

# Recommendations for the Cropland Irrigation Management Expert Panel

Prepared for the Chesapeake Bay Program Partnership’s Agriculture Workgroup by the Cropland Irrigation Management Expert Panel Establishment Group

April 7, 2015

## Background

In the current version of the Chesapeake Bay Program (CBP) partnership’s Watershed Model (version 5.3.2), cropland irrigation management is recognized as an interim practice used for planning purposes only. The potential nutrient reduction benefit stems not from the increased average yield (20-25%) of irrigated versus non-irrigated cropland, but from the greater consistency of crop yields over time matched to nutrient applications. This increased consistency in crop yields provides a subsequent increased consistency in plant nutrient uptakes over time matched to applications, resulting in a decrease in potential environmental nutrient losses. The placeholder effectiveness values are 4% total nitrogen (TN), 0% total phosphorus (TP) and 0% total suspended solids (TSS), based on the range in average yields from the 2002 and 2007 NASS Census of Agriculture data for irrigated and non-irrigated grain corn as a reference.

The Cropland Irrigation Management Expert Panel Establishment Group (EPEG) was formed to:

- Identify priority tasks for the Cropland Irrigation Management Expert Panel (EP),
- Recommend areas of expertise that should be included on the Cropland Irrigation Management EP, and
- Draft the Cropland Irrigation Management EP’s charge for the review process.

From March 3, 2015 through April 1, 2015 the EPEG met 4 times by conference call and worked collaboratively to complete this charge for presentation to the Agriculture Workgroup (AgWG) on April 16, 2015. Members of the EPEG are listed in Table 1.

**Table 1. Cropland Irrigation Management Expert Panel Establishment Group membership and affiliations.**

<b>Member</b>	<b>Affiliation</b>
Jen Nelson	Resource Smart, LLC
Jenn Volk	University of Delaware
Judy Denver	United States Geological Survey
Tim Sexton	Virginia Department of Conservation and Recreation
EPEG Support Staff	
Mark Dubin	University Maryland
Emma Giese	Chesapeake Research Consortium
Jennifer Ferrando	Tetra Tech, Inc.

## Method

The Cropland Irrigation management EPEG developed its recommendations in accordance with the process specified by the AgWG (AgWG 2014). This process is informed by the [strawman](#)

[proposal](#) presented at the December 11, 2014 AgWG meeting, the Water Quality Goal Implementation Team ([WQGIT](#)) Best Management Practice ([BMP](#)) [protocol](#), input from existing panelists and chairs, and the process recently undertaken by the [AgWG](#) to develop the charge for the Manure Treatment Technologies EP.

The collective knowledge and expertise of EPEG members formed the basis for the recommendations contained herein. The majority of the EPEG members have had experience on BMP expert panels, including the Cover Crops, Nutrient Management, and Wetlands Land Use Definition and Wetlands Restoration BMP Expert Panels as well as the Poultry Litter and Agricultural Modeling Subcommittees. EPEG members and the technical support team also have knowledge and/or expertise in state and federal programs, the Chesapeake Bay model, and cropland irrigation management practices within the Chesapeake Bay watershed.

Communication among EPEG members was by conference call and email. All decisions were consensus-based.

### **Recommendations for Expert Panel Member Expertise**

The AgWG expert panel organization process directs that each expert panel is to include eight members, including one non-voting representative each from the Watershed Technical Workgroup (WTWG) and Chesapeake Bay Program modeling team. Panels are also expected to include three recognized topic experts and three individuals with expertise in environmental and water quality-related issues. One of the six topic or environmental and water quality experts will serve as the panel Chair. A representative of USDA who is familiar with the USDA-Natural Resources Conservation Service (NRCS) practice standards should be included as one of the six individuals who have topic- or other expertise.

In accordance with the [WQGIT BMP protocol](#), EP members should not represent entities with potential conflicts of interest, such as entities that could receive a financial benefit from EP recommendations or where there is a conflict between the private interests and the official responsibilities of those entities. All Panelists are required to identify any potential financial or other conflicts of interest prior to serving on the EP. These conditions will minimize the risk that Expert Panels are biased toward particular interests or regions.

The Cropland Irrigation Management EPEG recommends that the Cropland Irrigation Management EP should include members with the following areas of expertise:

- Expertise in cropland irrigation management and cropping practices in the Chesapeake Bay watershed jurisdiction(s).
- Expertise in fate and transport of nitrogen, and/or phosphorus, and/or sediment in agricultural systems under various irrigation management systems representative of various Chesapeake Bay physiographic provinces.
- Understanding of Chesapeake Bay watershed hydrogeology in the context of chemical transport.
- Knowledge of irrigation system engineering and management requirements, including fertigation systems.

- Experience with carrying out research projects relating to irrigation management.
- Experience with verification of cropland irrigation management practice implementation.
- Knowledge of how BMPs are tracked and reported, and the Chesapeake Bay Program partnership's modeling tools.
- Knowledge of relevant NRCS practice codes or standards, if applicable.

Staff from the Chesapeake Bay Program and Tetra Tech will provide technical support for the Cropland Irrigation Management EP.

### **Expert Panel Scope of Work**

The Cropland Irrigation Management Expert Panel will develop definitions and loading or effectiveness estimates for the cropland irrigation management practice described above. The Expert Panel will develop effectiveness estimates for nitrogen, phosphorus, and sediment, where possible based on available data.

The panel will work with the AgWG and WTWG to develop a report that includes information as described in the WQGIT's *Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model*<sup>1</sup> (see Attachment 1).

Specifically, the Cropland Irrigation Management EPEG recommend the following four charges with associated tasks to be completed by the Cropland Irrigation Management EP:

1. Refine interim BMP definition and efficiency values for cropland irrigation under average hydrologic conditions, taking into account how efficiencies might deviate from average values during wet or dry years.
2. Consider developing BMP definitions and efficiency recommendations for three categories of cropland irrigation:
  - Cropland irrigation (i.e., decreased variation in yields between dry land and irrigated cropland production)
  - Irrigation water management (i.e., soil moisture management and water conservation practices)
  - Fertigation (i.e. utilization of irrigation systems to irrigate as well as apply supplemental organic or inorganic nutrients)
3. Consider establishing a baseline condition that addresses irrigation system operation and management.
4. Consider regional variations in irrigation practices and BMP efficiencies.

This scope of work addresses reduction efficiencies for nitrogen, phosphorus, and sediment.

The first charge is necessary because the interim definition and efficiency values for Cropland Irrigation Management are preliminary. The interim BMP for Cropland Irrigation included a preliminary TN reduction efficiency based on increased consistency of crop yields over time (e.g., reduced yield loss in dry years due to irrigation) matched to nutrient application. The efficiency

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<sup>1</sup> [http://www.chesapeakebay.net/documents/Nutrient-Sediment\\_Control\\_Review\\_Protocol\\_v7.14.2014.pdf](http://www.chesapeakebay.net/documents/Nutrient-Sediment_Control_Review_Protocol_v7.14.2014.pdf)

value was based on the difference in corn grain yields between dryland and irrigated commodity grain corn yields from the 2002 and 2007 Ag Censuses; the only two Ag Census reports which provided this separation of data at the time. The census analysis results identified a smaller range in crop yields for irrigated agriculture than dry land crops. The EP will gather additional information to either refine or replace the interim BMP definition for improved targeting of nutrient applications based on more consistent yields for irrigated systems. The EP also will consider including phosphorus and sediment reduction efficiencies if appropriate based on available data.

The second charge addresses the range of variation in cropland irrigation practices and their effects on potential nutrient and sediment loss pathways. The Expert Panel will consider developing definitions and effectiveness values for three potential categories of cropland irrigation:

1. Cropland irrigation. This category is comparable to the refinement of the interim BMP definition under the first charge. It addresses efficiencies to be gained through targeting of nutrient application rates to more predictable crop yields based on decreased annual yield variations.
2. Irrigation water management. This category addresses potential reductions in nutrient and sediment loss from improved management of the volume of water applied. The EP will consider potential efficiencies from reductions in both runoff and leaching past the root zone with enhanced water management.
3. Fertigation. This category addresses differences in crop yield response variation and surface and subsurface nutrient losses for irrigation systems that are used to deliver supplemental organic or inorganic nutrients. The EP should consider definitions and efficiencies based on cropland irrigation systems as a basis (i.e., analogous to the first category) and water management under fertigation systems (i.e., analogous to the second category). The EP will also consider whether to establish BMP definitions and efficiencies based on various types of irrigation systems (e.g., drip irrigation versus center pivot versus traveling gun irrigation). Finally, the EP will consider how to address acres where irrigation and fertigation are combined.

The EP will develop nitrogen, phosphorus, and sediment efficiencies for all categories of the BMP definition, to the extent possible based on available data.

The third charge acknowledges the potential variation in pollutant reduction efficiency based on irrigation type selection, operation and maintenance, and overall management of the irrigation system. Selection of type and management of irrigation systems dictates, to a high degree, the effect of irrigation on crop yields. Proper system design, operation, and maintenance are critical to achieving consistent yields in dry years and optimizing water use to achieve the desired crop yield response. Furthermore, improperly managed irrigation and fertigation systems can be pollutant sources rather than providing a pollution reduction benefit, especially in wet years. The EP will consider establishing a baseline condition for system management that would guide the identification of systems which would qualify for the practice. The EP will consider factors such as appropriate system selection and design, proper system installation and operation, and adequate system maintenance. In considering these and other appropriate factors, the EP will seek to balance improved confidence in the efficiency values for a well-managed system, with potential limitations in identifying BMP applicability for a specifically-defined baseline condition. The EP will consider whether a baseline condition is appropriate for all categories of the BMP and, if so, whether the same

baseline should apply to all categories. Finally, the EP will articulate how baseline conditions will be tracked, reported, and verified.

The fourth charge is necessary to address the potential differences in BMP efficiencies for different hydrologic, geomorphic, agricultural crop production, and other conditions that vary throughout the watershed. To the extent that adequate supporting data are available, the EP will address variations in BMP efficiencies for all categories based on physiographic region or other locational considerations. The EPEG notes that some of the previously approved CBWM BMPs have chosen to treat karst geology the same as coastal plains physiography to avoid the need to add karst as a separate category.

In addressing these charges, the EP will refer to the practices documented in EPA's [\*National Management Measures for the Control of Nonpoint Pollution from Agriculture\*](#), chapter 4F, Irrigation Water Management. The EP is advised of ongoing research by the U.S. Geological Survey (USGS) under the Small Watershed Studies project. USGS is investigating small watersheds in Delaware and Maryland to document the effects of irrigation and other conservation practices on hydrology and shallow groundwater quality. These projects are scheduled to end in July, 2016 ([Bucks Branch Project](#) [Delaware]) and September, 2016 ([Andover Branch Project](#) [Maryland]). The EP should consider interim data and preliminary results of these projects, to the extent they are available.

### **Timeline and Deliverables**

The Expert Panel project timeline for the development of the panel recommendations is based on the Phase 6.0 model development schedule. This timeline includes the development of a provisional recommendation for this BMP prior to the finalization of a fully documented recommendation report with effectiveness values. Provisional panel recommendations will be used only for initial Phase 6 model development and calibration, and not for future implementation progress reporting by the jurisdictions.

- May 2015 – Panel stakeholder kickoff meeting
- Fall 2015– Provisional BMP paper

Based on their written EPEG charge, the panel will develop a proposed scope of work including BMP structure and type, draft BMP definition(s), and initial elements of the BMP such as associated components and conservation practices, and USDA-NRCS associated conservation practice standard codes. Initially identified literature citations will be included to provide a range of potential effectiveness values that the panel will consider and supplement with further evaluation. The panel will present their provisional BMP paper to the AgWG, WTWG, and WQGIT for informational purposes, and for initial partnership comments on the proposed direction of the panel's evaluation. The paper will not represent a full recommendation report, and the partnership will not be asked for formal approval at this time.

- May 2016 – **Target date** for panel to release full recommendations and final report for approval by the AgWG, WTWG, and WQGIT.
- August 2016 – If approved by the partnership, panel recommendations are final and will be represented in the final Phase 6 modeling tools.

## **Phase 6.0 BMP Verification Recommendations**

The panel will utilize the Partnership approved *Agricultural BMP Verification Guidance*<sup>2</sup>, as the basis for developing BMP verification guidance recommendations that are specific to the BMP(s) being evaluated. The panel's verification guidance will provide relevant supplemental details and specific examples to provide the Partnership with recommended potential options for how jurisdictions and partners can verify Cropland Irrigation Management practices in accordance with the Partnership's approved guidance.

## **References**

AgWG (Agriculture Workgroup). 2014. Agriculture Workgroup expert panel organization – DRAFT January 8, 2014. Agriculture Workgroup, Chesapeake Bay Program.

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<sup>2</sup> <http://www.chesapeakebay.net/documents/Appendix%20B%20-Ag%20BMP%20Verification%20Guidance%20Final.pdf>

## **Attachment 1: Outline for Final Expert Panel Reports**

- Identity and expertise of Panel members
- Practice name/title
- Detailed definition of the practice
- Recommended nitrogen, phosphorus, and sediment loading or effectiveness estimates
  - Discussion may include alternative modeling approaches if appropriate
- Justification for the selected effectiveness estimates, including
  - List of references used (peer-reviewed, unpublished, etc.)
  - Detailed discussion of how each reference was considered, or if another source was investigated, but not considered.
- Description of how best professional judgment was used, if applicable
- Land uses to which the BMP is applied
- Load sources that the BMP will address and potential interactions with other practices
- Description of pre-BMP and post-BMP circumstances, including the baseline conditions for individual practices
- Conditions under which the BMP works:
  - Should include conditions where the BMP will not work, or will be less effective. An example is large storms that overwhelm the design.
  - Any variations in BMP effectiveness across the watershed due to climate, hydrogeomorphic region, or other measureable factors.
- Temporal performance of the BMP including lag times between establishment and full functioning (if applicable)
- Unit of measure (e.g., feet, acres)
- Locations within the Chesapeake Bay watershed where this practice is applicable
- Useful life; effectiveness of practice over time
- Cumulative or annual practice
- Description of how the BMP will be tracked, reported, and verified:
  - Include a clear indication that this BMP will be used and reported by jurisdictions
- Suggestion for a review timeline; when will additional information be available that may warrant a re-evaluation of the estimate
- Outstanding issues that need to be resolved in the future and a list of ongoing studies, if any
- Documentation of any dissenting opinion(s) if consensus cannot be reached
- Operation and Maintenance requirements and how neglect alters performance

### **Additional Guidelines**

- Identify ancillary benefits and unintended consequences
- Include negative results
  - Where studies with negative pollution reduction data are found (i.e. the BMP acted as a source of pollutants), they should be considered the same as all other data.

- Include results where the practice relocated pollutants to a different location. An example is where a practice eliminates a pollutant from surface transport but moves the pollutant into groundwater.

In addition, the Expert Panel will follow the “data applicability” guidelines outlined Table 1 of the Water Quality Goal Implementation Team Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model<sup>1</sup>.