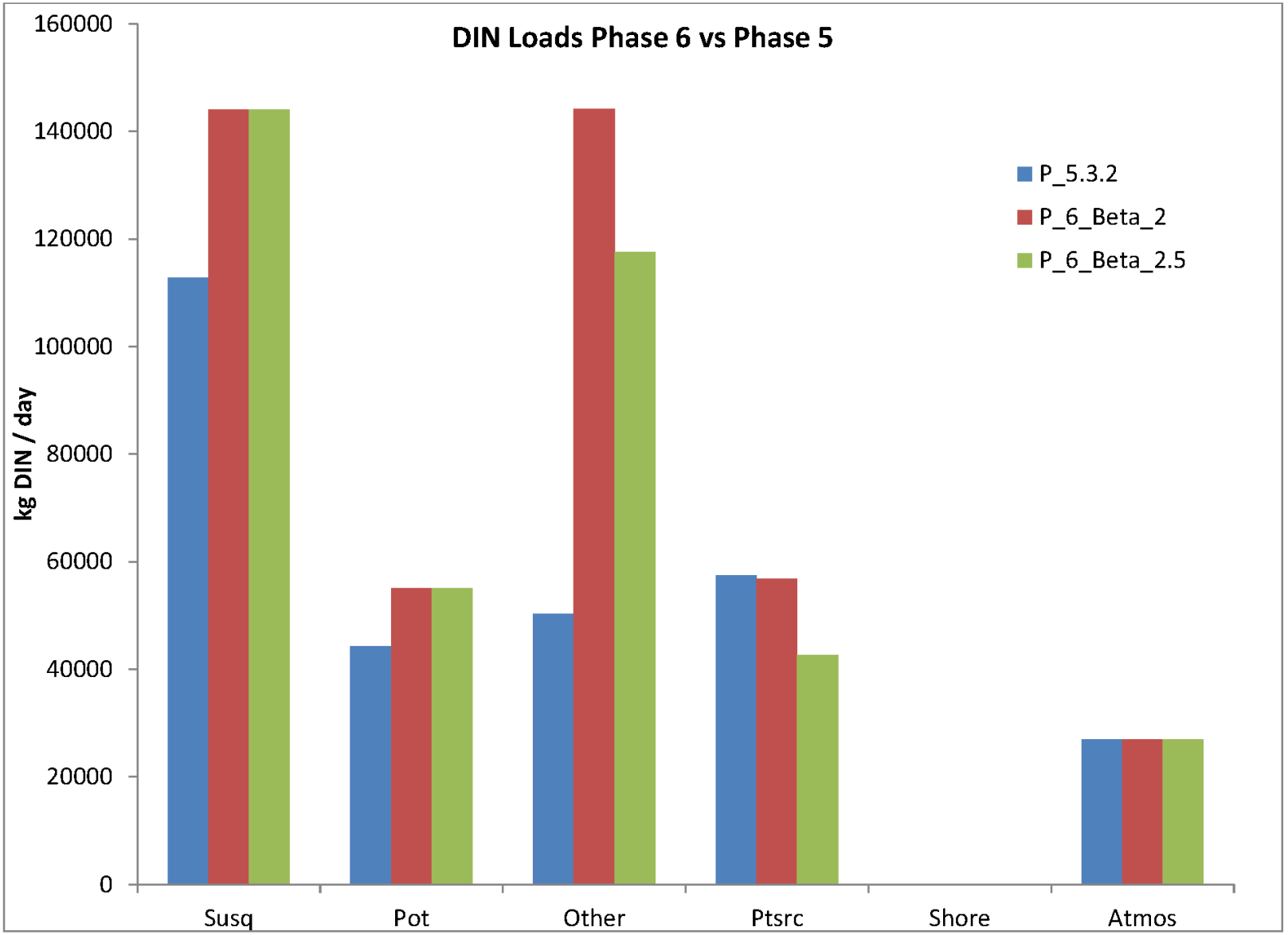
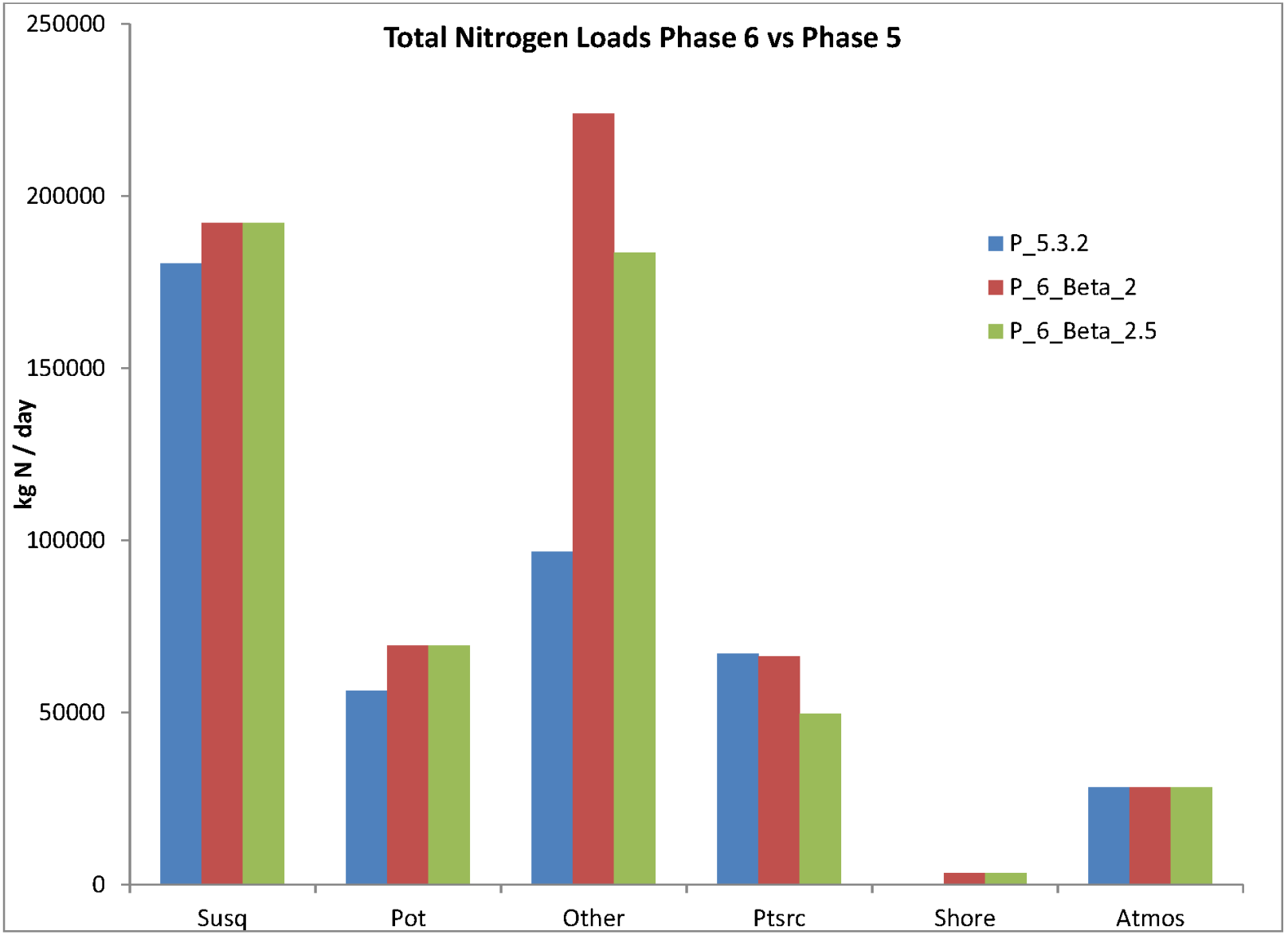
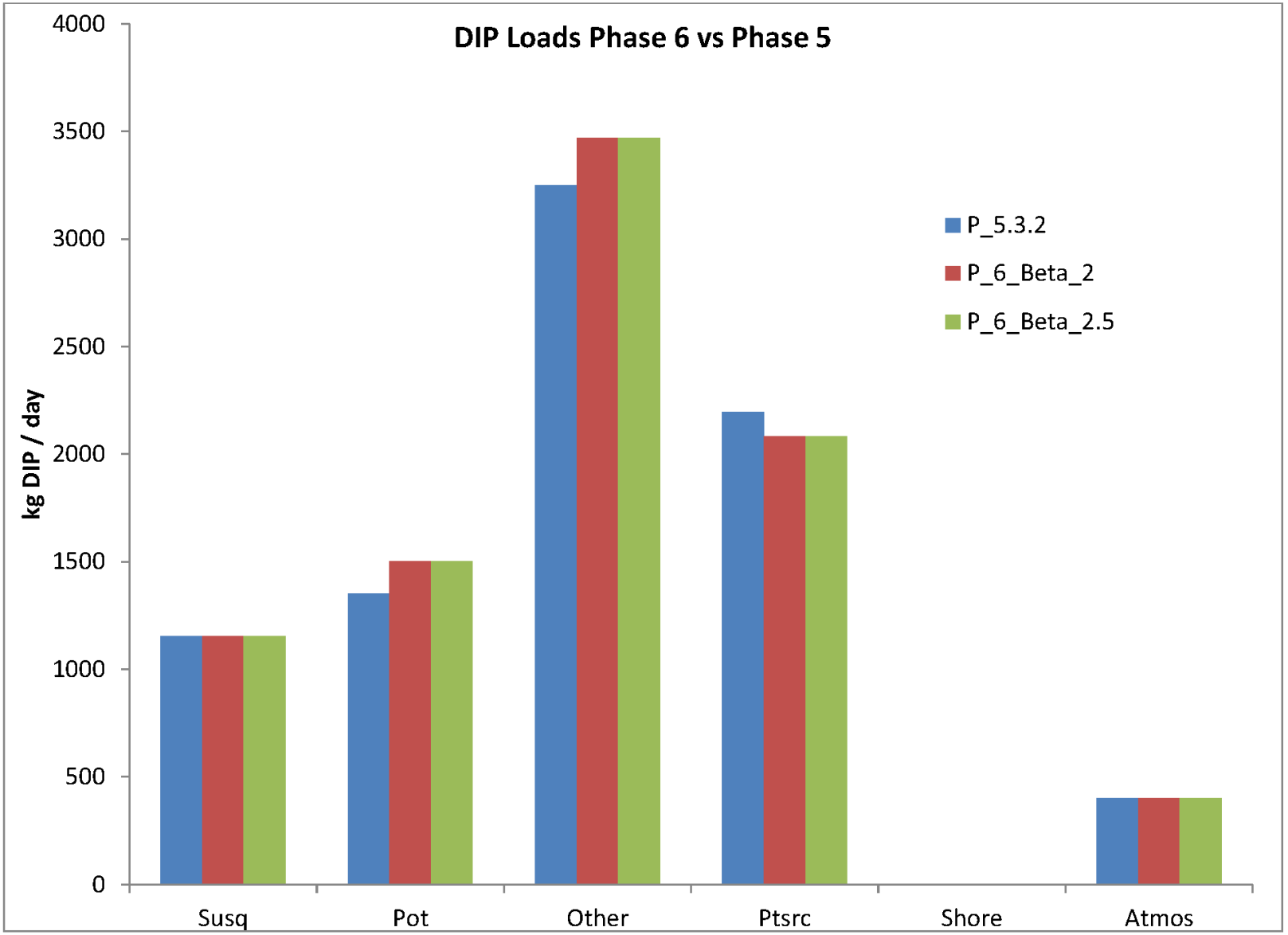
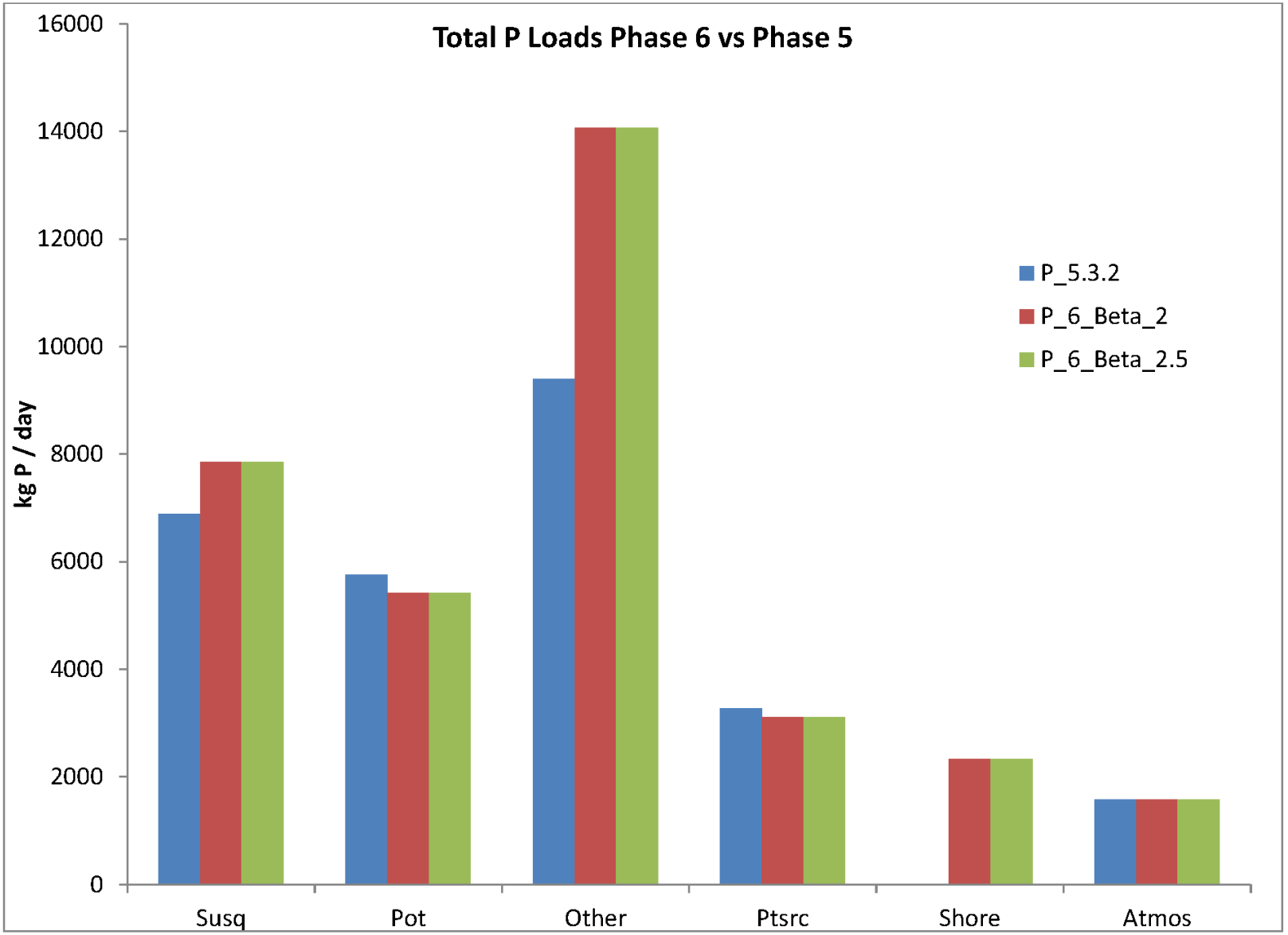
Major Transmissions from CBP

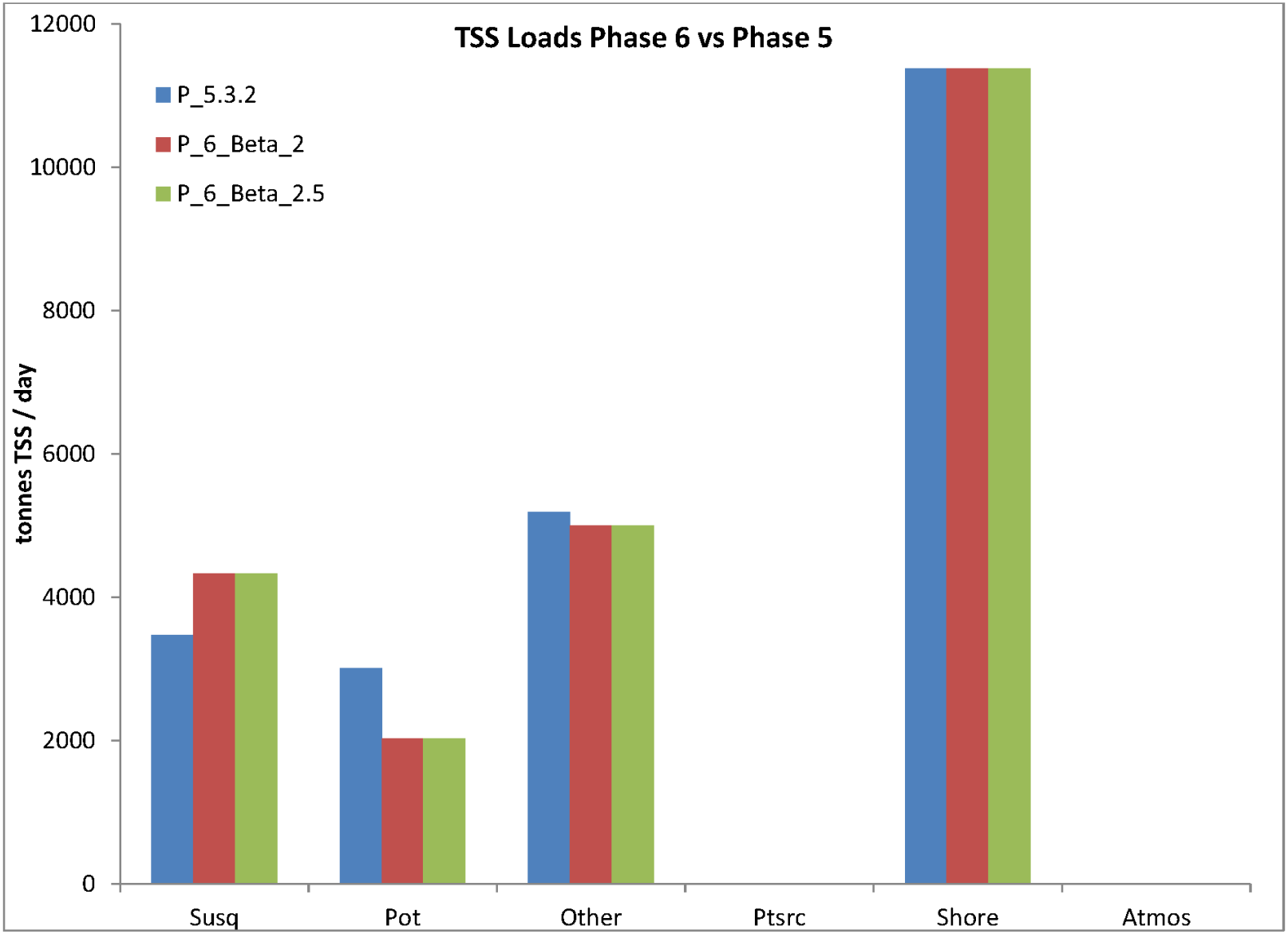
- July, 2013 – First 2002 – 2011 loads.
- April 2015 – First set of Phase 6 loads.
- December 2015 – Phase 6 Beta 1 loads.
- May 2016 – Phase 6 Beta 2 loads.
- June 2016 – Phase 6 Beta 2 ½ loads.
- August 2016 – Phase 6 Beta 3 loads.


DIN Loads Phase 6 vs Phase 5
kg DIN / day
160000
140000
120000
100000
80000
60000
40000
20000
0
Susq
Pot
Other
Ptsrc
Shore
Atmos
P_5.3.2
P_6_Beta_2
P_6_Beta_2.5


Total Nitrogen Loads Phase 6 vs Phase 5
250000
200000
150000
100000
50000
0
kg N / day
P_5.3.2
P_6_Beta_2
P_6_Beta_2.5
Susq
Pot
Other
Ptsrc
Shore
Atmos


DIP Loads Phase 6 vs Phase 5
kg DIP / day
4000
3500
3000
2500
2000
1500
1000
500
0
Susq
Pot
Other
Ptsrc
Shore
Atmos
P_5.3.2
P_6_Beta_2
P_6_Beta_2.5

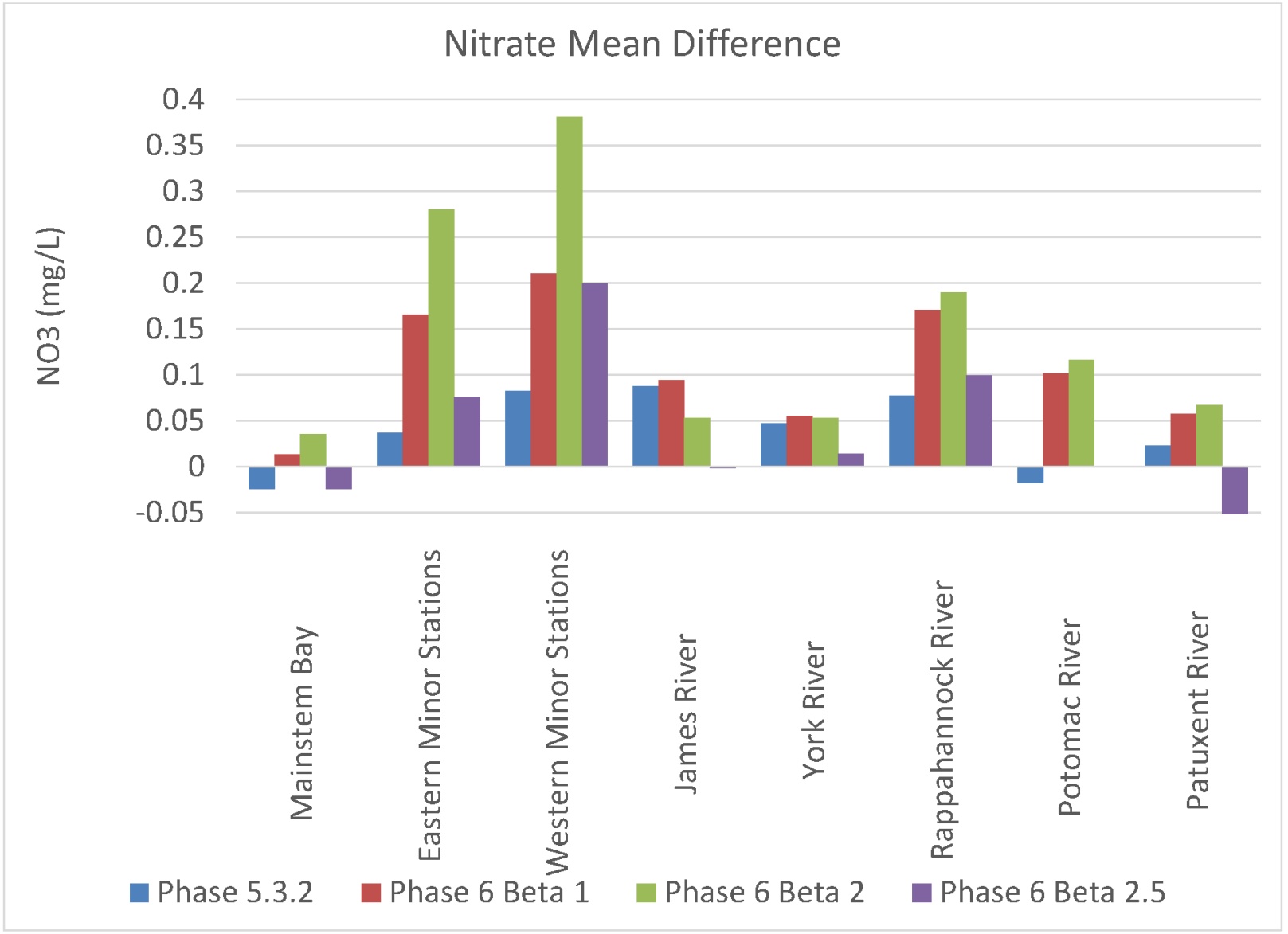

Total P Loads Phase 6 vs Phase 5
kg P / day
16000
14000
12000
10000
8000
6000
4000
2000
0
Susq
Pot
Other
Ptsrc
Shore
Atmos
P_5.3.2
P_6_Beta_2
P_6_Beta_2.5

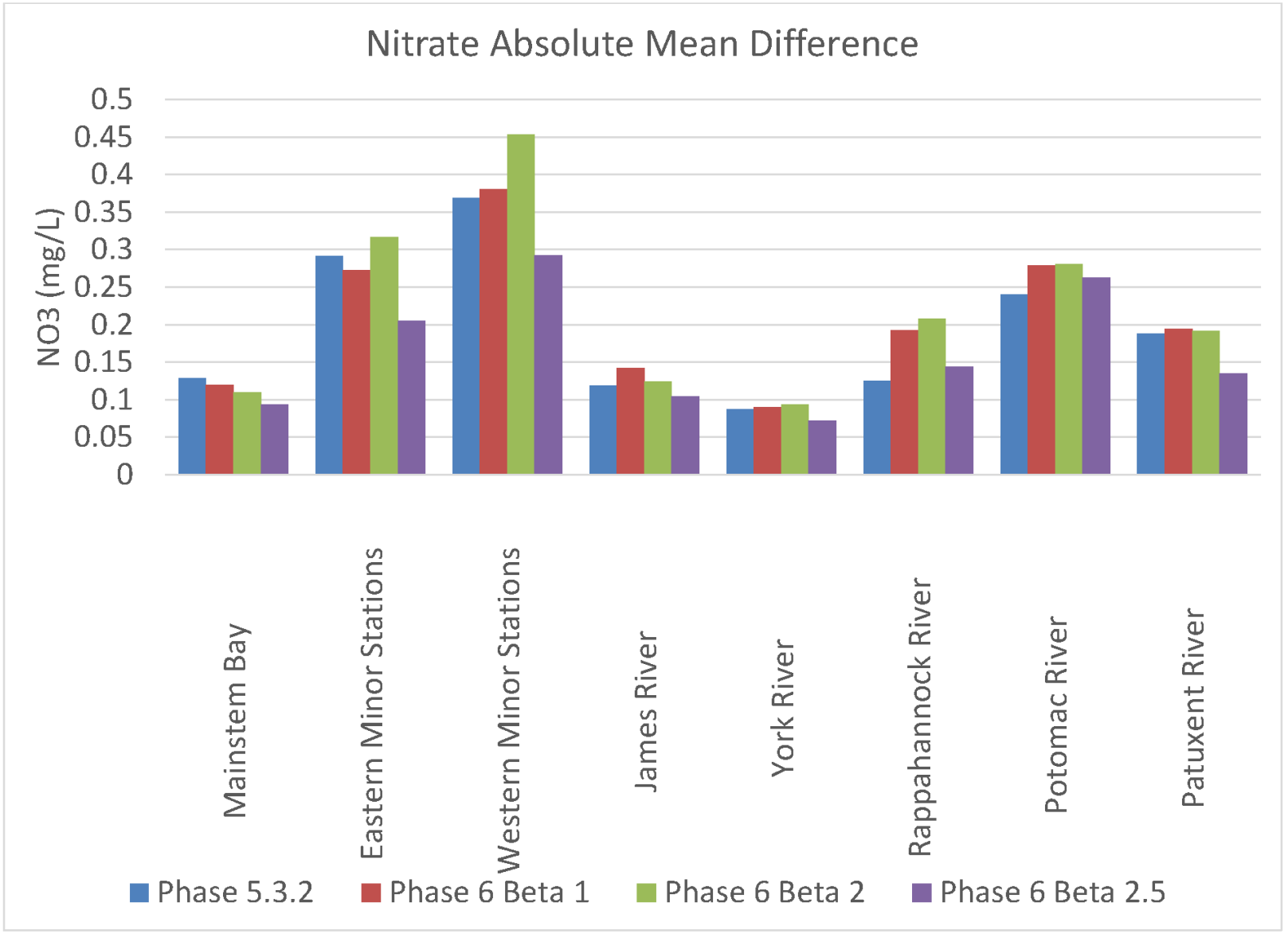

TSS Loads Phase 6 vs Phase 5
P_5.3.2
P_6_Beta_2
P_6_Beta_2.5
tonnes TSS / day
12000
10000
8000
6000
4000
2000
0
Susq
Pot
Other
Ptsrc
Shore
Atmos

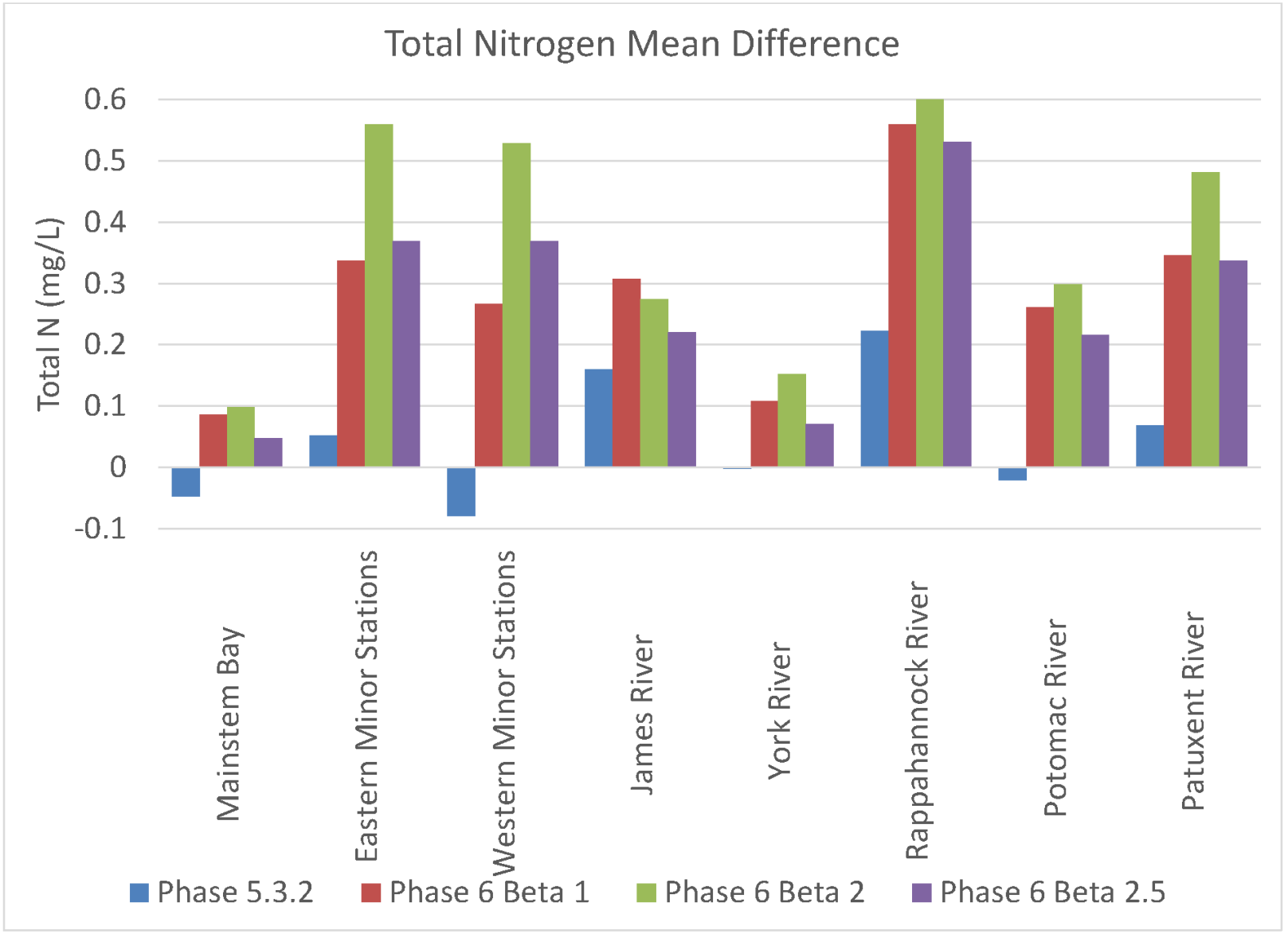
How is our model responding to these loads changes?

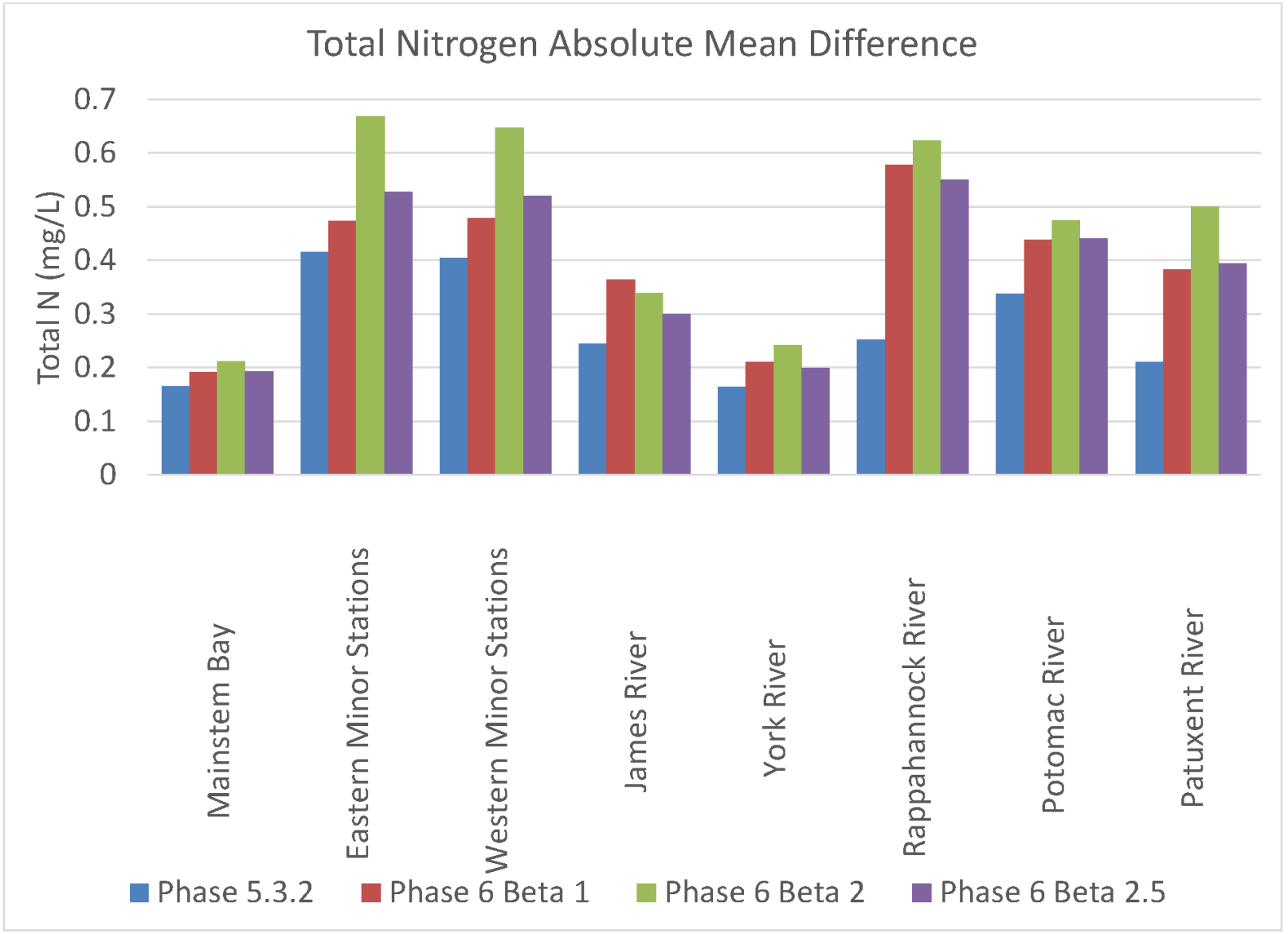
Use our traditional Mean Difference (MD) and Absolute Mean Difference (AMD) statistics.

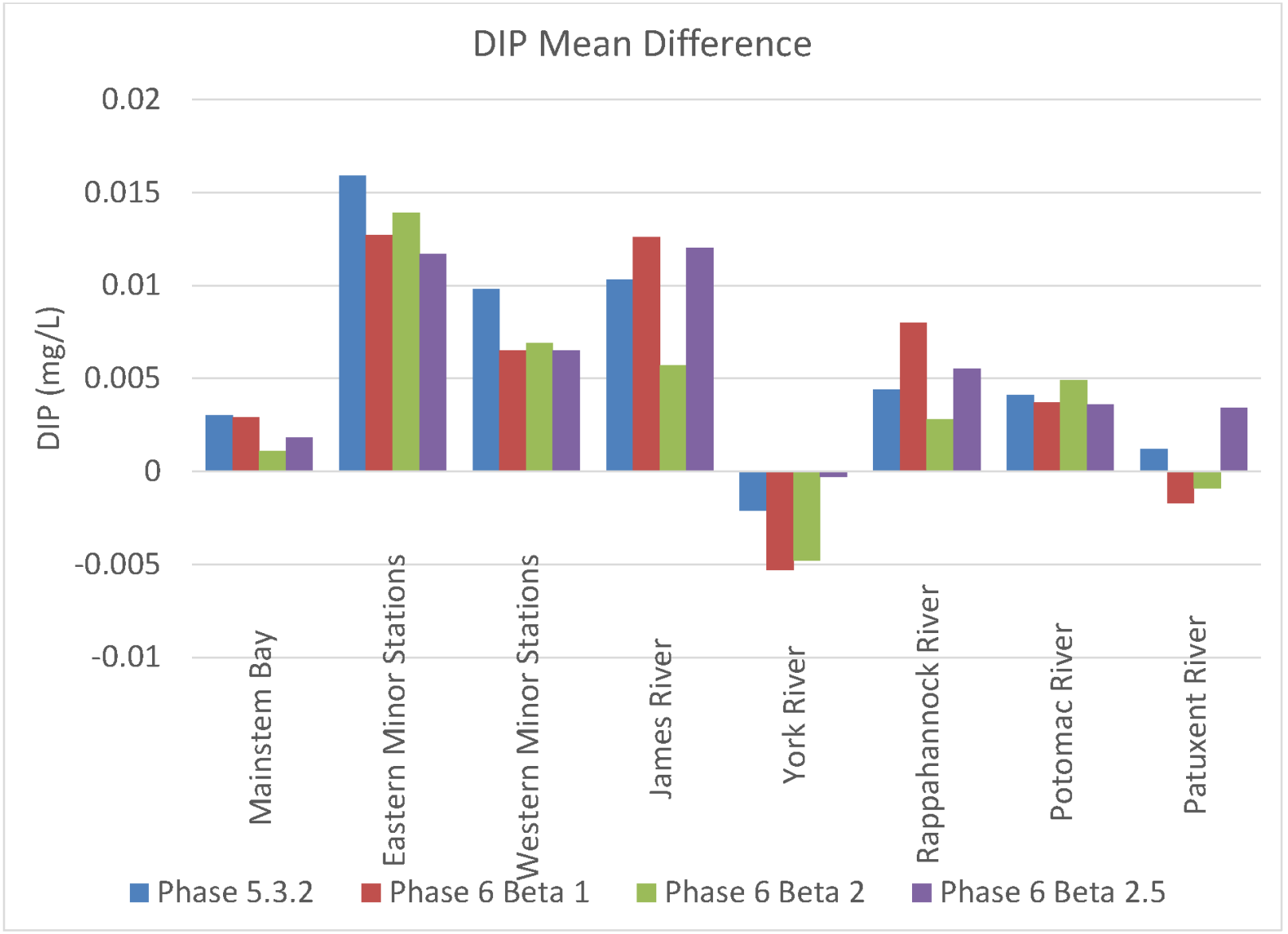
Remember, a positive mean difference means the model is higher than observations, on average.

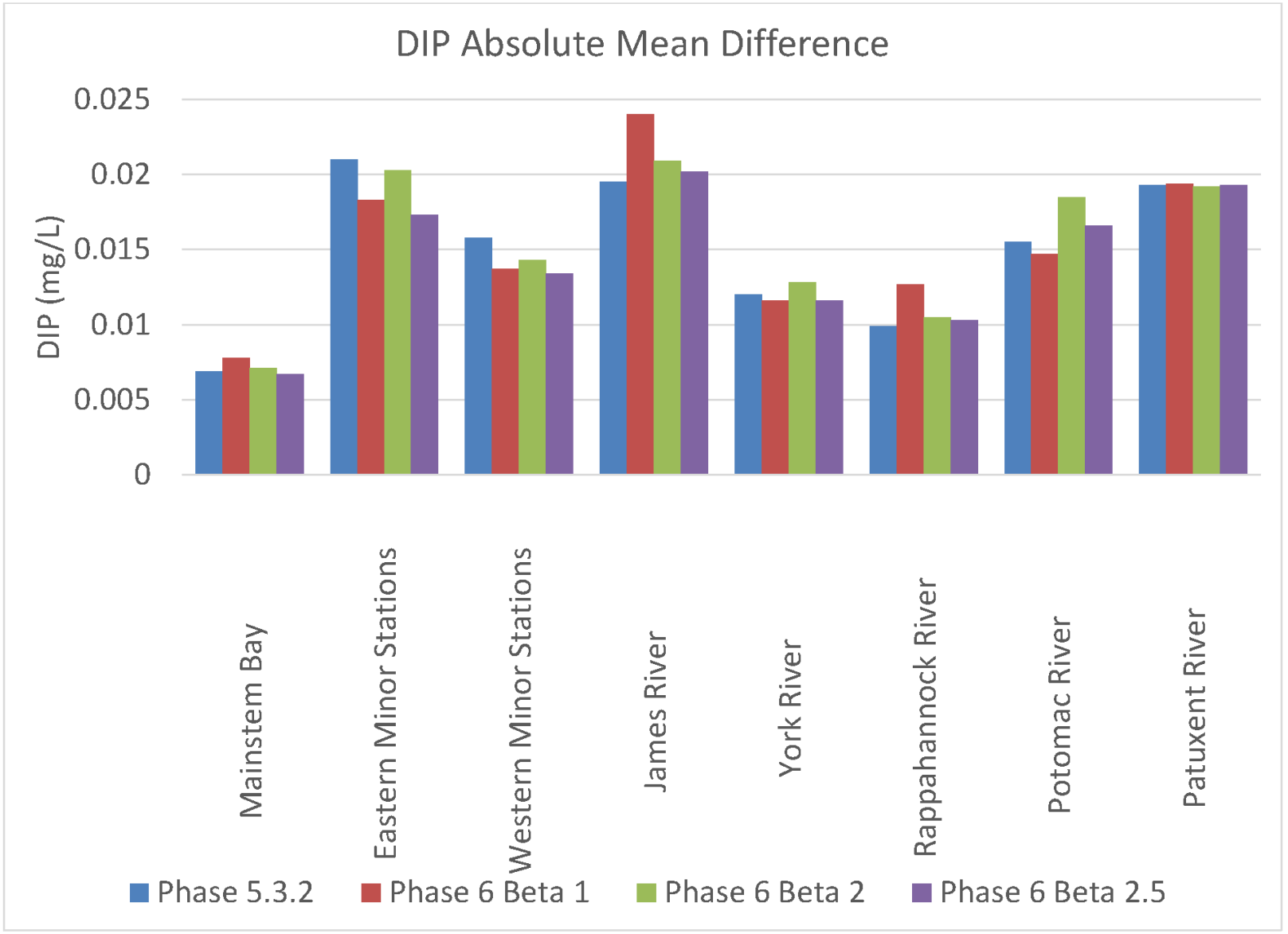

Nitrate Mean Difference
NO3 (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5

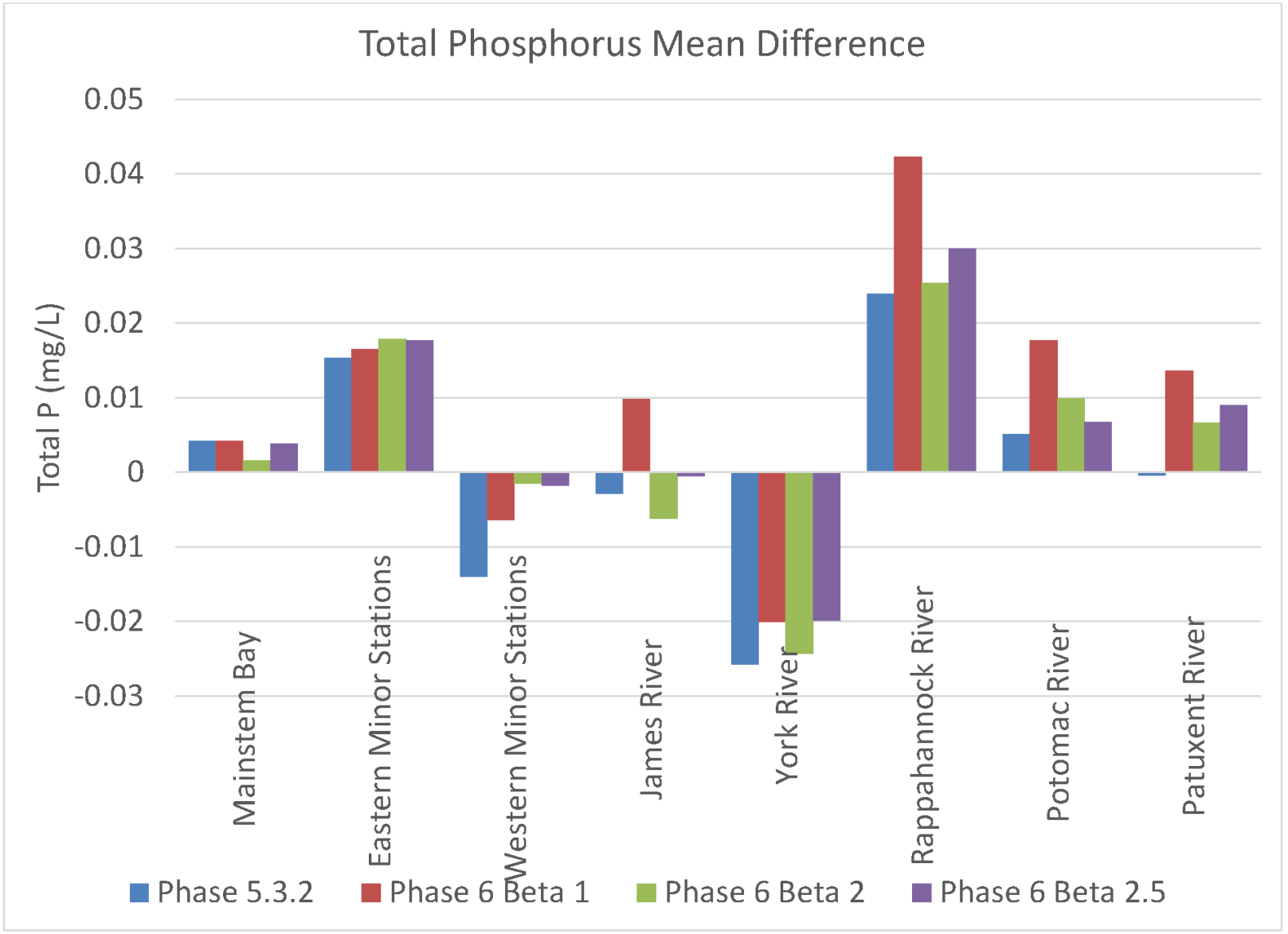

Nitrate Absolute Mean Difference
NO3 (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5

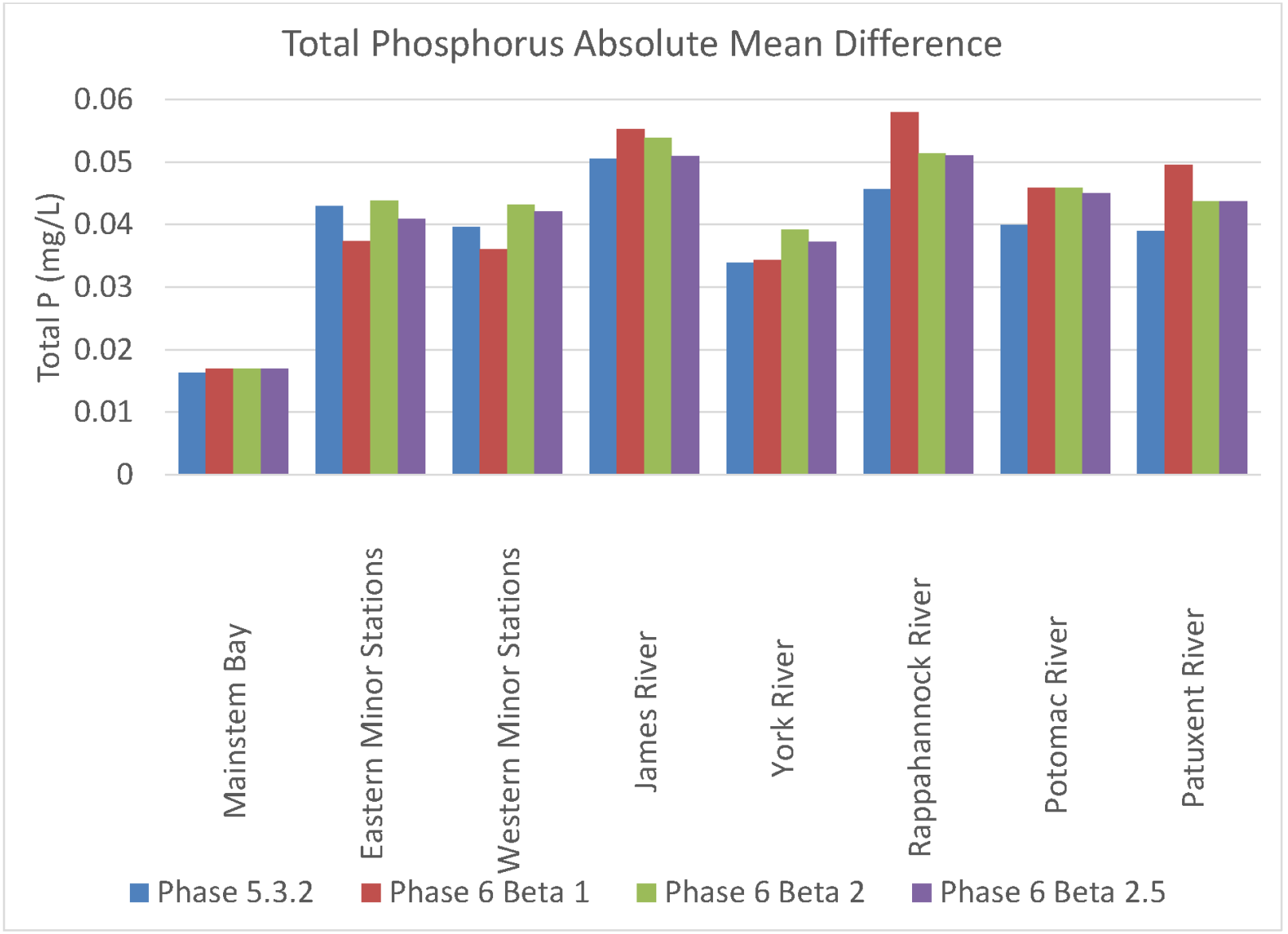

Total Nitrogen Mean Difference
Total N (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5

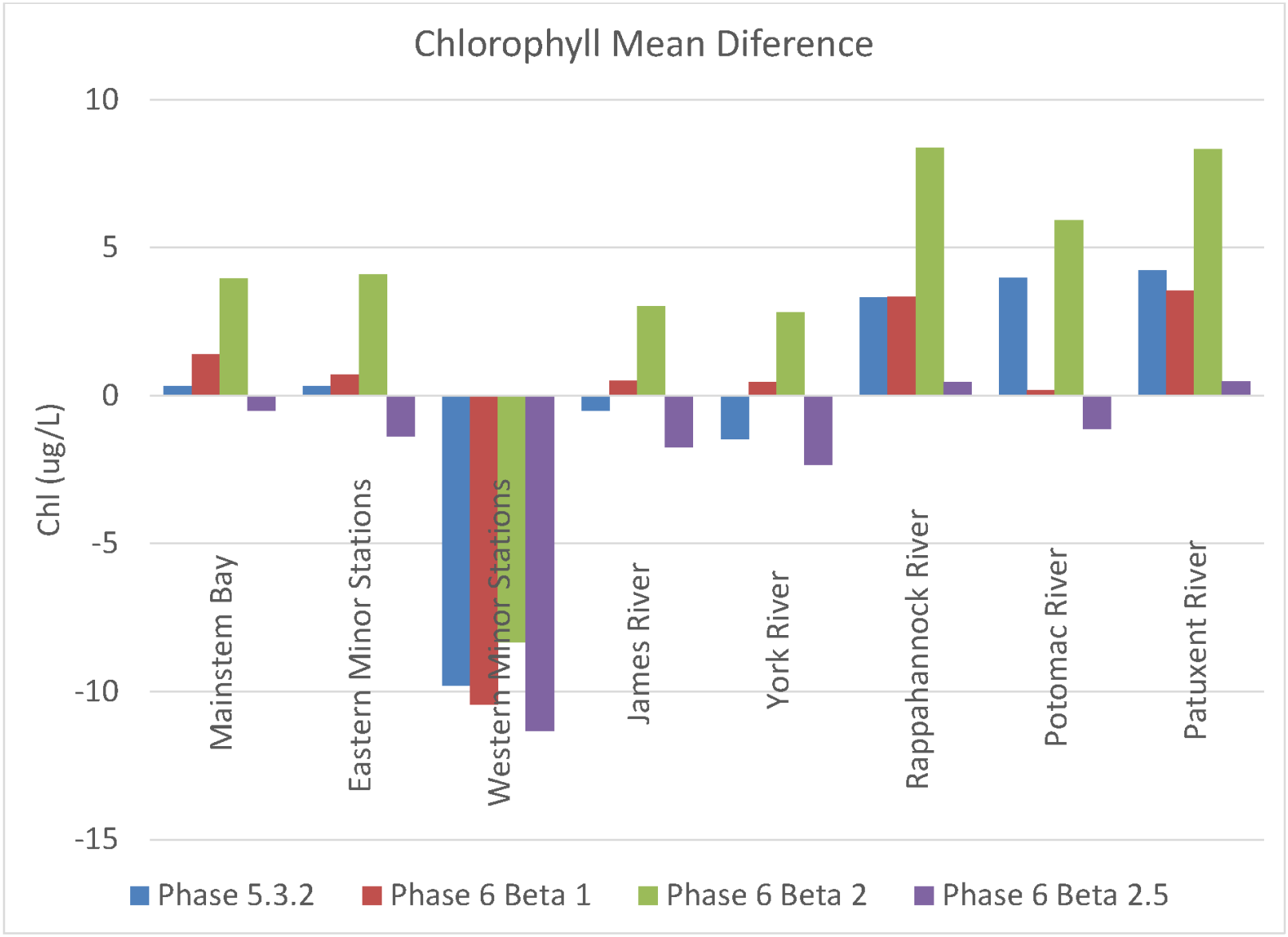

Total Nitrogen Absolute Mean Difference
Total N (mg/L)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5

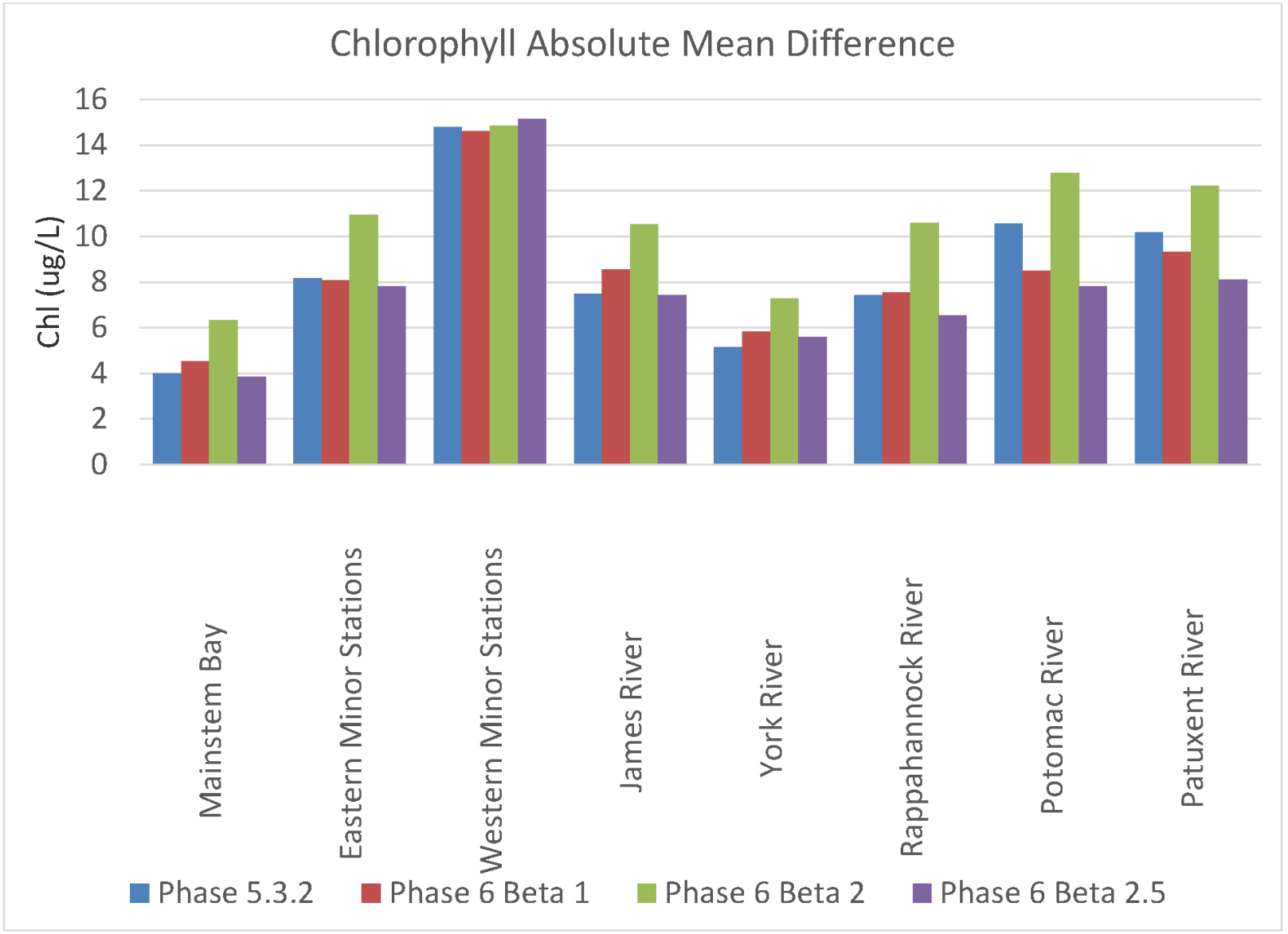

DIP Mean Difference
0.02
0.015
0.01
0.005
0
-0.005
-0.01
DIP (mg/L)
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5

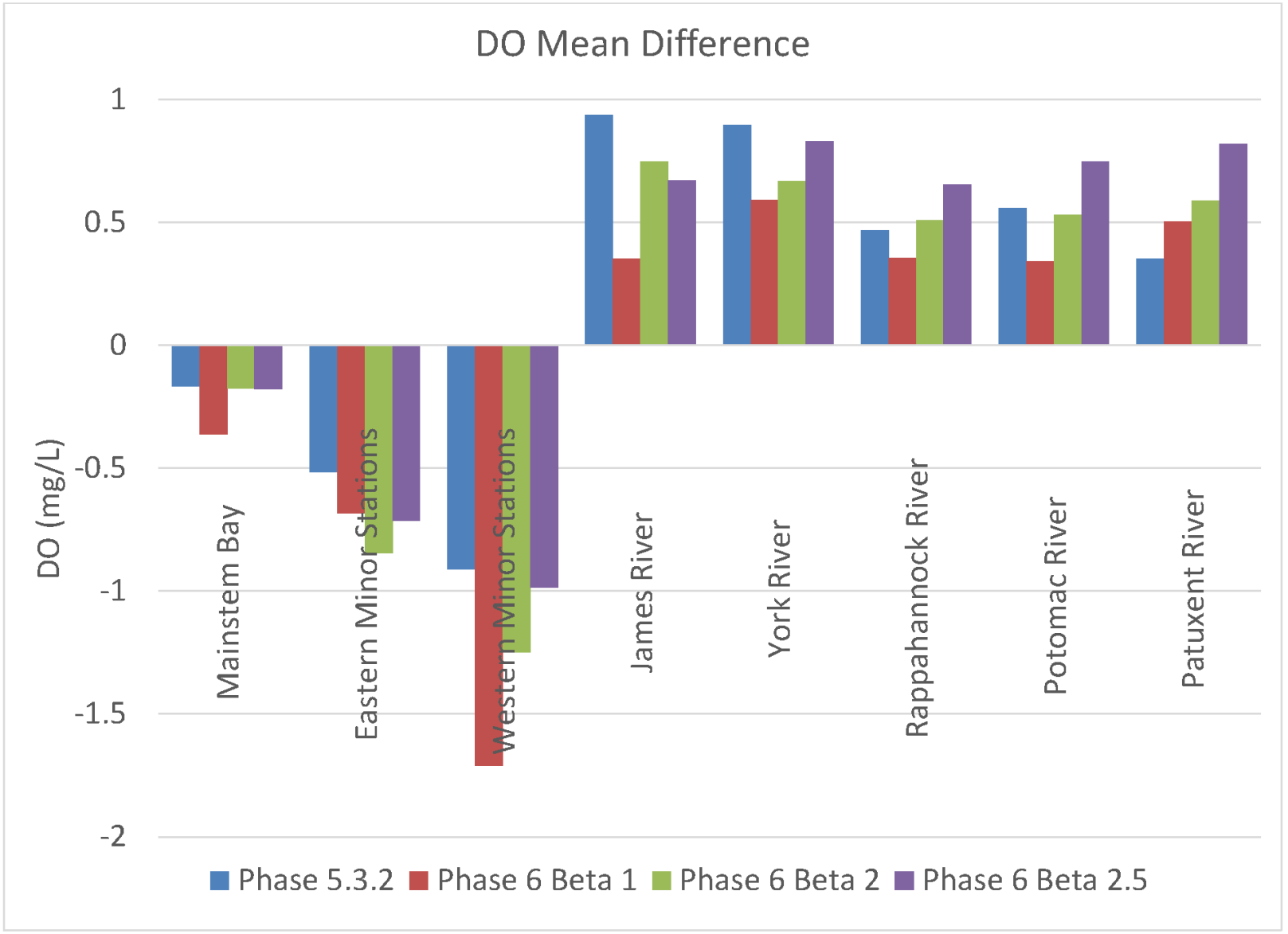

DIP Absolute Mean Difference
DIP (mg/L)
0.025
0.02
0.015
0.01
0.005
0
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5

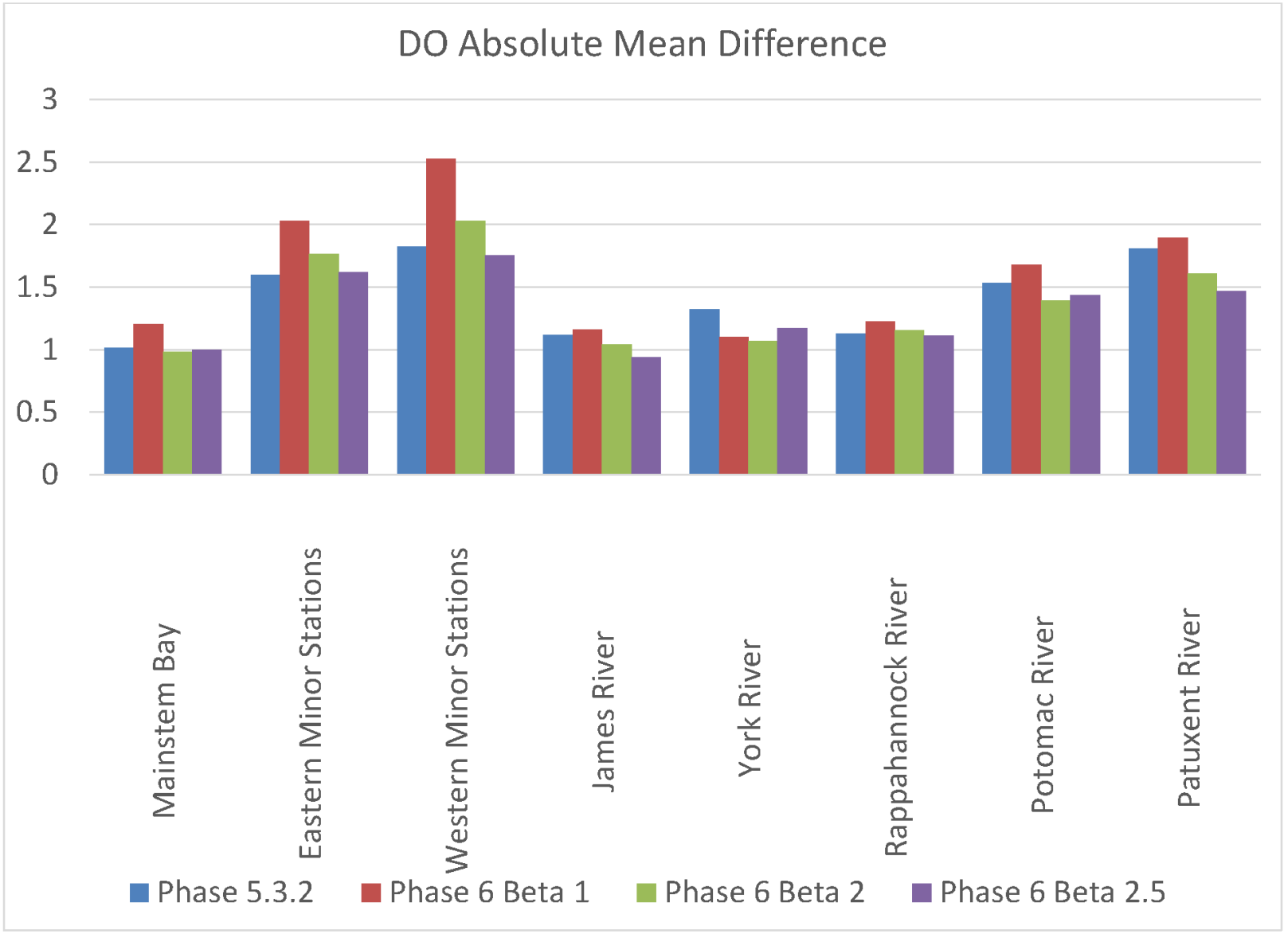

Total Phosphorus Mean Difference
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
Total P (mg/L)
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5


Total Phosphorus Absolute Mean Difference
Total P (mg/L)
0.06
0.05
0.04
0.03
0.02
0.01
0
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5


Chlorophyll Mean Diference
10
5
0
-5
-10
-15
Chl (ug/L)
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5


Chlorophyll Absolute Mean Difference
Chl (ug/L)
16
14
12
10
8
6
4
2
0
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5


DO Mean Difference
DO (mg/L)
1
0.5
0
-0.5
-1
-1.5
-2
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5

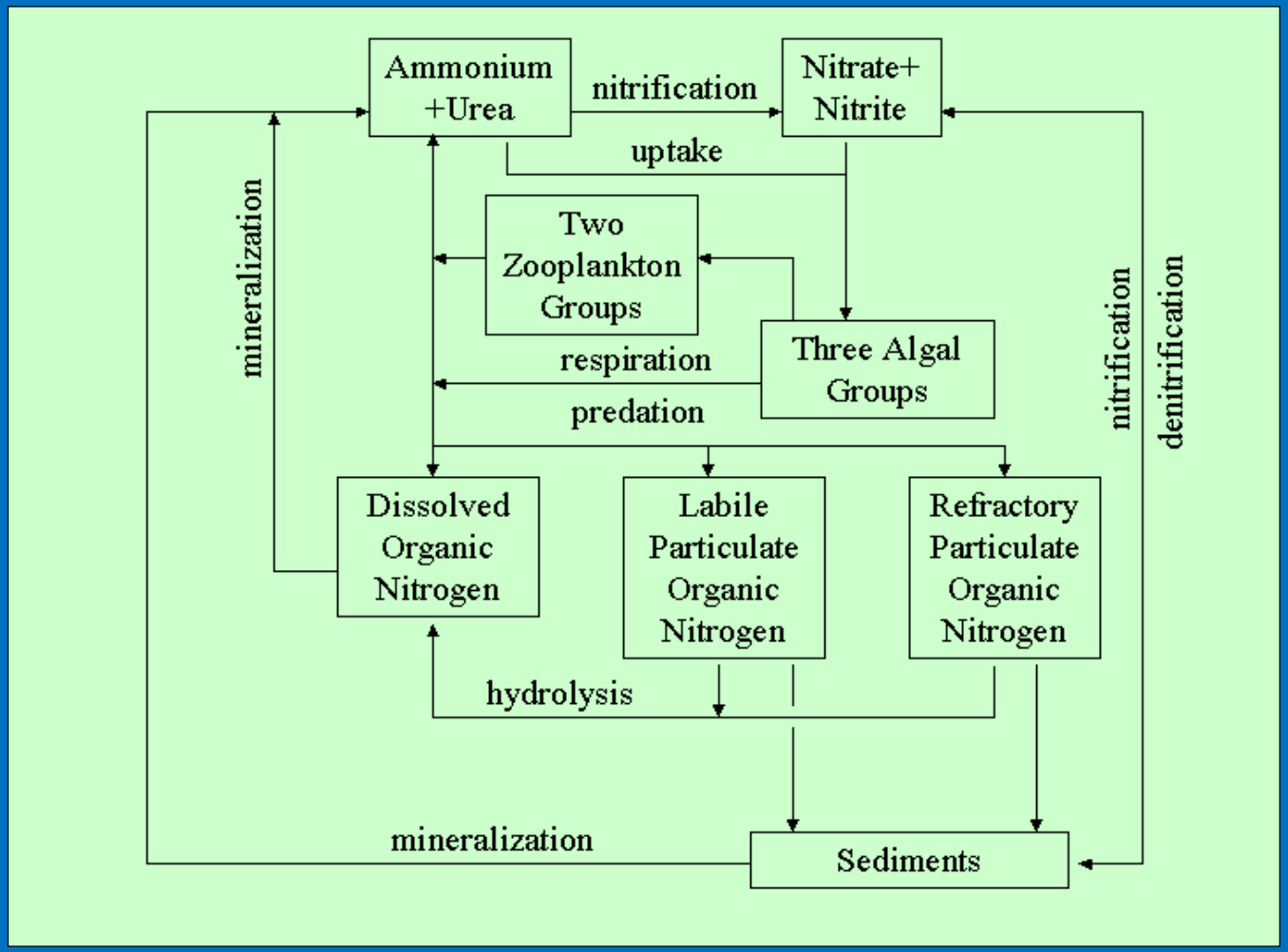

DO Absolute Mean Difference
3
2.5
2
1.5
1
0.5
0
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Phase 5.3.2
Phase 6 Beta 1
Phase 6 Beta 2
Phase 6 Beta 2.5

Summary

- DIP – Difficult to see trends or major changes. Model is high and always has been. Little difference from P5.3.2 to Phase 6 Beta 2.5
- Total P – No trend or uniform effect. We are about where we were with P5.3.2.
- NO3 – We are closer to zero MD for most systems. Best results so far for Phase 6 loads. Maybe a little better than P5.3.2.

Summary

- Total N – Every system has higher TN than Phase 5.3.2. We are improving our model response to Phase 6 loads but at this moment, TN calibration is universally deteriorated.
- Chlorophyll – Generally lower than P5.3.2. Also lower than earlier versions with Phase 6 loads. No significant change from P5.3.2.
- Dissolved Oxygen – Higher in some systems, lower in others. Difficult to see trend or meaningful improvement over P5.3.2. We are improving over initial model response to Phase 6 loads.



We can easily move nitrate around but there are only two ways to get rid of nitrogen: denitrification or burial.

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Sediment flux modeling: Simulating nitrogen, phosphorus, and silica cycles

Jeremy M. Testa [a,*], Damian C. Brady [b], Dominic M. Di Toro [c], Walter R. Boynton [d], Jeffrey C. Cornwell [a], W. Michael Kemp [a]

[a] Horn Point Laboratory, University of Marylan
[b] School of Marine Sciences, University of Main
[c] Department of Civil and Environmental Engin
[d] Chesapeake Biological Laboratory, University

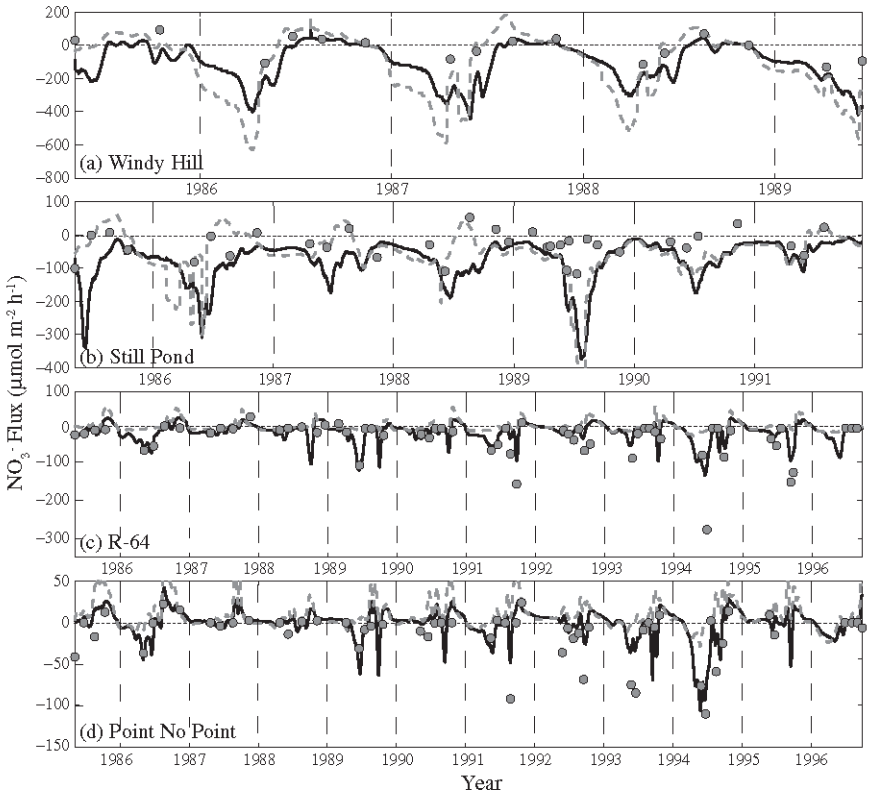
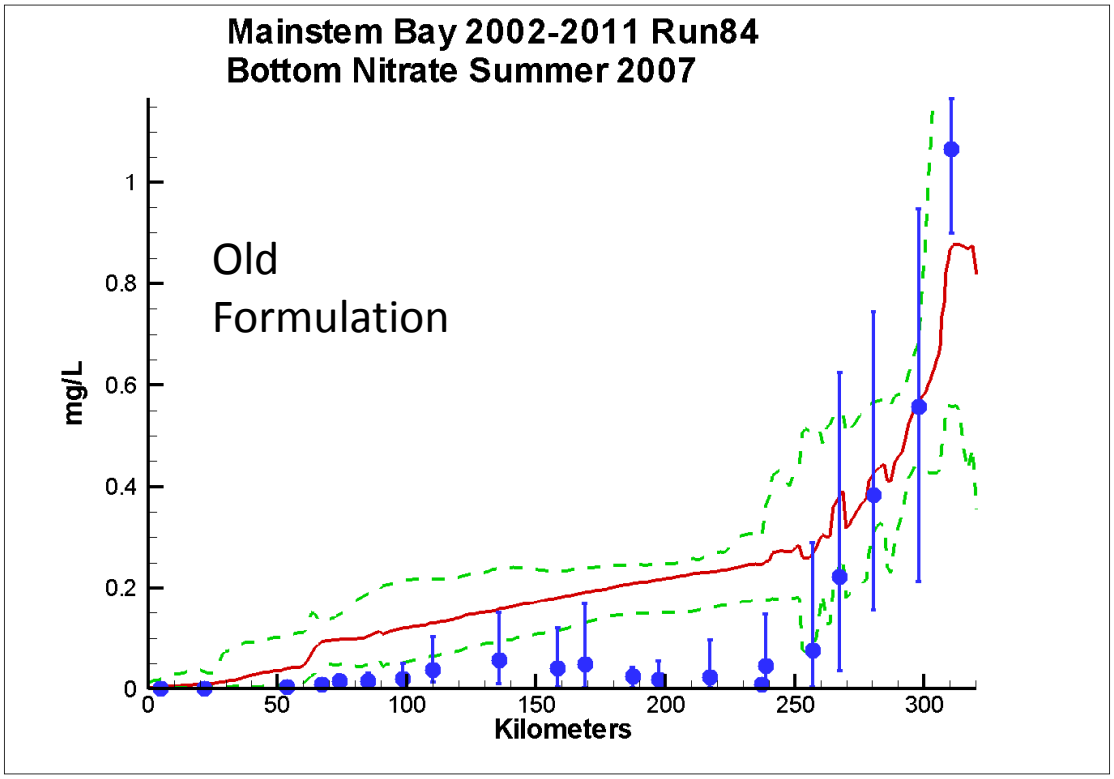
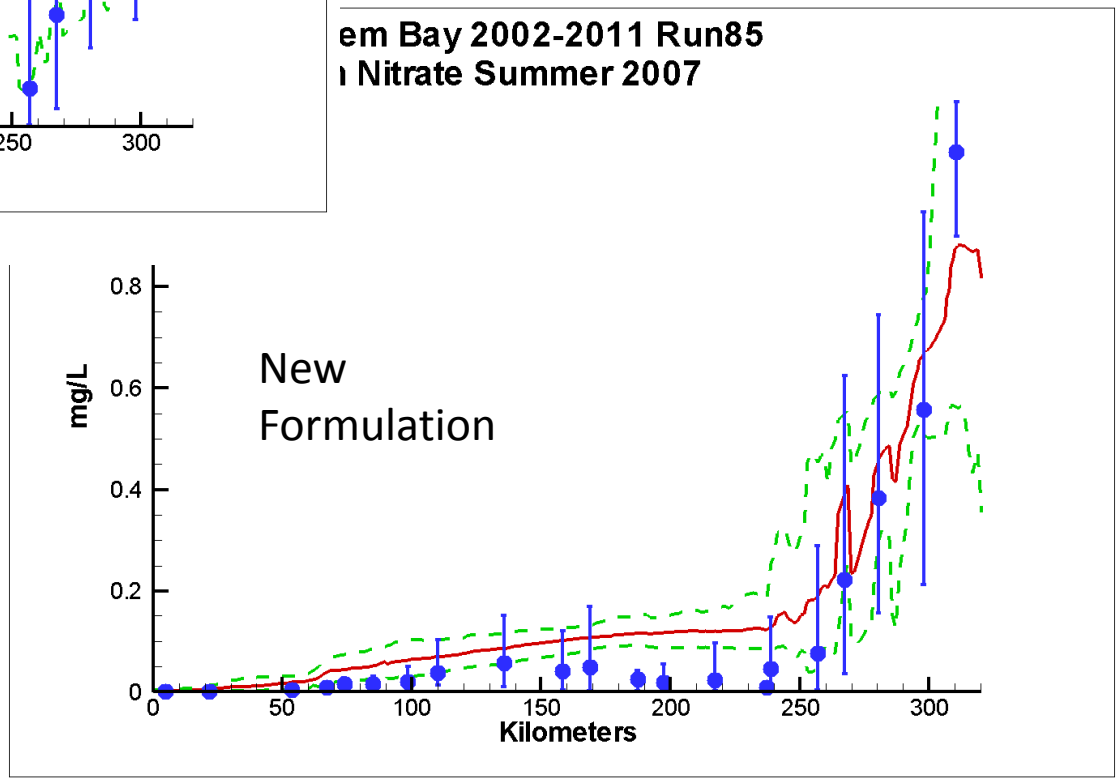
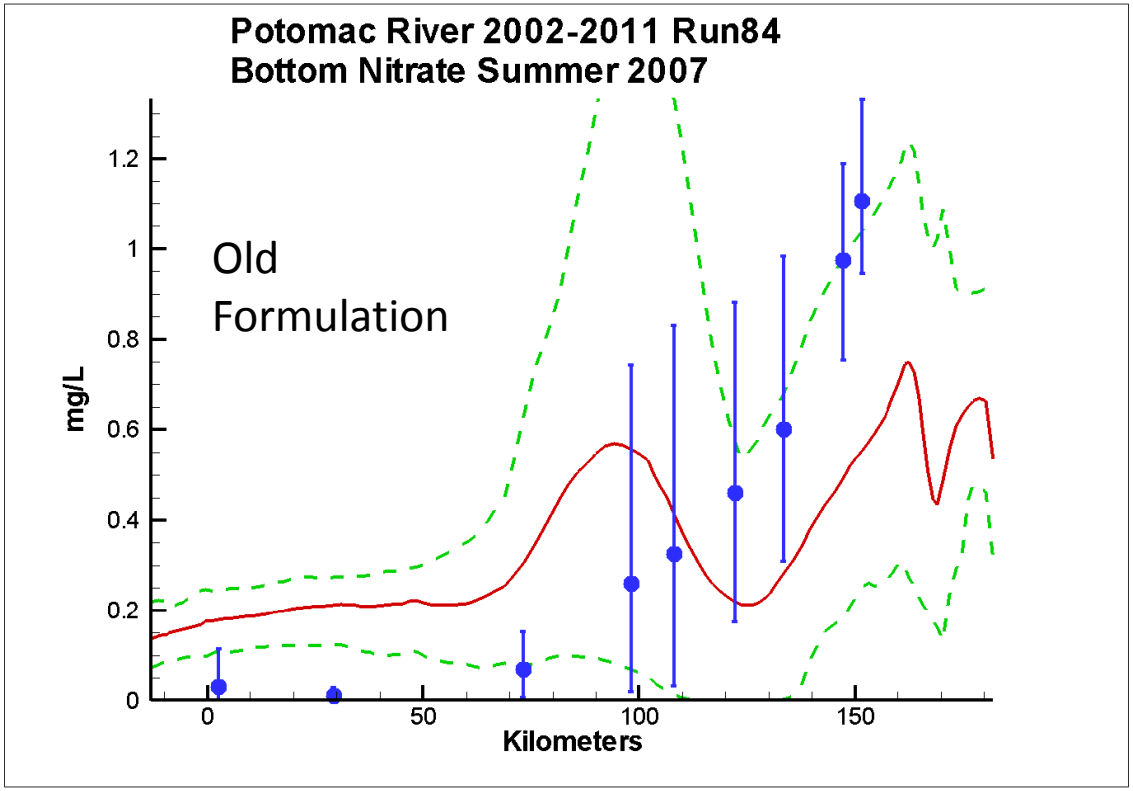
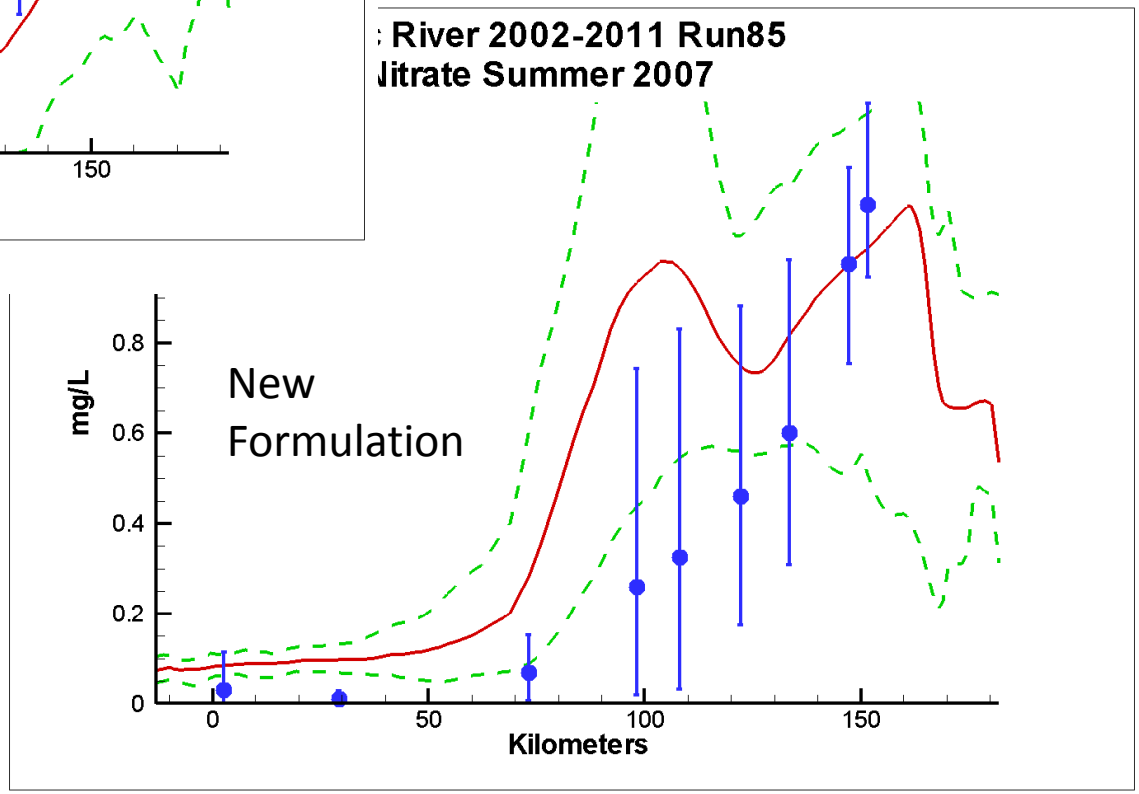


Fig. 6. Modeled (lines) and observed (circles) time series of NO_3^- flux from four stations in Chesapeake Bay (a: Windy Hill, b: Still Pond, c: R-64, d: Point No Point). Gray dashed lines represent model output using a layer 1 denitrification velocity of 0.1 m day $^{-1}$ from the original calibration, while black solid lines represent model output using the depth-independent, aerobic-layer denitrification model of 0.2 m day $^{-1}$.


Mainstem Bay 2002-2011 Run84
Bottom Nitrate Summer 2007
Old
Formulation
mg/L
0
0.2
0.4
0.6
0.8
1
0
50
100
150
200
250
300
Kilometers


em Bay 2002-2011 Run85
ı Nitrate Summer 2007
New
Formulation
mg/L
0
0.2
0.4
0.6
0.8
0
50
100
150
200
250
300
Kilometers


Potomac River 2002-2011 Run84
Bottom Nitrate Summer 2007
Old
Formulation
mg/L
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
Kilometers


River 2002-2011 Run85
Nitrate Summer 2007
New
Formulation
mg/L
0.8
0.6
0.4
0.2
0
0
50
100
150
Kilometers