

**Iowa State Nutrient Reduction Science Team**  
**Response Related to the Iowa Nutrient Research and Education Council and Geosyntec**  
**Report “Quantification of Phosphorus Loss due to Structural Agricultural BMP Implementation”**  
**April 15, 2024**

The [Iowa BMP \(Best Management Practices\) Mapping Project](#) was conducted to identify BMPs present across the state from 2007-2010 timeframe to quantify practice adoption, assess the benefits of these BMPs through watershed modeling, and future practice tracking. BMPs mapped included terraces, water and sediment control basins (WASCOB), grassed waterways, pond dams, contour strip cropping and contour buffer strips. A companion project assessed a representative sample of HUC-12 watersheds across the state, approximately 20% of each Major Land Resource Area (MLRA), to determine trends and changes in practice implementation from the 1980s, 2007-2010, and 2016-2018.

In 2019, the Iowa Nutrient Research and Education Council (INREC), a partner in the Iowa BMP Mapping Project, contracted with Geosyntec consultants to estimate the reduction of phosphorus losses due to the implementation of three types of structural BMPs on Iowa agricultural land (pond dams, terraces, and WASCOBs). Methodological details and project results were summarized in the report entitled [“Quantification of Phosphorus Loss due to Structural Agricultural BMP Implementation – Final Report”](#) (Geosyntec 2021).

In the INREC/Geosyntec assessment, estimates of phosphorus loss reductions were generated in three steps: 1) a literature review was conducted to inform ranges of phosphorus loss reductions for individual BMP implementations of pond dams, terraces, and WASCOBs; 2) a geographic information system analysis was completed to determine the land area treated by BMPs in the subset of Iowa watersheds for which practice use was identified for each of the three time periods prepared for the Iowa BMP Mapping Project; and, 3) estimates were combined to determine the in-field phosphorus loss reductions due to the estimated acres treated by BMPs in the surveyed watersheds. Because the surveyed watersheds were randomly distributed across Iowa, and representative of the MLRAs used by the INRS, phosphorus loss reductions were scaled to a statewide estimate.

As documented in the final report, the INREC/Geosyntec assessment estimated that implementation of the three BMPs (pond dams, terraces, and WASCOBs) implemented during the 1980s reduced phosphorus lost from agricultural fields by 4% (range: 2.8% to 5.2%). For 2016-2018, the phosphorus reduction loss with BMP implementation was estimated at 7% (range: 4.8% to 9.5%). As stated in the report, this implies that construction of these three BMPs between the 1980s and 2016-2018 increased the control of nonpoint source phosphorus export from agricultural fields by three percentage points. Results documented that areas treated by BMPs vary widely across the Major Land Resource Areas of Iowa, with BMPs far more numerous and treated areas far greater in the hilly areas of western and eastern Iowa. Implementation of terraces and pond dams were shown to have increased notably from the 1980s to 2016-2018, and the number of WASCOBs to have more than tripled during this period. Accordingly, the treated areas of all three BMP types increased during this period.

Methodologies employed in the INREC/Geosyntec project leveraged existing public databases to complete a novel analysis of the acres treated by BMPs implementation between the 1980s and 2016-2018 and estimate the reduction the losses of phosphorus from Iowa agricultural fields via surface runoff. Multiple elements of conservatism in the study methodology imply that actual field-scale phosphorus loss reductions due to BMP implementation may be higher than reported. Results from this effort estimate field to stream phosphorus transport, and do not address stream bed and bank

contributions, which have been identified as a significant source of total phosphorus export from Iowa (Schilling et al. 2021, Anderson 2022).

Outputs of the initial INREC/Geosyntec project provide context to the estimated benefits of structural BMP practice adoption from the 1980s to the 2016-2018 period at the scale of the state. The treated area and phosphorus loss reductions determined by Geosyntec from the 1980s for the three structural BMPs are the best estimate available due to limitations of spatial data and these figures are unlikely to be improved upon. There are ongoing efforts to continue to build on to public databases and detailed modelling efforts to further refine estimates of the reduction of phosphorus loss due to structural BMP implementation. These efforts utilize watershed-specific sediment and phosphorus loss outputs from the Iowa Daily Erosion Project and the Agricultural Conservation Planning Framework projects to: simulate, identify, and prioritize areas of high erosion and P transport potential; characterize potential BMP placement and benefits of existing BMPs; and quantify potential sediment and phosphorus reduction and costs at different scales, from field to the small catchment level. A goal of this current research will be to provide conservation practitioners with tools and quantitative outputs about sediment and phosphorus reduction and costs associated with various BMP scenarios at scales ranging from the field to the state.

## References

Iowa BMP Mapping Project. 2017. Iowa State University GIS Facility. <https://www.gis.iastate.edu/BMPs>.

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