Assessment of Chesapeake Assimilation Capacity Application to Phase III Draft Targets

Modeling Workgroup Conference Call
January 11, 2018

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Chesapeake Bay Program
Science, Restoration, Partnership

PSC Policy Decisions: Planning Targets

Approved the release of the **draft Phase III Planning Targets** as the starting point for the Partnership review process

- The PSC recognizes that the draft Phase III Planning Targets are subject to change based on the Partnership's review period and prior to finalizing the Phase III Planning Targets in May 2018

- The draft Phase III Planning Targets for West Virginia and New York reflect the same adjustments provided during the establishment of the 2010 Bay TMDL allocations. The PSC is committed to providing those same adjustments in the final Phase III Planning Targets

PSC Actions

Based on the revised draft Phase III Planning Targets that provide:

- an additional one million pounds of nitrogen and 100,000 pounds of phosphorus to New York and
- an additional two million pounds of nitrogen to West Virginia

EPA, in coordination with the WQGIT and Modeling Workgroup, will conduct further analyses to determine the source of those additional nitrogen and phosphorus pounds, and impacts to the Bay's assimilative capacity

PSC Actions

- In early February, EPA will present the following results:
  - Additional scenario runs to determine the Bay's assimilative capacity based on the revised draft Phase III planning targets (201.25 million pounds of nitrogen and 14.173 million pounds of phosphorus)
  - Determination if any additional pounds of nitrogen from implementation of Clean Air Act regulations are available to provide to West Virginia and New York
- The PSC will convene in mid-February to determine the Bay's assimilative capacity that will reflect agreed-upon results from these additional analyses

Draft Phase III Planning Targets*: Nitrogen

Jurisdiction	1985 Baseline	2013 Progress	Phase III Planning Target
NY	18.71	15.44	11.59
PA	122.41	99.28	73.18
MD	83.56	55.89	45.30
WV	8.73	8.06	8.35
DC	6.48	1.75	2.43
DE	6.97	6.59	4.59
VA	84.29	61.53	55.82
Basinwide	331.15	248.54	201.25

Includes a 1 million lb nitrogen addition to the New York draft target load.

Includes a 2 million lb nitrogen addition to the West Virginia draft target load.

Units: millions of pounds

*Draft planning targets are subject to change as a result of the Partnership's review period to be completed in May 2018

Draft Phase III Planning Targets*: Phosphorus

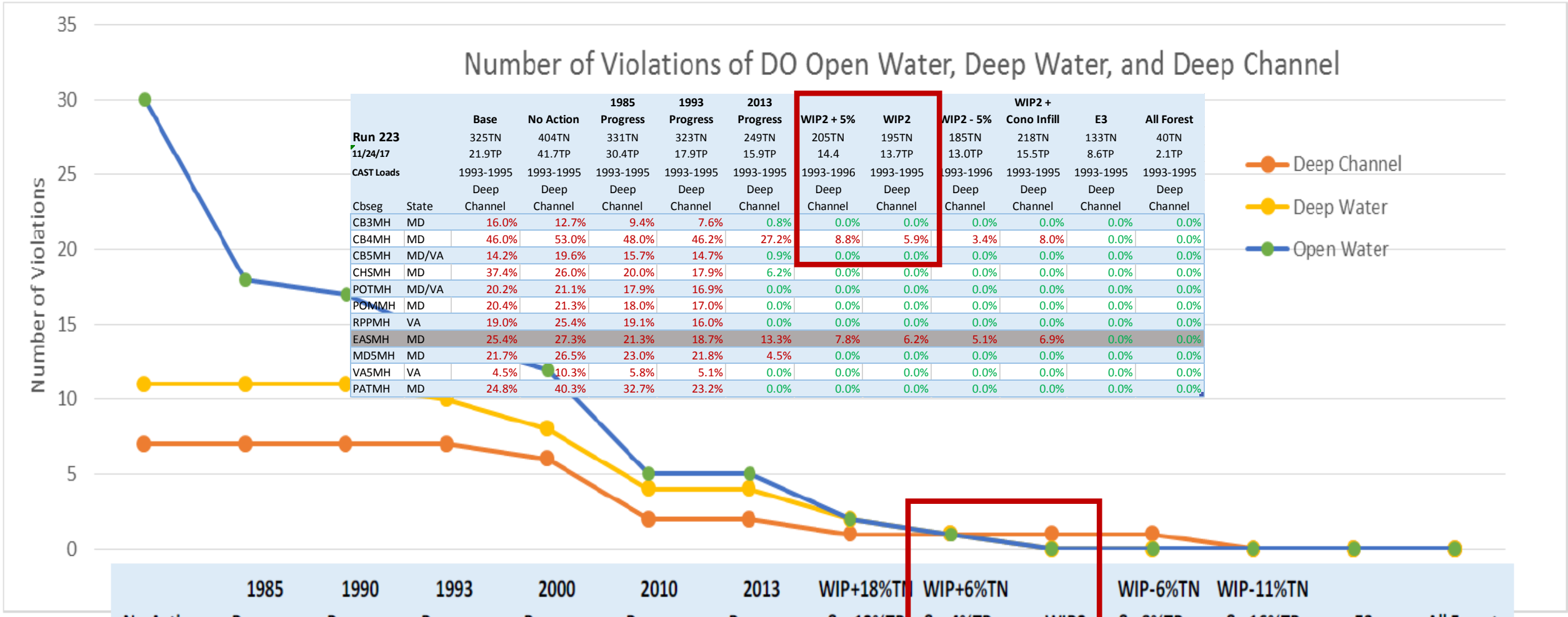
Jurisdiction	1985 Baseline	2013 Progress	Phase III Planning Target
NY	1.198	0.710	0.606
PA	6.115	3.696	3.073
MD	7.419	3.919	3.604
WV	0.793	0.560	0.456
DC	0.090	0.062	0.130
DE	0.225	0.115	0.120
VA	13.545	6.345	6.186
Basinwide	29.384	15.408	14.173

Includes a 0.1 million lb phosphorus addition to the New York draft target load.

Units: millions of pounds

*Draft planning targets are subject to change as a result of the Partnership's review period to be completed in May 2018

Determining the Bay's Ability to Absorb Pollutants



		Base	No Action	1985 Progress	1993 Progress	2013 Progress	WIP2 + 5%	WIP2	WIP2 - 5%	WIP2 + Cono Infill	E3	All Forest
Run 223		325TN	404TN	331TN	323TN	249TN	205TN	195TN	185TN	218TN	133TN	40TN
11/24/17		21.9TP	41.7TP	30.4TP	17.9TP	15.9TP	14.4	13.7TP	13.0TP	15.5TP	8.6TP	2.1TP
CAST Loads		1993-1995 Deep Channel	1993-1995 Deep Channel	1993-1995 Deep Channel	1993-1995 Deep Channel	1993-1995 Deep Channel	1993-1996 Deep Channel	1993-1995 Deep Channel	1993-1996 Deep Channel	1993-1995 Deep Channel	1993-1995 Deep Channel	1993-1995 Deep Channel
Cbseg	State											
CB3MH	MD	16.0%	12.7%	9.4%	7.6%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB4MH	MD	46.0%	53.0%	48.0%	46.2%	27.2%	8.8%	5.9%	3.4%	8.0%	0.0%	0.0%
CB5MH	MD/VA	14.2%	19.6%	15.7%	14.7%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHSMH	MD	37.4%	26.0%	20.0%	17.9%	6.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
POTMH	MD/VA	20.2%	21.1%	17.9%	16.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
POMMH	MD	20.4%	21.3%	18.0%	17.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RPPMH	VA	19.0%	25.4%	19.1%	16.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EASMH	MD	25.4%	27.3%	21.3%	18.7%	13.3%	7.8%	6.2%	5.1%	6.9%	0.0%	0.0%
MD5MH	MD	21.7%	26.5%	23.0%	21.8%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
VA5MH	VA	4.5%	10.3%	5.8%	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PATMH	MD	24.8%	40.3%	32.7%	23.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

No Action	1985 Progress	1990 Progress	1993 Progress	2000 Progress	2010 Progress	2013 Progress	WIP+18%TN & +12%TP	WIP+6%TN & +4%TP	WIP2	WIP-6%TN & -8%TP	WIP-11%TN & -16%TP	E3	All Forest
404TN	347TN	338TN	337TN	317TN	266TN	253TN	224TN	205TN	195TN	185TN	174TN	133TN	40TN
41.7TP	30.4TP	27.7TP	23.7	21.9TP	16.9TP	15.9TP	14.8TP	14.4	13.7TP	13.0TP	11.9TP	8.6TP	3.9TP

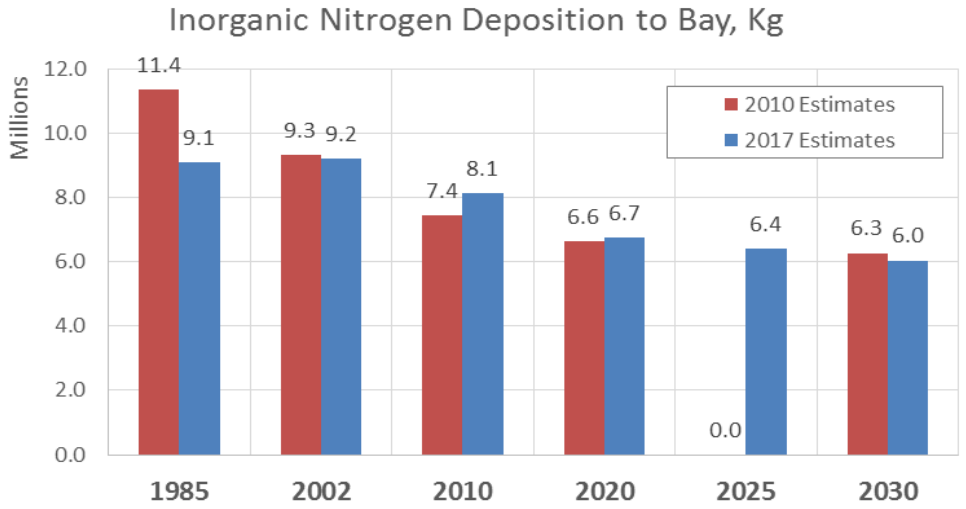
Deep Channel Sensitivity to Loads at the Susquehanna and Potomac Fall Lines

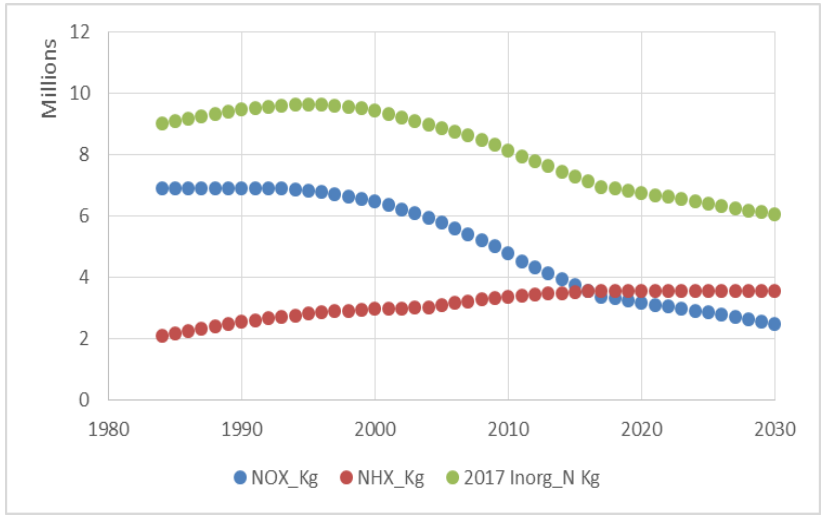
WIP2 Sensitivity: CAST Loads as modified at Sus and Pot Fall Lines		WIP2	WIP2 + Sus 1M TN & 0.1M TP Pot 2 M TN	WIP2 + Sus 0.75M TN & 0.075M TP Pot 1.5 M TN	WIP2 + Sus 0.5M TN & 0.05M TP Pot 1 M TN	WIP2 + Sus 0.25M TN & 0.025M TP Pot 0.5 M TN
		195TN	198TP	197TN	197TN	196TN
1/8/18		13.7TP	13.8TP	13.8TP	13.8TP	13.7TP
Cbseg	State	1993-1995 Deep Channel	1993-1995 Deep Channel	1993-1996 Deep Channel	1993-1997 Deep Channel	1993-1998 Deep Channel
CB3MH	MD	0.00%	0.00%	0.00%	0.00%	0.00%
CB4MH	MD	5.87%	6.95%	6.69%	6.47%	6.17%
CB5MH	MD	0.00%	0.00%	0.00%	0.00%	0.00%
CB5MH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
POTMH	MD	0.00%	0.00%	0.00%	0.00%	0.00%
RPPMH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
ELIPH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
CHSMH	MD	0.00%	0.00%	0.00%	0.00%	0.00%
EASMH	MD	6.24%	6.63%	6.45%	6.39%	6.35%

Deep Water Sensitivity to Loads at the Susquehanna and Potomac Fall Lines

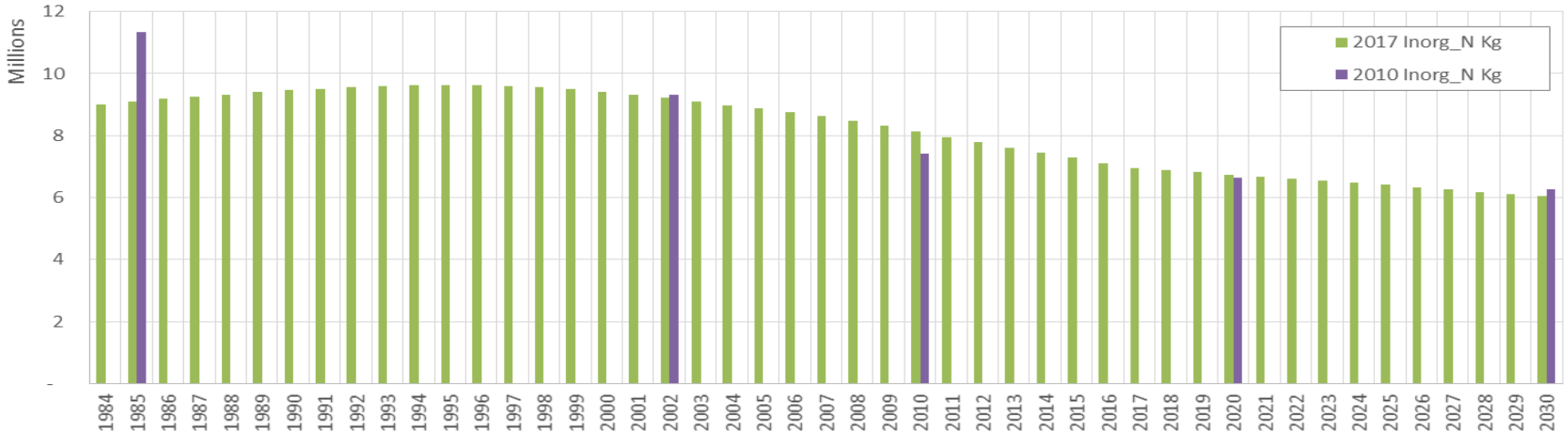
WIP2 Sensitivity: CAST Loads as modified at Sus and Pot Fall Lines 1/8/18		WIP2 195TN 13.7TP	WIP2 + Sus 1M TN & 0.1M TP Pot 2 M TN 198TP 13.8TP	WIP2 + Sus 0.75M TN & 0.075M TP Pot 1.5 M TN 197TN 13.8TP	WIP2 + Sus 0.5M TN & 0.05M TP Pot 1 M TN 197TN 13.8TP	WIP2 + Sus 0.25M TN & 0.025M TP Pot 0.5 M TN 196TN 13.7TP
		1993-1995	1993-1995	1993-1996	1993-1997	1993-1998
Cbseg	State	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water
CB3MH	MD	0.05%	0.05%	0.05%	0.05%	0.05%
CB4MH	MD	5.00%	5.23%	5.18%	5.13%	5.06%
CB5MH_MD	MD	0.94%	1.08%	1.05%	1.01%	0.98%
CB5MH_VA	VA	0.00%	0.00%	0.00%	0.00%	0.00%
CB6PH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
CB7PH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
PATMH	MD	0.67%	0.67%	0.67%	0.67%	0.67%
MAGMH	MD	1.21%	5.40%	5.40%	5.40%	1.21%
SOUMH	MD	2.96%	7.64%	7.64%	7.64%	7.64%
SEVMH	MD	0.00%	0.00%	0.00%	0.00%	0.00%
PAXMH	MD	0.00%	0.00%	0.00%	0.00%	0.00%
POTMH_MD	MD	0.00%	0.00%	0.00%	0.00%	0.00%
RPPMH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
YRKPH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
ELIPH	VA	0.00%	0.00%	0.00%	0.00%	0.00%
CHSMH	MD	0.00%	0.00%	0.00%	0.00%	0.00%
EASMH	MD	0.45%	0.45%	0.45%	0.45%	0.45%

Tidal Bay Loads of Atmospheric Deposition of Nitrogen





The EPA Air Allocation is 15.7 million pounds (TN) to the tidal waters of the Chesapeake Bay. The Phase 6 estimate of TN deposition to tidal waters is 15.6 million pounds in 2025 and 14.8 million pounds in 2030.



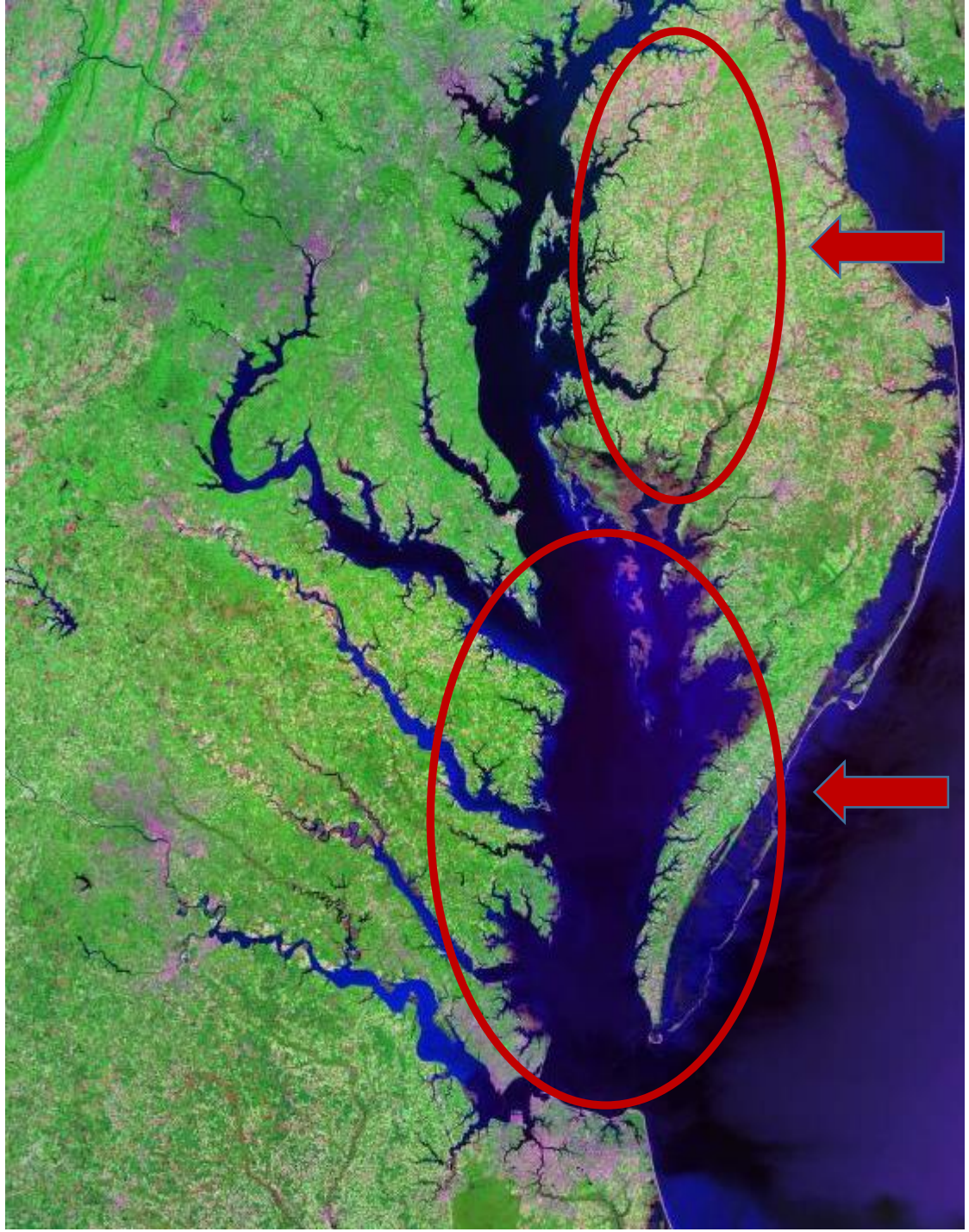
Basin to Basin and N to P Exchange Rates

Quartile change per 1,000,000 lbs N or P

GeoBasin	N	P
Susquehanna	16.325	38.503
Western Shore	14.109	35.264
Patuxent AFL	10.931	27.505
Patuxent BFL	13.514	35.667
Potomac AFL	14.045	22.210
Potomac BFL	13.201	22.165
Rappahannock AFL	8.065	11.765
Rappahannock BFL	9.278	15.453
York AFL	4.630	9.111
York BFL	5.165	8.681
James AFL	2.647	7.673
James BFL	2.351	7.434
Upper Eastern Shore	10.709	31.840
Middle Eastern Shore	11.244	43.196
Lower Eastern Shore	9.782	25.243
Virginia Eastern Shore	15.214	20.404
Atmospheric Deposition	**15.827**	

Why is the atmospheric deposition of DIN one half as effective as Susquehanna TN loads at influencing deep water hypoxia?

1. The nutrient addition of atmospheric deposition is relatively constant throughout spring, summer, fall and winter. In contrast, the Susquehanna nitrogen loads are pulsed during the spring freshet which is an effective time for hypoxia generation in the Chesapeake.



2. A portion of the atmospheric deposition falls on shallow tidal waters where it could be effectively processed in an aerobic region, having little influence on Chesapeake hypoxia.

3. Large surface area of the lower Bay is less likely to influence hypoxia because of the down estuary surface water flow.

Conclusions:

• The estimated assimilation capacity of the Chesapeake with the condition of maintaining no more than 6 percent nonattainment in CB4MH Deep Channel allows an increase 0.5 million lbs of TN and 0.05 million lbs of TP at the Susquehanna, and 1 million lbs of TN at Potomac fall line.

• The added loads at the Susquehanna and West Virginia fall lines are fungible, i.e., freely exchangeable for or replaceable by another of like nature or kind in the satisfaction of an obligation, among all basins and between TN and TP.

• An estimated 0.8 million pounds of TN (almost entirely comprised of NOx reductions) is available in 2030 from the EPA tidal water allocation freeboard/overshoot.

Conclusions *(continued)*:

- Estimates are that NOx deposition loads to the tidal Bay have an influence on Bay hypoxia equivalent to a factor of 0.97 and 1.13 at the Susquehanna and Potomac fall lines, respectively. This means that 100,000 lbs of atmospheric deposition to tidal waters reduced means that we can either increase loads at the Susquehanna by 97,000 lbs, or the Potomac fall line by 113,000 lbs.
- Using the refined assimilation capacity estimates and the 2030 estimated freeboard below the allocation of atmospheric deposition to tidal waters, the New York special case of 1 million pounds TN and 100k pounds TP at the Susquehanna fall line can be fully satisfied.
- The West Virginia special case of 2 million pounds TN at the Potomac fall line be only partially fulfilled by a little more than half, or an estimated 1.18 million pounds.

Next Steps:

- Short paper of findings to WQGIT by early next week.
- Presentation to the WQGIT on final assessment of assimilation capacity and additional estimated reductions from atmospheric deposition to tidal waters.
- Presentation to the PSC on estimated assimilation capacity, additional estimated reductions from atmospheric deposition to tidal waters, and implications for draft WIP3 targets.