

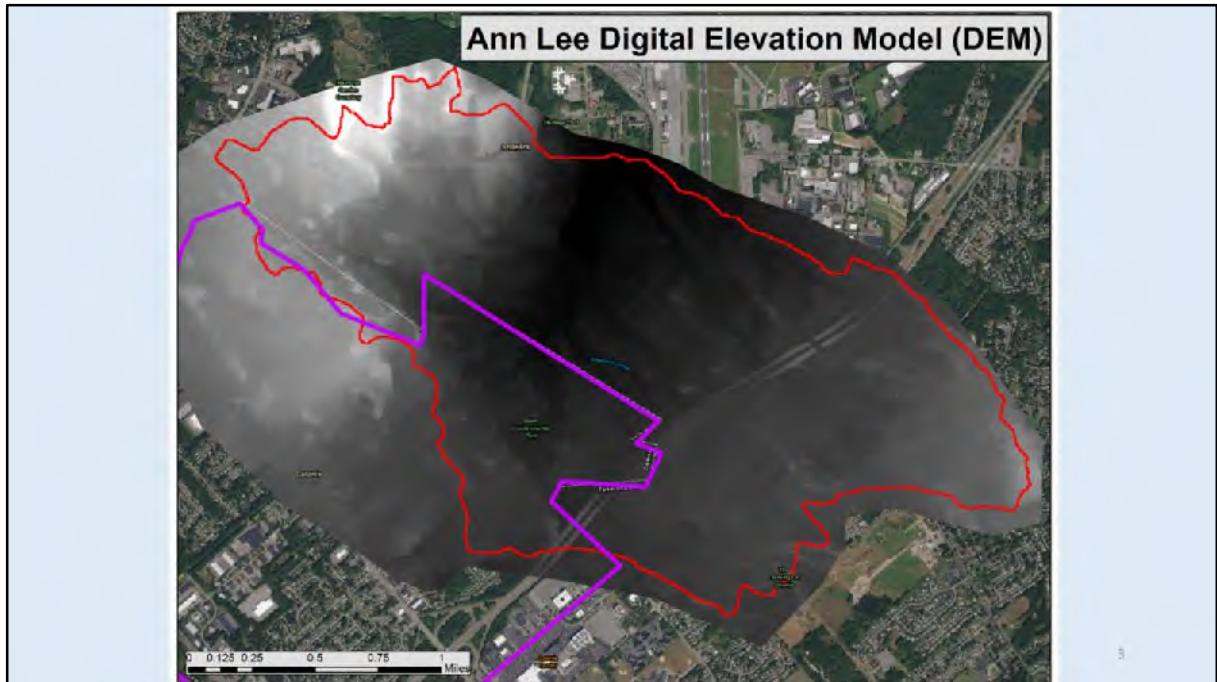
Sewershed Delineation and WinSLAMM Modeling

Stormwater Coalition of Albany County

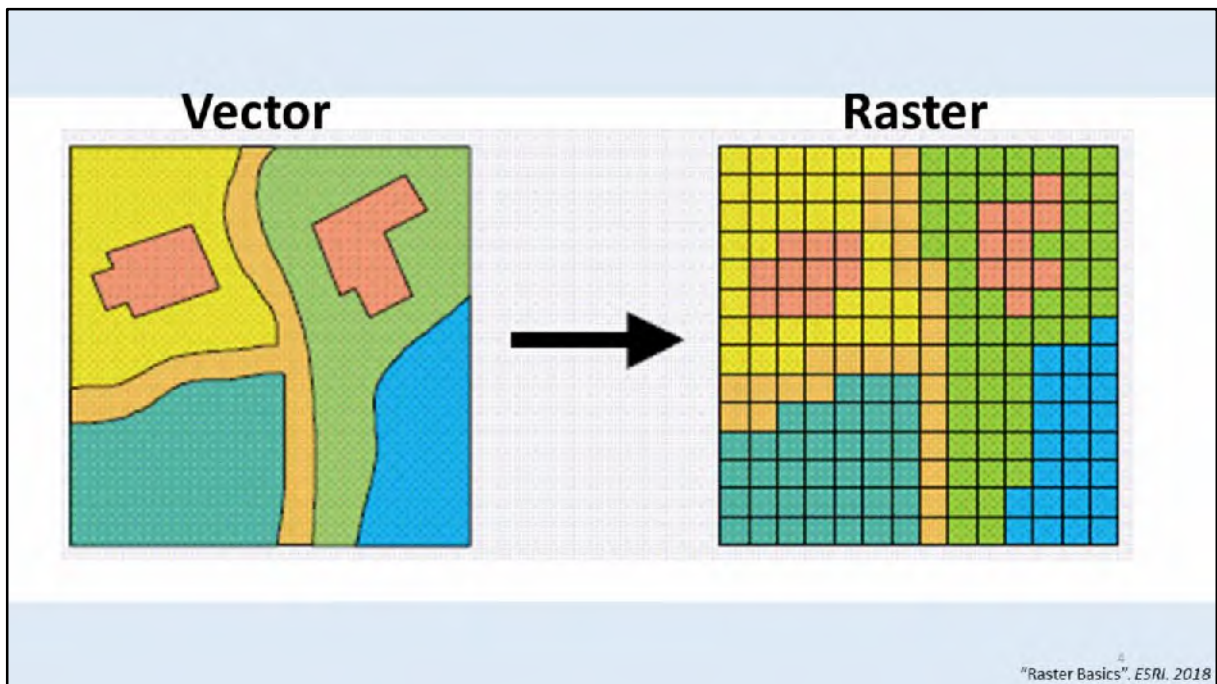
January 25, 2018



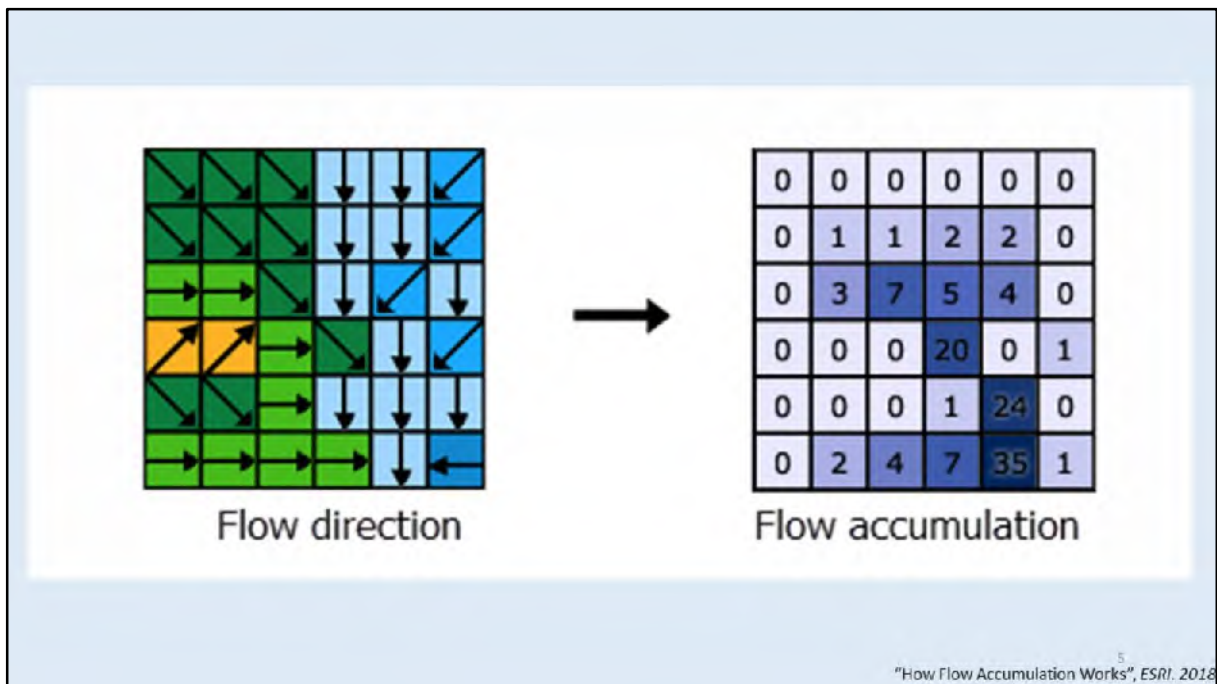
This is the Ann Lee Subwatershed with 2017 aerial imagery. The outlet of the watershed is marked with a green star. The border of the Village of Colonie is displayed in the purple outline. The rest of the subwatershed is in the Town of Colonie. This subwatershed was delineated by the Stormwater Coalition using USGS StreamStats



This is a digital elevation model (DEM). A DEM is a collection of raster pixels (explained on next slide) and each pixel has an elevation associated with it. In this particular DEM, each pixel represents a 3 foot by 3 foot area on the ground. The DEM is only shown for the area in and around the Ann Lee Subwatershed, but the Coalition has a DEM for all of Albany County. It is important to note that this DEM has been preprocessed using the “Fill” function. This tool corrects errors in the DEM, and will also help prevent “sinks” or pixels that would have no direction from them since they are the lowest relative elevation compared to the adjacent cells. This DEM was made using LiDAR data, the Stormwater Coalition and Albany County funded the collection of this data through a Department of Homeland Security grant



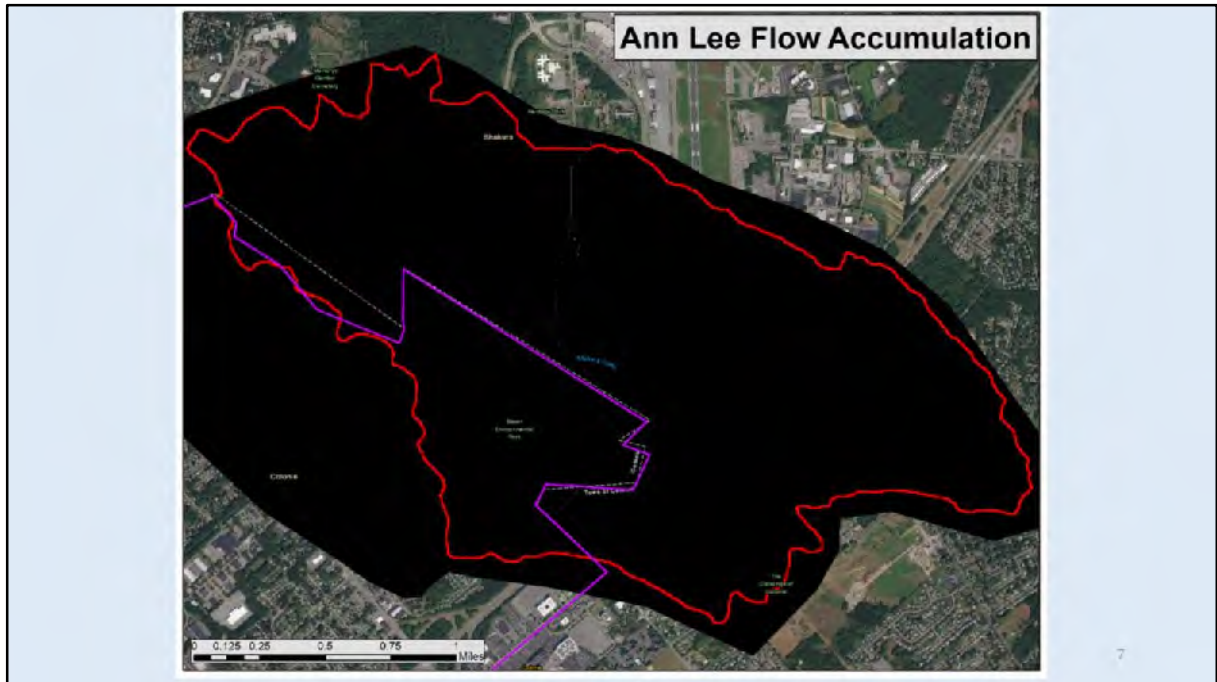
This graphic shows the differences between “Vector” and “Raster” data formats. These are the two ways that data can be represented in GIS. Vector data consists of points, lines, or polygons and are useful for storing and displaying data that have discrete boundaries, such as county borders. Raster data, the data format of the DEM, is comprised of “pixels” of a given, uniform size on the ground (in our DEM each pixel is 3 feet by 3 feet) and each pixel is assigned a value representing some attribute, so in the case of the DEM, each pixel has the elevation of that area associated with it.



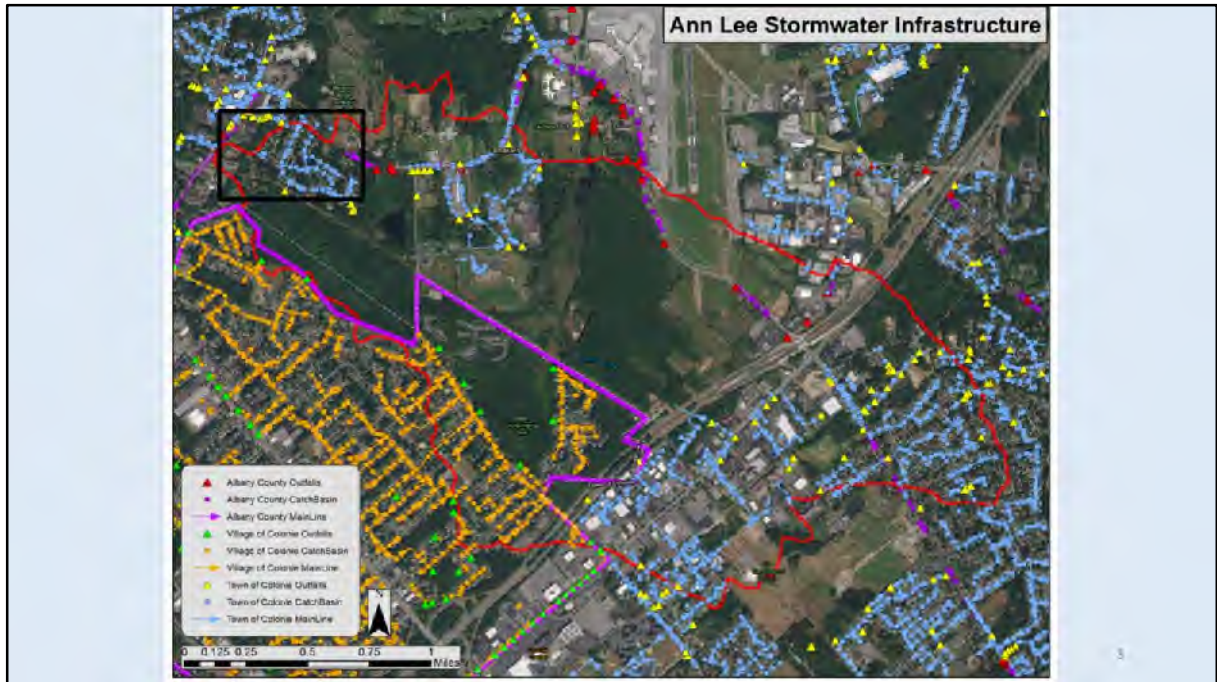
These graphics represent the "Flow Direction" and subsequent "Flow Accumulation" that are derived from our DEM. Using the "Flow Direction" tool, the GIS software finds the direction that water would flow based on the relative elevation of a cell compared to adjacent cells. Flow can move in 8 directions (through any of the 4 sides of the pixel, or any of the 4 corners), and the direction of flow will be toward an adjacent cell with the lowest elevation. Once "Flow Direction" is derived, "Flow Accumulation" can then be found by running the "Flow Accumulation" tool. If no unique value is specified then each pixel is assigned a default value of "1". A cell with a "Flow Accumulation" value of "2" means that this cell has 2 other cells flowing into it. In the above matrix the highest cell value is "35", meaning that 35 of the 36 cells are flowing into this cell, if this matrix represents a watershed, this cell would be the watershed outlet. It's important to note that "Flow Accumulation" is really the relative flow accumulation based on the direction of flow. The flow direction and flow accumulation in the Ann Lee watershed are displayed on the following 2 slides.



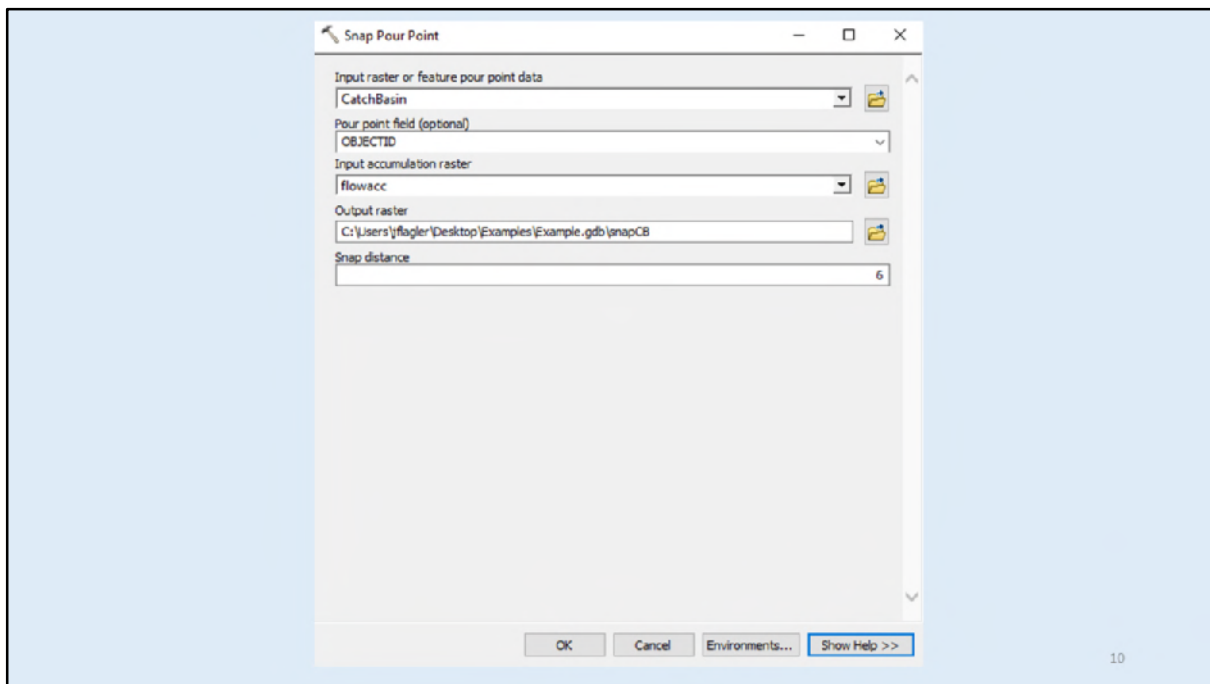
These are maps of flow direction for the Ann Lee Subwatershed. The map on the left has flow direction displayed as a raster format, and the map on the right is the generalized flow direction displayed as vector arrows, with each arrow representing the average flow direction for 35 pixels. Flow direction was processed for an area larger than the watershed boundary to include storm infrastructure connected within the Ann Lee Subwatershed.



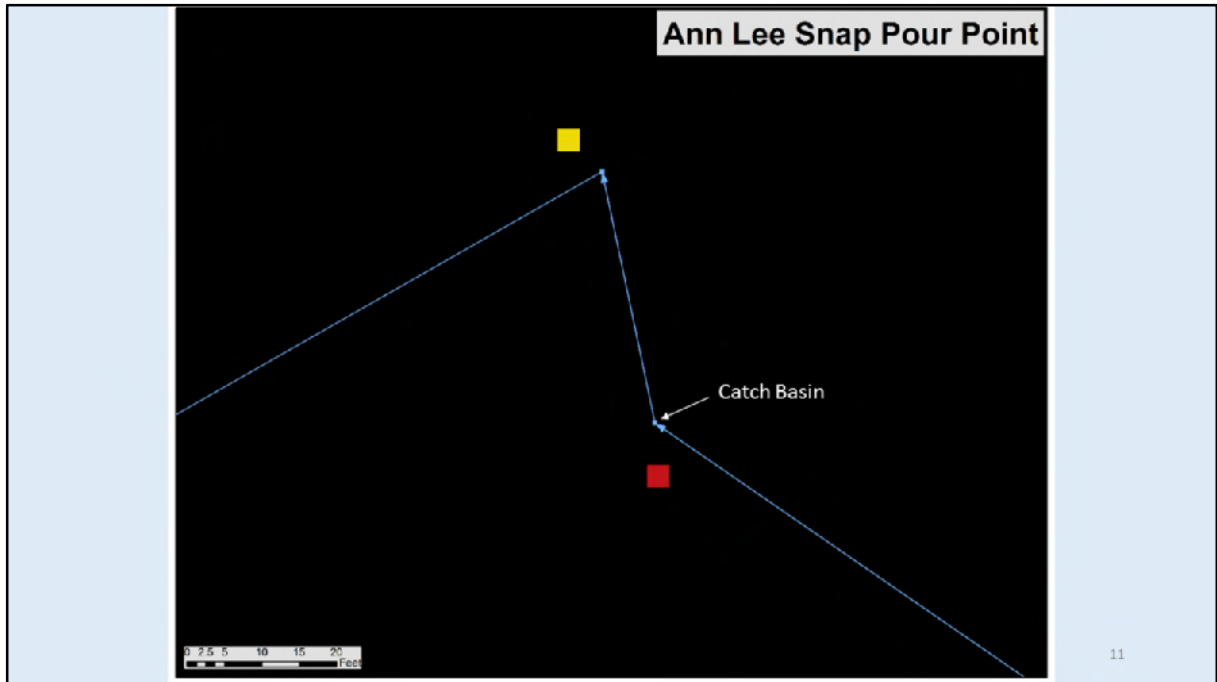
From the flow direction, the relative flow accumulation is pictured above. Pixels in white have relatively high flow accumulation.



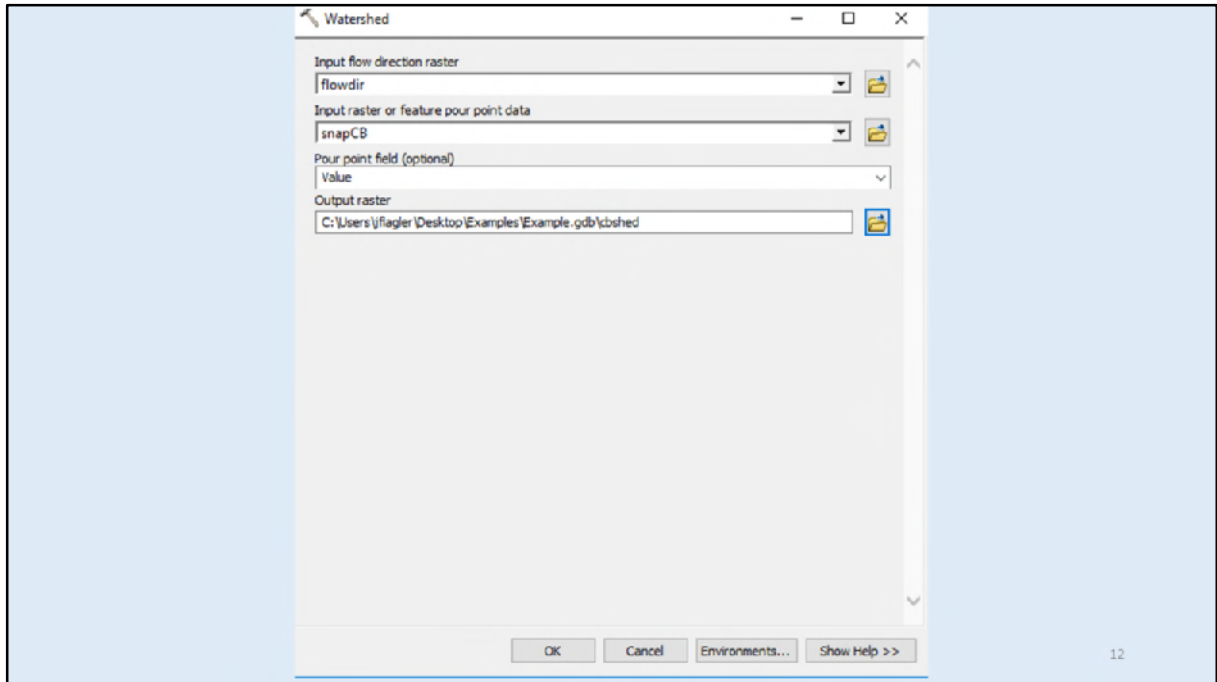
Based on System Mapping, this is the whole MS4 system for the Town of Colonie with an emphasis on the infrastructure within the Ann Lee Subwatershed. The most important infrastructure are “Catch Basins”, “Main Lines” and “Outfalls”, PCSMPs can be added later for subsequent “WinSLAMM” modeling. The black box in the northwestern part of the watershed is the isolated system that will be focused on in the following slides. The Town of Colonie data has not yet been finalized, but was provided by Rob Mateja, the town’s GIS Coordinator, on 1/9/2018. The Albany County dataset has also not yet been finalized



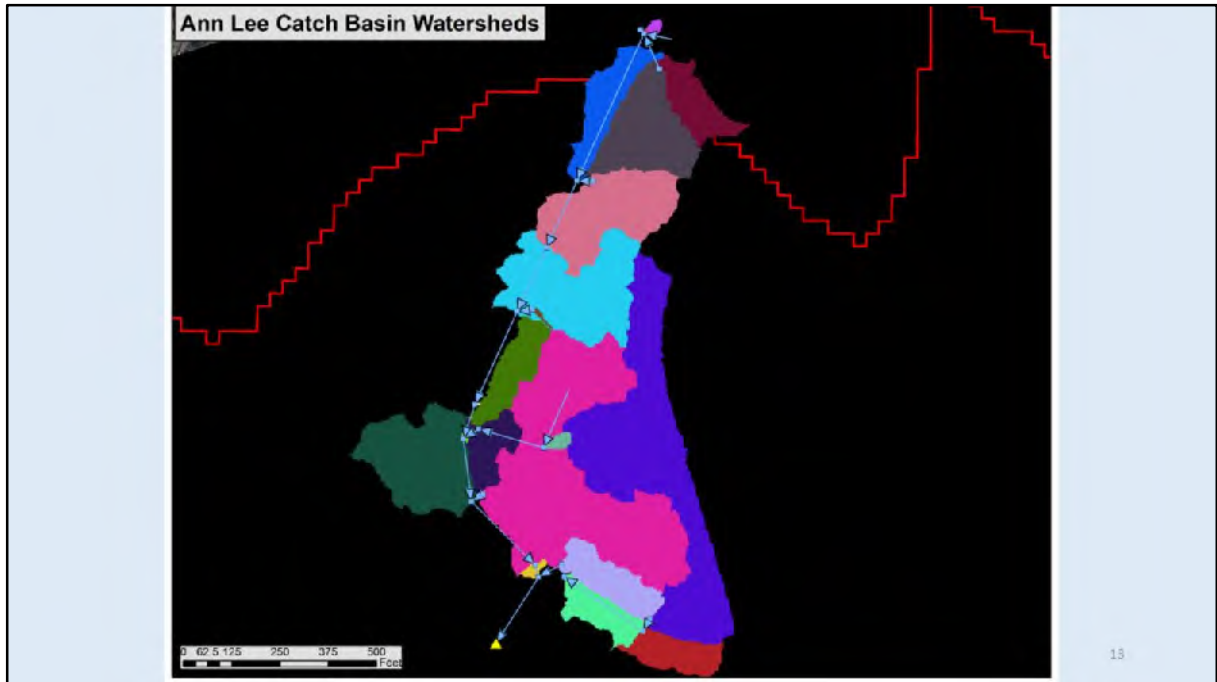
Now that the flow direction and flow accumulation have been found, and we have selected out the infrastructure connected to one outfall, we can begin delineating the source areas contributing water to the system ending at our selected outfall. The delineation is based on the topographic area contributing water to the catch basins in the system. The first step, shown here, is to “Snap Pour Point”. In this case the “pour points” are the catch basins in the system, therefore we input these as our “feature pour point data”, we also input the derived flow accumulation, and use a “Snap Distance” of 6, in this case our map units are feet, so our snap distance is 6 feet. With these inputs, the software searches a 6 foot radius around each catch basin to find the point of greatest flow accumulation. The purpose of this step is to account for any offset in the location where the catch basins were mapped and where they actually are, and also to mitigate assumptions in deriving flow accumulation from a DEM. By snapping to a pour point, our “outlet” of the small “watersheds” around each catch basin will be generalized to the highest flow accumulation to provide the best representation of source areas contributing to the catch basin. The value of a 6 foot snap distance was determined by FSI, now VHB, when delineating storm sewersheds for the Coalition in 2013. This distance had the best accuracy and therefore this value has been kept consistent.



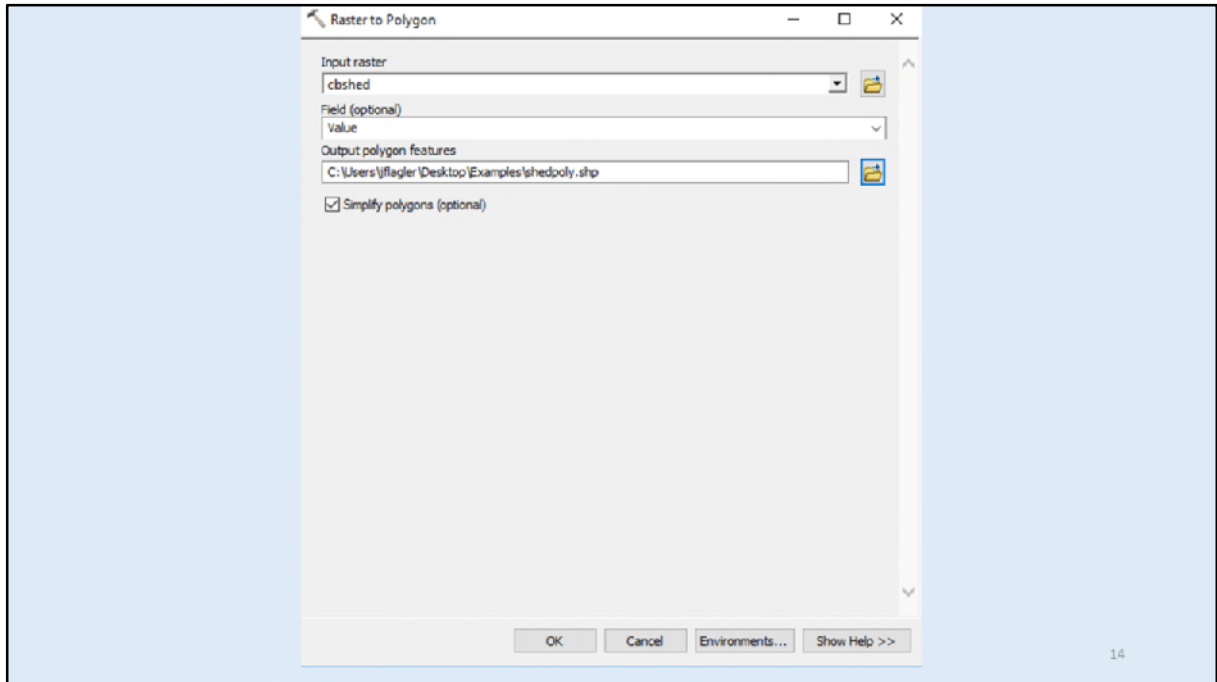
This is the result of the “Snap Pour Point” tool. The yellow and red squares represent the area within a 6 foot radius around the respective catch basins that have the highest flow accumulation. Take note of the offset, and also note that the offset is not always this dramatic.



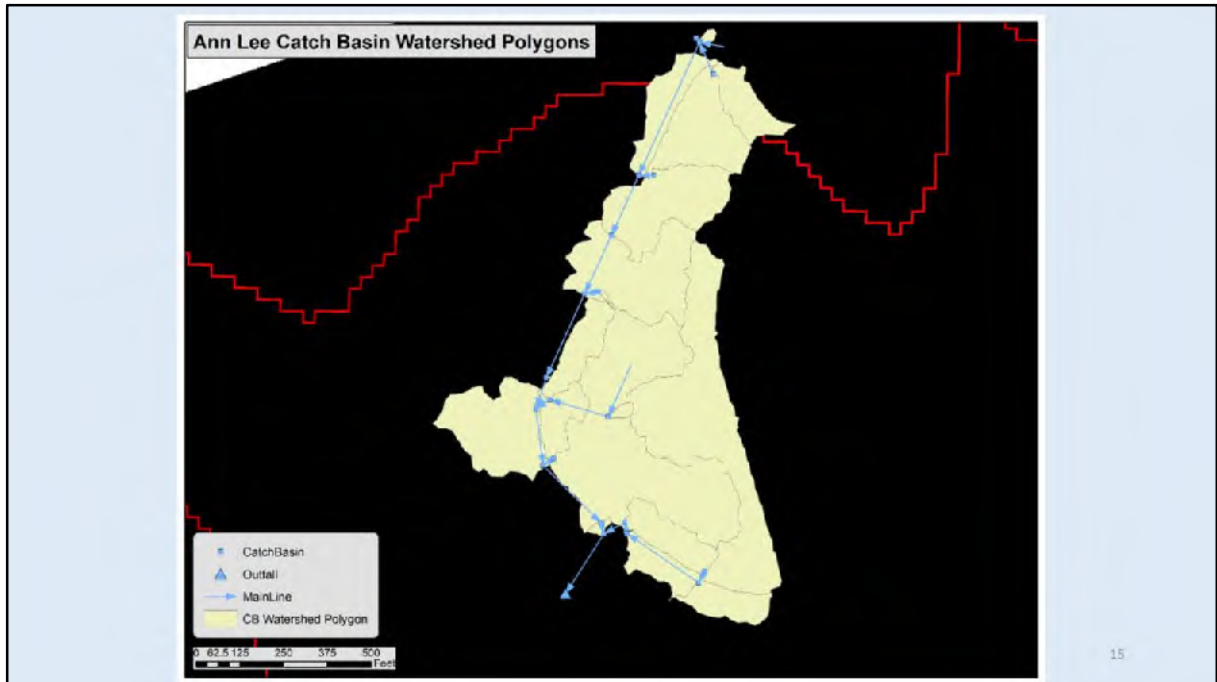
Once we've snapped to pour points, we want to delineate the watersheds around each catch basin (now snapped, so instead of inputting our "CatchBasins" as the "feature pour point data" we actually input the "snapCB", which is the result of the "Snap Pour Point" tool). We also input the flow direction derived from the DEM, and this will delineate the source area around each catch basin



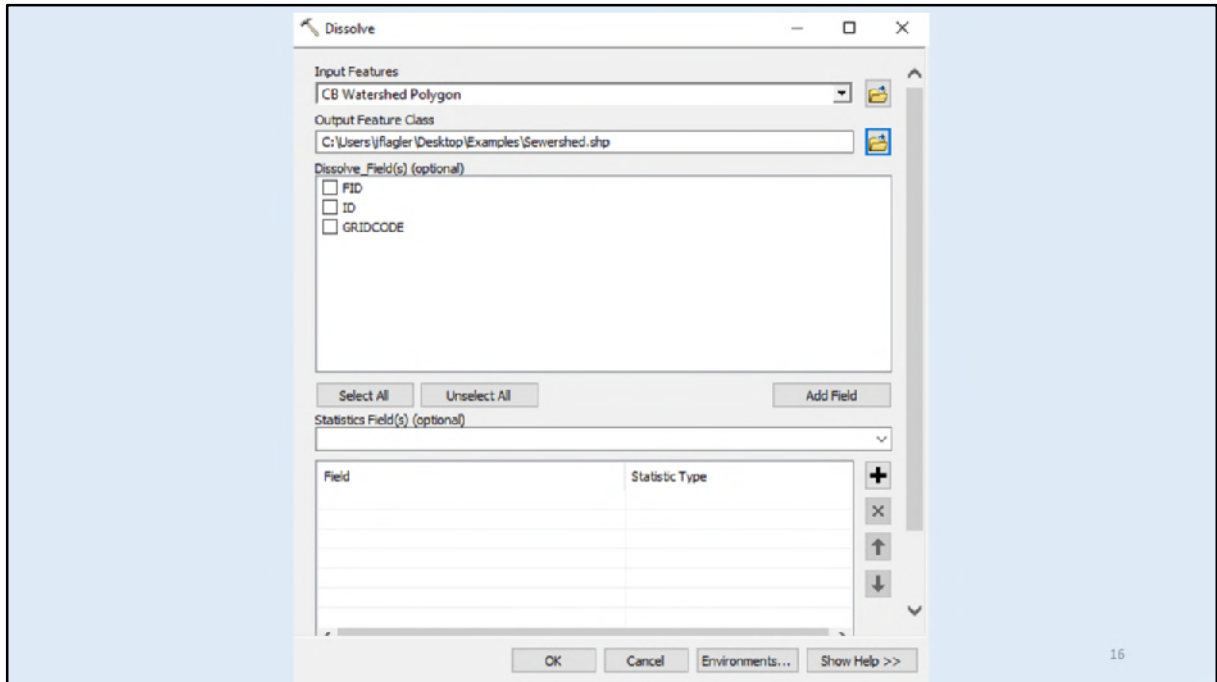
This is the result of the “Watershed” tool. The output is a raster format, and the different colored areas represent the source area pouring into a given catch basin



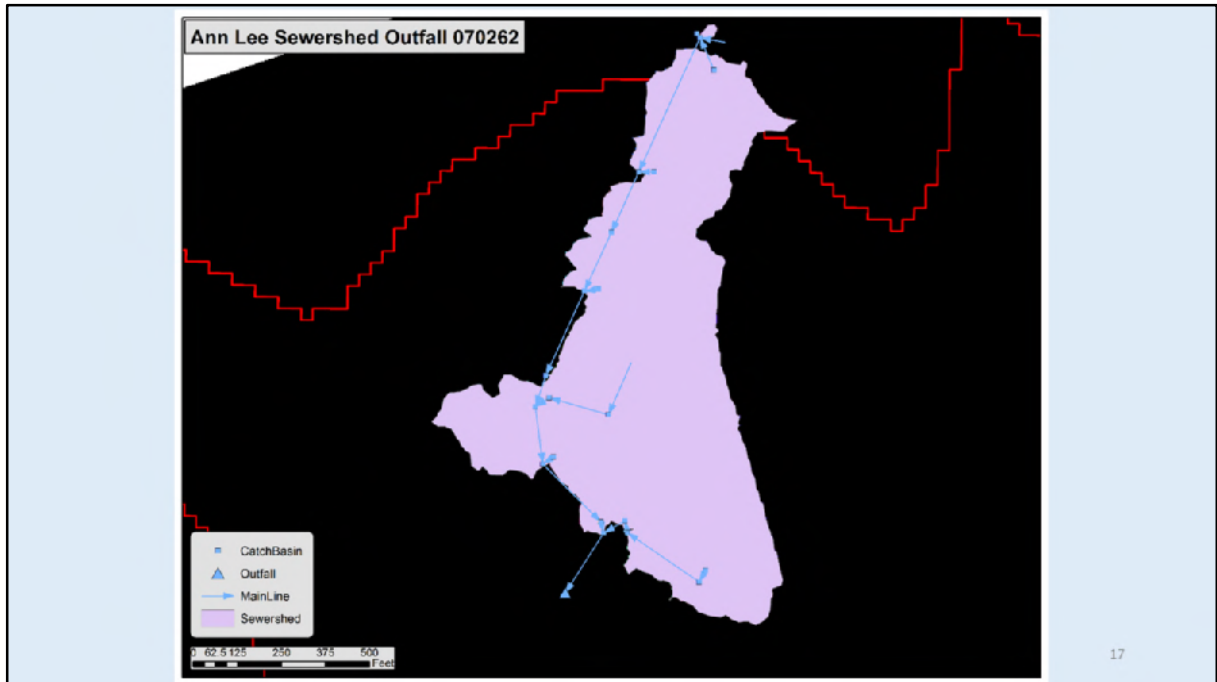
For representational purposes and for simplicity working with GIS data we now want to convert our output raster watersheds to a polygon layer using the “Raster to Polygon”. We input the watershed raster and let the program convert the data.



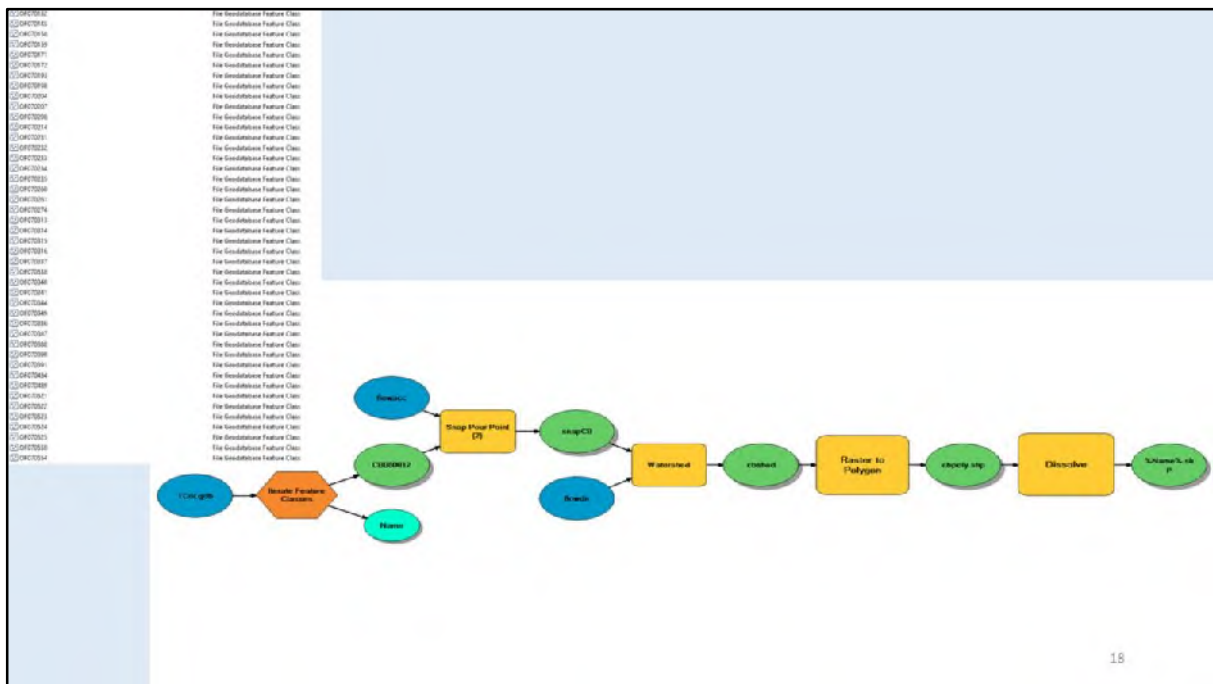
This is the result of the "Polygon to Raster" tool. Notice the lines separating the sewershed. These are still the individual source areas contributing to each catch basin. However, we want one shape to have a good representation of the aggregated sewershed, this also makes is easier to manipulate the sewershed.



Since we want one shape, we use the “Dissolve” tool, this takes the smaller watersheds for each catch basin and aggregates is into one shape, which is our final “Sewershed”

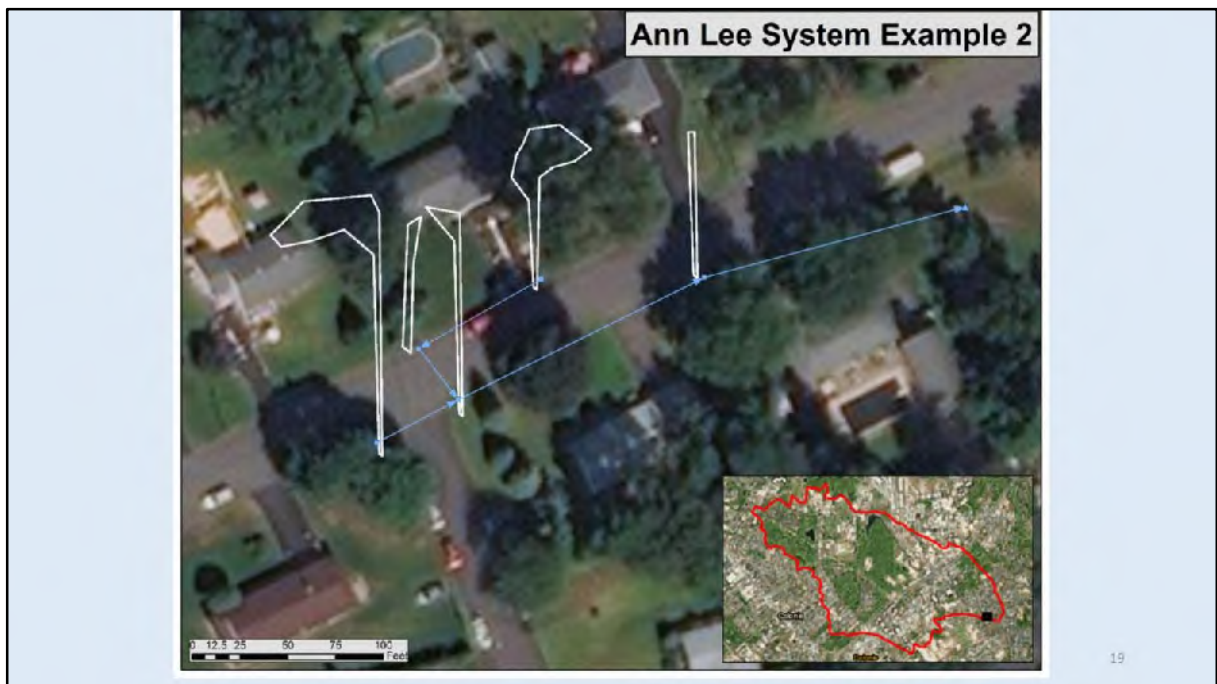


Here is our 16.5 acre sewershed in the Ann Lee Subwatershed. The areas in purple is the entire area that will spill into the catch basins contributing to the identified outfall.

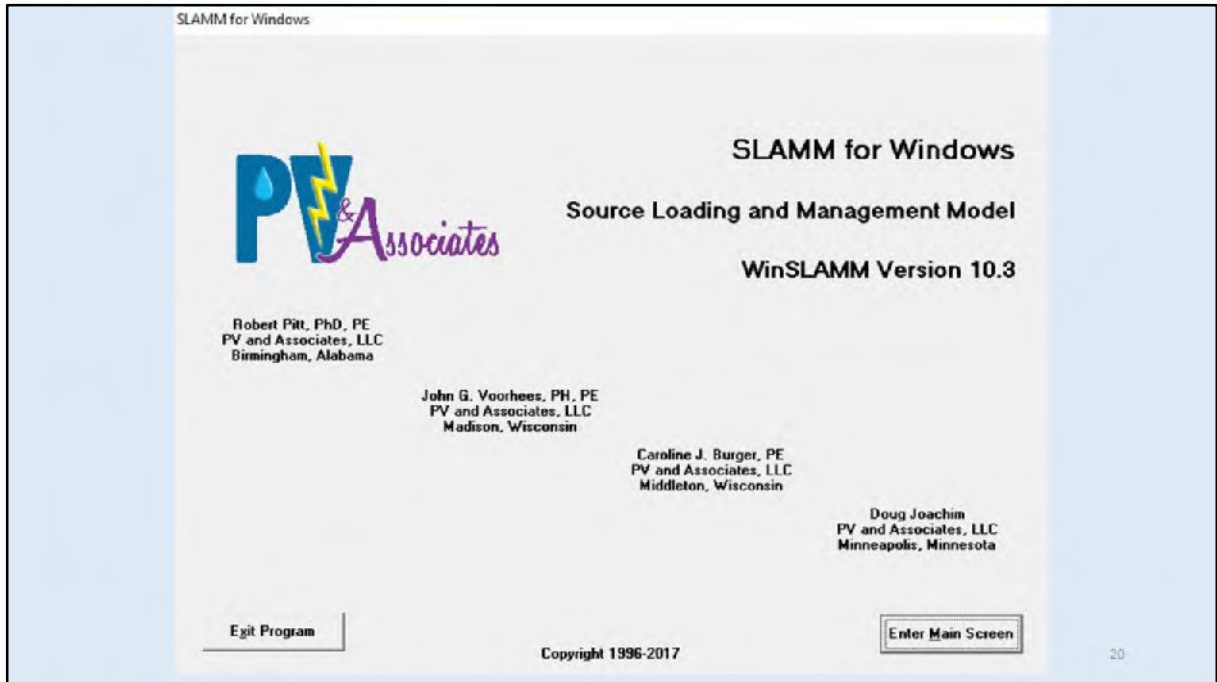


This is a screenshot of the model used to execute this process. As noted, one must go through the area of interest (in this case the Ann Lee subwatershed), select the catch basins contributing to a single outfall, and group those together. The grouped catch basins are labeled using the outfall ID for the outfall they are connected to. In the list above we see the groups of catch basins contributing to the respective outfalls for Town of Colonie outfalls within the Ann Lee Subwatershed. These catch basins are stored in a geodatabase labeled “Tcol.gdb” and this is shown as the blue oval in the model (blue ovals are input features, yellow rectangles are tools, green ovals are outputs of processes, and as will be discussed, the orange figure is an “iterator”). The grouped catch basin feature classes and the flow accumulation “flowacc” (blue oval) are input into the yellow rectangle labeled “Snap Pour Point”. The green oval “snapCB” is the output of this tool, and this, along with flow direction (“flowdir” in the blue oval) serve as the inputs in the yellow rectangle labeled “Watershed”. The output of this process is in the green oval labeled “cbshed” and is the raster of the small watersheds around each catch basin. This is then used as the input for the “Raster to Polygon” (yellow rectangle) and the output “cbpoly.shp” (green oval) is the small watersheds converted to a shapefile (vector format). This shape is then input into the “Dissolve” tool (yellow rectangle), and the output is our final sewershed, labeled as “%Name%.shp”. This label is between “%” because this tells the program that the name of this final output will be the same as the name of the input, meaning each sewershed receives the name of the outfall ID that it is a sewershed for. Once this process is complete,

we go back to the beginning with the orange figure labeled “Iterate Feature Classes”. This iterator makes it so that once the model processes are completed and the sewershed is delineated, the model, and all processes, will repeat on the next group of catch basins for the next outfall. So, once the catch basins are selected and grouped the model can automatically run on many sets of catch basins.



This is an example of a sewershed, derived from the same process, but is in the eastern portion of the Ann Lee Subwatershed. The reason that this image is included is to show that there might not be a large, “neat”, source area contributing to an outfall based on the topography in the DEM, whether or not this is the case. In the reality would need to be field verified



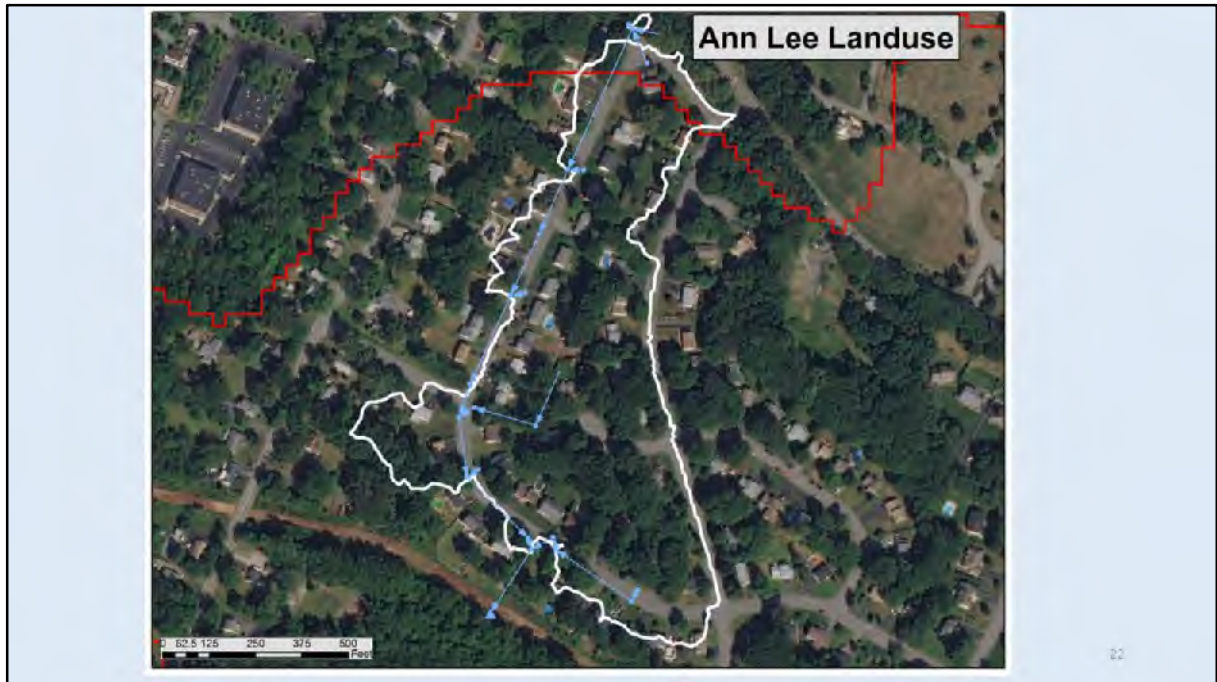
Now that the sewersheds are delineated we can model the system using WinSLAMM (Source Loading and Management Model for Windows) by PV associates. This mathematical model allows us to calculate pollutant concentrations, flow to the outfall, sediment delivery, and simulate various PCSMPs using stormwater infrastructure information

MODEL VS REALITY

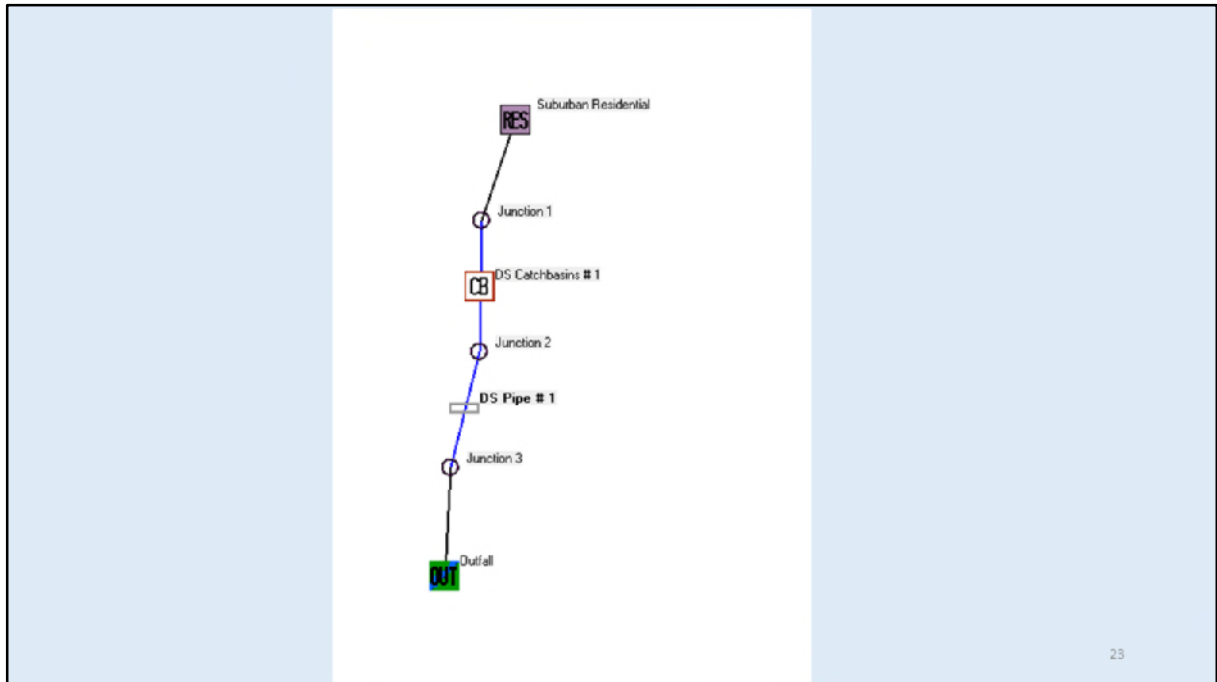
- Model as a tool to simulate and represent real scenarios, but models are NOT reality
 - Modeled systems with relatively high pollutant concentrations may only have minimal pollution when field checked. Conversely, modeled systems with low pollutant concentrations may have high pollutant levels when field checked
- Models are useful for a basic understanding of what might happen in a drainage area over a year, 2 years, 10 years, etc



When discussing modeling we need to start with these caveats. Models are important representations that assist users in understanding processes at a landscape scale, but these are not definitive, and models cannot account for things like illicit discharges. Models cannot determine that someone is dumping oil in a catch basin, but can describe what happens if the land area is mostly parking lots, driveways, etc.



This is our original sewershed, delineated in the white line, take note of the aerial imagery and the land use that we see in the watershed. This land use is classified as “Suburban Residential”



This is a visual representation of the model. The purple box labeled “Suburban Residential” is the land use area, this is connected to our Catch Basins, where stormwater then enters the pipes (“DS Pipe #1), and makes its way to the outfall. The inputs will be elaborated on in subsequent slides.

**Input
Files**

➔

**Math
Processes**

➔

**Output
Files**

Current File Data

SLAMM Data File Name:
C:\WinSLAMM Files\Projects\workinggroup.mdb

Site Descript.:

Edit Seed:

Edit Rain File: C:\WinSLAMM Files\Rain Files\NY Albany\WSPD AP 4899.RAN

Edit Start Date: ☒ Winter Season Range
Edit End Date: Start of Winter (mm/dd): End of Winter (mm/dd):

Edit Pollutant Probability Distribution File: C:\WinSLAMM Files\EastCoast April 05 2014.ppx

Edit Runoff Coefficient File: C:\WinSLAMM Files\EastCoast April 05 2014.rvw

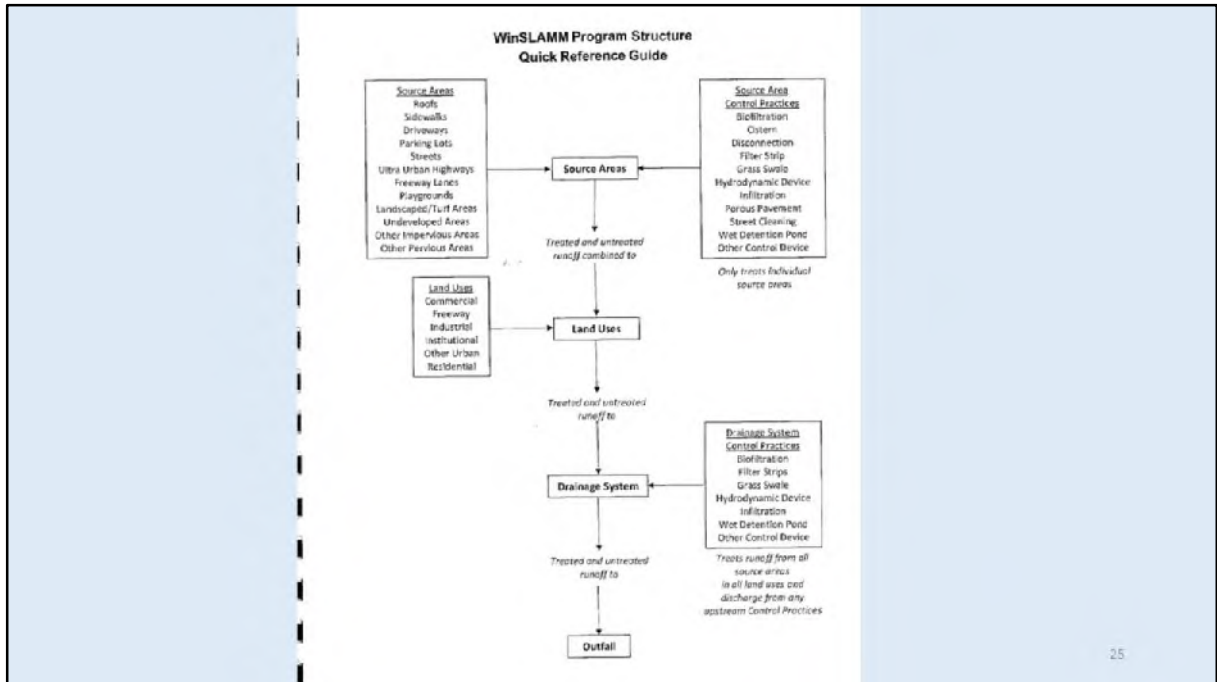
Edit Particulate Solids Concentration File: C:\WinSLAMM Files\EastCoast April 05 2014.psx

Edit Street Delivery File (Select LU)
☒ Residential LU ☐ Other Urban LU
☐ Institutional LU ☐ Freeways ☐ Commercial LU ☐ Industrial LU

Edit Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv

☐ Use Cost Estimation Option

These are the input data files for the WinSLAMM model. They include precipitation (we have data until 2005), pollutant probability, runoff coefficient, particulate solids, 6 different files for source areas, and peak to average flow ratios. These inputs have been calculated based on studies done by the USGS, and by members of PV Associates, and they are calculated for the northeast generally, and precipitation data comes from Albany Airport.



This is the WinSLAMM flowchart of the various source areas and land uses, which contribute to the drainage system, and ultimately result in the outputs at the outfall

Apply Standard Land Use (SLU) Data to a Land Use

Land Use Types Available:	Source Area Name	Area (ac)
High Rise Residential - HRR	Disconnected Pitched Roofs	2.60
High Density Res. with Alleys - HDRWA	Disconnected Paved Parking	0.10
High Density Res. No Alleys - HDRNA	Directly Connected Driveways	1.60
Mobile Homes - MOBH	Disconnected Driveways	1.20
Duplex - DUPLEX	Disconnected Sidewalks	0.10
Medium Density Res. No Alleys - MDRNA	Street Areas 1	0.70
Medium Density Res. With Alleys - MDRWA	Street Areas 2	3.30
Multi Family Residential - MFR	Small Landscaped Areas	84.80
Low Density Residential - LDR	Undeveloped Areas	5.50
Suburban Residential - SUBR	Isolated Areas	0.10

Selected Land Use Type: Suburban Residential - SUBR

Total Area: 100.000

Area of Land Use with Sandy Soils (ac): 16.5

Area of Land Use with Silty Soils (ac):

Area of Land Use with Clayey Soils (ac):

Total Area Allocated to Standard Land Uses (ac):

Create Land Use and Exit

Exit

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These are the generalized land use types with source areas (roofs, parking, undeveloped areas, etc.) attributes described. And the soil texture taken from the SSRGO database. In this sewershed the entire 16.5 acres are on sandy soils.



This is an example of digitization that can be done to focus on describing the area and attributes of the source areas within the sewershed. In most cases the generalized parameters and source area size will be “good enough”, as this method of digitization is time consuming and inefficient

Catchbasin Control Device

Drainage System Control Practice

CP Index #: 1

1. Fraction of drainage area served by catchbasins (0 - 1):

2a. Catchbasin density (cb/ac):

2b. Number of Catchbasins:

3. Average sump depth below catchbasin outlet invert (ft):

4. Depth of sediment in catchbasin sump at beginning of study period (ft):

5. Typical outlet pipe diameter (ft):

6. Typical outlet pipe Manning's n:

7. Typical outlet pipe slope (ft/ft):

8. Typical catchbasin sump surface area (sq ft):

9. Catchbasin Depth from Sump Bottom to street level (ft):

10. Inflow Hydrograph Peak to Average Flow Ratio:

11. Leakage rate through sump bottom (in/hr):

12. Critical Particle Size file name:
Not needed - calculated by program

Typical Catchbasin Densities

☐ Low density residential (0.25 inlets/acre)

☐ Medium density residential (0.5 inlets/acre)

☐ High density residential (1 inlet/acre)

☐ Strip commercial (1.2 inlets/acre)

☐ Shopping center (1.2 inlets/acre)

☐ Industry (0.8 inlets/acre)

☐ Freeways (1 inlet/acre)

Catchbasin Cleaning Dates

Catchbasin Cleaning No.	Catchbasin Cleaning Date (mm/dd/yy)
1	
2	
3	
4	
5	

Select

OR

Press 'F1' for Help

☒ Catchbasin Cleaning Frequency

☐ Monthly

☐ Three Times per Year

☐ Semi-Annually

☐ Annually

☒ Every Two Years

☐ Every Three Years

☐ Every Four Years

☐ Every Five Years

Control Practice #: 1 CP Index #: 1

This is the input file for Catch Basin attributes. In this area we know that there are 20 catch basins, and that the entire area is served by the catch basins (this is because our delineation method is focused on the area contributing runoff to the catch basins). Note that cleaning frequency and pipe attributes are among some of the inputs that can be described here.

Drainage System Pipe Geometry

Press 'F1' for Additional Help

☐ Use Pipe as a Link, without Modifying Hydrograph Timing

1. Pipe Length (ft): 2860

2. Pipe Diameter (ft): 1.25

3. Pipe Slope (ft/ft) 0.020

4. Mannings n 0.013

Copy Pipe Geometry Data Paste Pipe Geometry Data

☐ Copy all values into next Pipe when you place it

Clear

Cancel Continue

Control Practice #: 2 CP Index #: 2

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This is the input describing the pipe attributes once stormwater enters a catch basin. The pipe length is simply the sum of the pipes connecting the system to the outfall, the pipe diameter is averaged based on information we have from system mapping, Manning's number can be derived from the pipe type, and the slope is left at 0.020, which is a default model value.

Pollutant Selection			
	Particulate	Dissolved	Total
Solids	☒	☒	☒
Phosphorus	☒	☒	☒
Nitrates		☒	
TKN	☒	☒	☒
COD	☒	☒	☒
Fecal Coliform Bacteria		☒	
Chromium			
Copper	☒	☒	☒
Lead	☒	☒	☒
Zinc	☒	☒	☒
E Coli (#/100 ml)		☒	
Other 2			
Other 3			
Other 4			
Other 5			
Other 6			

The pollutants listed above are in the file

C:\WINSLAMM FILES\EASTCOAST APRIL 05 2014.PPD\X

Select a pollutant to evaluate it.

This is the file where one can select the pollutants they are interested in. For this simulation all possible pollutants were calculated in the output

Freeway Street Delivery file name: C:\WinSLAMM Files\EastCoast\Freeway.std
 Pollutant Relative Concentration file name: C:\WinSLAMM Files\EastCoast\April 05 2014.ppd
 Start of Winter Season: 12/02 End of Winter Season: 03/12
 Model Run Start Date: 12/21/89 Model Run End Date: 12/21/99
 Date of run: 01-11-2018 Time of run: 15:52:52
 Total Area Modeled (acres): 16.500
 Years in Model Run: 9.99

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of all Land Uses without Controls:	919591	-	215.3	12360	-
Outfall Total with Controls:	919592	0.00%	136.0	7809	36.82%
Annualized Total After Outfall Controls:	92060			781.7	

Pollutant	Concentration - No Controls	Concentration - With Controls	Conc. Units	Pollutant Yield No Controls	Pollutant Yield With Controls	Pol. Yield Units	Percent Reduction
Particulate Solids	215.3	136.0	mg/L	12360	7809	lbs	36.82 %
Filterable Solids	428.0	0	mg/L	24570	0	lbs	100.00 %
Total Solids	643.3	136.0	mg/L	36930	7809	lbs	78.86 %
Particulate Phosphorus	0.4042	0	mg/L	23.20	0	lbs	100.00 %
Filterable Phosphorus	0.1684	0	mg/L	9.670	0	lbs	100.00 %
Total Phosphorus	0.5726	0	mg/L	32.87	0	lbs	100.00 %
Nitrate	0.7297	0	mg/L	41.89	0	lbs	100.00 %
Particulate TKN	1.394	0	mg/L	80.04	0	lbs	100.00 %
Filterable TKN	0.5980	0	mg/L	34.33	0	lbs	100.00 %
Total TKN	1.992	0	mg/L	114.4	0	lbs	100.00 %
Particulate Chemical Oxygen D	52.90	0	mg/L	3037	0	lbs	100.00 %
Filterable Chemical Oxygen De	21.58	0	mg/L	1239	0	lbs	100.00 %
Total Chemical Oxygen Demand	74.49	0	mg/L	4276	0	lbs	100.00 %
Fecal Coliform Bacteria	239514	0	#/100 ml	6.233E+13	0	Count	100.00 %
Particulate Copper	23.53	0	ug/L	1.351	0	lbs	100.00 %
Filterable Copper	19.13	0	ug/L	1.098	0	lbs	100.00 %
Total Copper	42.66	0	ug/L	2.449	0	lbs	100.00 %
Particulate Lead	61.39	0	ug/L	3.524	0	lbs	100.00 %
Filterable Lead	5.149	0	ug/L	0.2956	0	lbs	100.00 %
Total Lead	66.54	0	ug/L	3.820	0	lbs	100.00 %
Particulate Zinc	85.76	0	ug/L	4.923	0	lbs	100.00 %
Filterable Zinc	57.24	0	ug/L	3.286	0	lbs	100.00 %
Total Zinc	143.0	0	ug/L	8.210	0	lbs	100.00 %
Filterable E Coli	3465	0	#/100 ml	9.016E+11	0	Count	100.00 %

This is the general model output text file. The general attributes are at the top of the page. The model run was simulated for a 10 year period. Note the pollutants modeled, and we can see the pollutant yield at the outfall with the controls (Catch Basins in this case) and without the controls.

Other Modelable Controls- Pond

Web Distributed Control Device

Pond Number 1
 Drainage System Control Practice
 Land Use: Suburban Residential
 Source Area: Paved Parking 2
 Total Area: 0.017 acres

Initial Stage Elevation (ft):
 Maximum Inflow into Pond (cfs):
 Enter 0 or leave blank for no limit:

Copy Pond Data Paste Pond Data

Enter Pond Stage Area Values
 Enter fraction (greater than 0) that you want to model at pond area by and then select Modify Pond Area's button

Recalculate Cumulative Volume

Stage (ft)	Area (acres)	Cumulative Volume (ac-ft)
0	0.00	0.0000
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

Not enough data to show device configuration

(Delete Pond) Cancel Continue Press 'F1' for Help

Control Practice #: 4 LP Index #: 3

Add | Sharp Crested Weir

Weir Length (ft)
 Height from datum to bottom of weir opening (ft)

Add | V-Notch Weir

Weir Angle (1/2° segments)
 Height from datum to bottom of weir opening (ft)
 Number of V-Notches

Add | Orifice Set 1

Orifice Diameter (ft)
 Invert elevation above datum (ft)
 Number of orifices in set

Add | Orifice Set 2

Orifice Diameter (ft)
 Invert elevation above datum (ft)
 Number of orifices in set

Add | Orifice Set 3

Orifice Diameter (ft)
 Invert elevation above datum (ft)
 Number of orifices in set

Add | Stone Weeper

Width at bottom of weeper (ft)
 Weeper side slope (L:1V)
 Upstream side slope (L:1V)
 Downstream side slope (L:1V)
 Horizontal flow path length at full of weeper (ft)
 Weeper crest elevation (ft)
 Distance from bottom to top of weeper (ft)
 Height from outlet to bottom of weeper (ft)

Add | Vertical Stand Pipe

Flow diameter (ft)
 Height above datum (ft)

Add | Broad Crested Weir (Recommended)

Weir crest length (ft)
 Weir crest width (ft)
 Height from datum to bottom of weir opening (ft)

Add | Sumpage Basin

Rectangular (ft x ft)
 Width of structure (ft)
 Length of structure (ft)
 Invert elevation of sumpage basin inlet above datum (ft)

Add | Pump

Monthly Evaporation (in/day)
 Variable Withflow Rate (cc P/day)

Stage (ft)
 Natural Seepage Rate (in/hr)
 Drain Outflow Rate (cfs)

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This slide and the next 2 are example input forms for other PCSMPs that can be modeled. Included are ponds, grassy swales, and porous pavement. These PCSMPs can be added if they are actually in the field, or added in a computer simulation to achieve a relative understanding of how pollutants, and discharge would be impacted if these controls were included in the system. Again, these are model outputs meant to provide a general understanding of these systems, but field studies are best at documenting the effectiveness and efficiency of any control practice.

Swale

Grass Swales

Drainage System Control Practice
Grass Swale Number 1
Press 'F1' for Help

Grass Swale Data	
Total Drainage Area (ac)	
Fraction of Drainage Area Served by Swales (0-1)	1.00
Swale Density (ft/ac)	0.00
Total Swale Length (ft)	0
Average Swale Length to Outlet (ft)	0
Typical Bottom Width (ft)	0.0
Typical Swale Side Slope (H : V)	0.0
Typical Longitudinal Slope (ft/ft, V/H)	0.000
Swale Retardance Factor	
Typical Grass Height (in)	0.0
Swale Dynamic Infiltration Rate (in/hr)	0.000
Typical Swale Depth (ft) for Cost Analysis (Optional)	0.0

☐ Use Total Swale Length Instead of Swale Density for Infiltration Calculations

Select Particle Size Distribution File

Particle Size Distribution File Name

Not needed - calculated by program

View Retardance Table

Select Swale Density by Land Use

☐ Low density residential - 240 ft/ac
☐ Shopping centers - 90 ft/ac

☐ Medium density residential - 350 ft/ac
☐ Industrial - 250 ft/ac

☐ High density residential - 375 ft/ac
☐ Freeways (shoulder only) - 480 ft/ac

☐ Strip commercial - 410 ft/ac
☐ Freeways (center and shoulder) - 540 ft/ac

Copy Swale Data
Paste Swale Data
Delete
Cancel
Continue

Control Practice #: 5
CP Index #: 4

Select dynamic infiltration rate by soil type

☐ Sand - 4 in/hr
☐ Loamy sand - 1.25 in/hr
☐ Sandy loam - 0.5 in/hr
☐ Loam - 0.25 in/hr
☐ Silt loam - 0.15 in/hr
☐ Sandy clay loam - 0.1 in/hr
☐ Clay loam - 0.05 in/hr
☐ Silty clay loam - 0.025 in/hr
☐ Silty clay - 0.02 in/hr
☐ Clay - 0.01 in/hr

Total area served by swales (acres)
Total area (acres)

Porous Pavement

Porous Pavement Control Device

Drainage System Control Practice

Land Use: Suburban Residential

Source Area: Paved Parking 2

Total Porous and Upstream Drainage Area: 0.000 ac.

Porous pavement area (acres): 0.000

Inflow Hydrograph Peak to Average Flow Ratio: 3.0

Pavement Geometry and Properties

1 - Pavement Thickness (in)	0.0
Pavement Porosity (>0 and <1)	0.00
2 - Aggregate Bedding Thickness (in)	0.0
Aggregate Bedding Porosity (>0 and <1)	0.00
3 - Aggregate Base Reservoir Thickness (in)	0.0
Aggregate Base Reservoir Porosity (>0 and <1)	0.00
Porous Pavement Area to Agg Base Area Ratio	1.00

Outlet/Discharge Options

Perforated Pipe Underdrain Diameter, 4 used (inches)	0.00
4 - Perforated Pipe Underdrain Outlet Invert Elevation (inches above datum)	0.0
Number of Perforated Pipe Underdrains (<250) or enter	0
Subgrade Seepage Rate (in/hr) - select below or enter	0.000
Use Random Number Generation to Account for Uncertainty in Seepage Rate	☐
Subgrade Seepage Rate (D.V.)	

Underdrain Discharge Percent TSS Reduction (0-100) or leave blank for program to calculate

Select Subgrade Seepage Rate	
☐ Sand - 8 in/hr	☐ Clay loam - 0.1 in/hr
☐ Loamy sand - 2.5 in/hr	☐ Silty clay loam - 0.05 in/hr
☐ Sandy loam - 1.0 in/hr	☐ Sandy clay - 0.05 in/hr
☐ Loam - 0.5 in/hr	☐ Silty clay - 0.04 in/hr
☐ Silt loam - 0.3 in/hr	☐ Clay - 0.02 in/hr
☐ Sandy silt loam - 0.2 in/hr	

Surface Pavement Layer

Initiation Rate Data

Initial Initiation Rate (in/hr)	0.00
Surface Pavement Percent Solids Removal Upon Cleaning (0-100)	0.0

Enter either these three values:

Percent of Initiation Rate After 2 Years (0-100)	
Percent of Initiation Rate After 5 Years (0-100)	
Time Period Until Complete Clogging Occurs (yrs)	

Or this value:

Surface Clogging Load (lb/ft)	0.06
-------------------------------	------

Restorative Cleaning Frequency

- ☒ Never Cleaned
- ☐ Three Times per Year
- ☐ Once Annually
- ☐ Annually
- ☐ Every Two Years
- ☐ Every Three Years
- ☐ Every Four Years
- ☐ Every Five Years
- ☐ Every Seven Years
- ☐ Every Ten Years

Select Particle Size Distribution File

Porous Pavement Geometry Schematic

Percent of Total Area that is Porous Pavement

Not connected to Drainage System



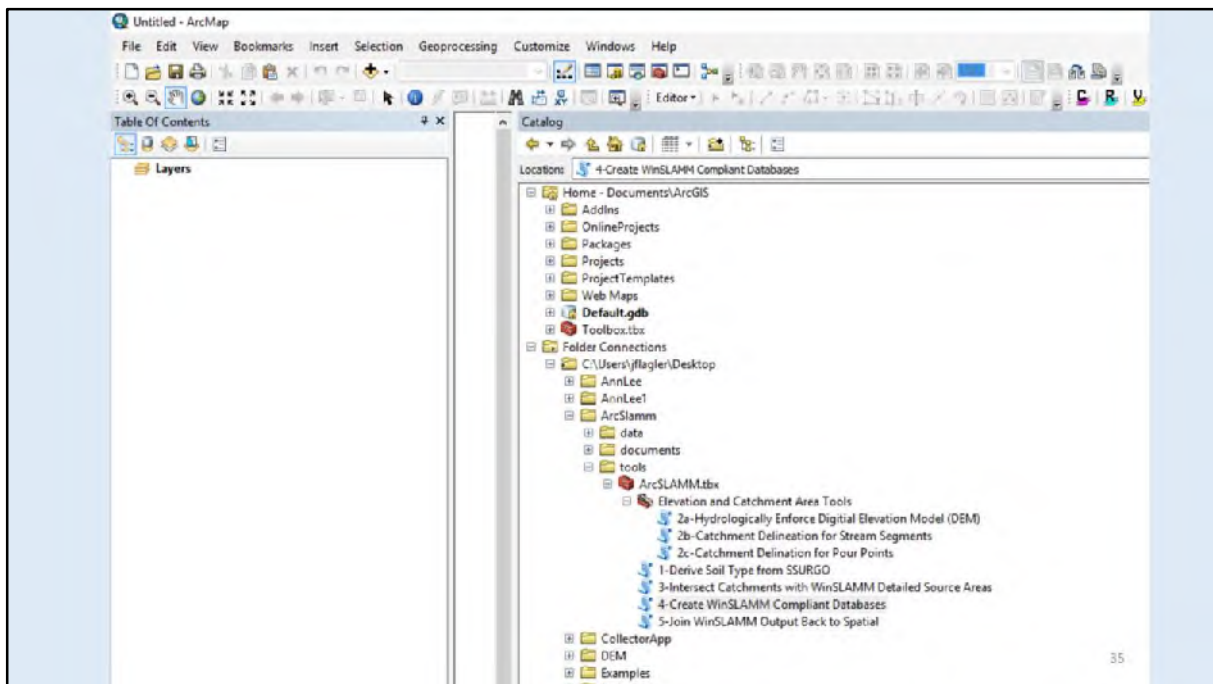
Copy Porous Pavement Data

Paste Porous Pavement Data

Press 'F1' for Help

Not enough data to show device configuration

Control Practice #: 4 CP Index #: 3 Porous Pavement Device Number 1



ArcSLAMM software/toolbox for use of WinSLAMM in ESRI's ArcGIS