Ag WG dialogue with model team – August 3, 2017

Discussion Points – Bill Angstadt (Draft – 7/7/17)

The Ag WG has scheduled a dialogue with the model team during this period of 6.0 Partnership review.

The Ag WG members desire a better understanding of the Phase 6 simulation to guide their implementation planning for 2018 to 2025.

The Ag WG members (and panels) have worked diligently to update the Phase 6 science and input data.

The Ag WG's expectation is a model that is responsive to changes in reduced inputs and increased bmps.

Ag Nutrient Mass Balance

Phase 5 simulated a nutrient mass balance (Figure 7). (Source: DEVELOPMENT AND APPLICATION OF THE 2010 CHESAPEAKE BAY WATERSHED TOTAL MAXIMUM DAILY LOAD MODEL, Gary W. Shenk and Lewis C. Linker, 2013)

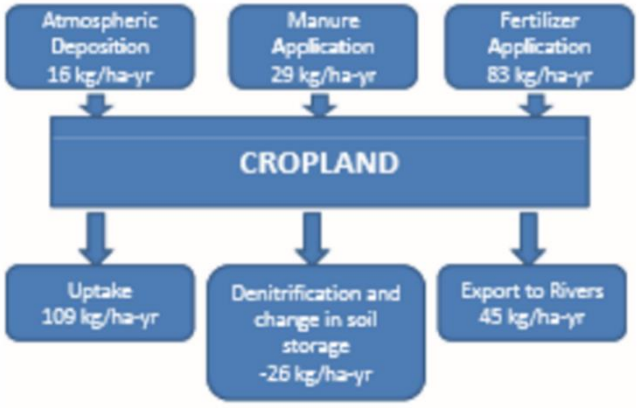


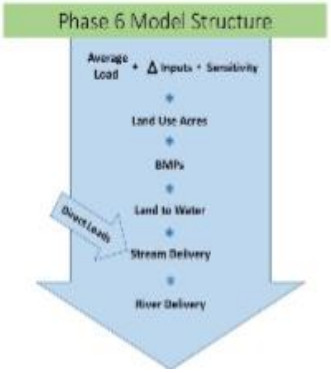
FIGURE 7. Average Mass Balance of Cropland Nitrogen over the Chesapeake Bay Watershed.

Phase 6 Cropland inputs have more accurately estimated manure applications, fertilizer applications, and crop yields (uptakes).

The logical outcome is for non-point nutrient exports of nitrogen and phosphorous to substantial decrease (as displayed in the visualization tool: "Total lbs. N & P Applied to Crop Goals") in Phase 6 from Phase 5 outputs.

Request 1: Please update Phase 6 Cropland nitrogen & phosphorous simulated mass balance for the CB watershed as revised from 2010 Phase 5.

Average Loads



Request 2: Please explain the interconnection between the Phase 6 Cropland nitrogen & phosphorous simulated mass balance to the Average Loading Rate (Phase 6 Model Structure).

Ag WG (1/21/16) approved the final Phase 6.0 Ag Land Use Loading Ratios Report.

However, the simulated Cropland Nitrogen Loading Rates (lb/ac/yr) have widely varied from 5.3.2, P6 Beta 2, P6 beta 3, to P6 final draft (Table 2-7, 6/1/17).

Request 3: Please explain the influence of the "Use of Multiple Models for Nitrogen Export Rate" for Cropland & Hay/Pasture classes (Documentation: Table 2-5) on "Average Load".

Soil Phosphorous

Request 4: How does crop uptake of soil phosphorous contribute to the phosphorous simulated mass balance?

Ag WG (3/16/17) approved the AMS recommendation to simulate soil P history by using a mass balance modeling approach combining APLE and soil test data. This decision was made with Pennsylvania abstaining.

Phosphorous Sensitivities

Request 5: P Sensitivity (Section 4.4) is calculated based on sediment loss, storm runoff, and soil test P. Please explain influence of bmps (which are credited after P sensitivity calculation) to adjust P Load (loss).

P Load from grain without manure =
1.87 + 0.013 * (Mehlich – 98.2) ppm
+ 0.144 * (storm runoff - 6.73) inches
+ 0.049 * (sediment loss - 4.75) tons
+ 0.015 * (WEP – 14.3) lbs

Phosphorous Stream Losses

Request 6: Please explain the decision to use the "12.8 million pounds" number and at what "model structure step" will future Progress Run input reductions and increased bmps offset that number.

> An area of considerable uncertainty is the phosphorus losses in stream reaches that are not reservoirs. Ator and others, 2011, Noe and others 2015a and 2016b indicate that the losses in free-flowing streams and rivers are relatively small. The Phase 5.3.2 watershed model had a significant loss of 12.8 million pounds of P in these systems. Attempts to calibrate the Phase 6 model in beta versions using the assumption of no let loss were not successful. Several major river systems had more phosphorus measured at the output than was generated by all upstream sources. For this reason, the Phase 5.3.2 losses of 12.8 million pounds were used in the final version (Section 2.5)

Land to Water

Request 7: Please explain the influence of Land to Water factors to estimate loads delivered to a stream. How do the SPARROW nitrogen coefficients interconnect with inputs reductions and increased bmps? (Reference: Table 7-2: Estimated Coefficients and Statistics from SPARROW Nitrogen Model of the Chesapeake Bay Watershed, Version 4)

2010 No Action and E3

Request 8: (Placeholder dependent on 7/20/17 Ag WG – changes to E3) The No-Action Scenario is used with the E3 Scenario to define controllable loads, the difference between No Action and E3 loads.

Split classes into individual land uses – Crop Nitrogen

Land class	Land Use	Acres	Loading Rate Ratio	Loading Rate (lb/ac/yr)
Cropland	Double Cropped Land	165,396	0.79	30.87
	Full Season Soybeans	282,456	0.71	27.74
	Grain with Manure	389,811	1.4	54.7
	Grain without Manure	451,318	1	39.07
	Other Agronomic Crops	417,838	0.45	17.58
	Silage with Manure	392,156	1.62	63.3
	Silage without Manure	69,204	1.16	45.33
	Small Grains and Grains	291,677	0.84	32.82
	Specialty Crop High	35,525	1.34	52.36
	Specialty Crop Low	125,509	0.31	12.11

Table 2-7: Total nitrogen land use acres, relative rates, and average loading rate

Table 2-5: Total nitrogen land class loads and average loading rates above RIM stations

Use of Multiple Models
for Nitrogen Export Rate

Land class	Crop	Pasture/Hay	Developed	Natural
Acres	2,620,895	4,535,321	2,690,480	21,458,991
P532 No BMP Loading Rate (pounds per acre per year)	47.51	14.95	16.80	4.21
CEAP Loading Rate (pounds per acre per year)	42.52	10.19	Not used	1.61
SPARROW Loading Rate with BMP effects removed (pounds per acre per year)	22.35	7.30	8.35	0.40
Average Ratio to Cropland Rate	1.00	0.29	0.36	0.05
Average Land class Loading Rate (pounds per acre per year)	38.22	11.22	13.90	1.84
Total Land class Load (million pounds per year)	100.16	50.88	37.39	39.45

Table 7-2: Estimated Coefficients and Statistics from SPARROW Nitrogen Model of the Chesapeake Bay Watershed, Version 4

James Davis-Martin	VA DEQ	We should reconsider the uniform soil test P application across all ag LUs. Logic suggests that w/o manure LUs should have lower soil P than those acres receiving manure. Maybe it should follow the manure application rules, LUs receiving the most manure should have the highest soil P and those receiving none should have the lowest, rather than applying the countywide average to all LUs	17/07/07

Table 7-2: Estimated Coefficients and Statistics from SPARROW Nitrogen Model of the Chesapeake Bay Watershed, Version 4

Variable	Estimate	90% Confidence Interval	Standard Error	P-value
Sources				
Point sources (kg yr^{-1})	0.774	0.375 – 1.17	0.242	0.0008
Crop fertilizer and fixation (kg yr^{-1})	0.237	0.177 – 0.297	0.0363	< 0.0001
Manure (kg yr^{-1})	0.0582	0.0138 – 0.103	0.0269	0.0157
Atmospheric deposition (kg yr^{-1})	0.267	0.179 – 0.355	0.0533	< 0.0001
Urban2 (km^2)	1090	707 – 1480	234	< 0.0001
Land-to-Water Delivery				
ln(Mean EVI for WY02 (dimensionless))	-1.7	-2.65 – -0.737	0.58	0.0039