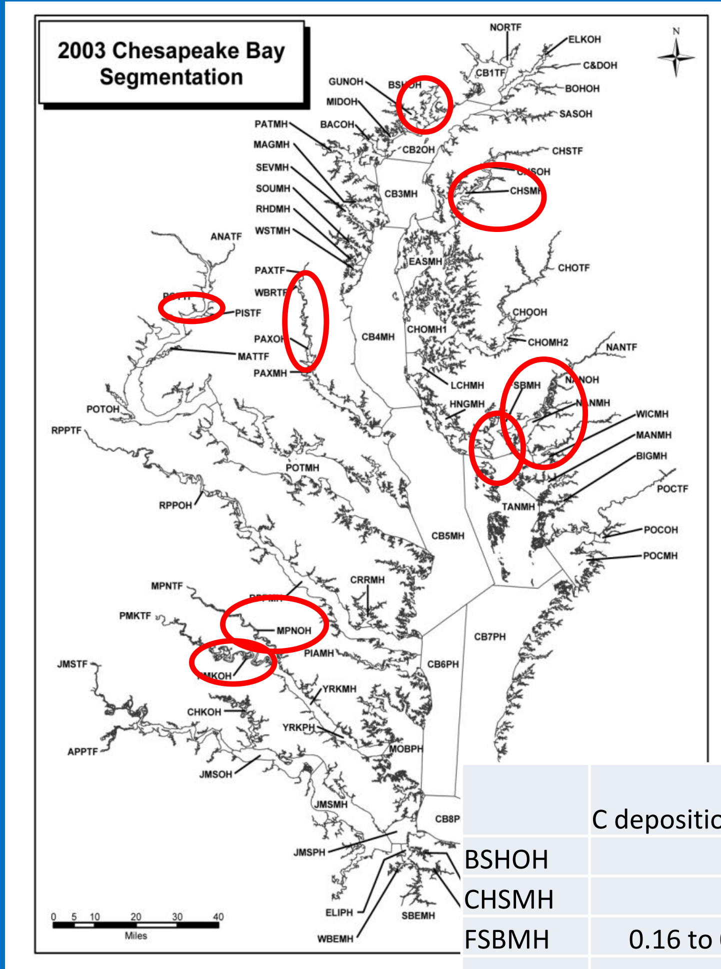


Hot Spots for Calibration

	C deposition	N deposition	P deposition	denitrification	solids deposition	respiration
BSHOH		0.008 to 0.032	0.001 to 0.006			
CHSMH		0.02 to 0.064	0.01 to 0.019		3.6	
FSBMH	0.16 to 0.33				0.3	
MPNOH	0.24 to 2.77	0.019 to 0.238	0.004 to 0.085		1.43 to 42.0	
MPNTF						
NANMH	0.033 to 0.126				1.61 to 8.12	
NANOH	0.033 to 0.126				1.61 to 8.12	
PAXOH		0.008	0.002		5.75	
PAXTF		0.033 to 0.064	0.01	0.108 to 0.197	5.75	
PMKOH	0.61	0.05		0.04		1.12 to 2.77
POTTF	1.44			0.043 to 0.06	5.88	
WICMH	0.033 to 0.126	0.037	2.74x10^-5 to 0.004		1.61 to 8.12	
CHOMH		0.053 to 0.074	4.9x10^-4 to 0.005			
WQGIT			0.0016	0.026		

Wetlands Module

- We don’t want to develop a complete wetlands biogeochemical model.
- We do want to develop a simplified module that includes:
  - Particle burial (organic and inorganic)
  - Respiration
  - Denitrification
  - Primary production?
  - Others?

Particle Settling

$$V \cdot \frac{dC}{dt} = Transport\ + Kinetics\ - WSw \cdot C \cdot Aw$$

V = volume of WQM cell adjacent to wetlands
C = concentration
WSw = wetland settling velocity
Aw = area of wetland adjacent to WQM cell

This applies to all particles, organic and inorganic. Present settling rates 0.05 m/d for most particles, 0.005 m/d for phytoplankton.

Respiration

$$V \cdot \frac{dC}{dt} = Transport \ + Kinetics \ - f(DO) \cdot f(T) \cdot WOC \cdot Aw$$

V = volume of WQM cell adjacent to wetlands
C = concentration
f(DO) = limiting factor = DO/(Kh+DO)
f(T) = temperature effect
WOC = wetland oxygen consumption
Aw = area of wetland adjacent to WQM cell

At present, WOC = 0.5 g DO/sq m/d at 20C. WOC doubles for a 10C temperature increase. Kh = 1.0 g DO/m3.

Previous calibration had WOC = 1 g DO/sq m/d and no limiting factor. Wetland areas from TMDL model.

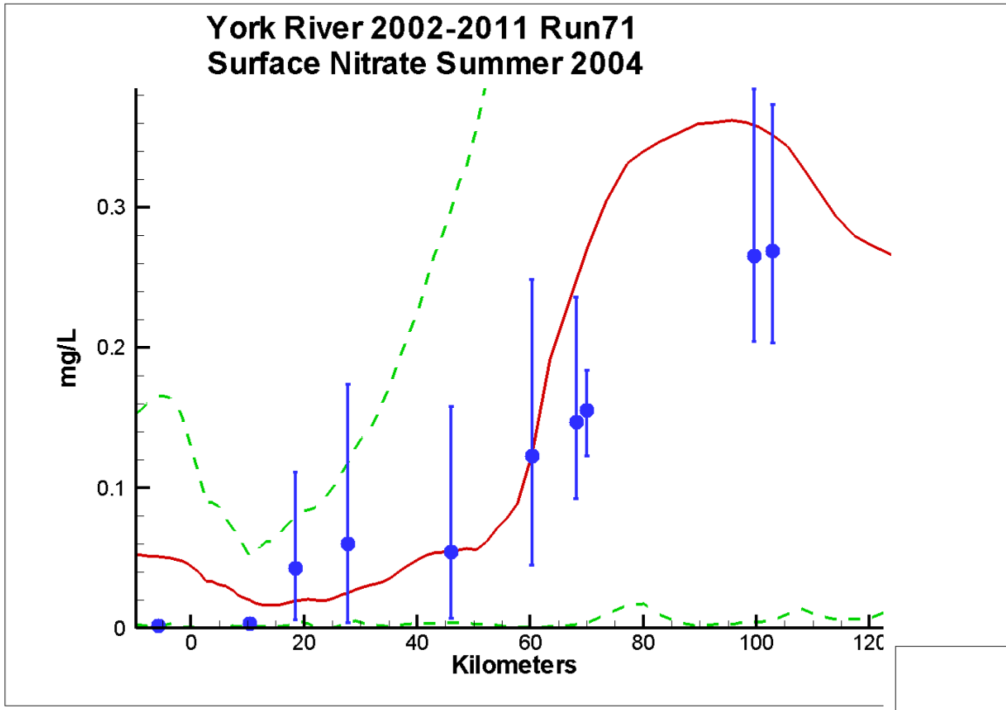
Denitrification

$$V \cdot \frac{dC}{dt} = Transport + Kinetics - MTC \cdot f(T) \cdot C \cdot Aw$$

V = volume of WQM cell adjacent to wetlands
C = nitrate concentration
MTC = mass-transfer coefficient
f(T) = temperature effect
Aw = area of wetland adjacent to WQM cell

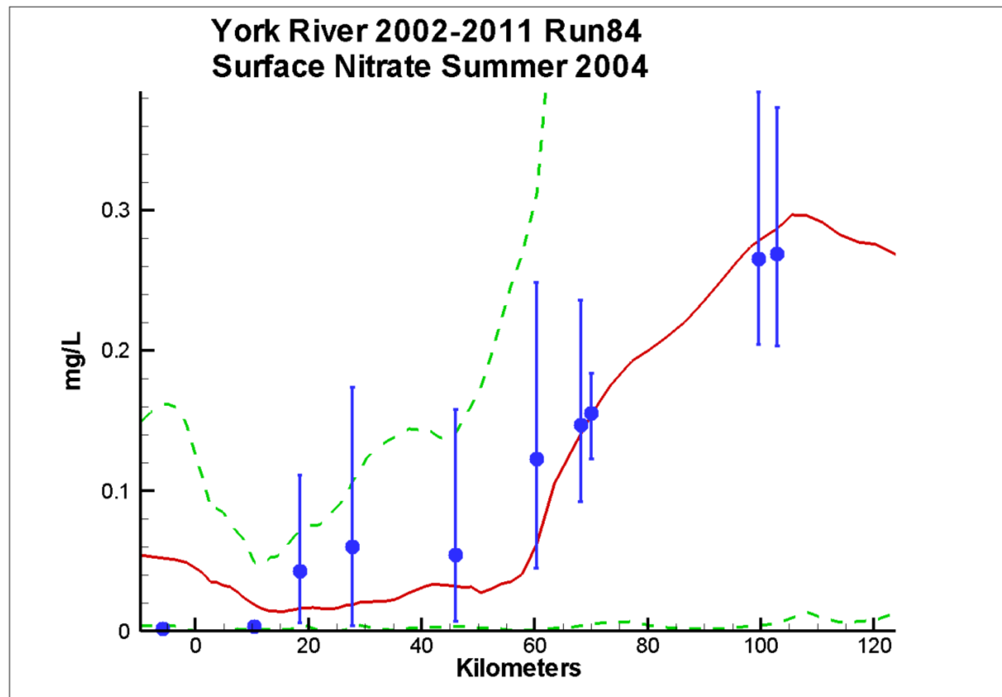
At present, the mass-transfer coefficient is 0.05 m/d.
Denitrification doubles for a 10C temperature increase.

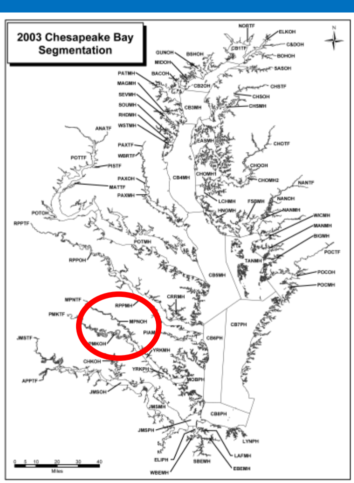
Nitrate in York River

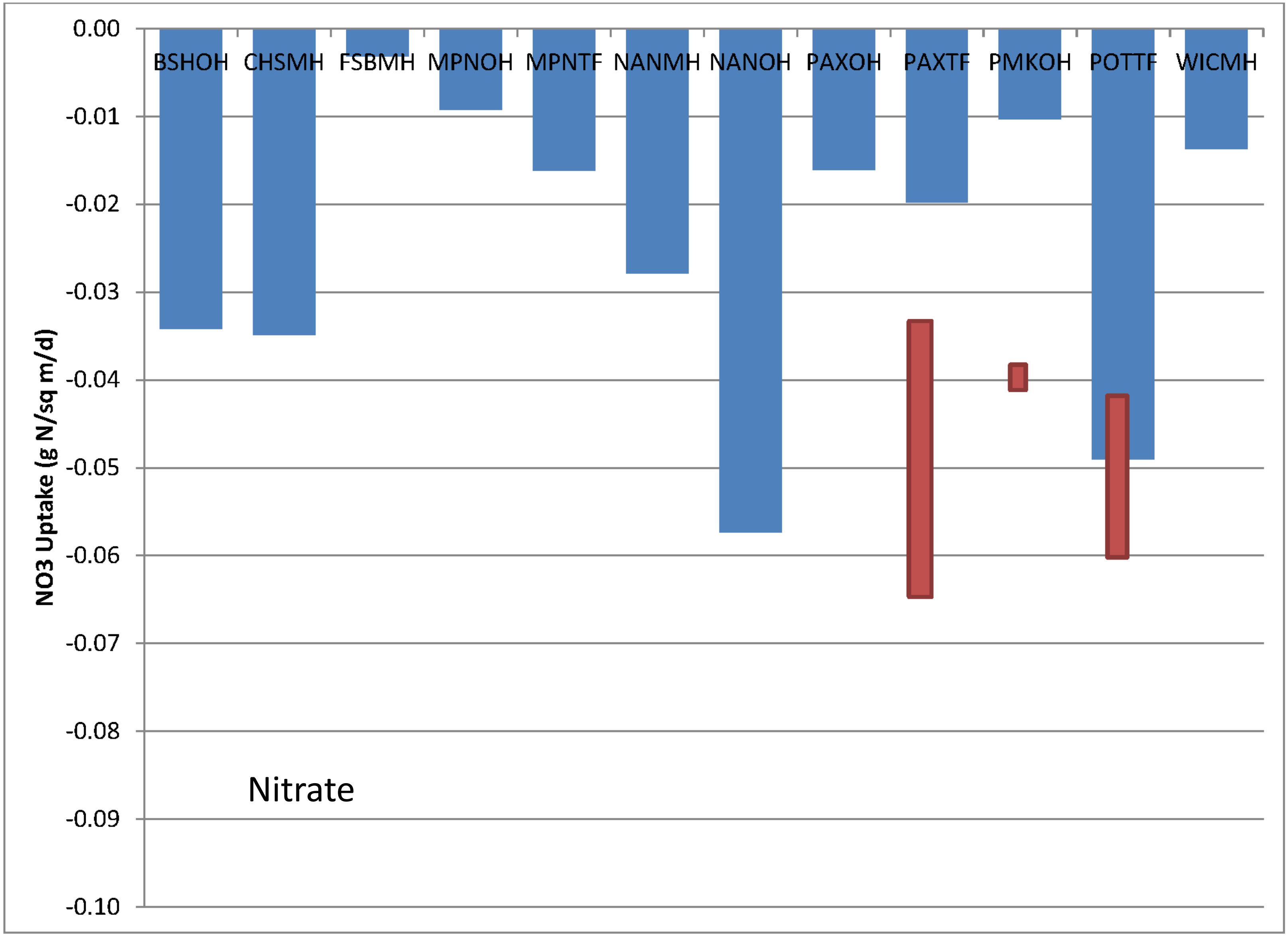


No Wetlands

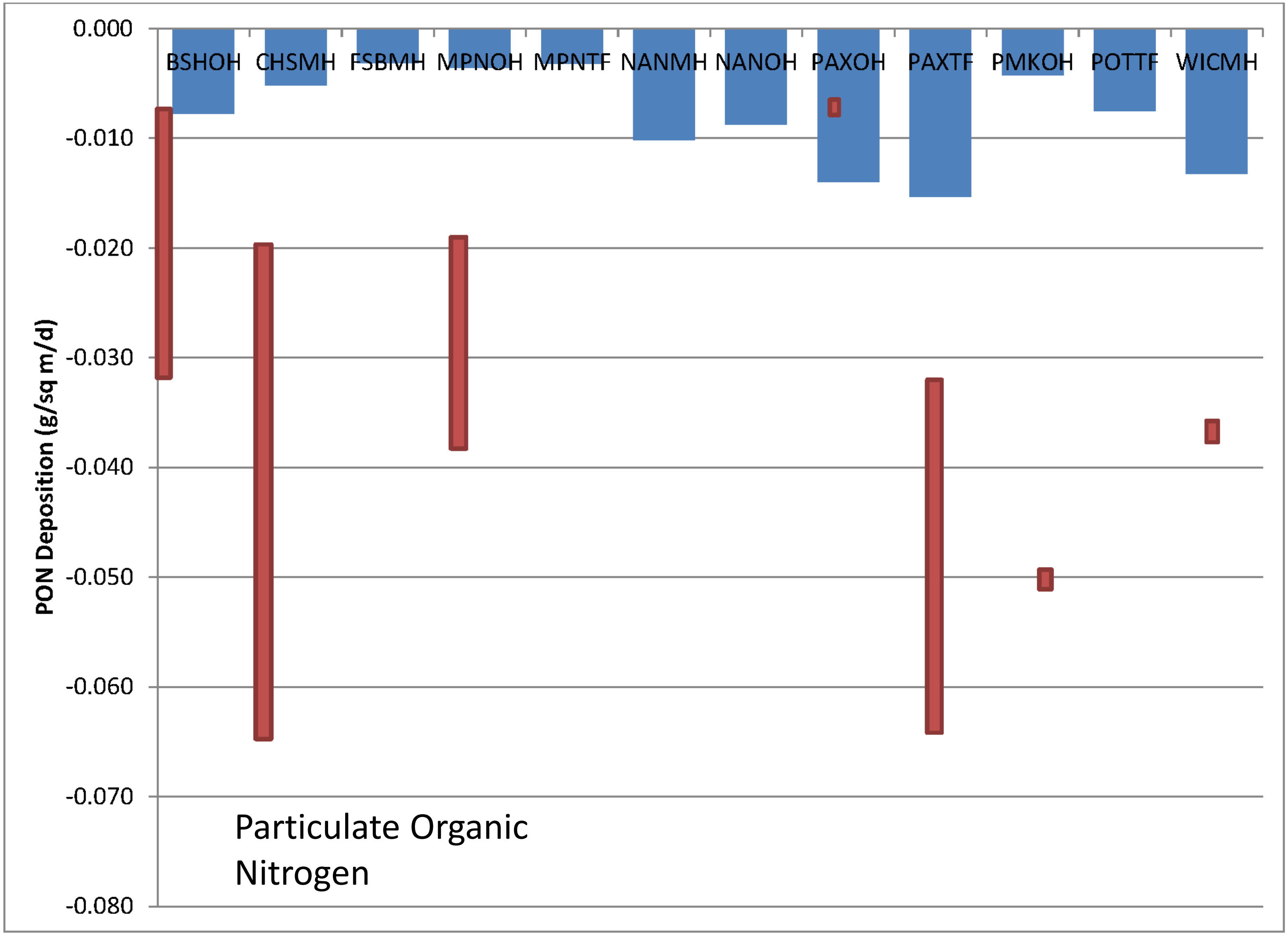
With Wetlands



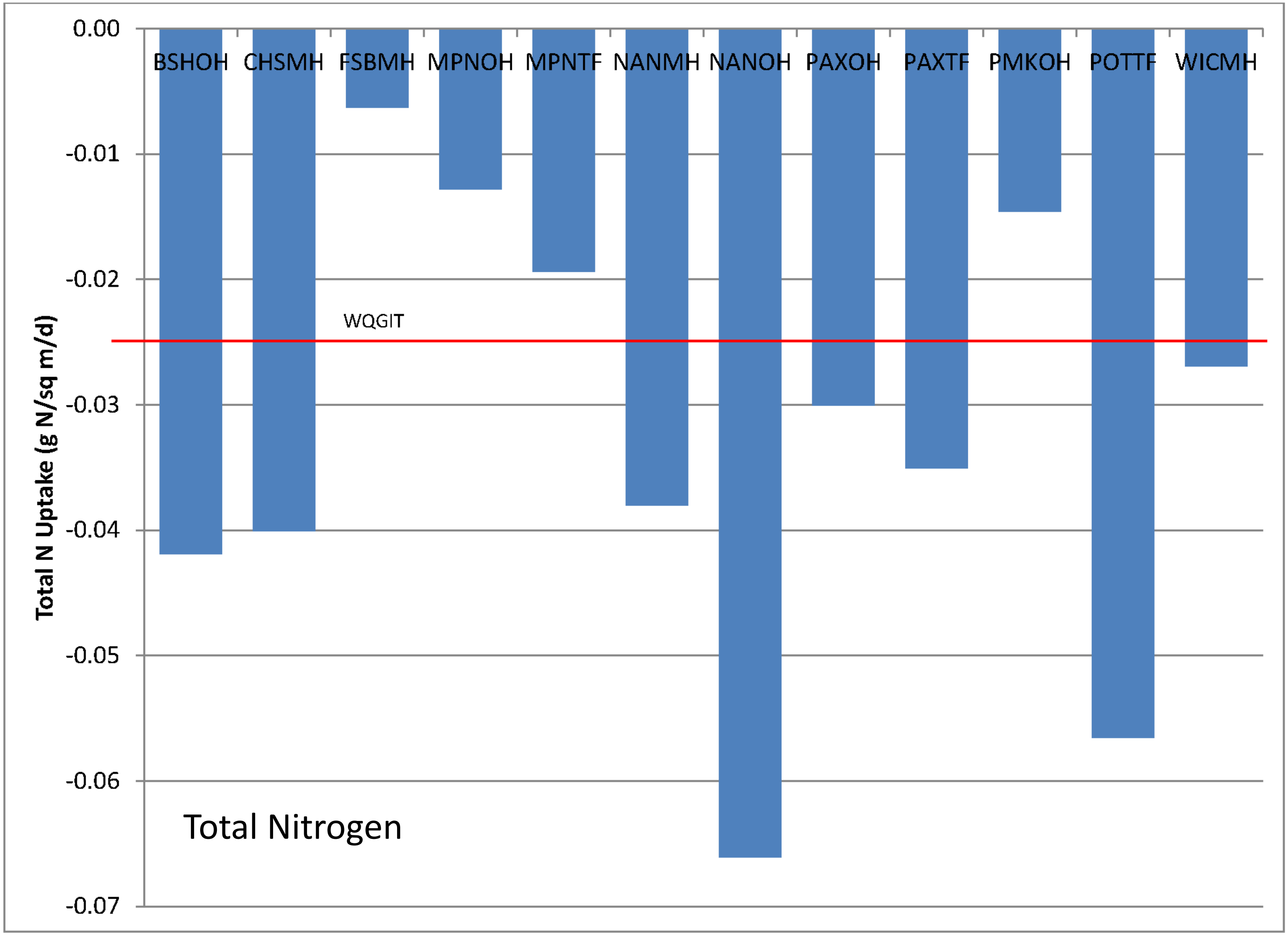


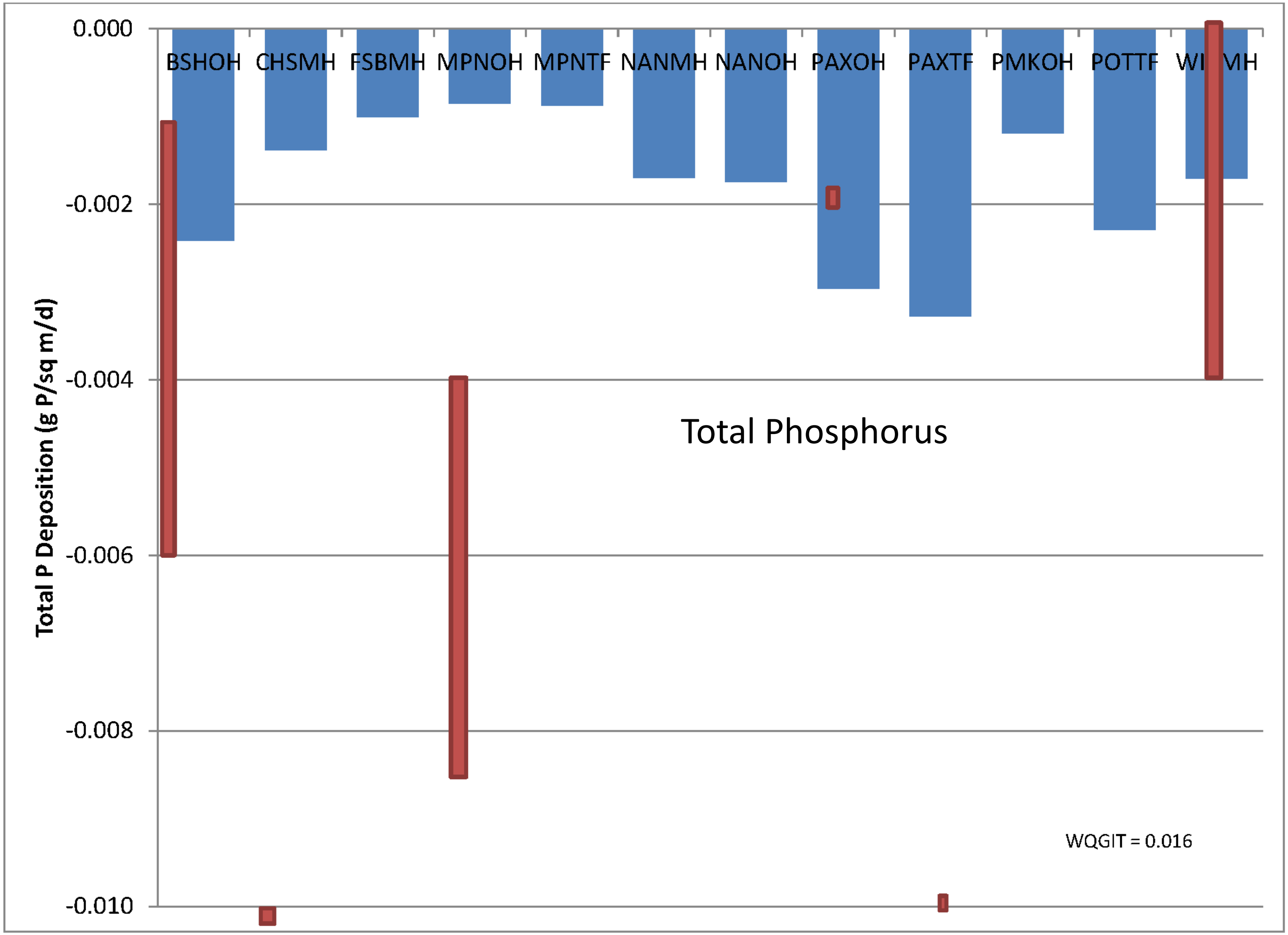


0.00
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
-0.08
-0.09
-0.10
NO3 Uptake (g N/sq m/d)
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
NANMH
NANOH
PAXOH
PAXTF
PMKOH
POTTF
WICMH
Nitrate

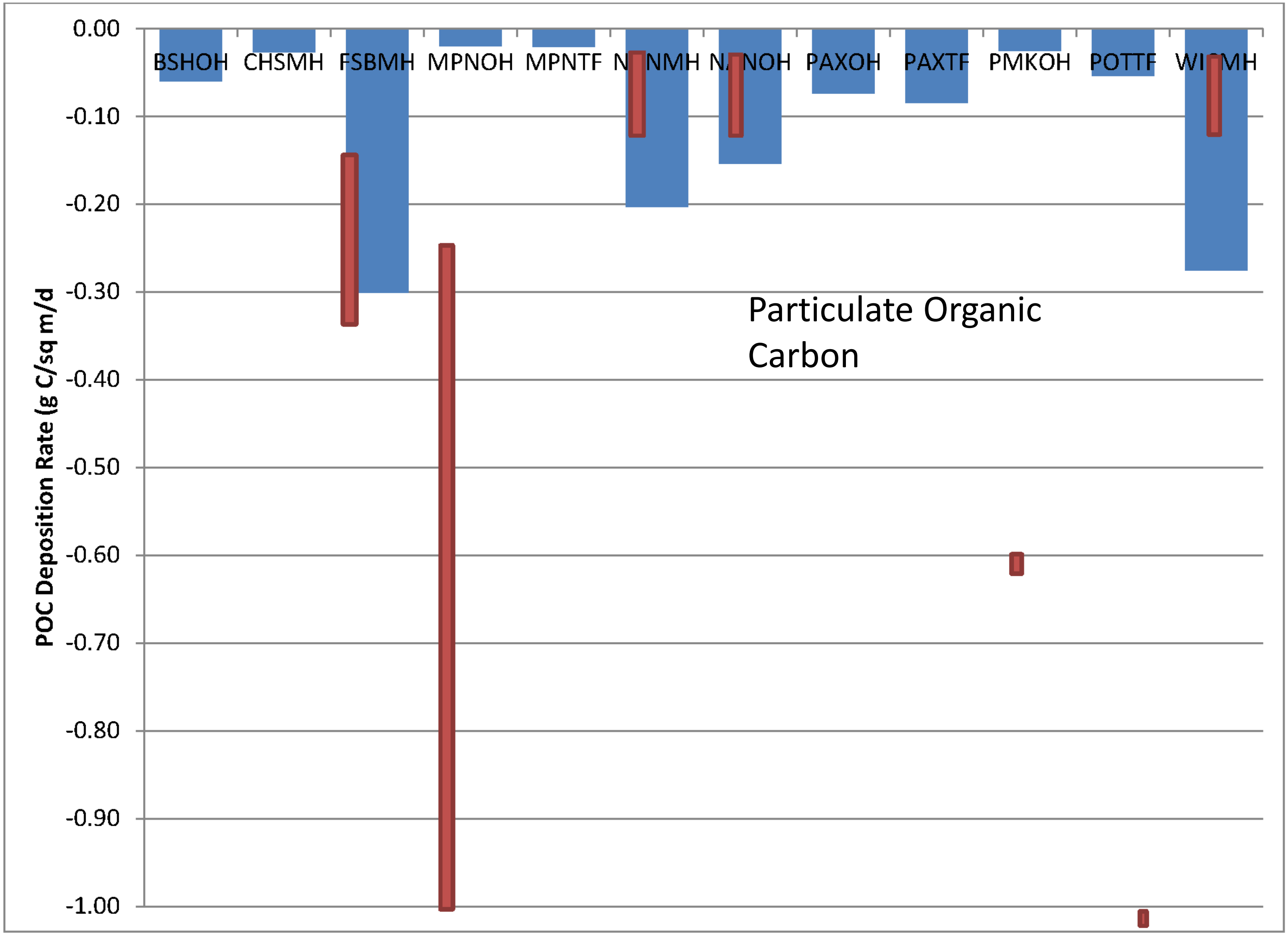


0.000
-0.010
-0.020
-0.030
-0.040
-0.050
-0.060
-0.070
-0.080
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
NANMH
NANOH
PAXOH
PAXTF
PMKOH
POTTF
WICMH
PON Deposition (g/sq m/d)
Particulate Organic Nitrogen

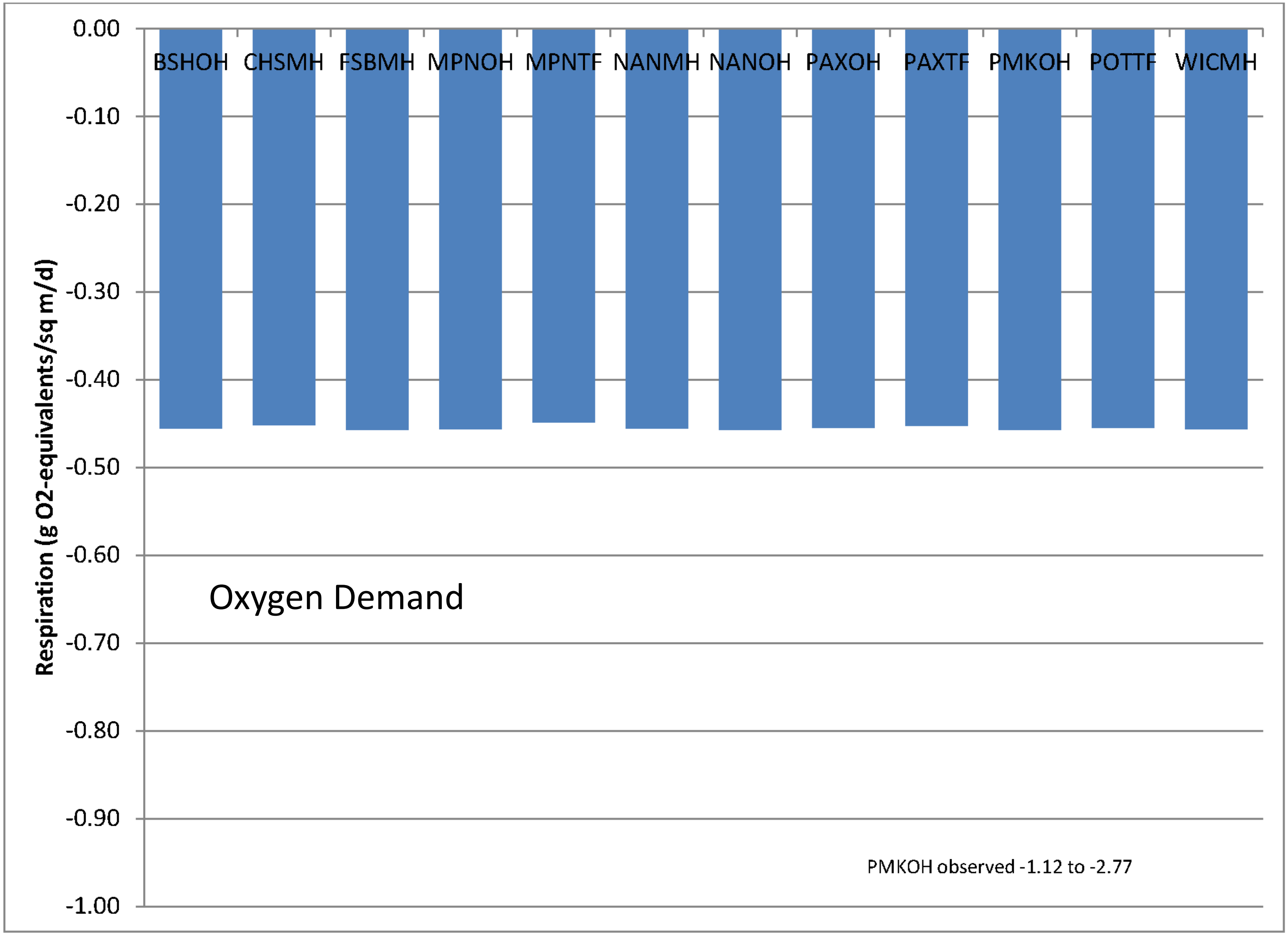

0.00
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
Total N Uptake (g N/sq m/d)
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
NANMH
NANOH
PAXOH
PAXTF
PMKOH
POTTF
WICMH
WQGIT
Total Nitrogen

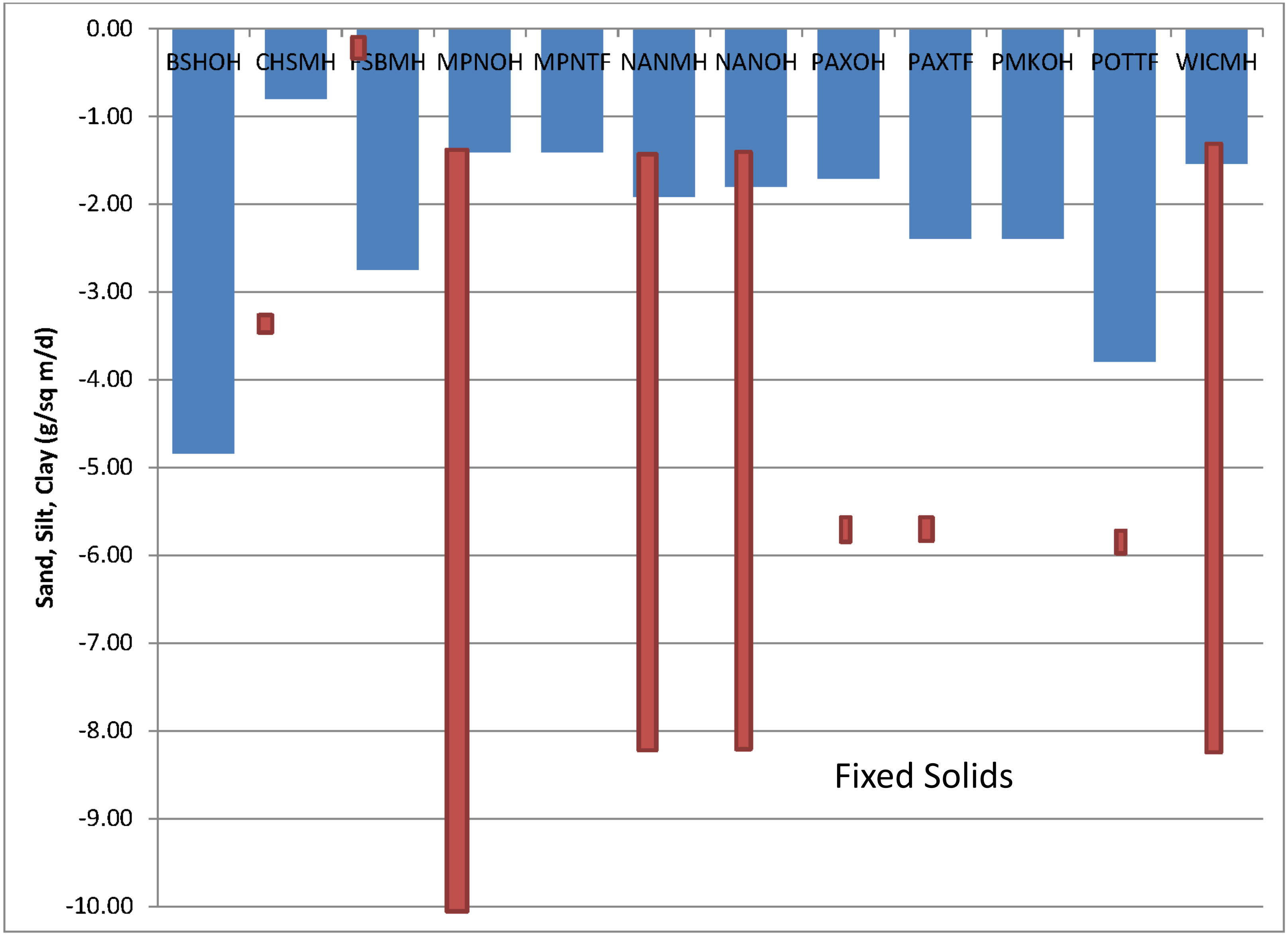


Total Phosphorus
Total P Deposition (g P/sq m/d)
0.000
-0.002
-0.004
-0.006
-0.008
-0.010
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
NANMH
NANOH
PAXOH
PAXTF
PMKOH
POTTF
WQGIT = 0.016

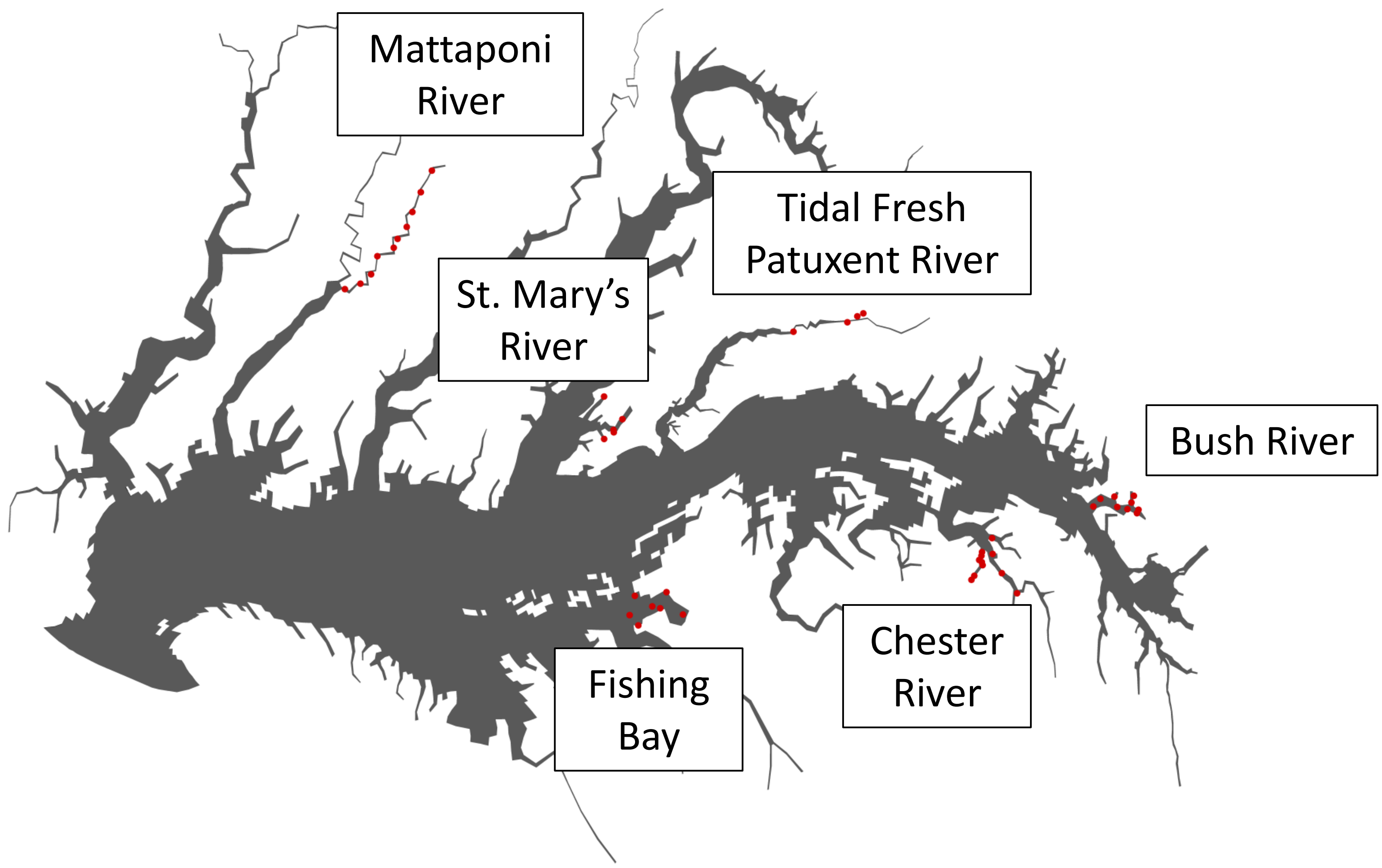


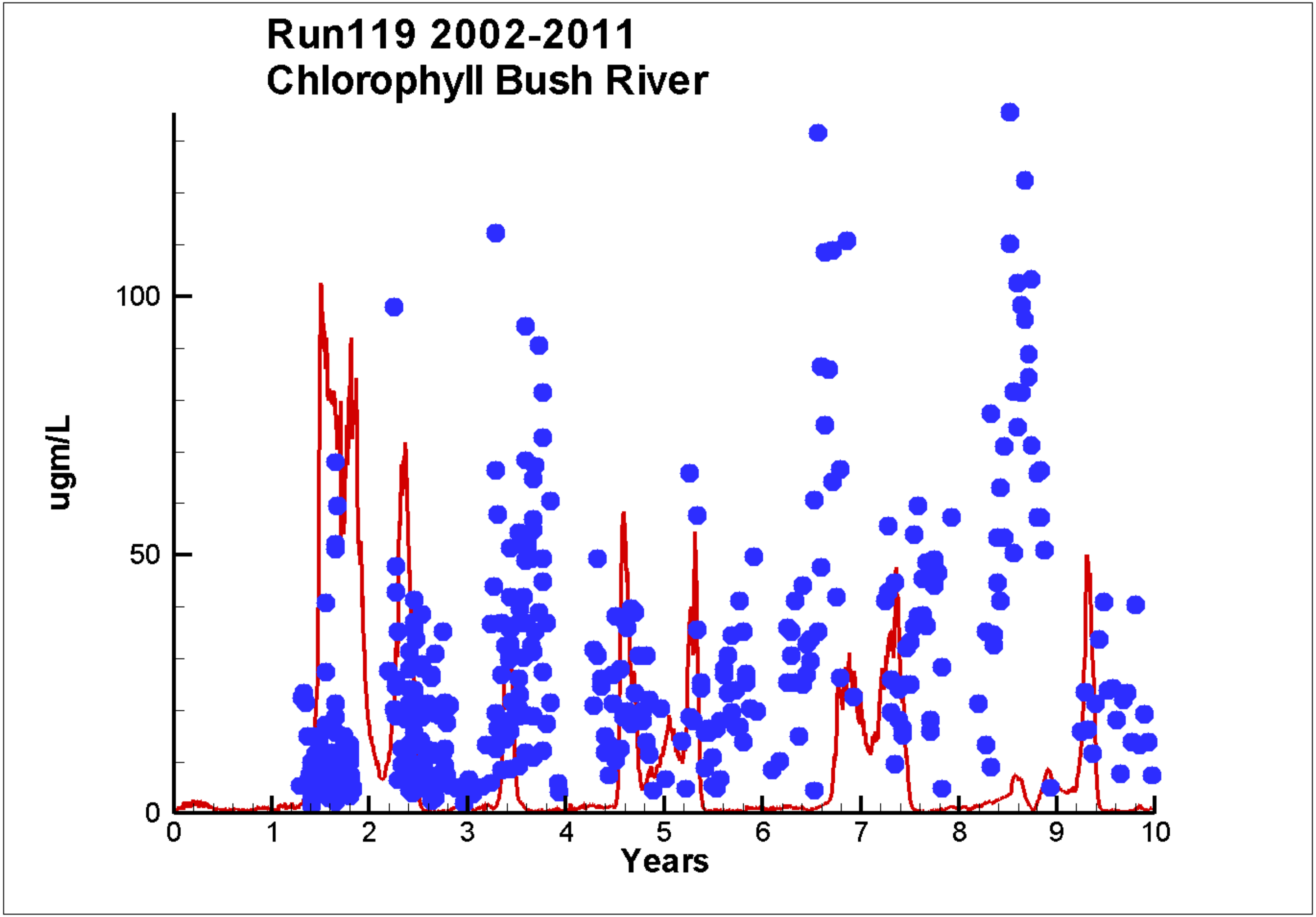
Particulate Organic Carbon
POC Deposition Rate (g C/sq m/d
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
PAXOH
PAXTF
PMKOH
POTTF

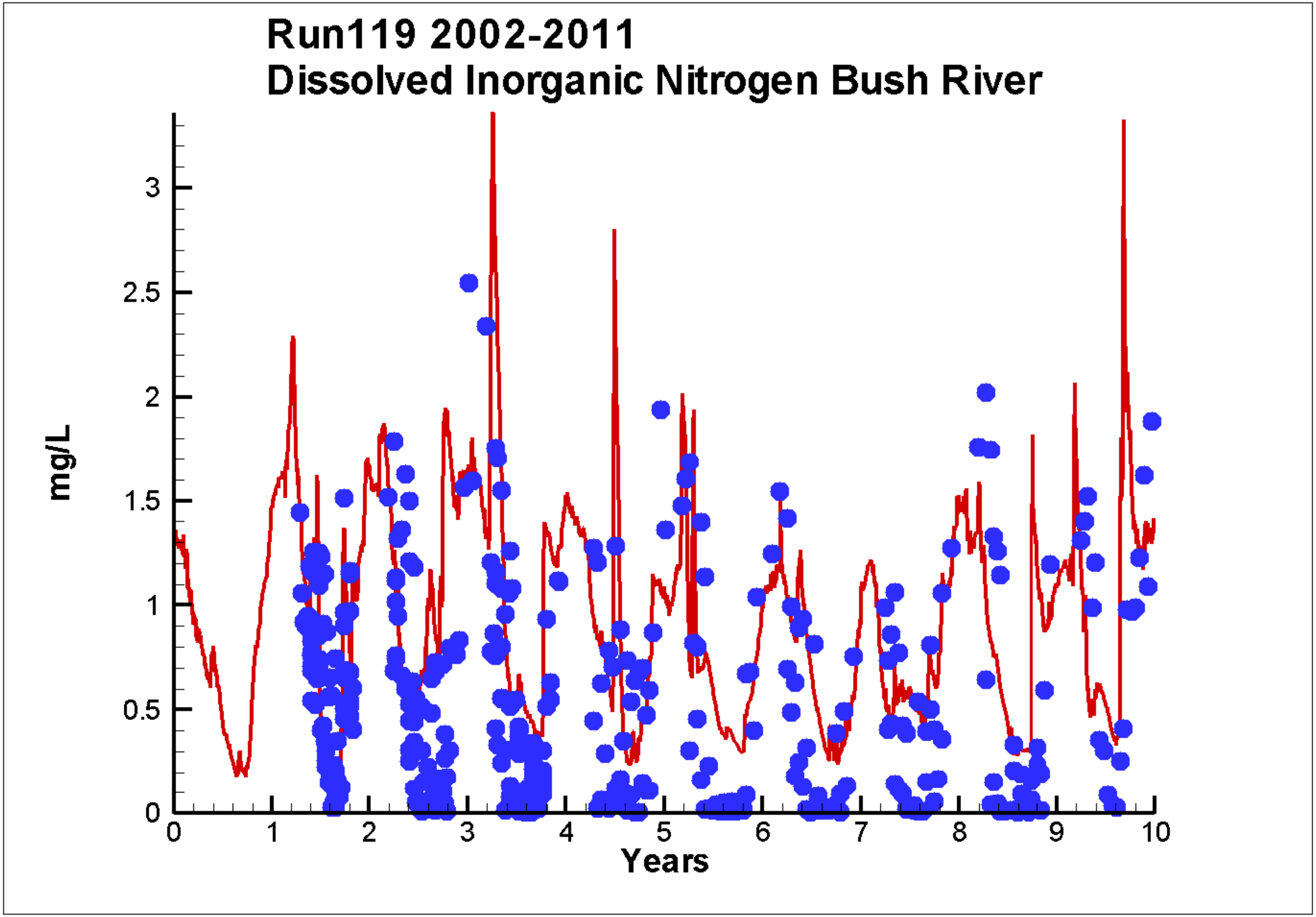

0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
Respiration (g O2-equivalents/sq m/d)
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
NANMH
NANOH
PAXOH
PAXTF
PMKOH
POTTF
WICMH
Oxygen Demand
PMKOH observed -1.12 to -2.77

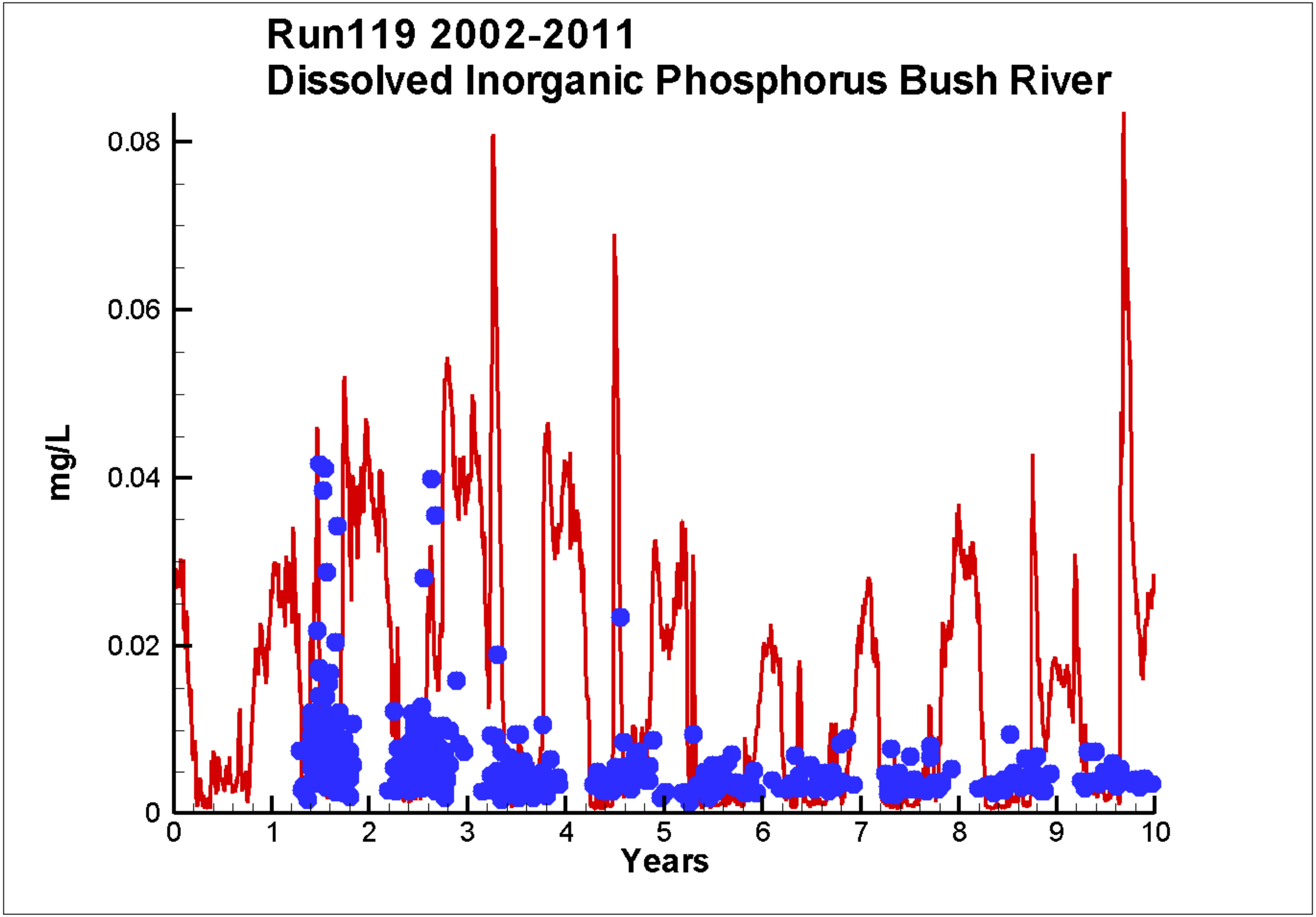


0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
-7.00
-8.00
-9.00
-10.00
Sand, Silt, Clay (g/sq m/d)
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
NANMH
NANOH
PAXOH
PAXTF
PMKOH
POTTF
WICMH
Fixed Solids

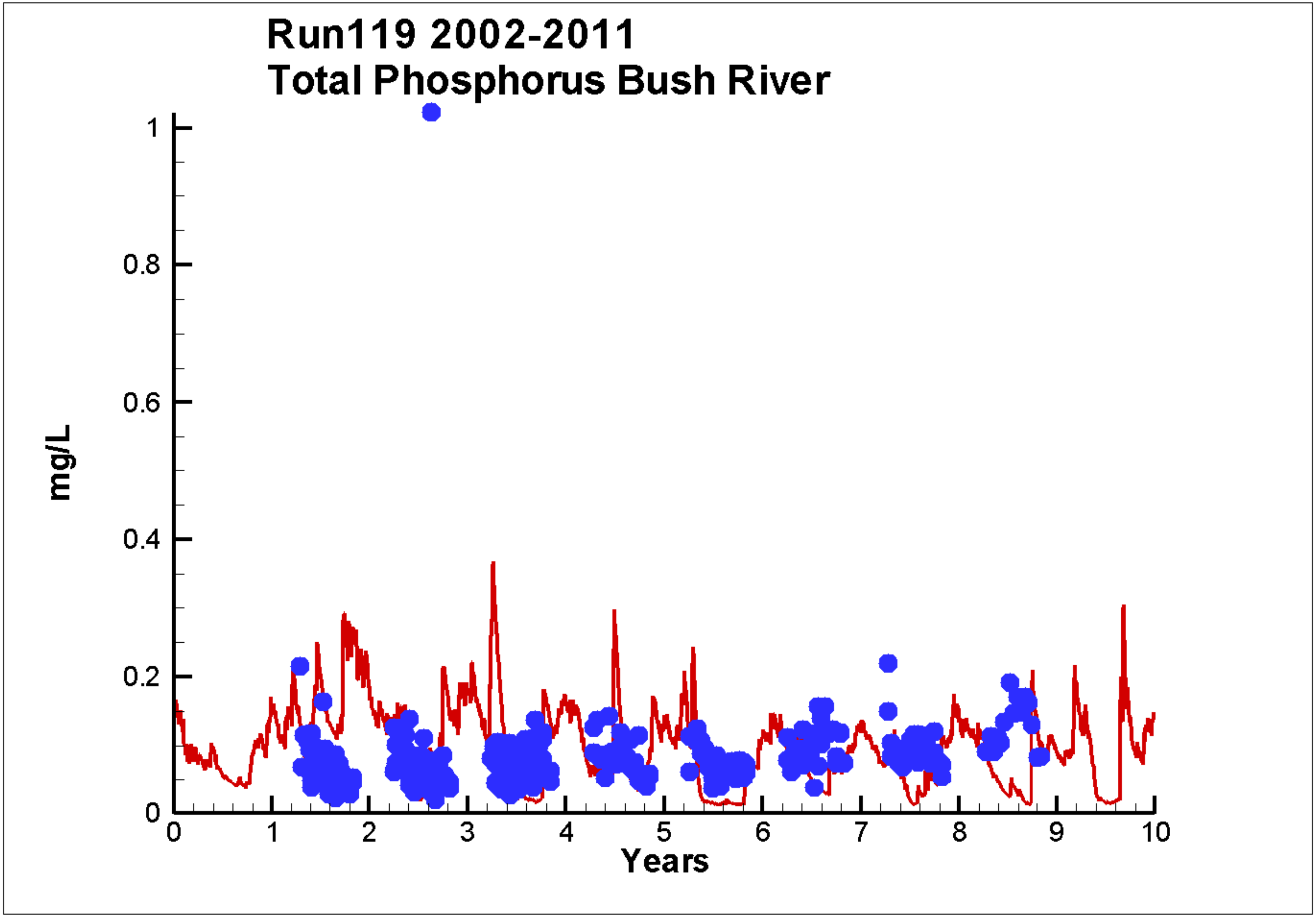

Mattaponi River
Tidal Fresh Patuxent River
St. Mary's River
Bush River
Chester River
Fishing Bay


Run119 2002-2011
Chlorophyll Bush River
ugm/L
100
50
0
0
1
2
3
4
5
6
7
8
9
10
Years

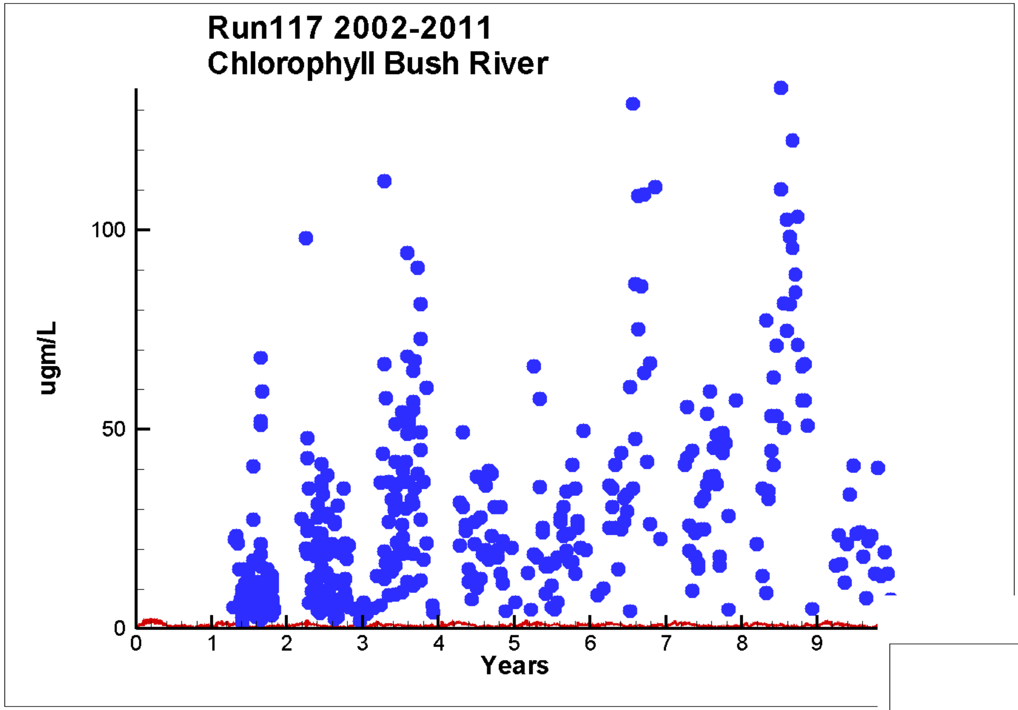

Run119 2002-2011
Dissolved Inorganic Nitrogen Bush River
mg/L
0
0.5
1
1.5
2
2.5
3
0
1
2
3
4
5
6
7
8
9
10
Years



Run119 2002-2011
Dissolved Inorganic Phosphorus Bush River
mg/L
0.08
0.06
0.04
0.02
0
0
1
2
3
4
5
6
7
8
9
10
Years

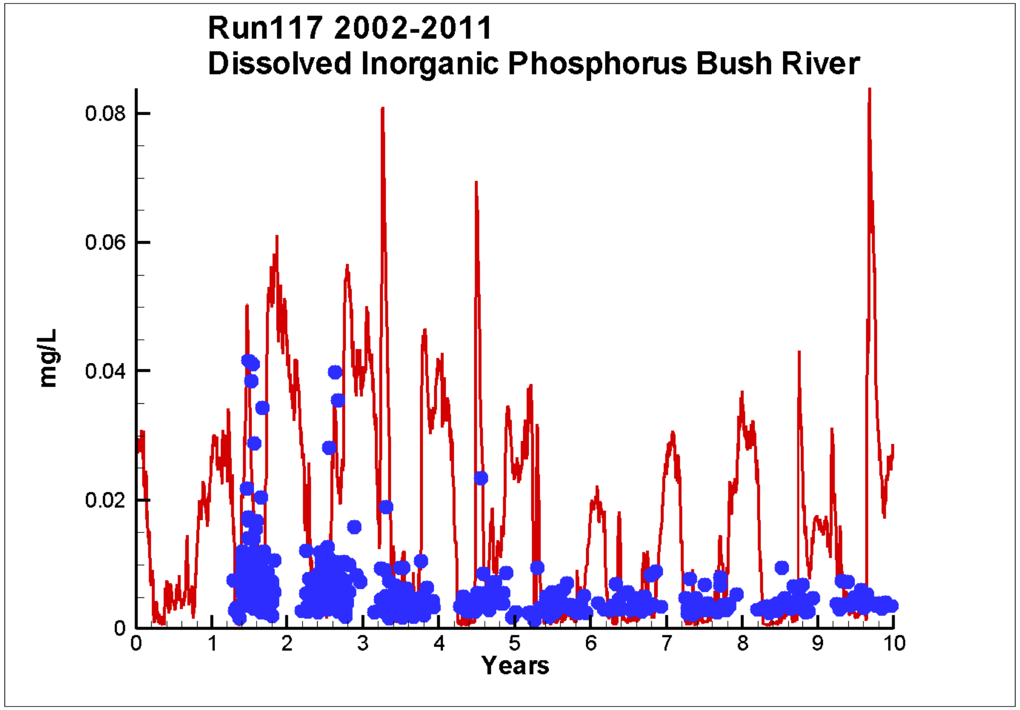


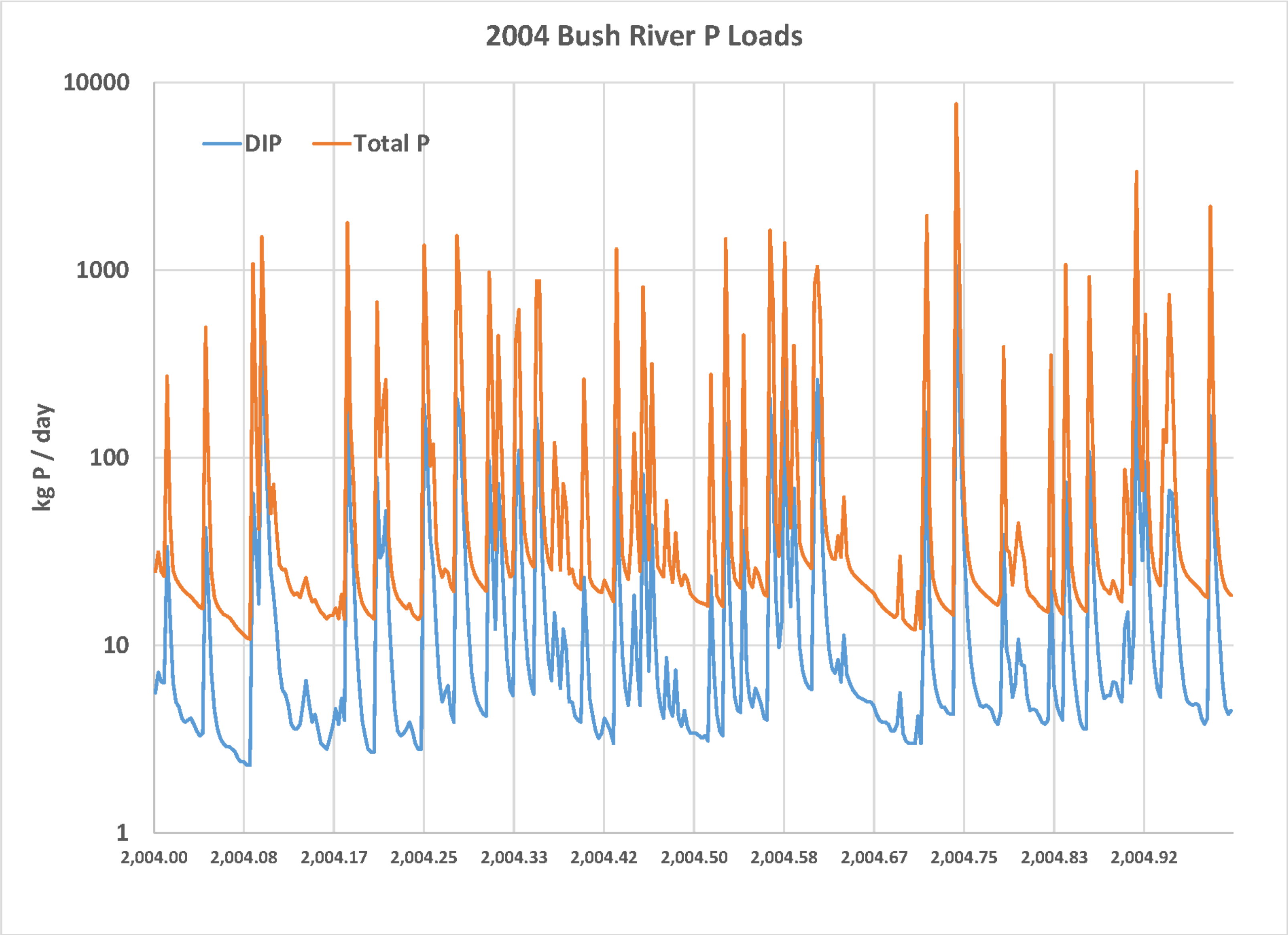
Run119 2002-2011
Total Phosphorus Bush River
mg/L
Years
0
0.2
0.4
0.6
0.8
1
0
1
2
3
4
5
6
7
8
9
10

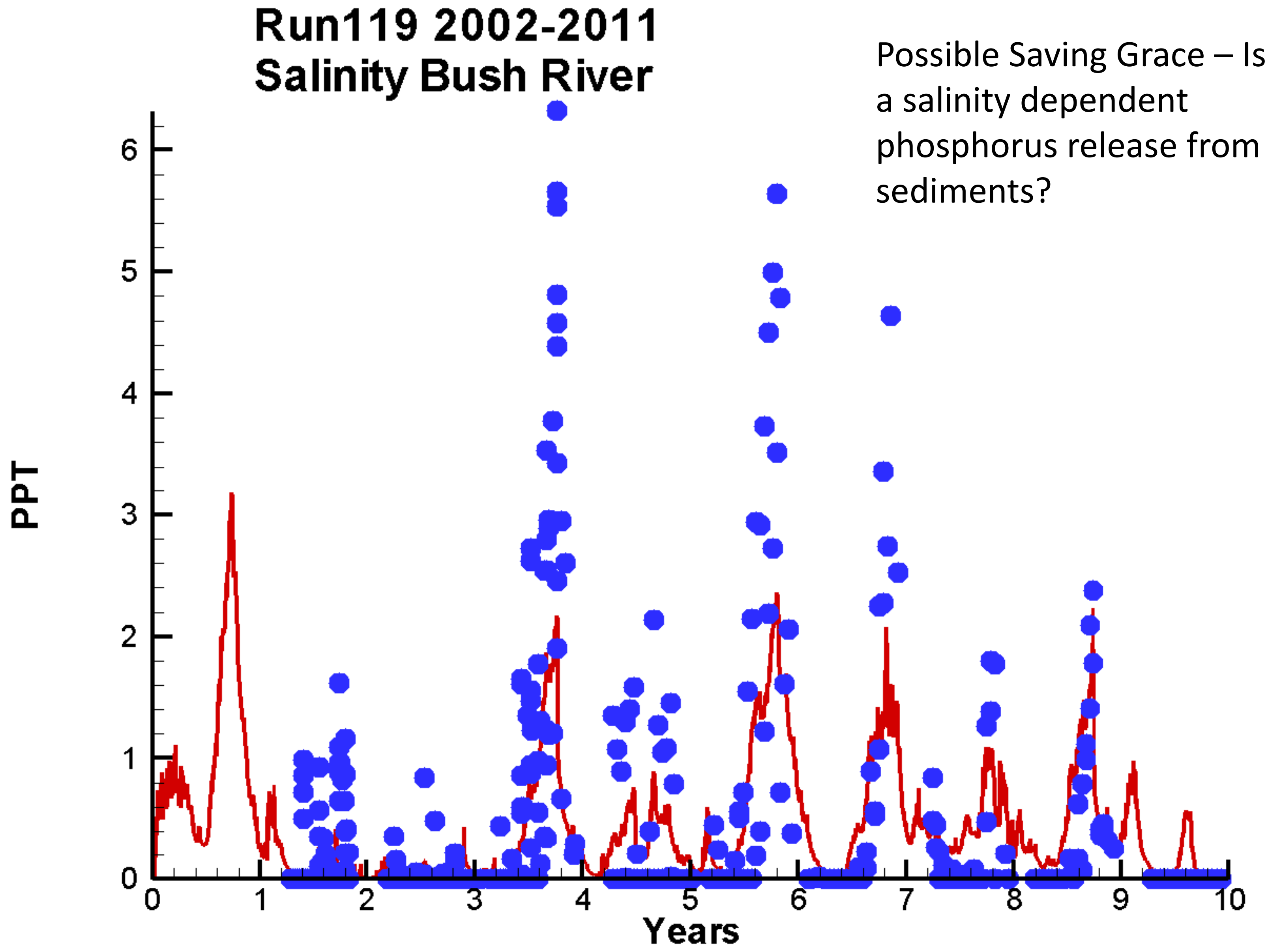


This was a bad model run. We grew no phytoplankton.

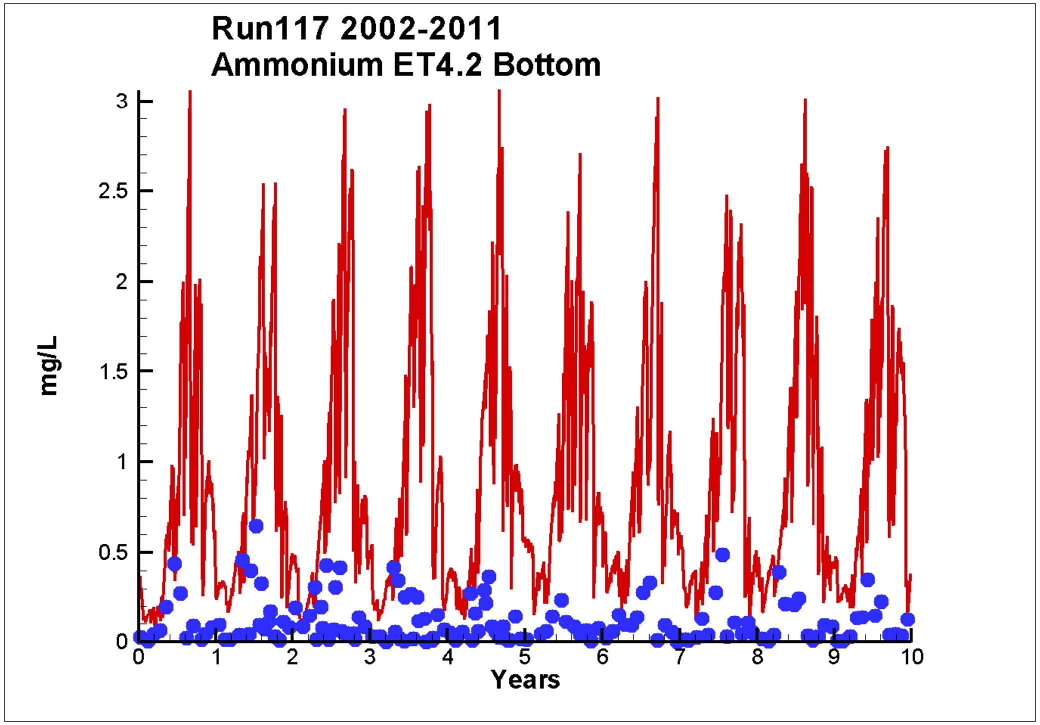
Even with no algal uptake, we have no DIP.



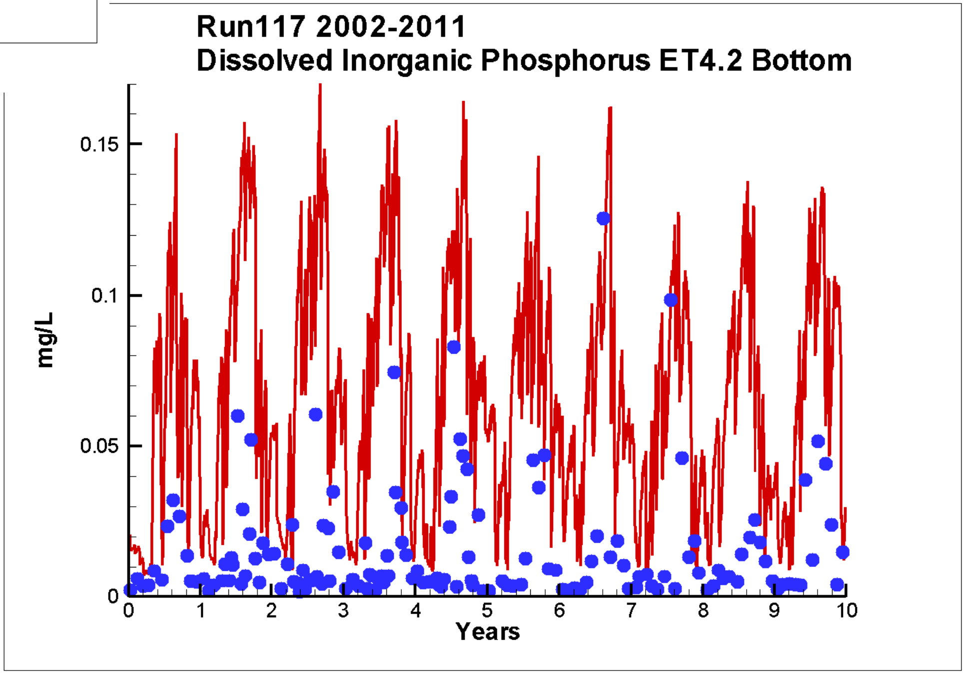

2004 Bush River P Loads
10000
1000
100
10
1
kg P / day
DIP
Total P
2,004.00
2,004.08
2,004.17
2,004.25
2,004.33
2,004.42
2,004.50
2,004.58
2,004.67
2,004.75
2,004.83
2,004.92

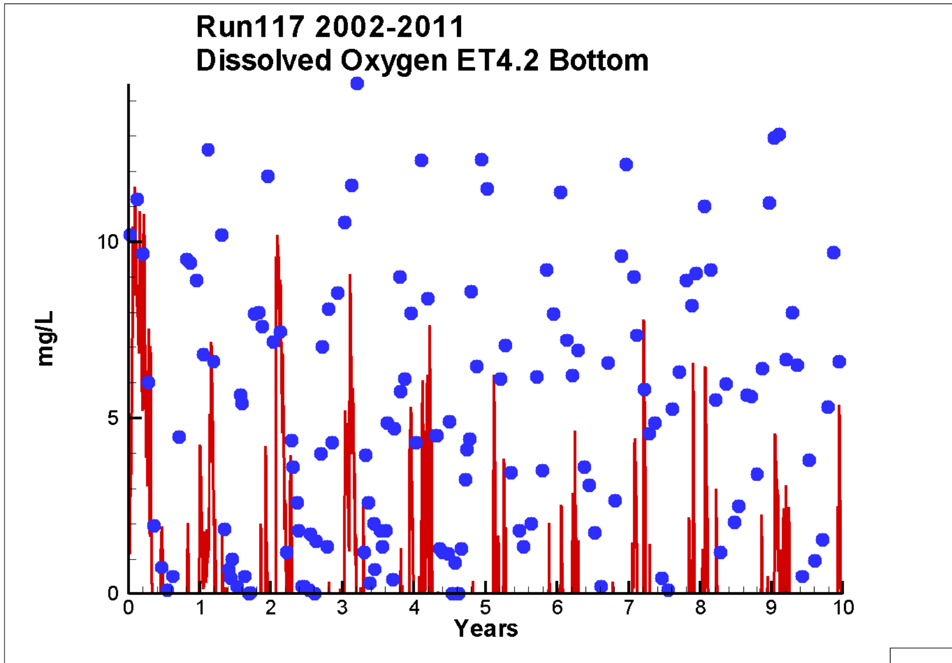


Possible Saving Grace – Is there a salinity dependent phosphorus release from sediments?



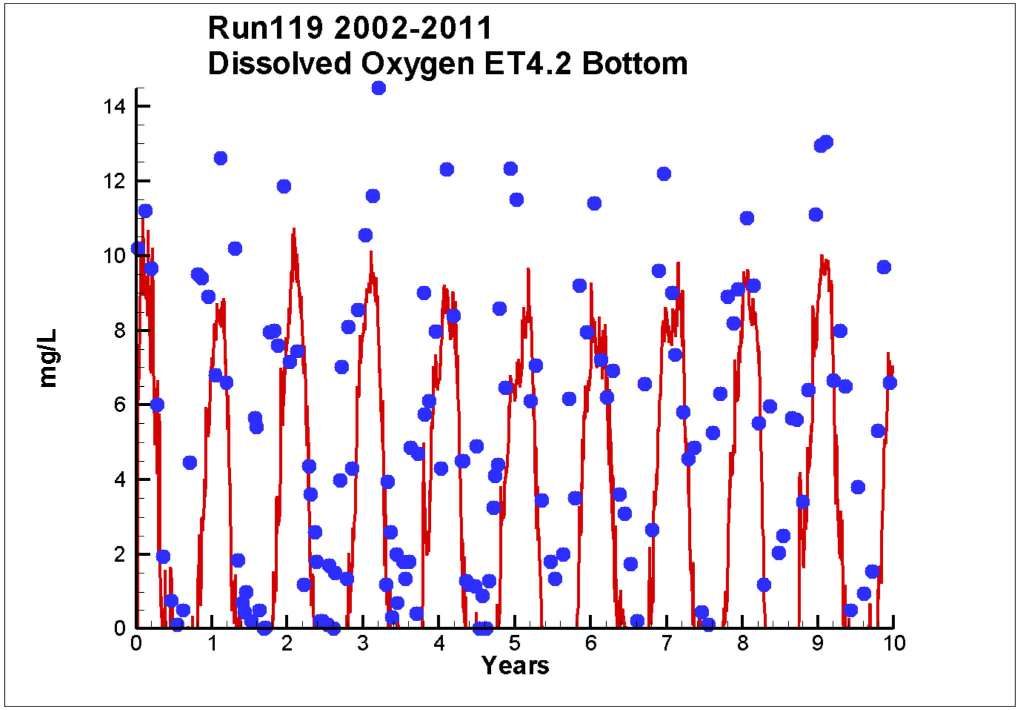
Let’s move to the Chester River, Station ET4.2

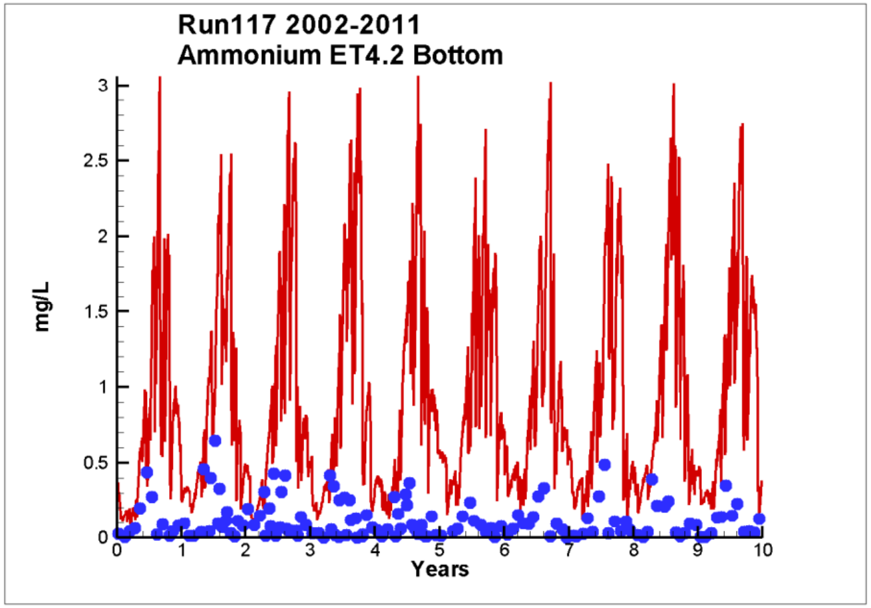


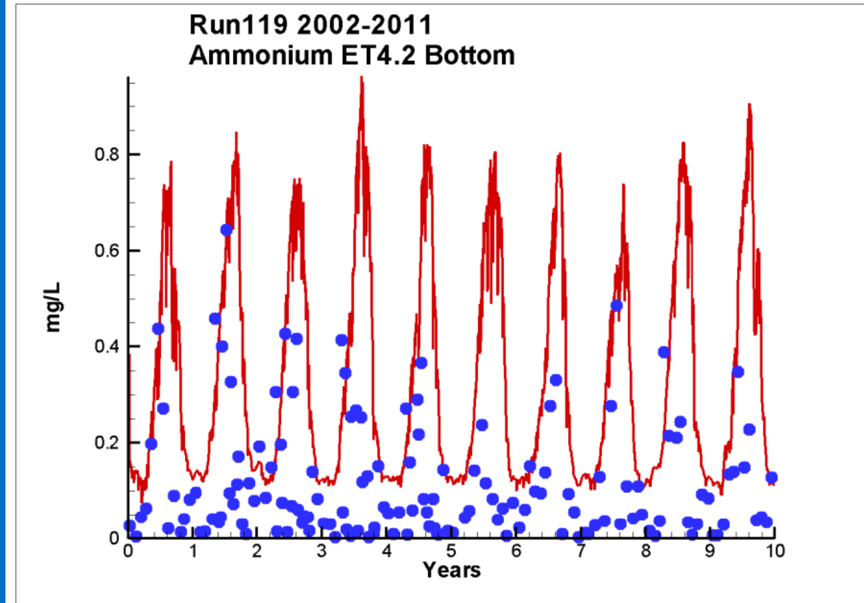


Calibration
Minimum vertical
diffusivity 0.014 cm²/s

Sensitivity
Minimum vertical
diffusivity 0.22 cm²/s

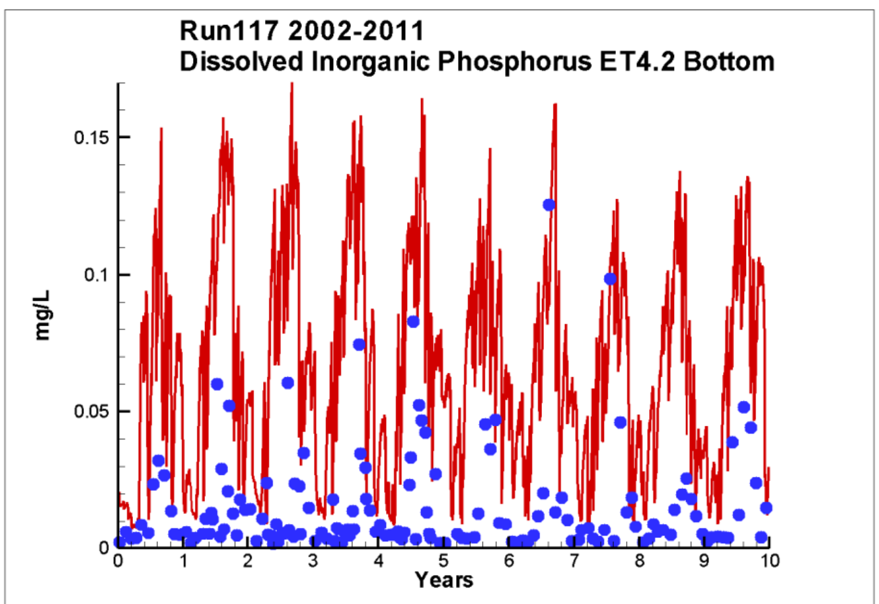


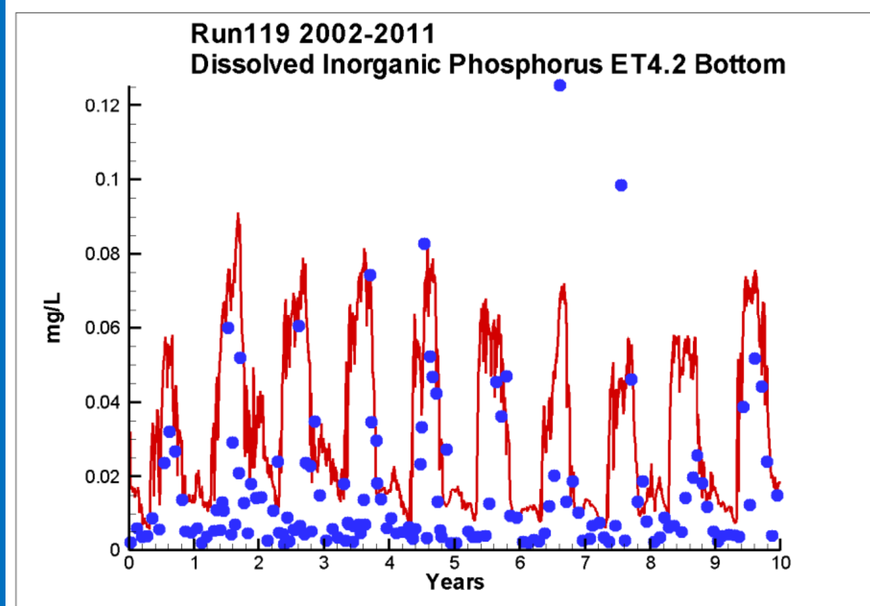


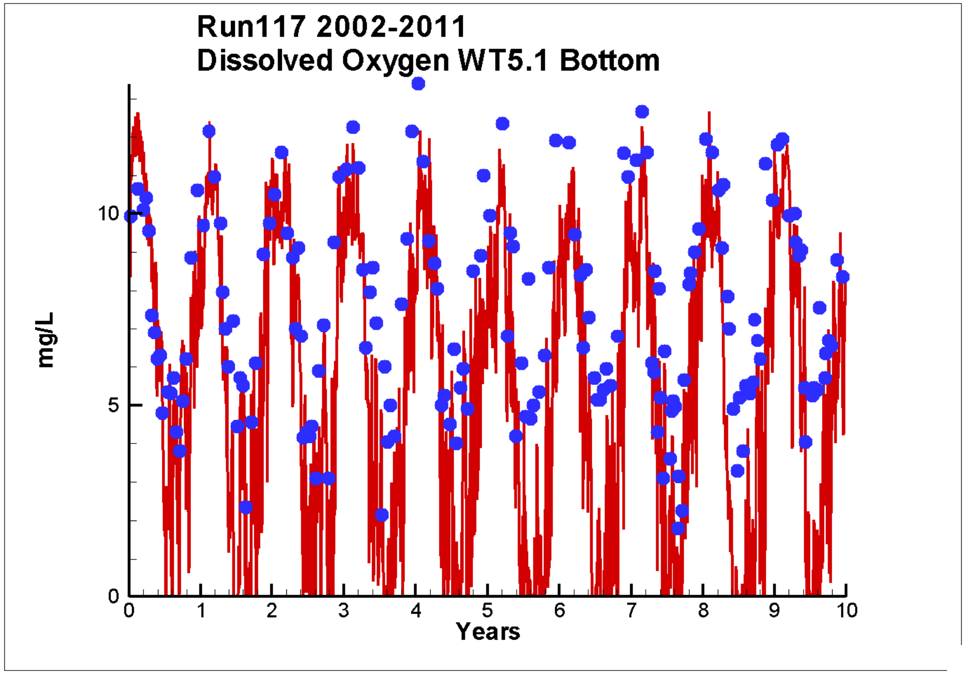


Calibration 0.014 cm^2/s

Sensitivity 0.22 cm^2/s

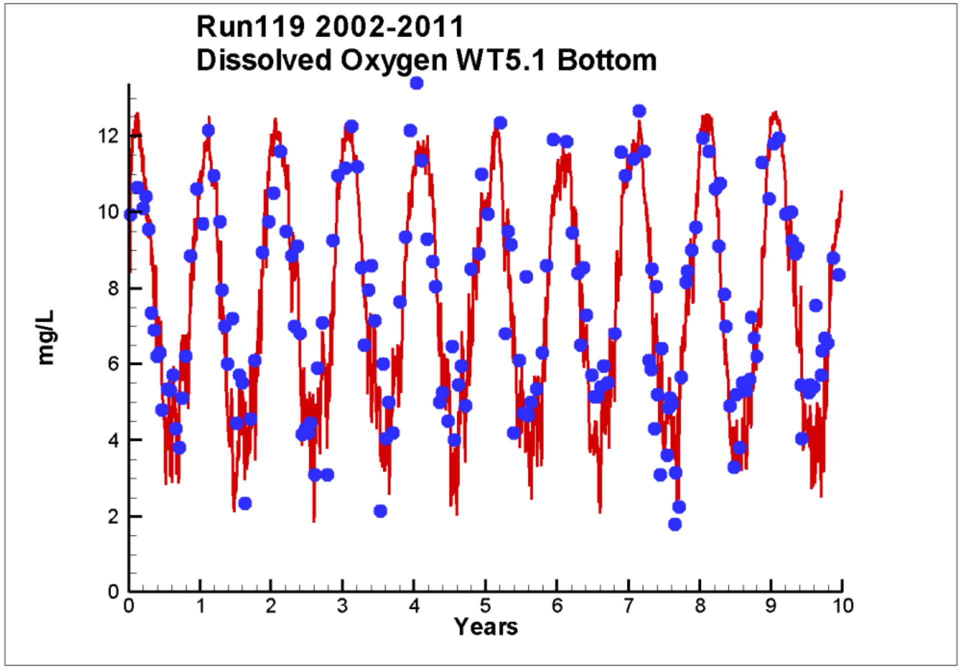


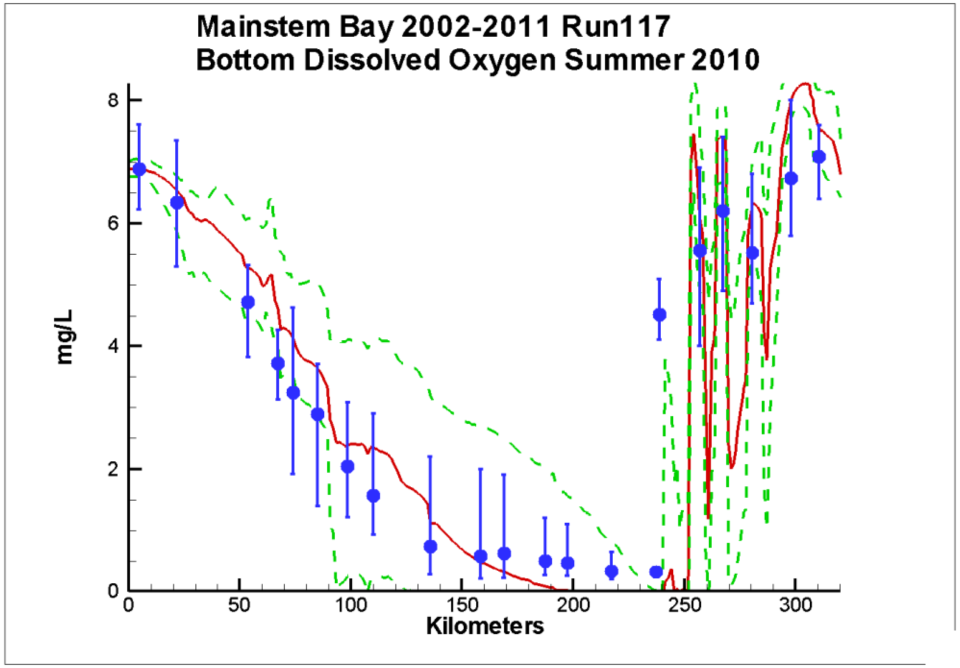




Calibration
Minimum vertical diffusivity 0.014 cm^2/s

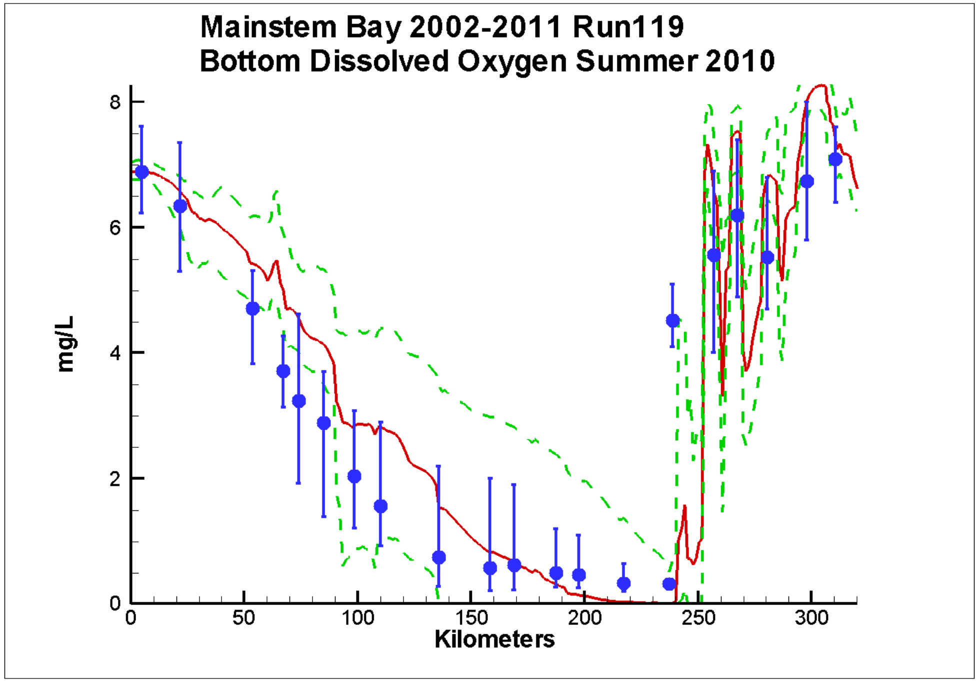
Sensitivity
Minimum vertical diffusivity 0.22 cm^2/s

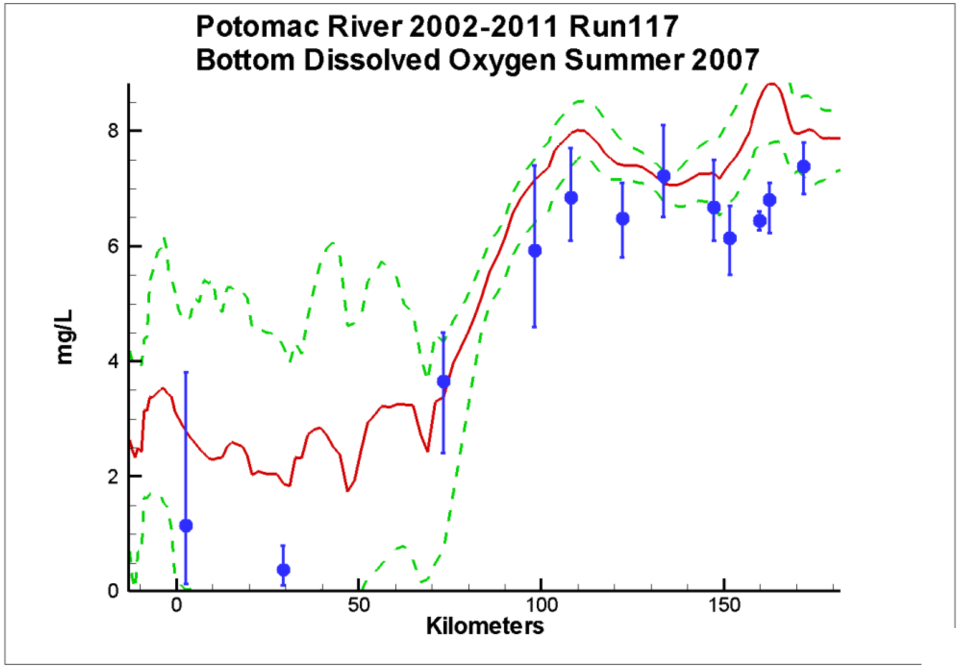




Calibration
Minimum vertical
diffusivity 0.014 cm^2/s

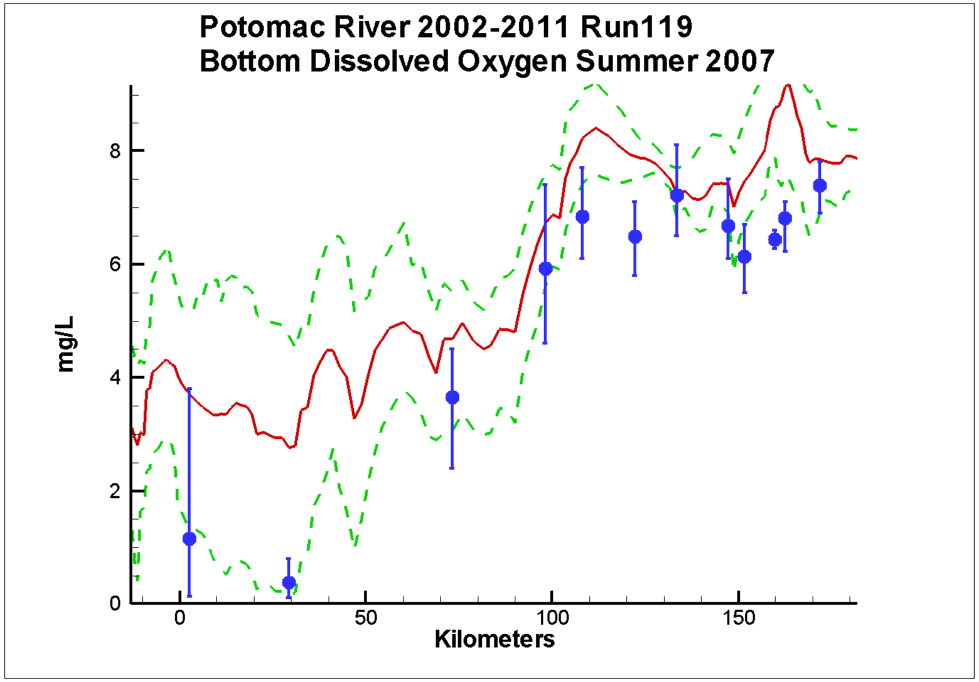
Sensitivity
Minimum vertical
diffusivity 0.22 cm^2/s

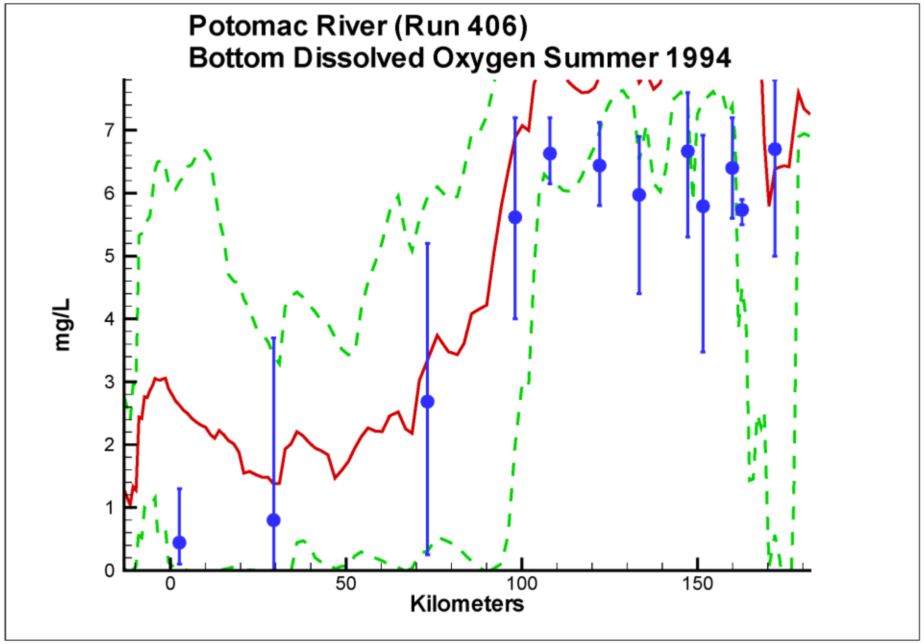


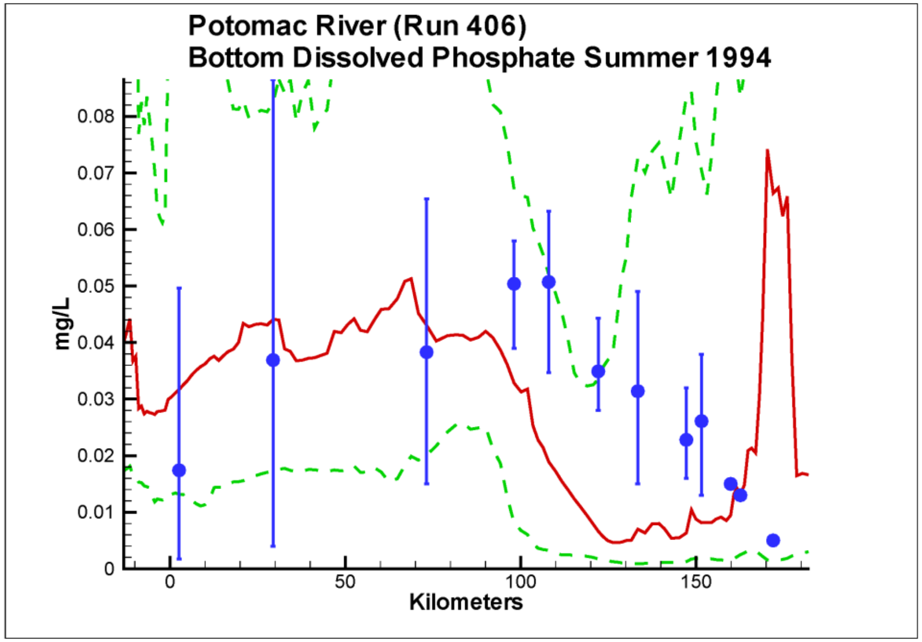


Calibration
Minimum vertical
diffusivity 0.014 cm^2/s

Sensitivity
Minimum vertical
diffusivity 0.22 cm^2/s







We've known for a long time we needed to correct (MINVERT) vertical diffusivity in tidal fresh water. It looks like the need to adjust minimum vertical diffusivity is more widespread. There's a cost to doing this but it seems like the correct way forward.