The Spreadsheet Tool for Estimating Pollutant Load (STEPL)

Introduction to STEPL

March 20, 2018

Webinar Logistics

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The Spreadsheet Tool for Estimating Pollutant Loads (STEPL)

Introduction to STEPL

March 20, 2018

Speakers

- Aileen Molloy, Tetra Tech, Inc.
- Mustafa Faizullabhoy, Tetra Tech, Inc.

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Agenda

- Overview of STEPL
- Using the model
  - Navigating worksheets
  - Basic inputs & outputs
- Tools and Calculators
- Adding and Modifying BMPs
- STEPL Updates

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STEPL OVERVIEW

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What is STEPL?

- STEPL– Spreadsheet Tool for Estimating Pollutant Load - an EPA model
- A customized MS Excel spreadsheet model designed to support planning level decision-making
  - What are the average annual pollutant loadings from the non-point sources?
  - How effective are BMPs in reducing pollutant loadings?

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What is STEPL?

- Calculates nutrient (N, P, and BOD pollutants) and sediment loads by land use type and aggregated by watershed
- Calculates load reductions as a result of implementing BMPs
- Data driven and highly empirical
- Simple and easy to use
- Formulas and default parameter values can be modified by users (optional) with no programming required

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Who are STEPL Users?

- Basic understanding of hydrology, erosion, and pollutant loading processes
  - Hydrology –> Curve Number approach
  - Erosion –> USLE and sediment delivery ratio, urban runoff concentration
  - Pollutant load –> runoff concentration
- Knowledge of environmental data (e.g., land use, agricultural statistics, and BMP efficiencies)
- Familiarity with MS Excel and Excel Formulas

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How is STEPL Used?

- Originally developed to assist State NPS project managers report load reductions to EPA
  - Performance measures for N, P, and Sediment
  - Data entered into the Grant Reporting & Tracking System (GRTS)
- Also used by other federal/state/local partners, environmental consultants, researchers, etc.
  - Primary model used for NPS project planning

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Progression of STEPL Prior to v.4.4

- First release Oct 2001
- Enhancements over the years
  - BMP calculator
  - Ability to add custom BMPs
  - Groundwater
  - Gullies & streambanks
  - Puerto Rico data
  - LID practices

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STEPL v.4.4 updates

- Expanded and updated weather data
- Added Manure application for pasture land
- Added tool for calculating average number of months for manure application
- Added reporting function (Export Input/Output Option)
- Expanded agricultural BMPs and updated pollutant efficiencies
- Added flow volume reductions for urban LID and infiltration practices
- Added ***Combined BMP Efficiency*** worksheet
- Added customized STEPL spreadsheet model for 10 watersheds with ability to determine size of BMP treatment area to meet load reduction target
- Added *E. coli* placeholder for possible future release

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STEPL Basic Tools

- STEPL
  - Calculates load for different sources at source and watershed level
  - User can specify and update BMP list
  - Urban BMP Tool for stormwater BMPs
- BMP calculator
  - Calculates the “combined efficiency” of multiple BMPs use when more than 1 type of BMP is applied on a single land use type
- Input Data Server
  - Map interface to generate input data for the model at the HUC12 level

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STEPL Input Data Requirements

- Watershed-level data
  - County & Weather Station
  - Land use distribution
  - Agricultural animal population and number of months manure applied
  - Septic system information
- Land cover specific
  - BMP type and % area applied
  - Urban Land use types for urban BMPs

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STEPL System Defaults

- Derived from user inputs, but can be modified
  - Soil information (based on county)
  - Curve Numbers (land use/soil group)
- Urban land use distribution
- Nutrient concentration in runoff/shallow groundwater

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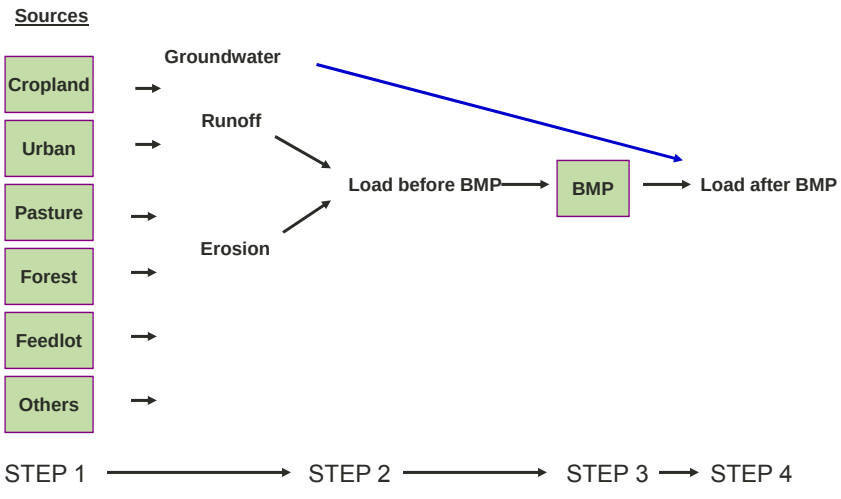
STEPL Process Steps



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System Requirements

- Windows operating system
- MS Excel 2010, 2013 or 2016
  - Not Compatible with Windows 7 operating system and MS Excel 2007 combination
- At least 30 MB hard disk space and memory >8GB RAM preferred

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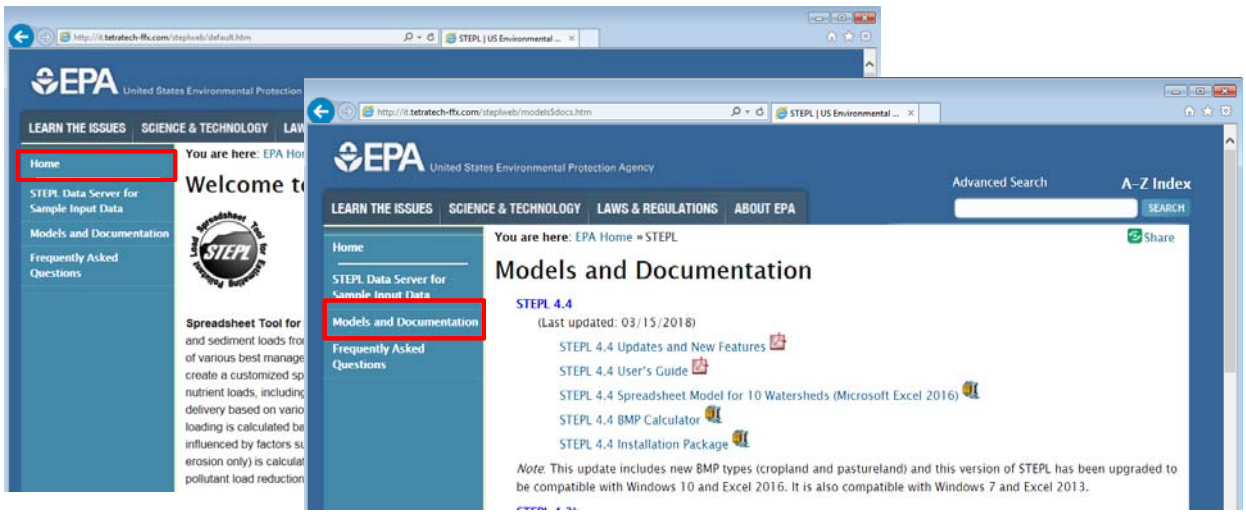
STEPL Website



Download the latest STEPL program file from: http://it.tetratech-ffx.com/steplweb/models$docs.htm

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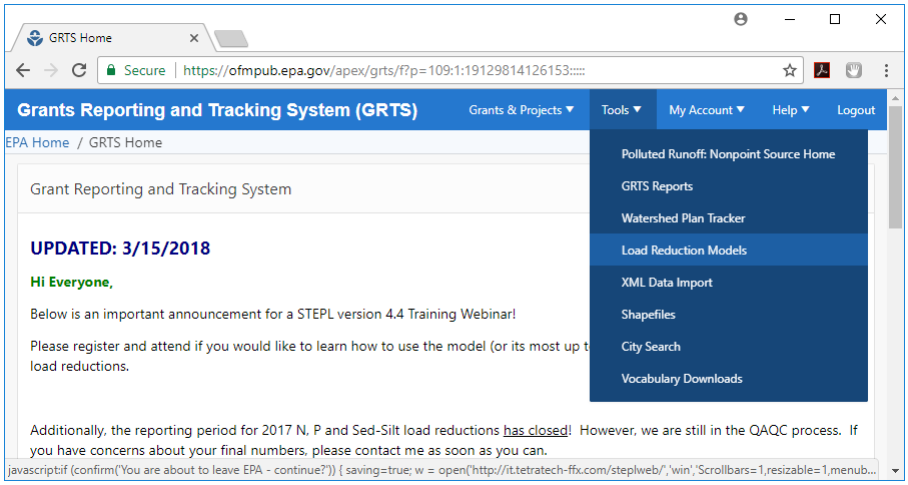
Alternate STEPL Access



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STEPL Installation

- Run the *STEPLSetup.exe* to install
  - must have admin rights
  - Important: install STEPL in a folder you have write access to

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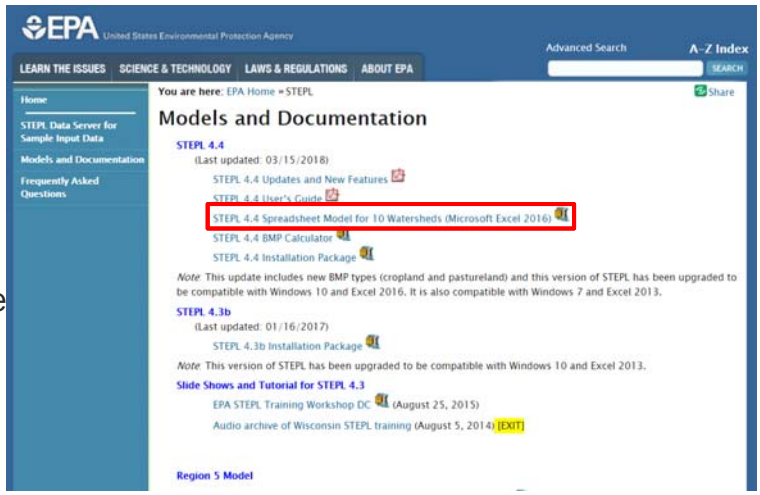
New!

Customized Spreadsheet Model

- Alternative to STEPLSetup.exe
  - Download *STEPL 4.4 Spreadsheet Model for 10 Watersheds*, which does not require admin rights
- Allows user to start working in STEPL without using installation package
- Provides ability to populate the model with up to 10 watersheds and 100 gullies and streambanks



STEPL Resources

- STEPL Installation Package includes:
  - STEPL User Guide
  - BMP Definitions
  - Sample Worksheets
  - Release Notes
  - BMP Calculator Guide
  - Support Worksheets contain input reference data

STEPL Resources

- Also on the website:
  - Frequently Asked Questions
  - STEPL Slide Shows & Tutorials
  - Alternative Models Document
  - Region 5 Model and documentation
- STEPL Support:

stepl@tetratech.com

How to use STEPL

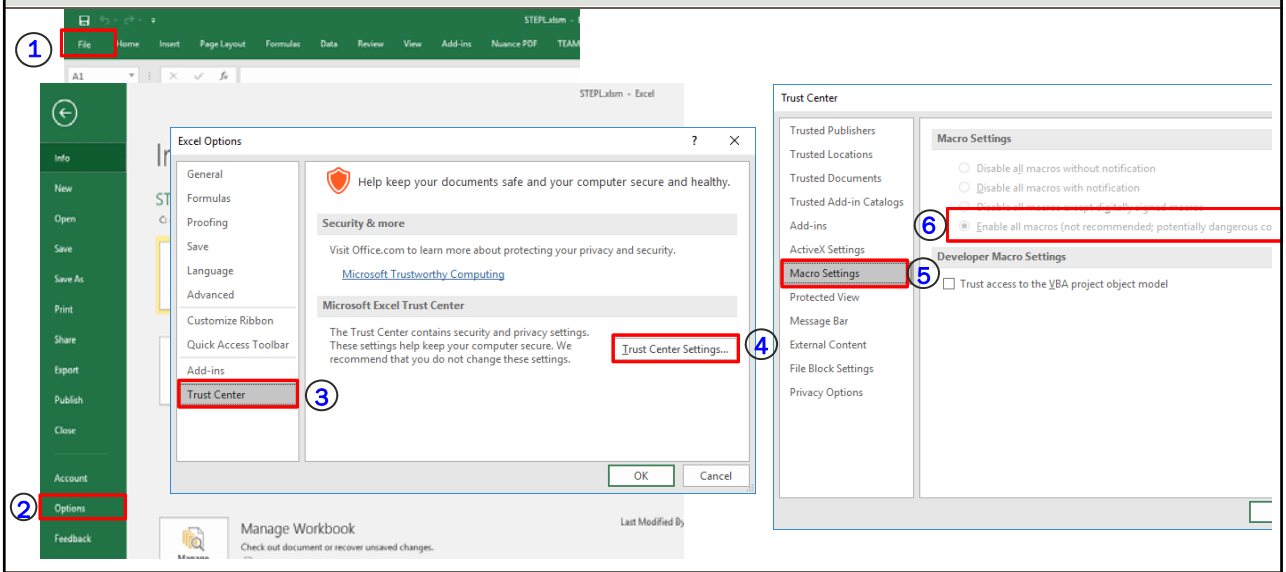
Running STEPL

- Know before you begin:
  - Number of watersheds
  - Number of gullies/streambanks
  - Tip: enter more than you need as placeholders
- Enable Macros
  - In Excel 2010, 2013 or 2016, Click on

    File menu > Options > Trust Center > Trust Center Settings > Macro Settings

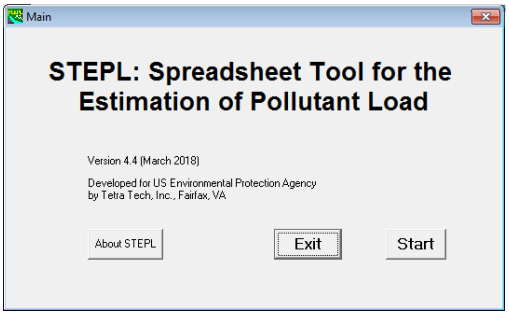
    Select “Enable all macros”

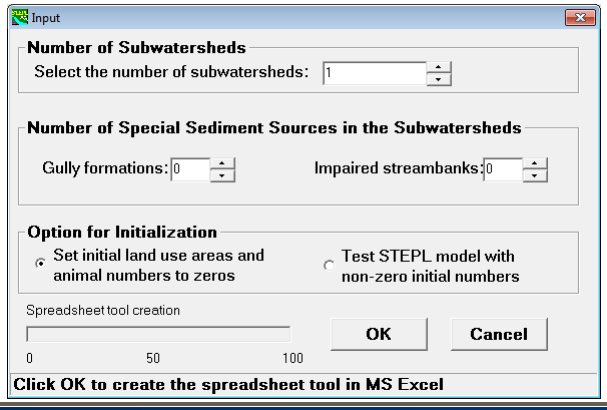
Macro Settings



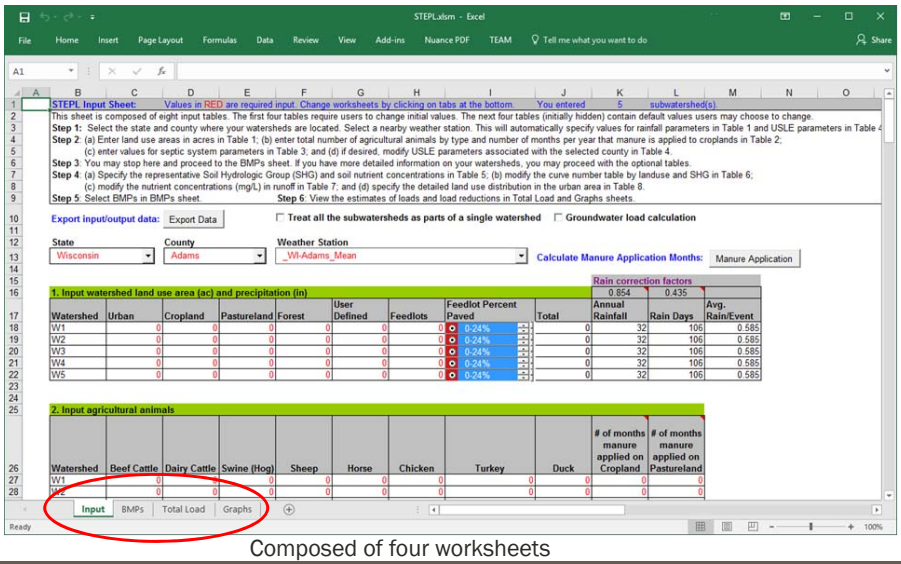
STEPL Main Program

- Run STEPL executable program *STEPLSetup.exe* to create and customize spreadsheet dynamically



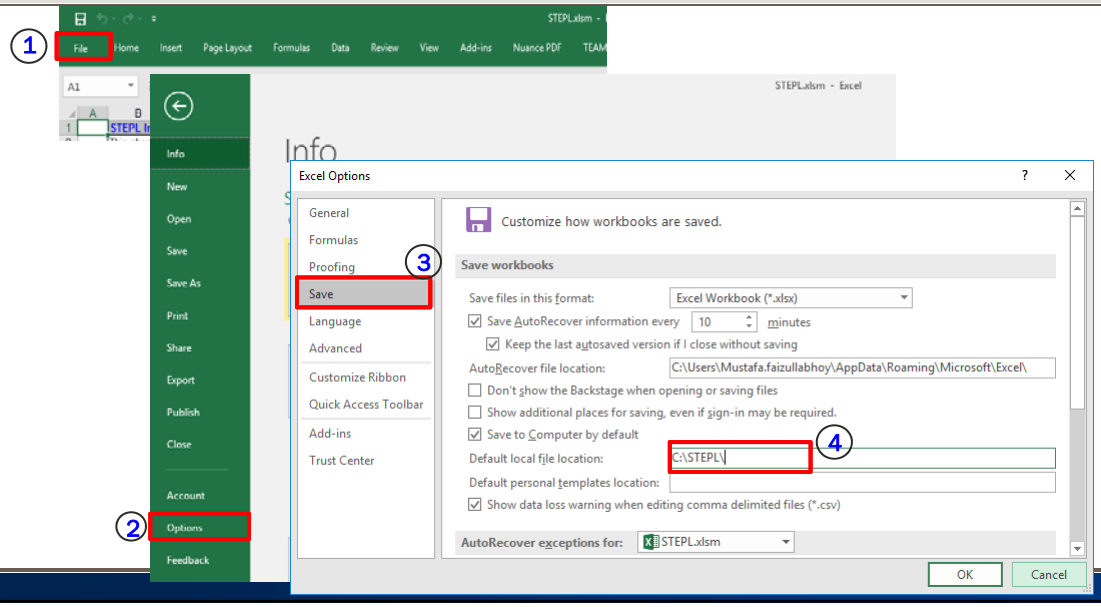


STEPL Spreadsheet



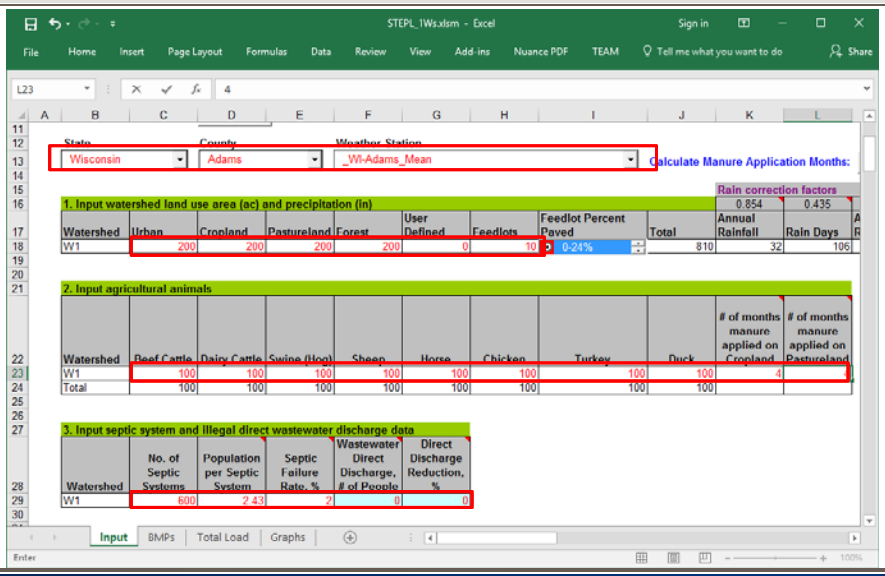
Composed of four worksheets

Default File Location



Data Input

- Type over Red text only
- Do not type in cells with black text



Data Input

4. Modify the Universal Soil Loss Equation (USLE) parameters

Watershed	Cropland					Pastureland					Forest		
	R	K	LS	C	P	R	K	LS	C	P	R	K	LS
W1	350.000	0.107	0.203	0.200	1.000	350.000	0.107	0.203	0.040	1.000	350.000	0.107	0.203
W2	350.000	0.107	0.203	0.200	1.000	350.000	0.107	0.203	0.040	1.000	350.000	0.107	0.203

Optional Data Input:

5. Select average soil hydrologic group (SHG), SHG A = highest infiltration and SHG D = lowest infiltration

Watershed	SHG A	SHG B	SHG C	SHG D	SHG Selected	Soil N conc.%	Soil P conc.%	Soil BOD conc.%	Soil E. coli conc. (#/100ml)
W1					B	0.080	0.031	0.160	0.000
W2					B	0.080	0.031	0.160	0.000

6. Reference runoff curve number (may be modified)

SHG	A	B	C	D
Urban	83	89	92	93
Cropland	67	78	85	89
Pastureland	49	69	79	84
Forest	39	60	73	79
User Defined	50	70	80	85

6a. Detailed urban reference runoff curve number (may be modified)

Urban\SHG	A	B	C	D
Commercial	89	92	94	95
Industrial	81	88	91	93
Institutional	81	88	91	93
Transportation	98	98	98	98
Multi-Family	77	85	90	92
Single-Family	57	72	81	86
Urban-Cultivat	67	78	85	89
Vacant-Develc	77	85	90	92
Open Space	49	69	79	84

7. Nutrient concentration in runoff (mg/l) and E. coli (MPN/100ml)

Land use	N	P	BOD	E. coli
1. L-Croplan	1.9	0.3	4	0
1a. w/ manure	8.1	2	12.3	0
2. M-Croplan	2.9	0.4	6.1	0
2a. w/ manure	12.2	3	18.5	0
3. H-Croplan	4.4	0.5	9.2	0
3a. w/ manure	16.3	4	24.6	0
4. Pastureland (see Table 10 for default values with manure)				
5. Forest	0.2	0.1	0.5	0
6. User Defin	0	0	0	0

7a. Nutrient concentration in shallow groundwater (mg/l) and E. coli (MPN/100ml)(may be modified)

Landuse	N	P	BOD	E. coli
Urban	1.5	0.063	0	0
Cropland	1.44	0.063	0	0
Pastureland	1.44	0.063	0	0
Forest	0.11	0.009	0	0
Feedlot	6	0.07	0	0
User-Defined	0	0	0	0

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Notes on Input Data

- Land use distribution is critical
- Modify inputs with current, local data where available
- Focus on sources being addressed by project
  - For example, agricultural data will not impact results for urban BMPs
  - Will affect total loads but not the load reduction

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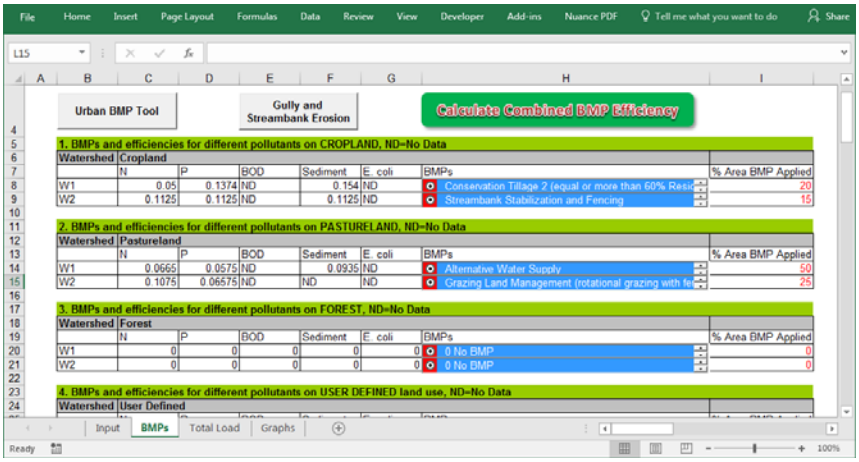
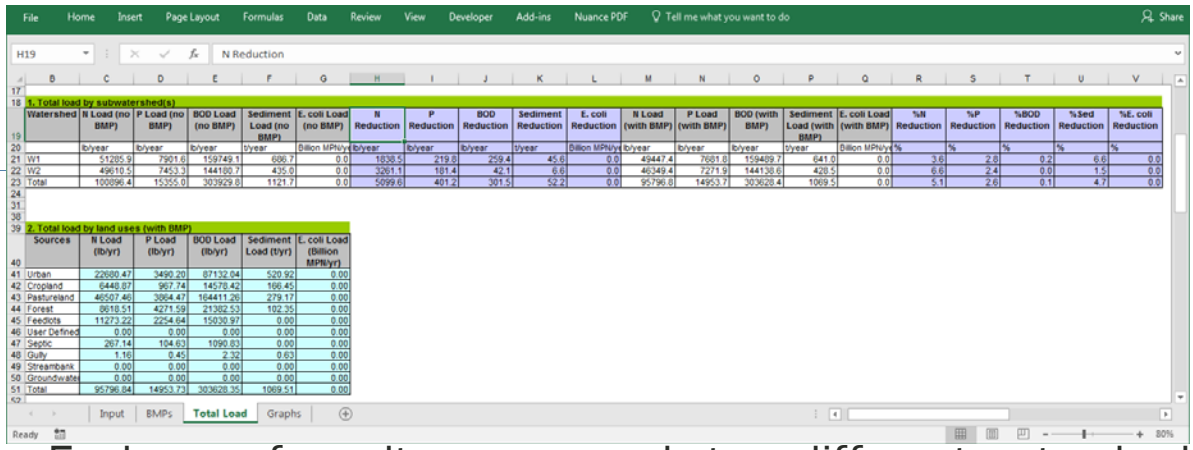
BMPs Worksheet



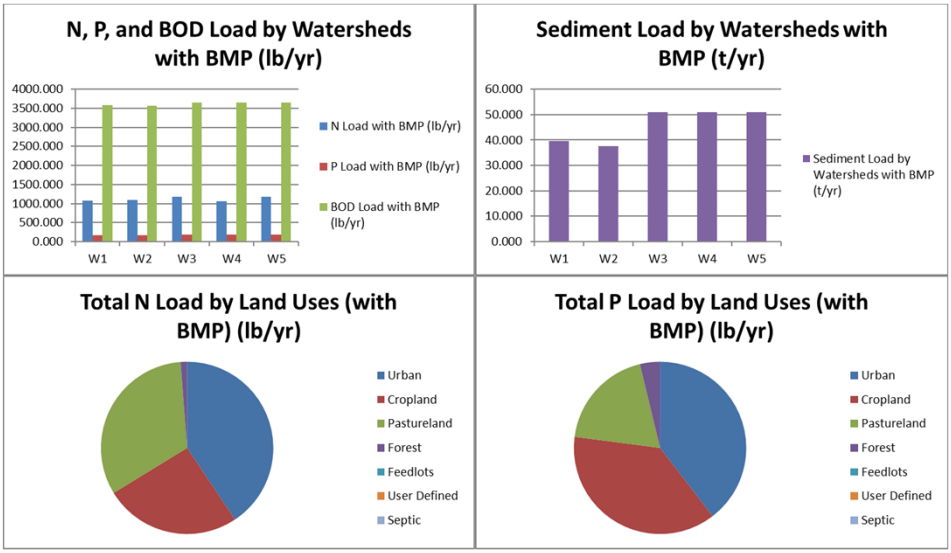
- Each land use type within each watershed can have one BMP
- % Area BMP Applied: calculate the proportion of acreage treated by the BMP for that land use

Total Load Worksheet



Each row of results corresponds to a different watershed or project

Graphs Worksheet



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Questions

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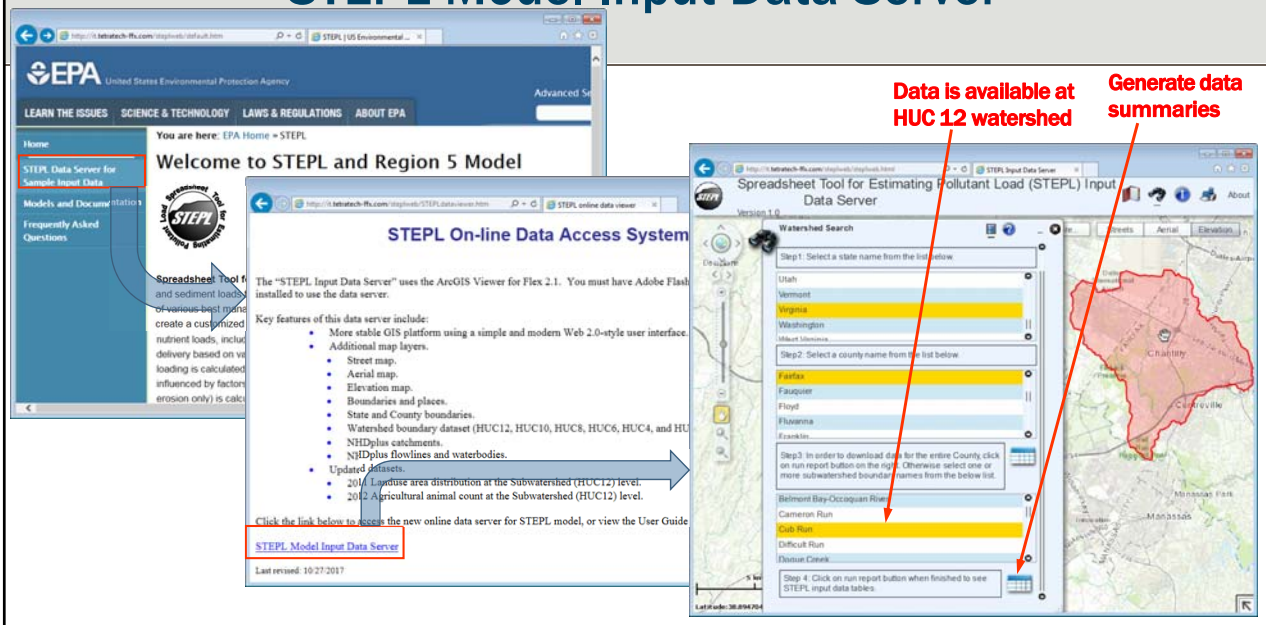
STEPL Input Data Server

STEPL Model Input Data Server



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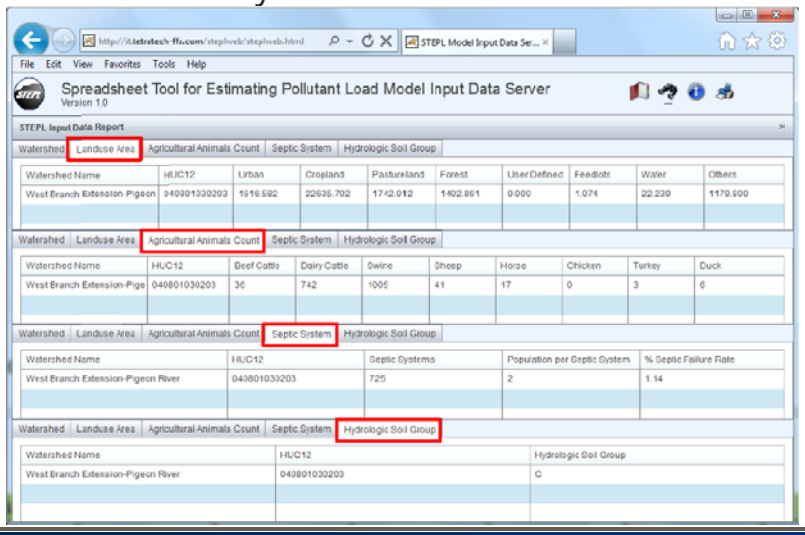
STEPL Model Input Data Server: Basic Report

- Data is summarized by HUC12 watershed



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New!

Manure Application

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Manure Application

- STEPL v4.4 allows application of manure on Pasture land (Table 2)

2. Input agricultural animals

Watershed	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck	# of months manure applied on Cropland	# of months manure applied on Pastureland
W1	100	100	100	100	100	100	100	100	9	6
W2	0	0	0	0	0	0	0	0	0	0

- A new table provides EMCs for pastureland based on six groups of livestock density (with and without manure)
  - Default values for all six categories are average EMC values from previous version STEPL 4.3
  - Will be updated on a later date based on the published literature and after review/approval by EPA

10. Pastureland Nutrient concentration in runoff (mg/l) and E. coli (MPN/100ml)

Land use	N	P	BOD	E. coli
1. L-Pasture	4	0.3	13	0
1a. w/ manure	4	0.3	13	0
2. M-Pasture	4	0.3	13	0
2a. w/ manure	4	0.3	13	0
3. H-Pasture	4	0.3	13	0
3a. w/ manure	4	0.3	13	0

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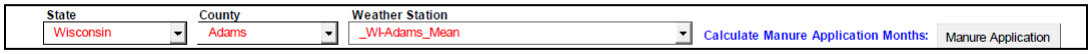
Manure Application

- STEPL v4.4 includes a new worksheet called ***ManureApplication***
- Worksheet is accessed via the Manure Application button next to the weather selection pull down menu in the ***Input*** worksheet



- The worksheet can be used for both cropland and pastureland calculations of months of manure application
- Allows calculation of average number of months for manure application per year

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Manure Application

- Can specify treatment subareas within a watershed in the *ManureApplication* worksheet
- Each subarea can have a specific number of months where manure is applied
- Calculates an area-weighted number of months when manure is applied across the watershed

Estimate an area-weighted frequency of application based on varying manure application across a watershed

Enter total land use area: 100.00 acres

Enter the subarea and its corresponding number of months of manure application below (upto 20 varying frequency of treatment allowed)

Treatment	Area (ac)	# of Months Manure Applied in a Year
1	50.00	9
2	20.00	7
3	30.00	0
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Total Land Use Area	100.00	6
Total Area check:	OK	

<--- *Enter the calculated value in Table 2, located in "Input" tab, under the appropriate watershed and landuse (cropland or pastureland under columns K or L)*

2. Input agricultural animals

Watershed	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck	# of months manure applied on Cropland	# of months manure applied on Pastureland
W1	100	100	100	100	100	100	100	100	9	6
W2	0	0	0	0	0	0	0	0	0	0

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Urban BMP Tool

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Urban Land Use Distribution

- STEPL automatically applies a default urban land use distribution to identify the % commercial, %industrial, etc. (Table 8 on "Input" sheet)

8. Input or modify urban land use distribution

Watershed	Urban Area (ac.)	Commercial %	Industrial %	Institutional %	Transportation %	Multi-Family %	Single-Family %	Urban-Cultivated	Vacant (developed)	Open Space %	Total % Area
W1	1760.9	15	10	10	10	10	30	5	5	5	100
W2	836.63	15	10	10	10	10	30	5	5	5	100

- Modify these values with local data when using STEPL to model results of urban BMPs
- The urban land use distribution (acres) will appear in Table 2 of the *Urban* worksheet

2. Urban landuse distribution

Landuse	Commerc	Industria	Institutio	Transpor	Multi-Fa	Single-F	Urban-C	Vacant (	Open Space
W1	264.135	176.09	176.09	176.09	176.09	528.27	88.045	88.045	88.045
W2	125.495	83.663	83.663	83.663	83.663	250.989	41.8315	41.8315	41.8315

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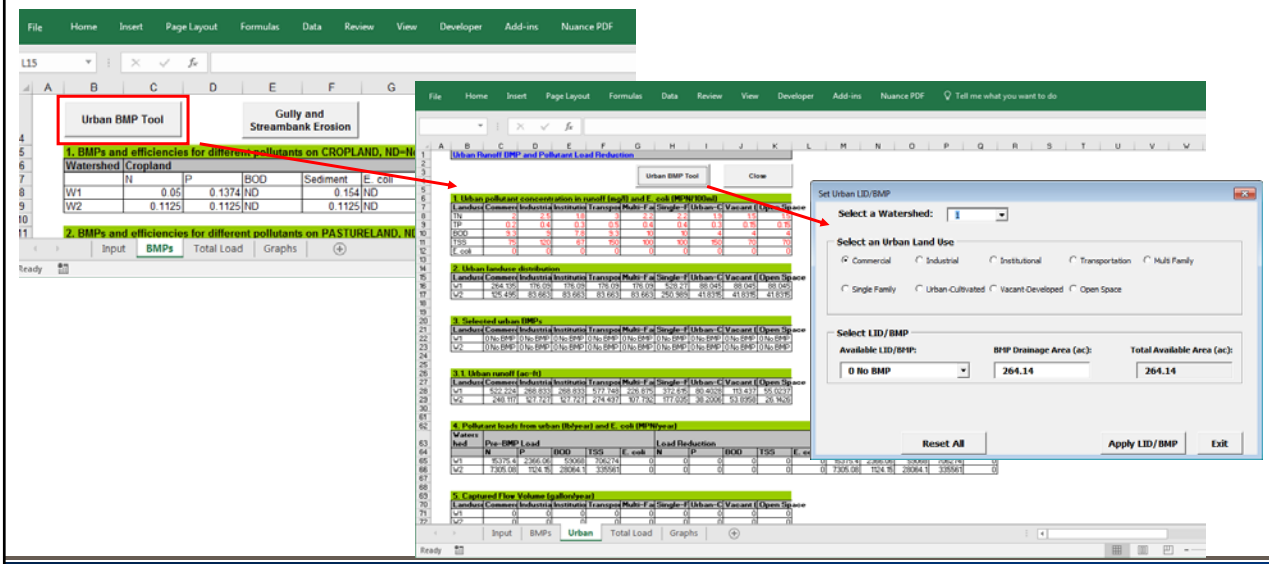
Urban BMP Tool



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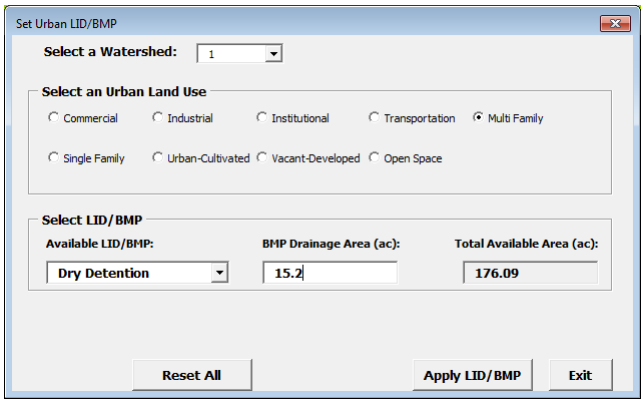
Urban BMP Tool

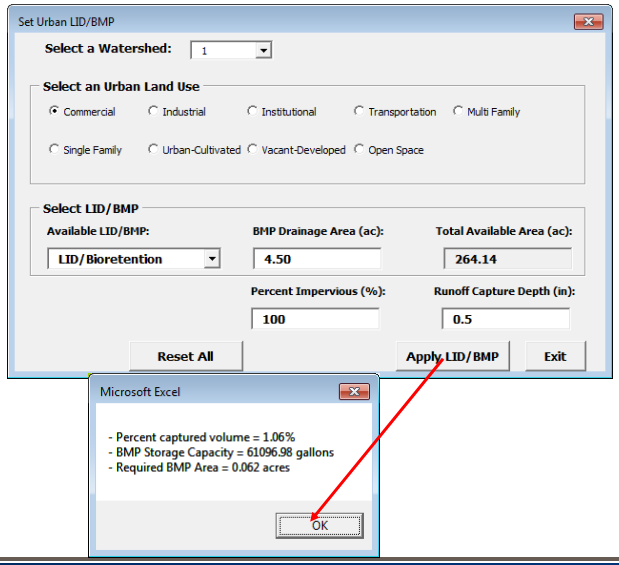


- Select the watershed
- Select an urban land use to apply the BMP
- Select the BMP
- Enter the drainage area to the BMP

New!

Flow Volume Reductions

- STEPL can now estimate flow volume reductions for Urban LID and Infiltration BMP practices
- The user enters the design runoff captured depth, percent imperviousness of the BMP drainage areas and BMP drainage area
- Pre-populated design storage depths for each of the available infiltration BMPs are included in the ***BMPList*** Worksheet
- Flow volume reductions represented as gallons/year by urban land use type in each watershed



Flow Volume Reductions

- ***Urban*** worksheet showing volume reductions from urban infiltration BMPs (Table 5 of ***Urban*** worksheet)
- Table 6 provides the BMP surface area of number of units (e.g. rain barrels)
- Urban LID and infiltration practices in STEPL version 4.4 with flow volume reductions

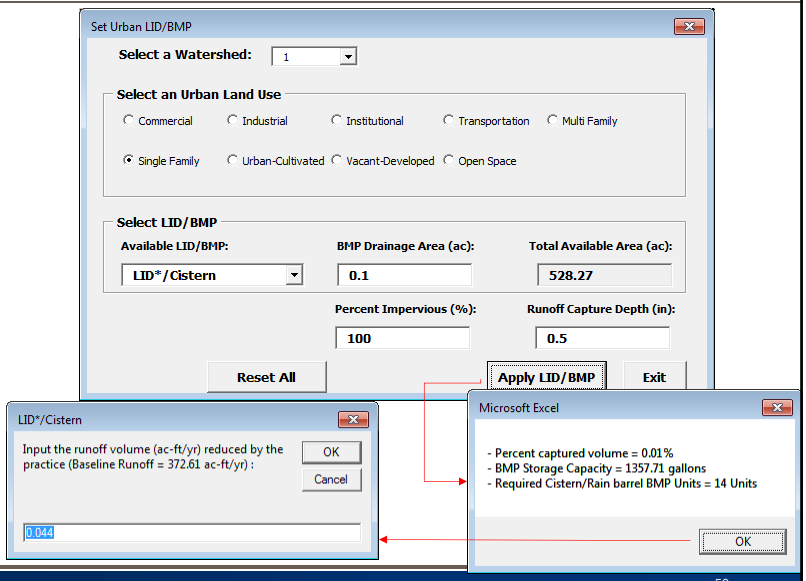
5. Captured Flow Volume (gallon/year)

Landuse	Commerci	Industrial	Institution	Transporta	Multi-Fam	Single-Far	Urban-Cul	Vacant (de	Open Space
W1	1435371.9	0	0	0	0	49855.14	0	0	0
W2	0	0	0	0	0	0	0	0	0

Land Use	BMP
Urban	Infiltration Basin
Urban	Infiltration Devices
Urban	Infiltration Trench
Urban	LID*/Cistern
Urban	LID*/Cistern+Rain Barrel
Urban	LID*/Rain Barrel
Urban	LID/Bioretention
Urban	LID/Dry Well
Urban	LID/Infiltration Swale
Urban	LID/Infiltration Trench
Urban	Porous Pavement
Urban	Sand Filter/Infiltration Basin

LID* BMPs

- For LID BMPs marked with an asterisk (*), STEPL calculates Runoff Volume (ac-ft/yr) reduced by the practice
  - LID*/Cistern
  - LID*/Cistern+Rain Barrel
  - LID*/Rain Barrel
- STEPL calculates the baseline runoff
  - If percentage runoff volume reduction is known, can apply this to determine runoff volume reduction amount
  - Load reduction efficiency = % runoff volume reduced



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Gullies and Streambanks

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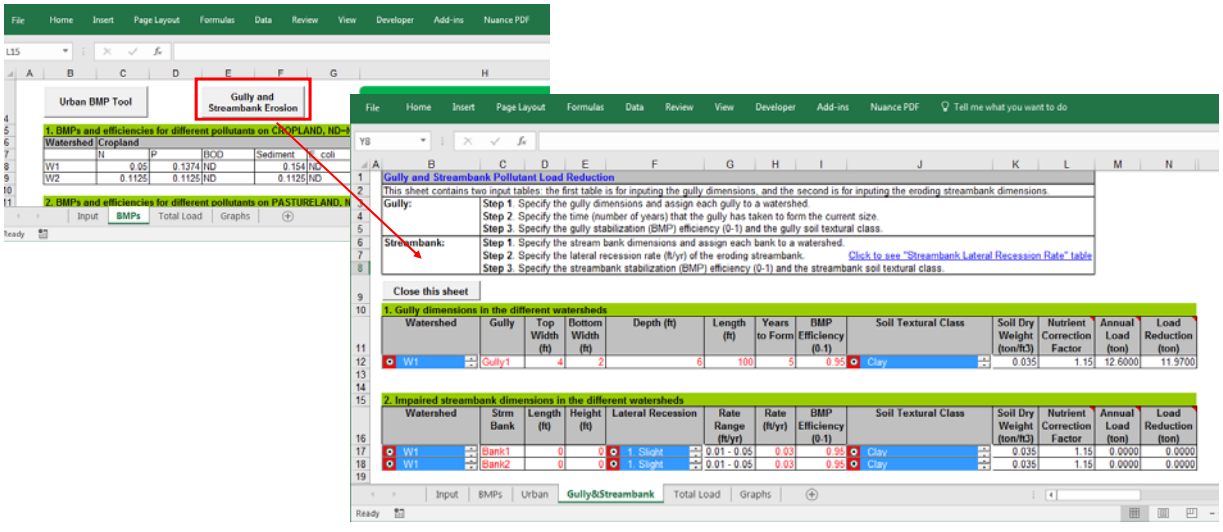
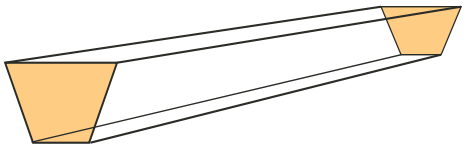
Gullies and Streambanks



STEPL Gully Stabilization

- Load
  - Average annual erosion during the life of the gully (ton/yr)
    = Volume x Soil Weight / Years
  - Nutrient load
    = Annual Erosion x Soil Nutrient Conc. x Correction Factor
- Load reduction after implementing gully stabilization
  - Specify reduction efficiency (95% efficiency by default)
  - Reduction is equal to annual erosion x user-specified efficiency



Volume = (Top Width +Bottom Width) / 2 x Depth x Length

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Gully Stabilization

- Nutrient Correction Factor
  - Smaller soil particles -> larger aggregated surface area -> more nutrients attached

Soil Texture	Nutrient Correction Factor
Clay	1.15
Silt	1.00
Sand	0.85
Peat	1.50

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Streambank Erosion

- Load (Channel Erosion)
  = Length * Height * Lateral Recession rate * Soil weight
- Load Reduction
  = Load * Load reduction efficiency

Determining Lateral Recession Rate by Field Observation

Lateral Recession Rate (ft/yr)	Category	Description
0.01 – 0.05	Slight	Some bare bank, no exposed roots
0.06 – 0.2	Moderate	Bank is mostly bare
0.3 – 0.5	Severe	Bank is bare with exposed roots
0.5+	Very Severe	Bank is bare with fallen trees

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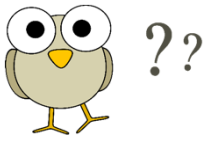
Questions



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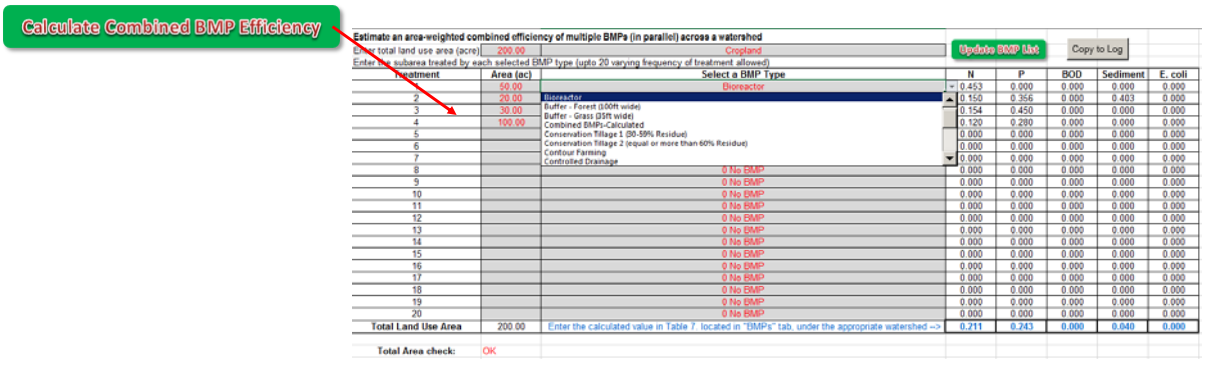
TETRA TECH

New!

Combined BMP Efficiency Pasture and Cropland

TETRA TECH

Combined BMP Efficiency – Pasture and Cropland



- Tool calculates a combined BMP efficiency from multiple types of parallel management practices on the same land use category across the watershed
- The user selects total treated area by land use and BMP types and acreage of treatment for each treatment area in the watershed

Combined BMP Efficiency – Pasture and Cropland

1. BMPs and efficiencies for different pollutants on CROPLAND, ND=No Data

Watershed	Cropland						
	N	P	BOD	Sediment	E. coli	BMPs	% Area BMP Applied
W1	0.05	0.1374	ND	0.154	ND	Conservation Tillage 2 (equal or more than 60% Resi	20
W2	0.1125	0.1125	ND	0.1125	ND	Streambank Stabilization and Fencing	15

2. BMPs and efficiencies for different pollutants on PASTURELAND, ND=No Data

Watershed	Pastureland						
	N	P	BOD	Sediment	E. coli	BMPs	% Area BMP Applied
W1	0.14295	0.1082	0	0.10005	0	Combined BMPs-Calculated	100
W2	0.1075	0.06575	ND	ND	ND	Grazing Land Management (rotational grazing with fe	25

- The resulting area-weighted values in blue color should be added to Table 7 in the ***BMPs*** worksheet
- Combined BMPs Calculated should then be used in Tables 1 and 2 on the ***BMPs*** Worksheet.

7. Combined watershed BMP efficiencies from the BMP calculator

Watershed	Watershed Combined BMP Efficiencies					
	N	P	BOD	Sediment	E. coli	BMPs
W1-Crop	0	0	0	0	0	Combined BMPs
W2-Crop	0	0	0	0	0	Combined BMPs
W1-Pasture	0.14295	0.1082	0	0.10005	0	Combined BMPs
W2-Pasture	0	0	0	0	0	Combined BMPs
W1-Forest	0	0	0	0	0	Combined BMPs
W2-Forest	0	0	0	0	0	Combined BMPs
W1-User	0	0	0	0	0	Combined BMPs
W2-User	0	0	0	0	0	Combined BMPs

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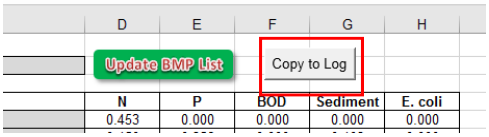
Saving Combined BMP Scenarios

- The "Copy to Log" allows the user to keep a record of the various combination of the combined BMP efficiencies scenarios that are evaluated
- Creates a Word document (bmplog.docx) in the same location where the STEPL spreadsheet is located



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TETRA TECH

Use the BMP Calculator for Multiple BMPs

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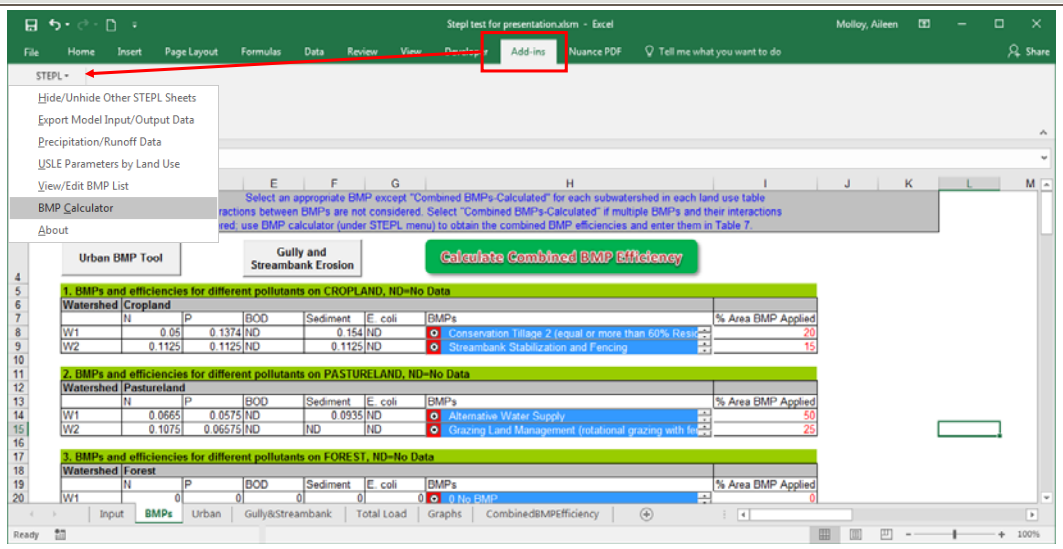
TETRA TECH

BMP Calculator



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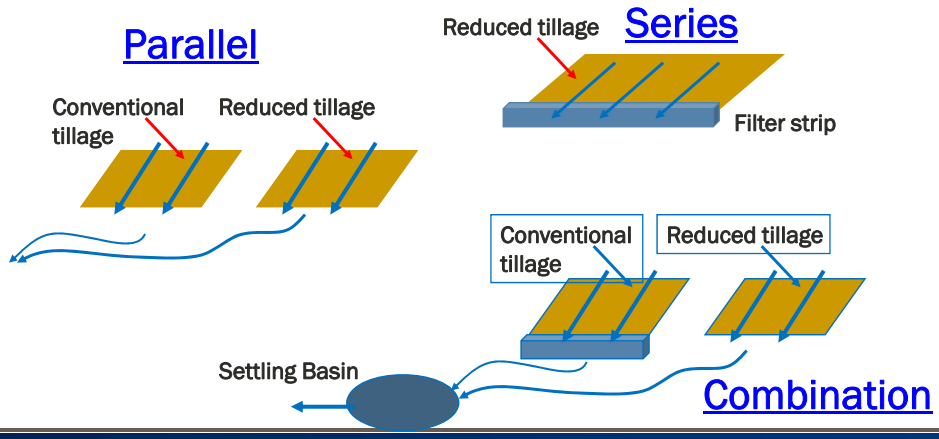
BMP Calculator

- Calculates combined efficiency of a BMP treatment train for a given land use
- The use of BMP calculator requires the understanding of BMPs and their placement in the watershed



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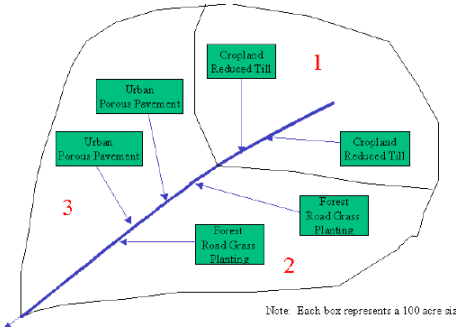
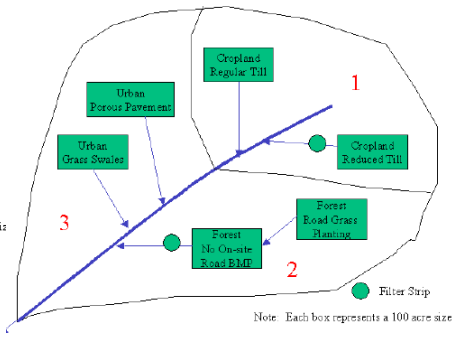
BMP Calculator

- When is BMP calculator needed?



Not needed -► No combined efficiency calculation



Needed -► Each land use type uses more than one type of BMP

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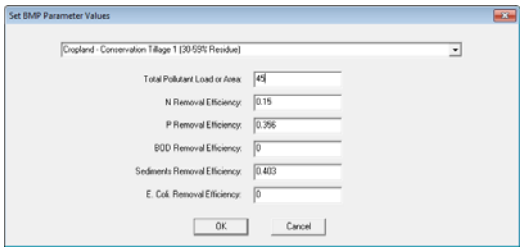
STEPL BMP Calculator

- Describe schematically the BMP configuration
  - Number and linkages
  - BMP type and efficiency
  - Land use area
- Calculate combined efficiency



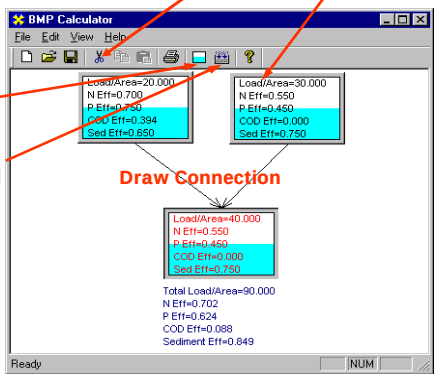
Add BMP box

Calculate combined efficiency

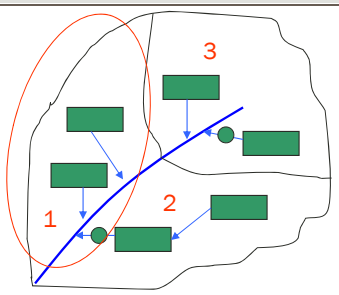
Delete Connection

Use source area or original load as the weighting factor

Draw Connection



BMP Calculator Example 1

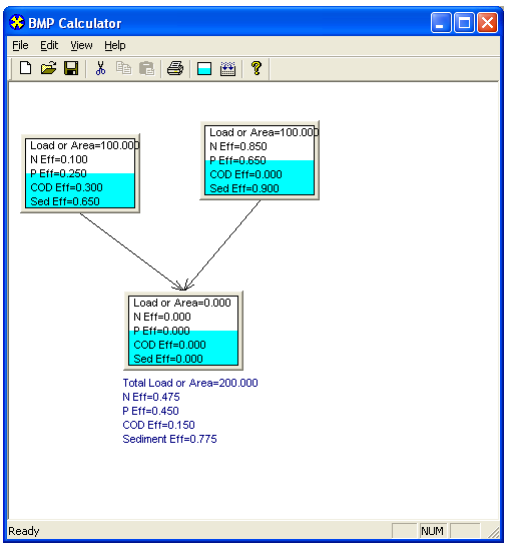


Each box represents 100 ac

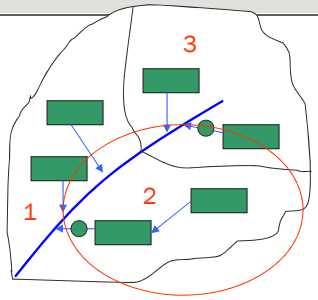
Urban Grass Swale

Urban Porous Pavement

Load



BMP Calculator Example 2



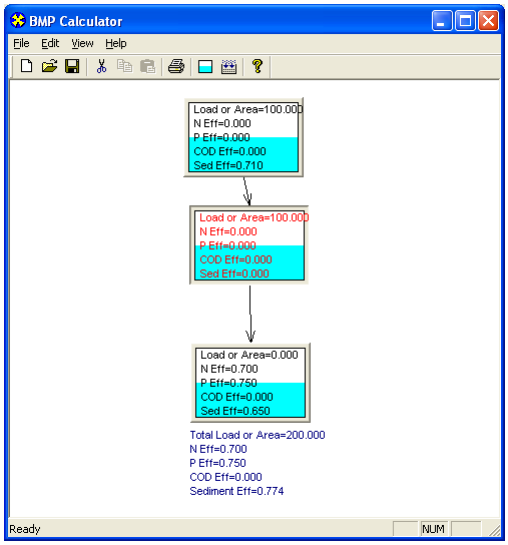
Each box represents 100 ac

Forest Road Grass Planting

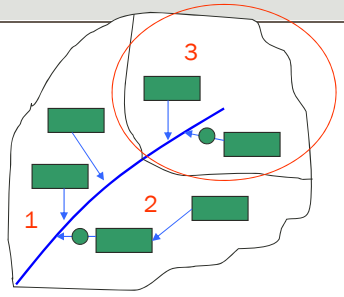
Forest No On-site Road BMP

Filter Strip

Load



BMP Calculator Example 3



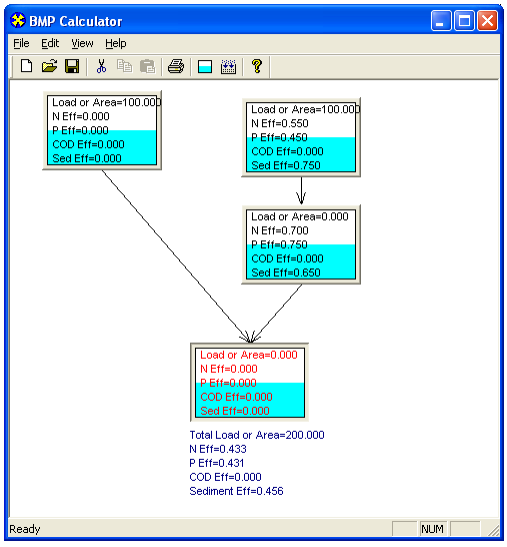
Each box represents 100 ac

Crop Regular Tillage

Crop Reduced Tillage

Filter Strip

Load



TETRA TECH

Questions

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TETRA TECH

Adding or Modifying BMPs

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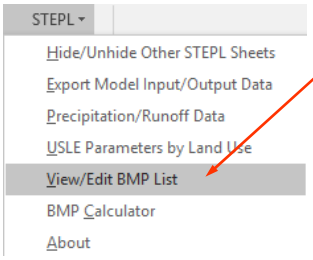
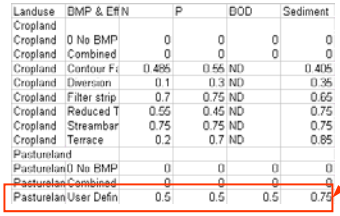
Ability to Add BMPs

- In STEPL customized menu, click "View/Edit BMP List"
- *BMPList* worksheet is shown, add or delete BMPs



Customized menu



Landuse	BMP & Eff N	P	BOD	Sediment
Cropland				
Cropland	0 No BMP	0	0	0
Cropland	Combined	0	0	0
Cropland	Contour Fa	0.495	0.55	ND 0.405
Cropland	Diversion	0.1	0.3	ND 0.35
Cropland	Filter strip	0.7	0.75	ND 0.65
Cropland	Reduced T	0.55	0.45	ND 0.75
Cropland	Streambar	0.75	0.75	ND 0.75
Cropland	Terrace	0.2	0.7	ND 0.85
Pastureland				
Pastureland	0 No BMP	0	0	0 0
Pastureland	Combined	0	0	0 0
Pastureland	User Defin	0.5	0.5	0.5 0.75

Example: New data inserted here

Add New Data to BMP List

Landuse	BMP & Efficiency	N	P	BOD	Sediment	E. coli
Cropland						
Cropland	0 No BMP	0	0	0	0	0
Cropland	Bioreactor	0.453	ND	ND	ND	ND
Cropland	Buffer - Forest (100ft wide					
Cropland	Buffer - Grass (35ft wide)					
Cropland	Combined BMPs-Calcula					
Cropland	Conservation Tillage 1 (30					
Cropland	Conservation Tillage 2 (ec					
Cropland	Contour Farming					
Cropland	Controlled Drainage					
Cropland	Cover Crop 1 (Group A Cc					
Cropland	Cover Crop 2 (Group A Tr					
Cropland	Cover Crop 3 (Group A Tr					
Cropland	Land Retirement	0.898	0.808	ND	0.95	ND
Cropland	Nutrient Management 1 (Determined Rate)	0.154	0.45	ND	ND	ND
Cropland	Nutrient Management 2 (Determined Rate Plus Additiona	0.247	0.56	ND	ND	ND
Cropland	Streambank Stabilization and Fencing	0.75	0.75	ND	0.75	ND
Cropland	Terrace	0.253	0.308	ND	0.4	ND
Cropland	Two-Stage Ditch	0.12	0.28	ND	ND	ND
Cropland	User Defined	0.5	0.5	0.5	0.5	ND
Pastureland						
Pastureland	0 No BMP	0	0	0	0	0
Pastureland	30m Buffe with Optimal Grazing	0.364	0.653	ND	ND	ND
Pastureland	Alternative Water Supply	0.133	0.115	ND	0.187	ND

Microsoft Excel

The BMP data were updated successfully. Click the BMPs worksheet and select BMPs.

OK

<Don't Delete
<Don't Delete

Update BMP Data | Save Updates

Instruction:
1. Do not delete the greyed rows.
2. BMP efficiencies should be <=1.
3. If you add a row for a new BMP, you must specify landuse, BMP name, and pollutant removal efficiencies.
4. Type "ND" for no data.
5. Click "Update BMP Data" to update selection boxes on the BMPs sheet.
6. Click "Save Updates" to save the BMP list to external text files in the STEPL/Support folder.

Update BMP button (BMPList Worksheet)

<Don't Delete
<Don't Delete

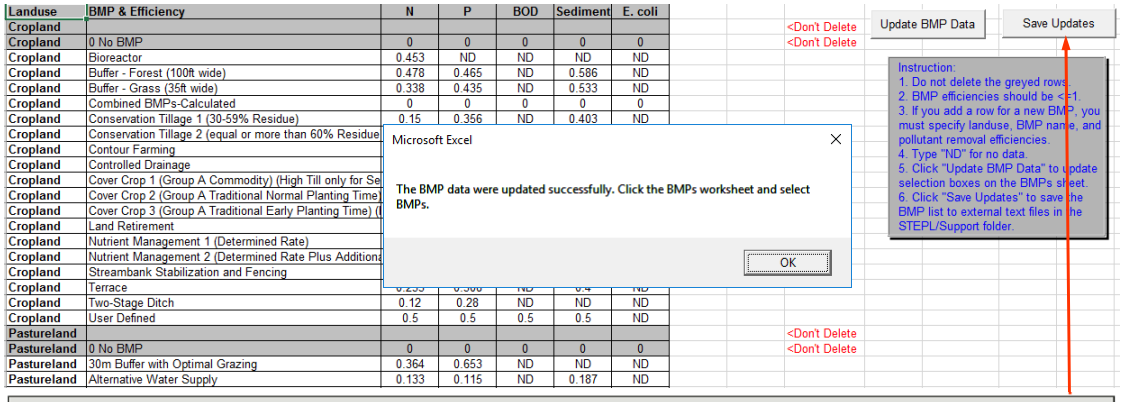
New BMP added!

New BMP added! (BMPs Worksheet)

1. BMPs and efficiencies for different pollutants on CROPLAND, ND=No Data

Watershed	Cropland						
	N	P	BOD	Sediment	E. coli	BMPs	% Area BMP Applied
W1	0.279	0.398	ND	0.341	ND	Contour Farming	100
W2	0.15	0.356	ND	0.403	ND	Conservation Tillage 1 (30-59% Residue)	100
W3	0	0	0	0	0	0 No BMP	0
W4	0.485	0.1	0	0	0	Combined BMPs-Calculated	100
W5	0.5	0.5	0.5	0.5	ND	User Defined	100

Update BMP List



Landuse	BMP & Efficiency	N	P	BOD	Sediment	E. coli	
Cropland							
Cropland	0 No BMP	0	0	0	0	0	<Don't Delete
Cropland	Bioreactor	0.453	ND	ND	ND	ND	<Don't Delete
Cropland	Buffer - Forest (100ft wide)	0.478	0.465	ND	0.586	ND	
Cropland	Buffer - Grass (35ft wide)	0.338	0.435	ND	0.533	ND	
Cropland	Combined BMPs-Calculated	0	0	0	0	0	
Cropland	Conservation Tillage 1 (30-59% Residue)	0.15	0.356	ND	0.403	ND	
Cropland	Conservation Tillage 2 (equal or more than 60% Residue						
Cropland	Contour Farming						
Cropland	Controlled Drainage						
Cropland	Cover Crop 1 (Group A Commodity) (High Till only for Se						
Cropland	Cover Crop 2 (Group A Traditional Normal Planting Time)						
Cropland	Cover Crop 3 (Group A Traditional Early Planting Time) (						
Cropland	Land Retirement						
Cropland	Nutrient Management 1 (Determined Rate)						
Cropland	Nutrient Management 2 (Determined Rate Plus Additiona						
Cropland	Streambank Stabilization and Fencing						
Cropland	Terrace						
Cropland	Two-Stage Ditch	0.12	0.28	ND	ND	ND	
Cropland	User Defined	0.5	0.5	0.5	0.5	ND	
Pastureland							
Pastureland	0 No BMP	0	0	0	0	0	<Don't Delete
Pastureland	30m Buffer with Optimal Grazing	0.364	0.653	ND	ND	ND	<Don't Delete
Pastureland	Alternative Water Supply	0.133	0.115	ND	0.187	ND	

- Click "Save Updates" to save changes to the BMP List (will be available to any STEPL project)
- You can also modify these spreadsheets manually

  C:\Stepl\Support\AllBMPstepl.csv

New BMPs and Updated Pollutant Efficiencies

New!

- New BMPs for cropland and pastureland have been added to STEPL version 4.4
  - The cropland BMP list has been expanded from 6 BMPs to 17
  - 17 pastureland BMPs added (previous versions of STEPL did not have pastureland BMPs)
- Pollutant efficiency numbers for some existing cropland BMPs have been updated
- All the efficiencies are summarized in the ***BMPList*** worksheet

New BMPs available in STEPL version 4.4 for Cropland and Pastureland

Land Use	BMP
Cropland	Bioreactor
Cropland	Buffer - Forest (100ft wide)
Cropland	Buffer - Grass (35ft wide)
Cropland	Combined BMPs-Calculated
Cropland	Conservation Tillage 1 (30-59% Residue)
Cropland	Conservation Tillage 2 (equal or more than 60% Residue)
Cropland	Contour Farming
Cropland	Controlled Drainage
Cropland	Cover Crop 1 (Group A Commodity) (High Till only for Sediment)
Cropland	Cover Crop 2 (Group A Traditional Normal Planting Time) (High Till only for TP and Sediment)
Cropland	Cover Crop 3 (Group A Traditional Early Planting Time) (High Till only for TP and Sediment)
Cropland	Land Retirement
Cropland	Nutrient Management 1 (Determined Rate)
Cropland	Nutrient Management 2 (Determined Rate Plus Additional Considerations)
Cropland	Streambank Stabilization and Fencing
Cropland	Terrace
Cropland	Two-Stage Ditch
Pastureland	30m Buffer with Optimal Grazing
Pastureland	Alternative Water Supply
Pastureland	Combined BMPs-Calculated
Pastureland	Critical Area Planting
Pastureland	Forest Buffer (minimum 35 feet wide)
Pastureland	Grass Buffer (minimum 35 feet wide)
Pastureland	Grazing Land Management (rotational grazing with fenced areas)
Pastureland	Heavy Use Area Protection
Pastureland	Litter Storage and Management
Pastureland	Livestock Exclusion Fencing
Pastureland	Multiple Practices
Pastureland	Pasture and Hayland Planting (also called Forage Planting)
Pastureland	Prescribed Grazing
Pastureland	Streambank Protection w/o Fencing
Pastureland	Streambank Stabilization and Fencing
Pastureland	Use Exclusion
Pastureland	Winter Feeding Facility

TETRA TECH

STEPL Updates

Weather Station Updates

- Increased spatial and temporal resolution of weather stations
  - updated to increase the number of weather stations in STEPL from 493 to 4,998
  - Each stations has at least 30 years of data
- Quality controlled data from BASINS
- Includes data from NOAA – NCDC's
  - Summary of the Day (SOD)
  - Hourly Precipitation Data (HPD)
  - Integrated Surface Hourly (ISH)

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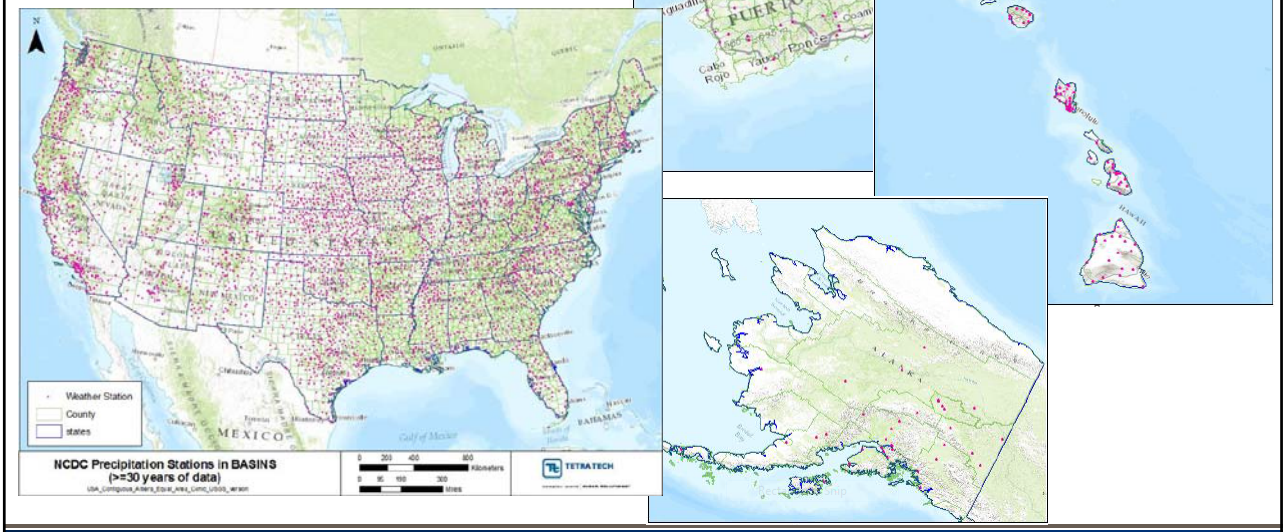
Weather Station Updates



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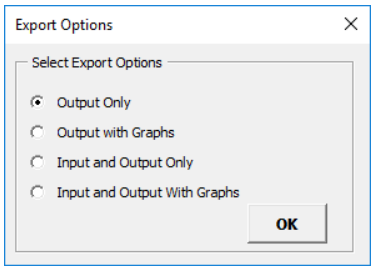
Export Input/Output Option

- An Export Data button has been added to the ***Input*** worksheet

- Allows four options to generate summary report into a MS Word Document for Input and/or Outputs



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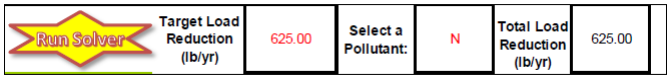
Customized Spreadsheet Model Solver



- A simple optimization algorithm (Run Solver) is now included in the customized spreadsheets model
  - Need to activate Excel Solver Add-In (follow instructions in the ***BMPs*** worksheet to activate Excel Solver Add-In)
  - Optimization is not available in the STEPL installation file version
- Allows the user to identify the extent of treatment areas to meet a load reduction target from the user selected BMP types
- The optimization algorithm only solves for non-urban BMPs
- The optimizer is intended to maximize the load reduction and minimize the treated land use area based on the suite of BMPs provided

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Customized Spreadsheet Model Solver

- Example land uses with BMPs selected and constraints set

1. BMPs and efficiencies for different pollutants on CROPLAND, ND=No Data

Watershed	Cropland							CONSTRAINT	
	N	P	BOD	Sediment	E. coli	BMPs	% Area BMP Applied	Min Area (%)	Max Area (%)
W1	0.24	0.23	ND	0.29	ND	Buffer - Forest (100ft wide)	50.00	0	50
W2	0.03	0.08	ND	0.09	ND	Conservation Tillage 1 (30-59% Residue)	22.25	0	50
W3	0.00	0.00	ND	0.00	ND	Contour Farming	0.00	0	50
W4	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W5	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W6	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W7	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W8	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W9	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W10	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0

2. BMPs and efficiencies for different pollutants on PASTURELAND, ND=No Data

Watershed	Pastureland							CONSTRAINT	
	N	P	BOD	Sediment	E. coli	BMPs	% Area BMP Applied	Min Area (%)	Max Area (%)
W1	0.20	0.30	ND	0.62	ND	Livestock Exclusion Fencing	100.00	0	100
W2	0.00	0.00	ND	0.00	ND	Alternative Water Supply	0.00	0	100
W3	0.00	0.00	ND	0.00	ND	Critical Area Planting	0.00	0	100
W4	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W5	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W6	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W7	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W8	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W9	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0
W10	0.00	0.00	0.00	0.00	0.00	0 No BMP	0.00	0	0

Summary

- STEPL is a simple model for estimating long term average pollutant load reductions to support watershed planning
- Can be applied at various scales from individual farm to large watershed or multiple watersheds
- STEPL is flexible but requires your input and judgment to apply it to your project
  - Easy to add new data and to customize for site specific needs
- Seek assistance from your colleagues
- Questions & suggestions for improvement are always welcome

Contact Information

To access STEPL, visit http://it.tetratech-ffx.com/steplweb/

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