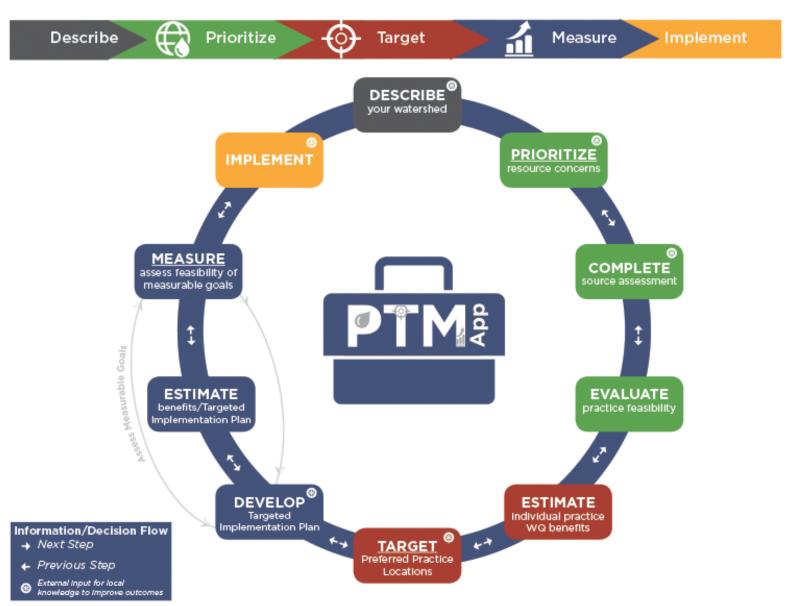
June 2018



WORKSHOP SECTION 3 MANUAL:

USING PTMAPP-DESKTOP OUTPUT DATA TO BUILD PRODUCTS

AN INNOVATIVE SOLUTION BY:







HoustonEngineering Inc.



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1 PURPOSE

The Prioritize, Target, Measure Application for Desktop (PTMApp-Desktop) is a software solution that consists of an ArcGIS toolbar to assist practitioners with executing their strategies. The output products from PTMApp-Desktop can be used in a number of business workflows (**Figure 1**). The business workflows are tasks that soil and water conservation district (SWCD) and watershed district (WD) staff might undertake as part of daily work to prioritize and target the locations of projects and practices that provide measurable water quality benefits. These workflows, or a subset of the workflows, might be completed as part of implementation strategy development for an annual work plan, development of Watershed Restoration and Protection Strategies (WRAPS), accelerated implementation grants (AIG) through BWSR, or federal 319 grants.

This workshop manual provides instructions for how to complete these business workflows using outputs from PTMApp-Desktop, beginning with the Complete Source Assessment step in **Figure 2** and working through steps to:

- Evaluate practice feasibility
- Estimate individual practice water quality benefits
- Target preferred practice locations
- Develop a Targeted Implementation Plan
- Estimate benefits of a Targeted Implementation Plan

The purpose of the workshop manual is to provide users with a "how to" guide for using PTMApp-Desktop outputs. Data has been developed for this workshop for a small subwatershed in Becker and Otter Tail counties. Therefore, text, figures, and other guidance materials are specific to this subwatershed but could easily be applied to other watersheds. This guide is intended to enable local government unit (LGU) staff the capability to use PTMApp-Desktop data to perform a number of planning and implementation activities, such as designing local targeted implementation strategies (without the need of a consultant) that are prioritized, targeted, and result in measurable water quality improvements. A detailed description of specific PTMApp-Desktop Theory & Documentation page. This manual neglects any description on how the data was generated and simply describes how to use the PTMApp-Desktop outputs to create products. For information on how PTMApp-Desktop Desktop data is created, the previous workshop sections (1 and 2) should be referenced.

There are numerous methods for assembling the PTMApp-Desktop outputs into products useful for watershed planning. This manual is not intended to provide a comprehensive description of all possible products that can be built with PTMApp-Desktop outputs, but rather provide some functional examples that will enable LGU staff to complete the workflows described herein and give them enough familiarity with the PTMApp-Desktop outputs to empower them to further utilize the data and information as a resource in project and practice planning, management, and implementation. While the examples are specific to this example plan area, the steps described in this manual are applicable to PTMApp-Desktop outputs in any study area.

****Note**** this manual assumes the user has at least introductory experience using ArcGIS. Users should be familiar with adding data to a map project, joining data tables, formatting map symbology, querying data based on attributes, and spatial selection. It also assumes that the user is familiar with preparing input data for PTMApp-Desktop and processing data through the toolbar.

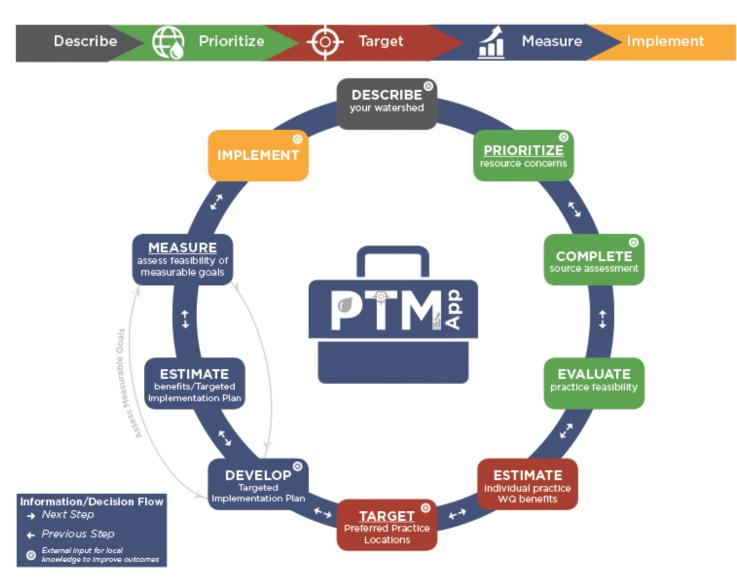


Figure 1. PTMApp Business Workflow

2 HOW TO BUILD STANDARD PTMAPP-DESKTOP PRODUCTS

2.1 COMPLETE SOURCE ASSESSMENT

This section walks through an example of how to develop a map that could be used to assess sources of sediment, total nitrogen (TN), or total phosphorus (TP) to downstream priority resources (**Figure 2**). An example map is shown below from the Pomme de Terre River Watershed in western MN. This section covers our workshop example subwatershed in the Crow Wing River Watershed, to determine sediment yields to the outlet of the subwatershed.

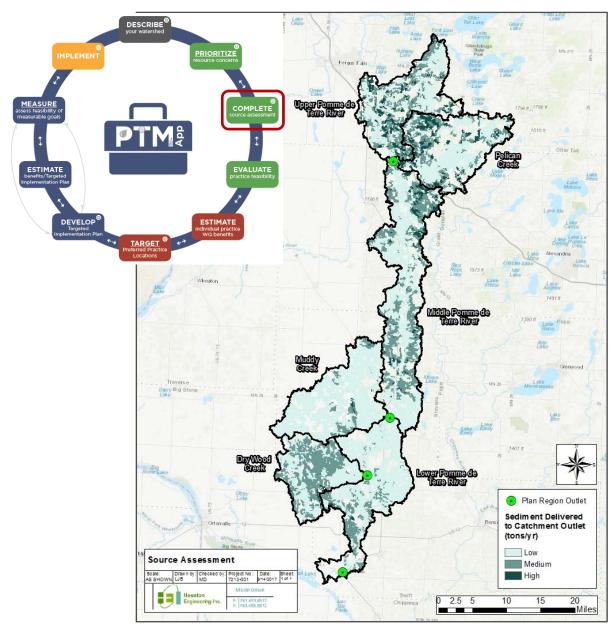


Figure 2. Example of a Source Assessment: Pomme de Terre River Watershed source assessment for sediment yield delivered to individual catchment outlets. Similar products can be developed for total nitrogen and total phosphorus.

2.1.1 HOW TO: DEVELOP SOURCE ASSESSMENT PRODUCTS

^{CP} HOW TO:

STEDS _

1. Add the following data to your table of contents in ArcGIS:

Data needed	Location	Description
catchments	processing.gdb	Individual hydrologic catchment boundaries that average 40 acres in area.
table_p_res_catchment_route	processing.gdb	Routing calculation table for priority resource catchments. Provides Sediment, TP, and, TN loads routed to priority resource points.
p_res_pts	processing.gdb	Point locations of priority resources and/or plan regions, with water quality goals in attributes. These were determined by user prior to running PTMApp-Desktop.

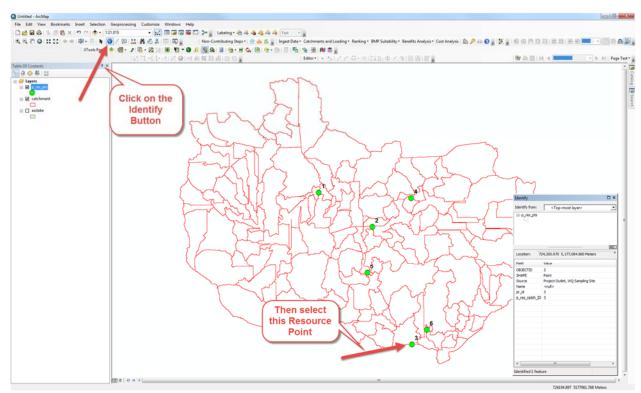
a. Attribute values used in this section:

Data Source	Attribute	Description
catchments	catch_ID	Unique whole number ID for catchments
table_p_res_catchment_route	p_res_catch_ID	Unique whole number ID for priority resource locations
	pr_sed_mass_tons_acre	Sediment yield in tons per acre delivered from catchment outlet to priority resource catchment outlet
p_res_pts	OBJECTID	The OBJECT ID from the p_res_pts point layer is used to create the p_res_catch_ID

2. Identify the priority resource point (p_res_pts) where you'd like information about source loading:

DESCRIPTION – This can be accomplished using the identify button (^(III)). The *p_res_pts* OBJECTID attribute is used to create the *p_res_catch_ID* in all PTMApp-Desktop output data. For this example, let's use the outlet of our subwatershed (*p_res_catch_ID* = 3).

STEFS-	
a. Select the identify function	
Q SourceAssessment - ArcMap	
File Edit View Bookmarks Insert Selection Geoprocessing	g Customize Windows Help
i 🗋 🖆 🖶 🖨 % 🇊 🛍 🗙 👥 🔩 🛧 1:107,631	- 🖌 🖾 🇊 🗖 🚳 🔼
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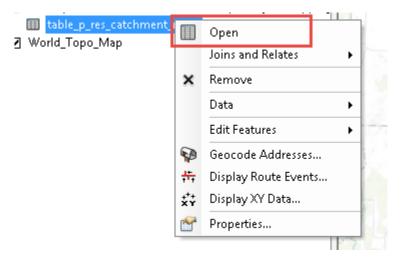
Click on the *p_res_pts* of interest and note the OBJECTID. In our case, OBJECTID = 3.

3. Select records for this Resource Point:

DESCRIPTION – <u>Open</u> the *table_p_res_catchment_route* attribute table and <u>select</u> by attribute, where "*p_res_catch_ID* = 3"

STEPS -

a. Right click on table_p_res_catchment_route and open the attribute table



b. Use the Select by Attributes feature to select 'p_res_catch_ID = 3':

Tał	ble					
• •	🗉 • 🖶 • 🔚 🐛					
tab	le_p_res_catch	Select By Attributes				
	OBJECTID *	p_res_catcn_ID	catch_ID *	C_		
H	OBJECTID* 1	p_res_catcn_ເບ້ 1	catch_ID * 45	с_ 3		
Þ	OBJECTID* 1 2	p_res_catcn_ເບ 1 1		c_ 3 4		
•	0BJECTID* 1 2 3	p_res_catcn_ש 1 1 1	45	c_ 3 4 4		

Select by Attributes
Enter a WHERE clause to select records in the table window.
Method : Create a new selection
OBJECTID p_res_catch_ID catch_ID
c_acres pr_min_tt +
<pre>= <> Like > >= And < <= Or _% () Not Is In Null Get Unique Values Go To: SELECT * FROM table_p_res_catchment_route WHERE: p_res_catch_ID =3</pre>
Clear Verify Help Load Save Apply Close

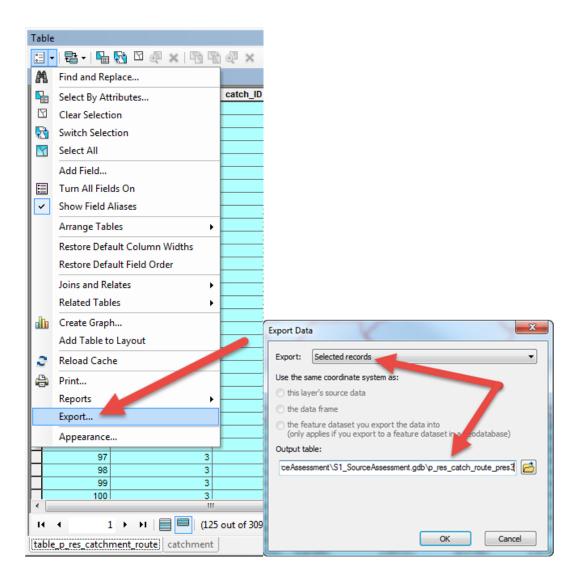
By clicking 'Apply' you will select only those records that report loading from the catchment outlet to resource point 3, our workshop subwatershed outlet. You should see 125 records selected (which matches your total number of catchments since all catchments drain to this point).

4. Export source loads:

DESCRIPTION - In *table_p_res_catchment_route*, <u>export</u> the selected data to a new table within a file geodatabase and <u>add</u> it to your table of contents. It is important to ensure that the selected records are output to a file geodatabase. Some of the names in *table_p_res_catchment_route* are longer than 8 characters and may need to be truncated if the table is exported to a location outside of a file geodatabase.

STEPS -

a. Select export from the Table Options dropdown box and, in the Export Data dialog box, choose Export: Selected Records.

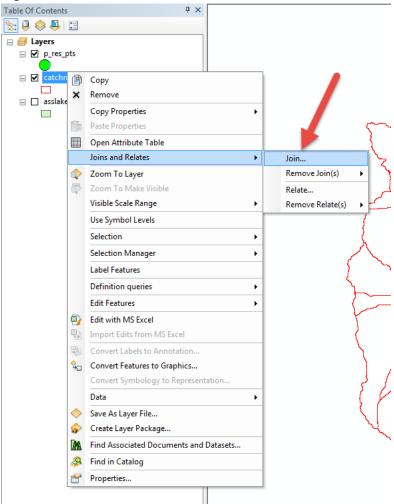


5. Join your data:

DESCRIPTION - Join the table created in Step 4 to *catchment* using the *catch_ID* as the join field for both data sources.

STEPS -

- a. Add table 'p_res_catch_route_pres3' to ArcMap
- b. Right click on *catchment* and select Joins and Relates > Join



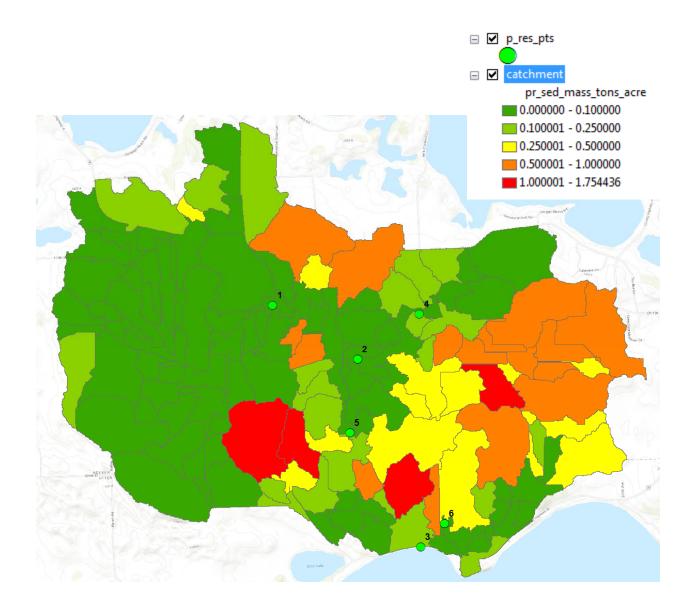
c. Make sure catch_ID is selected for both the catchment feature class join field (#1 in Join Data dialog box) and your exported table's join field (#3). Choose our exported table for #2. Click OK.

Join Data
Join lets you append additional data to this layer's attribute table so you can, for example, symbolize the layer's features using this data.
What do you want to join to this layer?
Join attributes from a table 🔹
1. Choose the field in this layer that the join will be based on:
catch_ID 👻
2. Choose the table to join to this layer, or load the table from disk:
💷 p_res_catch_route_pres3 💌 🖻
Show the attribute tables of layers in this list
3. Choose the field in the table to base the join on:
catch_ID 🗸
Join Options
Skeep all records All records in the target table are shown in the resulting table. Unmatched records will contain null values for all fields being appended into the target table from the join table.
Keep only matching records
If a record in the target table doesn't have a match in the join table, that record is removed from the resulting target table.
Validate Join
About joining data OK Cancel

6. Set the symbology of the catchment layer:

<u>Set</u> the catchment layer to display for the constituent (sediment, TN, or TP) of interest. For this example, let's use *pr_sed_mass_tons_acre*. Right-click the catchment layer and choose Properties. In the Layer Properties dialog box, choose the Symbology tab and symbolize as shown below. You can use the Classify button to set data ranges and the Color Ramp to choose colors that best display your data. Click OK when complete.

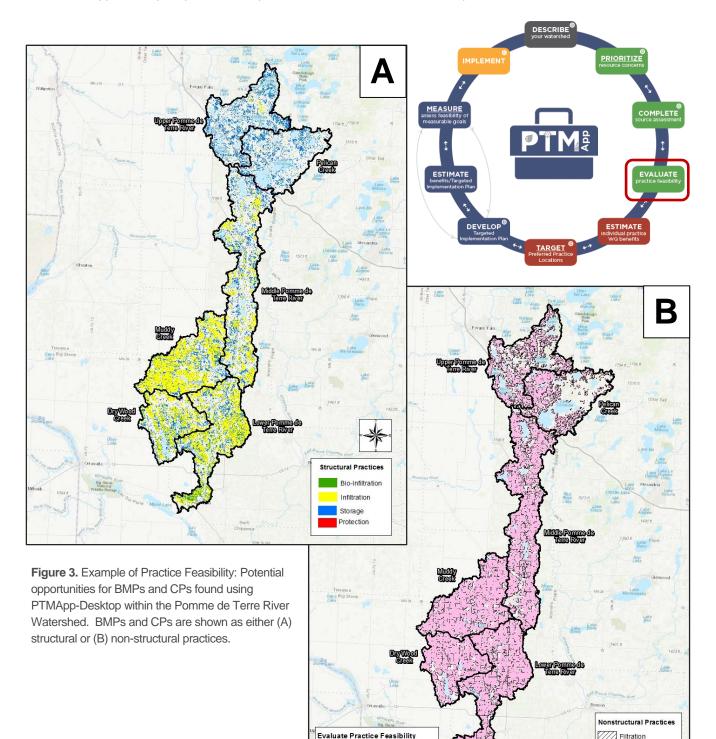
Joins & Relates Time HTML Popup General Source Selection Display Symbology Fields Definition Query Labels XCallout Show: Freatures Categories Import Import Import Import Graduated colors Graduated symbols Value: pr_sed_mass_tons_acre Cassification Manual Out density Normalization: none Import Cassify Color Ramp: Charts Symbol Range Label Import Symbol Range Label Multiple Attributes Symbol 0.000000 0.100001 0.250001 0.100001 0.250001 0.000001 0.250001 0.500001 1.000001 1.000001 1.000001 1.000001 0.500001 1.000001 1.754436 1.000001 1.754436 Advanced	yer Properties	0	21	1				 X
Show: Draw quantities using color to show values. Import Features Categories Quantities Draw quantities using color to show values. Import Giraduated colors Giraduated symbols Value: pr_sed_mass_tons_acre Manual Charts Normalization: none Color Ramp: Color Ramp: Color Ramp: Symbol Range Label Dimonscription of the symbols Symbol Range Label Multiple Attributes Symbol Range Label Dimonscription of the symbols Symbol Dimonscription of the symbols Out density Symbol Range Label Dimonscription of the symbols Dimonscriptic symbols <t< th=""><th>Jo</th><th>oins & Relates</th><th></th><th>Time</th><th></th><th>н</th><th>TML Popup</th><th></th></t<>	Jo	oins & Relates		Time		н	TML Popup	
Features Draw quantities using color to show values. Import Graduated colors Fields Classification Graduated symbols Nomalization: none Classes: 5 Classify Dot density Color Ramp: Color Ramp: Symbol Range Label Multiple Attributes 0.000000 - 0.100000 0.000000 - 0.100000 0.100001 - 0.250000 0.100001 - 0.250000 0.250001 - 0.500000 0.500001 - 1.000000 0.500001 - 1.754436 1.000001 - 1.754436	General Source	Selection	Display	Symbology A	Fields	Definition Query	Labels	XCallout
	Features Categories Quantities Graduated colors Graduated symbols Proportional symbols Dot density Charts	Fields Value: Normalization: Color Ramp: Symbol Ram 0.00 0.10 0.25 0.50 1.00	pr_sed_mas none nge 10000 - 0.100 10001 - 0.250 10001 - 0.500 10001 - 1.754	ss_tons_acre	Class Class Label 0.000000 0.100001 0.250001 0.500001	ification Manual es: 5 → Clas - 0.100000 - 0.250000 - 0.500000 - 1.000000 - 1.754436	isify	



Your data should now be displayed for use in source assessments, such as is shown below.

2.2 EVALUATE PRACTICE FEASIBILITY

This section walks through an example of how to develop a map that could be used to evaluate the feasibility of placing practices on the landscape (**Figure 3**). This section covers an example of field-scale locations where PTMApp-Desktop outputs indicate practices are feasible in our workshop subwatershed.



= =

Source Reduction

15 20 Miles

10

0 2.5

2.2.1 HOW TO: EVALUATE PRACTICE FEASIBILITY

^{CP} HOW TO:

1. Add the following data to your table of contents in ArcGIS:

Data needed	Location	Description
biofiltration	processing.gdb	Locations that have the potential for biofiltration practices
filtration	processing.gdb	Locations that have the potential for filtration practices
infiltration	processing.gdb	Locations that have the potential for infiltration practices
protection	processing.gdb	Locations that have the potential for protection practices
storage	processing.gdb	Locations that have the potential for storage practices
sourcereduction	processing.gdb	Locations that have the potential for source reduction
		practices

These polygons represent the results of the BMP Suitability tool, which uses NRCS Field Office Technical Guide (FOTG) criteria to determine where on the landscape BMPs are technically feasible. PTMApp-Desktop groups individual BMPs into treatment groups for computational purposes. Individual BMPs resolved in PTMApp, and the treatment group they're assigned to, are shown in the table below. Additional information on this process can be found in the <u>BMP Suitability Technical Memorandum</u>.

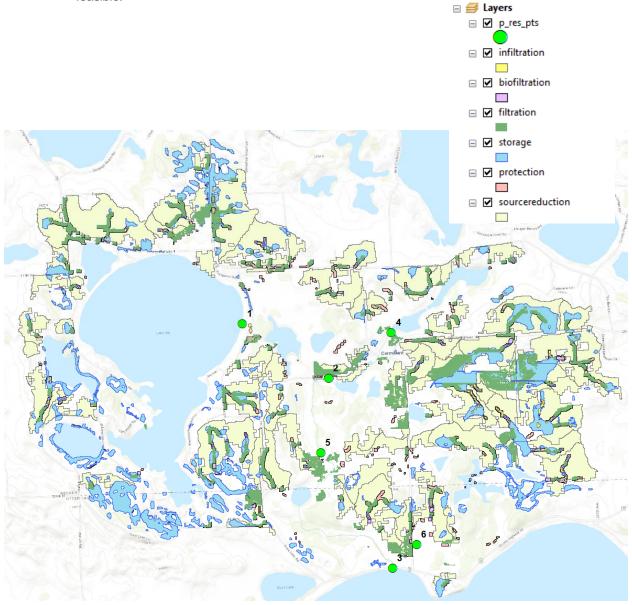
Treatment Group Feature Classes and Rasters		Individual BMP R	lasters		
Name	Group Code	Feature Class	Raster	BMP Type (NRCS Practice Code)	PTMApp Raster Name
				WASCOB (638)	wascob_bin
				Drainage Water Management/Controlled Drainage (554)	drain_bin
				Farm pond/wetland (378, 657, 658, 659)	pond_bin
				Regional Pond/Wetland (656)	reg_wet_bin
Storage	1	storage	bmp_storage	Regional Nutrient Reduction Wetland (656)	Nutr_wet_bin
				Grassed Waterway (412)	Gwater_bin
Filtration	2	filtration	bmp_filtration	Filter Strip (393)	filst_bin

Treatment Group Feature Classes and Rasters			Individual BMP R	asters	
Name	Group Code	Feature Class	Raster	BMP Type (NRCS Practice Code)	PTMApp Raster Name
				Denitrifying Bioreactor (605)	Denit_bin
Biofiltration	3	biofiltration	bmp_biofilt	Saturated Buffer (604)	SatBuff_bin
				Multi-stage Ditch (N/A)	ditch2s_bin
Infiltration	4	infiltration	bmp_infiltration	Infiltration Trench or Small Basin (N/A)	InfTrench_bin
				Grade Stabilization (410)	protect_bin
				Grassed Waterway (412)	Gwater_bin
				Critical Planting Areas (342)	crit_plant_bin
Protection	5	protection	bmp_prot	Shoreline Restoration/Protection (580)	shore_bin
				Cover Crops (340)	CovCrop_bin
				Perennial Crops (327)	peren_bin
Source Reduction	6	sourcereduction	bmp_sred	Nutrient Management of Groundwater for Nitrate (590)	NO3_bin

2. Set the symbology:

Set the symbology of the practice treatment groups to highlight areas on the map(s) where practices have the potential to be placed on the landscape. An example of which is shown below.

Your data should now be set up to display locations where PTMApp-Desktop predicts BMPs are feasible.



2.3 ESTIMATE WATER QUALITY BENEFITS

This section walks through an example of how to develop a map that displays the estimated water quality benefits of implementing practices in the workshop subwatershed. This section covers an example of the treatment cost for reducing sediment (\$/mass/year) to the outlet of the workshop subwatershed. An example map displaying similar results from the Pomme de Terre River Watershed is shown below (**Figure 4**).

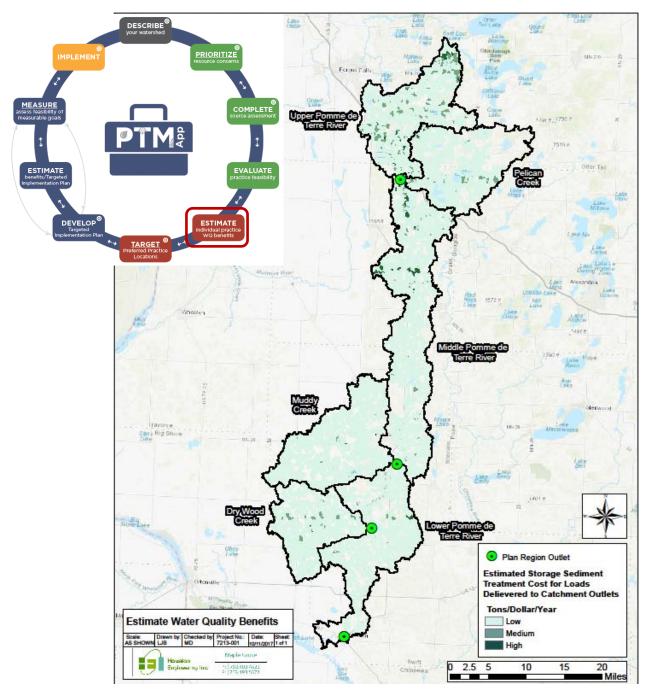


Figure 4. Example of water quality benefits estimation: The treatment cost (tons/dollar/year) of reducing sediment delivered to Planning Region outlets using Storage practices. Similar products can be developed for total nitrogen and total phosphorus.

2.3.1 HOW TO: ESTIMATE WATER QUALITY BENEFITS

^{CP} HOW TO:

1. Add the following data to your table of contents in ArcGIS:

Data needed	Location	Description
catchments	processing.gdb	Individual hydrologic catchment boundaries that average 40 acres in area
table_ca_bmp_costeff	processing.gdb	Table with BMP cost-effectiveness data for catchments, routed to priority resource locations
p_res_pts	processing.gdb	Point locations of priority resources and/or plan regions, with water quality goals in attributes. These were determined by user prior to running PTMApp-Desktop.

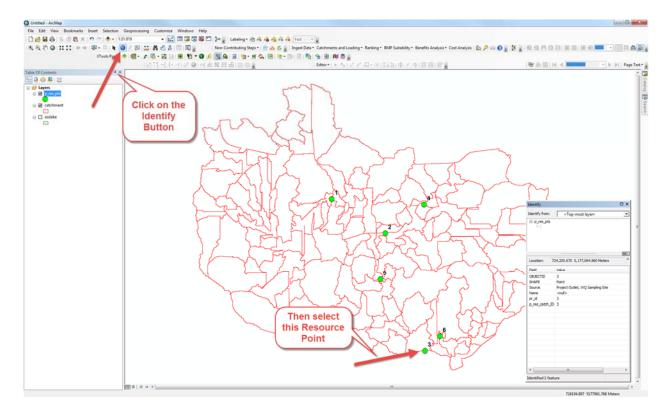
a. Attribute values used in this section:

Data Source	Attribute	Description
catchments	catch_ID	Unique whole number ID for catchments
table_ca_bmp_costeff	p_res_catch_ID	Unique whole number ID for priority resource locations
	grp_code	BMP treatment group code (1-6)
CI_SQ_02		BMP cost index for sediment reduction (BMP cost [\$]/ ton reduced) from 2-year, 24-hour event at a given priority resource point based upon median (Q2) effectiveness.
p_res_pts	OBJECTID	The OBJECT ID from the p_res_pts point layer is used to create the p_res_catch_ID

2. Identify the priority resource point (p_res_pts) where you'd like information about water quality benefits:

DESCRIPTION – This can be accomplished using the identify button (). The *p_res_pts* OBJECTID attribute is used to create the *p_res_catch_ID* in all PTMApp-Desktop output data. For this example, let's use the workshop subwatershed outlet, OBJECITID: 3 (also *p_res_catch_ID* = 3). This is consistent with the Source Load Assessment step.

a. Select the Identify function and then click on the *p_res_pts* of interest and note the OBJECTID. In our case we're looking at the project outlet, OBJECTID = 3.



3. Open the table_ca_bmp_costeff attribute table and select by attribute:

DESCRIPTION – <u>Select</u> records with "*p_res_catch_ID* = 3". Note, each catchment can be associated with multiple treatment groups. You may also want to select data based on the treatment group that you'd like displayed. To do this, <u>add</u> an "*AND*" to your query statement and <u>select</u> your desired treatment group based on the "*grp_code*" attribute. The table below shows the description of the treatment groups associated with the different "grp_code" integer values. For this example, let's include "*grp_code*= 6".

grp_code	Treatment Group
1	Storage
2	Filtration
3	Biofiltration
4	Infiltration
5	Protection
6	Source Reduction

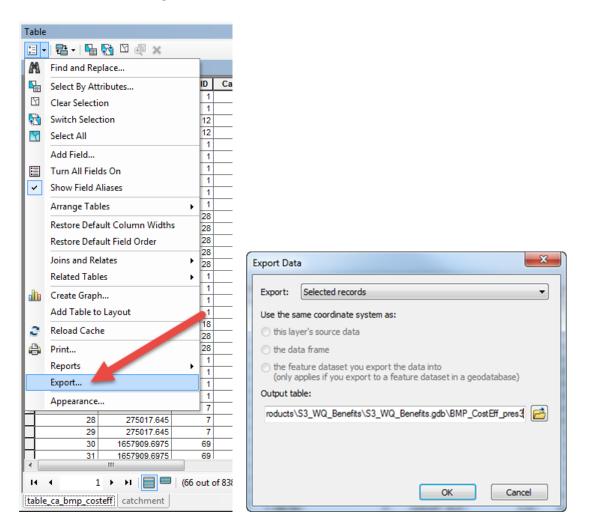
a. Right click on *table_ca_bmp_costeff* and open the attribute table, click on the Select by Attributes button, then enter a selection query as shown below. You should see 66 of the table's 838 records selected using the workshop subwatershed. These represent BMP reductions in catchments with source reduction (grp_code = 6) practices. 66 of the total 125 catchments have at least one source reduction practice.

	e_ca_bn ost	wtsArea ft	BMP ID	Catch ID	ur	Select by Attributes
	1	2490497.3625	1	500021	15	
F	2	2490497.3625	1	500407	1 5	Enter a WHERE clause to select records in the table window.
	31	3638198.2	12	500249	12	
	4			500274	12	Method : Create a new selection 👻
	- (Clic		500021	1_5	OBJECTID
		Cilc	n	500249	1_5	wtsArea ft
		Select	Rv/	500274	1_5	BMP ID
		Select	БУ	500407	1_5	Catch ID
		Attribu	toe	500428	1_5	ung_BMP_ID +
	1	AUTDU	les		1_5	
	11			500504	_	= <> Like
	12	2188569.9675	28	500522	_	
	13	2188569.9675	28	500552	-	> >= And
Ļ	14	2188569.9675	28		28_	
Ļ	15	2188569.9675	28	500566	-	< <= Or
L	16	2490497.3625	1		1_5	[%] () Not
Ł	17	2490497.3625	1		1_5	
Ł	18	2490497.3625	1		1_5	Is In Null Get Unique Values Go To:
Ł	19	2490497.3625	1		1_5	
ŀ	20	685929.5275	18		18_	SELECT * FROM table_ca_bmp_costeff WHERE:
Ł	21	2188569.9675	28		28_	p_res_catch_ID =3 AND grp_code =6
┞	22	2188569.9675	28	500566	-	
╀	23	1856234.555 1856234.555	1		1_5	
╀	24	1856234.555	1		1_5	
╀	25	1856234.555	1		1_3	T
╀	20	275017.645	7		7 5	Clear Verify Help Load Save
┝	28	275017.645	7		7 5	
⊦	20	275017.645	7		7 5	Apply Close
┢	30	1657909.6975	69	500243	-	(tobe
t	31	1657909.6975	69	500245	-	500243 4 1 41 0.0864871 11 165790
Ċ	511	1001000.00101		0002001		

4. Export the selected data:

DESCRIPTION – In the *table_ca_bmp_costeff*, <u>export</u> the selected data to a new table within a file geodatabase and <u>add</u> it to your table of contents. It is important to ensure that the selected records are output to a file geodatabase. Some of the names in *table_ca_bmp_costeff* are longer than 8 characters and may be truncated if the table is exported to a location outside of a file geodatabase.

Select Export from the table options dropdown menu and, in the Export Data dialog box, save the *Selected* records to a file geodatabase.

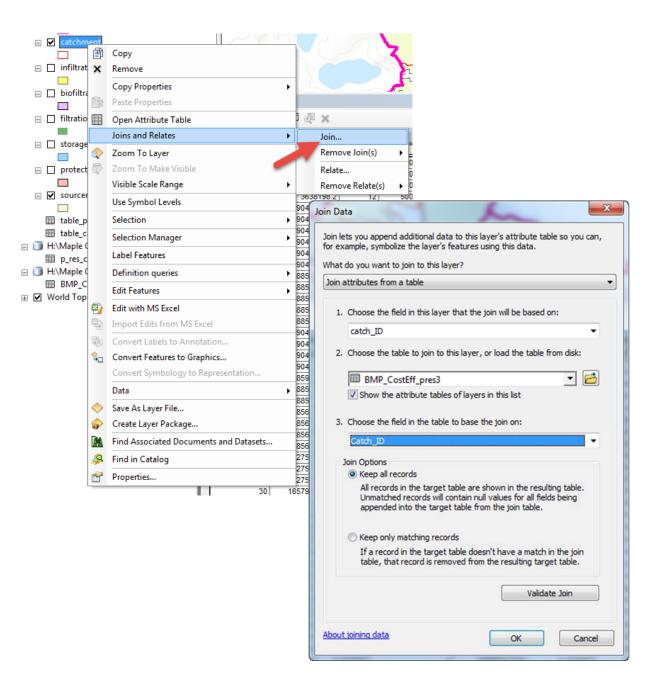


5. Join the tables:

DESCRIPTION – Join the table created in Step 4 to the *catchment* layer using the *catch_ID* as the join field for both data sources

STEPS -

- a. Right click on *catchment* and select Joins and Relates > Join
- b. Make sure catch_ID is selected for both the feature class and table join fields (#'s 1 and 3 in Join Data dialog box) and that the exported table from the previous step is your join table (#2).

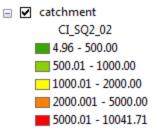


6. Set the symbology of the catchments layer:

DESCRIPTION – <u>Set</u> the *catchment* layer to display for the constituent (sediment, TN, or TP) of interest. For this example, let's use *CI_SQ_02*. Right-click the catchment layer and choose Properties. In the Layer Properties dialog box, choose the Symbology tab and symbolize as shown below. You can use the Classify button to set data ranges and the Color Ramp to choose colors that best display your data. You can also manually adjust how data are shown in your ArcMap Table of Contents under the 'Label' tab shown below. Click OK when complete.

Joins & Relates		Time		HTML Popup					
General	Source	Selectio	n	Display	Symbology	Fields	Definition Query	Labels	XCallout
1	ed colors ed symbols nal symbols ity	Draw qu Fields Value: Normaliza Color Ram Symbol	etion: p: 4.96 500. 1000 5000	CI_SQ2_02 none	00000 0.00000 00.00000 00.00000 00.00000 041.712573	Class	ification Manual es: 5 - Cla .00 .000.00 2000.00 - 5000.00 10041.71	ssify	

This will display the cost index (\$ spent/ton of sediment reduced) for treating sediment delivered to the priority resource and treatment group you selected. In our case, for Source Reduction practices (grp_code = 6) upstream of our project outlet (p_res_catch_id = 3). It is important to note that the default dollar values in this table are based on those run in the Cost Analysis module. By default, PTMApp-Desktop uses EQIP payments schedules for BMP costs, which represents the



cost for installation only. As these values may not reflect the true cost of implementing a practice or project in your area, you may want to consider displaying your information on a high to low scale, rather than exact dollars. The scale to the right shows raw values, but you could (for example) label these as "Very Low", "Low", "Moderate", "High", and "Very High". Your data should now be displayed for use in estimating water quality benefits.

2.4 TARGET PREFERRED PRACTICE LOCATIONS

This section covers an example of how to use PTMApp-Desktop data to develop a list of targeted practices to use in implementation planning. The example below (**Figure 5**) is from the Pomme de Terre River Watershed and shows preferred practices for treating sediment and nutrients in the Middle Pomme de Terre River Watershed Planning Region. After completing this step, you should be able to develop your own implementation scenarios and process them through PTMApp-Desktop Treatment Trains analysis.

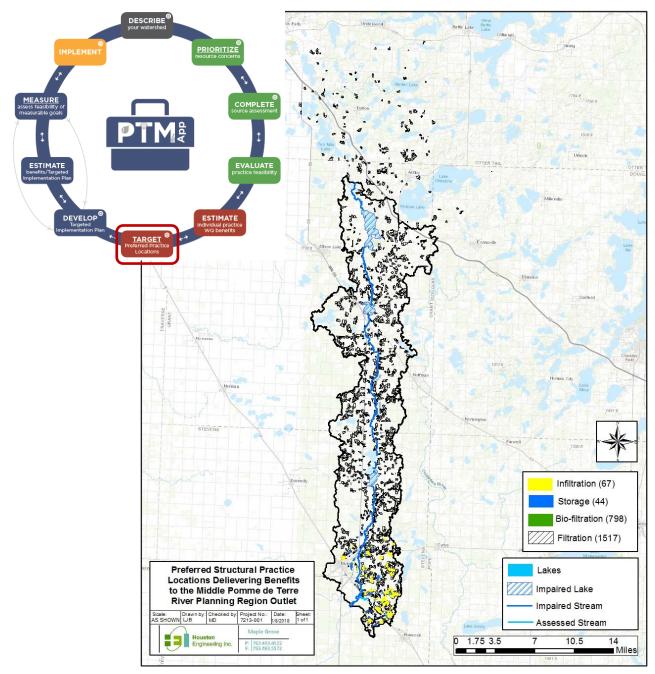


Figure 5. Example of conservation practice targeting: preferred locations for structural conservation practices in the Middle Pomme de Terre River Watershed Planning Region.

2.4.1 HOW TO: TARGET PREFERRED PRACTICE LOCATIONS

B HOW TO:

The following criteria were used for selecting practices for Targeting Preferred Practice Locations:

- Only look at structural practices biofiltration, infiltration, protection, and storage.
- Cost-effectiveness to reduce sediment < \$10,000/ton AND Cost-effectiveness to reduce TP <= \$10,000/lb as measured at the subwatershed outlet (p_res_catch_ID = 3).
- Sediment reductions from 2-year, 24-hour event > 1 ton AND TP reductions from 2-year, 24-hour event > 1 lb as measured at the subwatershed outlet (p_res_catch_ID = 3).
- 1. To extract BMPs based on these criteria, add the following data to your table of contents in ArcGIS:

Data needed	Location	Description
biofiltration	processing.gdb	Locations that have the potential for biofiltration practices
filtration	processing.gdb	Locations that have the potential for filtration practices
infiltration	processing.gdb	Locations that have the potential for infiltration practices
protection	processing.gdb	Locations that have the potential for protection practices
sourcereduction	processing.gdb	Locations that have the potential for source reduction practices
storage	processing.gdb	Locations that have the potential for storage practices
table_ba_bmp_all	processing.gdb	Table containing benefits analysis for each BMP
table_ba_load_red	processing.gdb	Table containing BMP load reductions at priority resource locations.

a. Attribute values used in this section:

Data Source	Attribute	Description
table_ba_bmp_all	unq_BMP_ID	Unique ID assigned to each BMP. Concatenation of BMP_ID, Catch_ID, and grp_code.
table_ba_load_red	p_res_catch_ID	Unique whole number ID for priority resource locations
	grp_code	BMP treatment group code (1-6)
	unq_BMP_ID	Unique ID assigned to each BMP. Concatenation of BMP_ID, Catch_ID, and grp_code.

Data Source	Attribute	Description
	R_SQ2_02	BMP sediment reduction (tons) from 2-year, 24- hour event at a given priority resource point based upon median (Q2) effectiveness
	R_PQ2_02	BMP total phosphorus reduction (tons) from 2- year, 24-hour event at a given priority resource point based upon median (Q2) effectiveness
p_res_pts	OBJECTID	The OBJECT ID from the p_res_pts point layer is used to create the p_res_catch_ID

2. Run the "Merge" operation on all BMP layers:

DESCRIPTION – This will join the spatial distribution of all the potential practices. Be sure to <u>save</u> the output to a file geodatabase. Similar to early steps, saving outside of a file geodatabase could cause attribute names to be truncated.

STEPS -

a. Select Data Management > General > Merge function from Arc Toolbox. Add the BMP treatment groups using the Input Datasets dropdown and save the data to a file geodatabase. (saved as ... WorkshopMaterials\Build_Products\S4_S5_Targeted_BMPs\S4_S5_Targeted_BMPs.gdb\allbmps)

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3. Attribute BMP costs:

DESCRIPTION – BMP costs, calculated after running the Cost Analysis module, have been added as a field in table_ba_bmp_all. Join 'allbmps' with this table so we can use it to attribute our BMP shapefile to include BMP costs.

Add BMP_cost as a field to *allbmps*.
 In the allbmps Attribute Catalog, click
 Table Options > Add Field. In the
 Add Field dialog box type
 'BMP_cost' for Name and choose
 Float type.

 Add Field
 X

 Name:
 BMP_cost

 Type:
 Float

 Field Properties
 Alias

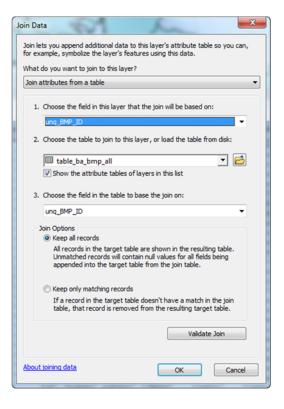
 Alias
 Yes

 Default Value
 OK

- Add table
 'table_ba_bmp_all' to ArcMap
- Right click on *allbmps* and select Joins and Relates > Join

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d. Make sure unq_BMP_ID is selected for both the allbmps feature class join field (#1 in Join Data dialog box) and table_ba_bmp_all join field (#3). Table_ba_bmp_all should be chosen as the table for #2. Click OK.



e. In the allbmps attribute table, find BMP_cost. Right click the attribute and choose Field Calculator. In the Field Calculator dialog box, in the Fields input, choose 'table_ba_bmp_all.BMP_tot_cost'. This represent the BMP_tot_cost attribute from table_ba_bmp_all. Click OK and remove the join from allbmps.

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About calculating fields	Clear	Load Save OK Cancel

4. Get Load Reductions for Subwatershed Outlet

DESCRIPTION – Extract records for BMPs that provide load reductions to our workshop subwatershed's outlet using *table_ba_load_red* where p_res_catch_ID = 3.

STEPS -

a. From the table options dropdown menu for *table_ba_load_red* click Select By Attributes. Select records where p_res_catch_ID = 3.

	BJE ID*	BMP_ID	Catch ID	ung BMB	PID* are code P SO2 10 P SO1 10 P SO3 10 P SOmin,1
	1	4	-	4 500021	Select by Attributes
	2	4	500021	4_500021_1	
	3	4	500021	4_500021_	Enter a WHERE clause to select records in the table window.
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Note that 641 of 1,581 records were selected in table_ba_load_red for our subwatershed, matching the total number of BMPs in table_ba_bmp_all and allbmps. So we have one record for each BMP.

 Export the selected records. From the table_ba_load_red Table Options dropdown, click 'Export' and in the 'Export Data' dialog box choose to export Selected Records to a file geodatabase.

Export Data	
Export:	Selected records
Use the sa	me coordinate system as:
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_Targete	d_BMPs\S4_Targeted_BMPs.gdb\table_ba_load_red_pres3
	OK Cancel

5. Calculate the Treatment costs:

DESCRIPTION – Treatment costs are calculated as a ratio of the load reduction to the estimated practice cost. For this example, we will base our treatment cost queries on sediment and TP reductions.

X

STEPS -

<u>Add</u> two fields to *allbmps*, the merged BMP layer created in Step 3: "Sq2_dol_ton" and "Pq2_dol_lb".
 Add Field

Table		Name:	Sq2_dol_ton	
Image: Select By Attributes Image: Select All Add Field	R_PQ; <null> <null> <null> <null> <null> <null></null></null></null></null></null></null>	Type: Field Prope	Float rties LL Values	Yes

b. Join the table created in the previous step (table_ba_load_red_pres3) to the merged BMP file, allbmps, using the unq_bmp_ID.

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Join Data
Join lets you append additional data to this layer's attribute table so you can, for example, symbolize the layer's features using this data.
What do you want to join to this layer?
Join attributes from a table
1. Choose the field in this layer that the join will be based on:
unq_BMP_ID
2. Choose the table to join to this layer, or load the table from disk:
💷 table_ba_load_red_pres3 💌 🖻
Show the attribute tables of layers in this list
3. Choose the field in the table to base the join on:
Join Options © Keep all records
All records in the target table are shown in the resulting table. Unmatched records will contain null values for all fields being appended into the target table from the join table.
Keep only matching records
If a record in the target table doesn't have a match in the join table, that record is removed from the resulting target table.
Validate Join
About joining data OK Cancel

c. Use the field calculator to <u>set</u> Sq2_dol_ton = "BMP_cost / R_SQ2_02" and Pq2_dol_lb = "BMP_cost / R_PQ2_02". Note that since allbmps is joined to our exported table, the attribute fields will include their shapefile names (as shown below).

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6. Select Preferred Practices:

DESCRIPTION – Use the select by attributes feature to select the records which fit our selection criteria. You can choose any of a number of criteria, including total reductions or cost-effectiveness to reduce sediment, TP, and TN as well as BMP treatment group, footprint (square-feet), drainage area (acres), or cost among others.

For this example, we'll use the following:

- Only look at structural practices biofiltration, infiltration, protection, and storage treatment groups.
- Cost-effectiveness to reduce sediment <= \$10,000/ton AND Cost-effectiveness to reduce TP
 <= \$10,000/lb as measured at the subwatershed outlet (p_res_catch_ID = 3).
- Sediment reductions from 2-year, 24-hour event > 1 ton AND TP reductions from 2-year, 24-hour event > 1 lb as measured at the subwatershed outlet (p_res_catch_ID = 3).

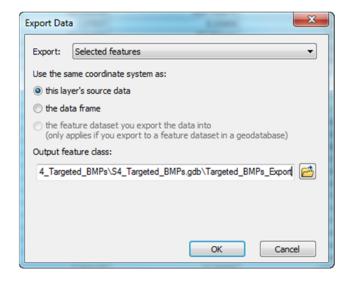
STEPS -

a. Your query statement should be: "allbmps.grp_code <> 2 AND allbmps.grp_code <> 6 AND allbmps.Sq2_dol_ton <=10000 AND allbmps.Pq2_dol_lb <=10000 AND table_ba_load_red_pres3.R_SQ2_02 >1 AND table_ba_load_red_pres3.R_PQ2_02 >1"

Method : Create a r	new selection
allbmps.Catch_ID allbmps.unq_BMP_ID allbmps.grp_code allbmps.T_Volume allbmps.CN_Wtsh	
= <> Like > >= And < <= Or _% () Not Is In Null SELECT * FROM allomp	1 2 3 4 5 6 Get Unique Values Go To: s_table_ba_load_red_pres3 WHERE:
allbmps.grp_code <> 2 allbmps.Sq2_dol_ton <=	AND allbmps.grp_code <> 6 AND 10000 AND allbmps.Pq2_dol_lb <=10000 g_pres3.R_SQ2_02 >1 AND
Clear Verify	Help Load Save

- <u>Export</u> the selected features to a file geodatabase. Right-click allbmps and navigate to Data > Export Data
- c. Be sure to save the output to a file geodatabase. Similar to early steps, saving outside of a file geodatabase could cause attribute names to be truncated.
- For the workshop materials, 60 BMPs met the criteria set in the previous step and were included in the exported shapefile.

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		227.925332
	Kemove	28.805485
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		92.91119
	Open Attribute Table	196.992365
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		70.050355
	Selection Manager	51,163026
	Label Features	67.716681
		35.729715
	Definition queries	105.887863
	Edit Features	57.501382
1000		155.434349
8	Edit with MS Excel	89.280689
12	Import Edits from MS Excel	108.760609
		106 685652
*	Convert Labels to Annotation	Repair Data Source
2	Convert Features to Graphics	Export Data
	Convert Symbology to Representation	
		Export To CAD
	Data	Make Permanent
<	Save As Layer File	View Item Description
6	Create Layer Package	View Metadata
12	Find Associated Documents and Datasets	Edit Metadata
	Find in Catalog	C4 Synchronize Metadata
m	Properties	Review/Rematch Addresses



7. Run Treatment Trains:

DESCRIPTION – Your layer, exported in Step 6, should be ready to input into the Treatment Trains tool. For simplicity, a smaller subset of the targeted BMPs was included with the workshop materials titled 'BMPs_For_TT'. This includes seven BMPs that might be considered as part of a grant application and/or your first round on implementation in the subwatershed. These were the better performing BMPs within each treatment group. Use this feature class to run treatment trains as shown below. For additional information on treatment trains, see Workshop Section 2.

Note: Apply Lakes should be checked if Lake Routing was run for your analysis.

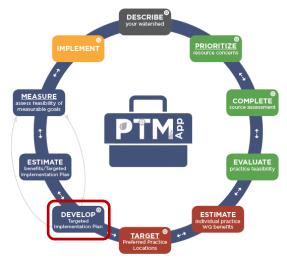
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2.5 DEVELOP TARGETED IMPLMENTATION PLAN

This section describes examples of the types of secondary data, not generated by PTMApp-Desktop, which could be used to finalize the list of practices considered for a Targeted Implementation Plan.

Previous steps described in this manual have relied exclusively on the data output from PTMApp-Desktop. However, a multitude of additional data and information can be used to help target practice locations for consideration in your implementation plan. For example, local knowledge could be used to exclude areas that lack landowners who are willing to implement additional conservation practices. The results of other analyzes, such as Zonation, could also be used to target practices in locations that provide multiple benefits in addition to water quality improvements.

PTMApp-Desktop users are encouraged to integrate and document the use of these external data sources, where applicable, when developing Targeted Implementation Plans.



2.6 ESTIMATE BENEFITS OF TARGETED IMPLMENTATON PLAN

This section walks through an example of how to develop a map that displays the water quality benefits (i.e. load reductions) associated with a Targeted Implementation Plan. This section shows how to use PTMApp-Desktop data to build the summary table and figures, such as in **Figure 6**, which shows an example implementation table with the "best" structural practices to begin implementation in the Middle Pomme de Terre River Watershed Planning Region.



1

ESTIMATE

DESCRIBE

PRIORITIZE

COMPLETE

TOP 10 BEST STRUCTURAL PRACTICES WITH ANTICIPATED WATER QUALITY BENEFITS WITHIN THE MIDDLE POMME DE TERRE PLANNING REGION

Practice Type	BMP ID Number	Drainage Area Treated (ft²)	Estimated Annual TP Load at BMP (Jb/yr)	Cumulative Est. Annual TP Load Reduction (臉/ɤֵר)	Cumulative TP Load Reduction (%)	Cumulative Progress Towards Goal (%)		nulative Est. Cost (\$)
Filtration	67745	475,075.49	5.68	0.34	6%	0.07%	\$	763.80
Storage	2156422	2,874,865.47	32.61	6.58	20%	1.27%	\$	15,814.22
Filtration	77705	472,362.99	2.08	0.19	9%	0.04%	\$	555.49
Filtration	72971	392,344.16	2.13	0.21	10%	0.04%	S	661.72
Filtration	88828	718,328.87	7.64	0.26	3%	0.05%	\$	878.32
Filtration	69424	330,731.59	1.79	0.13	7%	0.02%	S	543.57
Filtration	76415	493,772.38	3.87	0.61	16%	0.12%	\$	2,609.04
Storage	2122921	846,010.25	6.71	1.19	18%	0.23%	\$	5,130.71
Storage	2012750	4,767,514.30	40.42	4.95	12%	0.95%	\$	24,819.52
Filtration	77849	187,550.19	1.51	0.22	15%	0.04%	\$	1,102.17

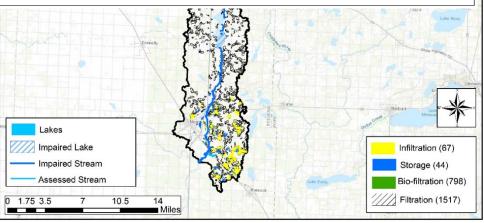


Figure 6. Example of a Targeted Implementation Plan: A table of the 10 "best" structural practices in the Middle Pomme de Terre River Watershed Planning Region.

2.6.1 HOW TO: BENEFITS OF TARGETED IMPLMENTATON PLAN



1. Export Results to Excel:

DESCRIPTION – After treatment trains has finished running, <u>add</u> the tables below to your ArcMap table of contents.

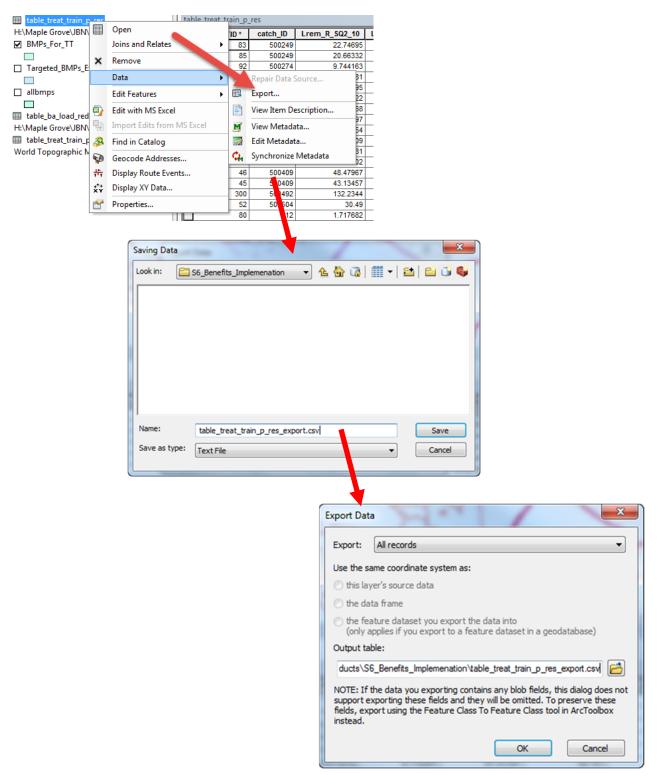
Then <u>export</u> the data to a .csv file. For this example, let's focus exclusively on the "*table_treat_train_p_res*" table.

Data needed	Location	Description
table_treat_train_catch	processing.gdb	Table with results of treatment train analysis. Loads are relative to catchment outlet.
table_treat_train_p_res	processing.gdb	Table with results of treatment train analysis. Loads are relative to priority resource catchment outlets (i.e. the resource points).
p_res_catchment	processing.gdb	Priority resource hydrologic catchment boundaries and/or plan regions.

a. Attribute values used in this section:

Data Source	Attribute	Description
table_treat_train_p_res	p_res_catch_ID	Unique whole number ID for priority resource locations
	Lred_R_SQ2_02	BMP sediment reduction (tons) at a given priority resource point from a 2-year, 24-hour event based upon median effectiveness of BMPs in user-defined shapefile.
	Lred_R_PQ2_02	BMP total phosphorus reduction (lbs) at a given priority resource point from a 2-year, 24-hour event based upon median effectiveness of BMPs in user-defined shapefile.
	Lred_R_NQ2_02	BMP total nitrogen reduction (lbs) at a given priority resource point from a 2-year, 24-hour event based upon median effectiveness of BMPs in user-defined shapefile.
	p_res_catch_ID	Unique whole number ID for priority resource catchment
p_res_catchment	p_res_catch_ID	Unique whole number ID for priority resource catchment

a. Right click on *table_treat_train_p_res* and select Export. Save the table to a text file and add '.csv' at the end of the file name (see example below):

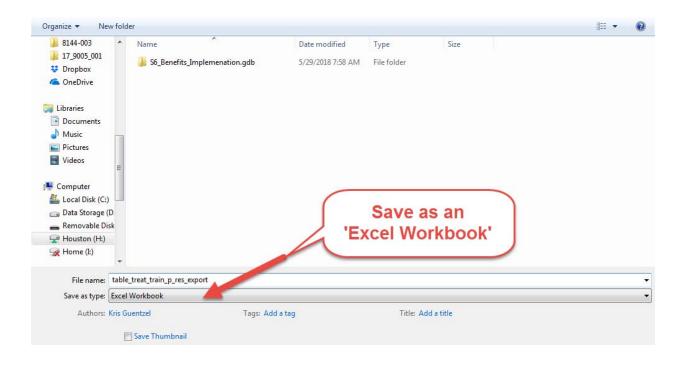


2. Open in Excel:

DESCRIPTION – <u>Open</u> the **.csv file** created in Step 1 in Microsoft Excel. Then, <u>save</u> the Excel worksheet to as Excel Workbook.

STEPS -

- a. Navigate to the location where you saved the file and open it using Microsoft Excel. If you saved it with the .csv extension you can just double-click to open it. Otherwise, you may need to open Excel first and navigate to the file in the software (File > Open > Browse with 'Text Files' chosen in the file dropdown options).
- b. Navigate to File > Save As and choose 'Browse'
- c. In the Save As dialog box, choose 'Excel Workbook' in the 'Save as type' dropdown.

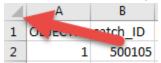


3. Generate a summary Pivot Table:

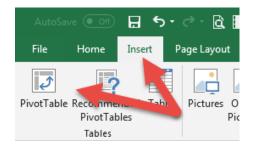
DESCRIPTION – Create a pivot table in Excel and summarize the load reductions of the targeted practices at priority resource locations.

STEPS -

a. In your Excel worksheet from Step 2, click the arrow to the upper-left of cell A1 (see below). This will select all data in your worksheet.

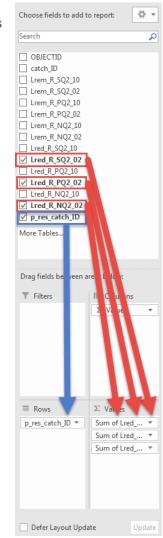


b. Click on the "INSERT" ribbon and select "Pivot Table" and save the output to a new worksheet within your Excel document.



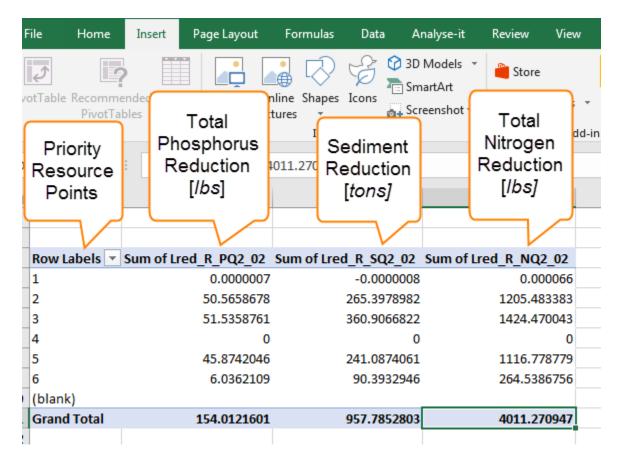
Create PivotTable	1 1	ନ	23
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Table/Range:	table_treat_train_p_res_	export!SA:SO	Î
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Choose whether you w	_	bles DK Can	icel

- c. \underline{Click} on each of the following attributes in the Pivot Table Fields
 - i. Lred_R_SQ2_02
 - ii. Lred_R_PQ2_02
 - iii. Lred_R_NQ2_02
 - iv. p_res_catch_ID
- d. Drag each 'Lred...' attribute into the 'Values' box. If 'Sum of' isn't chosen as the default way to summarize 'Lred' values, you can change it by right-clicking items in the 'Values' box and selecting Value Field Settings > Sum.
- e. Drag p_res_catch_ID into the 'Rows' box.



4. View load reductions at Priority Resource Points

DESCRIPTION –This step will provide you the total load reductions to each priority resource location that was inserted at the start of running PTMApp-Desktop. The same information could be summarized at different spatial scales (i.e. catchments).



Note: Priority resource points 1 and 4 had received no treatment from BMPs in the 'BMPs_for_TT' implementation shapefile. Although there are reduction values shown for resource point 1, they represent rounding errors in the tool and are effectively '0'.

2.7 ASSESS FEASIBILITY OF MEASURABLE GOALS

Briefly, this process should involve comparing your anticipated benefits and investments (time, money, etc.) towards implementing your Targeted Implementation Plan and your resource goals to assess if attaining the goals is feasible through your targeted implementation plan.

The results of a Targeted Implementation Plan described in **Section 2.6**, should be evaluated to determine if they are feasible to achieve and if they are sufficient to reach local management goals. If a scenario developed through this workflow is not feasible, simply loop back through and develop a new targeted scenario.



3 CONCLUSIONS

This workshop manual was developed with the purpose of demonstrating how the PTMApp-Desktop outputs could be used to develop a Targeted Implementation Plan. The intended outcome is to empower local governmental units (LGU), who have completed processing data with PTMApp-Desktop, to be able to utilize the data on their own without the need for external consultation. **This should position LGUs to utilize PTMApp-Desktop to develop implementation plans that are prioritized, targeted, and result in measurable water quality improvements.**