

The Farm Phosphorus Reduction Planner (Farm-PREP): Developing an Integrated Tool to Meet Farm and Basin-Scale Water Quality and Climate Goals

STONE
ENVIRONMENTAL
100% EMPLOYEE-OWNED

Services / Products

Web-Based Application and Tool Development
User Interface / User Experience Design
Agricultural Stewardship
Producer Conservation
Farm-Field Nutrient Management
Agricultural Policy Environmental eXtender (APEX) Model Customization and Integration
Watershed and Water Quality Planning
TMDL Implementation Support

Technology

ArcGIS Server 10.5, PostGres 12.2, PostGIS 2.17, Vagrant, Packer, VMWare, Amazon AWS EC2 and S3, ArcGIS JavaScript API v3, JavaScript, HTML5, CSS3, Node.JS, GruntJS, Yeoman, AngularJS, Compass, Microsoft Windows Server 2012 R2, Python, Assembla, AGILE methodologies

Markets

State Government
Agriculture
Farmers and Crop Consultants
Conservation Districts

Project Location

Vermont

Date Completed

2017–Present

Project Owner

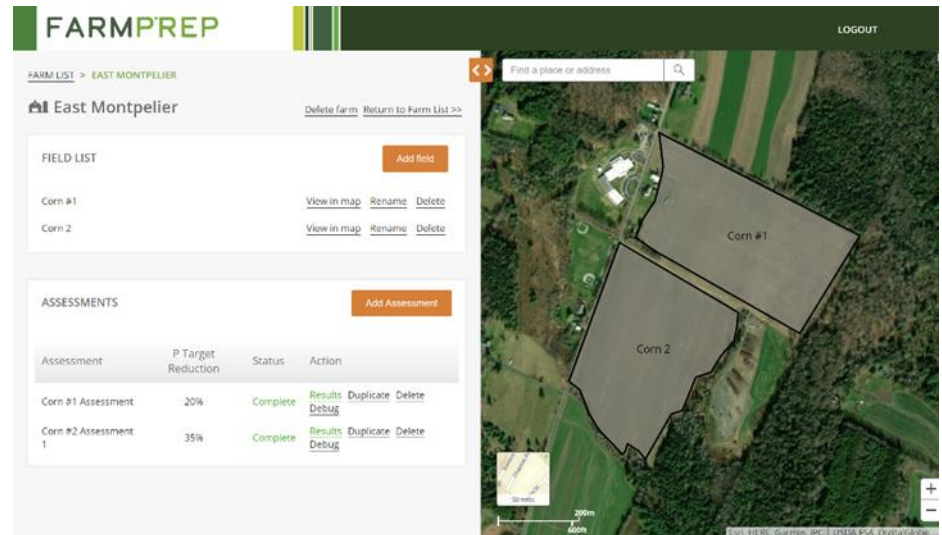
Stone Environmental

Partial funding: Lake Champlain Basin Program.

Project Manager

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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 developed the Farm Phosphorus Reduction Planner (Farm-PREP) to help farmers, technical crop consultants, and stakeholders evaluate the impacts of field-level best-management practices on farm-scale phosphorus loss reductions, and identify modifications to their field operations to help achieve water quality improvement targets on the watershed-scale. Farm-PREP is an integrated web-based application that brings the power of the USDA Natural Resource Conservation Service's farm-scale water quality model, the APEX, to a much broader audience through a streamlined and user-friendly interface that evaluates thousands of farm management scenarios. The tool integrates agronomic and hydrologic science, numerical modeling, and web-based application development into a high-powered scientific modeling tool utilized by an elegant and intuitive user-facing front end.

Development of the Farm-PREP tool and integration with the APEX model allows for thousands of possible use cases. Stone worked closely with the University of Vermont agricultural scientists, local crop consultants, and stakeholders to develop APEX model inputs that represent thousands of possible field-practice combinations representative of Vermont dairy operations. These model inputs were built into a relational database and accessed by the Farm-PREP tool.

Stone is also supporting the ongoing development of a version of the Farm-PREP for the Vermont Agency of Agriculture, Food and Markets' (VAAFM) Pay for Phosphorus Program. This program provides farmers with performance-based payments for reducing phosphorus loss through conservation practices. The VAAFM opened applications for the program in January 2022 after receiving a \$7 million grant from the USDA Natural Resources Conservation Services. This expansion of the



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APEX-based Farm-PREP tool required substantial model testing and evaluation, including a critical review of the physical process linkages between soil carbon and nutrient dynamics, crop growth, water quality, and agronomic management decisions.

We continue to work with VAAFM to evaluate a subset of greenhouse gas models that can be incorporated into the Farm-PREP tool to evaluate a farm-scale footprint more holistically for not only water quality indicators but GHG emissions and carbon sequestration. This effort expands the tool's capabilities to:

- Include non-agricultural natural and working lands,
- Model carbon emissions and carbon sequestration,
- Represent soil aggregate stability.

The tool framework will continue to focus on evaluating and tracking improvements and progress toward water quality and climate goals by implementing better practices in agricultural management.

The screenshot displays the FARM-PREP web application. The top section is a table of farm fields with columns: Field, Acres, Soil Name, Hydro Group, Slope, HBMA, and Proximate to Water. Below this is an 'Assessments' section with a 'Hint' and a 'Create new assessment' button. The bottom section is a table titled 'Planned/Actual Management' showing assessment details.

Field	Acres	Soil Name	Hydro Group	Slope	HBMA	Proximate to Water
J5_1	139	Massena	C/D	1.4	Corn/Hay-Well drained	✓
J5_10	17	Unadilla	B	2.6	Corn/Hay-Well drained	
J5_2	46	Binghamville	C/D	0.2	Perm Corn-Well drained	
J5_3	24	Massena	C/D	2.2	Corn/Hay-Well drained	✓
J5_4	105	Au Gres	A/D	0.7	Perm Corn-Well drained	

Assessment Name	Program Status	Status	Total P Reduction	Action
Actual 2022	Verified	Complete	52%	Results Review
Actual 2023	Verified	Ready		Review
Planned 2022	Submitted	Complete	95%	Results Review
Planned 2023	Submitted	Complete	60%	Results Review
Planned 2024	Data Entry	Complete	26%	Results Edit Create Actual Delete

Farm-PREP has been customized to support implementation of the Pay for Phosphorus Program and evaluation of the impact of agricultural conservation practices against historic baseline management scenarios.

