Four Options

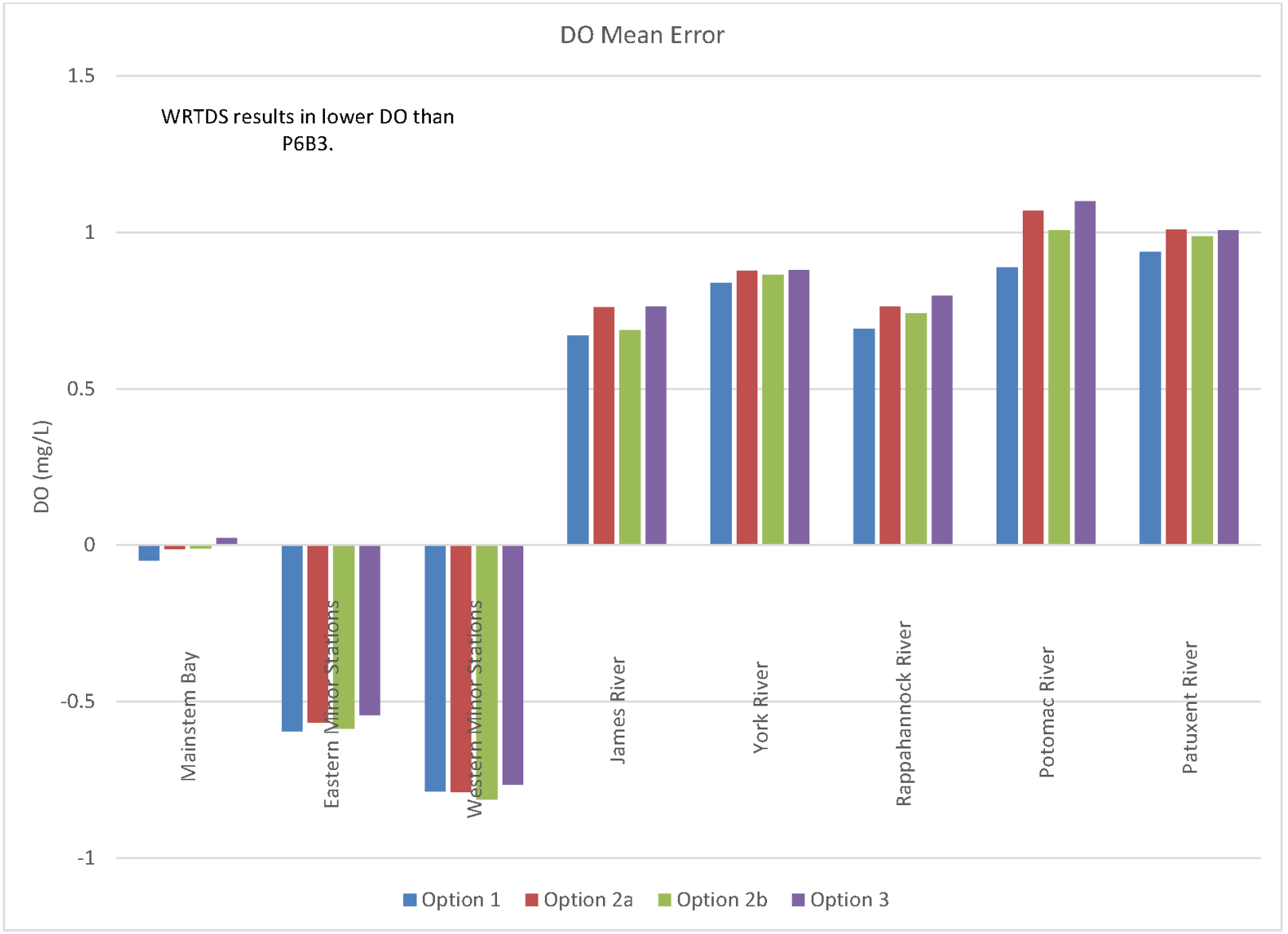
- Option 1: Loads at RIM stations from WRTDS (USGS regression program).
- Option 2a: Phase 6 Beta 3 Total N and Total P loads corrected based on WRTDS. (We are calibrating the WQSTM to this load set.)
- Option 2b: Phase 6 Beta 3 individual species corrected based on WRTDS.
- Option 3: Pure, unadulterated Phase 6 Beta 3 loads.

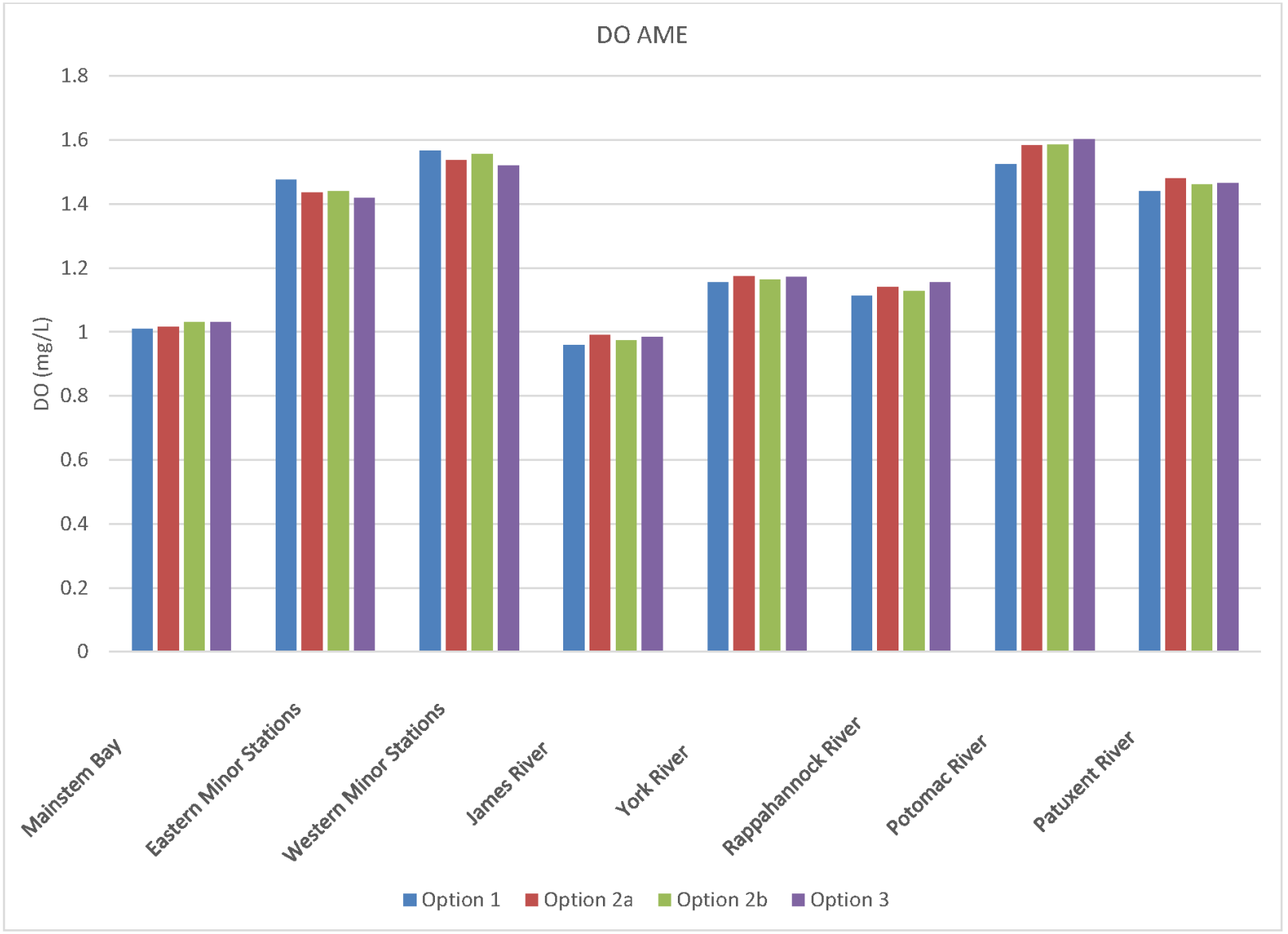
Statistics

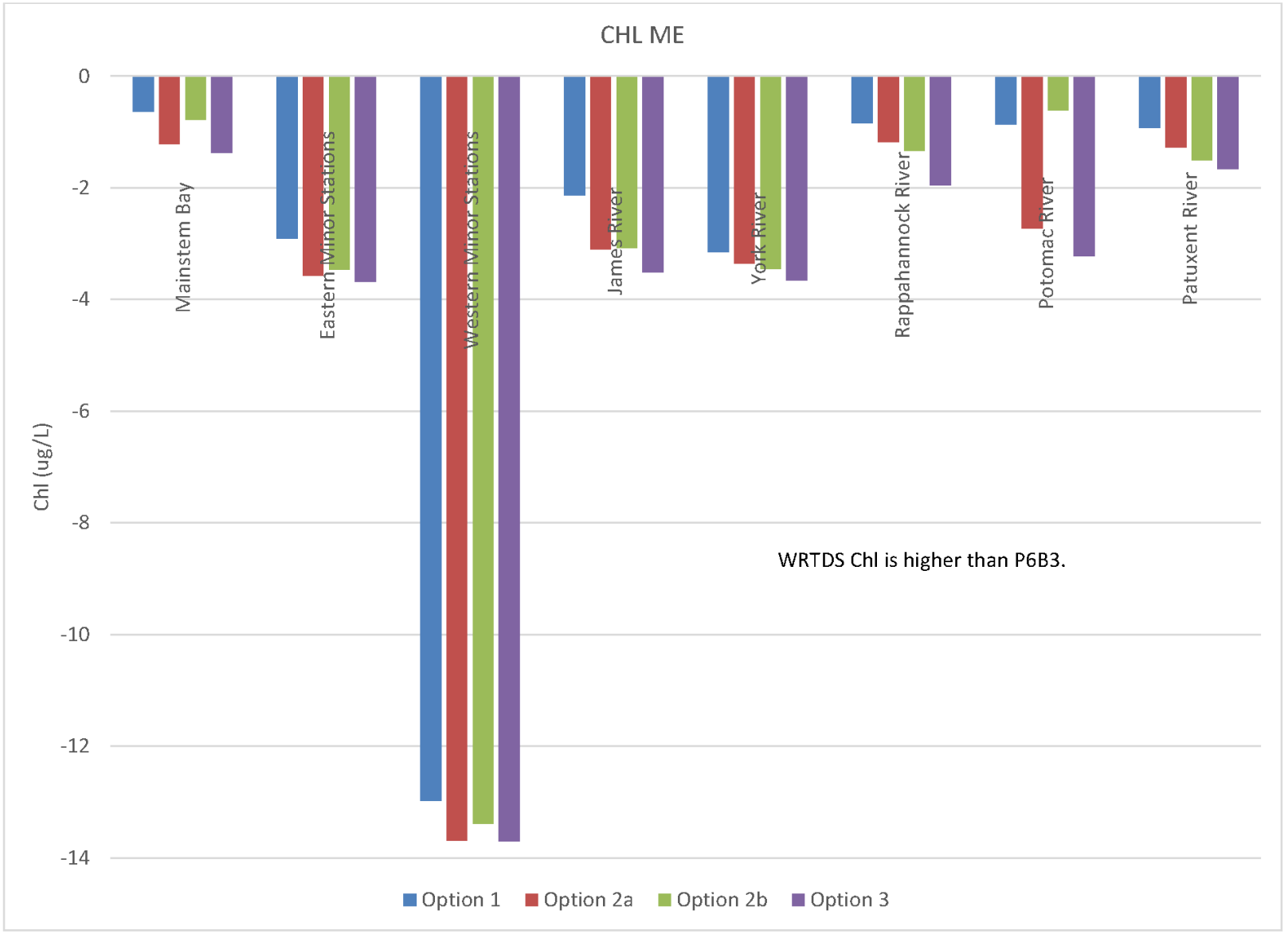
- We are going to look at some statistical summaries of model performance.
- The statistics indicate how the model reacts to various representations of loads. The statistics say nothing about accuracy of the loads.
- Mean Error (ME) – Average value of predictions minus observations. ME > 0 indicates model is high, on average. ME < 0 indicates model is low.
- Absolute Mean Error (AME) – Absolute average value of predictions minus observations. Always positive. AME = 0 indicates a perfect model.

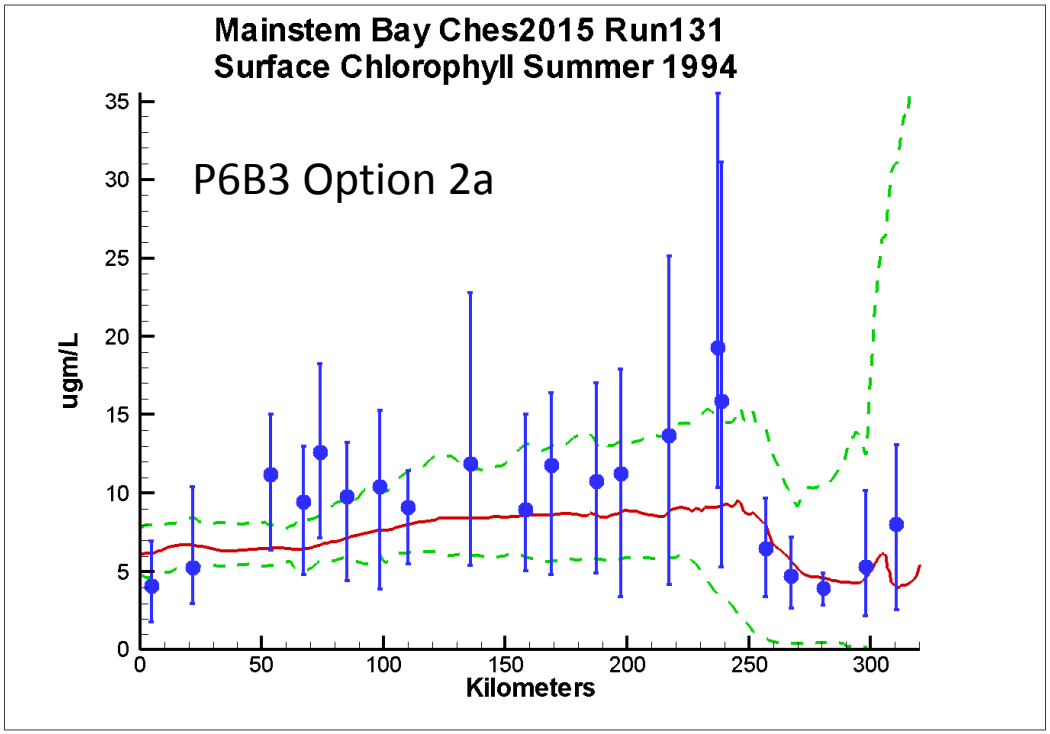
Conclusions

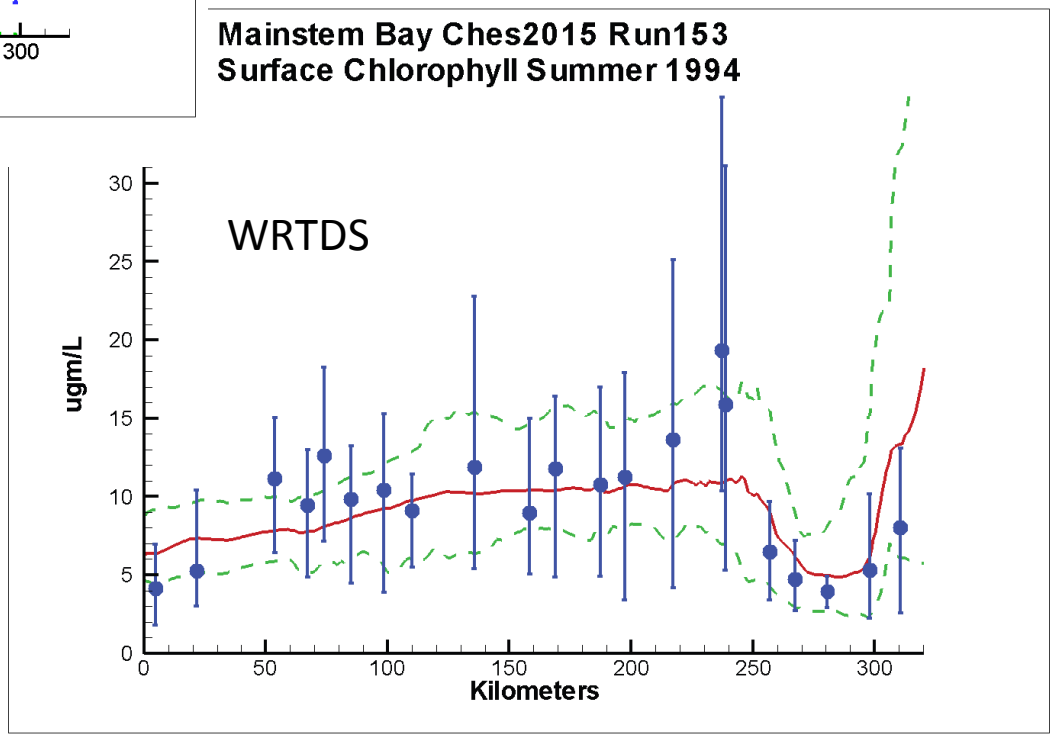
- No representation of loads clearly and consistently produces the best model results.
- WRTDS loads result in superior computations of mainstem DO and chlorophyll.
- There is no clear advantage to adjusting Phase 6 Beta 3 loads to match WRTDS loads.
- In some cases, the adjustment process results in anomalous loads and deteriorated model results. My recommendation is forego the adjustment procedure.

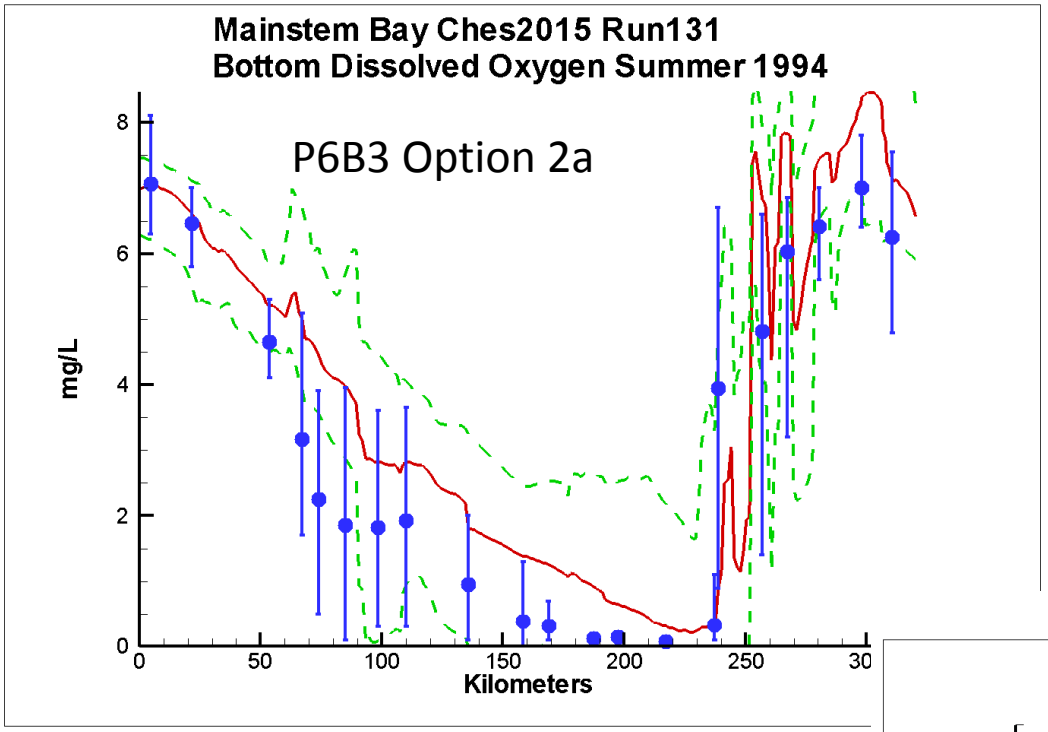

DO Mean Error
WRTDS results in lower DO than P6B3.
1.5
1
0.5
0
-0.5
-1
DO (mg/L)
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

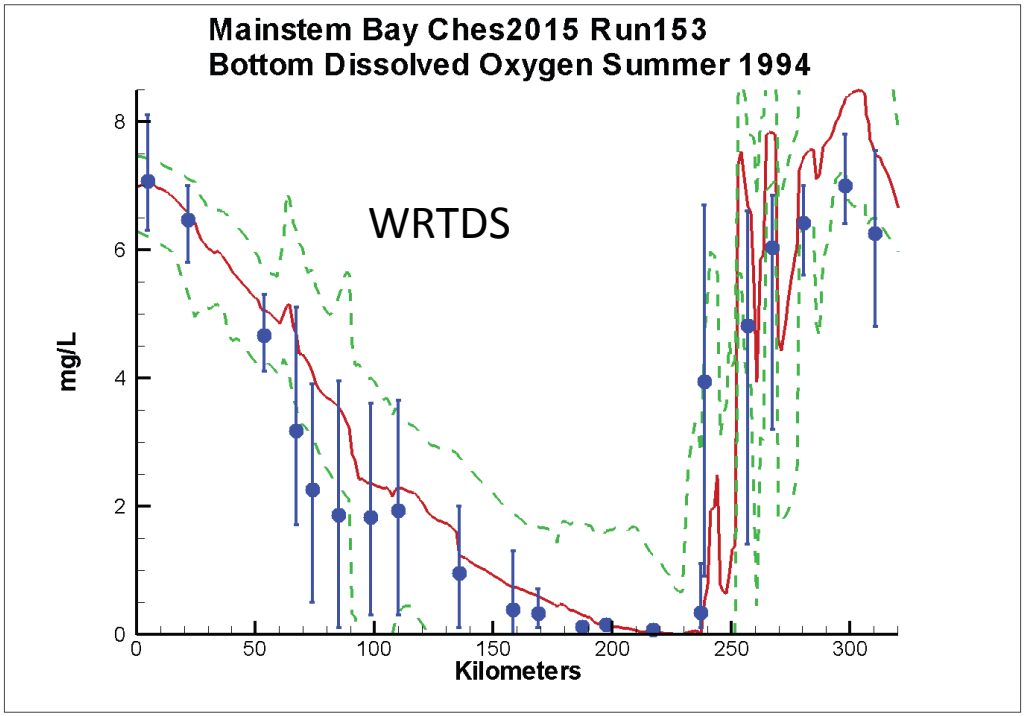

DO AME
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
DO (mg/L)
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

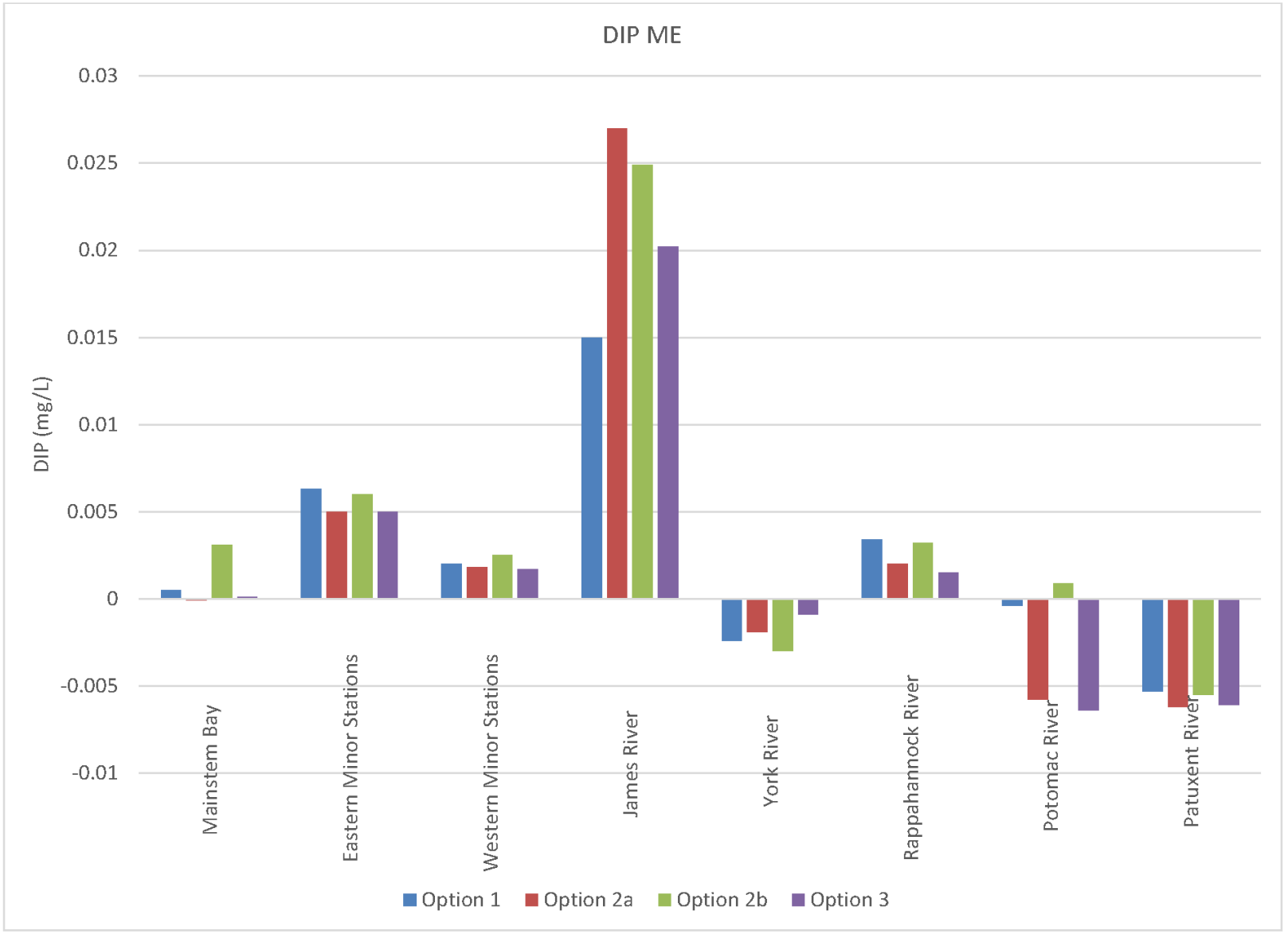

CHL ME
0
-2
-4
-6
-8
-10
-12
-14
Chl (ug/L)
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
WRTDS Chl is higher than P6B3.
Option 1
Option 2a
Option 2b
Option 3

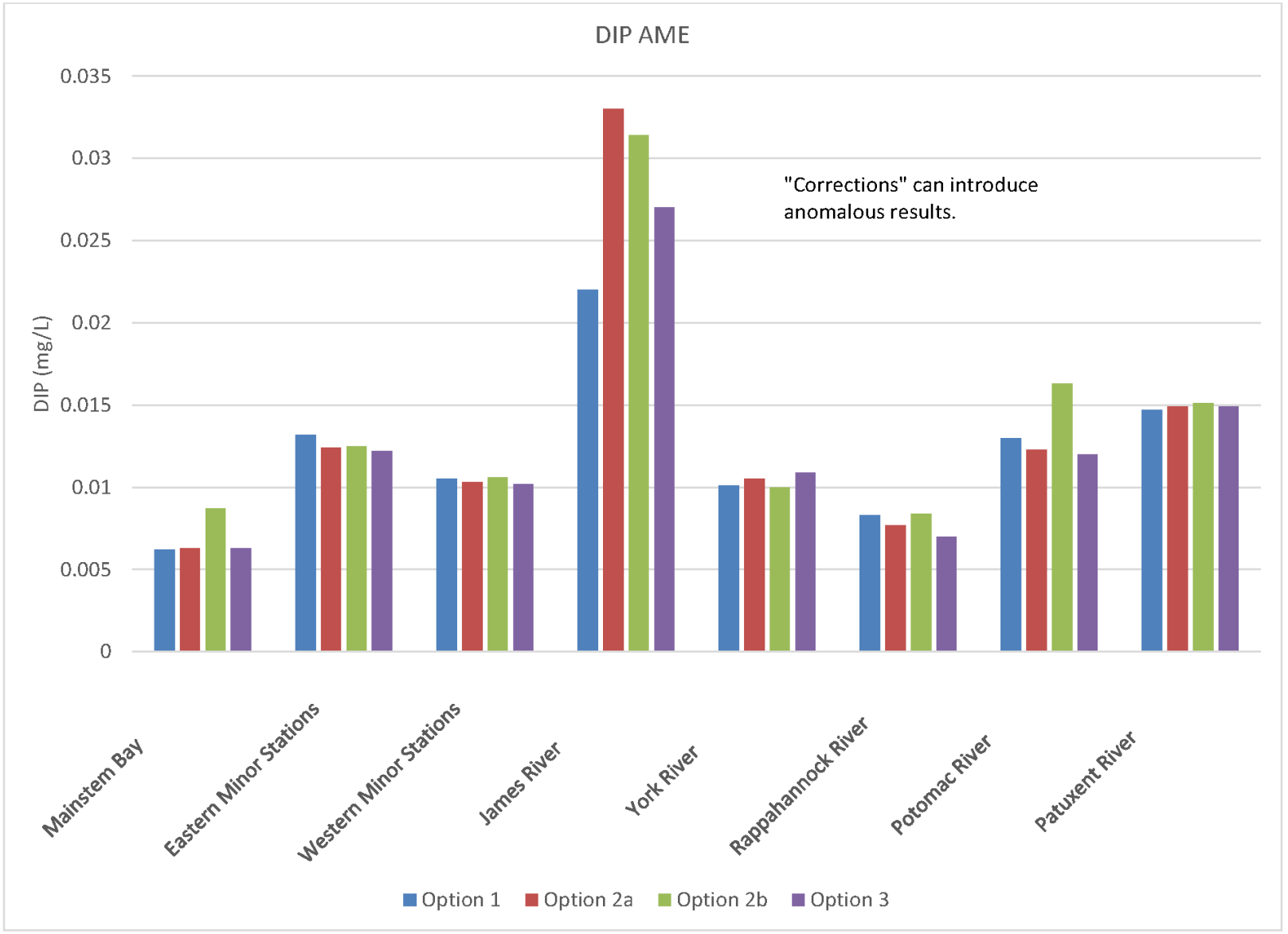

Mainstem Bay Ches2015 Run131
Surface Chlorophyll Summer 1994
P6B3 Option 2a
ugm/L
Kilometers
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300

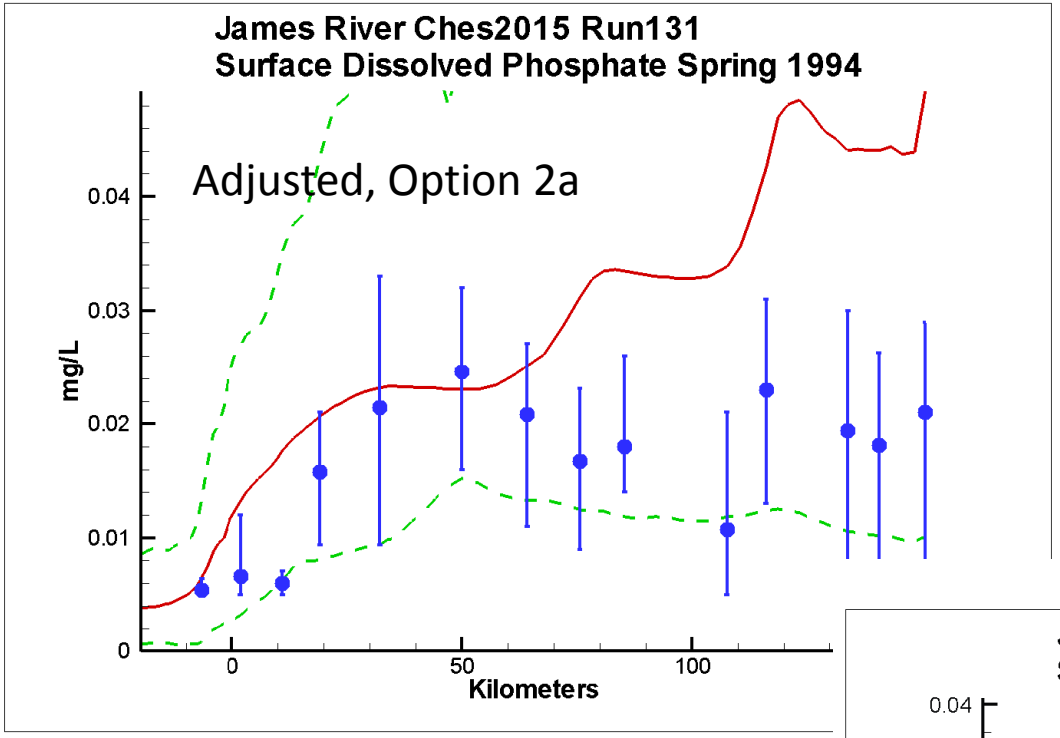

Mainstem Bay Ches2015 Run153
Surface Chlorophyll Summer 1994
WRTDS
ugm/L
Kilometers
0
5
10
15
20
25
30
0
50
100
150
200
250
300

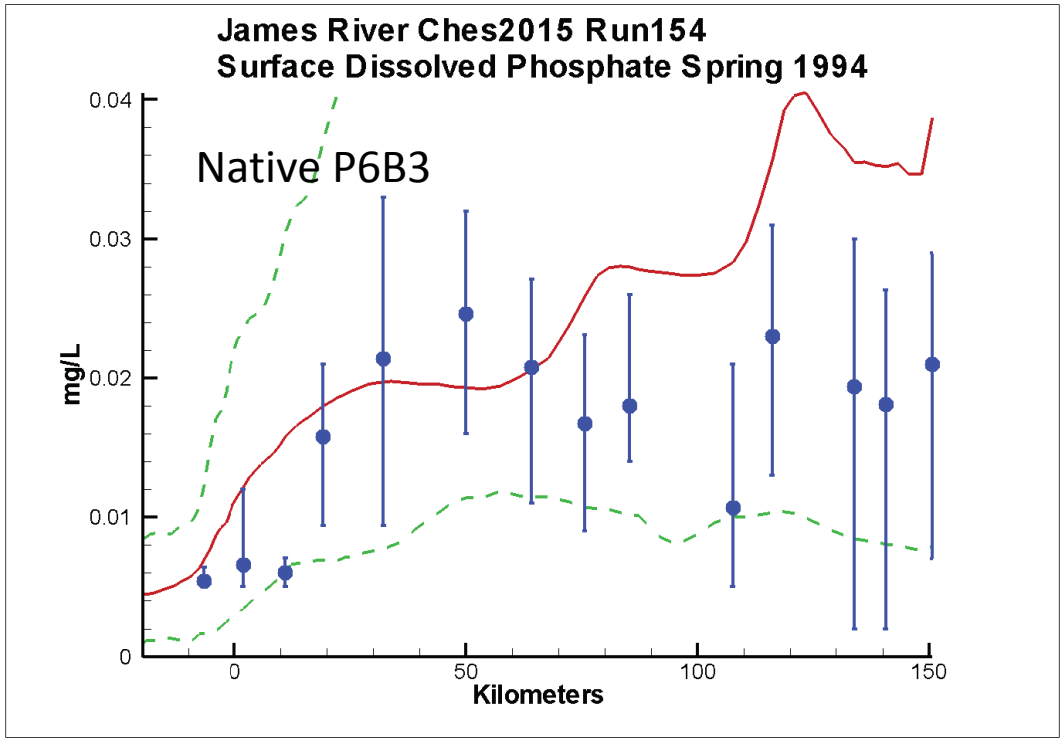

Mainstem Bay Ches2015 Run131
Bottom Dissolved Oxygen Summer 1994
P6B3 Option 2a
mg/L
Kilometers
0
2
4
6
8
0
50
100
150
200
250
30

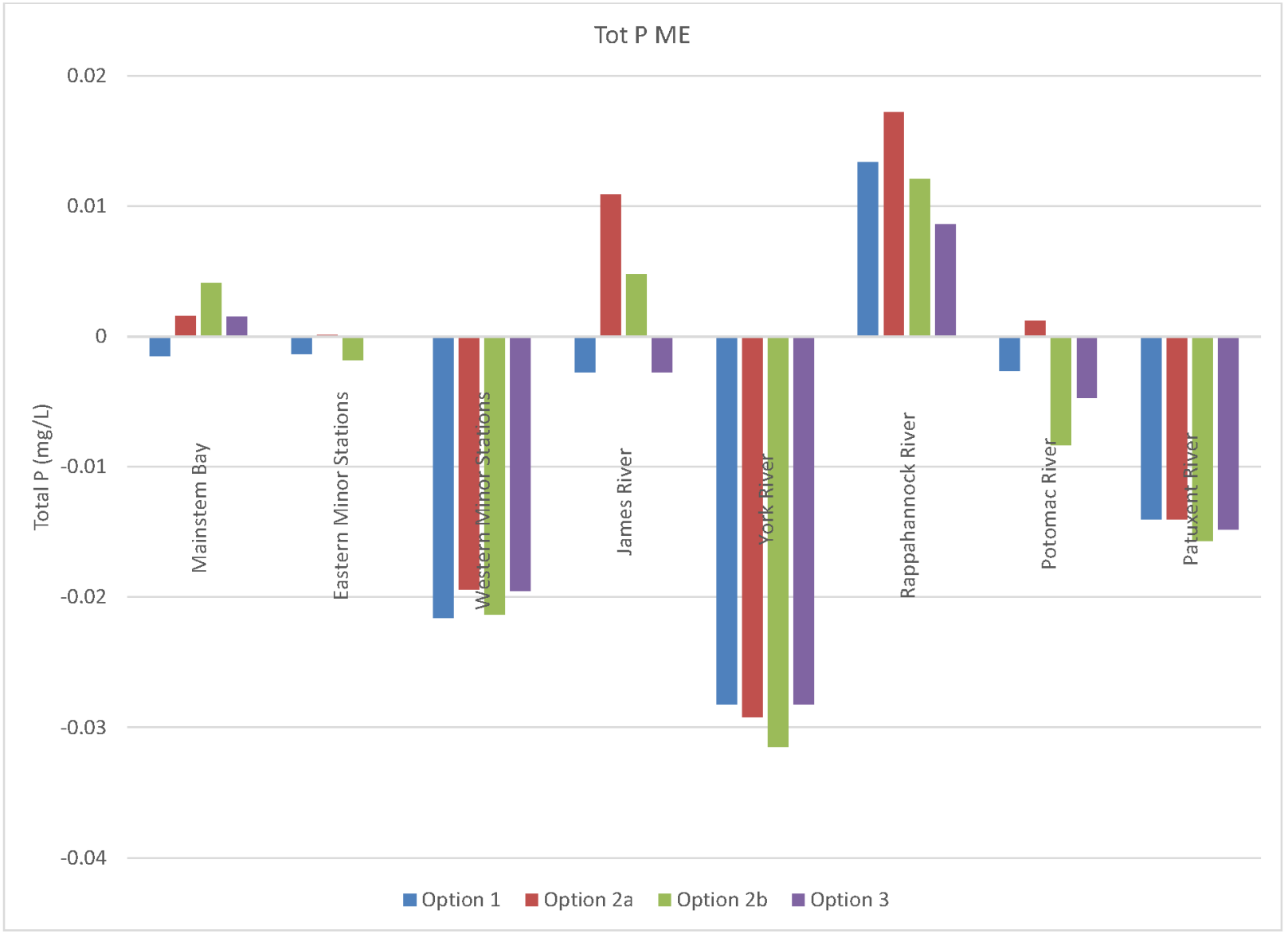

Mainstem Bay Ches2015 Run153
Bottom Dissolved Oxygen Summer 1994
WRTDS
mg/L
Kilometers
0
2
4
6
8
0
50
100
150
200
250
300

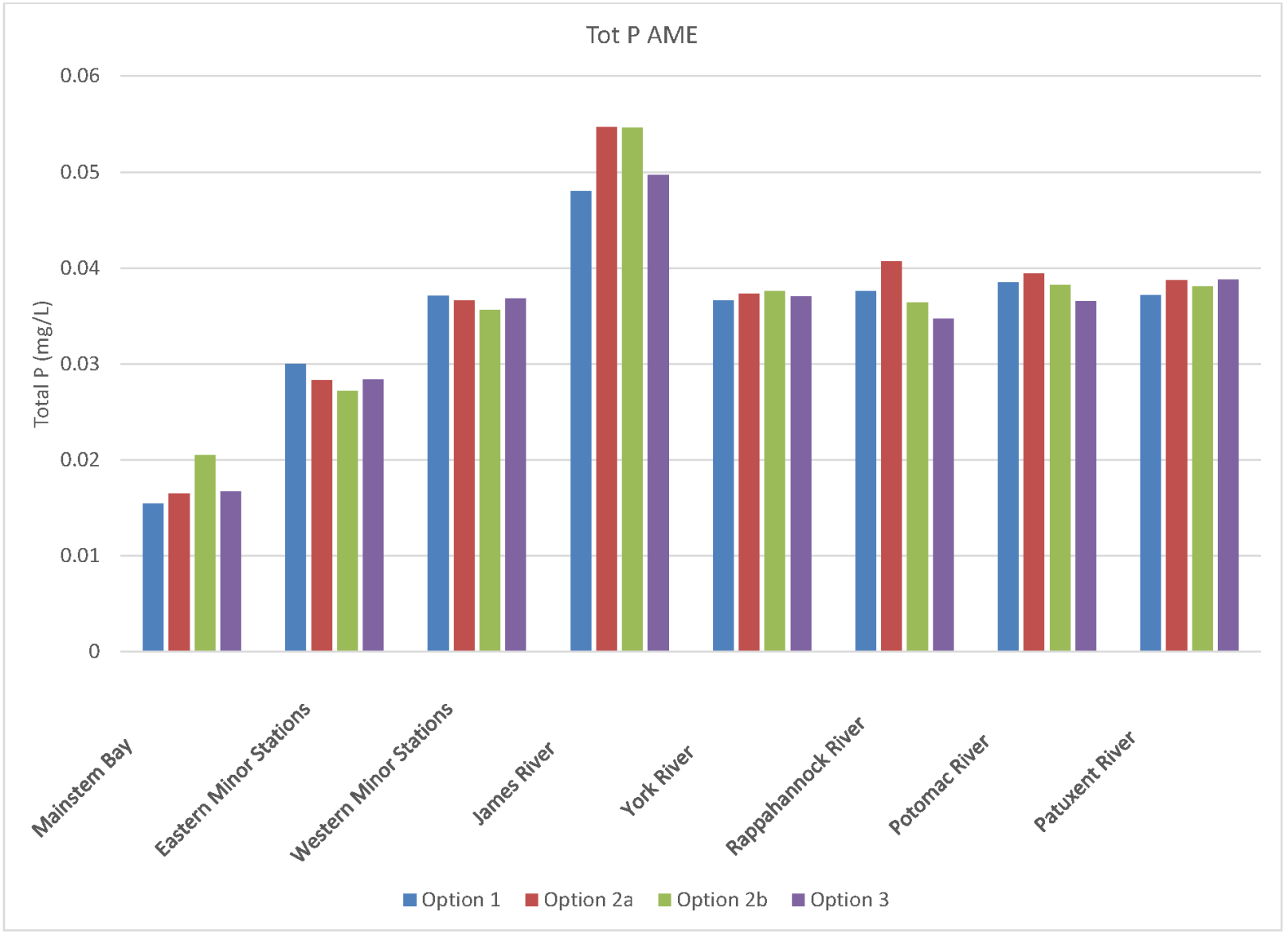

DIP ME
0.03
0.025
0.02
0.015
0.01
0.005
0
-0.005
-0.01
DIP (mg/L)
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

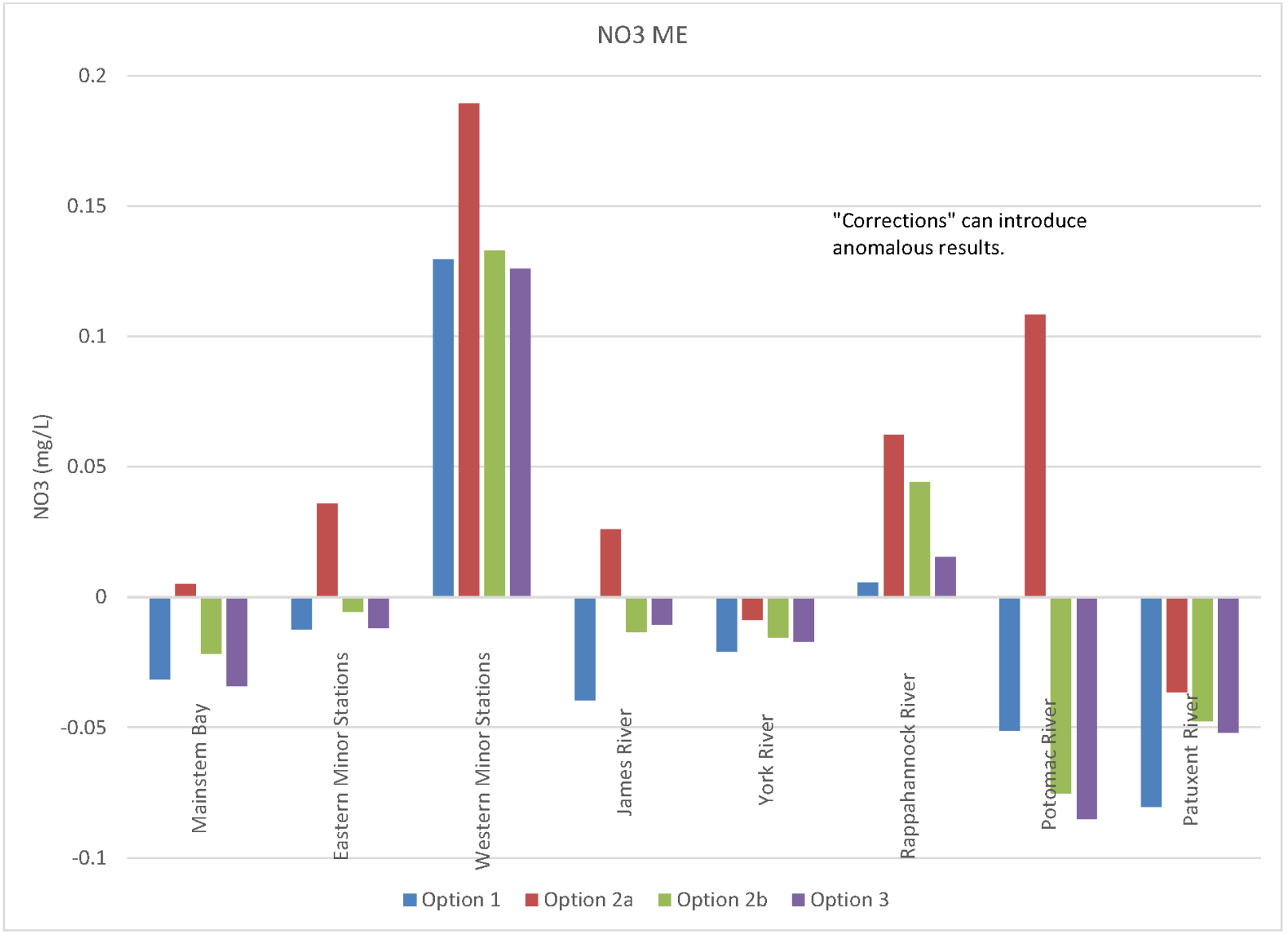

DIP AME
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
DIP (mg/L)
"Corrections" can introduce anomalous results.
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

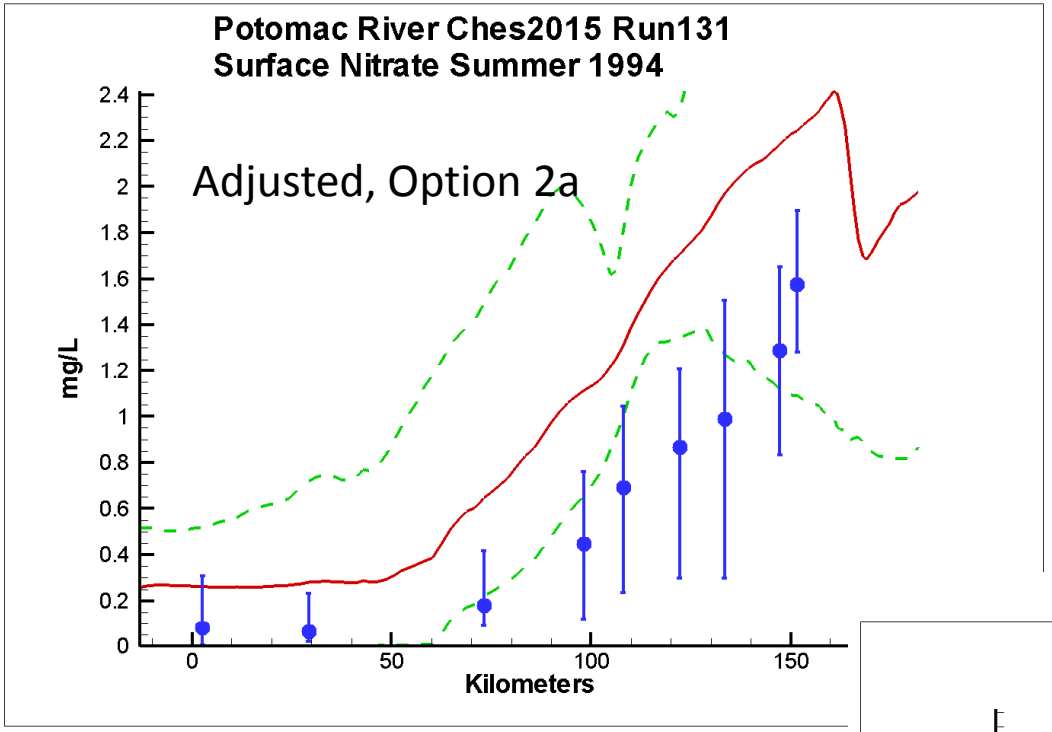

James River Ches2015 Run131
Surface Dissolved Phosphate Spring 1994
Adjusted, Option 2a
mg/L
0.04
0.03
0.02
0.01
0
0
50
100
Kilometers

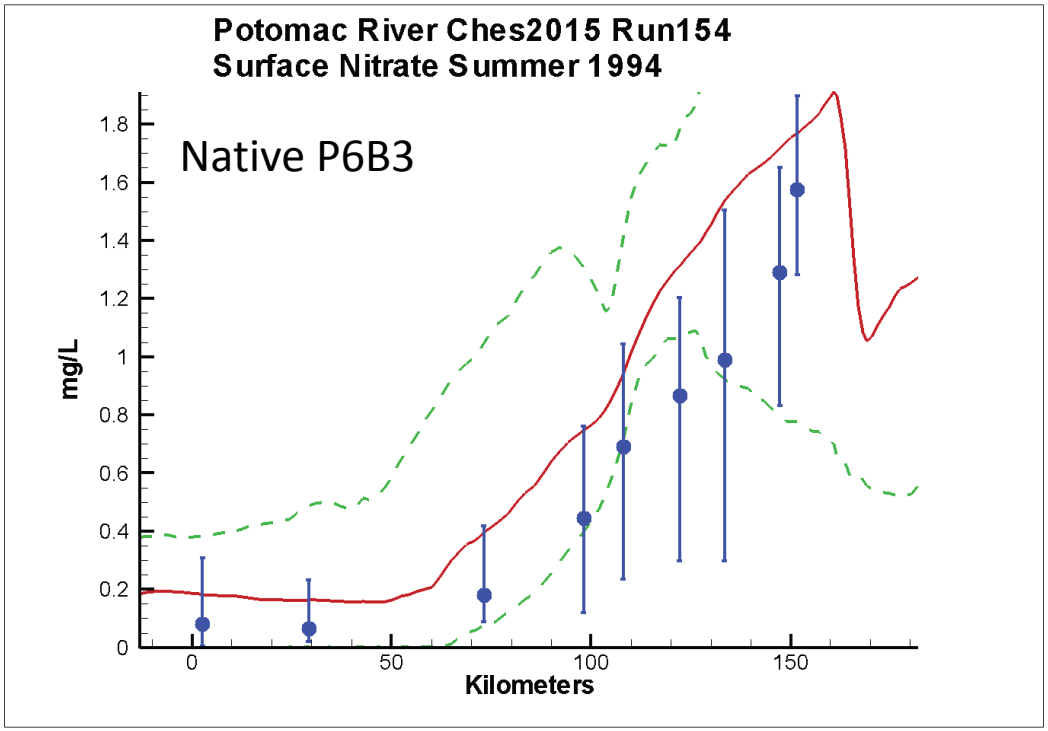

James River Ches2015 Run154
Surface Dissolved Phosphate Spring 1994
Native P6B3
mg/L
0.04
0.03
0.02
0.01
0
0
50
100
150
Kilometers

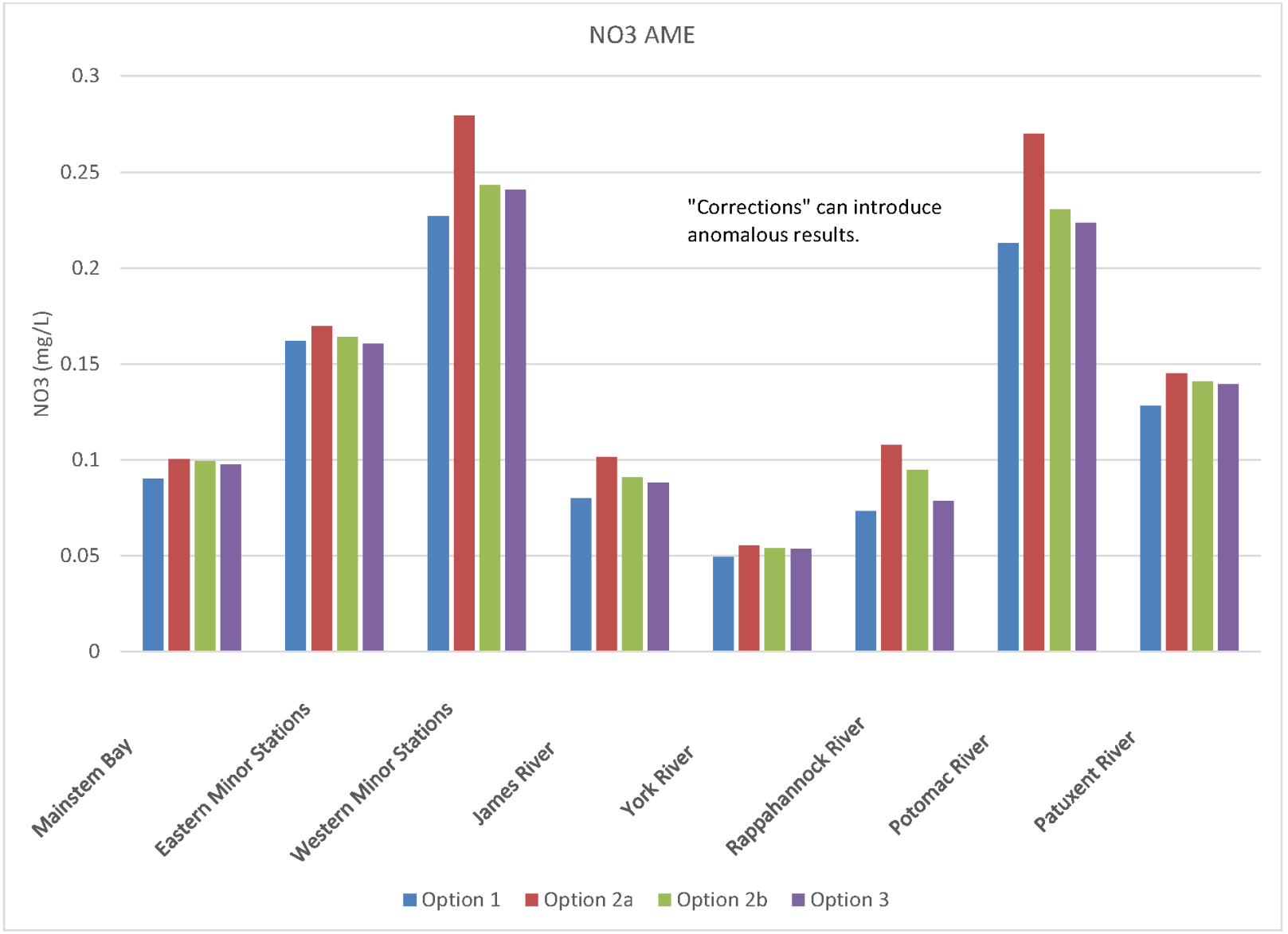

Tot P ME
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
Total P (mg/L)
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

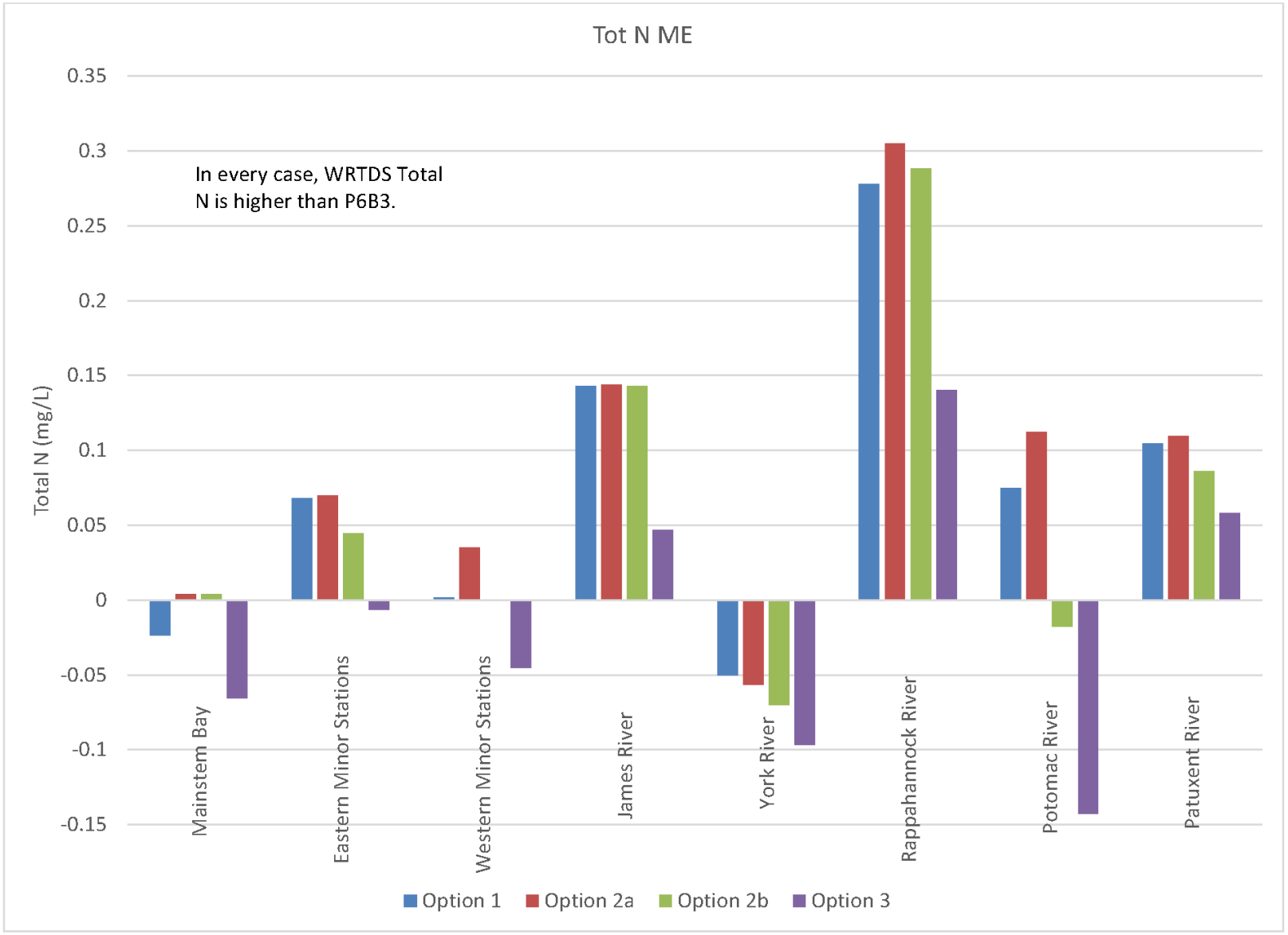

Tot P AME
0.06
0.05
0.04
0.03
0.02
0.01
0
Total P (mg/L)
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

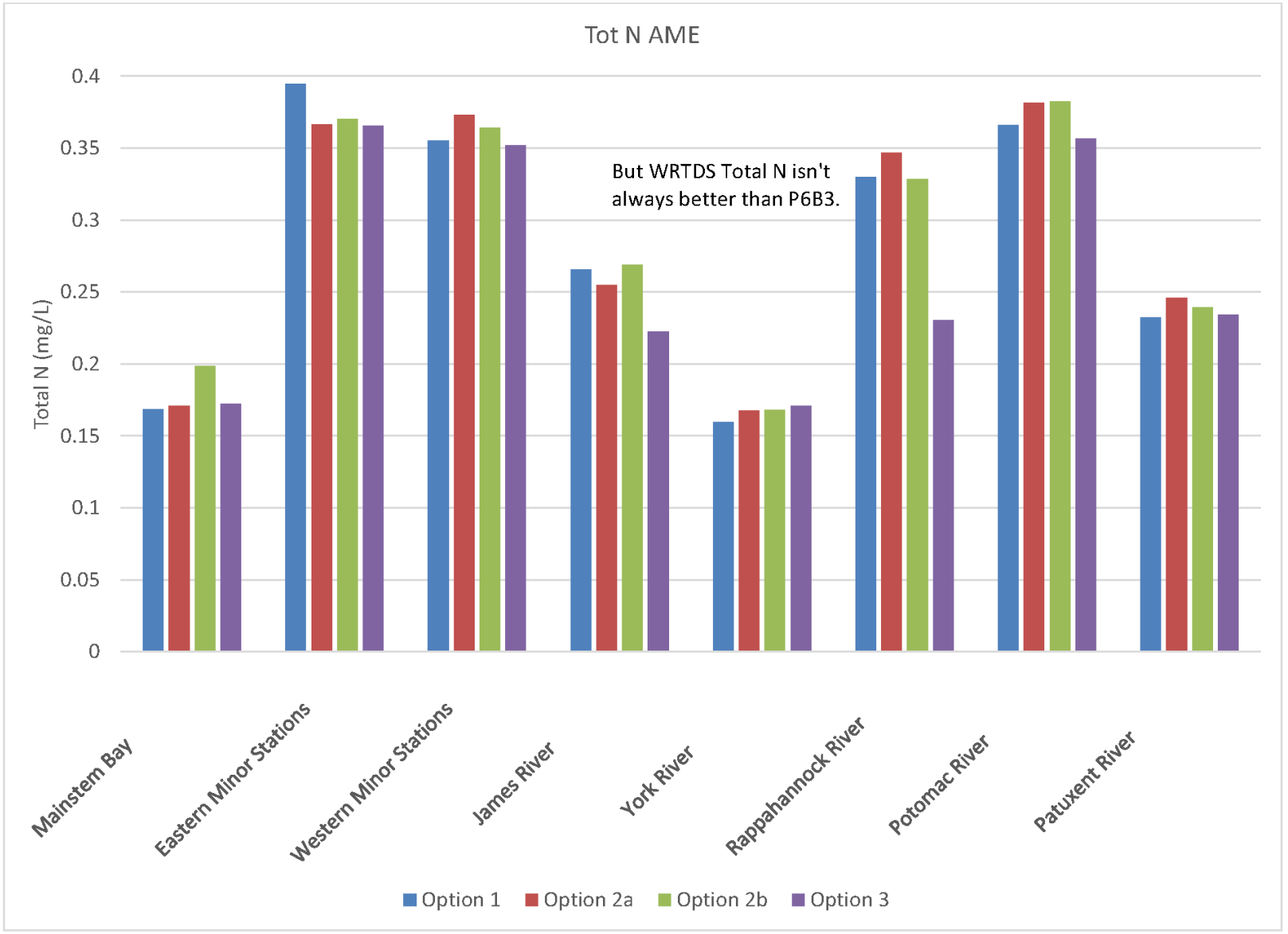

NO3 ME
0.2
0.15
0.1
0.05
0
-0.05
-0.1
NO3 (mg/L)
"Corrections" can introduce anomalous results.
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

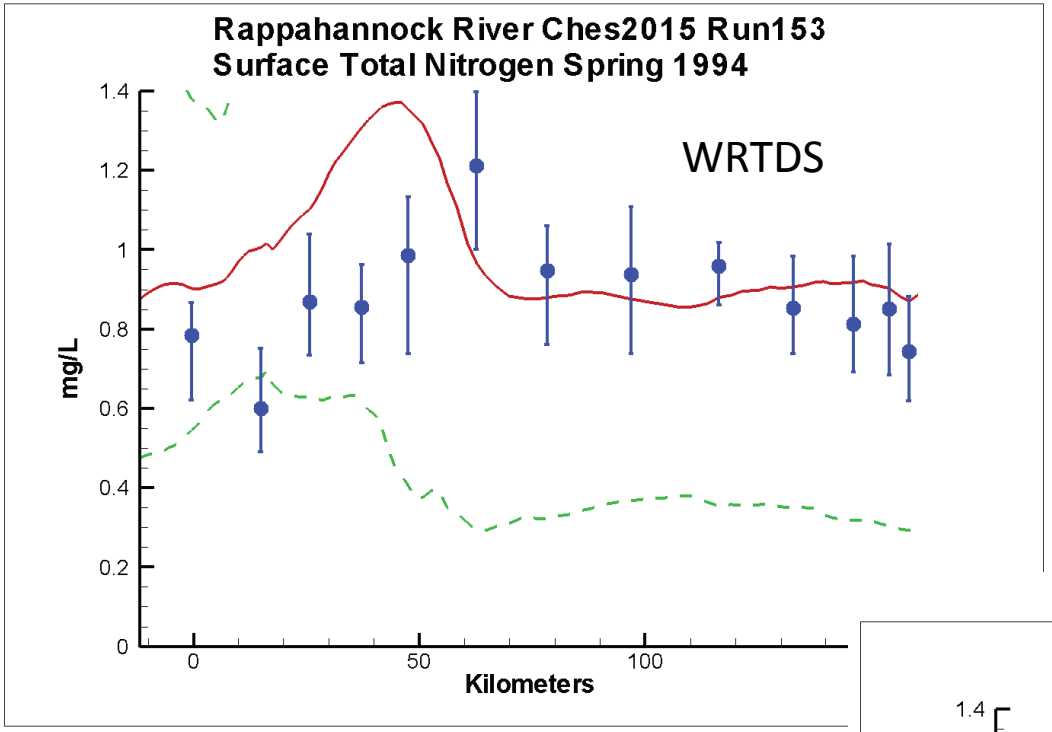

Potomac River Ches2015 Run131
Surface Nitrate Summer 1994
Adjusted, Option 2a
mg/L
Kilometers
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
0
50
100
150


Potomac River Ches2015 Run154
Surface Nitrate Summer 1994
Native P6B3
mg/L
Kilometers
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
0
50
100
150

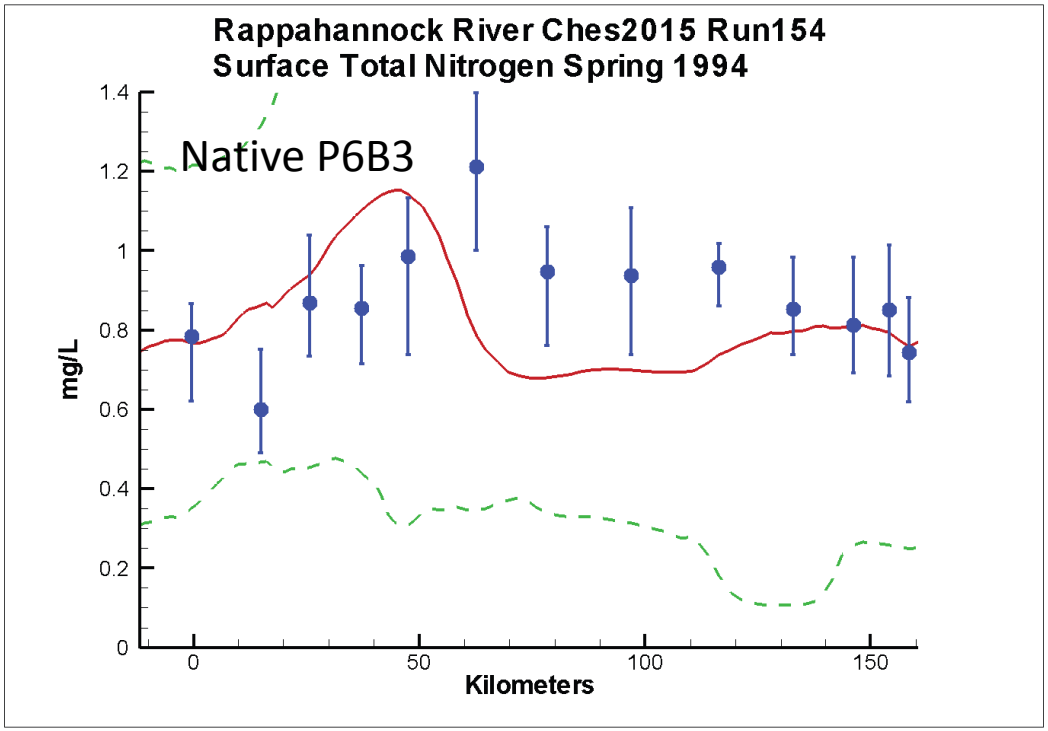

NO3 AME
0.3
0.25
0.2
0.15
0.1
0.05
0
NO3 (mg/L)
"Corrections" can introduce anomalous results.
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

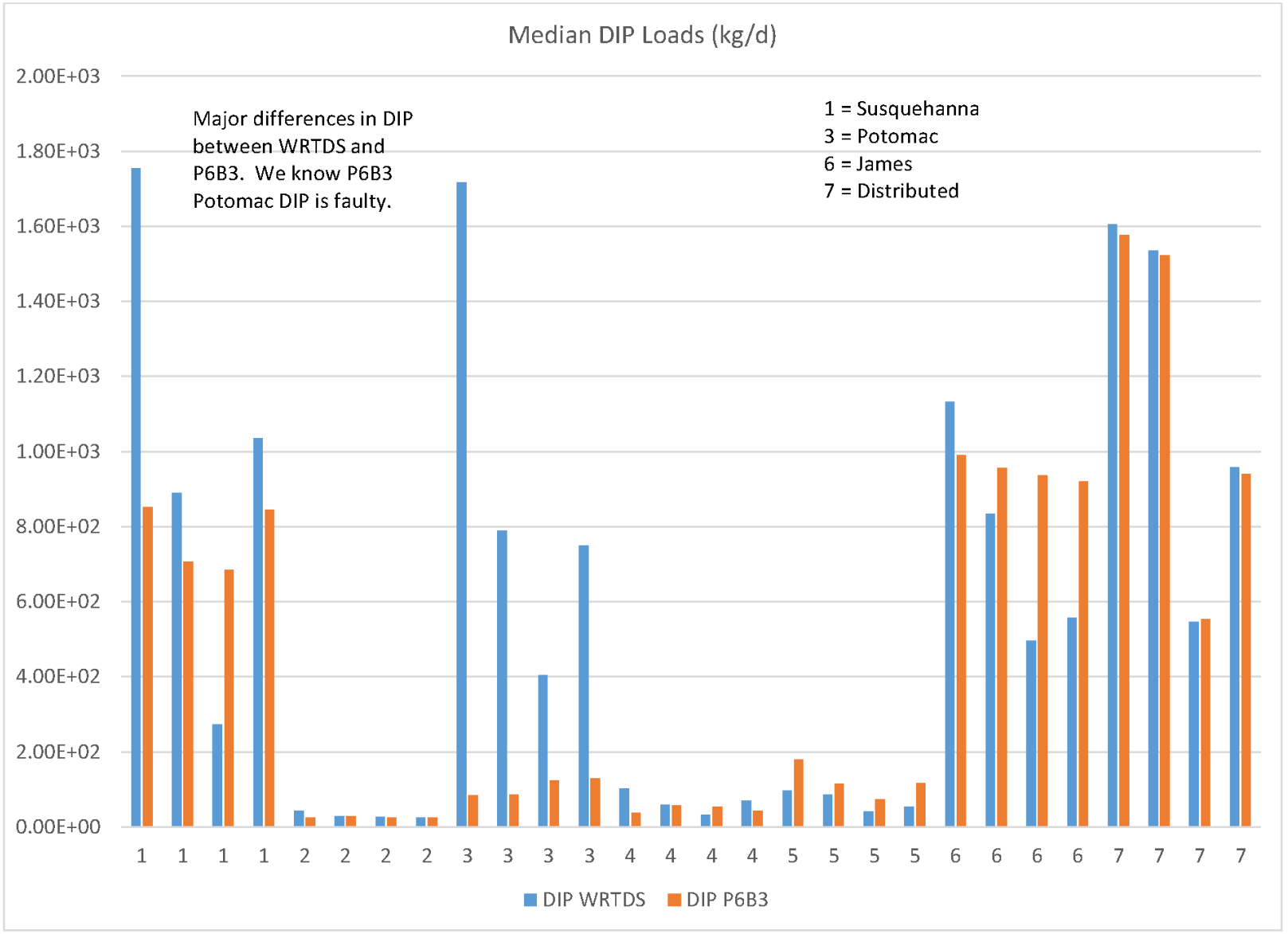

Tot N ME
In every case, WRTDS Total N is higher than P6B3.
Total N (mg/L)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

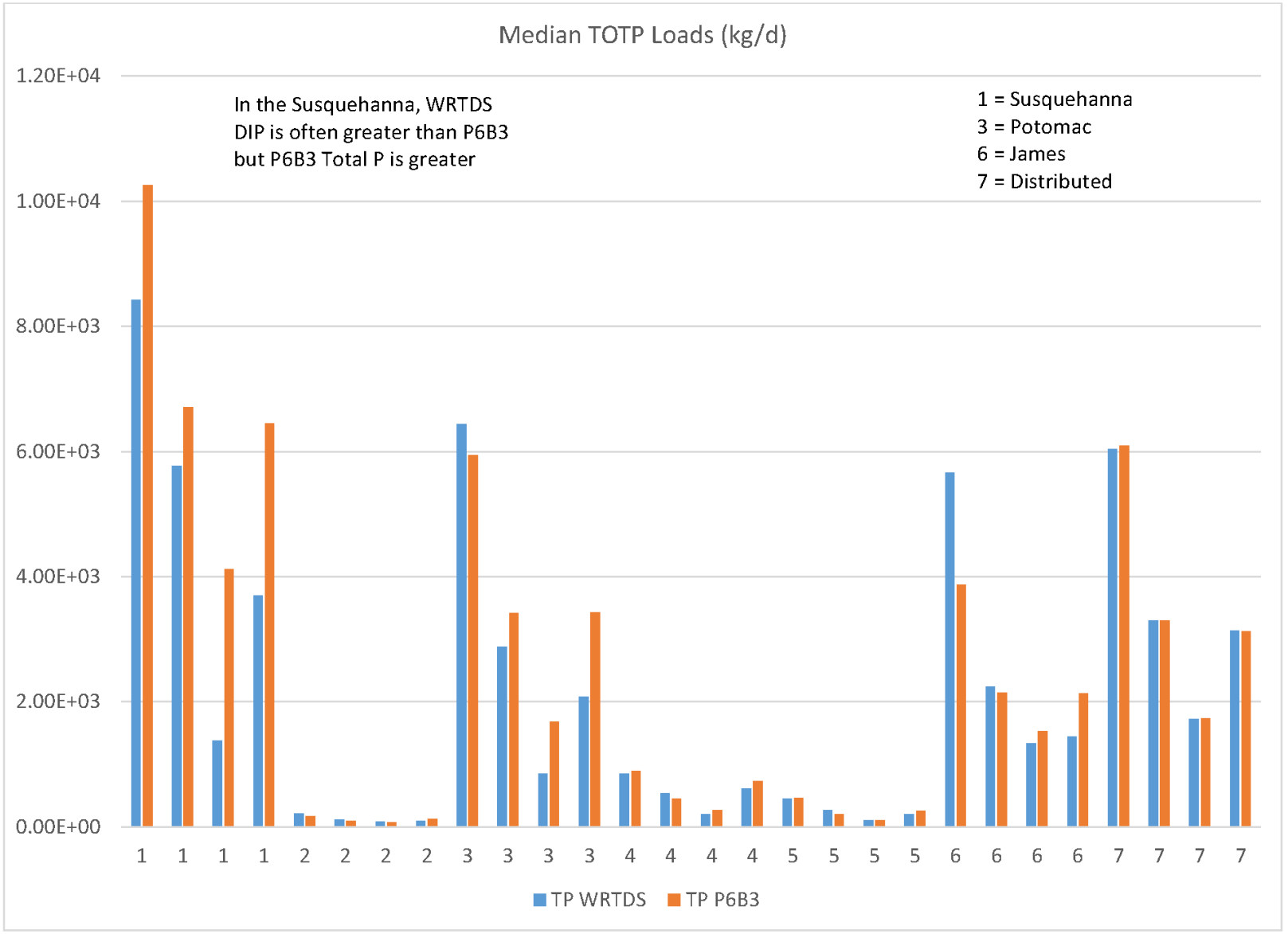

Tot N AME
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Total N (mg/L)
But WRTDS Total N isn't always better than P6B3.
Mainstem Bay
Eastern Minor Stations
Western Minor Stations
James River
York River
Rappahannock River
Potomac River
Patuxent River
Option 1
Option 2a
Option 2b
Option 3

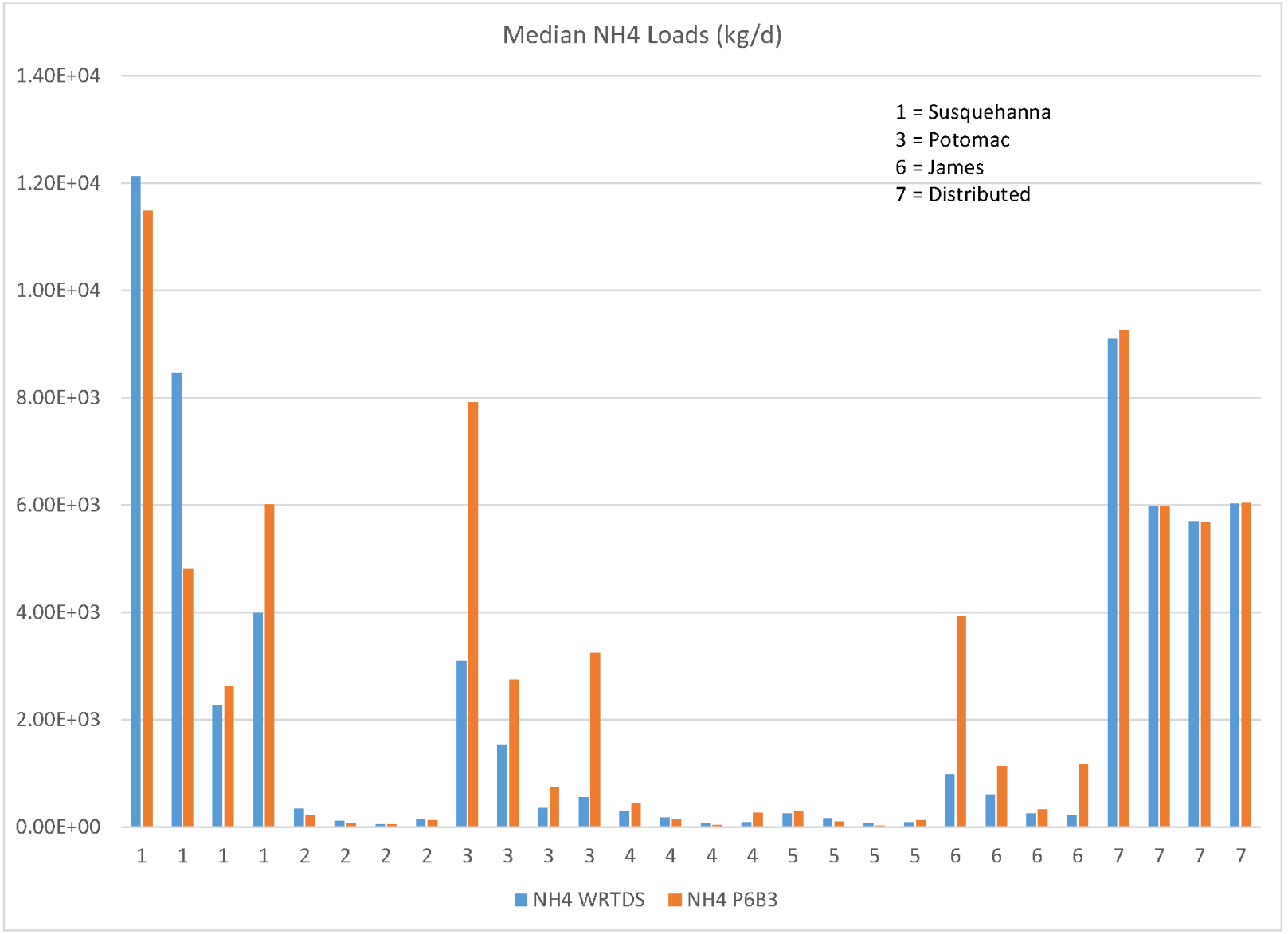


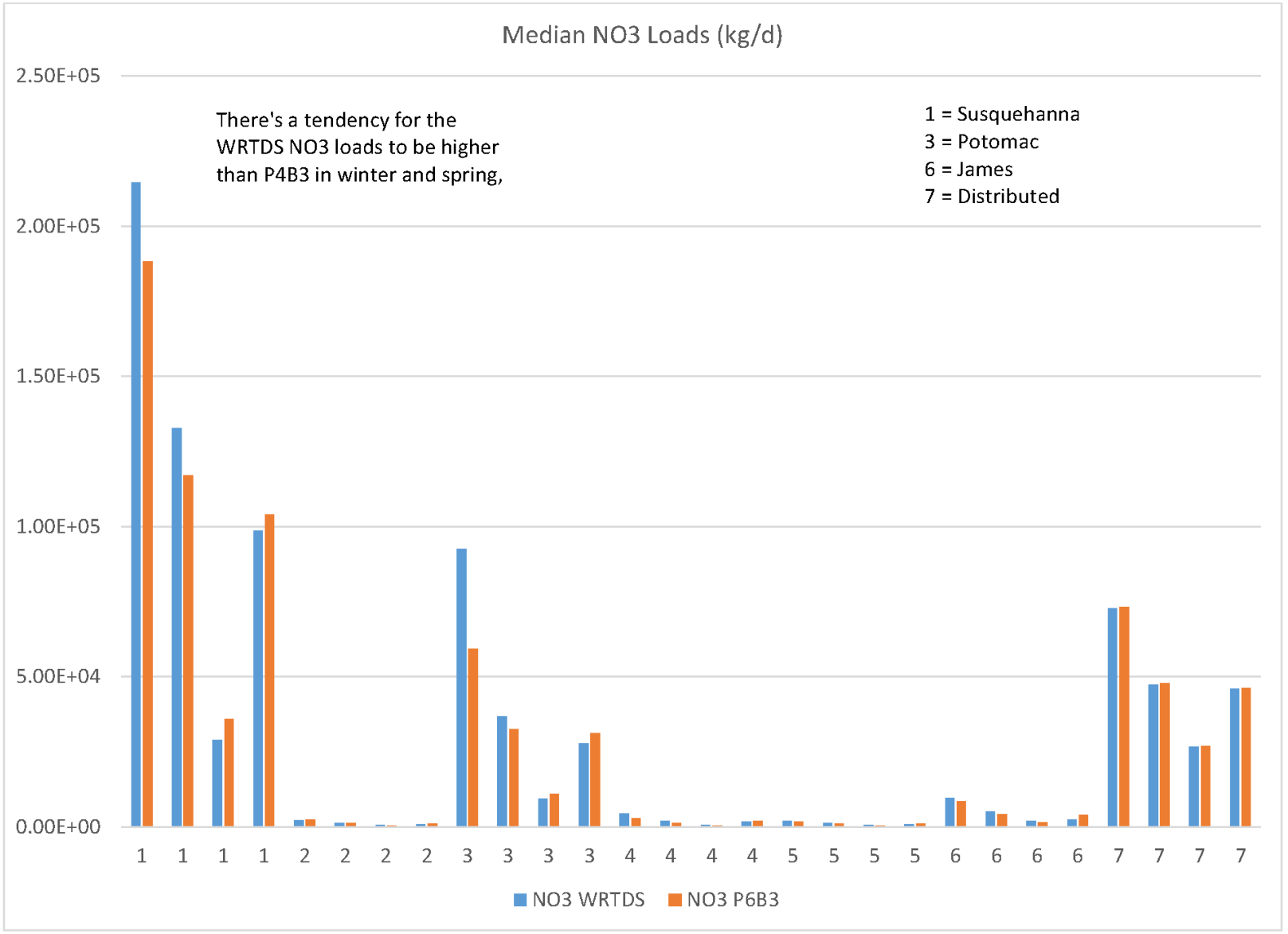
To the eye, WRTDS is higher than P6B3, as the ME statistic shows. The eye does not pick up that P6B3 is closer to the observations.

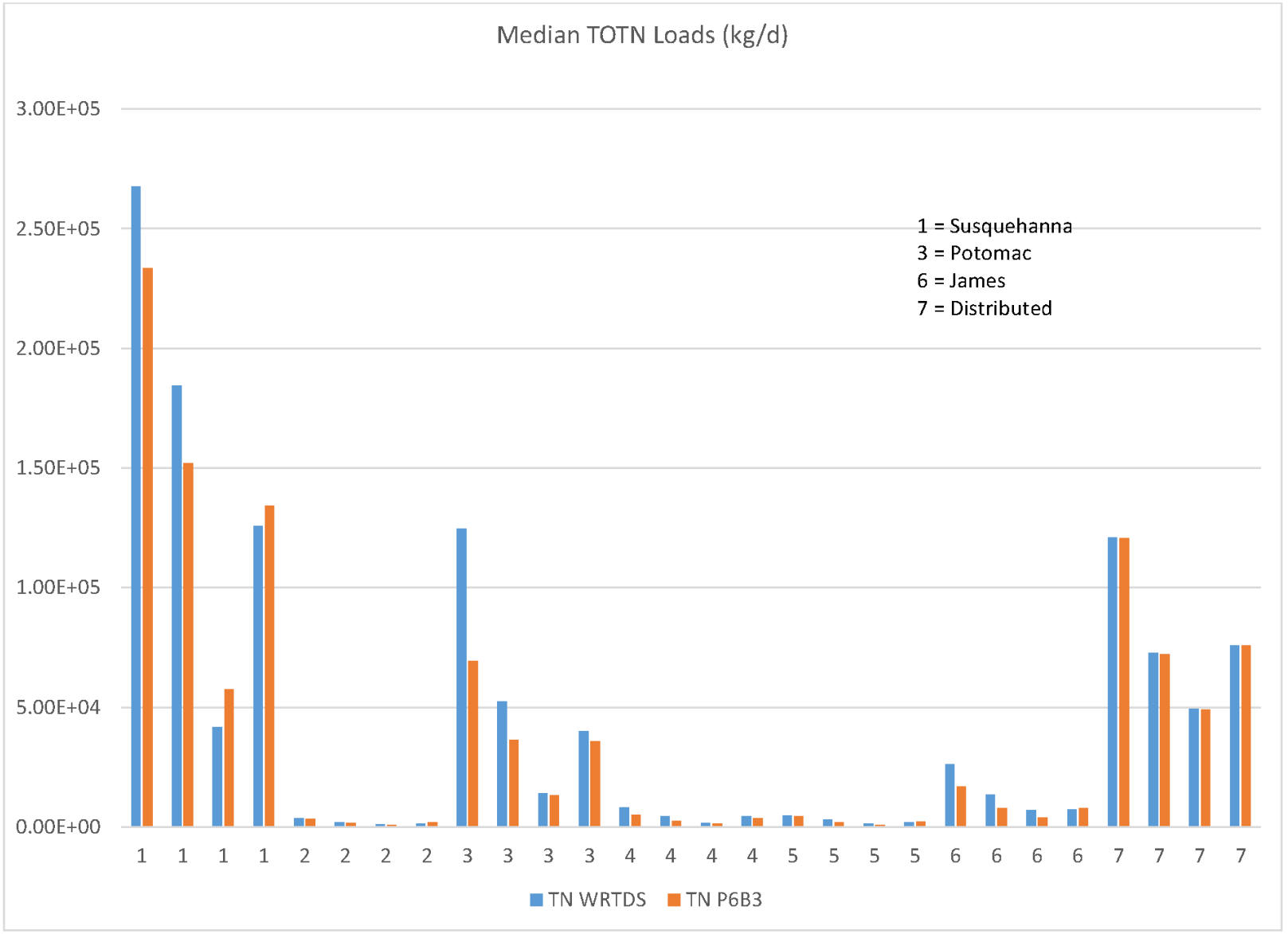



Median DIP Loads (kg/d)
Major differences in DIP between WRTDS and P6B3. We know P6B3 Potomac DIP is faulty.
1 = Susquehanna
3 = Potomac
6 = James
7 = Distributed
2.00E+03
1.80E+03
1.60E+03
1.40E+03
1.20E+03
1.00E+03
8.00E+02
6.00E+02
4.00E+02
2.00E+02
0.00E+00
1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 6 6 6 6 7 7 7 7
DIP WRTDS
DIP P6B3


Median TOTP Loads (kg/d)
In the Susquehanna, WRTDS
DIP is often greater than P6B3
but P6B3 Total P is greater
1 = Susquehanna
3 = Potomac
6 = James
7 = Distributed
1.20E+04
1.00E+04
8.00E+03
6.00E+03
4.00E+03
2.00E+03
0.00E+00
1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 6 6 6 6 7 7 7 7
TP WRTDS
TP P6B3


Median NH4 Loads (kg/d)
1.40E+04
1.20E+04
1.00E+04
8.00E+03
6.00E+03
4.00E+03
2.00E+03
0.00E+00
1 = Susquehanna
3 = Potomac
6 = James
7 = Distributed
1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 6 6 6 6 7 7 7 7
NH4 WRTDS
NH4 P6B3


Median NO3 Loads (kg/d)
There's a tendency for the WRTDS NO3 loads to be higher than P4B3 in winter and spring,
1 = Susquehanna
3 = Potomac
6 = James
7 = Distributed
2.50E+05
2.00E+05
1.50E+05
1.00E+05
5.00E+04
0.00E+00
1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 6 6 6 6 7 7 7 7
NO3 WRTDS
NO3 P6B3


Median TOTN Loads (kg/d)
3.00E+05
2.50E+05
2.00E+05
1.50E+05
1.00E+05
5.00E+04
0.00E+00
1 = Susquehanna
3 = Potomac
6 = James
7 = Distributed
1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 6 6 6 6 7 7 7 7
TN WRTDS
TN P6B3

Conclusions

- No representation of loads clearly and consistently produces the best model results.
- WRTDS loads result in superior computations of mainstem DO and chlorophyll.
- There is no clear advantage to adjusting Phase 6 Beta 3 loads to match WRTDS loads.
- In some cases, the adjustment process results in anomalous loads and deteriorated model results. My recommendation is forego the adjustment procedure.