Briefing Paper: Issues associated with agricultural nutrient management in Scenario Builder (SB) and the Chesapeake Bay Watershed Model phase 5.3 (CBWM5.3)

Background:

In mid-March, 2010, Chesapeake Bay Program (CBP) partners expressed concern that early CBWM5.3 runs did not show a significant nutrient reduction benefit for agricultural nutrient management (NM) plans. This is a critical issue as NM plans are the primary agricultural conservation tool for achieving water quality goals (2011 state milestones include more than one million acres of NM). This concern prompted a series of meetings between the CBP modeling team (Gary Shenk, Jeff Sweeney, Chris Brosch, Guido Yactayo, and Lewis Linker), Agriculture Workgroup (AgWG) coordinator Mark Dubin, and Water Quality Goal Implementation Team (WQGIT) co-chair Dave Hansen. This group generated a summary[a] of how NM is credited in CBWM5.3 and SB which was presented to the AgWG on March 29. The AgWG developed a list of recommendations[b] for improving the way NM is credited in the CBWM and these recommendations were presented to the WQGIT on April 6. The WQGIT requested that Gary Shenk work with the modeling team to; a) determine the anticipated impact of the recommendations on CBWM5.3 output and the December 31, 2010 TMDL schedule, and b) explore alternative approaches to provide credit for NM in such a way that the TMDL schedule is not impacted. Gary Shenk presented this summary[c] to the WQGIT on April 12.

Issue:

In SB and the CBWM5.3, nutrient applications are based on plant nitrogen needs. There are two land application rates for each crop; nutrient management (NM) and non-nutrient management (nonNM). The nitrogen rate for nonNM agricultural land is calculated based on the maximum reported yield (across the watershed) for each crop. The nitrogen rate for NM agricultural land is a percentage of the nonNM rate and is calculated, using state-level data and per individual state regulation (usually the average of the best 3 of the last 5 reported crop years), and dividing this average by the nonNM rate. For example, the NM application rate for corn is approximately 80% of the nonNM application rate.

Currently, both SB and the CBWM5.3 use the nonNM application rate only in situations where manure is in excess of plant needs at the NM rate. In other words, all agricultural land that has received inorganic nutrients (fertilizer) to meet plant nitrogen needs receive the NM nitrogen application rate, even if no NM acres are reported. **The impact is that, in many cases, NM does not provide a water quality benefit and could not be used by states to achieve their load reductions.**

Options considered by the WQGIT (4/12):

At their March 29 meeting the AgWG discussed the nutrient application rates and associated issues. Their recommendations were summarized in the WQGIT presentation on April 6[b]. After discussion between Dubin, Hansen, and the CBP modeling team on April 7, some of these recommendations were tabled for later discussion. The following options were presented to the WQGIT on April 12:

a. http://archive.chesapeakebay.net/pubs/calendar/47984_03-29-10_Presentation_1_10714.pdf
b. http://archive.chesapeakebay.net/pubs/calendar/47043_04-05-10_Presentation_1_10559.pdf
c. http://archive.chesapeakebay.net/pubs/calendar/47043_04-12-10_Presentation_1_10736.pdf

1. Use annual USDA National Agriculture Statistics Service (NASS) data (where available) to calculate crop yields versus the current use of 5-year USDA-NASS Agricultural Census data.
2. Increase the spatial resolution of yield data by using state-level versus Bay watershed data for maximum yields, and county-level versus state-level yield data to calculate the NM application rate.
3. Stop the automatic (non-reported) transport of manure from counties with excess to adjoining counties within the models; manure stays in the county where it was generated unless the state reports manure transport.
4. Change the process of allocating excess manure within the originating county on nonNM land uses.
5. Increase the nonNM inorganic (fertilizer) application rate to be consistent with the nonNM organic (manure) application rate.
6. Treat post-2005 NM as a best management practice (efficiency) rather than a land use.

Recommendations:

The modeling team summary of these options is presented in Table 1. **The WQGIT recommended options 3, 4, and 5 be implemented immediately.** The WQGIT did not support Options 1 and 2 at this time because of timing considerations, previous problems with data availability, and minimal expected impacts. Option 6 was not supported because it does not address the underlying problems within the model, it does not allow credit for pre-2005 NM, and it does not allow significant credit for post-2005 NM. **It has been estimated by the modeling team that it will take approximately 3 months to make all of the recommended changes to the CBWM and SB.**

Table 1. Summary of nutrient management options presented to the Water Quality Goal Implementation Team on April 12, 2010.

Option	Time to complete	Expected impact*
1: Use annual NASS data	4+ months	Minimal overall, could be important locally
2: Improve spatial resolution of yield data	6 months	Minimal overall, could be important locally
3: Stop modeled manure transport	1 week	Minimal overall, could be important in high-manure areas
4: Change process of allocating excess manure	2 months	Possible E3 effect, could be important locally
5: Increase nonNM inorganic rate	3 months	Minor impact on state basin loads, potential large impact on Watershed Implementation Plans
6: Treat post-2005 NM as an efficiency (BMP)	Immed.	Would allow some NM credit, no change in calibration

* Options 1-5 are all expected to result in a more accurate model calibration

Submitted by Dave Hansen, University of Delaware, co-chair WQGIT, 4/16/2010

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