

# The Spreadsheet Tool for Estimating Pollutant Loads (STEPL)



Training for Wisconsin DNR  
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# Introductions

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# Agenda

- Overview of STEPL
- Using the model
  - Navigating worksheets
  - Basic inputs & outputs
- Urban BMP Tool
- Gullies and Streambanks
- BMP Calculator
- STEPL Input Data Server



# STEPL Overview



# 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
- A customized MS Excel spreadsheet model
  - Simple and easy to use
  - Formulas and default parameter values can be modified by users (optional) with no programming required



# 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



# How STEPL is 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 and evaluations under GLRI



# Progression of STEPL

- First release Oct 2001
- Several enhancements over the years
  - BMP calculator
  - Ability to add a BMP
  - Partial BMP applications
  - Groundwater
  - Gullies & streambanks



# 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



# Other Tools

- BMP Efficiency Estimator
- Region 5 Model



# 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



# STEPL System Defaults

- These data are 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
- Other optional input data
  - Special sediment sources from gullies and impaired streambanks



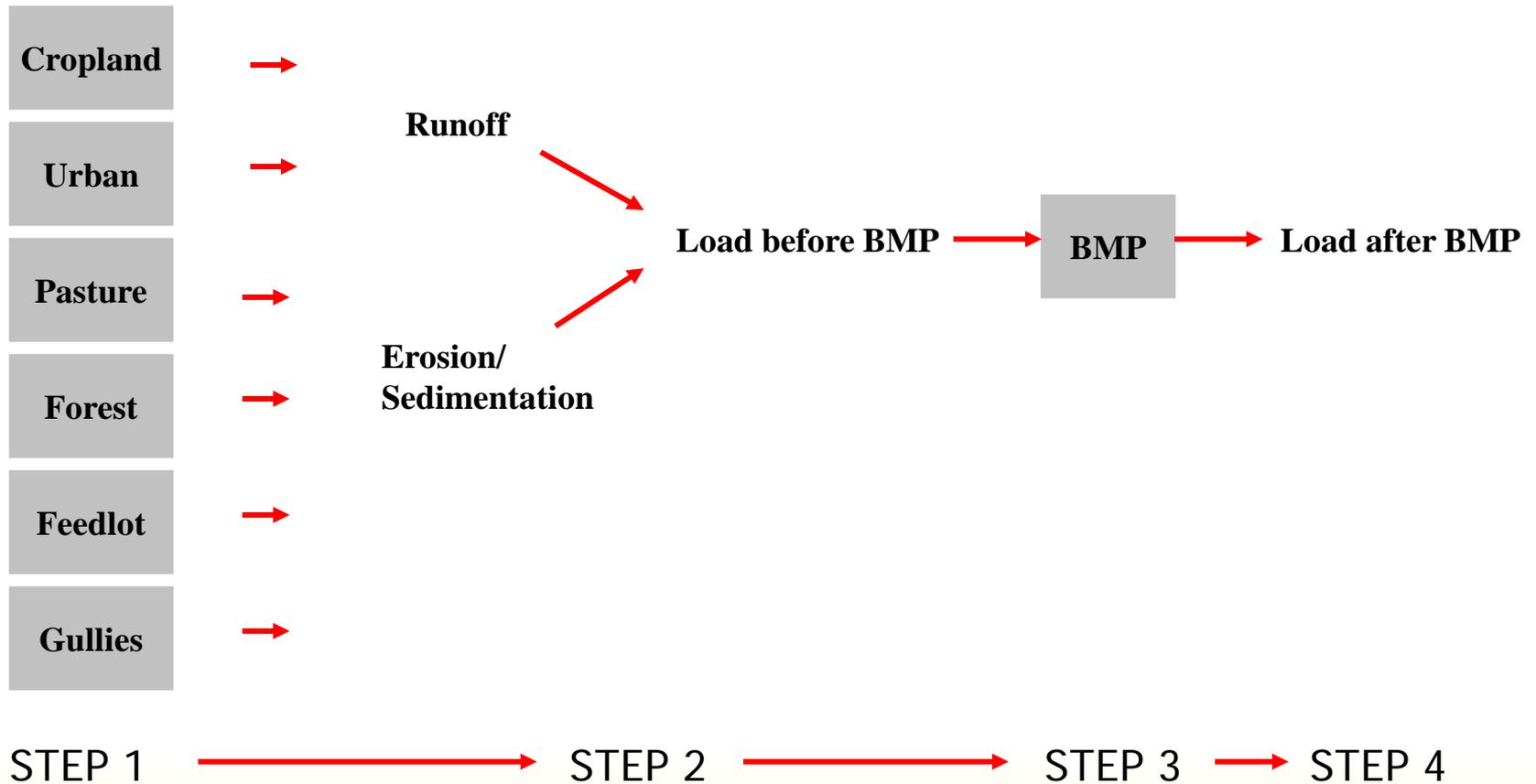
# Notes on Input Data

- 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 amount
- % Area Applied: calculate the proportion of acreage treated by the BMP(s) for that land use type



# Process

## Sources



# BMPs Available

- Cropland
  - Combined BMPs-Calculated
  - Contour Farming
  - Diversion
  - Filter strip
  - Reduced Tillage Systems
  - Streambank stabilization and fencing
  - Terrace
- Pastureland
  - Combined BMPs-Calculated
  - User Defined



# BMPs Available - Cont

- Feedlots
  - Diversion
  - Filter strip
  - Runoff Mgmt System
  - Solids Separation Basin
  - Solids Separation Basin w/Infilt Bed
  - Terrace
  - Waste Mgmt System
  - Waste Storage Facility



# BMPs Available - Cont

- Forest
  - Combined BMPs-Calculated
  - Road dry seeding
  - Road grass and legume seeding
  - Road grass and legume seeding-New
  - Road hydro mulch
  - Road straw mulch
  - Road tree planting
  - Site preparation/hydro mulch/seed/fertilizer
  - Site preparation/hydro mulch/seed/fertilizer/transplants
  - Site preparation/steep slope seeder/transplant
  - Site preparation/straw/crimp seed/fertilizer/transplant
  - Site preparation/straw/crimp/net
  - Site preparation/straw/net/seed/fertilizer/transplant
  - Site preparation/straw/polymer/seed/fertilizer/transplant



# BMPs Available - Cont

- Urban

- Alum Treatment
- Bioretention facility
- Combined BMPs-Calculated
- Concrete Grid Pavement
- Dry Detention
- Extended Wet Detention
- Filter Strip-Agricultural
- Grass Swales
- Infiltration Basin
- Infiltration Devices
- Infiltration Trench
- LID\*/Cistern
- LID\*/Cistern+Rain Barrel
- LID\*/Rain Barrel
- LID/Bioretention
- LID/Dry Well
- LID/Filter/Buffer Strip
- LID/Infiltration Swale
- LID/Infiltration Trench
- LID/Vegetated Swale
- LID/Wet Swale
- Oil/Grit Separator
- Porous Pavement
- Sand Filter/Infiltration Basin
- Sand Filters
- Settling Basin
- Vegetated Filter Strips
- Weekly Street Sweeping
- Wet Pond
- Wetland Detention
- WQ Inlet w/Sand Filter
- WQ Inlets



# STEPL Website

<http://it.tetrattech-ffx.com/steplweb/>

The image shows two overlapping browser windows displaying the EPA STEPL website. The background window shows the main site with a navigation menu where 'Models and Documentation' is highlighted with a red box. The foreground window shows the 'Models and Documentation' page, where 'STEPL 4.2' is also highlighted with a red box. The website features the EPA logo and navigation tabs for 'LEARN THE ISSUES', 'SCIENCE & TECHNOLOGY', 'LAWS & REGULATIONS', and 'ABOUT EPA'. The main content area includes a 'You are here' breadcrumb, a 'Home' link, and a list of links: 'STEPL Data Server for Sample Input Data', 'Models and Documentation', and 'Frequently Asked Questions'. The 'Models and Documentation' link is highlighted with a red box. Below this, there are links for 'Slide Shows and Tutorial for STEPL Training 2013' (last updated 12/17/2013) and 'STEPL 4.2' (last updated 04/09/2013). The 'STEPL 4.2' link is highlighted with a red box. Below the 'STEPL 4.2' link is a link for 'STEPL 4.2 Installation Package'. A note at the bottom states: 'Note: This update was to add the Puerto Rico data into STEPL model.'

# System Requirements

- Windows operating system
- MS Excel 2003 or 2007 or 2010
- 14 MB hard disk space
- Not Compatible with Windows 7 operating system and MS Excel 2007 combination



# STEPL Installation

- Download the STEPL 4.2 zip file from:  
[http://it.tetrattech-ffx.com/steplweb/models\\$docs.htm](http://it.tetrattech-ffx.com/steplweb/models$docs.htm)
- Run the setup.exe to install (must have admin rights)
- **Important: Install STEPL in a folder you have write access to**



# Running STEPL

- Know before you begin:
  - Number of watersheds
  - Number of gullies/streambanks
- Tip: enter more than you need as placeholders
- Check box to turn off Microsoft compatibility checker
- Enable Macros
  - In Excel 2010, Click on File menu > Options > Trust Center > Trust Center Settings > Macro Settings



# 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, cont.

- Also on the website:
  - Frequently Asked Questions
  - STEPL Slide Shows & Tutorials
  - Alternative Models Document
  - Region 5 Model and documentation
- STEPL Support:  
[stepl@tetrattech.com](mailto:stepl@tetrattech.com)

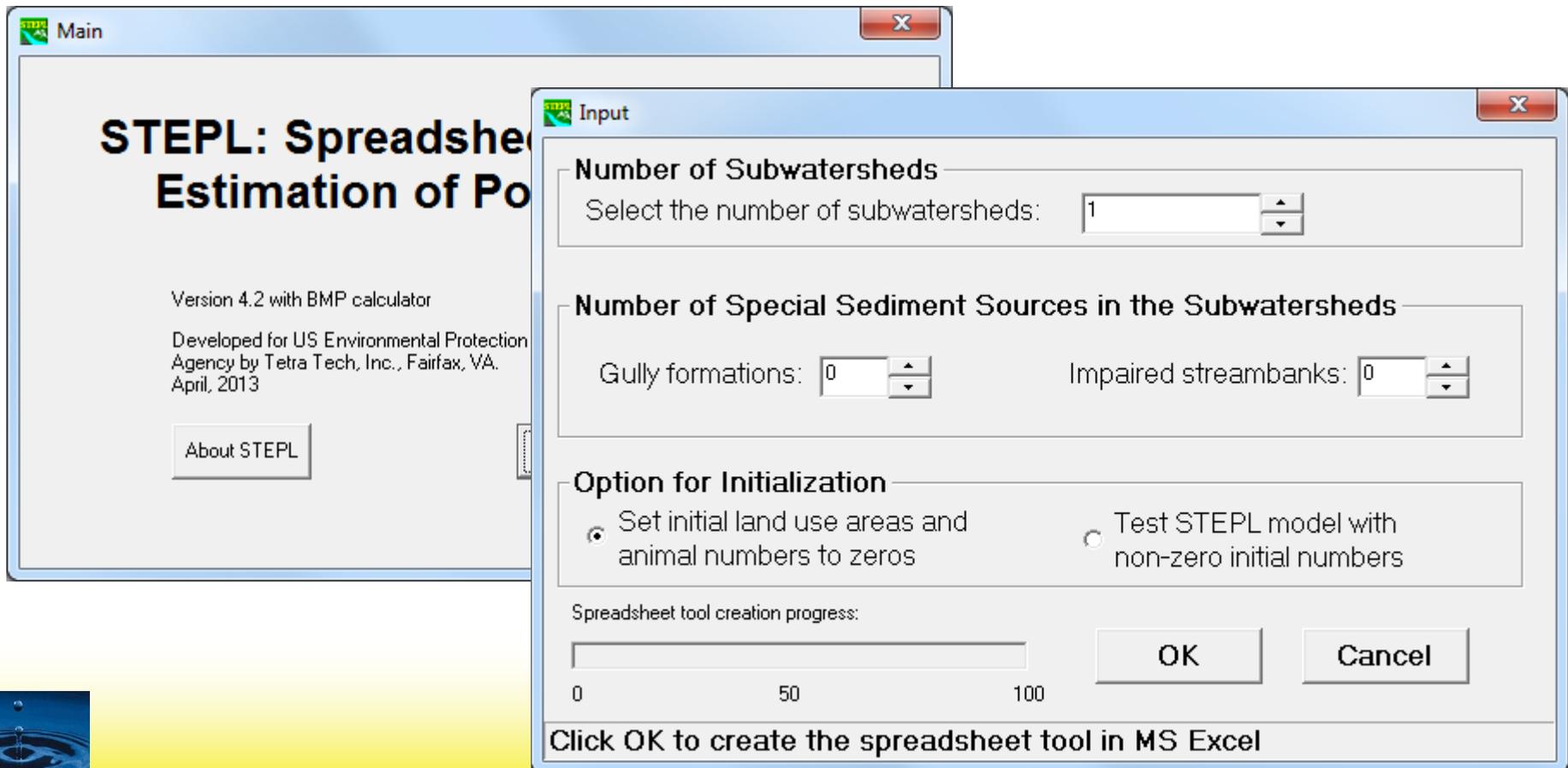


# How to Use STEPL

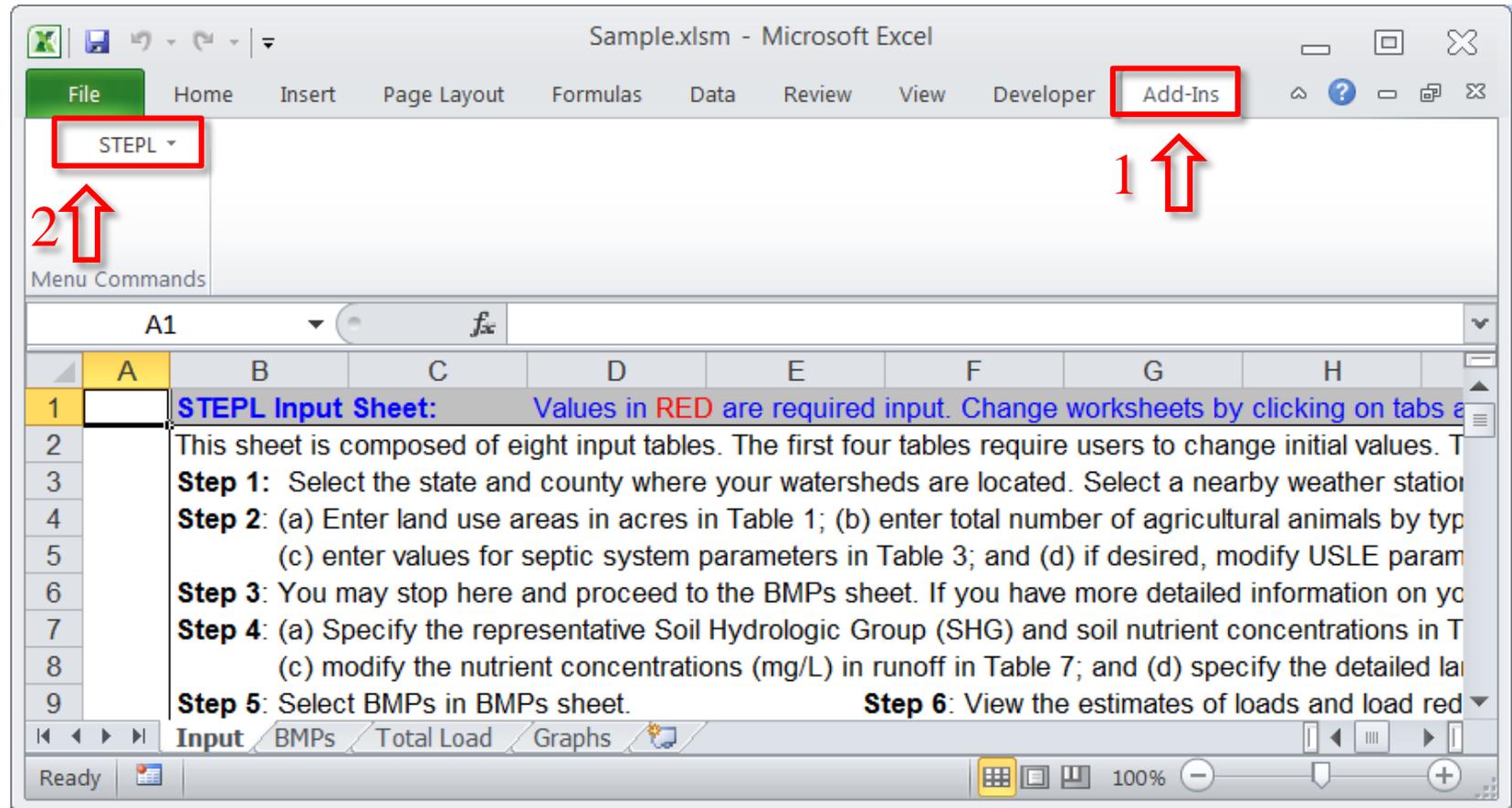


# STEPL Main Program

- Run STEPL executable program to create and customize spreadsheet dynamically



# Customized Menu in Excel 2010



- To view the STEPL menu in Excel 2010, click on the Add-Ins tab

**TIP:** Make sure macros are enabled first

# Macro Settings – Excel 2010

The image shows the Microsoft Excel 2010 interface with the 'File' menu open. The 'Options' item is highlighted. The 'Excel Options' dialog box is displayed, with the 'Trust Center' category selected in the left-hand pane. The 'Trust Center Settings...' button is highlighted in the right-hand pane.

1. Red arrow pointing to the 'File' menu.

2. Red arrow pointing to the 'Options' item in the File menu.

3. Red arrow pointing to the 'Trust Center' category in the Excel Options dialog.

4. Red arrow pointing to the 'Trust Center Settings...' button in the Excel Options dialog.



# Macro Settings – Excel 2010

The screenshot shows the Trust Center dialog box with the following elements:

- 1** A red arrow points to the **Macro Settings** option in the left sidebar.
- 2** A red box highlights the radio button for **Enable all macros (not recommended; potentially dangerous code can run)** in the Macro Settings section.
- 3** A red box highlights the **OK** button at the bottom right.

The dialog box contains the following sections:

- Trusted Publishers**
- Trusted Locations**
- Trusted Documents**
- Add-ins**
- ActiveX Settings**
- Macro Settings** (selected)
- Protected View**
- Message Bar**
- External Content**
- File Block Settings**
- Privacy Options**

**Macro Settings**

- Disable all macros without notification
- Disable all macros with notification
- Disable all macros except digitally signed macros
- Enable all macros (not recommended; potentially dangerous code can run)

**Developer Macro Settings**

- Trust access to the VBA project object model

**OK** **Cancel**



# STEPL Spreadsheet

Sample.xlsm - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Add-Ins Nuance PDF Team

Clipboard Font Alignment Number Styles Cells Editing

A1

**STEPL Input Sheet:** Values in RED are required input. Change worksheets by clicking on tabs at the bottom. You entered

This sheet is composed of eight input tables. The first four tables require users to change initial values. The next four tables (initially hidden) are:

**Step 1:** Select the state and county where your watersheds are located. Select a nearby weather station. This will automatically specify values for the weather station.

**Step 2:** (a) Enter land use areas in acres in Table 1; (b) enter total number of agricultural animals by type and number of months per year that they are kept; (c) enter values for septic system parameters in Table 3; and (d) if desired, modify USLE parameters associated with the selected county.

**Step 3:** You may stop here and proceed to the BMPs sheet. If you have more detailed information on your watersheds, click the Yes button in the optional input tables.

**Step 4:** (a) Specify the representative Soil Hydrologic Group (SHG) and soil nutrient concentrations in Table 5; (b) modify the curve number for the selected county; (c) modify the nutrient concentrations (mg/L) in runoff in Table 7; and (d) specify the detailed land use distribution in the urban area in Table 8.

**Step 5:** Select BMPs in BMPs sheet. **Step 6:** View the estimates of loads and load reductions in Total Load and Graphs sheets.

Show optional input tables?    Treat all the subwatersheds as parts of a single watershed  Groundwater

State: Alabama County: Autauga Weather Station (for rain correction factors): 0 Default

**1. Input watershed land use area (ac) and precipitation (in)**

Watershed	Urban	Cropland	Pastureland	Forest	User Defined	Feedlots	Feedlot Percent Paved	Total
W1	200	200	200	200	0	10	0-24%	810

Input BMPs Total Load Graphs Composed of four worksheets

# Type over Red text only

- Do not type in cells with black text

**STEPL Input Sheet:** Values in RED are required input. Change worksheets by clicking on tabs at the bottom. You entered

This sheet is composed of eight input tables. The first four tables require users to change initial values. The next four tables (initially hidden),

**Step 1:** Select the state and county where your watersheds are located. Select a nearby weather station. This will automatically specify \

**Step 2:** (a) Enter land use areas in acres in Table 1; (b) enter total number of agricultural animals by type and number of months per year th  
(c) enter values for septic system parameters in Table 3; and (d) if desired, modify USLE parameters associated with the selected c

**Step 3:** You may stop here and proceed to the BMPs sheet. If you have more detailed information on your watersheds, click the Yes button

**Step 4:** (a) Specify the representative Soil Hydrologic Group (SHG) and soil nutrient concentrations in Table 5; (b) modify the curve number  
(c) modify the nutrient concentrations (mg/L) in runoff in Table 7; and (d) specify the detailed land use distribution in the urban area i

**Step 5:** Select BMPs in BMPs sheet. **Step 6:** View the estimates of loads and load reductions in Total Load and Graphs she

Show optional input tables?    Treat all the subwatersheds as parts of a single watershed  Group

State: Alabama County: Baldwin Weather Station (for rain correction factors): 0 Default

**1. Input watershed land use area (ac) and precipitation (in)**

Watershed	Urban	Cropland	Pastureland	Forest	User Defined	Feedlots	Feedlot Percent Paved	Total
WV1	200	200	200	200	0	10	0-24%	810
WV2	200	200	200	200	0	10	0-24%	810
WV3	200	200	200	200	0	10	0-24%	810

Input / BMPs / Total Load / Graphs



# Required areas under Input tab are bound in red

Sample.xlsm - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer Add-Ins Nuance PDF Team

A1

State County Weather Station (for rain correction factors)

Alabama Autauga 0 Default

Rain correctio

0.814

1. Input watershed land use area (ac) and precipitation (in)

Watershed	Urban	Cropland	Pastureland	Forest	User Defined	Feedlots	Feedlot Percent Paved	Total	Annual Rainfall
W1	200	200	200	200	0	10	0-24%	810	60

2. Input agricultural animals

Watershed	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck	# of months manure applied
W1	100	100	100	100	100	100	100	100	4
Total	100	100	100	100	100	100	100	100	

3. Input septic system and illegal direct wastewater discharge data

Watershed	No. of Septic Systems	Population per Septic System	Septic Failure Rate, %	Wastewater Direct Discharge, # of People	Direct Discharge Reduction, %
W1	600	2.43	2	0	0

Input BMPs Total Load Graphs BMPList

Ready 100%



# BMPs Worksheet

Urban BMP Tool

Gully and  
Streambank Erosion

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

Watershed	Cropland					BMPs	% Area BMP Applied
	N	P	BOD	Sediment			
W1	0.485	0.55	ND	0.405	<input checked="" type="radio"/> Contour Farming	100	
W2	0.1	0.3	ND	0.35	<input checked="" type="radio"/> Diversion	100	
W3	0	0	0	0	<input checked="" type="radio"/> No BMP	100	

- Each land use type within each watershed can have one BMP
- Specify % Area BMP Applied



# Total Load Worksheet

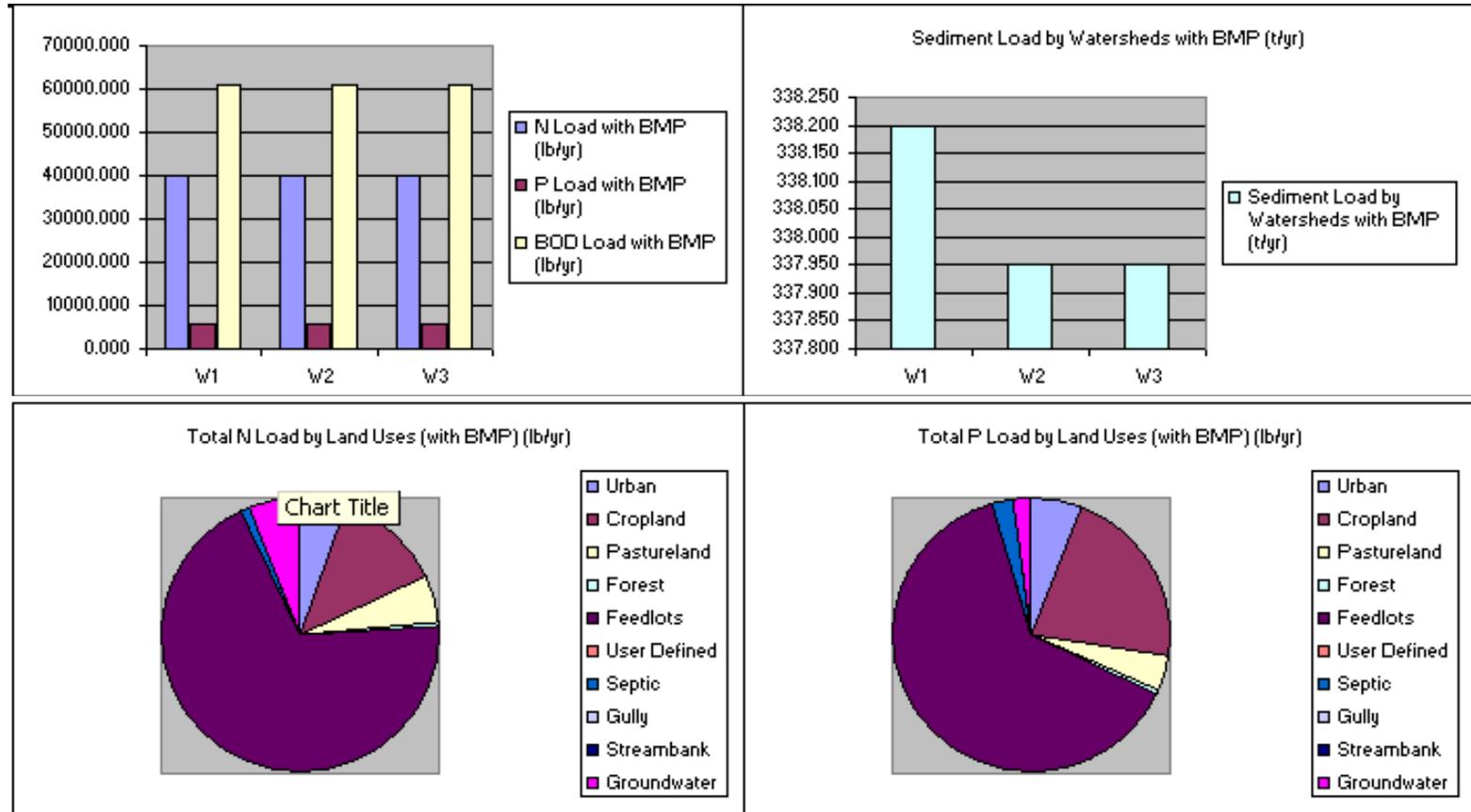
## 1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	39888.8	5615.6	60882.3	342.9	8.6	3.3	17.1	4.7
W2	39879.8	5612.2	60864.2	338.0	0.0	0.0	0.0	0.0
W3	39879.8	5612.2	60864.2	338.0	0.0	0.0	0.0	0.0
Total	119648.4	16839.9	182610.8	1018.8	8.6	3.3	17.1	4.7

Each row of results corresponds to a different watershed or project.



# Graphs Worksheet



# Urban BMP Tool



# Urban Land Use Distribution

- STEPL automatically applies a default Urban Land Use distribution to identify the % commercial, %industrial, etc. (Table 8 on Input sheet)
- Modify these values with local data when using STEPL to model results of urban BMPs



# LID BMPs

- Reference #26: Maryland Prince George's County and the U.S. Environmental Protection Agency. 1999. Low-Impact Development Design Strategies: An Integrated Design Approach.

<http://www.epa.gov/owow/NPS/lid/lidnatl.pdf>

- Efficiencies provided on page 72

**Table 4-3 Reported Pollutant Removal Efficiency of IMPs**

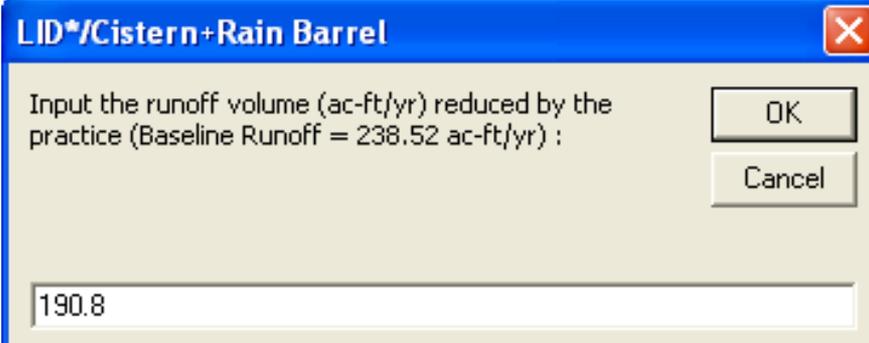
PMP	TSS	Total P	Total N	Zinc	Lead	BOD	Bacteria
Bioretention	-	81	43	99	99	-	-
Dry Well	80-100	40-60	40-60	80-100	80-100	60-80	60-80
Infiltration Trench	80-100	40-60	40-60	80-100	80-100	60-80	60-80
Filter/Buffer Strip	20-100	0-60	0-60	20-100	20-100	0-80	-
Vegetated Swale	30-65	10-25	0-15	20-50	20-50	-	Neg.
Infiltration Swale	90	65	50	80-90	80-90	-	-
Wet Swale	80	20	40	40-70	40-70	-	-
Rain Barrel	NA	NA	NA	NA	NA	NA	NA
Cistern	NA	NA	NA	NA	NA	NA	NA

Source: CRC, 1996; Davis et al. 1997; MWCG, 1987; Urbonas & Stahre, 1993; Yousef et al., 1985; Yu et al., 1992; Yu et al., 1993.



# LID\* BMPs

- For LID BMPs marked with an asterisk (\*), need to know the 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



LID\*/Cistern+Rain Barrel

Input the runoff volume (ac-ft/yr) reduced by the practice (Baseline Runoff = 238.52 ac-ft/yr) :

190.8

OK

Cancel

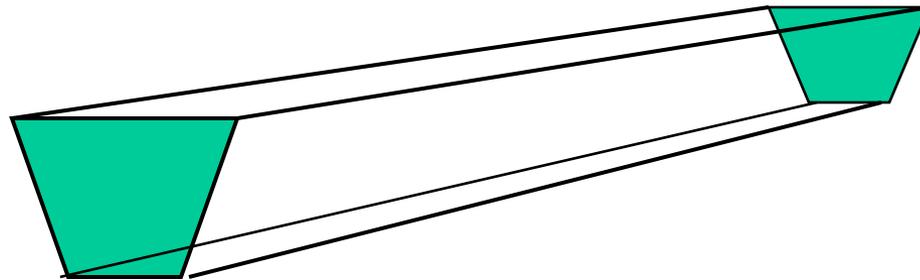


# Gullies and Streambanks



# 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 (100% efficiency by default)
  - Reduction is equal to annual erosion x user-specified efficiency



$$\text{Volume} = (\text{Top Width} + \text{Bottom Width}) / 2 \times \text{Depth} \times \text{Length}$$



# Gully Stabilization, cont.

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

<b>Soil Texture</b>	<b>Nutrient Correction Factor</b>
Clay	1.15
Silt	1.00
Sand	0.85
Peat	1.50



# 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

<b>Lateral Recession Rate (ft/yr)</b>	<b>Category</b>	<b>Description</b>
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

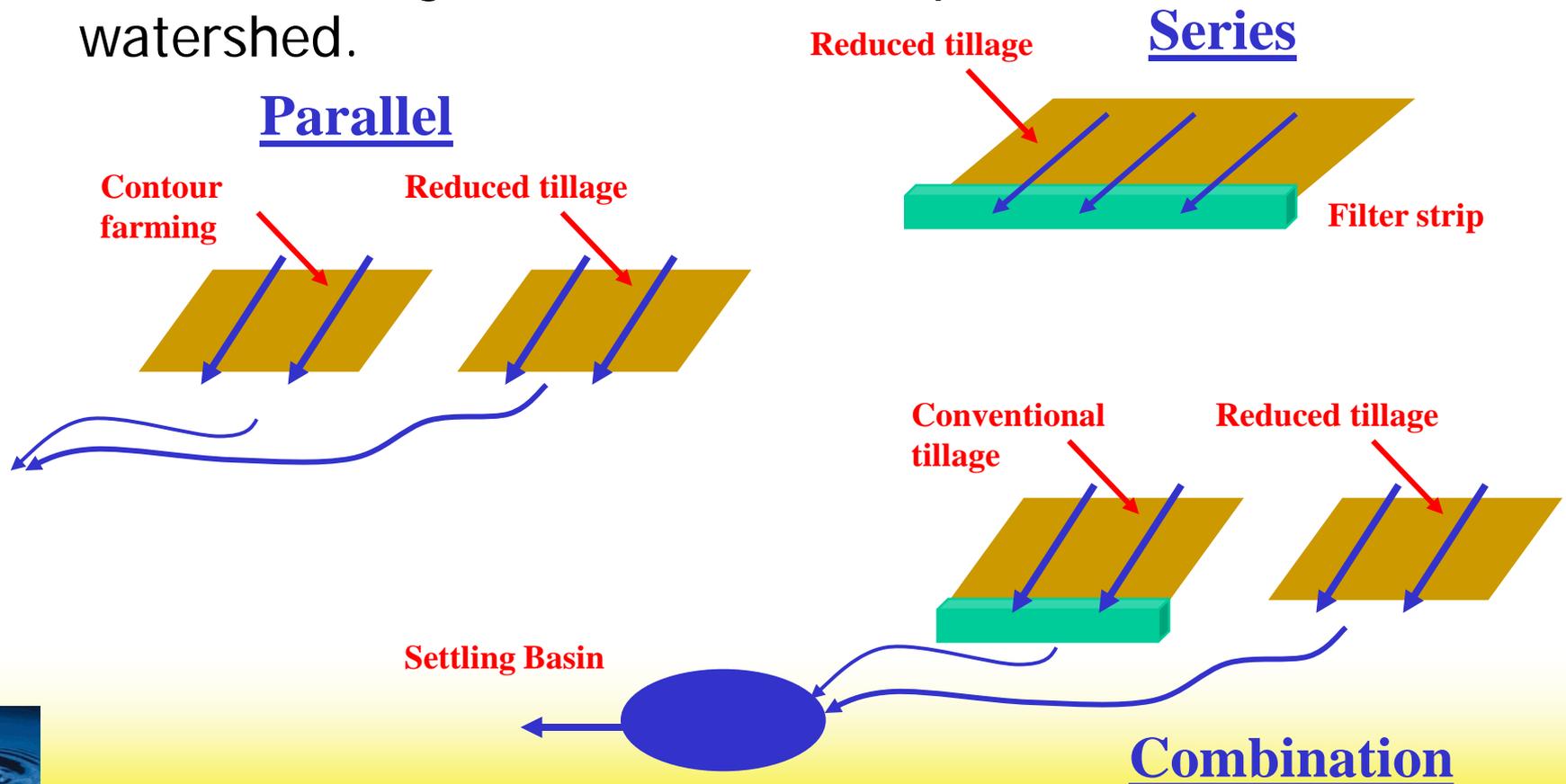


# Use the BMP Calculator for Multiple BMPs



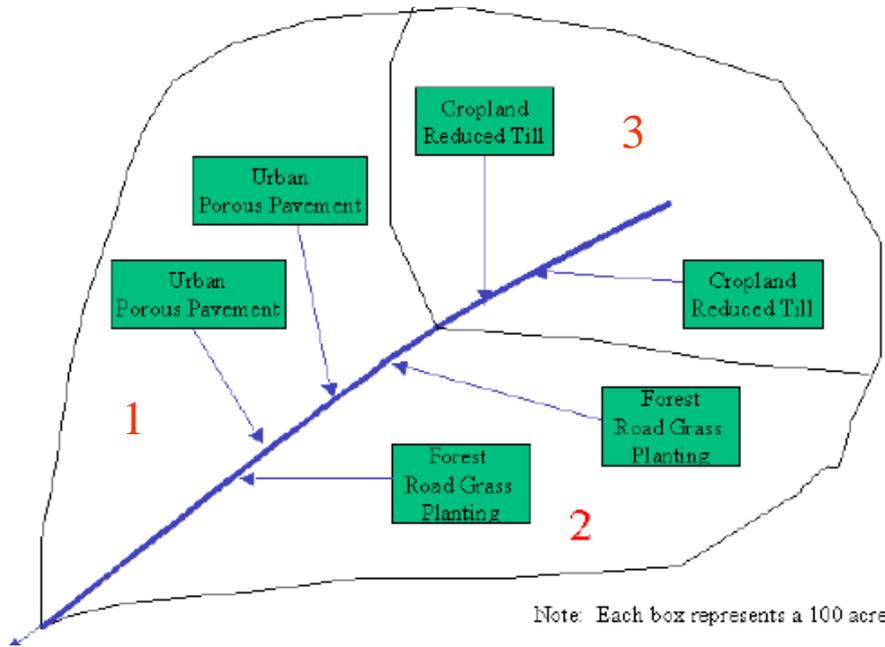
# STEPL BMP Calculator

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

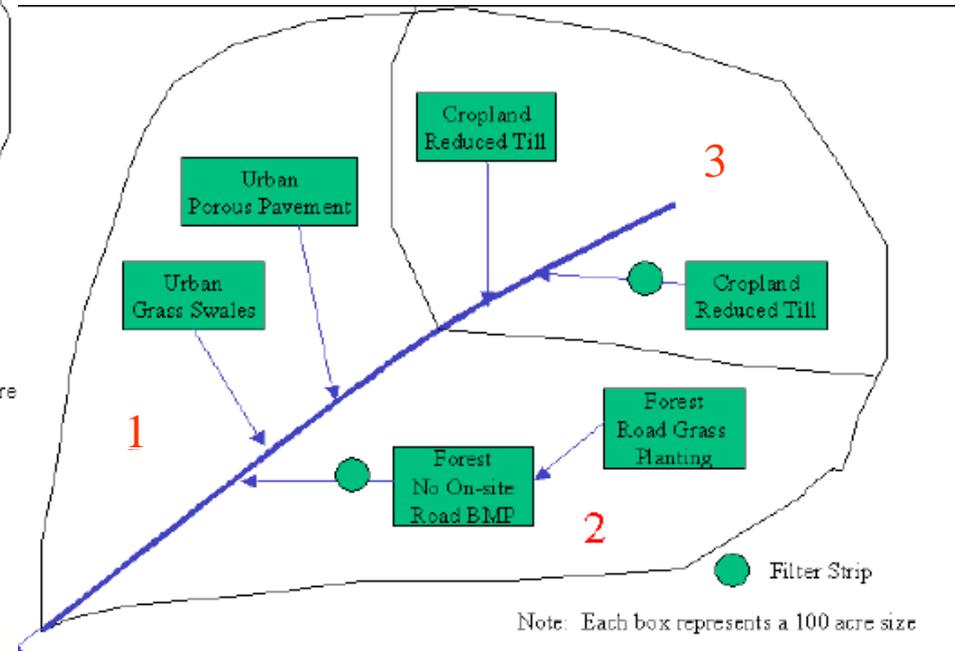


# Need for BMP Calculator

- When is BMP Calculator needed?



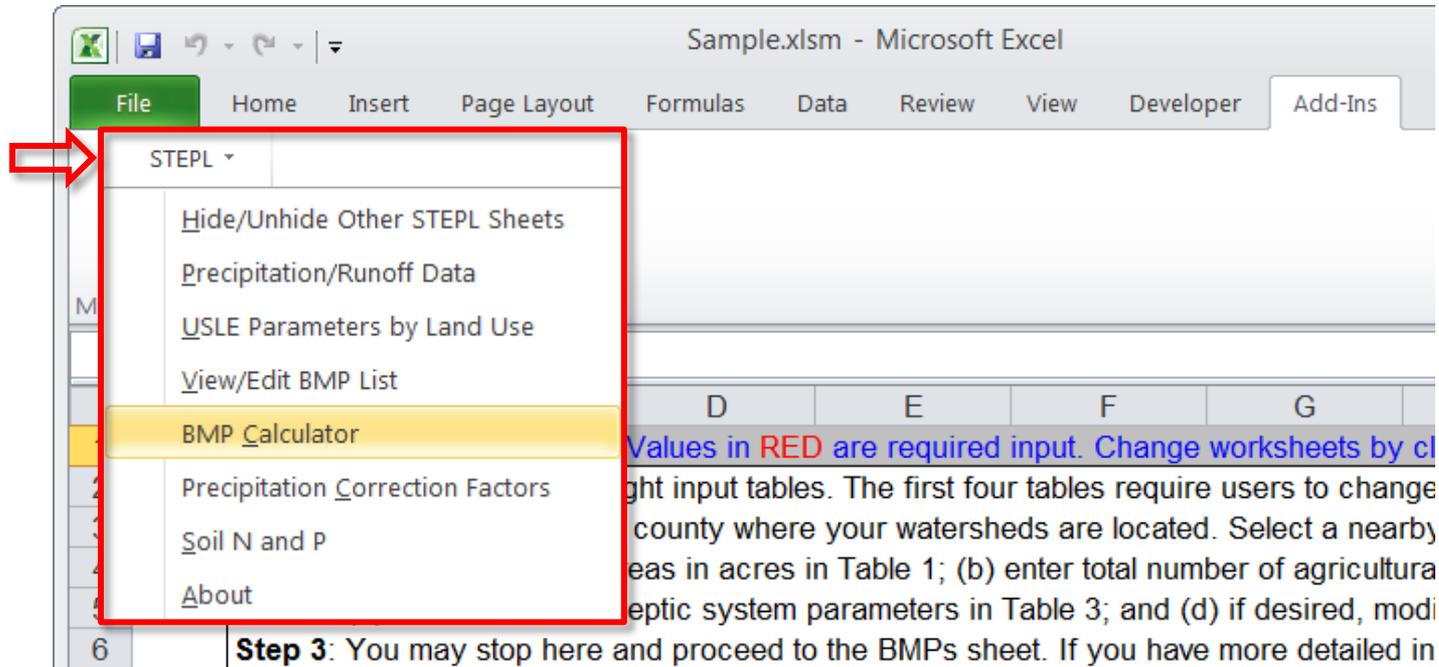
Not needed -> No combined efficiency calculation



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



# Customized Menu



**Tip:** To ensure that files are linked to the customized menu, set Excel **Default file location** to C:\STEPL or D:\STEPL

**Step:** In Excel 2010, click on File menu > Options > Save



# Default File Location

The image shows a Microsoft Excel window titled "Sample.xlsxm - Microsoft Excel". The "File" menu is open, and the "Options" option is selected. The "Excel Options" dialog box is displayed, with the "Save" category selected. The "Default file location" field is set to "C:\STEPL\". The "OK" button is highlighted.

1. Click the File menu.

2. Click the Options option in the File menu.

3. Click the Save option in the Excel Options dialog box.

4. Click the Default file location field.

5. Click the OK button.



# STEPL BMP Calculator

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

**Add BMP box**

**Delete Connection**

**Use source area or original load as the weighting factor**

**Draw Connection**

**Calculate combined efficiency**

**Move BMP box**

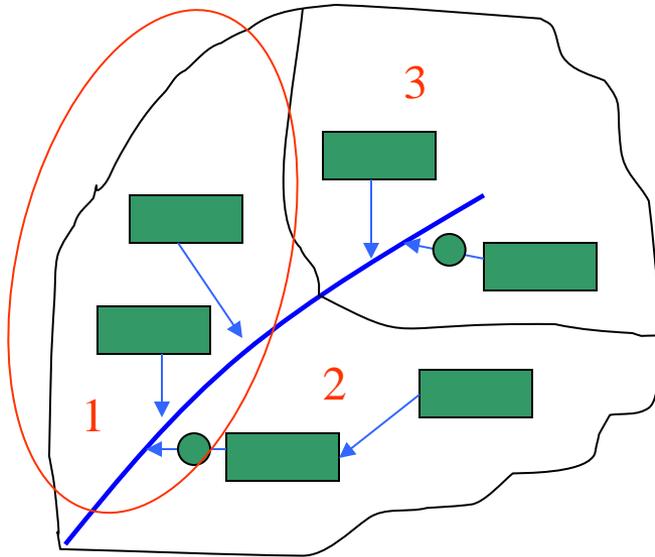
The screenshot shows the 'BMP Calculator' window with a menu bar (File, Edit, View, Help) and a toolbar. The main workspace contains three BMP boxes. Two boxes at the top represent individual BMPs, and one box at the bottom represents the combined system. Arrows from the text labels point to specific elements: 'Add BMP box' points to the toolbar's 'Add BMP' icon; 'Delete Connection' points to the 'Delete Connection' icon; 'Use source area or original load as the weighting factor' points to the 'Load or Area' field in the top-right box; 'Draw Connection' points to the arrow connecting the two top boxes to the bottom box; 'Calculate combined efficiency' points to the bottom box; and 'Move BMP box' points to the bottom box.

Box	Load or Area	N Eff	P Eff	BOD Eff	Sed Eff
Top Left	20.000	0.700	0.750	0.000	0.650
Top Right	30.000	0.550	0.450	0.000	0.750
Bottom (Combined)	40.000	0.550	0.450	0.000	0.750

Total Load or Area=90.000  
N Eff=0.702  
P Eff=0.624  
BOD Eff=0.000  
Sediment Eff=0.849



# BMP Calculator – Example 1



Each box represents 100 ac



Load

**BMP Calculator**

File Edit View Help

Load or Area=100.000  
N Eff=0.100  
P Eff=0.250  
BOD Eff=0.300  
Sed Eff=0.650

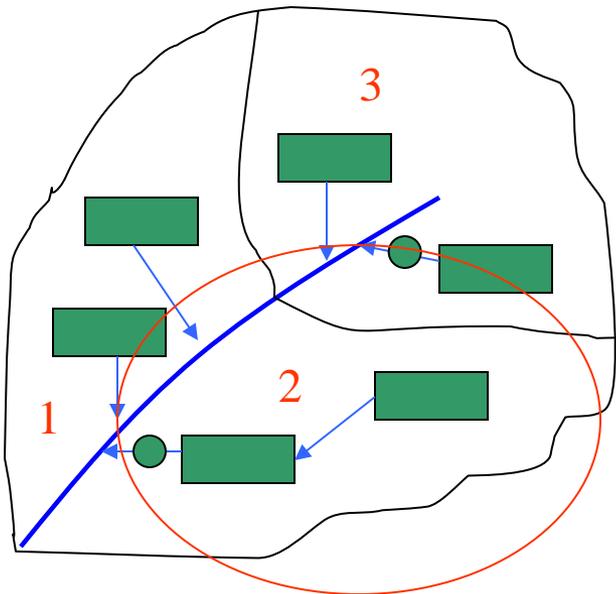
Load or Area=100.000  
N Eff=0.850  
P Eff=0.650  
BOD Eff=0.000  
Sed Eff=0.900

Load or Area=0.000  
N Eff=0.000  
P Eff=0.000  
BOD Eff=0.000  
Sed Eff=0.000

Total Load or Area=200.000  
N Eff=0.475  
P Eff=0.450  
BOD Eff=0.150  
Sediment Eff=0.775

Ready

# BMP Calculator – Example 2



Each box represents 100 ac

**Forest Road  
Grass Planting**

**Forest No On-site  
Road BMP**

**Filter Strip**

**Load**

**BMP Calculator**

File Edit View Help

Load or Area=100.000  
N Eff=0.000  
P Eff=0.000  
BOD Eff=0.000  
Sed Eff=0.710

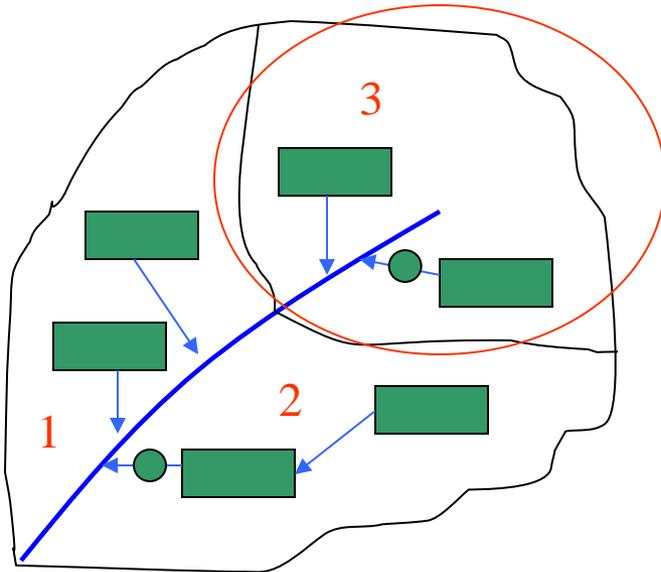
Load or Area=100.000  
N Eff=0.000  
P Eff=0.000  
BOD Eff=0.000  
Sed Eff=0.000

Load or Area=0.000  
N Eff=0.700  
P Eff=0.750  
BOD Eff=0.000  
Sed Eff=0.650

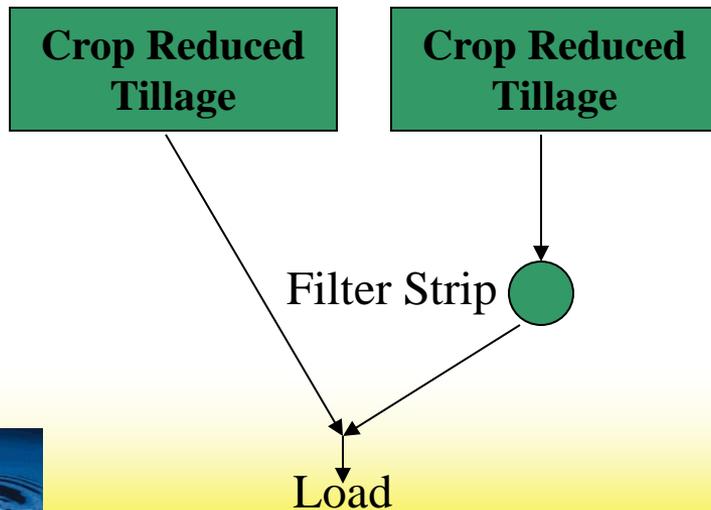
Total Load or Area=200.000  
N Eff=0.700  
P Eff=0.750  
BOD Eff=0.000  
Sediment Eff=0.774

Ready

# BMP Calculator – Example 3



Each box represents 100 ac



**BMP Calculator**

File Edit View Help

Load or Area=100.000  
N Eff=0.550  
P Eff=0.450  
BOD Eff=0.000  
Sed Eff=0.750

Load or Area=100.000  
N Eff=0.550  
P Eff=0.450  
BOD Eff=0.000  
Sed Eff=0.750

Load or Area=0.000  
N Eff=0.700  
P Eff=0.750  
BOD Eff=0.000  
Sed Eff=0.650

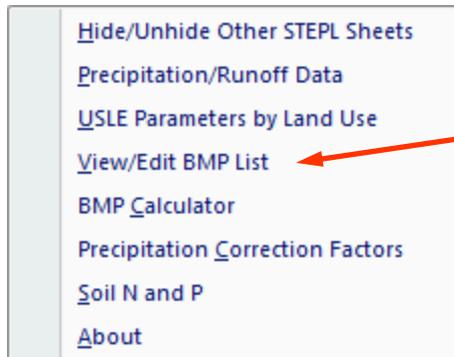
Load or Area=0.000  
N Eff=0.000  
P Eff=0.000  
BOD Eff=0.000  
Sed Eff=0.000

Total Load or Area=200.000  
N Eff=0.707  
P Eff=0.656  
BOD Eff=0.000  
Sediment Eff=0.831

Ready

# 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	0
Cropland	Combined	0	0	0	0
Cropland	Contour Fa	0.485	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



# STEPL: Add New Data to BMP List

A	B	C	D	E	F	G	H	I	J	K	
Landuse	BMP & Efficiency	N	P	BOD	Sediment						
Cropland	0 No BMP	0	0	0	0	<Don't Delete	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.				
Cropland	Combined BMPs-Calculated	0	0	0	0	<Don't Delete					
Cropland	Contour Farming	0.485	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 Tillage Systems	0.55	0.45	ND	0.75						
Cropland	Streambank stabilization and fencing	0.75	0.75	ND	0.75						
Cropland	Terrace	0.2	0.7	ND	0.85						
Pastureland	0 No BMP	0	0	0	0	<Don't Delete					
Pastureland	Combined BMPs-Calculated	0	0	0	0	<Don't Delete					
Pastureland	User Defined	0.5	0.5	0.5	0.75						
Forest						<Don't Delete					
Forest	0 No BMP	0	0	0	0	<Don't Delete	Update BMP Data				

Update BMP button  
(BMPList worksheet)

New BMP added!  
(BMPs worksheet)

New BMP added!

2. BMPs and efficiencies for different pollutants on pastureland, ND=No Data					
Watershed	Pastureland				
	N	P	BOD	Sediment	BMPs
W1	0.5	0.5	0.5	0.75	<input checked="" type="radio"/> User Defined

Click "Update BMP Data" button to update the BMP selections in the BMPs worksheet

Note: once you click Update BMP Data, the BMP selections will be reset. This means if you had applied any BMPs, you will need to re-select them.

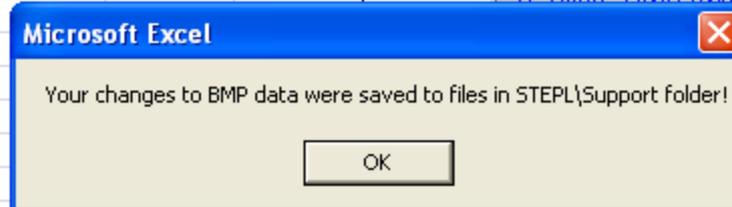


# Update BMP List

1	Landuse	BMP & Efficiency	N	P	BOD	Sediment
2	Cropland					
3	Cropland	0 No BMP		0	0	0
4	Cropland	Combined BMPs-Calculated		0	0	0
5	Cropland	Contour Farming	0.485	0.55	ND	0.405
6	Cropland	Cover Crops	0.3	0.25	ND	0.25
7	Cropland	Diversion	0.1	0.3	ND	0.35
8	Cropland	Filter strip	0.7	0.75	ND	0.65
9	Cropland	Reduced Tillage Systems	0.55	0.45	ND	0.75
10	Cropland	Streambank stabilization and fencing	0.75	0.75	ND	0.75
11	Cropland	Terrace	0.2			
12	Pastureland					
13	Pastureland	0 No BMP		0		
14	Pastureland	Combined BMPs-Calculated		0		
15	Forest					
16	Forest	0 No BMP		0		
17	Forest	Combined BMPs-Calculated		0	0	0
18	Forest	Road dry seeding	ND	ND	ND	0.41
19	Forest	Road grass and legume seeding	ND	ND	ND	0.71
20	Forest	Road hydro mulch	ND	ND	ND	0.41
21	Forest	Road straw mulch	ND	ND	ND	0.41
22	Forest	Road tree planting	ND	ND	ND	0.5
23	Forest	Site preparation/hydro mulch/seed/fertilizer	ND	ND	ND	0.71
24	Forest	Site preparation/hydro mulch/seed/fertilizer	ND	ND	ND	0.69
25	Forest					
26	Forest					
27	Forest					
28	Forest					
29	Forest					
30	User					
31	User					
32	User					

## Instruction:

1. Do not delete the greyed rows.
2. BMP efficiencies should be  $\leq 1$ .
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 text files in the folder.



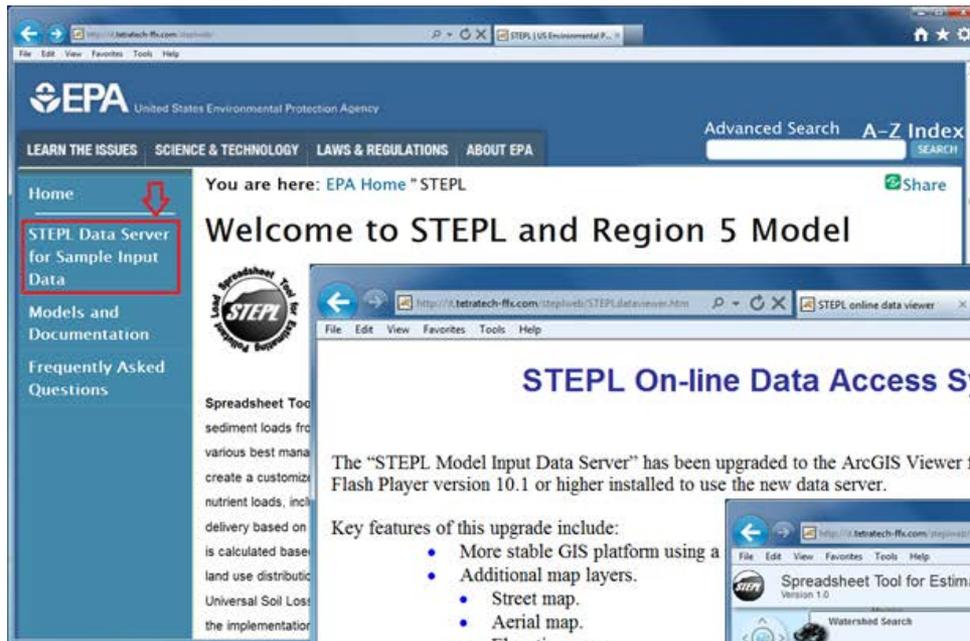
Save Updates

- 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: or D:\Step\Support\AllBMPstepl.csv
  - C: or D:\Step\Support\AllBMPs.csv

# **STEPL Model Input Data Server**



# STEPL Model Input Data Server



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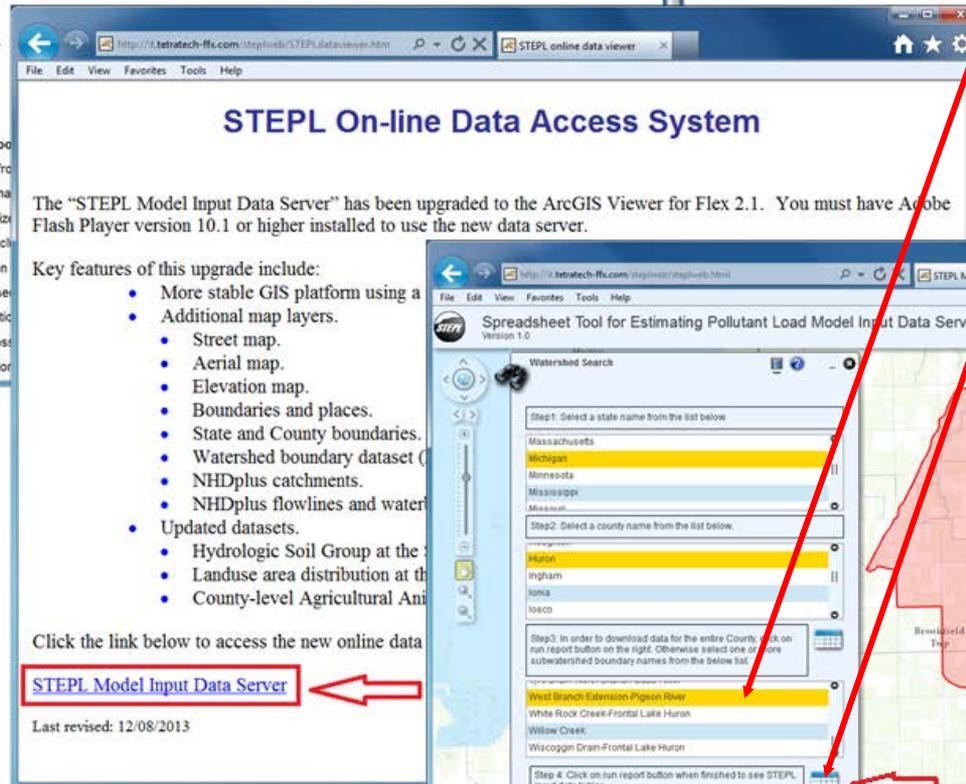
**STEPL Data Server for Sample Input Data**

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Spreadsheet Tool

sediment loads from various best management practices create a customized nutrient loads, including delivery based on is calculated based land use distribution Universal Soil Loss the implementation



### STEPL On-line Data Access System

The "STEPL Model Input Data Server" has been upgraded to the ArcGIS Viewer for Flex 2.1. You must have Adobe Flash Player version 10.1 or higher installed to use the new data server.

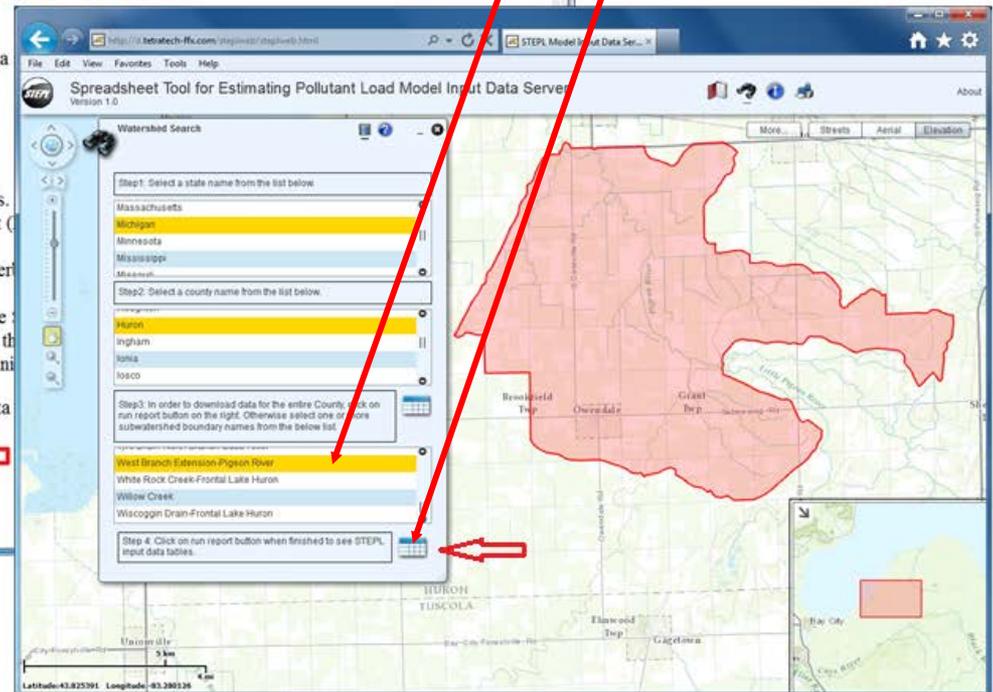
Key features of this upgrade include:

- More stable GIS platform using a
- Additional map layers.
  - Street map.
  - Aerial map.
  - Elevation map.
  - Boundaries and places.
  - State and County boundaries.
  - Watershed boundary dataset (NHDplus catchments.
  - NHDplus flowlines and water
- Updated datasets.
  - Hydrologic Soil Group at the
  - Landuse area distribution at the
  - County-level Agricultural An

Click the link below to access the new online data

[STEPL Model Input Data Server](#)

Last revised: 12/08/2013



### Spreadsheet Tool for Estimating Pollutant Load Model Input Data Server

Version 1.0

Watershed Search

Step1: Select a state name from the list below

- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Missouri

Step2: Select a county name from the list below

- Huron
- Ingham
- Ionia
- Iosco

Step3: In order to download data for the entire County, click on run report button on the right. Otherwise, select one or more subwatershed boundary names from the below list

- West Branch Extension-Pigeon River
- White Rock Creek-Frontal Lake Huron
- Willow Creek
- Wisconsin Drain-Frontal Lake Huron

Step 4: Click on run report button when finished to see STEPL input data tables.

Map showing a watershed boundary in red over a satellite view of the Huron, Tuscara, and Elsworth townships in Michigan. The map includes a scale bar and an inset map of Michigan.

Data is available at HUC 12 watershed

Generate data summaries



# STEPL Model Input Data Server: Basic Report

Data is summarized by HUC12 watershed

The screenshot displays the STEPL Model Input Data Server web application. The browser address bar shows the URL: <http://it.tetrattech-ffx.com/steplweb/steplweb.html>. The application title is "Spreadsheet Tool for Estimating Pollutant Load Model Input Data Server Version 1.0".

The main content area shows a "STEPL Input Data Report" for the "West Branch Extension-Pigeon" watershed. The report is organized into four summary tables, each with a tab highlighted by a red box:

- Landuse Area:** A table with columns for Watershed Name, HUC12, Urban, Cropland, Pastureland, Forest, User Defined, Feedlots, Water, and Others. The data row shows: West Branch Extension-Pigeon, 040801030203, 1616.582, 22635.702, 1742.012, 1402.861, 0.000, 1.074, 22.239, 1179.800.
- Agricultural Animals Count:** A table with columns for Watershed Name, HUC12, Beef Cattle, Dairy Cattle, Swine, Sheep, Horse, Chicken, Turkey, and Duck. The data row shows: West Branch Extension-Pigeon, 040801030203, 36, 742, 1005, 41, 17, 0, 3, 6.
- Septic System:** A table with columns for Watershed Name, HUC12, Septic Systems, Population per Septic System, and % Septic Failure Rate. The data row shows: West Branch Extension-Pigeon River, 040801030203, 725, 2, 1.14.
- Hydrologic Soil Group:** A table with columns for Watershed Name, HUC12, and Hydrologic Soil Group. The data row shows: West Branch Extension-Pigeon River, 040801030203, C.

# Coming soon: STEPL Enhancements

- Additional BMPs
  - Several for Pasture lands
  - Crosswalk to NRCS standards and GRTS
- Ecoli load reductions
- Flow volume reductions
- Improved guidance and reporting tools





# STEPL Documentation

- EPA's STEPL QDP provides a specific record of how the load reductions were estimated, with acknowledgement and explanation of the assumptions & decisions made during the process
- Helps grantees identify the data needed and avoid pitfalls & delays



# Summary

- STEPL is a simple model for estimating long term average pollutant load reductions to support watershed planning
- STEPL is flexible but requires your input and judgment to apply it to your project
- Seek assistance from your colleagues
- Questions & suggestions for improvement are always welcome



**BEGIN HANDS-ON EXERCISES**



# Exercise #1

- Create a STEPL worksheet with 4 watersheds, 2 gullies, and 2 streambanks
- Save as "TrainingExercise1"
- Make sure macros are enabled





# Exercise #2

- Review primary worksheets
  - Locate 4 input tables
  - Show optional input tables
    - how many input tables are there?
  - Access STEPL customized menu
    - What is the first option listed? Select it.
    - How many worksheets are there?
    - Select again to Hide the additional sheets
  - Unhide the Reference sheet only
- 



# Exercise #3

## Estimate total annual loads for a subwatershed of the Pigeon River

- Select state = Michigan, and county = Huron.
  - Notice that initial values for Annual Rainfall and Number of Rain Days are automatically specified in Table 1 as you select a state or county.
- Select a weather station = MI Flint WSCMO.
  - Notice that rain correction factors change with the selected weather station.



# Download data from the STEPL Input Data Server for the West Branch Extension-Pigeon River Subwatershed

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  - Hydrologic Soil Group at the
  - Landuse area distribution at the
  - County-level Agricultural An

Click the link below to access the new online data

**STEPL Model Input Data Server**

Last revised: 12/08/2013

Spreadsheet Tool for Estimating Pollutant Load Model Input Data Server

Version 1.0

Watershed Search

Step1: Selected a state name from the list below

Massachusetts  
**Michigan**  
Minnesota  
Mississippi  
Missouri

Step2: Selected a county name from the list below.

**Huron**  
Ingham  
Ionia  
Iosco

Step3: In order to download data for the entire County, click on run report button on the right. Otherwise, select one or more subwatershed boundary names from the below list.

**West Branch Extension-Pigeon River**  
White Rock Creek-Frontal Lake Huron  
Willow Creek  
Wiscoggin Drain-Frontal Lake Huron

Step 4: Click on run report button when finished to see STEPL input data tables.

Map showing the selected watershed (West Branch Extension-Pigeon River) in red.



# Enter data in the Input Worksheet

Browser address bar: <http://it.tetrattech-ffx.com/steplweb/steplweb.html>

Page Title: STEPL Model Input Data Ser... x

Menu: File Edit View Favorites Tools Help

Logo: STEPL Spreadsheet Tool for Estimating Pollutant Load Model Input Data Server Version 1.0

STEPL Input Data Report

Watershed | Landuse Area | Agricultural Animals Count | Septic System | Hydrologic Soil Group

Watershed Name	HUC12	Urban	Cropland	Pastureland	Forest	User Defined	Feedlots	Water	Others
West Branch Extension-Pigeon	040801030203	1616.582	22635.702	1742.012	1402.861	0.000	1.074	22.239	1179.800

Watershed | Landuse Area | Agricultural Animals Count | Septic System | Hydrologic Soil Group

Watershed Name	HUC12	Beef Cattle	Dairy Cattle	Swine	Sheep	Horse	Chicken	Turkey	Duck
West Branch Extension-Pigeon	040801030203	36	742	1005	41	17	0	3	6

Watershed | Landuse Area | Agricultural Animals Count | Septic System | Hydrologic Soil Group

Watershed Name	HUC12	Septic Systems	Population per Septic System	% Septic Failure Rate
West Branch Extension-Pigeon River	040801030203	725	2	1.14

Watershed | Landuse Area | Agricultural Animals Count | Septic System | Hydrologic Soil Group

Watershed Name	HUC12	Hydrologic Soil Group
West Branch Extension-Pigeon River	040801030203	C

# Sample Problem Exercise #3

- Examine estimated load in Total Load and Graph worksheets and compare the results below:

## 1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	105540.6	17827.4	246734.9	2587.9	0.0	0.0	0.0	0.0
W2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	105540.6	17827.4	246734.9	2587.9	0.0	0.0	0.0	0.0

Note that load reduction = 0 because you have not specified any BMP yet



# Sample Problem Exercise #3

## 2. Total load by land uses (with BMP)

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	8810.39	1360.50	34239.01	202.29
Cropland	84953.78	15128.10	178055.46	2358.96
Pastureland	9349.81	726.20	30286.21	25.17
Forest	291.14	145.01	725.41	1.52
Feedlots	1923.96	384.79	2565.28	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	211.48	82.83	863.53	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	0.00	0.00	0.00	0.00
Groundwater	0.00	0.00	0.00	0.00
Total	105540.55	17827.43	246734.90	2587.93

- Which land use has the highest annual load contributions?
- Review the Input Data parameters. Which required value did we leave out?



# Sample Problem Exercise #3

Set the number of months manure applied to 8.

- Note the difference in total loads.

## 1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)
	lb/year	lb/year	lb/year	t/year
W1	273930.6	63998.9	472160.3	2587.9
W2	0.0	0.0	0.0	0.0
W3	0.0	0.0	0.0	0.0
W4	0.0	0.0	0.0	0.0
Total	273930.6	63998.9	472160.3	2587.9

- Which pollutant load value did not change?



# Exercise #4

For the same farm area, estimate total annual load reduction assuming **reduced tillage** is adopted on **all cropland**

- Enter BMP data in BMPs worksheet
  - In Table 1 which is for cropland areas, select Reduced Tillage System under BMP column. Note that initial values of BMP efficiencies are automatically specified with the selected BMP.





# Sample Problem Exercise #4

- Examine estimated load reduction in Total Load and Graph worksheets and with the results below:

N Reduction	P Reduction	BOD Reduction	Sediment Reduction
lb/year	lb/year	lb/year	t/year
140848.8	28456.7	11323.0	1769.2

- How many acres were treated by Reduced Tillage? Is this realistic?
- Calculate the load reductions assuming Reduced Tillage is applied on 550 cropland acres



- Examine estimated load reduction in Total Load worksheet and compare with the results below:

**1. Total load by subwatershed(s)**

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	273930.6	63998.9	472160.3	2587.9	3422.6	691.5	275.1	43.0
W2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

**2. Total load by land uses (with BMP)**

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
Urban	8810.39	1360.50	34239.01	202.29	0.0	0.0	0.0	0.0
Cropland	249921.19	60608.06	403205.69	2315.97	0.0	0.0	0.0	0.0
Pastureland	9349.81	726.20	30286.21	25.17	0.0	0.0	0.0	0.0
Forest	291.14	145.01	725.41	1.52	0.0	0.0	0.0	0.0
Feedlots	1923.96	384.79	2565.28	0.00	0.0	0.0	0.0	0.0
User Defined	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
Septic	211.48	82.83	863.53	0.00	0.0	0.0	0.0	0.0
Gully	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
Streambank	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
Groundwater	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
<b>Total</b>	<b>270507.97</b>	<b>63307.39</b>	<b>471885.13</b>	<b>2544.94</b>	<b>3422.6</b>	<b>691.5</b>	<b>275.1</b>	<b>43.0</b>



## Exercise #4, cont.

- A waste management system is installed to treat the entire 1.074 acres of runoff from Feedlots.
- Add the BMP and calculate the new total load reductions for the watershed.



## 5. BMPs and efficiencies for different pollutants on FEEDLOTS, ND=No Data

Watershed	Feedlots					%Area BMP Applied
	N	P	BOD	Sediment	BMPs	
W1	0.8	0.9	ND	ND	Waste Mgmt System	100

### 1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	273930.6	63998.9	472160.3	2587.9	4961.8	1037.8	275.1	43.0
W2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	273930.6	63998.9	472160.3	2587.9	4961.8	1037.8	275.1	43.0

### 2. Total load by land uses (with BMP)

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	8810.39	1360.50	34239.01	202.29
Cropland	249921.19	60608.06	403205.69	2315.97
Pastureland	9349.81	726.20	30286.21	25.17
Forest	291.14	145.01	725.41	1.52
Feedlots	384.79	38.48	2565.28	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	211.48	82.83	863.53	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	0.00	0.00	0.00	0.00
Groundwater	0.00	0.00	0.00	0.00
Total	268968.80	62961.08	471885.13	2544.94

# Gullies and Streambanks

- Let's say the project also restores 2,000 feet of severely eroding streambank
- View Gully and Streambank erosion worksheet
- Add the BMP and calculate the new total load reductions for the watershed.
  - Assume bank is 2 ft high and soil class is Fine Sandy Loam



## 2. Impaired streambank dimensions in the different watersheds

Watershed	Strm Bank	Length (ft)	Height (ft)	Lateral Recession	Rate Range (ft/yr)	Rate (ft/yr)	BMP Efficiency (0-1)	Soil Textural Class
W1	Bank1	2000	2	3. Severe	0.3 - 0.5	0.4	0.95	Fine Sandy loam

## 1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	274039.4	64040.8	472377.9	2667.9	5065.2	1077.6	481.9	119.0
W2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	274039.4	64040.8	472377.9	2667.9	5065.2	1077.6	481.9	119.0

## 2. Total load by land uses (with BMP)

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	8810.39	1360.50	34239.01	202.29
Cropland	249921.19	60608.06	403205.69	2315.97
Pastureland	9349.81	726.20	30286.21	25.17
Forest	291.14	145.01	725.41	1.52
Feedlots	384.79	38.48	2565.28	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	211.48	82.83	863.53	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	5.44	2.09	10.88	4.00
Groundwater	0.00	0.00	0.00	0.00
Total	268974.24	62963.18	471896.01	2548.94

Note this is just one bank, whereas normally you would model them in pairs.



# End of Exercise 4

- What if another streambank was restored, how would you add it to the model?
- What if Cover Crops were used instead of Reduced Tillage?
- What if Cover Crops and Reduced Tillage were used together?





# Exercise #5

- In the example watershed, what % of urban land use is open space?
- Next we will apply LID/Bioretenention to 5 acres of Open Space



# Sample Problem Exercise #5

- Click Urban BMP Tool
  - Select Open Space under urban land use options->Select LID/Bioretenation under Available LID/BMP -> Click Apply LID/BMP

Set Urban LID/BMP

Select a Watershed: 1

Select an Urban Land Use

Commercial  Industrial  Institutional  Transportation  Multi Family

Single Family  Urban-Cultivated  Vacant-Developed  Open Space

Select LID/BMP

Available LID/BMP:	LID/BMP Area (ac):	Total Available Area (ac):
LID/Bioretenation	5	80.83

Simple form

Reset All

Apply LID/BMP

Exit

- Click Apply, and review results on Urban worksheet
  - The BMP reduced 4.3 lbs N and 0.8 lbs P





# Sample Problem Exercise #5

- The project will also install rain barrels in 20 single family homes
- Do you need to use BMP Calculator in this situation?
- What inputs do you need?

Remember: The LID practices with an \* require runoff volume input (Cisterns and Rain Barrels)





# Exercise #5, cont.

- The average size of each home's total rooftop area is  $\sim 4,000$  sq ft (0.1 acres)
- The total runoff volume from the rooftops is 43,560 cubic ft (1 ac-ft) per year



Set Urban LID/BMP

Select a Watershed:

Select an Urban Land Use

Commercial   
 Industrial   
 Institutional   
 Transportation   
 Multi Family  
 Single Family   
 Urban-Cultivated   
 Vacant-Developed   
 Open Space

Select LID/BMP

Available LID/BMP:    
LID/BMP Area (ac):    
Total Available Area (ac):

Simple form   
   
   

LID\*/Rain Barrel

Input the runoff volume (ac-ft/yr) reduced by the practice (Baseline Runoff = 261.29 ac-ft/yr):

### 3. Selected urban BMPs

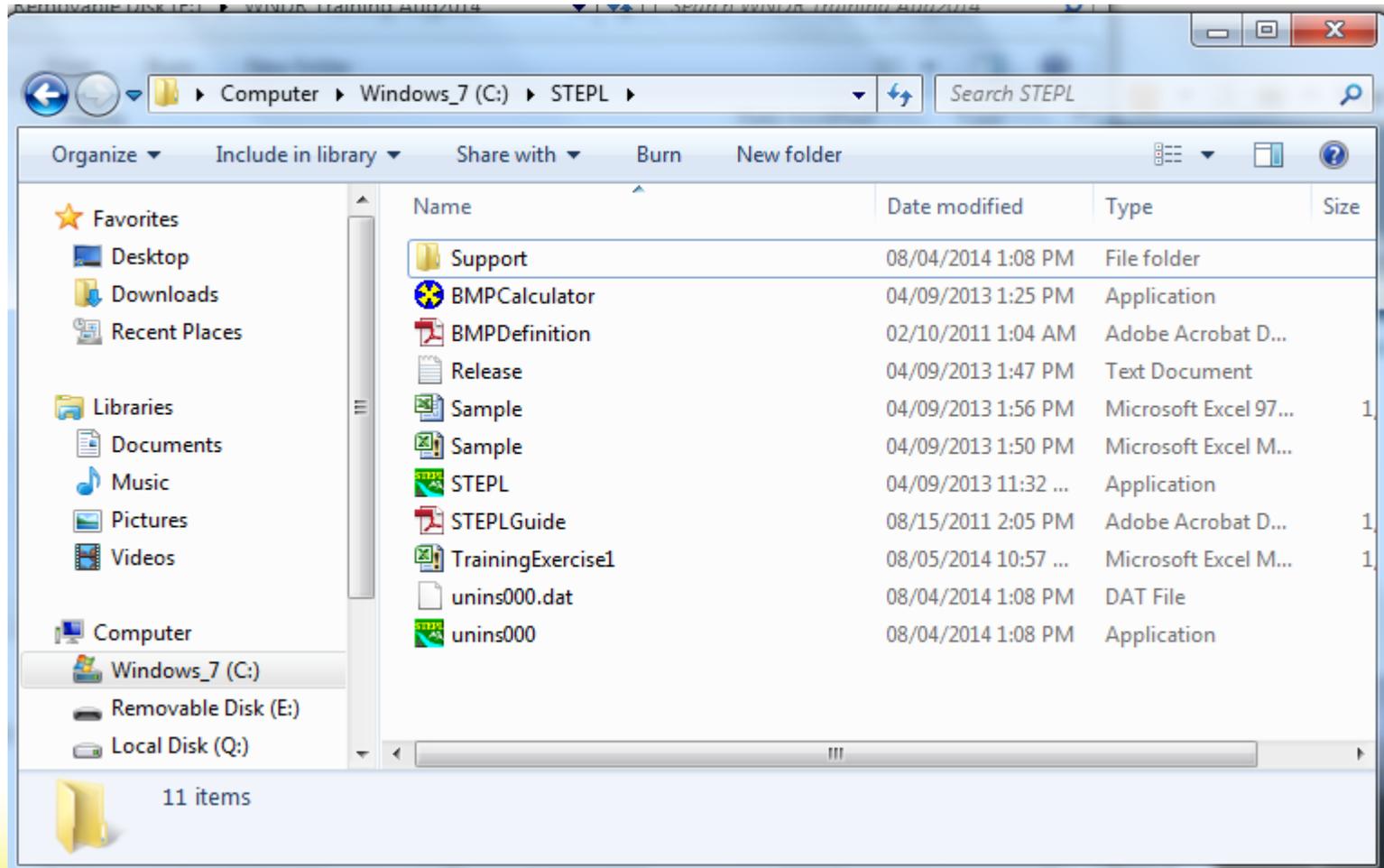
Landuse	Commercial	Industrial	Institutional	Transportation	Multi-Family	Single-Family	Urban-Cultivated	Vacant (developed)	Open Space
W1	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	LID*/Rain Barrel	0 No BMP	0 No BMP	LID/Bioretenion

### 4. Pollutant loads from urban in lb/year

Watershed	Pre-BMP Load				Load Reduction			
	N	P	BOD	TSS	N	P	BOD	TSS
W1	8810.390028	1360.4991	34239.012	404571.87	4.2907646	0.808260304	0	0
W2	0	0	0	0	0	0	0	0
W3	0	0	0	0	0	0	0	0
W4	0	0	0	0	0	0	0	0



# Demo Installation Package



# Exercise #6

- Download data for all 4 subwatersheds making up the Pigeon River drainage in Huron County, MI
  - West Branch Extension-Pigeon River
  - Dr Blair Drain-Pigeon River
  - Campau Drain-Pigeon River
  - Little Pigeon River
- Save and open file in Excel



**Watershed Search**

Step1: Select a state name from the list below.

- Michigan
- Minnesota
- Mississippi
- Missouri
- Montana

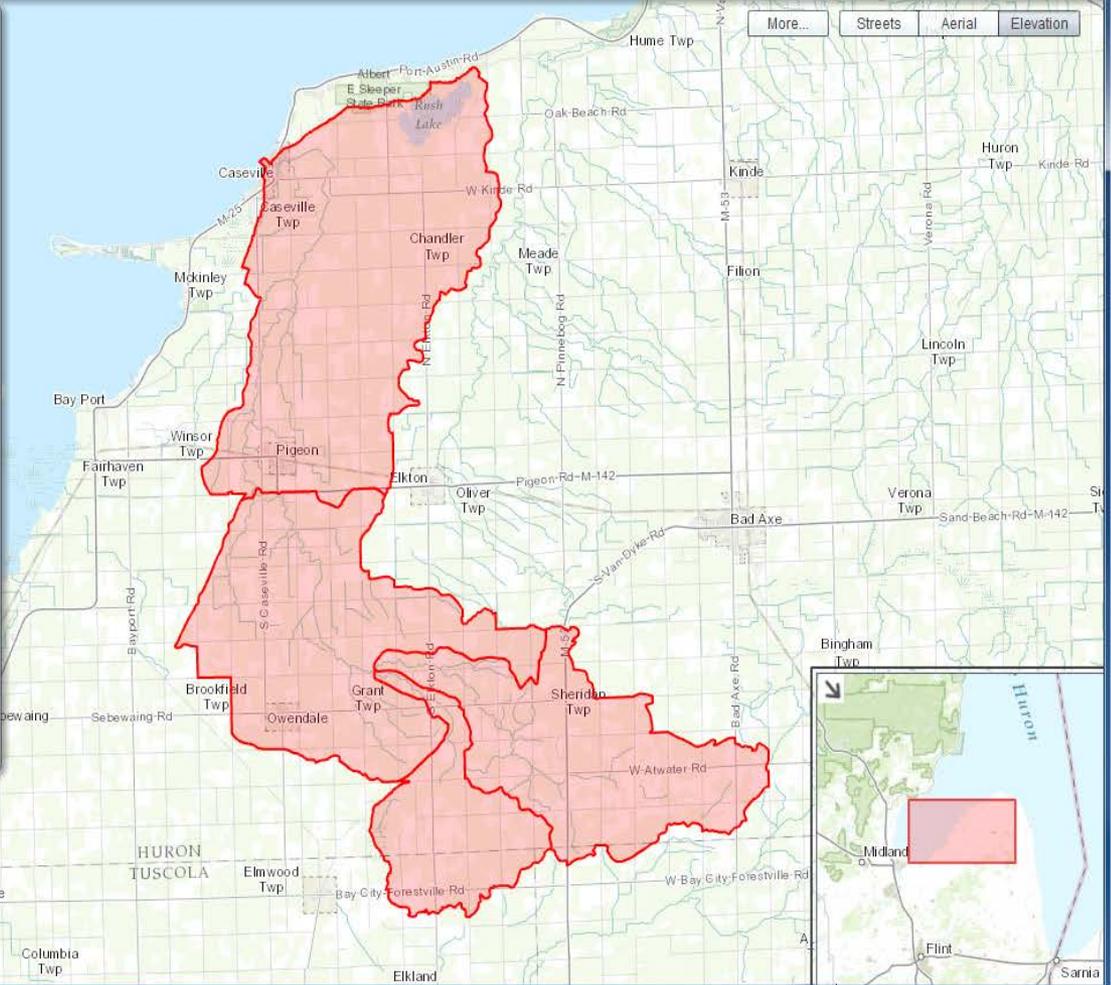
Step2: Select a county name from the list below.

- Huron
- Ingham
- Ionia
- Iosco
- Iron

Step3: In order to download data for the entire County, click on run report button on the right. Otherwise select one or more subwatershed boundary names from the below list.

- Campau Drain-Pigeon River
- County Line Creek-Frontal Lake Huron
- Darlington Drain-Black River
- Dr Blair Drain-Pigeon River
- East Branch Milliken Creek

Step 4: Click on run report button when finished to see STEPL input data tables.



10 km  
10 mi  
Latitude:44.008914 Longitude:-82.982084



# Exercise 6, cont.

- Copy and paste input data into your STEPL workbook, in this order:
  - West Branch Extension-Pigeon River
  - Dr Blair Drain-Pigeon River
  - Campau Drain-Pigeon River
  - Little Pigeon River
- What required piece of information was not provided?



### 1. Input watershed land use area (ac) and precipitation (in)

Watershed	Urban	Cropland	Pastureland	Forest	User Defined	Feedlots
W1	1616.582	22635.702	1742.012	1402.861	0	1.074
W2	1131.095	13391.452	2864.212	2300.666	0	1.741
W3	2764.358	29911.543	3369.491	492.157	0	2.077
W4	558.209	6807.034	1609.243	906.033	0	0.77

### 2. Input agricultural animals

Watershed	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck
W 1	38	742	1005	41	17	0	3	8
W 2	60	1208	1618	67	28	2	6	9
W 3	70	1438	1944	80	32	0	7	11
W 4	40	495	755	32	25	0	4	6
Total	208	3879	5320	220	102	2	20	32

### 3. Input septic system and illegal direct wastewater

Watershed	No. of Septic Systems	Population per Septic System	Septic Failure Rate, %
W1	725	2	1.14
W2	366	2	1.14
W3	1213	2	1.14
W4	130	2	1.14

### Optional Data Input:

#### 5. Select average soil hydrologic group (SHG), SHG A = highest infiltration an

Watershed	SHG A	SHG B	SHG C	SHG D	SHG Selected
W1	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	C
W2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	B
W3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	C
W4	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	B



- Review Results on Total Load worksheet

### 1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	274039.4	64040.8	472377.9	2667.9	5069.4	1078.4	481.9	119.0
W2	55897.8	9378.0	135292.5	1689.7	0.0	0.0	0.0	0.0
W3	148807.5	24355.0	357517.3	3268.4	0.0	0.0	0.0	0.0
W4	29105.0	4920.2	70765.7	1010.5	0.0	0.0	0.0	0.0
Total	507849.6	102694.0	1035953.4	8636.5	5069.4	1078.4	481.9	119.0

### 2. Total load by land uses (with BMP)

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	31517.66	4862.69	122126.29	723.85
Cropland	417979.78	91011.51	755220.48	7638.22
Pastureland	43164.59	3381.65	139703.01	145.47
Forest	799.02	397.30	1987.94	6.01
Feedlots	8603.73	1682.27	13523.86	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	709.98	278.07	2899.08	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	5.44	2.09	10.88	4.00
Groundwater	0.00	0.00	0.00	0.00
Total	502780.20	101615.59	1035471.55	8517.55



# Exercise #7

- Add Cover Crop BMP with the following efficiencies: Nitrogen 0.3, Phosphorus 0.25, Sediment 0.35
- Update BMP Data and view in Cropland BMP dropdown list



# Steps to Add New BMP

- From STEPL customized menu, select View/Edit BMP List option
  - You can also unhide **BMPList** worksheet (see Exercise 2 to unhide a worksheet)
- Insert a new row after the Cropland Contour Farming BMP on the BMPList worksheet
- Enter **Cropland** under Landuse column and **Cover Crop** BMP with the following efficiencies: Nitrogen 0.3, Phosphorus 0.25, Sediment 0.35
- Click on **Update BMP Data** and view in Cropland BMP dropdown list on BMP worksheet
- Click on **Save Updates** to update the BMP list for BMP calculator (for next exercise)



TrainingExercise7.xlsm - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Add-Ins Esri Maps Nuance PDF Team

STEPL

Menu Commands

A6 f<sub>x</sub> Cropland

	A	B	C	D	E	F	G	H	I	J	K
1	Landuse	BMP & Efficiency	N	P	BOD	Sediment					
2	Cropland						<Don't Delete				
3	Cropland	0 No BMP	0	0	0	0	<Don't Delete				
4	Cropland	Combined BMPs-Calculated	0	0	0	0					
5	Cropland	Contour Farming	0.485	0.55	ND	0.405					
6	Cropland	Cover Crop	0.3	0.25	ND	0.35					
7	Cropland	Diversion	0.1	0.3	ND	0.35					
8	Cropland	Filter strip	0.7	0.75	ND	0.65					
9	Cropland	Reduced Tillage Systems	0.55	0.45	ND	0.75					
10	Cropland	Streambank stabilization and fencing	0.75	0.75	ND	0.75					
11	Cropland	Terrace	0.2	0.7	ND	0.85					
12	Pastureland						<Don't Delete				
13	Pastureland	0 No BMP	0	0	0	0	<Don't Delete				
14	Pastureland	Combined BMPs-Calculated	0	0	0	0					
15	Forest						<Don't Delete				
16	Forest	0 No BMP	0	0	0	0	<Don't Delete	Update BMP Data			
17	Forest	Combined BMPs-Calculated	0	0	0	0					
18	Forest	Road dry seeding	ND	ND	ND	0.41					
19	Forest	Road grass and legume seeding	ND	ND	ND	0.71					
20	Forest	Road hydro mulch	ND	ND	ND	0.41					
21	Forest	Road straw mulch	ND	ND	ND	0.41					
22	Forest	Road tree planting	ND	ND	ND	0.5					
23	Forest	Site preparation/hydro mulch/seed/fertilizer	ND	ND	ND	0.71					
24	Forest	Site preparation/hydro mulch/seed/fertilizer/transplants	ND	ND	ND	0.69					
25	Forest	Site preparation/steep slope seeder/transplant	ND	ND	ND	0.81					
26	Forest	Site preparation/straw/crimp seed/fertilizer/transplant	ND	ND	ND	0.95					
27	Forest	Site preparation/straw/crimp/net	ND	ND	ND	0.93					
28	Forest	Site preparation/straw/net/seed/fertilizer/transplant	ND	ND	ND	0.83					

**Instruction:**

1. Do not delete the greyed rows.
2. BMP efficiencies should be  $\leq 1$ .
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 Data

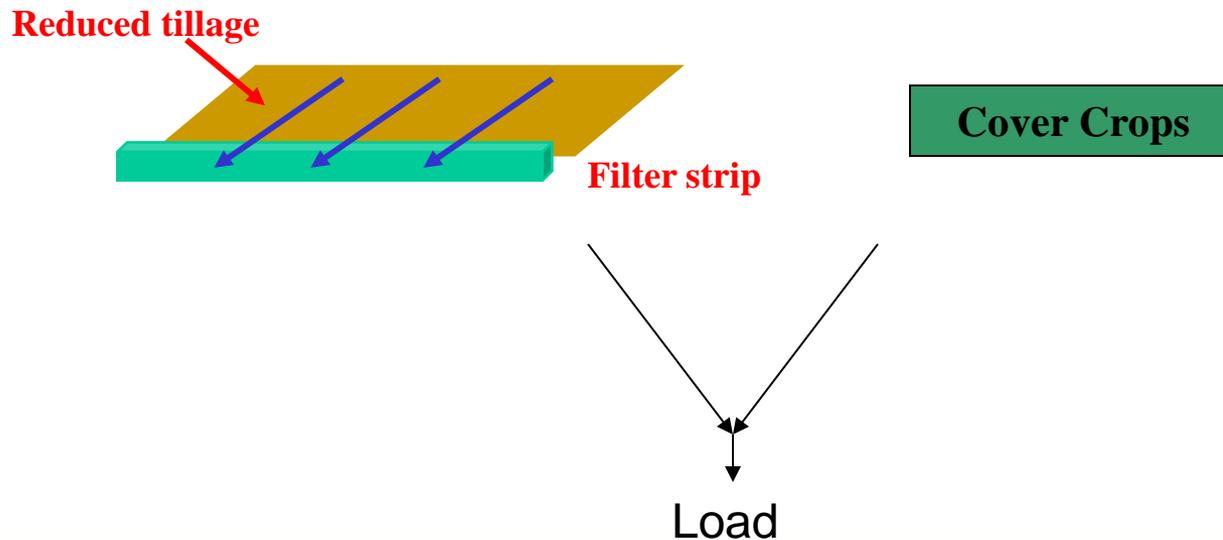
Save Updates

Ready | Input | BMPs | Total Load | Graphs | **BMPList** | Average: 0.3 | Count: 6 | Sum: 0.9 | 100%



# Exercise #8

Estimate total annual load and load reduction with reduced tillage and filter strips (shown below) applied to 550 acres **cropland** and cover crops applied to another 550 acres



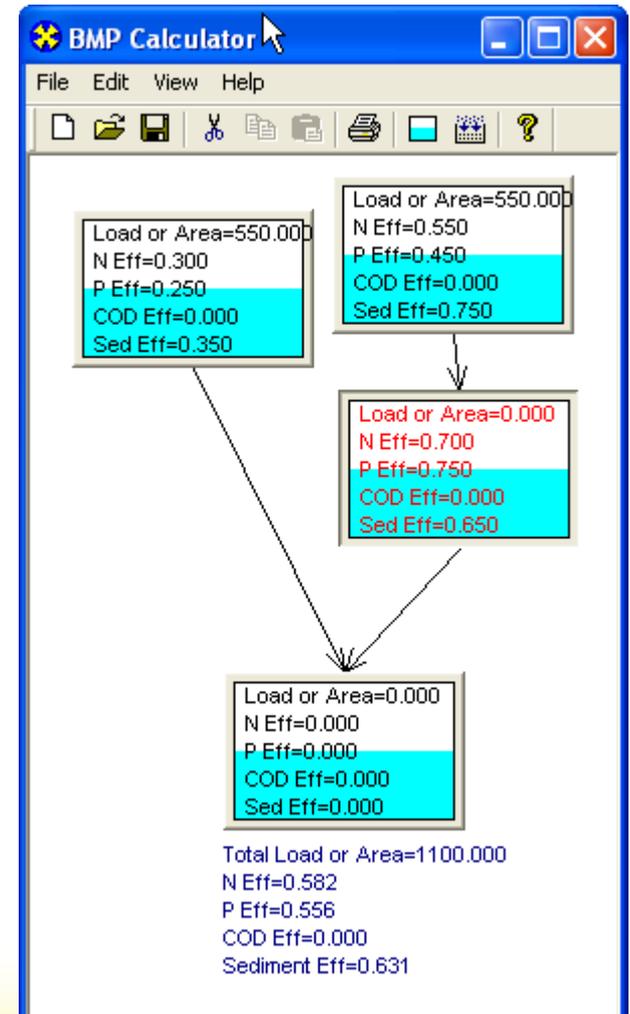
# Exercise #8

- Enter BMP data in BMP worksheet
  - In Table 1, which is for cropland areas, select “Combined-BMP calculated” under BMP column to indicate that we have multiple BMPs applied to cropland.
  - Note that the N, P, BOD, and Sediment BMP efficiencies remained zero.
  - If you had the combined efficiency values for this particular BMP train, you would enter them in Table 7 (number in red).
  - We do not have the values, so we will use the BMP calculator (next step)



# Exercise #8

- Run the BMP Calculator by selecting the STEPL/BMP Calculator menu of the STEPL spreadsheet.
  - If the system cannot find the BMP Calculator program, navigate to /STEPL folder and select BMPCalculator.exe
- Using the BMP Calculator interface, do the following
  - Add 4 BMP boxes (one for each BMP plus the Combined total)
  - Enter BMP information (type, area, etc.) for each BMP box by double-clicking the box
  - Left click and hold to draw a connection between boxes. You may move the boxes around.
  - Click the Run button to calculate the Combine efficiency
  - Enter the combined efficiencies in Table 7 of STEPL spreadsheet. Note the efficiencies are reflected in Table 1.
  - Also note the Total Area treated. Calculate the new % Area BMP Applied



- Enter the combined efficiencies in Table 7 of STEPL spreadsheet. (copy and paste)

**7. Combined watershed BMP efficiencies from the BMP calculator**

Watershed	Watershed Combined BMP Efficiencies				
	N	P	BOD	Sediment	BMPs
W1-Crop	0.582	0.556	0	0.631	Combined BMPs

- Also note the Total Area treated. Calculate the new % Area BMP Applied

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

Watershed	Cropland					
	N	P	BOD	Sediment	BMPs	% Area BMP Applied
W1	0.0282852	0.0270216	0	0.0306666	Combined BMPs-Calculated	4.86



- Review Results

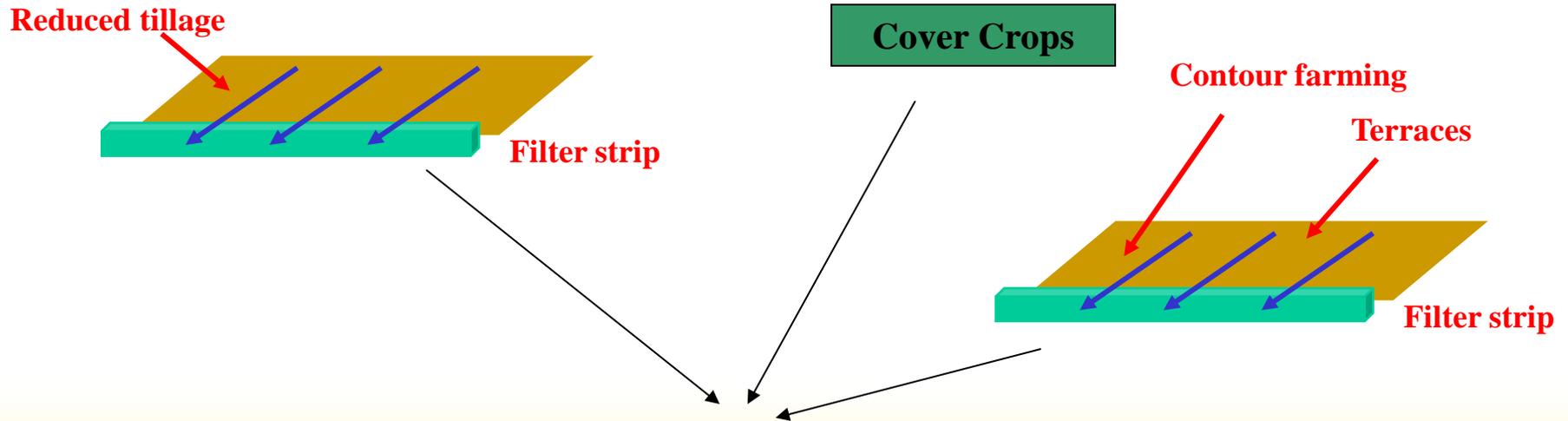
1. Total load by subwatershed(s)								
Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	274039.4	64040.8	472377.9	2667.9	8830.7	2053.9	669.7	148.3
W2	55897.8	9378.0	135292.5	1689.7	0.0	0.0	0.0	0.0
W3	148807.5	24355.0	357517.3	3268.4	0.0	0.0	0.0	0.0
W4	29105.0	4920.2	70765.7	1010.5	0.0	0.0	0.0	0.0
Total	507849.6	102694.0	1035953.4	8636.5	8830.7	2053.9	669.7	148.3

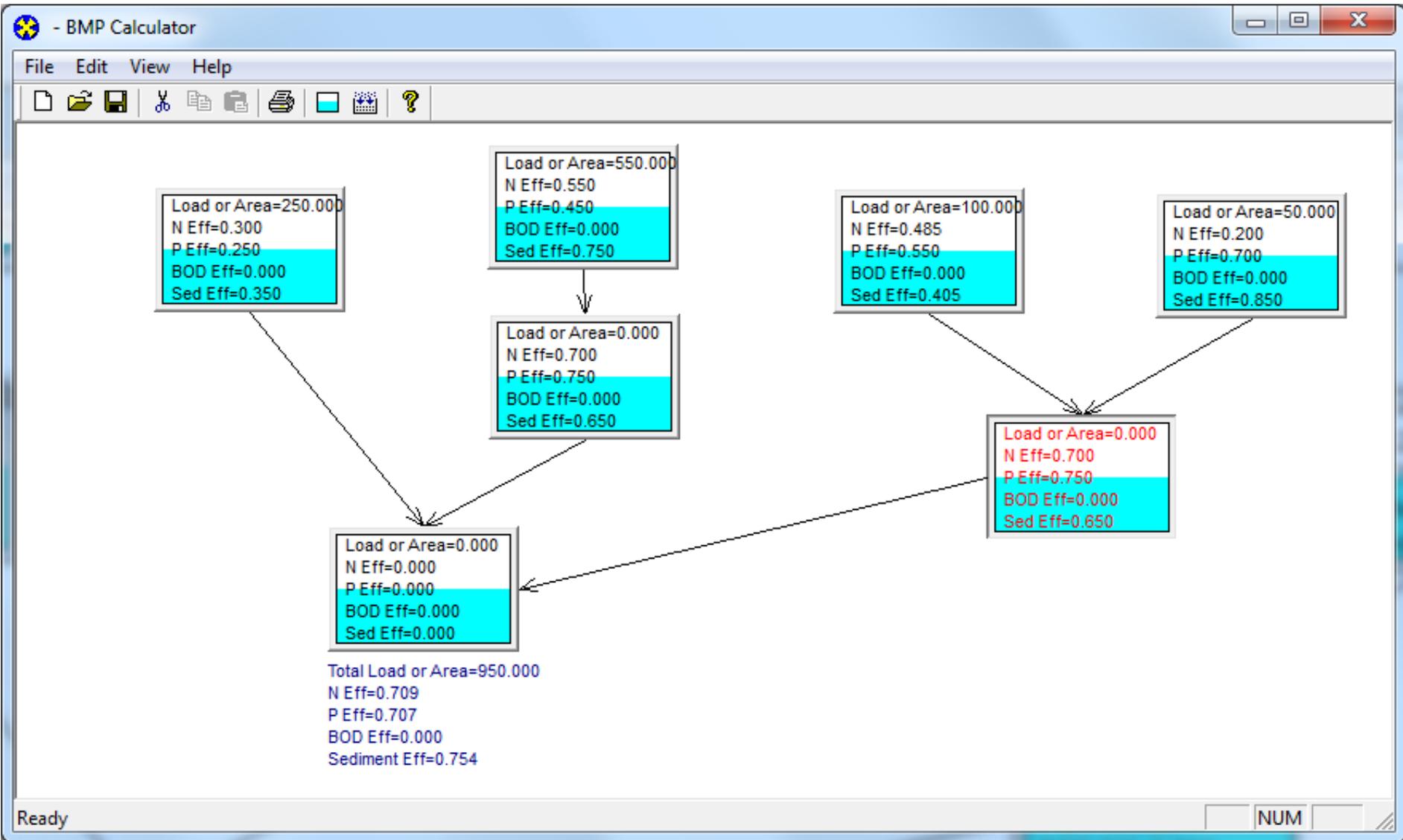
2. Total load by land uses (with BMP)				
Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	31517.66	4862.69	122126.29	723.85
Cropland	414218.55	90036.00	755032.65	7608.87
Pastureland	43164.59	3381.65	139703.01	145.47
Forest	799.02	397.30	1987.94	6.01
Feedlots	8603.73	1682.27	13523.86	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	709.98	278.07	2899.08	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	5.44	2.09	10.88	4.00
Groundwater	0.00	0.00	0.00	0.00
Total	499018.96	100640.08	1035283.71	8488.20



# Exercise 9

- Multiple **cropland** practices are applied in W2
- Estimate total annual load and load reduction with reduced tillage and filter strips applied to 550 acres, cover crops applied to another 250 acres, contour farming on 100 acres, and terraces on 50 acres
- Filter strips are in place to treat runoff from the upland terraces and contoured fields





- Enter the combined efficiencies for W2

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

Watershed Cropland							
	N	P	BOD	Sediment	BMPs		% Area BMP Applied
W1	0.0282852	0.0270216	0	0.0306666	<input type="checkbox"/>	Combined BMPs-Calculated	4.86
W2	0.050339	0.050197	0	0.053534	<input type="checkbox"/>	Combined BMPs-Calculated	7.1

**7. Combined watershed BMP efficiencies from the BMP calculator**

Watershed Watershed Combined BMP Efficiencies						
	N	P	BOD	Sediment	BMPs	
W1-Crop	0.582	0.556	0	0.631	Combined BMPs	
W2-Crop	0.709	0.707	0	0.754	Combined BMPs	



- Review Results

### 1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	274039.4	64040.8	472377.9	2667.9	8830.7	2053.9	669.7	148.3
W2	55897.8	9378.0	135292.5	1689.7	1887.8	356.7	522.2	81.6
W3	148807.5	24355.0	357517.3	3268.4	0.0	0.0	0.0	0.0
W4	29105.0	4920.2	70765.7	1010.5	0.0	0.0	0.0	0.0
Total	507849.6	102694.0	1035953.4	8636.5	10718.5	2410.6	1191.9	229.9

### 2. Total load by land uses (with BMP)

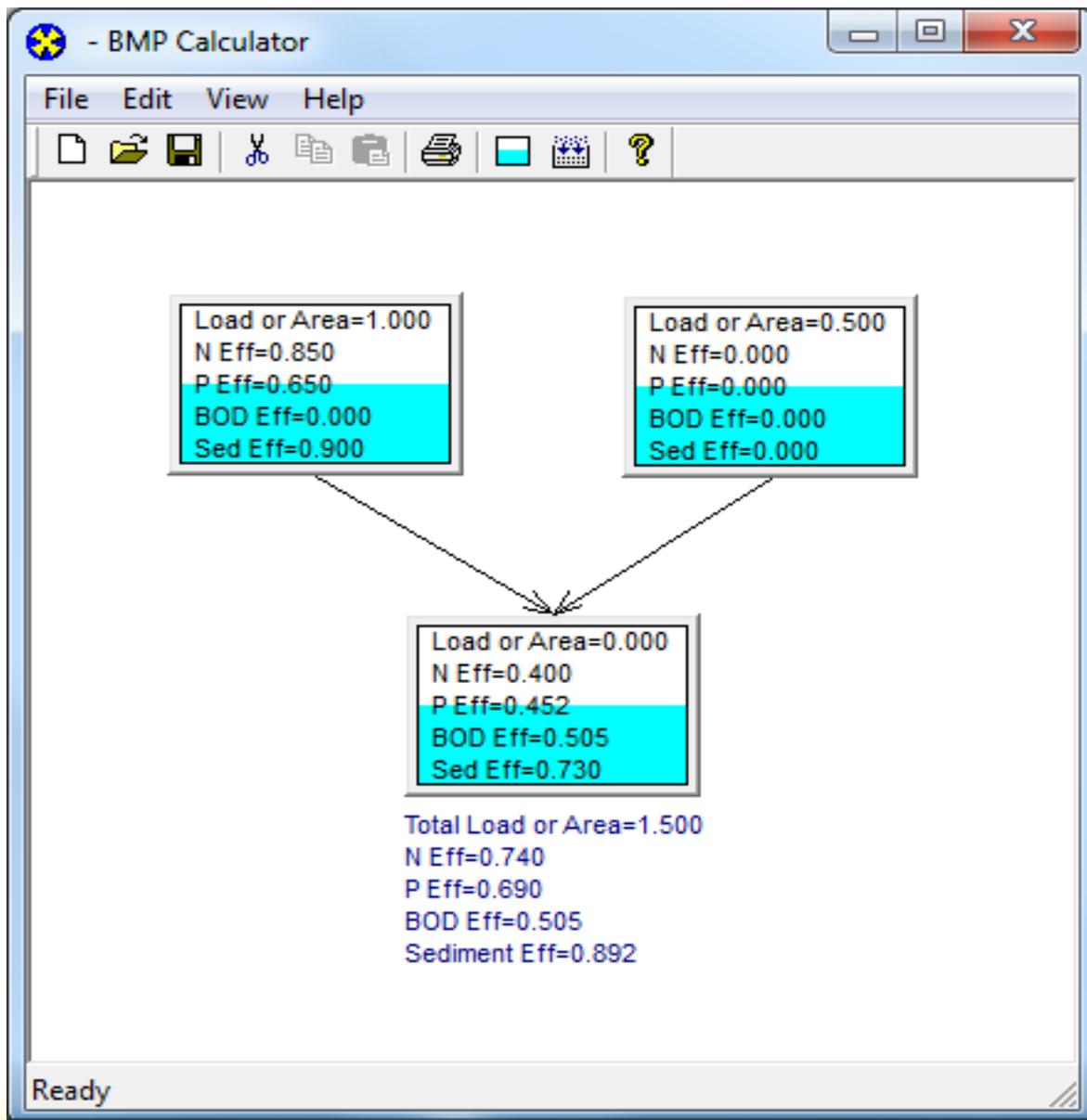
Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	31517.66	4862.69	122126.29	723.85
Cropland	412330.71	89679.34	754510.43	7527.27
Pastureland	43164.59	3381.65	139703.01	145.47
Forest	799.02	397.30	1987.94	6.01
Feedlots	8603.73	1682.27	13523.86	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	709.98	278.07	2899.08	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	5.44	2.09	10.88	4.00
Groundwater	0.00	0.00	0.00	0.00
Total	497131.13	100283.43	1034761.49	8406.60



# Exercise #10

- Congratulations, you secured grant funding to retrofit a 1.5-acre industrial parking lot. The project will replace 1 acre of concrete with porous pavement. The entire parking lot will be bordered by vegetated filter strips to capture runoff. Add these BMPs to watershed 1.
  - Hint: you will need to use the BMP Calculator





Set Urban LID/BMP

Select a Watershed: 1

Select an Urban Land Use

Commercial
  Industrial
  Institutional
  Transportation
  Multi Family

Single Family
  Urban-Cultivated
  Vacant-Developed
  Open Space

Select LID/BMP

Available LID/BMP: Combined BMPs-Calcula

LID/BMP Area (ac): 1.5

Total Available Area (ac): 161.66

Simple form

Combined BMPs-Calculated Efficiencies

Enter the calculated BMP efficiencies:

N Removal efficiency (0-1): 0.74

P Removal efficiency (0-1): 0.69

BOD Removal efficiency (0-1): 0.505

TSS Removal efficiency (0-1): 0.892

- Review results in Urban worksheet

#### 4. Pollutant loads from urban in lb/year

Watershed	Pre-BMP Load				Load Reduction			
	N	P	BOD	TSS	N	P	BOD	TSS
W1	8810.390028	1360.4991	34239.012	404571.87	11.492883	1.88273858	17.693854	416.71071
W2	5119.32894	787.77169	19643.972	235220	0	0	0	0
W3	15065.7821	2326.4558	58548.77	691818.59	0	0	0	0
W4	2526.450465	388.77481	9694.5365	116083.9	0	0	0	0



- Review Results on Total Load worksheet

1. Total load by subwatershed(s)								
Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	274039.4	64040.8	472377.9	2667.9	8837.9	2055.0	687.4	148.5
W2	55897.8	9378.0	135292.5	1689.7	1887.8	356.7	522.2	81.6
W3	148807.5	24355.0	357517.3	3268.4	0.0	0.0	0.0	0.0
W4	29105.0	4920.2	70765.7	1010.5	0.0	0.0	0.0	0.0
Total	507849.6	102694.0	1035953.4	8636.5	10725.7	2411.6	1209.6	230.1

2. Total load by land uses (with BMP)				
Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	31510.46	4861.62	122108.60	723.64
Cropland	412330.71	89679.34	754510.43	7527.27
Pastureland	43164.59	3381.65	139703.01	145.47
Forest	799.02	397.30	1987.94	6.01
Feedlots	8603.73	1682.27	13523.86	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	709.98	278.07	2899.08	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	5.44	2.09	10.88	4.00
Groundwater	0.00	0.00	0.00	0.00
Total	497123.92	100282.35	1034743.80	8406.40



# Contact Us

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