What We'll Cover

- Compare National Wetlands Inventory (NWI) and Sea-Level Affecting Marshes Model (SLAMM) wetlands areas.
- SLAMM projections of wetlands areas.
- Model Status.

National Wetlands Inventory

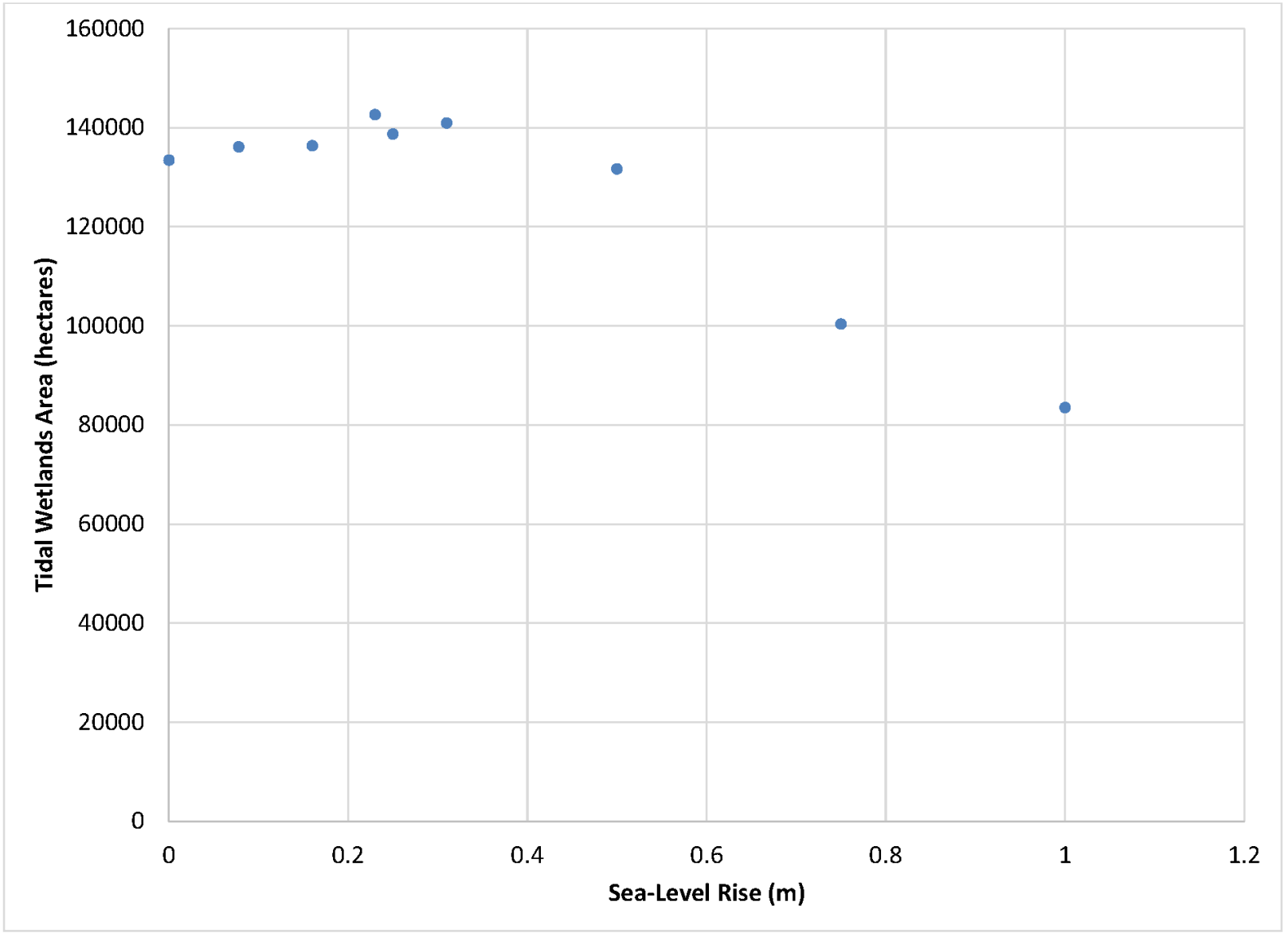
- Based on 1996 surveys (mostly aerial photos).
- GIS files provided by CBP summer 2016.
- Three Broad Categories:
  - Sub-tidal
  - Inter-tidal
  - Palustrine
- Multiple categories within these broad categories.
- The sum of inter-tidal Emergent, Scrub-Shrub, Forested is 124,834 hectares.

SLAMM

- Originated with 2008 report by Patty Glick to National Wildlife Federation.
- Refined in 2014 masters thesis by Jennifer Bryan.
- GIS files provided courtesy of Lora Harris 2016.
- Four Categories:
  - Brackish Marsh
  - Salt Marsh
  - Transitional Marsh
  - Tidal Freshwater Marsh
- The sum of four categories is 133,436 hectares (sufficiently close to NWI 124,834).

SLAMM Scenarios

- IPCC B1: 0.31 m sea-level rise, broken into four increments.
- 1 Meter: 1 m sea-level rise, broken into four increments.


160000
140000
120000
100000
80000
60000
40000
20000
0
Tidal Wetlands Area (hectares)
0
0.2
0.4
0.6
0.8
1
1.2
Sea-Level Rise (m)

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.

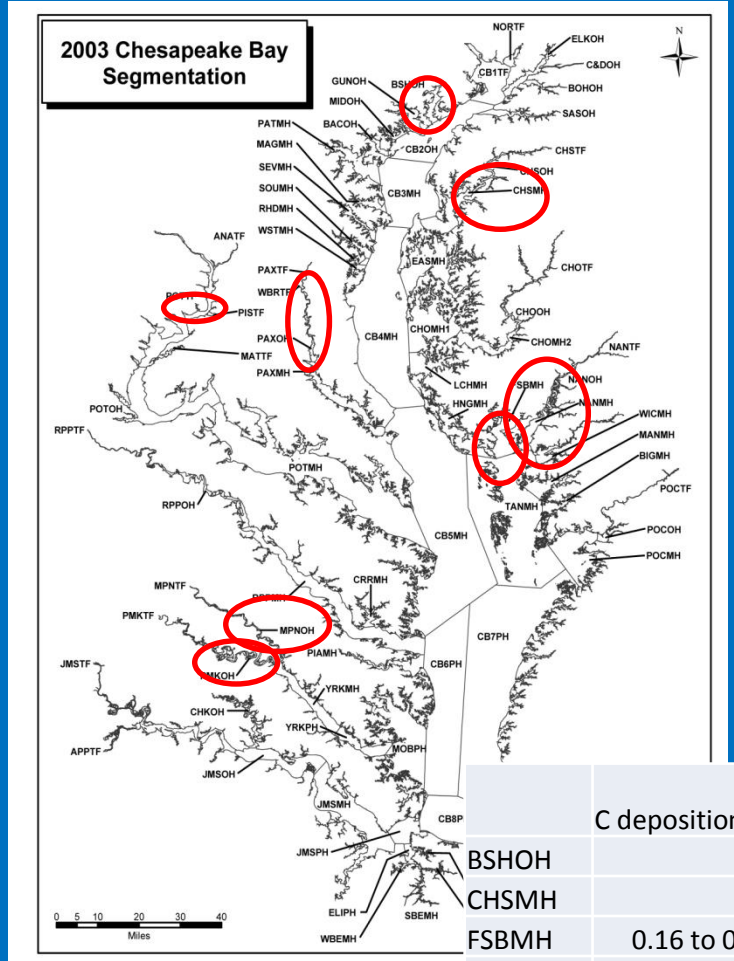
Previous calibration had WOC = 1 g DO/sq m/d and no limiting factor. Wetland areas from TMDL model.

Denitrification

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

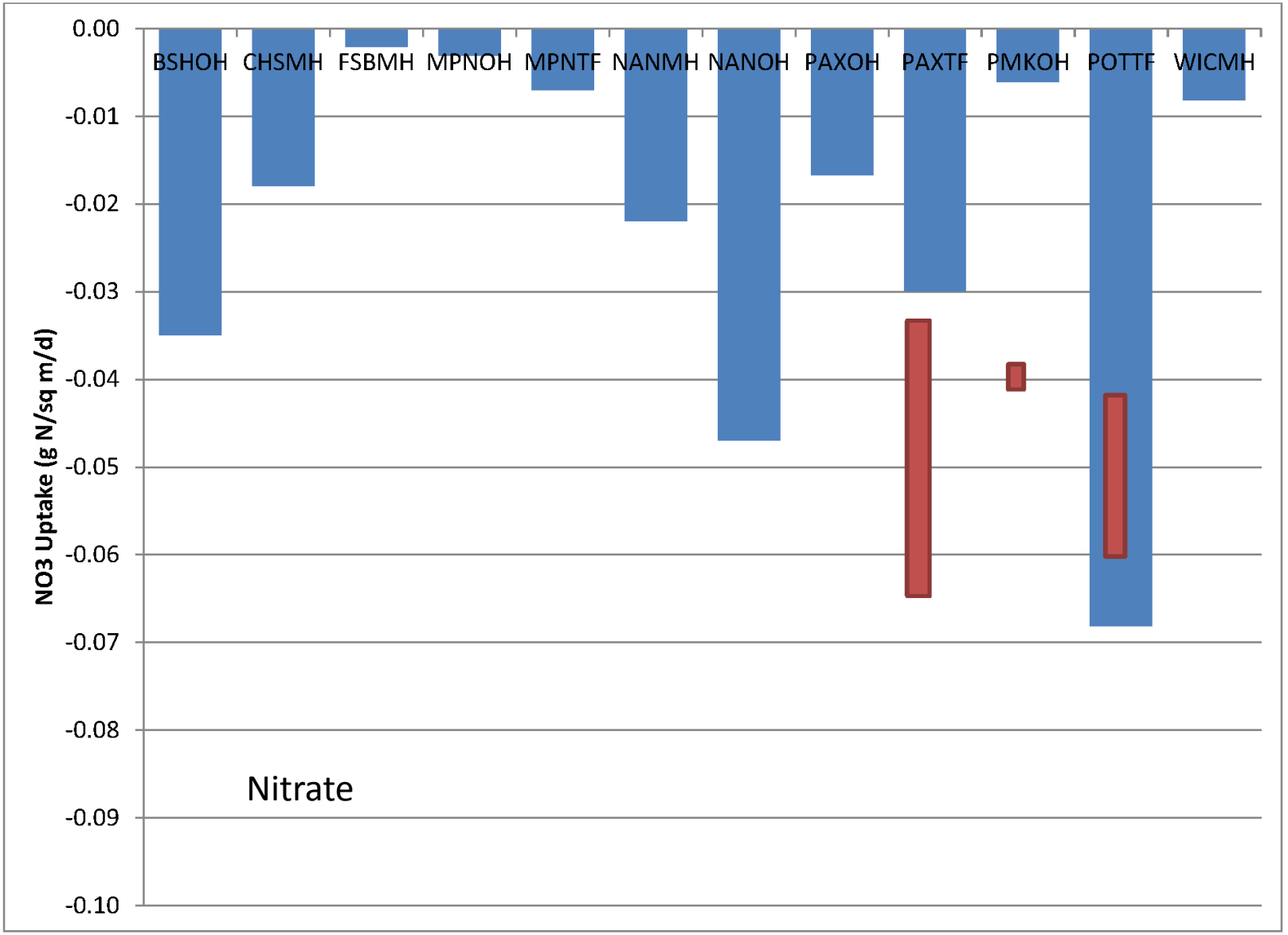
V = volume of WQM cell adjacent to wetlands
C = nitrate concentration
MTC = mass-transfer coefficient
f(T) = temperature effect
Aw = area of wetland adjacent to WQM cell

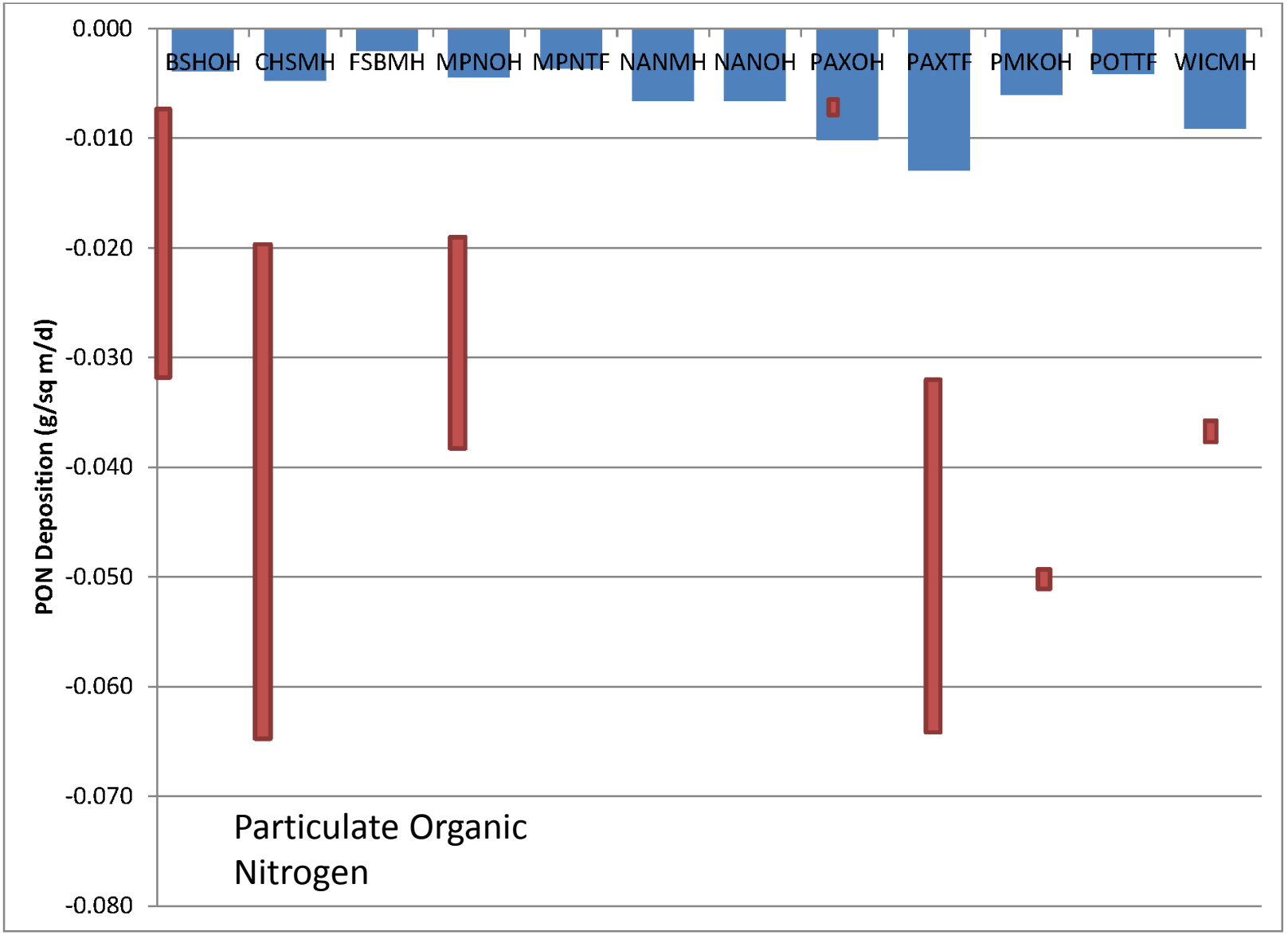
At present, the mass-transfer coefficient is 0.05 m/d.
Denitrification doubles for a 10C temperature increase.

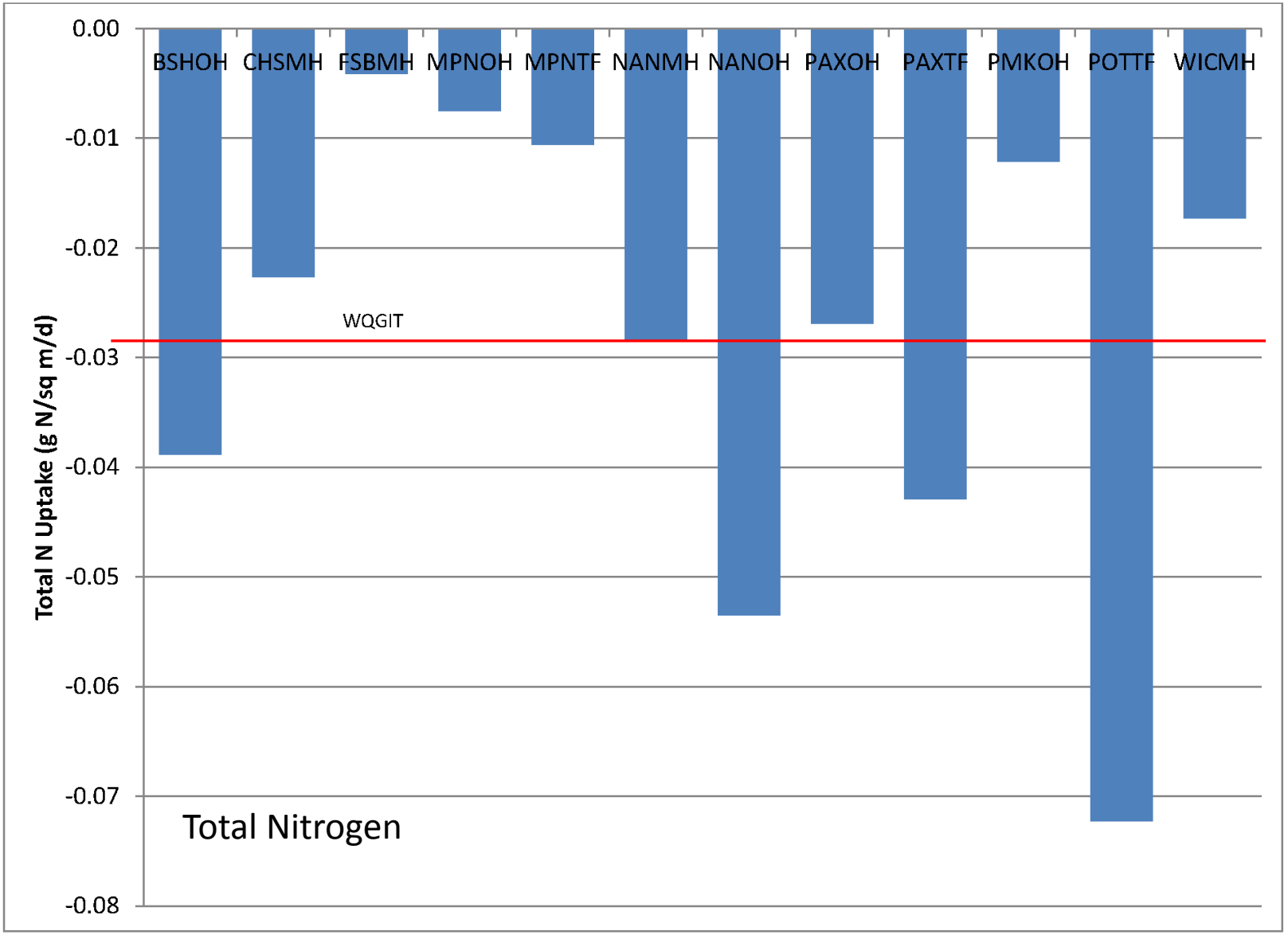


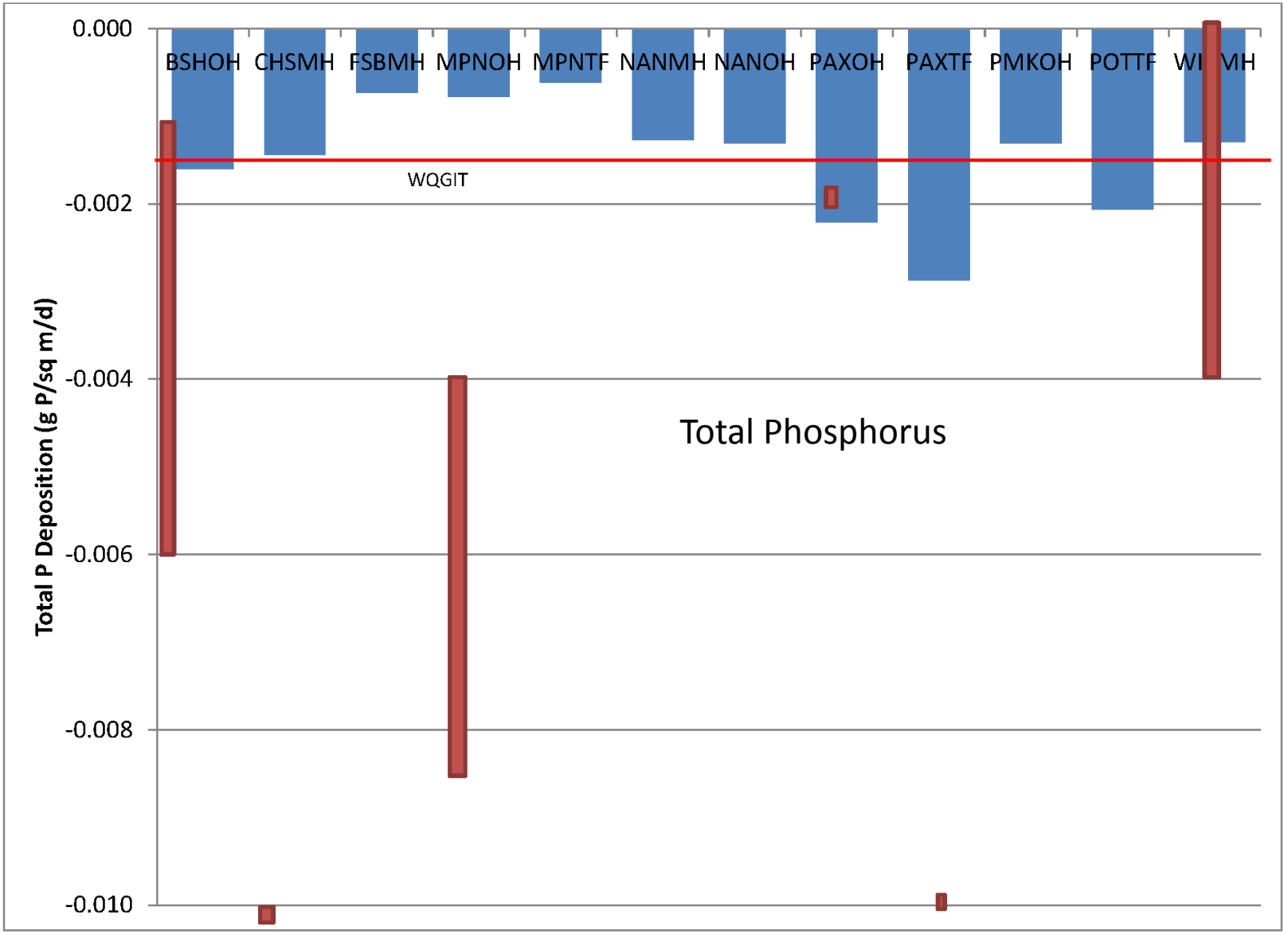
Hot Spots for Calibration

	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		


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

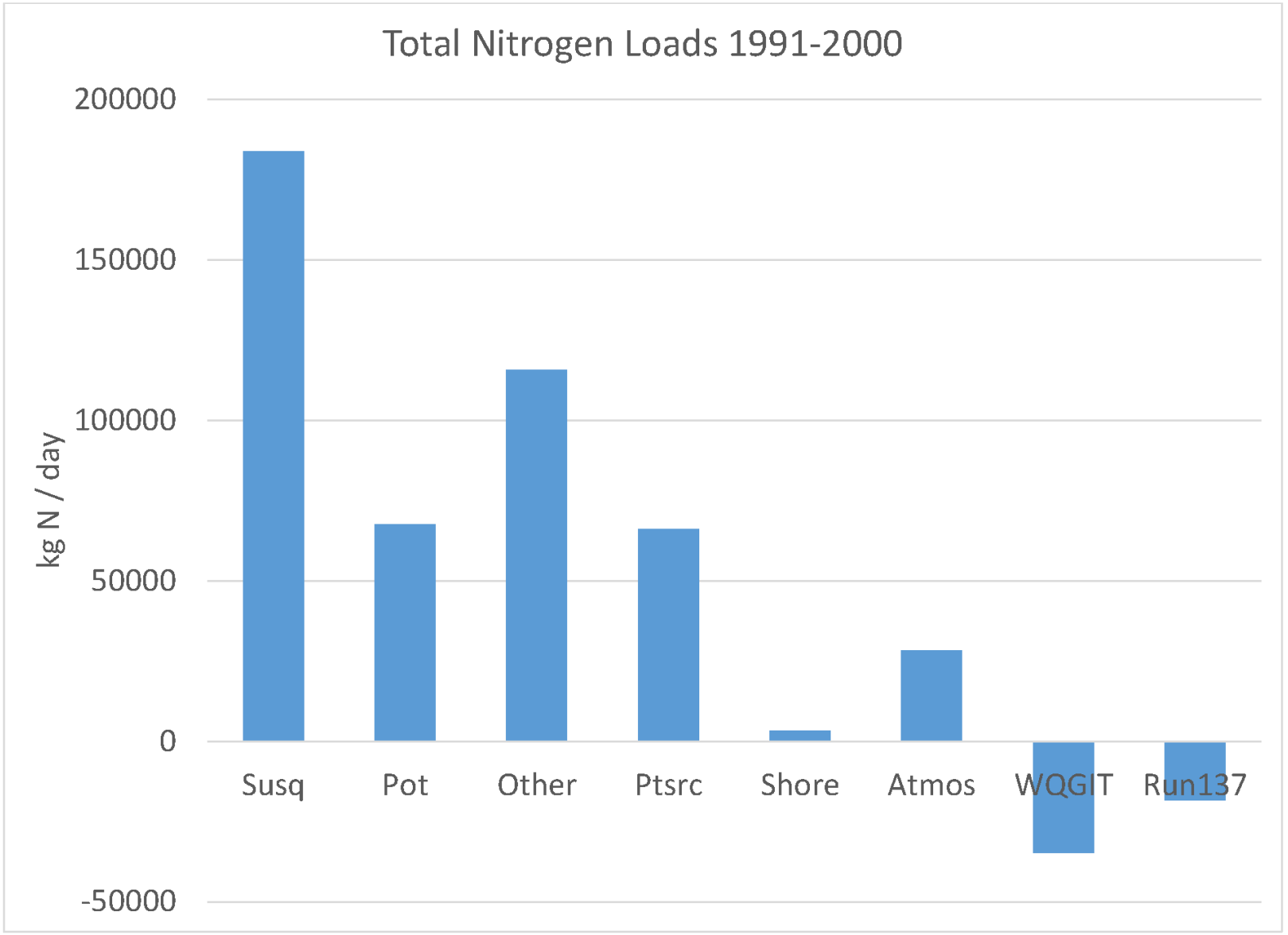

0.000
-0.010
-0.020
-0.030
-0.040
-0.050
-0.060
-0.070
-0.080
PON Deposition (g/sq m/d)
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
NANMH
NANOH
PAXOH
PAXTF
PMKOH
POTTF
WICMH
Particulate Organic Nitrogen

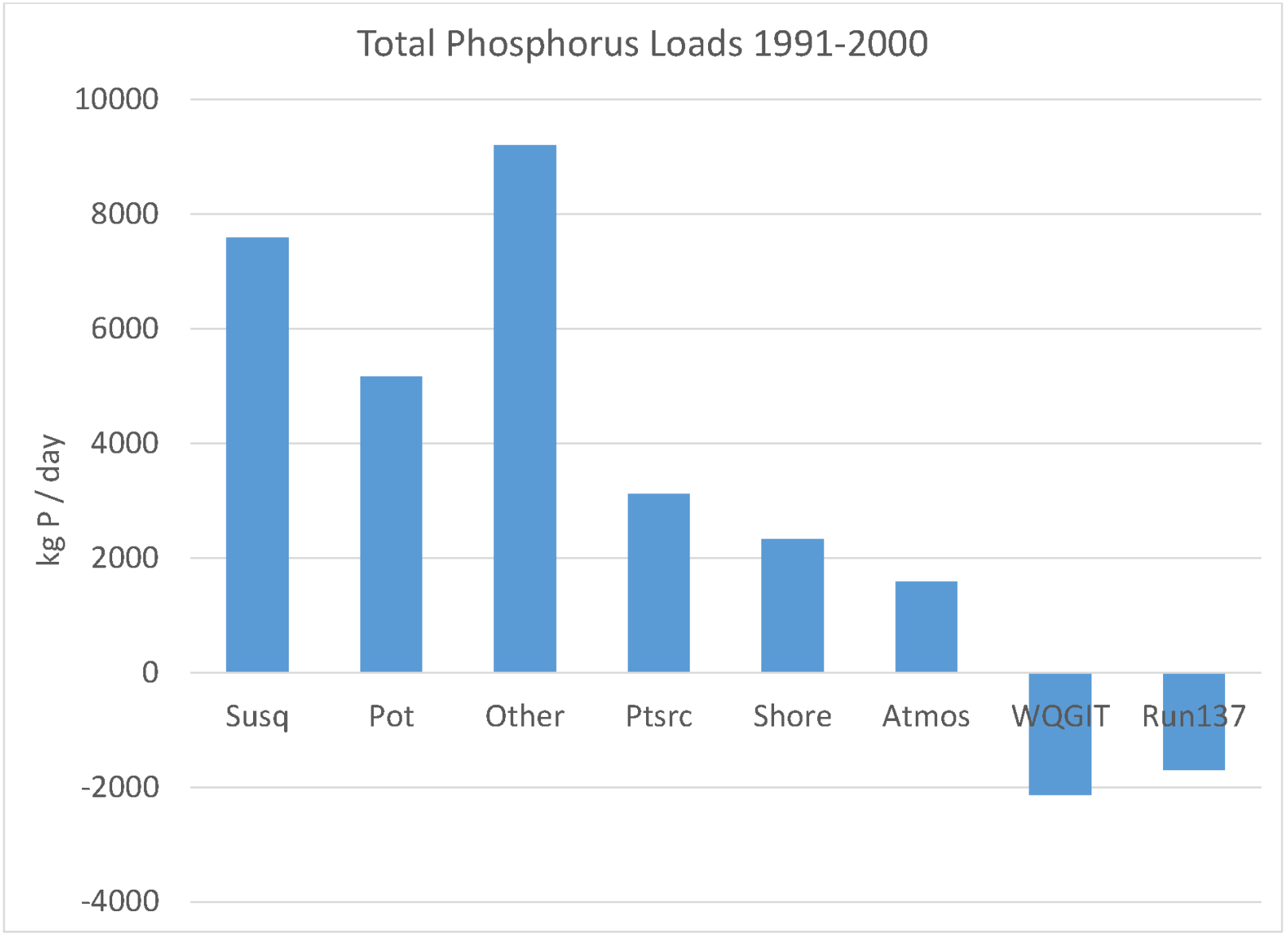

0.00
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
-0.08
Total N Uptake (g N/sq m/d)
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
NANMH
NANOH
PAXOH
PAXTF
PMKOH
POTTF
WICMH
WQGIT
Total Nitrogen


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

Let's Do Some Comparisons

- N and P Removal. WQGIT allowances (0.026 g N/m2/d, 0.0016 g P/m2/d) times SLAMM base wetland area.
- N and P Removal. Sum of model computations from Run137.
- Phase 6 Beta 3 WSM and other loads.


Total Nitrogen Loads 1991-2000
200000
150000
100000
50000
0
-50000
kg N / day
Susq
Pot
Other
Ptsrc
Shore
Atmos
WQGIT
Run137


Total Phosphorus Loads 1991-2000
10000
8000
6000
4000
2000
0
-2000
-4000
kg P / day
Susq
Pot
Other
Ptsrc
Shore
Atmos
WQGIT
Run137

Summary

- There's not much change in total wetlands area for sea-level rise of 0.3 to 0.5 m.
- Our wetlands module produces results comparable to WQGIT estimates. We could probably bury a little more N and P.
- Globally, wetlands N and P removal are comparable in magnitude to secondary load sources such as shoreline erosion and direct atmospheric deposition. Wetlands nutrient removal is much less than loads from major fall lines.