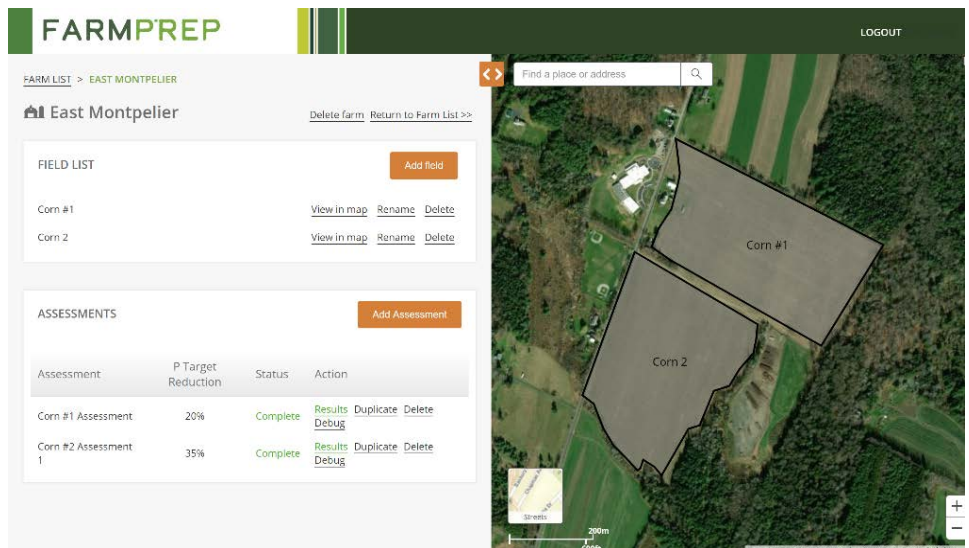# The Farm-P Reduction Planner (Farm-PREP): An Integrated Tool for Optimizing Field Practices to Achieve Farm-Scale Nutrient Reductions and Improve Water Quality

Stone developed the Farm Phosphorus Reduction Planner (Farm-PREP), an integrated web-based application, to help farmers, technical crop consultants, and stakeholders easily evaluate the impacts of field-level best management practices on farm scale phosphorus (P) loss reductions and identify modifications to their field operations to help achieve water quality improvement targets on the watershed-scale.

Farm-PREP brings the power of the USDA Natural Resource Conservation Service's farm-scale water quality model, the Agricultural Policy Environmental eXtender model (APEX), to a much broader audience through a streamlined and user-friendly user interface allowing for evaluation of thousands of farm management scenarios. The tool integrates agronomic and hydrologic science, numerical modeling, and web-based application development that is packed with science and engineering on the back-end, yet elegant and intuitive on the user-facing front end.

Farm-PREP's web-based user interface provides *a streamlined and user-friendly interface to APEX, allowing farmers, crop consultants, and other stakeholders to easily identify options for field-level practices that meet water quality objectives and identify solutions that meet their farm's operational needs and preferences.*

Stone worked closely with the University of Vermont agricultural scientists, local crop consultants, and stakeholders on the development of APEX model inputs to represent thousands of possible field practice combinations representative of Vermont dairy operations. These model inputs were then built into a relational database and accessed by the Farm-PREP tool based on user input. Using the tool, Stone tested APEX model simulations and evaluated the model predictions for a broad range of agricultural practices and field conditions.

Numerical modeling and optimization methods were developed to enable the execution of thousands of APEX model simulations for each farm to identify management solutions that met a target for reducing phosphorus losses. The modeling and optimization approach utilized distributed cloud computing in a dynamic framework that could accommodate increasingly complex analyses associated with increasing farm size and number of concurrent users. Farm-PREP's web-based user interface with a logical work-flow is designed to allow efficient inputs of the most critical farm information required to conduct the modeling analysis. The information provided by the tool offers farmers multiple options for field-level practices that meet water quality objectives and allows the farmer to make decisions on solutions that also meet their farm's operational needs and preferences.

Users provide current crop rotations and agronomic practices, and Farm-PREP generates model simulations of multiple combinations of field practices to arrive at a farm-level plan that meets pre-determined farm phosphorous reduction targets.

The Farm-PREP tool is currently being expanded throughout the state of Vermont and is being enhanced to include additional field-level management practices and consideration of alternative nutrient management technologies. The implementation of this tool will lead to a substantially more quantitative and targeted approach to implementing improvements in farm agronomic practices that meet water quality objectives required to satisfy the Lake Champlain P Total Maximum Daily Load (TMDL).

Expanding the Use of Farm-PREP to Other Agricultural States and Regions

Farm-PREP is ready for expansion into other agricultural regions of the United States. Stone's team of environmental modelers, hydrologists, and application developers will work with you to develop appropriate crop rotation and agricultural practice inputs for your region. Farm-PREP will provide you with a consistent, defensible approach to decision-making and quantifying environmental sustainability benefits.

To learn more about the Farm-PREP tool please visit https://farm-prep.net/info. You can also contact Michael Winchell (mwinchell@stone-env.com) or Barbara Patterson (bpatterson@stone-env.com) for additional information or a free demo.