Field to Market Water Quality Metric

Version 1.0 – Published June 2021

CONTENTS

FIELD TO MARKET VISION & MISSION

Our Vision: To harness the collective action of the value chain to support resilient ecosystems and enhance farmer livelihoods.

Our Mission: To meet the agricultural challenge of the 21st century by providing collaborative leadership that is transparent; grounded in science; focused on outcomes; open to the full range of technology choices; and committed to creating productive and profitable opportunities across the agricultural value chain for continuous improvements in environmental outcomes.

OVERVIEW

Field to Market sustainability metrics are reviewed and, if necessary, revised once every three years in order to ensure they remain grounded in best available science. In addition, any member can request review of a metric based on advances in models or research that indicate a change may be warranted. The Metrics Committee has been discussing possible replacement metrics for Water Quality for a number of years. The NRCS Water Quality Index (WQI) tool was adopted by Field to Market in 2011 along with a recommendation to use WQI temporarily while an alternative, quantitative approach to assessing the nutrient loss from individual farm fields was identified or developed. Since then, Field to Market's Metrics Committee and Science Advisory Council, in collaboration with expert advisors from University members of the Affiliate Sector have explored a number of alternative tools and approaches for their potential as a Water Quality Metric. The conclusion from these explorations is that full national adoption of a quantitative water quality approach at the field level is not yet scientifically or technically feasible; however, an alternative metric approach is adoption of a new index model that has a strong grounding in national quantitative modeling assessments. Thus, the Metrics Committee has recommended that Field to Market replace WQI with STEP (Stewardship Tool for Environmental Performance)[1] a component of the USDA Natural Resources Conservation Service (NRCS) Resource Stewardship Evaluation Tool (RSET), while continuing to follow developments in science and technology that would eventually enable a quantitative approach.

STEP is the water quality component of the RSET conservation planning platform currently available to NRCS conservation staff nationwide. While STEP has multiple sub-components for sediment, nutrients and pesticides, the initial Field to Market implementation would focus on STEP-nutrients which includes four loss pathways (N lost in surface water runoff; N lost to subsurface leaching; total P loss; soluble P loss). Suggestions for Field to Market approaches to sediment and pesticides are made toward the end of this document.

[1] See "STEP within RSET" documentation link at the bottom of web page

A streamlined version of STEP is included in the NRCS CART (Conservation Application Ranking Tool) platform. The CART implementation is simplified from the RSET implementation as it is targeted specifically to assess farmer qualifications for NRCS programs. This simplification reduces the number of management practices that influence nutrient outcomes and so was not considered as a metric that would offer substantial benefits over the current WQI tool.

Based on NRCS documentation, we expect RSET components, including STEP, to continue to be developed and to be made publicly available in the future. Specific timelines for new versions and public release are not currently available. RSET model services are currently deployed for operational use by NRCS. STEP availability in these model services, which are already used by Field to Market's Fieldprint Platform for soil erosion models, means that Field to Market could begin technical work towards incorporation of STEP at any time.

Scientific Basis

An overview of the scientific basis for STEP is available in the NRCS documentation "STEP within RSET" and the calculations and scoring in STEP have been developed out of the series of national modeling exercises USDA conducts as part of the Conservation Effects Assessment Project (CEAP) cropland reports. CEAP is an ongoing assessment of water quality and conservation practice adoption that applies complex biophysically based crop and water quality models (APEX and SWAT) to detailed survey results from the National Resources Inventory. STEP utilizes these detailed quantitative results to characterize the relative potential for nutrient loss and effectiveness of different conservation practices on water quality based on a field's specific soil and topographic characteristics and climate conditions.

STEP is an index tool designed to rate the potential for nutrients to runoff the edge of the field or leach below the rootzone for each of four categories of nutrient loss. It does not dynamically model a field or provided a quantitative estimate of the amount of nutrient loss occurring. STEP operates by determining the site-specific risk of nutrient loss, and then evaluating the farm management practices based on how they do or don't mitigate for the site-specific risk. STEP has been run nationally using USDA NRI survey information collected from farmers, and these results were compared to the detailed quantitative modeling results from CEAP. This comparison informed the STEP calculations and determination of site specific risk for nutrient losses. More detail on how the CEAP modeling was used to inform STEP development is available in the NRCS documentation.

How STEP compares to WQI

Direct comparisons of the two tools have been done in Minnesota; one major difference is that WQI doesn't explicitly characterize subsurface N loss through leaching, and this drives differences in the results where some fields that achieve good stewardship

scores with the NRCS WQ criteria using WQI would not meet the stewardship threshold set by STEP. Both tools result in an "index" result of the risk of loss of nutrients and sediment, rather than a quantitative accounting of the amount lost. However, because the nutrient loss in STEP is divided into specific pathways, the results provide specific insights into where the greatest loss potential is for a given field, and what practices are most effective at mitigating the risk of nutrient loss. STEP would therefore provide new opportunities for targeting water quality improvements within Field to Market projects, including more specific guidance and educational materials for farmers, and greater insight for value chain partners into the specific practices that can lead to improvement in a given supply region.

WQI includes a pest management component of the overall score that is based on IPM (Integrated Pest Management) practice adoption. STEP also includes a pesticide component; however, this is represented by the WinPST model which requires additional data on chemical active ingredients used on the field that is not currently collected in Field to Market's Fieldprint Platform. This discrepancy is addressed further toward the end of this document.

The STEP model was run for a set of sample fields in the Fieldprint Platform with basic nutrient management as well as for a set of sample fields using advanced nutrient management practices in order to better understand the data requirements for running STEP and how the water quality outcome score compares to WQI. Overall, the existing data entries, principally from the rotation builder, provided sufficient information to run the STEP model services. Some interpretation and assumptions were required on the part of the tester. If approved, implementation would require automating this process through code in the Fieldprint Platform by developing the interactions pass input data to and receive output data from the STEP-nutrient model services maintained by USDA NRCS.

From the user perspective, implementing STEP for nutrients would not require any additional information beyond what is currently provided; it would, however, change the best method of collecting the information. Given the importance of fertilizer application timing in STEP compared to WQI, the the information provided in the rotation builder schedule of practices would become the primary set of input data for the STEP calculation. Additional user guidance on entering complete and accurate information in the rotation builder is recommended. The Fieldprint Platform would also need to add one specific question on whether the farmer conducted a soil P test for the field. The data entries and results for two sample fields for both STEP and WQI are included at the end of this document, along with an example showing change in STEP scoring in response to change in nutrient management practices.

STEP CALCULATIONS AND IMPLEMENTATION FOR FIELD TO MARKET

STEP can be considered as a way to evaluate whether a specific field is losing nutrients at below or above a field-specific risk level that is informed by research documented in

the Conservation Effects Assessment Project cropland reports. A set of physical nutrient loss thresholds, informed by the nationwide CEAP modeling results, were used to develop conservation planning thresholds for STEP. These thresholds are used as a key reference point in STEP to determine the level of conservation practice adoption (mitigation points) needed for specific locations and site vulnerability characteristics. The mitigation points are considered sufficient to mitigate nutrient losses if the CEAP modeling determined there was an 80% probability that existing conservation practices could mitigate that loss. Thus, the thresholds inform the level of mitigation needed to offset the site vulnerability.

It is important to note that the thresholds are not considered desirable or sustainable levels of nutrient loss; rather, since certain conditions make fields more susceptible to nutrient loss, having a common threshold is a necessary model component in order to establish the site specific differences in the level of conservation practices needed to mitigate nutrient loss. Note that in Field to Market's implementation, the objective is continuous improvement in the metric score over time rather than meeting a specific target level.

The calculations described below and presented in the NRCS documentation are done on a crop specific basis; results can also be averaged across different crops/years for a full rotation result. STEP calculations can be considered in three main phases.

Phase 1: Water Quality Sensitivity Rating (WQSR)

As noted above, each field has characteristics that influence how likely it is to lose nutrients. These characteristics include soil leaching potential, soil runoff potential, rainfall intensity and irrigation; thus, the first calculation in STEP is to establish the specific risk for an individual field, termed the "Water Quality Sensitivity Rating" (WQSR). For fields with diverse soils, STEP conducts an area-weighting of the major soils present to determine the soil leaching and runoff potential across the field as a whole unit.

The calculation result classifies the field into one of 16 categories of site vulnerability to nutrient loss (see NRCS documentation for detail); this may be different for the different nutrient loss pathways (surface and subsurface; N and P). WQSR is then used to determine how easy or difficult it is to manage the field to reduce the risk of nutrient loss, expressed as the number of conservation practice points required. The points assigned to specific practices were developed by NRCS staff, informed by the CEAP model results and additional modeling analyses with CEAP data. The points are crop system specific and are detailed in the accompanying excel spreadsheet.
For Fieldprint Platform implementation, the WQSR calculations would occur in the background using user supplied information on field boundaries to access soil and weather databases and user supplied information on irrigation management. No additional data entry would be required. Users would be informed of their WQSR category for each loss pathway to help communicate the relative risk of nutrient loss for their field.

Phase 2: Risk Mitigation.

The second phase of STEP calculations evaluates field practices (crop rotation, tillage, irrigation, nutrient management) to determine the level of risk mitigation (RM) achieved with the actual field management system. STEP evaluates a full rotation (typically over multiple years), including any fallow periods or winter cover crops, and requires management data for each crop in the rotation period. For Fieldprint Platform implementation, input data requirements for this phase would be met by information already entered in the rotation builder for each field.

Field practices included in the STEP calculation are listed below. The risk mitigation scores associated with the responses to questions, and the calculation of total risk mitigation for each loss pathway, is detailed in figures in the separate NRCS documentation.

Tillage: The timing and level of tillage is used to determine the amount of residue on the field.

Nitrogen management:

- Amount of N credit carried over from a cover crop or prior year applications
- Amount of inorganic N fertilizer applied
- Amount of organic N applied
- Timing of first N application
    - Is the first N application a split application
    - Is the first N application <40 lb/ac
- Split applications – are they split into 3 or more applications?
- N application method
- Crop type – used to determine the N ratio (N removed in crop harvest)

Phosphorous Management:

- Amount of inorganic P fertilizer applied
- Amount of organic N fertilizer applied
- Is the P application intended for multiple years of the rotation
- Is the P application intended for cover crops, and over how many years
- P application timing
    - Is the first application split
    - Is the first application <25 lb/ac
- P application method

On response to questions from the Metrics Committee, NRCS provided the following additional details about how specific nutrient management practices are counted in STEP:

- Starter fertilizer is considered if less than 40 units of N are applied at planting.

- Enhanced Efficiency Fertilizer (nitrogen) is accounted for as a Management technique.
- Management credits are given for precision technology use, which includes variable rate technology on both nitrogen and phosphorus.
- Fertilizer application dates progressively closer to planting or after planting accrue more mitigation credits.
- Soil P test levels impact credit applied for one-year vs two-year application. If soil test P levels are not High or Very High, two years of P may be applied at one time at a rate based on two years of crop removal.
- Does the tool account for nitrogen application in the fall with regards to BMPs on anhydrous ammonia after soil temperatures are below 50 degrees? In this situation no Timing credits are provided if the application is done prior to 21 days before planting. This practice could receive Management credits for a nitrification inhibitor. Currently, STEP does not accrue points for soil temperatures being 50 degrees or lower.
- With phosphorus application, is the tool operating under a build/maintain or sufficiency method? No. STEP does not support either building P when soil test levels are already high, nor does it support not applying enough P when soil test levels are medium or lower. If there is any risk of P loss, based on site conditions, STEP will show a points penalty for applying more than two years of P at any one time. The table below shows the P schema used in STEP:

Phosphorus Application Rate					
	Phosphorus Soil Test				
P Rate	Excessive/ Very High	High (Optimum)	Medium	Low	No Test
No P application	**15**	**20**	**15**	**0**	**0**
<= 1.0	**-10**	**15**	**20**	**15**	**-10**
<= 1.2	**-30**	**10**	**15**	**20**	**-30**
<= 1.4	**-50**	**0**	**10**	**15**	**-50**
>1.4	**-50**	**0**	**0**	**0**	**-50**

Responses to these questions are used to calculate the total risk mitigation achieved for each of the loss pathways; these calculations are detailed in the separate NRCS documentation.

The Fieldprint Platform collects the necessary tillage information and approximately 80% of the data requested for N and P management. For implementation, we would need to consider reframing existing questions or adding additional questions to capture:

N credit assumed from prior fertilizer applications/cover crops; splits into 3 or more applications; organic P amount; multi-year P applications.

Phase 3: Evaluating Mitigation Points Achieved Relative to Nutrient Loss Risk

The calculations in Phase 1 and 2 will then provide a site vulnerability and risk mitigation score for each of the nutrient loss pathways, filling out the matrix of variables below.

Loss Pathway	Sensitivity Rating (WQSR)	Risk Mitigation (RM)
Total Phosphorus – Surface and Subsurface	$WQSR_{tp}$	RM_{tp}
Soluble Phosphorus - Surface and Subsurface	$WQSR_{sp}$	RM_{sp}
Surface Nitrogen (runoff and wind erosion)	$WQSR_{sn}$	RM_{sn}
Subsurface Nitrogen (leaching)	$WQSR_{ln}$	RM_{ln}

STEP as implemented by NRCS considers the relative points of risk mitigation achieved compared to the sensitivity rating for that field in their conservation planning process with individual producers. These scores, specific to the four nutrient loss pathways, are used to make practice recommendations for additional mitigation where necessary.

Fieldprint Platform implementation could illustrate these results as a numerical score such as a ratio:

Loss Pathway	WQSR Category	WQSR	Risk Mitigation	RM:WQSR
Total P	Moderate	45	46	1.02
Soluble P	Moderately High	50	48	0.96
Surface N	Low	30	37	1.23
Subsurface N	High	65	53	0.82

In this example, metric scores greater than 1 indicate good water quality stewardship for that factor; scores less than 1 indicate additional risk mitigation is needed in that factor. As an alternative, scores could be arithmetically transformed to be presented on a scale of 0-10, similar to the current Field to Market water quality metric. The Field to Market

Metrics Committee will evaluate and select an appropriate results presentation option in consultation with the Education & Outreach Committee, Verification Committee and Project Administrators Network.

NRCS guidelines state that the results should not be aggregated across the resource concerns; therefore, an aggregate metric would need to reflect the individual components; e.g. that 50% of nutrient loss pathways are adequately mitigated, represented by 2 of 4 ratios exceeding 1.0, in this example.

For Field to Market communications and claims, the guidance could be similar to how we currently refer to the Soil Conditioning Index (Soil Carbon metric), where values above a certain level indicate low risk of nutrient loss and values below a certain level indicate opportunities for improvement. Improvements in the scores at a project level could be described as the number of fields (or acres) where the risk of nutrient loss has been reduced over time.

Sediment Component for STEP: STEP can include a sediment component which has not been included here. The Fieldprint Platform incorporates a separate Soil Conservation metric that quantitatively models wind and water erosion of sediment using USDA models. Providing a separate metric outcome on erosion calculated with the STEP threshold approach might prove confusing to users of the Platform; the current recommendation is to not include sediment as an explicit component of the water quality metric. However, in cases where there is specific interest for a crop or project, customized presentation of results to emphasize the water quality considerations of sediment loss can be considered.

Pesticide Component for STEP: The above documents the nutrient components of the STEP tool. NRCS utilizes their WinPST tool to evaluate pesticide risk based on soil properties and active ingredients applied. Options for Field to Market include:

- Continuing to follow the WQI approach (based on IPM adoption) for pesticide loss risk to water and adapting the calculation into our implementation of STEP.
- Adapting the STEP-pesticide component based on WinPST
- Adopting a separate, new metric for pesticide management based on WinPST and IPM practices.

The Field to Market Board of Directors has accepted the recommendation of the Pest Management Task Force that the Metrics Committee explore a pest management specific metric for addition to the program. This work in ongoing within the Committee, with a recommendation expected no sooner than early 2021. At this time, we recommend proceeding to adopt STEP for nutrients and consider ways to enhance the pest management and environmental outcome concerns from agricultural chemical use in the ongoing Metrics Committee pest management discussions.

EXAMPLES

Example 1: Comparing STEP and WQI for a Corn and Soybean rotation in Iowa

Data entry in the Rotation Builder of the Fieldprint Platform.

Date	Operation	Crop	Notes	STIR	Comment
Iowa Lyon County Farm					
5/15/19	Tillage, subsoil, chisel, plow			45.5	
6/10/19	Tillage, cultivator, disk			26	
6/10/19	Seeding, planter	Soybean, grain	45	2.44	crop, bu/ac
7/10/19	Sprayer, post emergence		Pesticide	0.15	
11/5/19	Harvest, killing crop 20pct standing stubble			0.15	
11/15/19	Drill or air seeder, double disk	Small grain, winter, forage	2240	6.34	cover crop, lbs/ac
12/1/19	Fert. applic. anhyd knife 30 inch spacing		Fertilzer	2.6	34-0-0
5/20/20	Fert applic. surface broadcast		Fertilzer	0.06	Semi-Solid Manure
5/20/20	Sprayer, kill crop		Pesticide	0.15	
6/1/20	Planter, double disk opnr, fluted coulter	Corn, grain, seed	175	2.44	crop, bu/ac
8/1/20	Sprayer, fungicide, insecticide tank mix		Pesticide	0.15	
11/20/20	Harvest, killing crop 50pct standing stubble			0.15	
				43.065	Annual STIR

STEP Scoring

	N Leaching	N Runoff	Total P	Soluble P	
Soybean only score					
Soil Loss Potential	MODERATE	MODERATE	MODERATE	MODERATE	
Mitigation Threshold Score	30	30	45	20	Rfactor 122, WQSR non-sensitive
Crop Residue	0	3.5	3.5	0	tillage multiplier = 0.6
Winter Cover	0	0	0	0	
Application Rate	30	30	0	0	No N fertilization, no P soil test
Timing - 1st Application	0	0	0	0	
Timing - 1st Split Application	0	0	0	0	
Timing - 1st Application Size	0	0	0	0	
Timing - Total Splits	0	0	0	0	
Application Method	0	0	0	0	
Phosphorus Muti-Year	0	0	0	0	
Practice/Technique (CMPT)	0	0	0	0	
Mitigation Score	30	33.5	3.5	0	For Soybeans
Mitigation/Threshold	**1.00**	**1.12**	**0.08**	**0.00**	
Meets/Exceeds Threshold?	Yes	Yes	No	No	
Corn only score					
Soil Loss Potential	MODERATE	MODERATE	MODERATE	MODERATE	
Mitigation Threshold Score	30	30	45	20	Rfactor 122, WQSR non-sensitive
Crop Residue	0	14	14	0	tillage multiplier = 1.0
Winter Cover	0	0	0	0	cover crop planted too late
Application Rate	15	15	-10	-10	no P soil test
Timing - 1st Application	5	5	10	10	
Timing - 1st Split Application	5	5	0	0	Fertilizing cover crop constitutes split application?
Timing - 1st Application Size	0	0	0	0	
Timing - Total Splits	0	0	0	0	
Application Method	0	15	0	0	
Phosphorus Muti-Year	0	0	0	0	
Practiice/Technique (CMPT)	0	0	0	0	
Mitigation Score	25	54	14	0	For Corn
Mitigation/Threshold	**0.83**	**1.80**	**0.31**	**0.00**	
Meets/Exceeds Threshold?	No	Yes	No	No	
Corn-soybean rotation score					
Rotation Threshold	30	30	45	20	
Rotation Mitigation Score	27.5	43.75	8.75	0	
Mitigation/Threshold	**0.92**	**1.46**	**0.19**	**0.00**	
Meets/Exceeds Threshold?	No	Yes	No	No	

Example 2: Comparing STEP and WQI for a Corn and Soybean field in Missouri

Data Entry in the Rotation Builder of the Fieldprint Platform

Missouri Cooper County Farm					
Date	Operation	Crop	Notes	STIR	Comment
4/15/19	Chisel, st. pt.			45.5	
5/10/19	Cultivator, field 6-12 in sweeps			26	
5/10/19	Planter, double disk opnr	Soybean, grain	85	2.44	crop, bu/ac
6/10/19	Sprayer, post emergence		Pesticide	0.15	
10/5/19	Harvest, killing crop 20pct standing stubble			0.15	
11/1/2019	Fert. applic. anhyd knife 30 inch spacing		Fertilizer	6.34	Anhyd. Ammonia
4/20/2020	Fert. applic. Surface broadcast		Fertilizer	0.06	MAP 11-52-0
4/20/2020	Sprayer, kill crop		Pesticide	0.15	
5/1/2020	Planter, double disk opnr, fluted coulter	corn, grain, seed	220	2.44	crop, bu/ac
7/1/2020	Sprayer, fungicide, insecticide tank mix		Pesticide	0.15	
10/20/2020	Harvest, killing crop 50pct standing stubble			0.15	
				41.765	Annual STIR

STEP Results

	N Leaching	N Runoff	Total P	Soluble P	
Soybean only score					
Soil Loss Potential	MOD HIGH	MODERATE	MODERATE	MOD HIGH	
Mitigation Threshold Score	40	30	45	30	Rfactor 122, WQSR non-sensitive
Crop Residue	0	3.5	3.5	0	tillage multiplier = 0.6
Winter Cover	0	0	0	0	
Application Rate	30	30	0	0	No N fertilization, no P soil test
Timing - 1st Application	0	0	0	0	
Timing - 1st Split Application	0	0	0	0	
Timing - 1st Application Size	0	0	0	0	
Timing - Total Splits	0	0	0	0	
Application Method	0	0	0	0	
Phosphorus Muti-Year	0	0	0	0	
Practiice/Technique (CMPT)	0	15	15	0	riparian forest buffer
Mitigation Score	30	48.5	18.5	0	for Soybeans
Mitigation/Threshold	**0.75**	**1.62**	**0.41**	**0.00**	
Meets/Exceeds Threshold?	No	Yes	No	No	
Corn only score					
Soil Loss Potential	MOD HIGH	MODERATE	MODERATE	MOD HIGH	
Mitigation Threshold Score	40	30	45	30	Rfactor 122, WQSR non-sensitive
Crop Residue	0	14	14	0	tillage multiplier = 1.0
Winter Cover	0	0	0	0	no cover crop
Application Rate	20	20	0	0	no P soil test
Timing - 1st Application	0	0	0	0	
Timing - 1st Split Application	0	0	0	0	fertilizing cover crop constitutes split application?
Timing - 1st Application Size	0	0	0	0	
Timing - Total Splits	0	0	0	0	
Application Method	0	0	0	0	
Phosphorus Muti-Year	0	0	0	0	
Practiice/Technique (CMPT)	0	15	15	0	riparian forest buffer
Mitigation Score	20	49	29	0	for Corn
Mitigation/Threshold	**0.50**	**1.63**	**0.64**	**0.00**	
Meets/Exceeds Threshold?	No	Yes	No	No	
Corn-soybean rotation score					
Rotation Threshold	40	30	45	30	
Rotation Mitigation Score	25	49	24	0	
Mitigation/Threshold	**0.63**	**1.63**	**0.53**	**0.00**	
Meets/Exceeds Threshold?	No	Yes	No	No	

WQI Scores for Example 1 and 2

		Iowa Field – WQI Results	Missouri Field – WQI Results
Factor	**Weighting**	**Score (1-10 scale, poor to good)**	
Field Characteristics and Soil Physical/Erosion Factors	25%	7	7
Nutrient Management	25%	3.75	4.75
Tillage Management	25%	7.5	7.5
Pest Management	25%	2	7
Sub-Factor Scores	100%	5.06	6.56
Adjustment for Tile Drain Management	0%	5.06	6.56
Adjustment for Irrigation Management	0%	5.06	6.23
Adjustment for Grass Waterways	35%	6.83	----------
Adjustment for Field Borders	37.5%	8.02	----------
Adjustment for Riparian Forest buffer	37.5%	----------	7.65
Final WQI Score		**8.02**	**7.65**

Example 3: Comparison of STEP scores for a strip-till corn field in 2014 and 2018 with a change in nutrient management practices

STEP Scoring – Strip-Till Corn 2014

	Mitigation Points			
	N Runoff	N leaching	Total P	Soluble P
Crop Name: Corn				
Crop Yield: 186 bu/ac				
Tillage Type: Strip-Till				
Next Cover Type: Cover crop				
N carry-over or applied? Yes				
N carry-over from previous crop or cover crop? Yes				
N applied to this crop? Yes, crop growout ratio 1.22	15	15		
Amount of inorganic N: 189 lb/ac				
Amount of organic N: 0				
Timing of first N application: In Fall				
Split application? No				
First N application <=40 lbs/ac? No				
Total number of split applications:				
N application method: Injected	20			
Is P applied to this crop? Yes, crop growout ratio <1.2			20	20
Amount of inorganic P: Per soil test				
Amount of organic P: Per soil test				
Is P application part of multi-crop P application? Every other year				
Timing of first P application: In Fall				
Split application? No				
P application method: Broadcast				
Management Techniques				
Nutrient Application Rate – Precision Application	10	10	10	10
Nutrient Application Form – N Stabilizer		10		
Conservation Practices				
Residue and Tillage Management – Reduced Till (Strip Till)	3.15		3.15	
Conservation Crop Rotation – Management	17.5		17.5	

STEP Scoring				
Threshold Level	65	40	60	20
Mitigation Points	65.7	35	50.7	30
Ratio	1.0	0.9	0.8	1.5

STEP Scoring – Strip-Till Corn 2018

	Mitigation Points			
	N Runoff	N Leaching	Total P	Soluble P
Crop Name: Corn				
Crop Yield: 203 bu/ac				
Tillage Type: Strip-Till				
Next Cover Type: Cover crop				
N carry-over or applied? Yes				
N carry-over from previous crop or cover crop? Yes				
N applied to this crop? Yes, crop growout ratio 1.32	15	15		
Amount of inorganic N: 100 lb/ac				
Amount of organic N: 116 lb/ac				
Timing of first N application: Within 7 days of planting cover crop	10	10		
Split application? Yes	10	10		
First N application <=40 lbs/ac? No				
Total number of split applications: 2				
N application method: Banded	15			
Is P applied to this crop? Yes, crop growout ratio <1.2			20	20
Amount of inorganic P: Per soil test				
Amount of organic P: Per soil test				
Is P application part of multi-crop P application? No				
Timing of first P application: At cover crop planting			10	10
Split application? No				
P application method: incorporated (w/strip tillage)			10	
Management Techniques				
Nutrient Application Rate – Precision Application	10	10	10	10
Nutrient Application Form – N Stabilizer		10		
Conservation Practices				
Residue and Tillage Management – Reduced Till (Strip Till)	3.15		3.15	
Conservation Crop Rotation – Management	17.5		17.5	
Cover Crop – 15+ Days before end of growing season	6.625	10	6.625	7.5

STEP Scoring				
Threshold Level	65	40	60	20
Mitigation Points	87.3	65	77.3	47.5
Ratio	1.3	1.6	1.3	2.4

VERSION HISTORY

Status of Document:	Version 1.0 – Effective June 01, 2021
Contact Details:	athomson@fieldtomarket.org www.fieldtomarket.org
Next Planned Update:	As needed