, 12TP

Cbseg	179 Loading Scenario 179TN, 12.0TP, 5510TSS '91-'93 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '92-'94 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '93-'95 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '94-'96 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '95-'97 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '96-'98 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '97-'99 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '98-'00 CL Spring Seasonal
DCATF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DCPTF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
JMSTFL	0%	0%	2%	2%	2%	0%	0%	0%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	3%	3%	3%	0%	3%
JMSMH	2%	0%	0%	0%	0%	0%	0%	0%
JMSPH	0%	0%	0%	0%	0%	0%	0%	0%

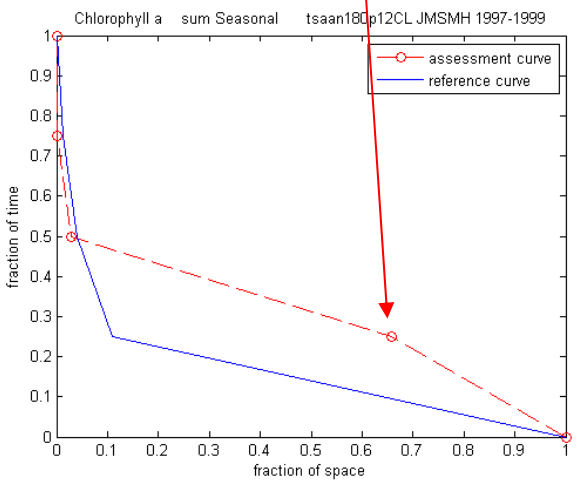
Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
DCATF	NoData	NoData	NoData	NoData	NoData	NoData	0%	0%
DCPTF	28%	51%	44%	20%	22%	22%	22%	0%
JMSTFL	0%	0%	0%	0%	5%	14%	14%	7%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	14%	13%
JMSPH	0%	0%	0%	0%	0%	0%	10%	10%

Chlorophyll *a* Problem Segments: JMSMH

Summer JMSMH Chla criterion = 10 ug/L

JMSMH summer vio rate

year	observed	180/12
1997	28%	3%
1998	0%	0%
1999	93%	66%
2000	0%	0%



assessment CFD plot

station data

LE5.1	chl a (ug/L)	
month	obs	180/12
Jul-99	10.9	9.41
Aug-99	10.2	8.45
Sep-99	21	5.42

station data

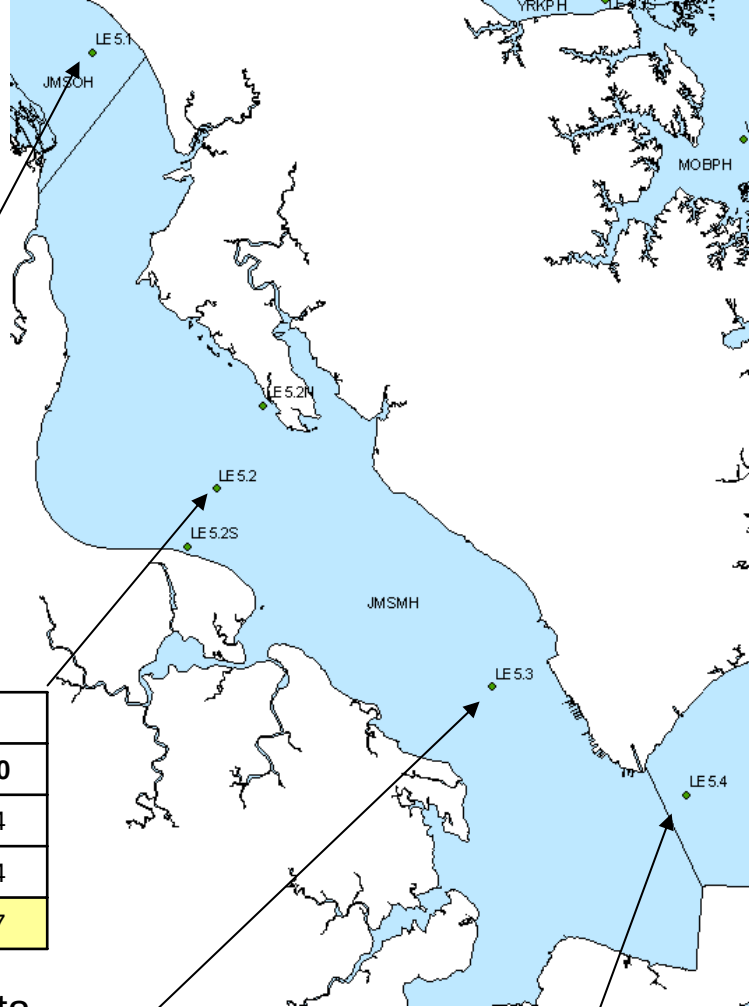
LE5.2	chl a (ug/L)	
month	obs	n180
Jul-99	11.1	8.94
Aug-99	6.19	5.34
Sep-99	14	23.7

station data

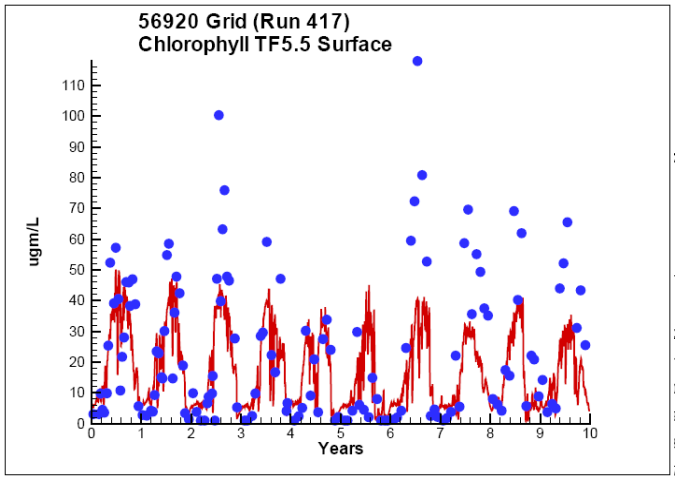
LE5.3	chl a (ug/L)	
month	obs	180/12
Jul-99	12.1	10.9
Aug-99	8.35	7.46
Sep-99	20.3	24.8

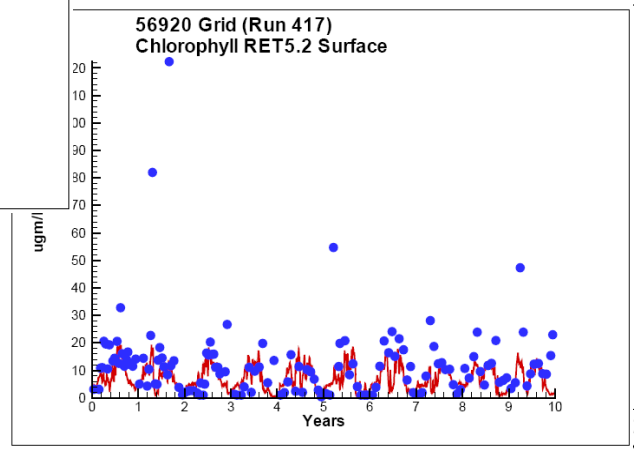
station data

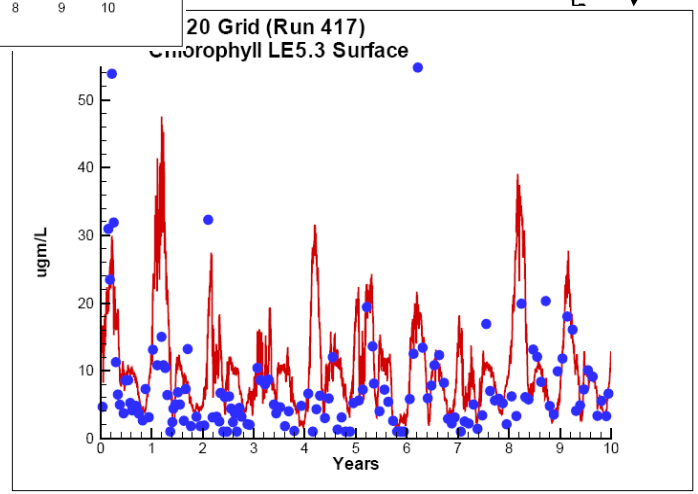
LE5.4	chl a (ug/L)	
month	obs	180/12
Jul-99	11	8.78
Aug-99	10.3	8.33
Sep-99	8.97	7.66



James River Chlorophyll *a* Surface Calibration Plots





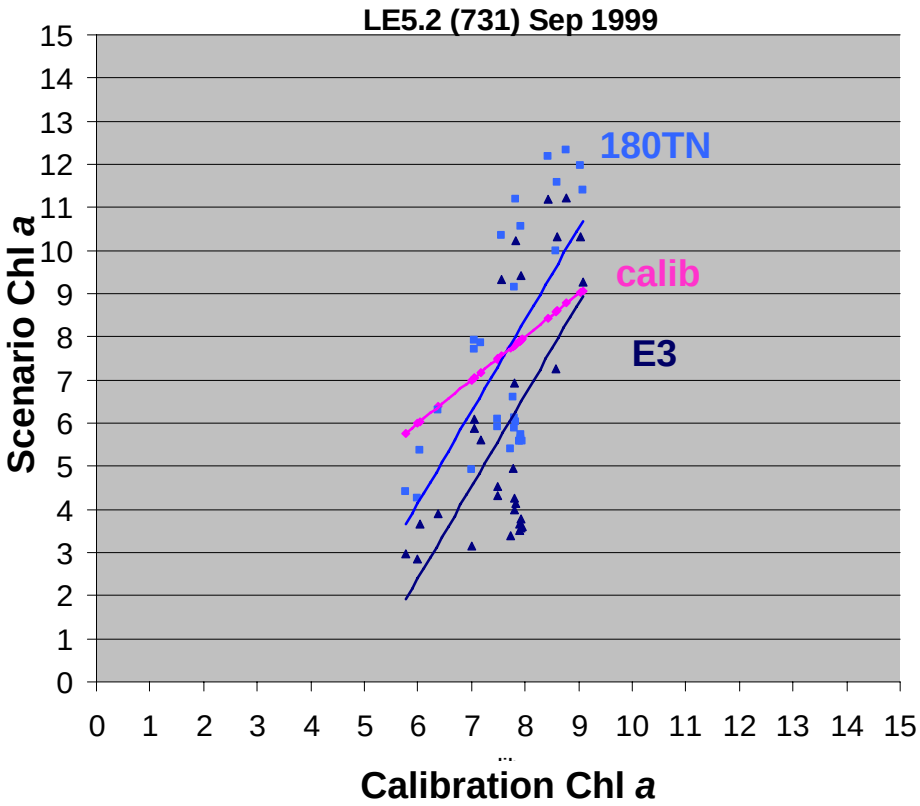


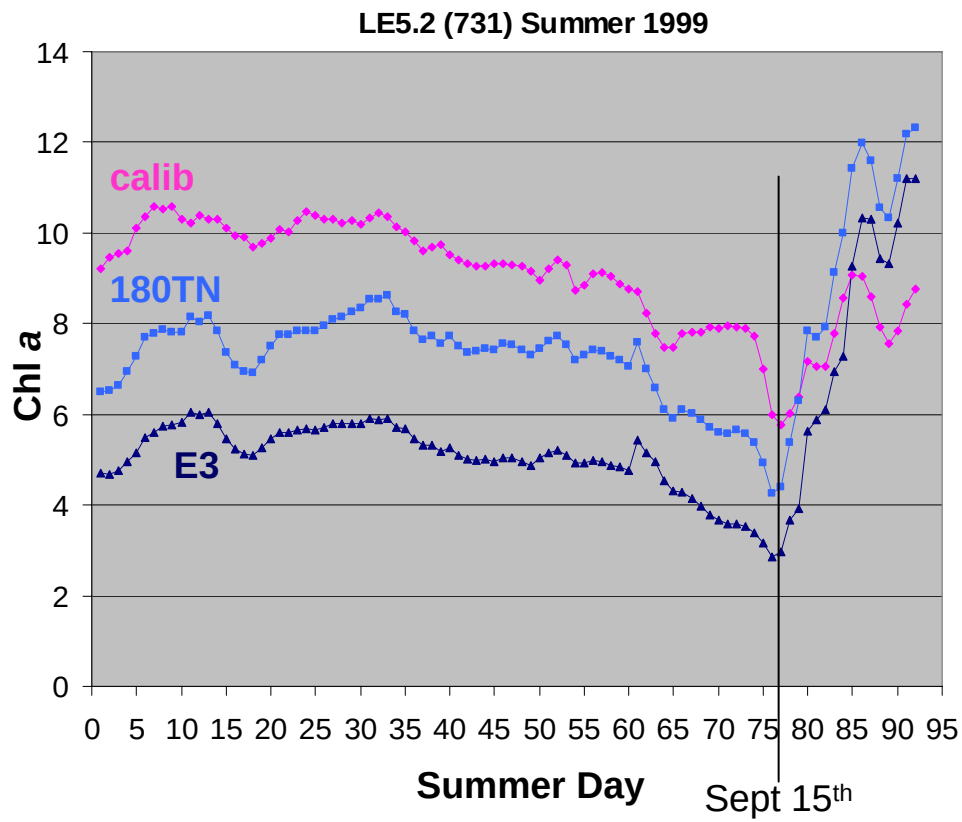
Chlorophyll *a* Problem Segments: JMSMH

station data

LE5.2	chl a (ug/L)	
month	obs	n180
Jul-99	11.1	8.94
Aug-99	6.19	5.34
Sep-99	14	23.7

WQSTM Cell 731 (LE5.2) Simulations, Summer 1999

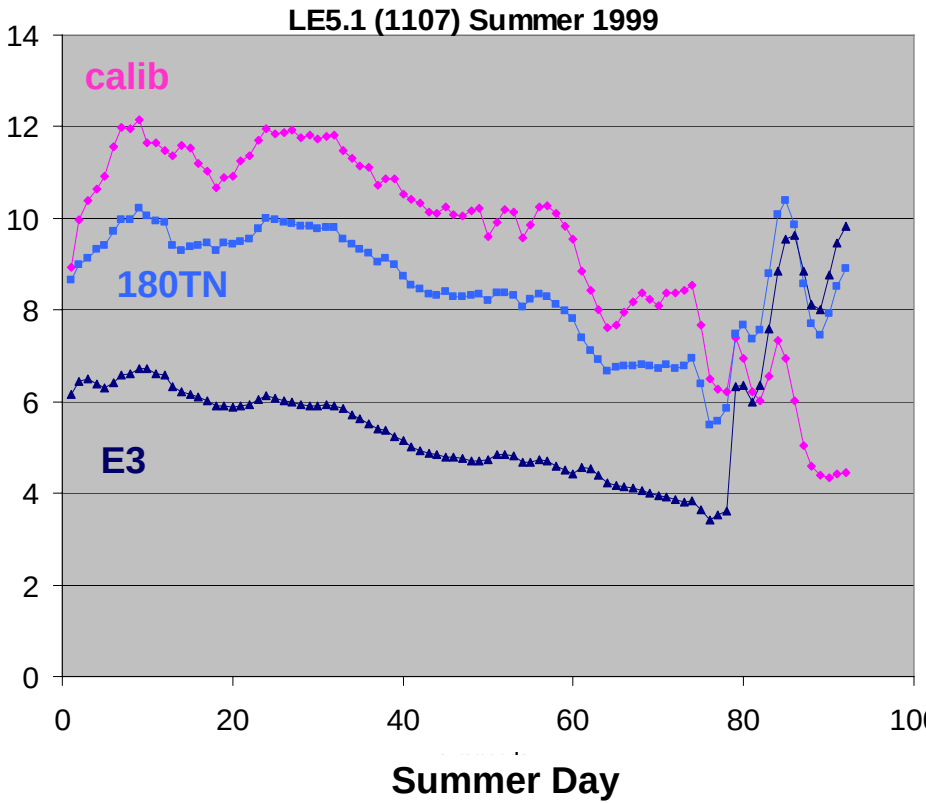




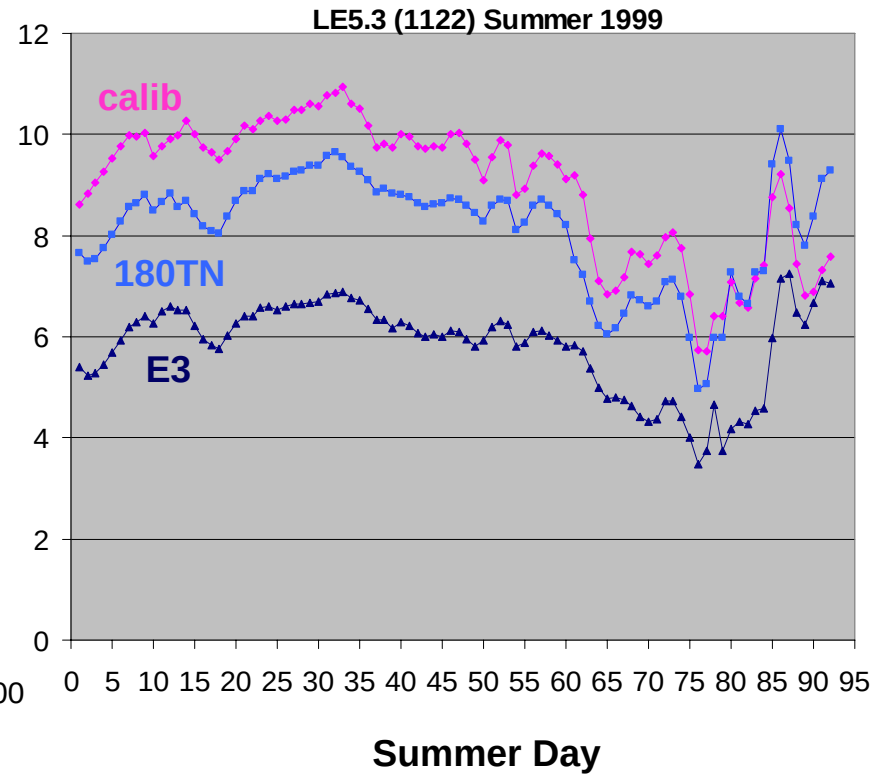
Chlorophyll *a* Problem Segments: JMSMH

WQSTM Simulations, Summer 1999

Cell 1107 (LE5.1)



Cell 1122 (LE5.3)



Chlorophyll *a* Problem Segments: JMSMH

Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
JMSMH	0%	0%	0%	0%	0%	0%	14%	13%
JMSPH	0%	0%	0%	0%	0%	0%	10%	10%

Additional work week of June 7th to determine whether data suggest attainment at 180 TN in Sept 1999, or need for further reductions.

Chlorophyll *a* Attainment at 179TN, 12.0TP

Cbseg	179 Loading Scenario 179TN, 12.0TP, 5510TSS '91-'93 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '92-'94 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '93-'95 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '94-'96 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '95-'97 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '96-'98 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '97-'99 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '98-'00 CL Spring Seasonal
DCATF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DCPTF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
JMSTFL	0%	0%	2%	2%	2%	0%	0%	0%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	3%	3%	3%	0%	3%
JMSMH	2%	0%	0%	0%	0%	0%	0%	0%
JMSPH	0%	0%	0%	0%	0%	0%	0%	0%

Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
DCATF	NoData	NoData	NoData	NoData	NoData	NoData	0%	0%
DCPTF	28%	51%	44%	20%	22%	22%	22%	0%
JMSTFL	0%	0%	0%	0%	5%	14%	14%	7%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	14%	13%
JMSPH	0%	0%	0%	0%	0%	0%	10%	10%

Chlorophyll *a* Problem Segments: DCPTF

DCPTF	1985 Scenario 342TN, 24.1TP, 9790TSS CL Summer Seasonal	"91 -'00 Base Scenario 309TN, 19.5TP, 8950TSS CL Summer Seasonal	2009 Scenario 248TN, 16.6TP, 8110TSS CL Summer Seasonal	Target Load Option A 200TN, 15TP, 6390TSS CL Summer Seasonal	Tributary Strategy 191TN, 14.4TP, 6462TSS CL Summer Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS CL Summer Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS CL Summer Seasonal	170 Loading Scenario 170TN, 11.3TP, 5650TSS CL Summer Seasonal	E3 2010 Scenario 141TN, 8.5TP, 5060TSS CL Summer Seasonal
'91-'93	0%	9%	0%	0%	42%	36%	28%	22%	0%
92-'94	0%	9%	0%	0%	42%	36%	51%	38%	2%
'93-'95	0%	34%	0%	22%	46%	22%	44%	37%	2%
'94-'96	0%	22%	0%	22%	22%	0%	20%	13%	2%
'95-'97	3%	46%	22%	46%	46%	22%	22%	22%	22%
'96-'98	3%	22%	22%	22%	22%	22%	22%	22%	22%
'97-'99	3%	22%	22%	22%	22%	22%	22%	22%	22%
'98-'00	0%	0%	0%	0%	0%	0%	0%	0%	0%

Chlorophyll *a* Problem Segments: DCPTF

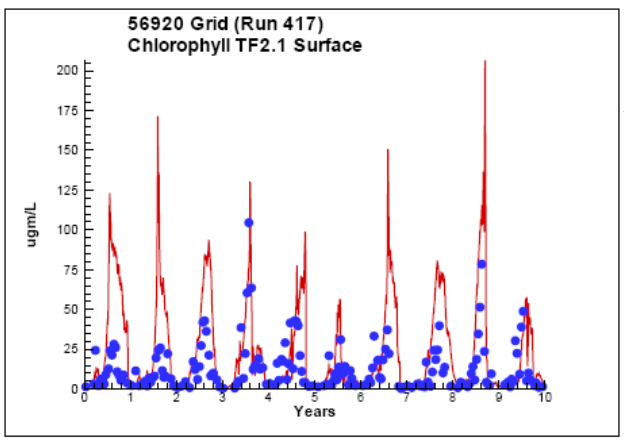
Summer DCPTF chla criterion = 25 ug/L

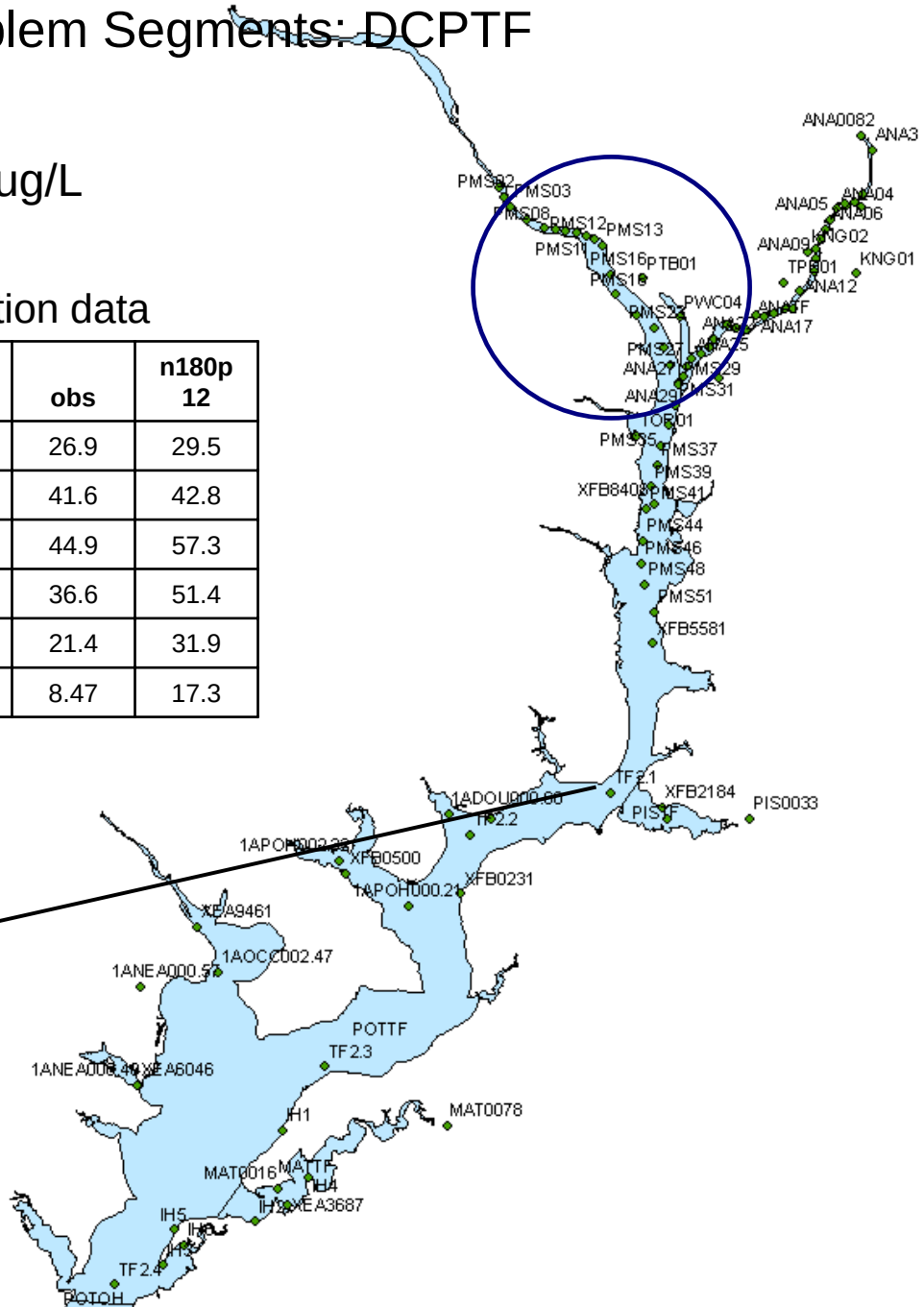
annual violation rate

DCPTF	obs	n179p12
1991	0%	0%
1992	0%	28%
1993	50%	100%
1994	0%	93%
1995	100%	0%
1996	0%	0%
1997	100%	100%
1998	0%	0%
1999	0%	0%

station data

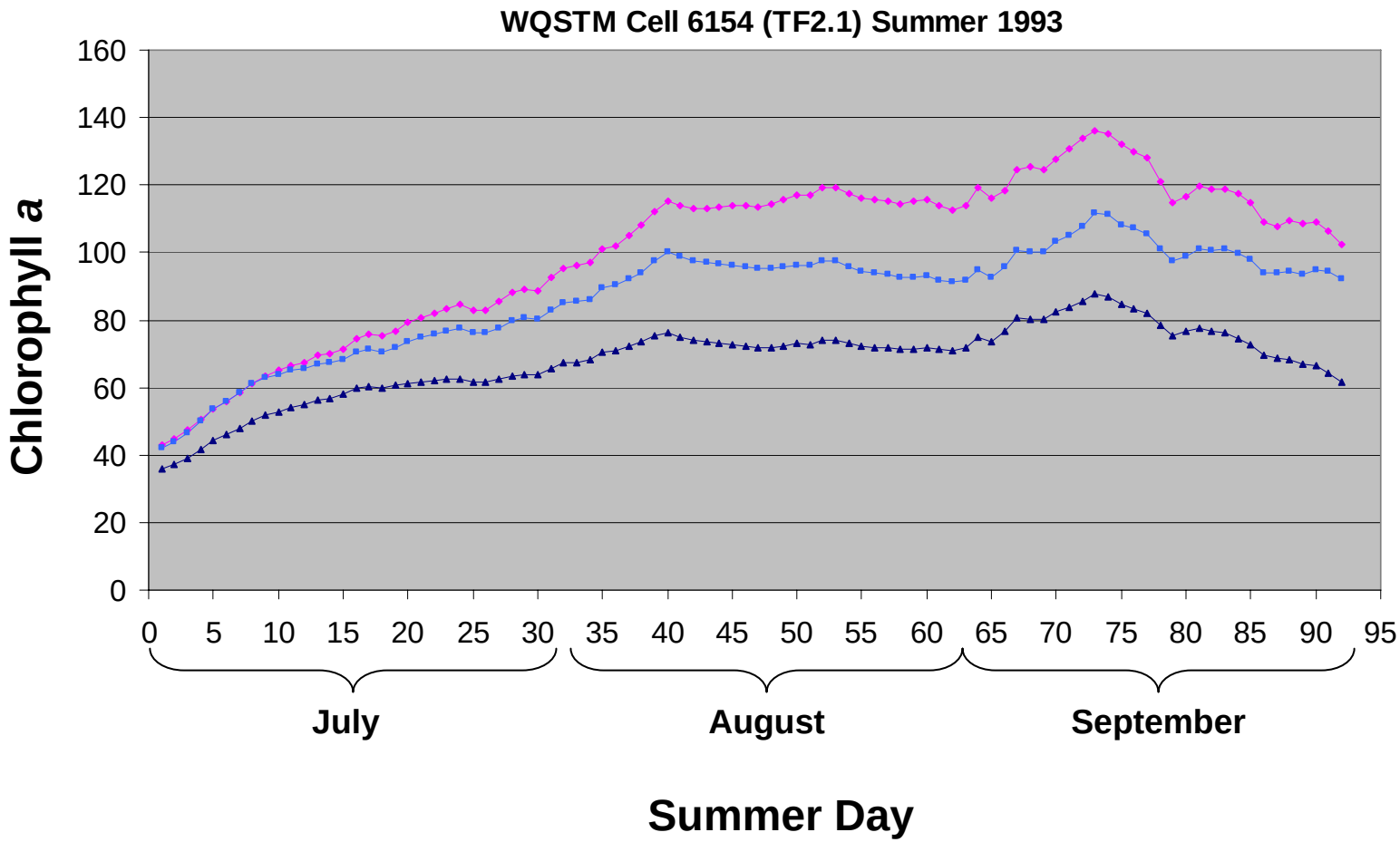
TF2.1	obs	n180p 12
July 1993 c1	26.9	29.5
July 1993 c2	41.6	42.8
Aug 1993 c1	44.9	57.3
Aug 1993 c2	36.6	51.4
Sep 1993 c1	21.4	31.9
Sept 1993 c2	8.47	17.3



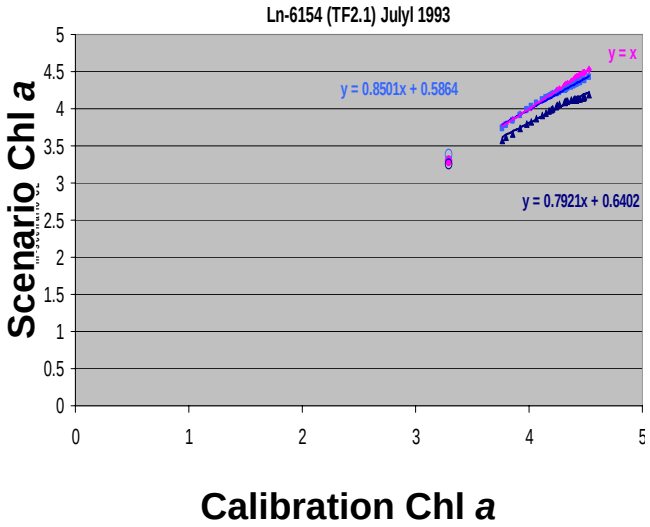


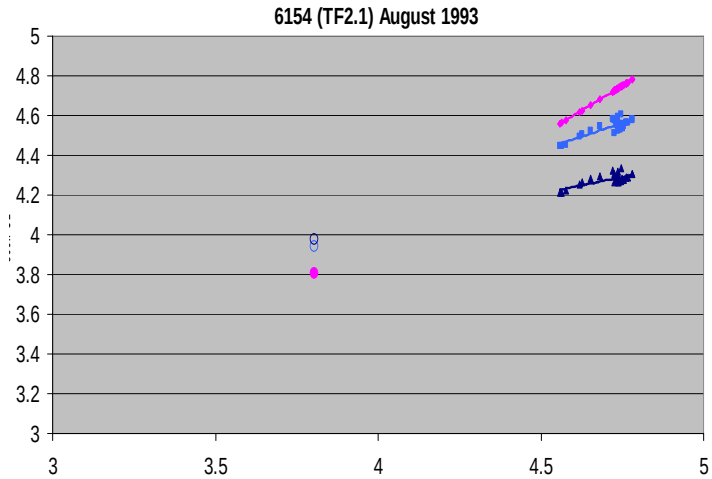
Chlorophyll *a* Problem Segments: DCPTF

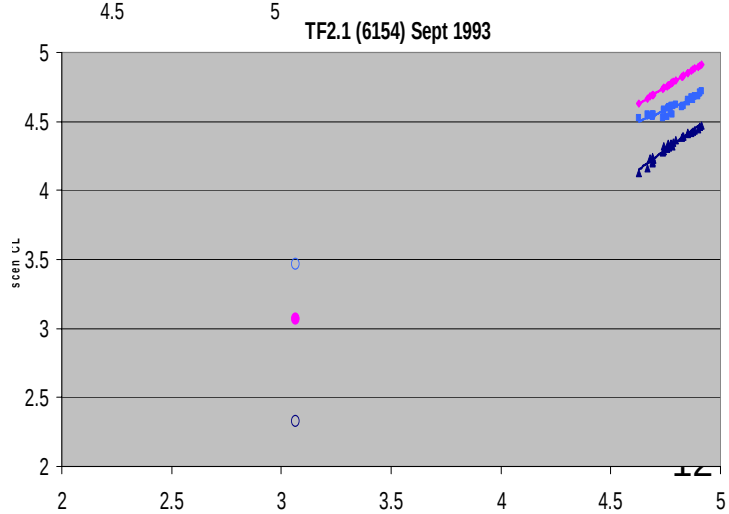
WQSTM Cell 6154 (TF2.1) Simulations, Summer 1993



Chlorophyll *a* Problem Segments: DCPTF







Chlorophyll *a* Attainment at 179TN, 12.0TP

Cbseg	179 Loading Scenario 179TN, 12.0TP, 5510TSS '91-'93 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '92-'94 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '93-'95 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '94-'96 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '95-'97 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '96-'98 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '97-'99 CL Spring Seasonal	179 Loading Scenario 179TN, 12.0TP, 5510TSS '98-'00 CL Spring Seasonal
DCATF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DCPTF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
JMSTFL	0%	0%	2%	2%	2%	0%	0%	0%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	3%	3%	3%	0%	3%
JMSMH	2%	0%	0%	0%	0%	0%	0%	0%
JMSPH	0%	0%	0%	0%	0%	0%	0%	0%

Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
DCATF	NoData	NoData	NoData	NoData	NoData	NoData	0%	0%
DCPTF	28%	51%	44%	20%	22%	22%	22%	0%
JMSTFL	0%	0%	0%	0%	5%	14%	14%	7%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	14%	13%
JMSPH	0%	0%	0%	0%	0%	0%	10%	10%

Chlorophyll *a* Problem Segments: JMSTFL

annual violation rate

JMSTFL	violation rate	
year	observed	n180p12
1993	0%	0%
1994	0%	0%
1995	35%	19%

station data

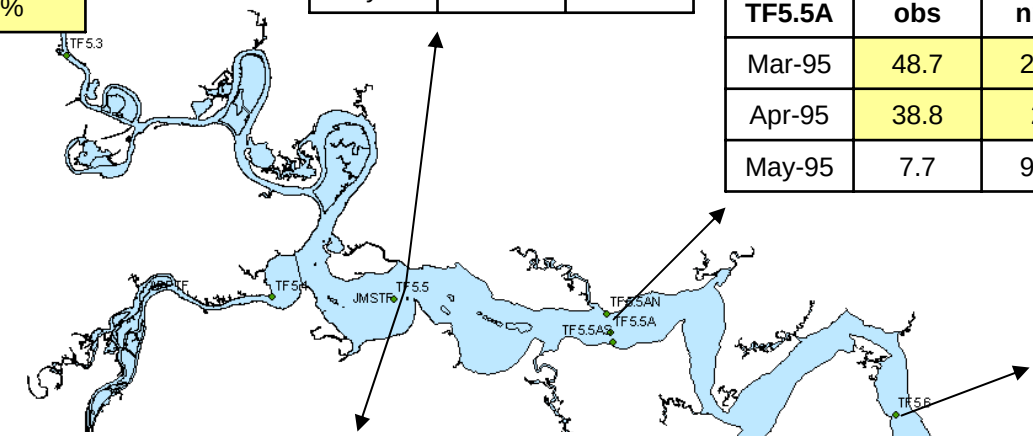
TF5.5	obs	n180
Mar-95	5.1	5.53
Apr-95	30.2	18.2
May-95	9.1	7.49

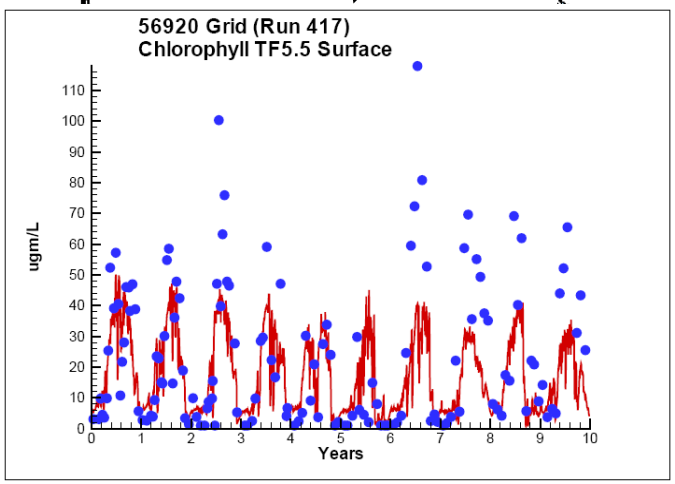
station data

TF5.5A	obs	n180
Mar-95	48.7	28.2
Apr-95	38.8	21
May-95	7.7	9.39

station data

TF5.6	obs	n180
Mar-95	1	1.29
Apr-95	12.5	10.6
May-95	6.7	6.78





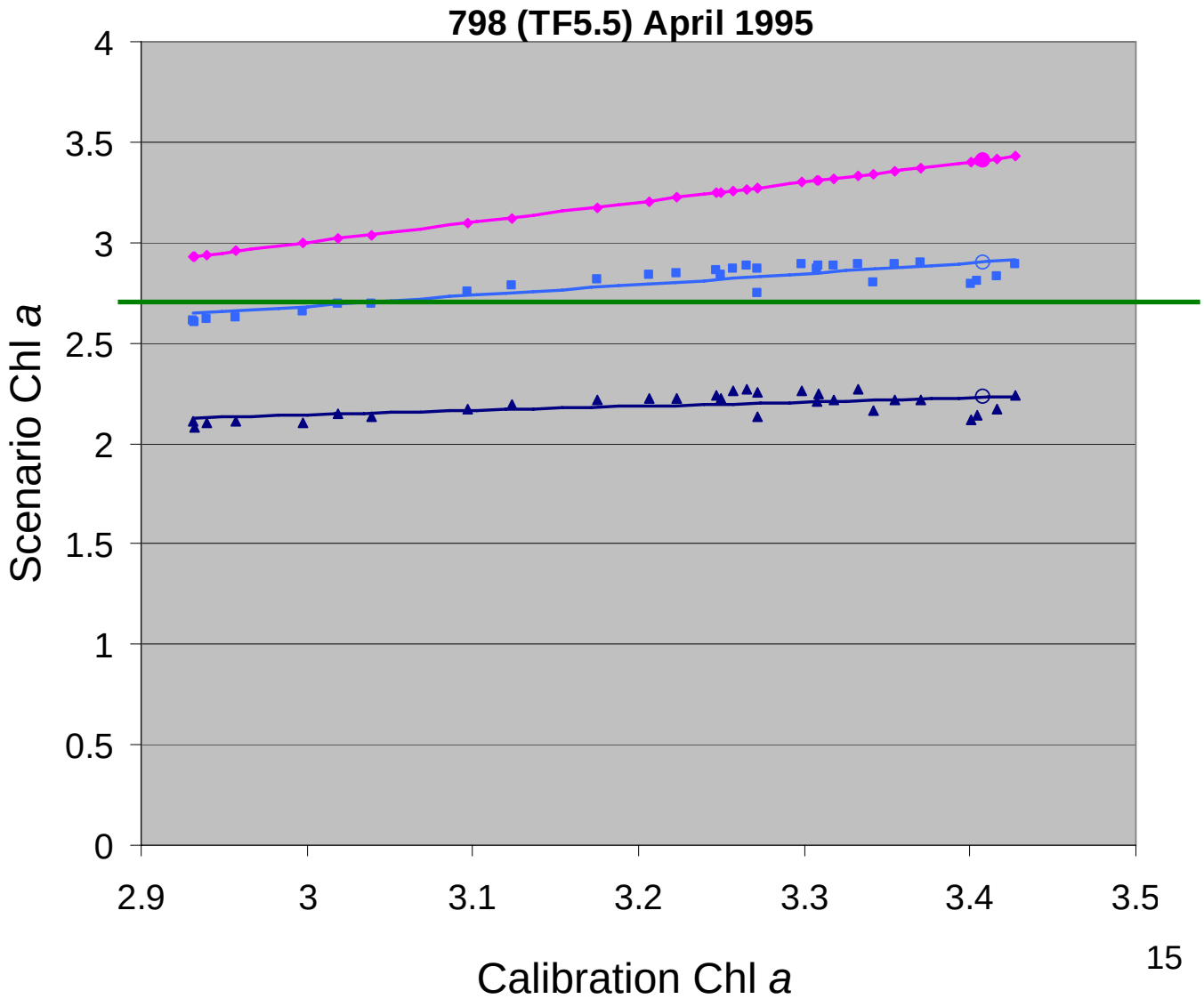
Chlorophyll *a* Problem Segments: JMSTFL

station data

TF5.5	obs	n180
Mar-95	5.1	5.53
Apr-95	30.2	18.2
May-95	9.1	7.49

Spring JMSTFL
Chla criterion:

15 ug/L (ln =~2.71)



Summary: Preliminary Findings

- JMSMH 1999: conditions of late September 1999 generated chlorophyll *a* violations in this region, and the model struggled to simulate these conditions. Further analyses needed to determine whether additional lines of evidence suggest attainment at 180TN or the need for further reductions.
- DCPTF: the estuarine model simulates reductions with reduced loads in the POTTF region, however simulations are well outside the range of observed values. Further analyses needed as above.
- JMSTFL: the estuarine model simulates reductions with reduced loads, and the observed values are within the range of model simulations. Lines of evidence suggest that further loads reductions are needed (down to 170TN/11.3TP) to achieve WQS in Spring 1995 for the JMSTFL segment.
- We will continue to systematically step through these persistent violations to determine whether they represent:
  - Insufficient load reductions to achieve WQS
  - Anomoly in the dataset or estuarine model simulation is causing persistent violations, in which case:
    - Additional lines of evidence or refined application of the regression suggests either that the segment will attain at the 180TN/12TP level or else that further reductions are needed to attain WQS.