

STEPL Training August 25, 2015



Agenda

- | | |
|------------------------|---|
| 12:30 – 1:00 pm | Introduction to STEPL |
| 1:00 – 1:30 pm | STEPL Spreadsheet and Agricultural BMPs
Exercises 1-2 |
| 1:30 – 2:00 pm | Urban BMPs and STEPL Input Data (online data server)
Exercises 3-4 |
| 2:00 – 2:30 pm | Adding a new BMP and Use of BMP Calculator
Exercises 5-6 |

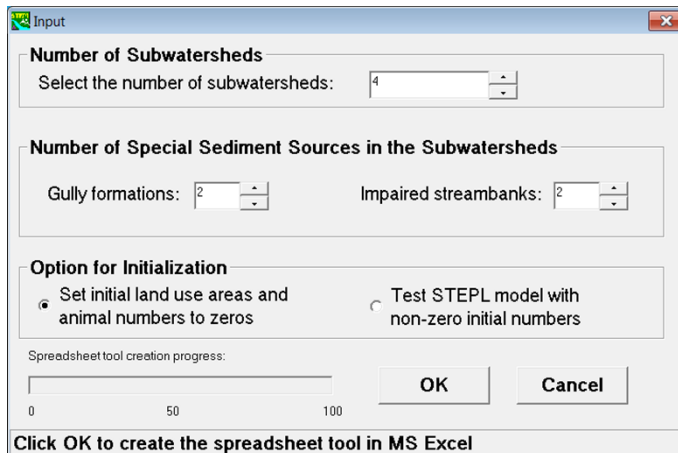
This page intentionally left blank.

Exercise 1

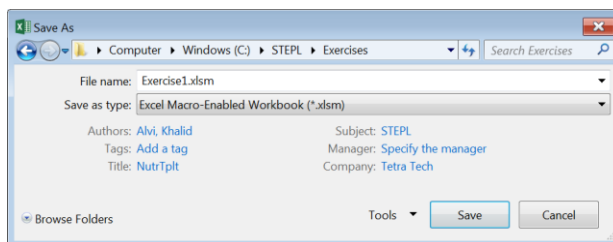
- Download and install the latest version of STEPL model. Make sure to uninstall the older version first before installing the newer version.




 [http://it.tetrattech-ffx.com/steplweb/models\\$docs.htm](http://it.tetrattech-ffx.com/steplweb/models$docs.htm)

- Create a STEPL worksheet with 4 watersheds, 2 gullies, and 2 impaired stream banks.



- Create a folder **Exercises** under **STEPL** folder and save as “*Exercise1.xlsm*”



- Make sure macros are enabled
 -  **Excel 2003 version:** Click on Tools menu > Macro > Security > Security Level > Medium
 -  **Excel 2007 version:** Click on Office icon > Excel Options > Trust Center > Trust Center Settings > Macro Settings
 -  **Excel 2010/2013 version:** Click on File menu > Options > Trust Center > Trust Center Settings > Macro Settings



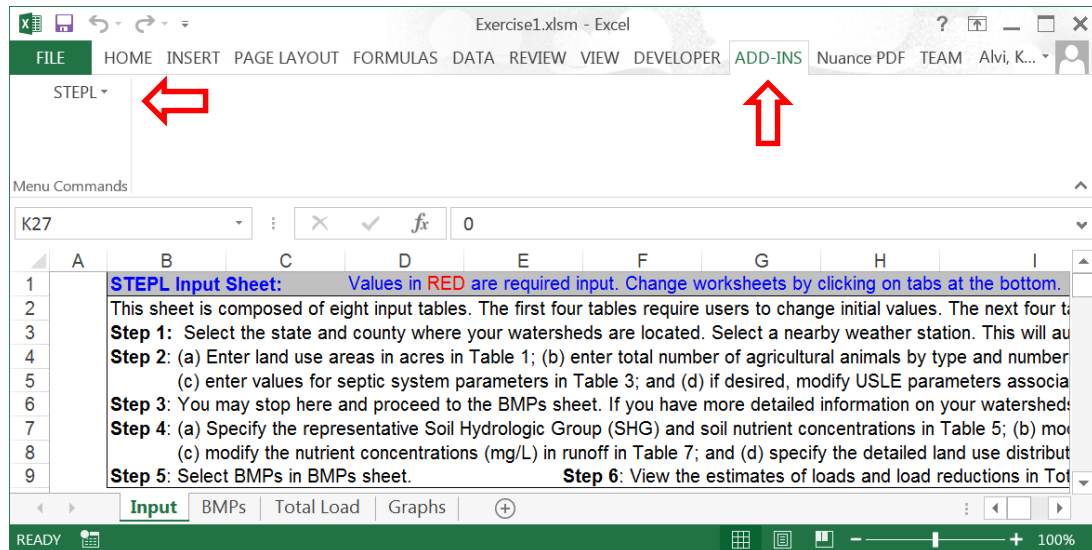
You need admin rights to install the software.

Windows operating system only (not compatible with Mac)

Ensure that you have write access to the STEPL installation folder (e.g., C:\STEPL)

STEPL is not compatible with the combination of MS Excel 2007 and Windows 7

- Set the STEPL installation folder as default file location (e.g., "C:\STEPL").
 - ✚ **Excel 2003 version:** Click on Tools menu > Options > General tab
 - ✚ **Excel 2007 version:** Click on Office icon > Excel Options > Save
 - ✚ **Excel 2010/2013 version:** Click on File menu > Options > Save
- Review primary worksheets
 - ✚ Input, BMPs, Total Load, Graphs
- Locate input tables
 - How many total input tables are there?
 - How many of them are optional?
- Access STEPL customized menu




- What is the first option listed? Select it.
- Select first option again to Hide the additional sheets
- Unhide the Reference sheet only (click right mouse button on any tab)
- Hide the Reference sheet



If you do not see the Add-Ins option in the toolbar, make sure you have enabled the macros. Save the spreadsheet, close it, and reopen the spreadsheet.

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

- Select state = Michigan, and county = Huron
- Select a weather station = MI Flint WSCMO.

 Notice that values for Annual Rainfall and Number of Rain Days are automatically specified in Table 1 as you select a weather station.

Enter data in the Input Worksheet (numbers in red in spreadsheet)

- Enter data in Tables 1, 2, 3, and 5 as shown in below tables

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	0	0	0	0	0	0
W3	0	0	0	0	0	0
W4	0	0	0	0	0	0

2. Input agricultural animals

















Watershed	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck
W1	36	742	1005	41	17	0	3	6
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	36	742	1005	41	17	0	3	6

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	0	0	0
W3	0	0	0
W4	0	0	0

Optional Data Input:

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

Watershed	SHG A	SHG B	SHG C	SHG D	SHG Selected
W1					C
W2					B
W3					B
W4					B

- Examine estimated load in Total Load worksheet 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

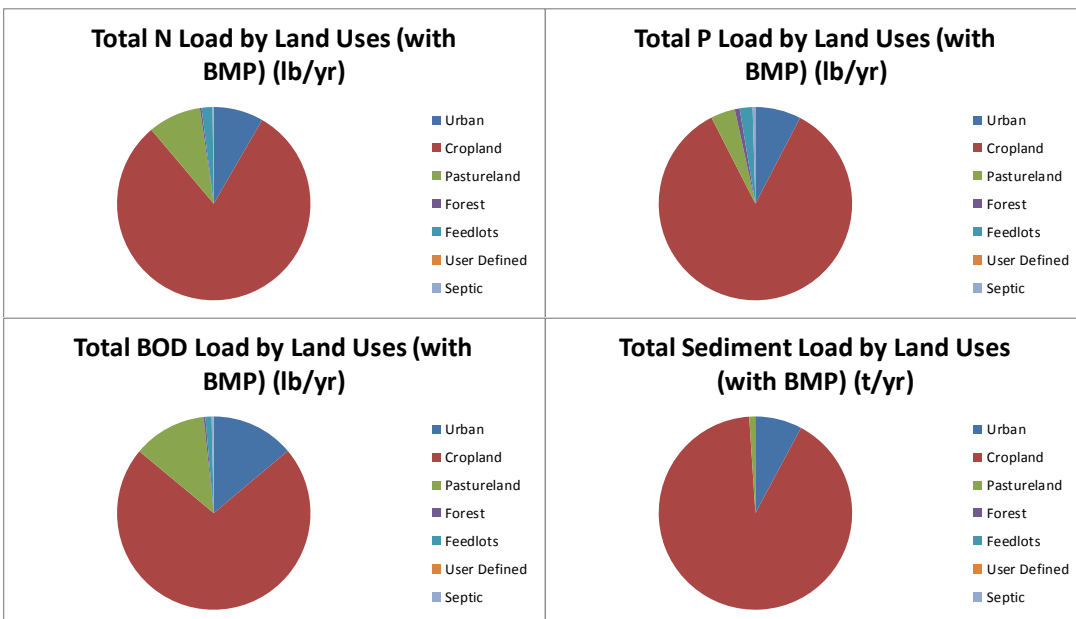
✚ Notice there are no load reductions because no BMP information is entered yet.

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?

✚ Cropland



- Review the Input Data parameters. Which required value did we leave out?

 # of months manure applied

- Set the number of months manure applied to 8 and note the difference in total loads.

2. Input agricultural animals

Watershed	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck	# of months manure applied
W1	36	742	1005	41	17	0	3	6	8
W2	0	0	0	0	0	0	0	0	0
W3	0	0	0	0	0	0	0	0	0
W4	0	0	0	0	0	0	0	0	0
Total	36	742	1005	41	17	0	3	6	

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	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	273930.6	63998.9	472160.3	2587.9	0.0	0.0	0.0	0.0

- Which pollutant load value did not change?

 Sediment


Exercise 2

Estimate total annual load reduction assuming reduced tillage is adopted on all cropland

- Save Exercise 1 as Exercise 2 (make sure to save Exercise 1 before saving it as Exercise 2)

 Select Excel Macro-Enabled Workbook (*.xslm) save option


- Enter BMP data in BMPs worksheet
 - In Table 1 which is for cropland areas, select Reduced Tillage System under BMPs column and enter 100 for % area BMP applied. Note that initial values of BMP efficiencies are automatically specified for the selected BMP.


1. BMPs and efficiencies for different pollutants on CROPLAND, ND=No Data							
Watershed	Cropland						
	N	P	BOD	Sediment	BMPs	% Area BMP Applied	
W1	0.55	0.45	ND	0.75	 Reduced Tillage Systems	100	

- 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	140848.8	28456.7	11323.0	1769.2
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	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

 Hint: 550 out of 22635.702 is 2.43%

1. BMPs and efficiencies for different pollutants on CROPLAND, ND=No Data							
Watershed	Cropland						
	N	P	BOD	Sediment	BMPs	% Area BMP Applied	
W1	0.013365	0.010935	ND	0.018225	 Reduced Tillage Systems	2.43	

- 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
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	3422.6	691.5	275.1	43.0

A waste management system is installed to treat the runoff from the entire 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						
	N	P	BOD	Sediment	BMPs		%Area BMP Applied
W1	0.8	0.9	ND	ND	Waste Mgmt System		100

- 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	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 & Streambanks

- Let's say the project also restores 2,000 feet of severely eroding streambank
- From the BMP worksheet, click the button to view the Gully and Streambank erosion worksheet
- Add the BMP and calculate the new total load reductions for the watershed.

— Assume bank is 2 feet 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

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

- 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	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


Exercise 3

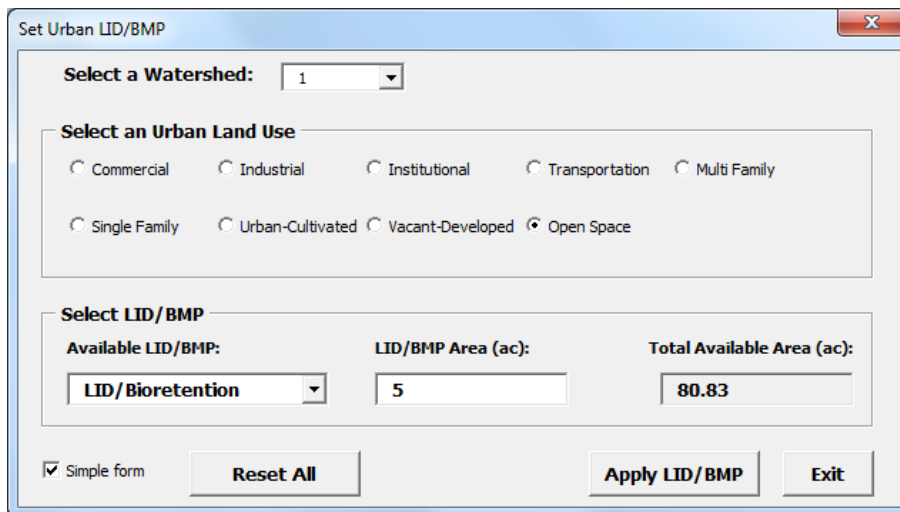
Urban BMPs/LIDs


- Save Exercise 2 as Exercise 3 (make sure to save Exercise 2 before saving it as Exercise 3)

 Select Excel Macro-Enabled Workbook (*.xlsm) save option

Apply LID/Bioretenction to 5 acres of Open Space.

- In the example watershed, what % of urban land use is open space?
 -  Review the default urban land use distribution in Table 8 under the Input worksheet. If desired, use local zoning layer to update the default numbers.
- Click Urban BMP Tool
 - Select Open Space under urban land use options
 - Select LID/Bioretenction under Available LID/BMP
 - Click Apply LID/BMP



 Note that the LID/BMP Area is the area treated by the practice

- Review results on 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	8810.39	1360.4991	34239.012	404571.87	4.2907646	0.8082603	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

Apply LID*/Rain Barrel to 20 single family homes.

- The average size of each home's total rooftop area is around 0.1 acre
- The total runoff volume from the rooftops is 1 acre-feet per year (assume 100% reduction)

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*/Rain Barrel

LID/BMP Area (ac): 2.00

Total Available Area (ac): 484.97

☒ Simple form
 Reset All
Apply LID/BMP
Exit

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

LID*/Rain Barrel

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

OK Cancel

1

- Review results on Urban worksheet

4. Pollutant loads from urban in lb/year

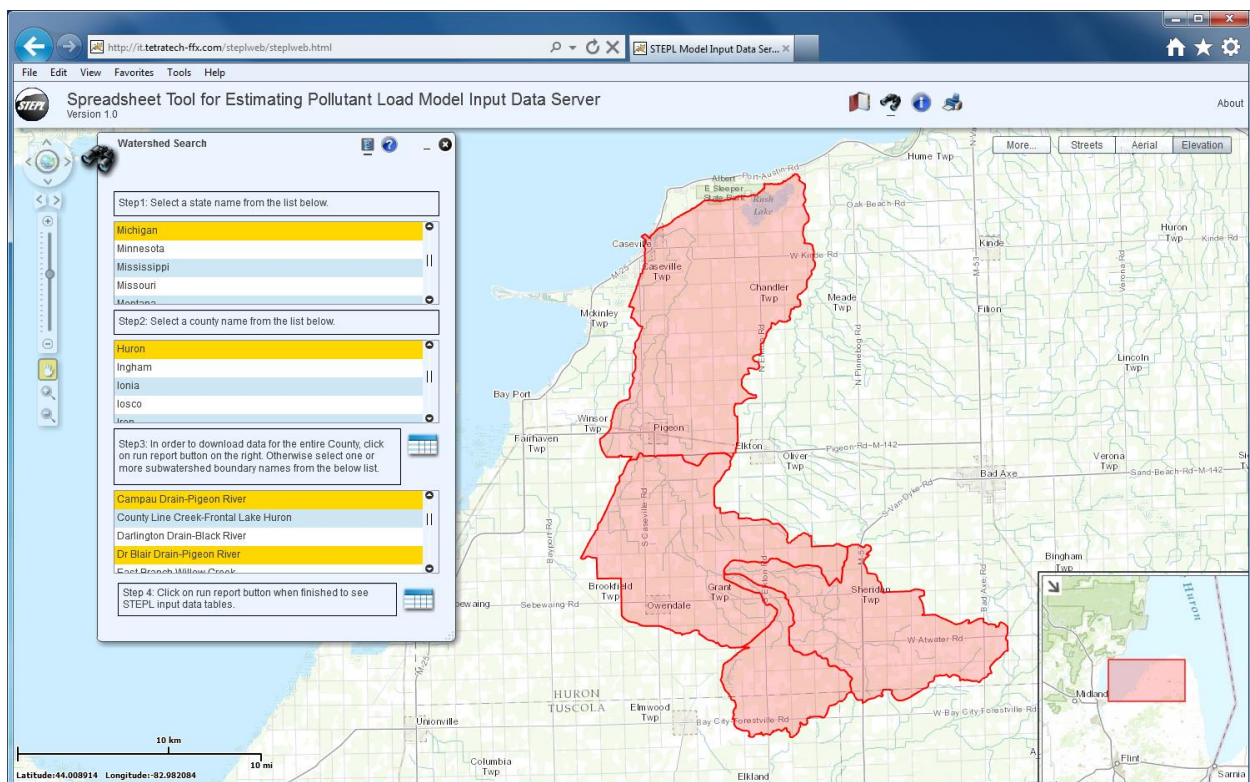
Watershed	Pre-BMP Load				Load Reduction			
	N	P	BOD	TSS	N	P	BOD	TSS
W1	8810.390028	1360.4991	34239.012	404571.87	4.2907646	0.808260304	0	0
W2	0	0	0	0	0	0	0	0
W3	0	0	0	0	0	0	0	0
W4	0	0	0	0	0	0	0	0



To clear/delete the existing urban BMPs/LIDs in the urban worksheet, click on “Reset All” button available on the Urban BMP Tool.

Exercise 4

- Save Exercise 3 as Exercise 4 (make sure to save Exercise 3 before saving it as Exercise 4)
 - ✚ Select Excel Macro-Enabled Workbook (*.xlsm) save option
- Download data for all 4 subwatersheds making up the Pigeon River drainage in Huron County, MI
 - ✚ <http://it.tetrattech-ffx.com/steplweb/steplweb.html>
 - ✚ Select state = Michigan, county = Huron.
 - ✚ Select HUC12 watersheds
 - West Branch Extension-Pigeon River
 - Dr Blair Drain-Pigeon River
 - Campau Drain-Pigeon River
 - Little Pigeon River



- Click on tabular report button shown on Step 4 of the above figure.
- Export the data and save the input data file under **Exercises** folder.
- Close the input data report.
- Open the input data spreadsheet and copy the data into your STEPL workbook
 - ✚ Paste special **as values** to preserve the data format of Input worksheet.
 - ✚ Enter data for the selected watersheds in the same order as shown below

- West Branch Extension-Pigeon River
- Dr Blair Drain-Pigeon River
- Campau Drain-Pigeon River
- Little Pigeon River

- Land cover, agricultural animals, and septic system data

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
W1	36	742	1005	41	17	0	3	6
W2	60	1206	1616	67	28	2	6	9
W3	70	1436	1944	80	32	0	7	11
W4	40	495	755	32	25	0	4	6
Total	206	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

- Change Hydrologic Soils Groups if necessary (Optional Input Table #5)

Optional Data Input:

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

Watershed	SHG A	SHG B	SHG C	SHG D	SHG Selected
W1					C
W2					B
W3					C
W4					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 5

Adding a new BMP and Use of BMP Calculator

- Save Exercise 4 as Exercise 5 (make sure to save Exercise 4 before saving it as Exercise 5)
 - ✚ Select Excel Macro-Enabled Workbook (*.xlsm) save option
- From STEPL customized menu, select View/Edit BMP List option
- Insert a new row at the end of Cropland BMPs on the BMPList worksheet
- Enter **Cropland** under Landuse column and **Cover Crops** 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

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

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.

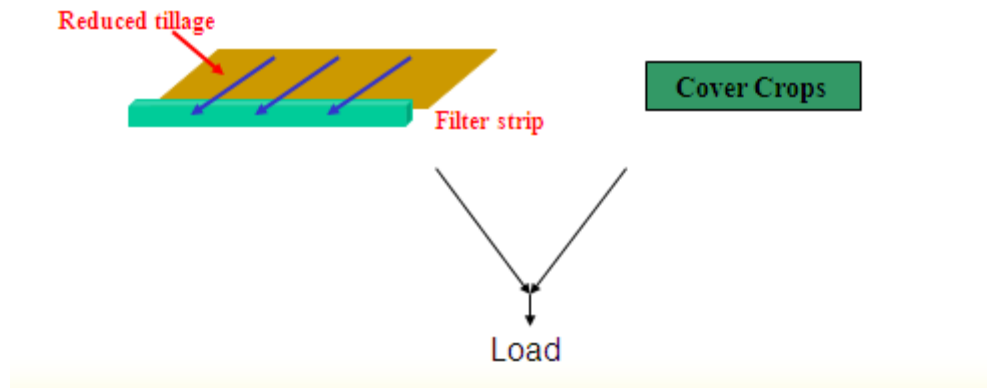
Update BMP Data

Save Updates



Ensure you have set the STEPL installation folder as default file location (see Exercise 1) before you click "Save Updates" button otherwise the newly added BMPs will not appear in the BMP list of BMP calculator.

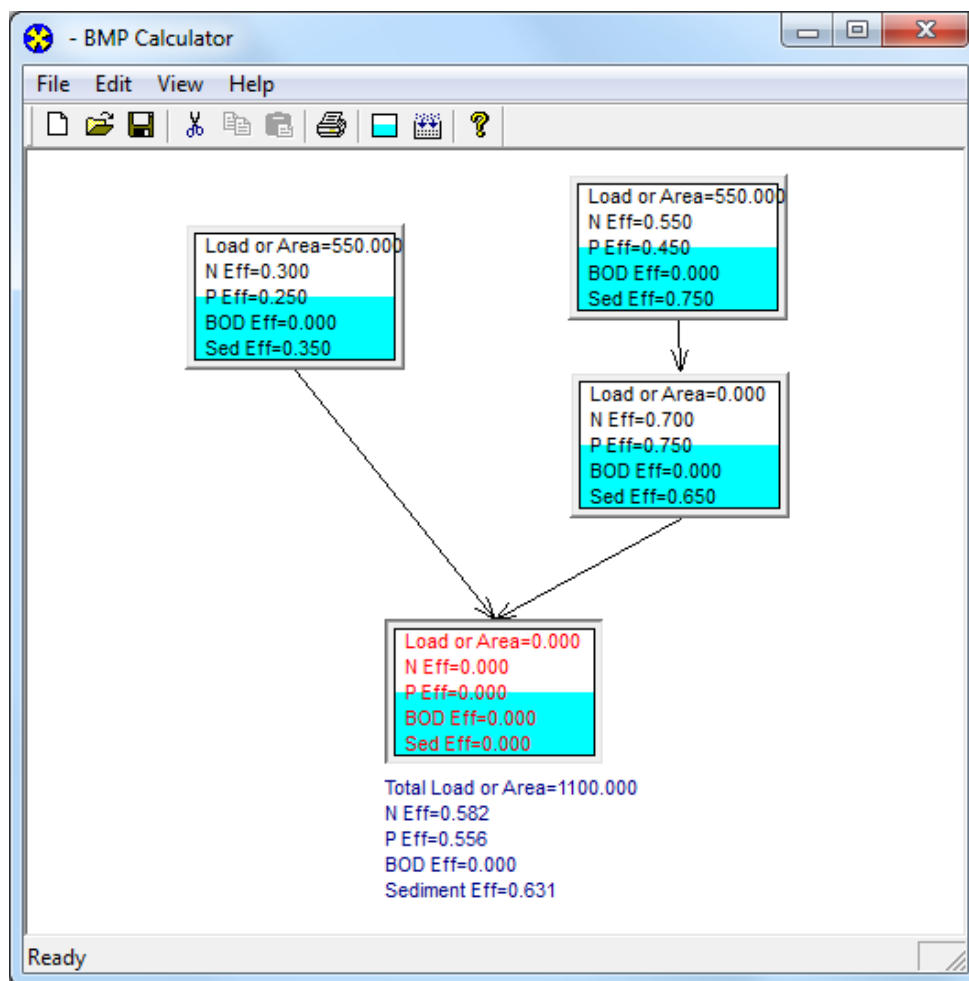
- Estimate total annual load and load reduction with reduced tillage and filter strips (shown below) applied to 550 acres cropland and cover crops applied to another 550 acres in West Branch Extension-Pigeon River watershed (W1).



- 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)
- 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
 - Save the current BMP configuration as **Exercise5.inp** under Exercises folder



To copy the combined efficiency value from the BMP calculator click right mouse button on the combined efficiency number and select the copy option. You have to copy those values one at a time.



- Enter the combined efficiencies in Table 7 of STEPL spreadsheet.

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



To copy the combined efficiency value from the BMP calculator click right mouse button on the combined efficiency number and select the copy option. You have to copy those values one at a time.

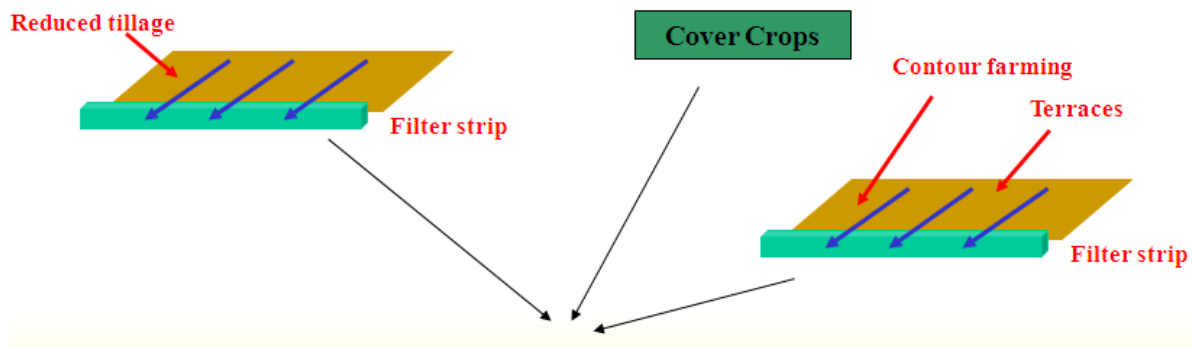
- Review results on Total Load worksheet

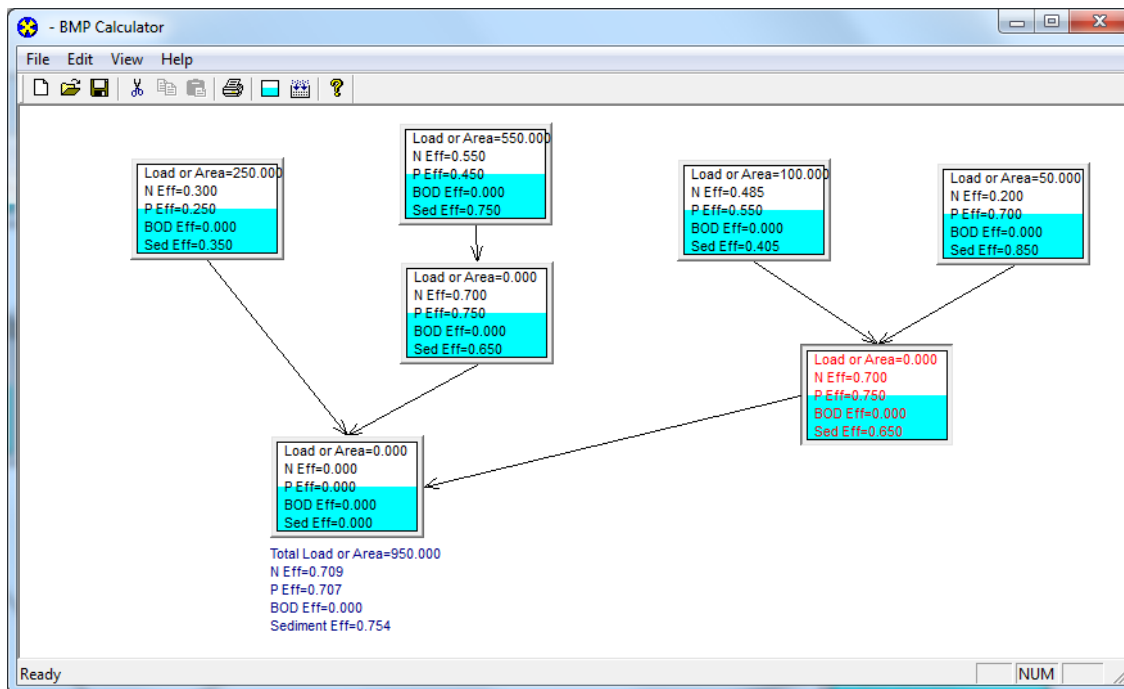
1. Total load by subwatershed(s)								
Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	274039.4	64040.8	472377.9	2667.9	8830.7	2053.9	669.7	148.3
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

Multiple cropland practices are applied in Dr Blair Drain-Pigeon River watershed (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





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

Watershed	Cropland					% Area BMP Applied
	N	P	BOD	Sediment	BMPs	
W1	0.0282852	0.0270216	0	0.0306666	Combined BMPs-Calculated	4.86
W2	0.050339	0.050197	0	0.053534	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

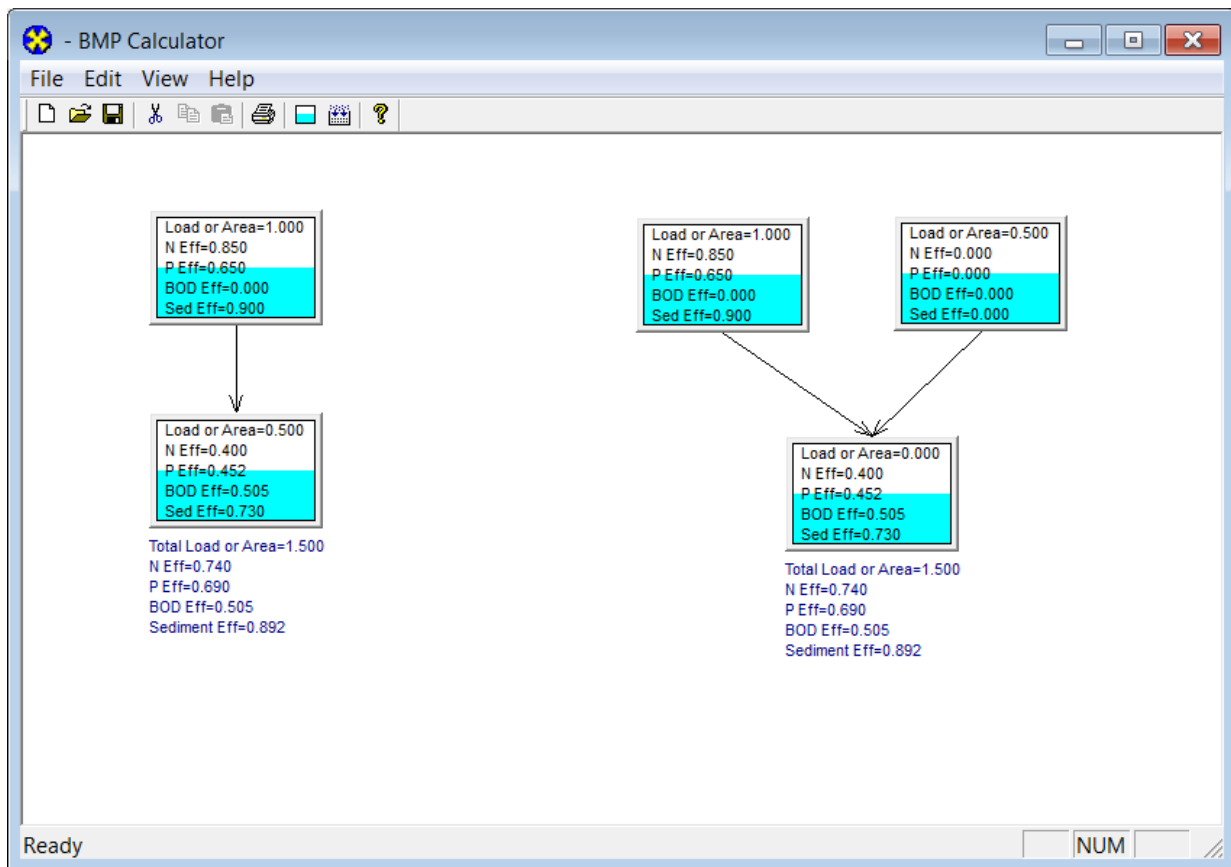
- Review results on Total Load and Graphs worksheets

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

Exercise 6

- Save Exercise 5 as Exercise 6 (make sure to save Exercise 5 before saving it as Exercise 6)
 - ✚ Select Excel Macro-Enabled Workbook (*.xlsm) save option
- 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 West Branch Extension-Pigeon River watershed (W1).
 - ✚ Hint: you will need to use the BMP Calculator



The Set Urban LID/BMP dialog box contains the following fields and controls:

- Select a Watershed:** A dropdown menu with "1" selected.
- Select an Urban Land Use:** Radio buttons for Commercial, Industrial (selected), Institutional, Transportation, Multi Family, Single Family, Urban-Cultivated, Vacant-Developed, and Open Space.
- Select LID/BMP:** A dropdown menu with "Combined BMPs-Calculat" selected.
- Available LID/BMP:** A text field with "1.5" entered.
- LID/BMP Area (ac):** A text field with "1.5" entered.
- Total Available Area (ac):** A text field with "161.66" entered.
- Simple form:** A checked checkbox.
- Buttons:** Reset All, Apply LID/BMP, and Exit.

The Combined BMPs-Calculated Efficiencies dialog box contains the following fields and controls:

- Enter the calculated BMP efficiencies:**
 - N Removal efficiency (0-1): A text field with "0.74" entered.
 - P Removal efficiency (0-1): A text field with "0.69" entered.
 - BOD Removal efficiency (0-1): A text field with "0.505" entered.
 - TSS Removal efficiency (0-1): A text field with "0.892" entered.
- Buttons:** OK.

- Review results on Urban worksheet

2a. Effective BMP application area (ac)

Landuse	Commercial	Industrial	Institutional	Transportation	Multi-Family	Single-Family	Urban-Cultural	Vacant (developable)	Open Space
W1	242.4873	1.5	161.6582	161.6582	161.6582	2	80.8291	80.8291	5
W2	0	0	0	0	0	0	0	0	0
W3	0	0	0	0	0	0	0	0	0
W4	0	0	0	0	0	0	0	0	0

3. Selected urban BMPs

Landuse	Commercial	Industrial	Institutional	Transportation	Multi-Family	Single-Family	Urban-Cultural	Vacant (developable)	Open Space
W1	0 No BMP	Combined	0 No BMP	0 No BMP	0 No BMP	LID*/Rain Barrel	0 No BMP	0 No BMP	LID/Bioretenion
W2	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP
W3	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP
W4	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP	0 No BMP

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