

Appendix H

Analysis: Maryland's 2025 Scenario meets the Required Water Quality Response (MDE Memorandum to EPA)

Note: The March 30, 2012 WIP scenario loads used in the Appendix H analysis have been adjusted in the October 2012 revised final Phase II WIP to reflect refinements to county-scale urban and onsite septic system nutrient and sediment reduction strategies submitted by local jurisdictions in July 2012. The agricultural strategies and point source loads remain unchanged since March 30, 2012. Statewide, and by major basin, the updated 2025 scenario loads are almost identical to the March 30 strategy results. As with the March 30th strategies, the updated October strategies achieve loads below the EPA targets for nitrogen, and well below the EPA targets for phosphorus. Because both the nitrogen and phosphorus loads are below the EPA targets and the results of the March and October strategies are similar for each major basin, it is concluded that the analysis presented in the March 30 memorandum to EPA remains valid, demonstrating that Maryland's Phase II WIP strategies will achieve the required water quality response needed to meet water quality standards in the tidal waters of the Chesapeake Bay. Therefore, the Appendix H memorandum of March 30 remains unchanged.

MEMO

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Date: March 30, 2012
Su: Analysis: Maryland's Phase II WIP 2025 Scenario meets the Required Water Quality Response

This memorandum supersedes the January 18th, 2012 memo to EPA and provides a revised water quality response analysis that is based upon Maryland's Phase II WIP 2025 scenario submitted to EPA on March 30, 2012. This revision is necessary due to updates in BMP strategies that have occurred during the draft Phase II WIP public comment period. As summarized in Table 1 below, the updated 2025 strategy achieves greater (or the same) reduction as the draft scenario, for both nitrogen and phosphorus.

Table 1: Comparison of Draft (January) WIP Scenario to Final (March) WIP Scenario

Major Basin		January 6th	January 6th	March 30th	March 30th
		MD 2025 WIP Scenario TN Load	MD 2025 WIP Scenario TP Load	MD 2025 WIP Scenario TN Load	MD 2025 WIP Scenario TP Load
S	Susquehanna	1.31	0.06	1.31	0.06
E	Eastern Shore	12.52	0.91	12.45	0.89
W	Western Shore	8.44	0.48	8.41	0.48
X	Patuxent	3.09	0.24	3.04	0.23
P	Potomac	15.65	0.97	15.62	0.97
Maryland Total		41.01	2.66	40.83	2.63

Using the Bay Watershed and Water Quality Model scenario results, an estimate for the nontidal in-stream transport can be determined based on watershed delivery factors, and estuarine transport can be estimated using the Bay Water Quality Model geographic isolation runs. The isolation runs consider the influence of a change in load on DO levels in the central Bay and the lower Potomac River specific to the load change within a geographic region. Essentially the estuarine effectiveness is the change in DO concentration per change in delivered load, for a given basin. The water quality response is calculated by multiplying the delivered load by estuarine effectiveness. In this manner the water quality response is a measure of the total impact on DO levels, with a lower value signifying an increase or improvement in DO concentrations.

Using the Phase II planning targets provided by EPA, the water quality response needed to meet water quality standards in the Bay is calculated by multiplying the delivered basin loading targets by their corresponding estuarine effectiveness values. Because the Phase II planning target loads were provided at the five major basin level and the estuarine effectiveness values are given at a finer scale (9 basins versus 5 major basins), MDE estimated target loads for the 9 sub-basins. This was done by calculating proportions from the Phase I planning targets which were available at the 9 sub-basin scale.

Table 2: EPA Phase II Planning Targets

Major Basin	GeoRun Basin		EPA Phase II TN Planning Target	Estimated EPA Phase II TN Planning Target	EPA Phase II TP Planning Target	Estimated EPA Phase II TP Planning Target	
S	Susquehanna	Susq, MD	Susquehanna	1.19	1.19	0.06	0.06
E	Eastern Shore	LowES, MD	Eastern Shore Lower	11.82	4.46	1.02	0.38
		UpES, MD	Eastern Shore Upper		4.33		0.34
		MidES, MD	Eastern Shore Middle		3.03		0.29
W	Western Shore	Wsh, MD	Western Shore	9.77	9.77	0.55	0.55
X	Patuxent	PxtB, MD	Patuxent Below Fall Line	3.10	1.86	0.24	0.15
		PxtA, MD	Patuxent Above Fall Line		1.24		0.09
P	Potomac	PotB, MD	Potomac Below Fall Line	15.29	5.12	0.94	0.38
		PotA, MD	Potomac Above Fall Line		10.17		0.56
Maryland Total				41.17	41.17	2.81	2.81

As shown in Table 2 and Table 3, the estimated EPA target water quality response is 289 for TN and 19.7 for TP. The March 12th MD 2025 scenario produces a water quality response of 286 for TN and 18.3 for TP, both below the target response values thus indicating the revised MD targets meet the required water quality response and are expected to meet water quality standards.

Table 3: TN Water Quality Response

GeoRun Basin		Estimated EPA Phase II TN Planning Target (a)	MD 2025 WIP Scenario TN Load (b)	EPA Estuarine Effectiveness (c)	EPA Phase II TN Planning Target WQR (a)*(c)	MD 2025 WIP Scenario TN WQR (b)*(c)
Susq, MD	Susquehanna	1.19	1.31	10.32	12.3	13.5
LowES, MD	Eastern Shore Lower	4.46	5.07	7.97	35.5	40.4
UpES, MD	Eastern Shore Upper	4.33	4.44	7.50	32.5	33.3
MidES, MD	Eastern Shore Middle	3.03	2.94	6.93	21.0	20.4
Wsh, MD	Western Shore	9.77	8.41	7.91	77.3	66.5
PxtB, MD	Patuxent Below Fall Line	1.86	1.84	6.38	11.9	11.7
PxtA, MD	Patuxent Above Fall Line	1.24	1.21	3.09	3.8	3.7
PotB, MD	Potomac Below Fall Line	5.12	5.13	6.17	31.6	31.7
PotA, MD	Potomac Above Fall Line	10.17	10.49	6.19	62.9	64.9
Maryland Total		41.17	40.83		288.9	286.2

Table 4: TP Water Quality Response

GeoRun Basin		Estimated EPA Phase II TP Planning Target (a)	MD 2025 WIP Scenario TP Load (b)	EPA Estuarine Effectiveness (c)	EPA Phase II TP Planning Target WQR (a)*(c)	MD 2025 WIP Scenario TP WQR (b)*(c)
Susq, MD	Susquehanna	0.06	0.06	10.32	0.6	0.6
LowES, MD	Eastern Shore Lower	0.38	0.38	7.97	3.1	3.0
UpES, MD	Eastern Shore Upper	0.34	0.28	7.50	2.6	2.1
MidES, MD	Eastern Shore Middle	0.29	0.23	6.93	2.0	1.6
Wsh, MD	Western Shore	0.55	0.48	7.91	4.4	3.8
PxtB, MD	Patuxent Below Fall Line	0.15	0.14	6.38	1.0	0.9
PxtA, MD	Patuxent Above Fall Line	0.09	0.09	3.09	0.3	0.3
PotB, MD	Potomac Below Fall Line	0.38	0.32	6.17	2.4	2.0
PotA, MD	Potomac Above Fall Line	0.56	0.65	6.19	3.4	4.0
Maryland Total		2.81	2.63		19.7	18.3

Basin Targets

In addition to meeting the statewide target water quality response, the critical Eastern Shore basin target load can be met by exchanging TN and TP when applying EPA's exchange coefficients. Maryland's 2025 WIP scenario achieves sufficient TP reduction in the Eastern Shore basin to offset the TN deficit compared to EPA's Eastern Shore TN planning target, while still maintaining a surplus of TP (Table 4). This provides further confidence that Maryland's 2025 Scenario will achieve water quality standards as specified by EPA's Phase II basin targets.

Table 5: N:P Exchange

Major Basin	EPA Phase II TN Planning Target	EPA Phase II TP Planning Target	MD 2025 WIP Scenario TN	MD 2025 WIP Scenario TP	TN Deficit (+) / Surplus (-)	TP Deficit (+) / Surplus (-)	N:P Exchange Ratio	TP Needed (+) / Available (-)	TN Needed (+) / Available (-)	TN Target After Exchange	TP Target After Exchange
Susquehanna	1.19	0.06	1.31	0.06	0.12	-0.005	5.7	0.021	-0.026	1.22	0.06
Eastern Shore	11.82	1.02	12.45	0.89	0.63	-0.13	9.6	0.066	-1.247	12.45	0.95
Western Shore	9.77	0.55	8.41	0.48	-1.36	-0.07	9.1	-0.150	-0.630	9.77	0.55
Patuxent	3.10	0.24	3.04	0.23	-0.06	-0.007	8.8	-0.007	-0.057	3.10	0.24
Potomac	15.29	0.94	15.62	0.97	0.33	0.03	5.3	0.062	0.138	15.29	0.94
Maryland	41.17	2.81	40.83	2.63						41.83	2.74