

Appendix F

**Scope of Work:
Modifying Delaware's Nutrient Budget Protocol
for Use as an Offset Tracking Tool in the Chesapeake Bay Watershed**

July 22, 2010

Department of Natural Resources and Environmental Control Contact:
Jennifer Volk, Jennifer.Volk@state.de.us, 302-739-9939

Tetra Tech Contact:
Eugenia Hart, eugenia.hart@tetrattech.com, 302-645-2440

EPA Contact:
Pat Gleason, Gleason.Patricia@epamail.epa.gov, 215-814-5740

The Department of Natural Resources and Environmental Control (DNREC) is taking the lead to develop Delaware's Watershed Implementation Plan (WIP) for the Chesapeake Bay Total Maximum Daily Load (TMDL). One of the requirements EPA has identified as a necessary component of WIPs is a method to account for growth. Growth can be addressed in one of two ways: target load for future growth or offset loads resulting from future growth. Delaware is interested in pursuing an offset program.

DNREC staff previously developed a tool known as the Nutrient Budget Protocol. The Protocol compares the loads of a parcel pre- and post-development and determines if the proposed development will achieve local TMDL required nonpoint source reductions. DNREC asked Tetra Tech to review the tool to determine its usefulness in a Chesapeake offset program. Tetra Tech concurred that Nutrient Budget Protocol would be a useful tool in support of Chesapeake Bay WIP with some modifications based on their review of similar tools in use in other parts of the US. Recommendations for these modifications are presented below under the Recommendations section.

DNREC has reviewed the recommendations and would like Tetra Tech to pursue executing the proposed modifications to the Protocol for its use as the primary tracking tool for a Chesapeake offset program. Recommendations have been amended with DNREC staff comments. Additional tasks have also been identified. DNREC requests Tetra Tech review this proposal and provide a detailed budget and schedule.

Currently, the Protocol can be used in most of the State of Delaware. DNREC would like the modified tool to maintain the statewide usability. As Tetra Tech performs work, DNREC requests that all Delaware watersheds be included in the tool. Tetra Tech should add the necessary loading rates and efficiencies for watersheds that are currently not captured that are located within the Chesapeake Watershed. For watersheds currently not in the Protocol and not within the Chesapeake Watershed, DNREC requests that those watersheds be added so that DNREC staff can add the necessary information for those watersheds in the future.

Additionally, because DNREC's Sediment and Stormwater Program is also developing a tool, DURMM, to specifically to look at the stormwater volume and associated nutrient and sediment loads of development projects, DNREC requests linking DURMM and the Protocol. The DURMM tool should be utilized for stormwater calculations within the Protocol. This linkage will likely negate several of the technical recommendations however Tetra Tech should consult with the Sediment and Stormwater Program for thorough understanding of the DURMM tool.

Recommendations (as provided by Tetra Tech and amended by DNREC)

It is recommended that the Nutrient Budget Protocol go through a thorough review. The review of the Nutrient Budget Protocol spreadsheet should include review for mathematical accuracy. Given the complexity of the calculations and the frequent use of IF statements, it was difficult to verify whether the entire worksheet is performing calculations as stated. Based on that review, necessary updates should be made. The look and feel of the spreadsheet tool should also be improved since it is intended for public use.

The spreadsheet tool should be more user-friendly if it is ultimately intended for public use. Modifications should be made so that the tool is more intuitive. Equations should also be locked so the user cannot overwrite them. Specific recommendations for the technical aspects of the tool as well as user-friendliness are provided below. The recommendations are presented in order of importance. The technical recommendations are critical before application to the Chesapeake Bay watershed. The user-friendliness recommendations are not as critical and can be addressed post-application to the Bay.

Technical Recommendations

- 1. Drainage areas.** To calculate the effect of BMPs accurately, the spreadsheet should have discrete drainage areas with post-developed site land area and BMP(s) assigned to each drainage area. In the current implementation, a BMP is applied to a general portion of the site; it does not target specific land uses or account for variations in development density within drainage areas. As a result, treatment can be over- or under-estimated. An effective BMP targeting a locally highly impervious drainage area might not receive proper credit.
 - Since the DURMM tool will be utilized instead of existing stormwater calculations in the Protocol, Tetra Tech should consult with DNREC's Sediment and Stormwater Program for how drainage areas are handled in DURMM for stormwater BMPs.
- 2. Impervious area.** When a specific percent imperviousness is not entered by the user, default percent impervious values are applied regardless of density for a set of developed land use categories. This provides an incentive for not stating impervious cover – a developer could project impacts below the true loading rates. On the other hand, the assumptions overestimate loading for low density development, which would be punitive for someone who is developing low density but does not specify imperviousness. The tool should require the user to specify impervious area, even if the user is providing an estimate. The following example illustrates this point. Assume the default value for commercial development is 45% impervious. In reality, it is reasonable for impervious area for commercial development to

range widely – a range from 20% to 80% is completely reasonable, especially in a rural setting. The loading rates will differ by nearly a factor of four between 20% and 80%, but the use of a single value will calculate an identical loading rate impact from two very different sites.

- Since the DURMM tool will be utilized instead of existing stormwater calculations in the Protocol, Tetra Tech should consult with DNREC’s Sediment and Stormwater Program for how impervious areas are handled in DURMM and if this component is still needed within the Protocol.

3. BMP removal rates. The BMP removal rates for TN and TP (Table 5, page 27 of the User’s Guide) are based on older studies. A more recent and fairly local set of BMP removal rates can be found in Virginia’s Runoff Reduction technical memo (<http://www.dcr.virginia.gov/documents/stmrunredmethmemo.pdf>). The Runoff Reduction Method is the newest and most comprehensive study of BMP nutrient effectiveness to date.

- DNREC suggests utilizing the BMP efficiencies currently in use by the Chesapeake Bay Program in order to ensure loads between the various models are comparable. If the Bay Program does not have an efficiency for a particular BMP, DNREC supports using the Virginia values unless more local information is available and appropriate. The Protocol does not currently contain efficiencies for sediment and this needs to be added for each BMP, as appropriate.

4. Subwatershed loading rates. The spreadsheet cannot calculate loads for all areas of Delaware’s Chesapeake Bay drainage at this point. It does not contain loading rates for the following subwatersheds within the Bay watershed: Chester River, Marshyhope Creek, Elk Creek, Sassafras River, Bohemia Creek, and a small 12 acre watershed near the canal in Newark (Personal communication with Lyle Jones 2010). Loading rates for these additional watersheds need to be included so the spreadsheet tool can be useful throughout the entire Chesapeake drainage area.

- DNREC believes that loading rates for the Chester River and Marshyhope Creek are currently captured in the Protocol. DNREC agrees that the other watersheds in the Chesapeake need to be added to the Protocol. Tetra Tech should utilize loading rates currently in use by the Chesapeake Bay program for all Chesapeake watersheds in order to ensure loads between the various models are comparable. The Protocol does not currently contain loading rates for sediment and this needs to be added for each land use, as appropriate

5. BMP representation. There is a limited number of BMPs currently represented in the spreadsheet. There was some concern from the stormwater group about the Chesapeake Bay model not including BMP technologies such as green roofs, rooftop disconnection, or permeable pavement (just some examples). It appears that the Nutrient Budget Protocol doesn’t include them either. If there are plans to install these types of BMPs throughout the watershed it would be useful to include them in the spreadsheet. The BMP section will need to be modified to include all BMPs that will be applied in the watershed.

- DNREC would like all BMPS that are currently captured by the Chesapeake Bay Program model to be captured in the Nutrient Budget Protocol. DNREC would also like the ability to easily add new BMPs to the Protocol in the future. Additionally, the

Sediment and Stormwater Program is working to identify efficiencies for several of the stormwater related practices listed above and will hopefully be able to capture those BMPs in DURMM.

6. **Grass buffers.** It appears the spreadsheet could potentially over-calculate grass buffers as they are asked for under Agricultural Buffers and again as part of Grassland.
7. **Loading rate documentation.** The source and derivation of the loading rates is not sufficiently documented in the User's Guide. Specifically cite the source of the loading rates and how they were derived.
 - Agreed, better documentation is needed. Please see "Additional Tasks Requested by DNREC" below.

Recommendations for User-friendliness:

1. **Worksheet reorganization.** The input **Worksheet** needs to be reorganized to be more intuitive for the user. Suggestions include simplifying the land use and BMP input areas. A possible solution for simplification would be to provide multiple clearly named input worksheets such as one for pre-development land use, one for post-development land use, one for BMPs, and one for other components such as wastewater, buffers, and credits. This would make the input areas easier to navigate. Pre and post-development land use inputs should be simplified by clearly stating the needed land use areas. An example would be to change the pre-development land use categories to the following:
 - a. Total Area
 - b. Agriculture
 - i. Agriculture with routine chicken manure application
 - c. Golf course
 - d. Urban/residential
 - e. Forest (non-wetland, including buffers)
 - f. Forested wetlands
 - g. Tidal wetlands
 - h. Non-tidal emergent wetlands
 - i. Grassland (including buffers)
 - j. Brushland
 - k. Gravel pits
2. **Loads by land use.** The **Results** sheet doesn't show loads from all land uses. It would be helpful to see the break-down. For example, the **Results** sheet currently only shows loads from Urban Impervious. The **Results** sheet makes it appear that developed land is ultimately represented by impervious surface loading rates only, and does not include the load from the developed pervious portion. In a conversation with Lyle Jones, he stated that the loads for pervious developed land are included in the **Load Calculation** sheet. These loads should be moved to the **Results** sheet, along with loads for all other land uses, where the user can clearly see them.

3. **Potential to overwrite formulas.** It appears that the user can overwrite calculation formulas on the main data entry sheet **Worksheet**. The locking of equations is recommended to prevent accidental overwriting. Note that formulas in the range of G72:G79 refer to cell J72, which is not designated as an input cell, and the instructions appear to advise the user to overwrite the formulas in the range of B72:B79. However, as noted previously (Technical Recommendation 1) it is recommended that explicit entry of land area and BMP treatment for each site drainage area is provided, which would remove this section from the spreadsheet entirely.
4. **Buffer width.** Identify the units in which the buffer width is needed in question 9C, row 67 in the **Worksheet**.
5. **Reword Question 10a, row 69.** If the current BMP implementation is retained, this question should be reworded as: Are stormwater BMPs going to be used independently, in series, or in combination? This implies that some areas will have individual Stormwater BMPs and other areas will have stormwater BMPS in a treatment train.

Additional Tasks Requested by DNREC:

1. DNREC is interested in adding the capability to generate a report and table of output.
2. Tetra Tech should update/develop technical document and a user guide for the modified tool.
3. Tetra Tech should provide a minimum of 1 day of training to DNREC staff on the modified tool.
4. Since the Protocol will become part of a regulatory tool for an offset program, Tetra Tech should plan to attend public workshops and provide presentations on the modified tool.