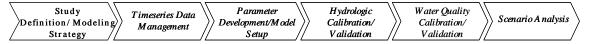
Exercise 1 – Adding Data to a New BASINS Project

STATES - CONSOL - CON

BASINS/HSPF Application Steps



Question addressed in this section:

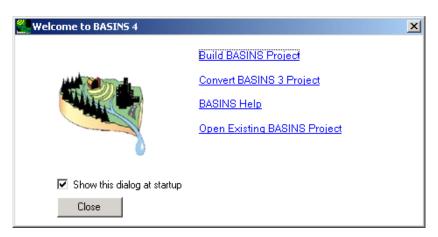
- 1) How do I build a new BASINS project?
- 2) How do I navigate the BASINS 4.0 GIS environment?
- 3) How do I add land use data?
- 4) How do I add NHDPlus data?
- 5) How do I add BASINS census and TIGER line data?
- 6) How do I add BASINS Digital Elevation Model (DEM) grids?
- 7) How do I import other shapefiles?
- 8) How do I download timeseries data for use in modeling?

A. Building a BASINS Project

QUESTION ANSWERED:

1) How do I build a BASINS project?

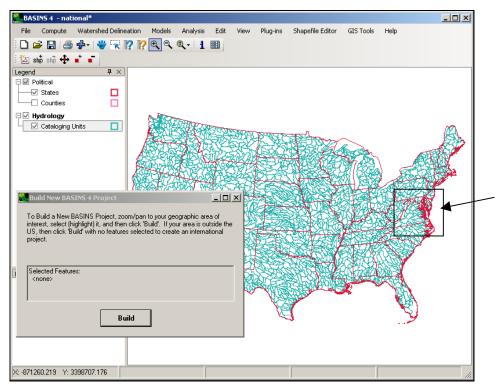
1. From the **Start** menu under **Programs**, select **BASINS** and then **BASINS 4**. The "Welcome to BASINS 4" window will open.



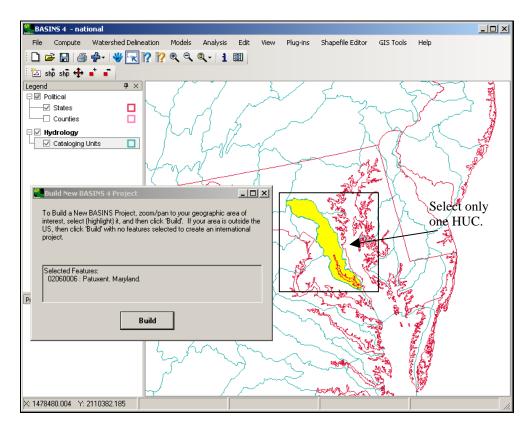
2. Click the "Build BASINS Project." The following window will open.

EASINS 4 - national*	
File Compute Watershed Delineation Models Analysis Edit Vie	w Plug-ins Shapefile Editor GIS Tools Help
ं 🗋 🖆 🗐 🖆 🦊 🐨 院 🦹 🔍 🔍 🔍 🔍 🕄	
🖄 ship ship 💠 📲	
Legend	
Political	
States 🔲	
Counties	
P V Hydrology	
Cataloging Units	MA I
	HERE AND
🛃 Build New BASINS 4 Project	
To Build a New BASINS Project, zoom/pan to your geographic area of interest, select (highlight) it, and then click 'Build'. If your area is outside the	
US, then click 'Build' with no features selected to create an international	
project.	
	ASHAR ARABARA RANA
Selected Features: <none></none>	
Build	A
X: -871260.219 Y: 3398707.176	
, , , , , , , , , , , , , , , , , , , ,	, , , , , , , , , , , , , , , , , , , ,

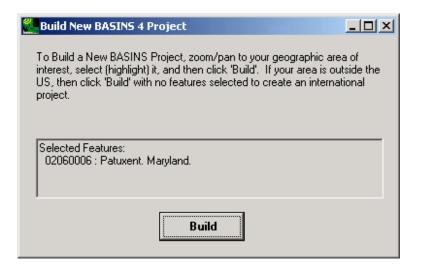
3. Click (Zoom In tool). Using the "Zoom In" tool, zoom into the area near the states of Virginia and Maryland.



- 4. Click (Select Feature tool).
- 5. Click the Patuxent Watershed (Cataloging Unit number 02060006). Notice that the description of the selected feature(s) appears in the "Build New BASINS 4 Project" window.



6. Click BUILD in the "Build New BASINS 4 Project" window.



7. Enter "Patuxent.mwprj" as the file name.

Save new projec	t as				<u>? ×</u>
Save jn:	02060006		•	🗕 🖻 💣 🎟 •	
History Desktop Runner My Network P					
	File <u>n</u> ame:	Patuxent.mwprj		•	<u>S</u> ave
	Save as <u>t</u> ype:			_	Cancel

8. Click SAVE. The "Projection Properties" window will open.

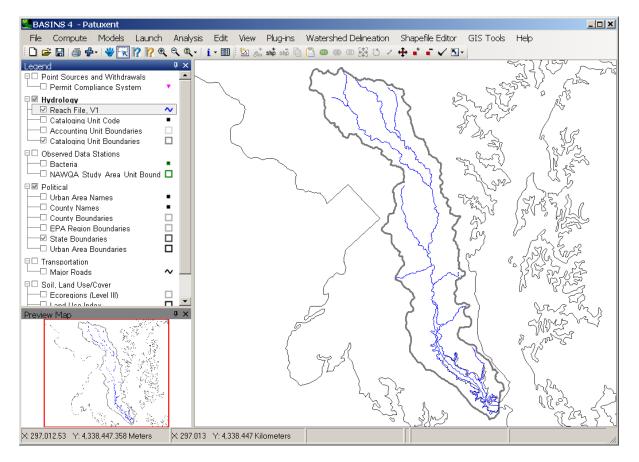
nojectio	n Properties	_ _ _ ×
	Standard C Custom	
Category	Projections of the World Geographic	_
Name Spheroid	Sphere	
	<u>O</u> K Cancel	

- 9. From the "Category" menu, select "UTM 1983."
- 10. From the "Type" menu, select "Zone 18."

🌉 Projectio	n Properties		<u> </u>
	Standard	C Custom	
Category Name Spheroid	UTM - 1983 Zone 18 GRS 80		•
	<u>0</u> K	Cancel	

11. Click OK. At this point the data will be downloaded, extracted, and projected. Wait while this process proceeds.

Downloaded 18 Layers
OK



12. Click OK. The new BASINS project will open.

B. Navigating the BASINS 4.0 GIS Environment

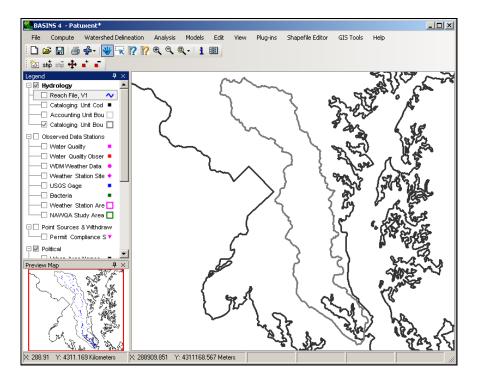
QUESTION ANSWERED:

2) How do I navigate the BASINS 4.0 GIS environment?

Notice that within the BASINS 4.0 GIS environment there are three distinct panels. The most prominent one is the map itself. To the left of the map is the legend showing which layers are currently available and/or displayed on the map. In the bottom left corner is the preview map providing an image of the map zoomed to the full extent of all layers. The preview map can be used to orient you within the many map layers.

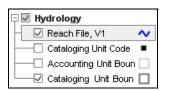
Notice in the map legend that sets of layers are combined into logical groups. For instance layers pertaining to hydrology are listed in a group labeled 'Hydrology.' Similar groups exist for Observed Data, Political Boundaries, Point Source Data, Transportation Layers, etc.

1. The *Reach File*, *V1* layer is currently "on" because the box is checked next to its name. Click the check box next to *Reach File*, *V1* to turn this layer "off." Notice that



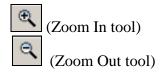
when you do so, the blue lines disappear from the map.

2. Now turn it back "on" by clicking the check box again. Notice that the *Reach File*, *V1* name in the "Table of Contents" is shaded and surrounded by a box (see figure below). This means the layer is "active."



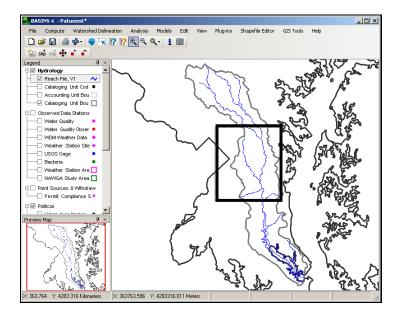
Zooming Tools

BASINS 4.0 has typical GIS tools for zooming in and out.

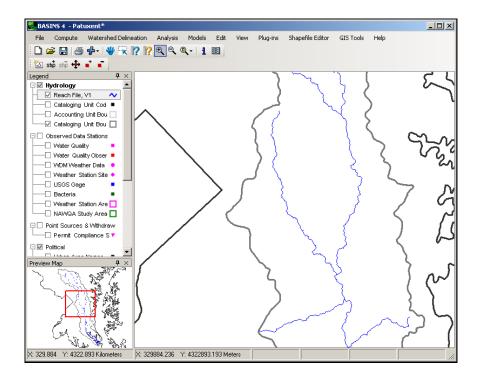


1. Click (Zoom In tool).

2. Drag a box on the map around the area you would like to zoom to.



Notice that the map zooms into that area.



3. **Right click** on the *Cataloging Units Boundary* layer and select "Zoom to Layer." This will return the map to the full extent of the *Cataloging Units Boundary* layer.

- 🔽 Cataloging Unit Bou	
Diserved Data Station	Add Group
	Add Layer
	Remove Layer
	Clear Layers
	Zoom to Layer
—— USGS Gage 📃	200m to Layer
Bacteria	View Metadata
	View Attribute Table
	Expand Groups
Point Sources & Withd	
Permit Compliance	Expand All
	Collapse Groups
Political	Collapse All
eview Map	
	Properties
N 34 38 438 -	

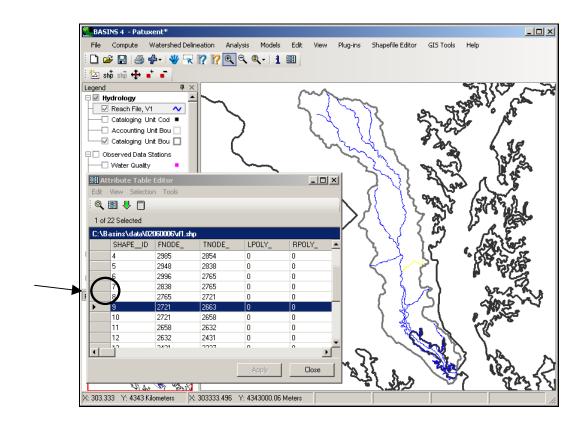
Table Editor Tool

BASINS 4.0 has a "Table Editor tool", BASINS 4.0 has a "Table Editor tool", but the attributes associated with map features.

- 1. Make sure the *Reach File*, *V1* layer is "on" and "active."
- 2. Click (Table Editor tool). The "Attribute Table Editor" will appear. It displays the attribute table associated with the "active" layer.

A1 lit	ttribute Ta View Sek	ble Editor ection Too						
		SCUOIT TOU	л 5					
	1 🕂 🗖							
~f	22 Selected							
_ا B،	ASINS\dat							
	SHAPE_I	FNODE_	TNODE_	LPOLY_	RPOLY_	LENGTH	RF1_	RF1_ID
	0	3045	2985	0	0	0.132863	1619	2008
	1	3034	2948	0	0	0.3162	1620	2009
	2	3051	2996	0	0	0.401804	1621	2010
	3	2948	2883	0	0	0.113995	1622	2011
	4	2985	2854	0	0	0.278523	1623	2012
	5	2948	2838	0	0	0.472969	1624	2013
	6	2996	2765	0	0	0.55747	1625	2014
	7	2838	2765	0	0	0.121823	1626	2015
	8	2765	2721	0	0	0.068366	1627	2016
	9	2721	2663	0	0	0.144631	1628	2017
	10	2721	2658	0	0	0.089696	1629	2018
	11	2658	2632	0	0	0.047687	1630	2019
	12	2632	2431	0	0	0.29027	1631	2020
	13	2431	2327	0	0	0.289488	1632	2021
	14	2327	2193	0	0	0.21747	1633	2022
								•
						Арр	. 1	Close

3. Select a cell in the left-most column of the table. The feature corresponding to the row you selected will be highlighted in yellow on the map.



4. Close the "Attribute Table Editor" window.

C. Importing Land Use Data

QUESTION ANSWERED:

2) How do I add land use data?

BASINS 4.0 provides access to land use data in 3 forms: GIRAS land use data from the 1970s, and National Land Cover Data (NLCD) for 1992 and 2001. The GIRAS data is in shapefile format, and the NLCD data is distributed as grids. For this example we will download and add the GIRAS land use to our project because these files are relatively quick to download and reproject.

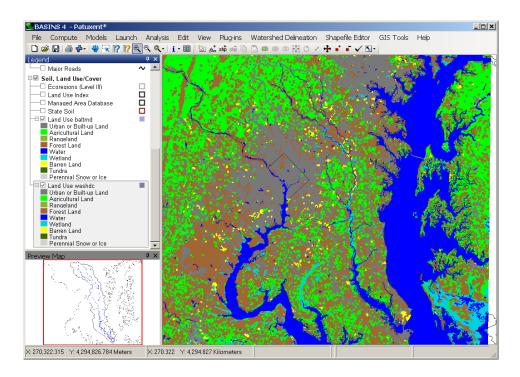
- 1. From the **File** menu, select **Download Data**.
- 2. With the 'Region to Download' set to 'Hydrologic Unit 02060006', check the box next to "GIRAS Land Use."

Download Data				×
Region to Download	Hydrologic Unit 020	060006		•
DEM Shape	GIRAS Land Use		Census	🗆 303(d)
National Hydrography			i Meteorologi	
		Catchments		
Elevation Grid		Hydrography	/	
Flow Direction Grid		🗆 Hydrologic U	Jnits	
Flow Accumulation	Grid	🗆 Streamgage	Events	
Station Locations from	US Geological Survi Water Quality	ey National Wate		
Data Values from US Station Locations mus				
National Land Cover E	Data 2001			
Land Cover	Impervious	Canopy	🗖 1992 Land C	over
EPA STORET Water (Quality Results			
Merge	Clip to Region		Cancel	Download

- 3. Click DOWNLOAD.
- 4. Click OK when the data has been downloaded.

Download Complete 🛛 🗙
Downloaded 2 Layers
ок

- Note: The GIRAS Land use data comes in tiles. There are two land use tiles that contribute to the Patuxent watershed: "*l_baltmd.shp*" and "*l_washdc.shp*," corresponding to Baltimore, Maryland, and Washington DC, respectively. We added both of these layers to the Patuxent project.
- 5. Scroll down in the "Table of Contents" to *Land Use baltmd* and *Land Use washdc*. Click the '+' next to the layer name to expand the legend for each layer. Your view should look like the following.



- **Note:** You probably can not see the outline of your watershed very well. If you want, you can change the color and/or thickness of the boundary by double clicking on the *Cataloging Unit Boundaries* layer and changing the line thickness.
- 6. Turn "off" *Land Use baltmd* and *Land Use washdc*.
 - Note: Often, users may have an alternative land use layer available to them that is more detailed or recent than the land use layer in the core BASINS data set. A new land use layer can be imported into a BASINS project using the BASINS "Add Layer" button. Additionally, the National Land Cover Data (NLCD) for 1992 and 2001 can be downloaded and added to your project by using the Download Data tool. Once a new land use data set is added, it can be reclassified using the Reclassify Land Use tool.

D. Importing NHDPlus Data

QUESTION ANSWERED: 4) *How do I add NHDPlus data?*

The National Hydrography Dataset (NHD) is a more complete hydrography layer than the Reach File, V1 (RF1) layer in the BASINS core data set. NHDPlus incorporates features of other national data sets with the NHD, adding additional map layers and additional attributes to the NHD.

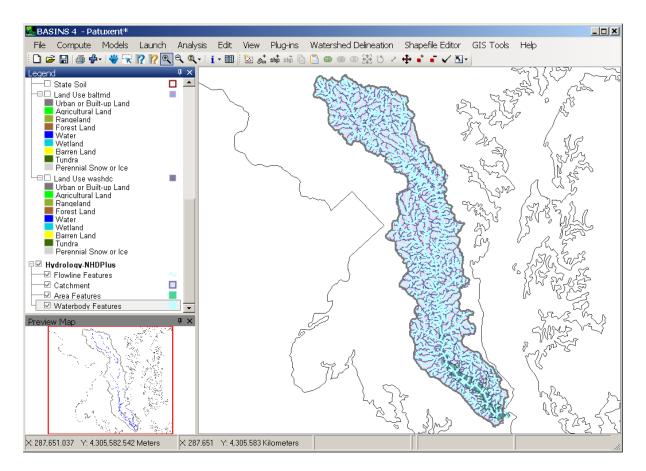
- 1. From the **File** menu, select **Download Data**.
- 2. Check the box next to "Catchments" and "Hydrography" within the NHDPlus section of the Data Download tool.

Download Data					>
Region to Download	Hydrologic Unit 020	60006			•
-BASINS	,				
DEM Shape	GIRAS Land Use		🗖 Census	🗖 303(d)	
🗖 DEM Grid	C Legacy STORET		🗖 Meteorolog	gic 🗀	
National Hydrography	Dataset Plus				
I All		🔽 Catchments			
Elevation Grid		Hydrograph	у		
Flow Direction Grid		🗆 Hydrologic U	Jnits		
Flow Accumulation (Grid	🗆 Streamgage	e Events		
Station Locations from	US Geological Surve	ey National Wate	r Information Syst	em	
🗖 Daily Discharge	🗖 Water Quality	🗆 Measureme	nts 🗖 Groun	d Water	
Data Values from US C	Geological Survey Na	ational Water Info	rmation System -		
Station Locations mus	t be selected on the r	nap before data	value download		
National Land Cover D	ata 2001				
Land Cover	🗖 Impervious	🗆 Canopy	🗖 1992 Land	Cover	
EPA STORET Water C	Quality				
Stations	Results				
□ Merge	Clip to Region		Cancel	Download	4

3. Click DOWNLOAD. When the download has finished, the following window will appear.

Download Complete	×
Downloaded 4 Layers	
ОК	

4. Click OK. Turn off the *RF1* layer, and scroll down the table of contents until you see the NHDPlus *Flowlines, Catchments, Area Features,* and *Waterbody Features* in a group entitled 'Hydrology-NHDPlus'. You may wish to zoom closer to examine these new layers.



5. Turn "off" the NHDPlus layers, and turn "on" the *RF1* layer again.

E. Importing the BASINS Census and TIGER Line Data

QUESTION ANSWERED:

5) How do I add BASINS Census and TIGER line data?

The BASINS Census data includes boundary information and tabular data from the 1990 and 2000 Census, as well as TIGER line data such as detailed roads and railroads.

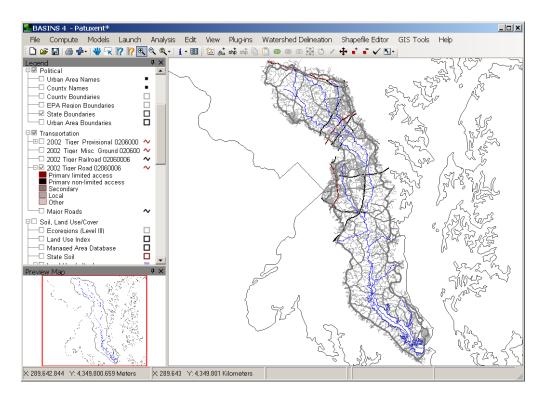
- 1. From the **File** menu, select **Download Data**.
- 2. Check the box next to "Census."

Download Data				×
Region to Download	Hydrologic Unit 020	160006		•
DEM Shape	GIRAS Land Use			ic 🔁
National Hydrograph	y Dataset Plus			
🗆 All		Catchments		
Elevation Grid		🗆 Hydrograph	ıу	
Flow Direction Grid	k	Hydrologic	Units	
Flow Accumulation	n Grid	🗖 Streamgage	e Events	
Station Locations from	m US Geological Surve			
	Geological Survey Na ust be selected on the r		-	
National Land Cover	Data 2001			
🗖 Land Cover	Impervious	🗖 Canopy	🗖 1992 Land (Cover
EPA STORET Water	Quality			
Merge	Clip to Region		Cancel	Download

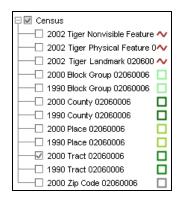
3. Click DOWNLOAD. When the download has finished, the following window will appear.

Download Complete 🛛 📕
Downloaded 16 Layers
OK

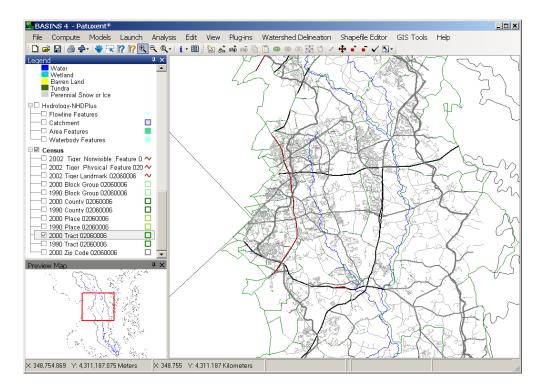
- 4. Click OK.
- 5. Scroll down in the "Table of Contents" to see the group of "Census" layers.
- 6. Scroll up in the "Table of Contents" to see the group of "Transportation" layers. Notice that the 2002 Tiger Road 02060006 layer was automatically turned "on" when the BASINS Census data was downloaded.



- 7. Click the '+' next to 2002 *Tiger Road* 02060006 layer to see the different types of roads.
- 8. Turn "on" the 2000 Census Tract 02060006 boundaries layer.



9. Zoom in to a portion of the watershed to see the detail of the 2002 *Tiger Road* 02060006 layer using the zoom tool.



10. Turn "off" 2002 Tiger Road 02060006 and 2000 Census Tract 02060006. **Right** click on the Cataloging Unit Boundaries layer and use the "Zoom to Layer" feature to return to the full extent of the Cataloging Unit.

F. Importing the BASINS Digital Elevation Model (DEM) Grids

QUESTION ANSWERED:

6) How do I add BASINS DEM grids?

A digital elevation model (DEM) is a grid of elevations. Each grid cell contains one elevation value and the assembly of grid cells represents the topography of a coverage area. The DEM is useful in topographic relief mapping and watershed delineation. DEMs are available through BASINS as either shapefiles or GeoTiff grids. Since this data is most conventionally used in grid format, we will download the grid format DEM.

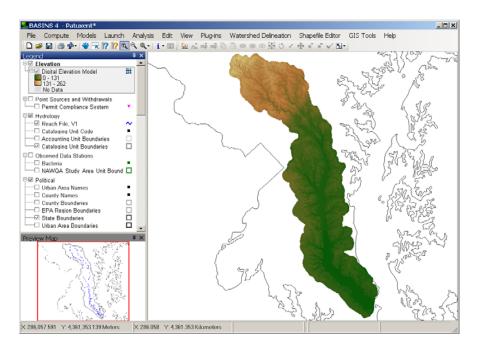
- 1. From the **File** menu, select **Download Data**.
- 2. Check the box next to "DEM Grid".

Download Data					×
Region to Download	Hydrologic Unit 020	60006		_	
DEM Shape DEM Grid	GIRAS Land Use		Census	🗆 303(d)	
National Hydrograph					
	-	Catchments			
Elevation Grid		Hydrography			
Flow Direction Grid	ł	Hydrologic Units			
Flow Accumulation Grid Streamgage Events					
Station Locations from US Geological Survey National Water Information System					
	Geological Survey Na ist be selected on the m		· · · · ·		
National Land Cover			_]
Land Cover	□ Impervious	Canopy	🗖 1992 Land (Cover	
EPA STORET Water	Quality Results				
Merge	Clip to Region	[Cancel	Download	

3. Click DOWNLOAD. When the download has finished, the following window will appear.

Download Complete
Downloaded Layer: Digital Elevation Model
ОК

- 4. Click OK. The *Digital Elevation Model* layer will be added to your "Table of Contents" under the "Elevation" group.
- 5. Turn "on" the *Digital Elevation Model* layer, and click the '+' next to the layer in the "Table of Contents."



- 6. Zoom into a section of the Cataloging Unit.
- 7. Click (Identify Tool) and then click around to view some elevation values in the watershed.
- 8. Turn "off" the grid layer *Digital Elevation Model*. **Right click** on the *Cataloging Unit Boundaries* layer and use the "Zoom to Layer" feature to return to the full extent of the Cataloging Unit.

G. Adding Additional Shapefiles to the Map

QUESTION ANSWERED:

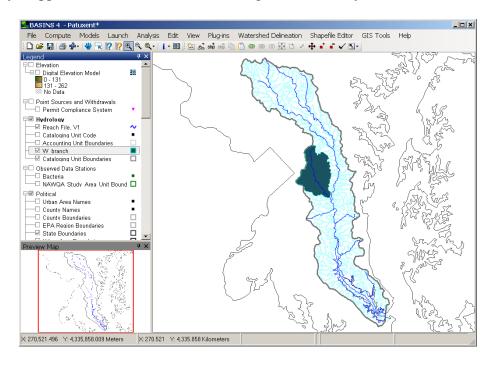
7) How do I import other shapefiles?

Users will often have additional GIS layers that would be useful to display along with the BASINS layers (e.g., a study area boundary). Users can import their own shapefile layers using the BASINS "Add Layer" tool.

- 1. Turn "on" the *NHDPlus Flowline Features* layer.
- 2. From the **View** menu, select **Add Layer**, or click the button.
- 3. Navigate to *c*:*basins**Predefined Delineations*. Select "*w_branch.shp*" and click OPEN.

Add Map Layer					<u>?</u> ×
Look jn:	Predefined D	elineations	•	🗢 🗈 💣 🎫	
History Desktop Runner Wy Network P	West Branch W_branch.shp	1			
	File <u>n</u> ame:	W_branch.shp		•	<u>O</u> pen
	Files of type:	All supported formats		•	Cancel

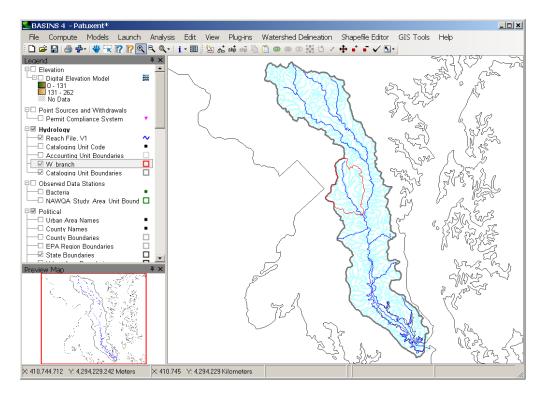
4. The layer *W_branch* will be added to the "Table of Contents" and turned "on." This layer appears filled in. We want to change it so that only the outline is visible.



5. **Double click** *W_branch* in the "Table of Contents." The "Legend Editor" will appear.

Number 2015 Legend Editor	
1 2↓	
Coloring Scheme	
ColoringScheme	[None]
Display Properties	s
FillColor	4, 142, 35
FillStyle	fsNone
LineStyle	IsNone
OutlineColor	Red 💌
OutlineWidth	1
ShowFill	False

- 6. In the "Legend Editor," change the "OutlineColor" to "Red" and "ShowFill" to "False."
- 7. Close the "Legend Editor." The layer will appear as shown below.



8. From the **File** menu select **Save**.

H. Adding Timeseries Data to our Project

QUESTION ANSWERED:

8) How do I download timeseries data for use in modeling?

When setting up a new project you will want to download the meteorological timeseries data necessary for modeling. This section focuses on using the "Data Download" tool to retrieve meteorological data and create a meteorological WDM file (which contains the required weather data for HSPF) for our current project. Later in the training, the contents and uses of WDM files will be discussed.

Prior to the October 2007 update to BASINS 4.0, BASINS meteorological WDM files were distributed by state. These files were very limited in scope, with an average of only 10 stations per state, and the data were only provided through the year 1995.

With the October 2007 (or later) update to BASINS 4.0 installed, BASINS provides more comprehensive and recent meteorological data for modeling. The updated database contains

data at over 16,000 stations, although not all stations are still active and most of them contain only a subset of all the meteorological constituents used in BASINS. For those stations that are current, data have been updated through the year 2006.

The following steps show how to download the updated BASINS Meteorological data.

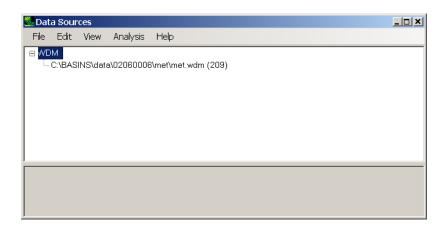
- 1. From the **File** menu, select **Download Data**.
- 2. Check the box next to "Meteorologic".

Download Data					×
Region to Download	Hydrologic Unit 02060006			•	
BASINS					
🗖 DEM Shape	GIRAS Land Use	e 🗖 NED	🗖 Census	🗖 303(d)	
🗖 DEM Grid	Legacy STORE	r 🗖 NHD	Meteorolog	jic 🗀	
National Hydrography	Dataset Plus				
🗆 All		Catchments			
Elevation Grid		🗆 Hydrography	/		
Flow Direction Grid	Hydrologic Units				
Flow Accumulation	Grid 🗖 Streamgage Events				
Station Locations from US Geological Survey National Water Information System					
🗖 Daily Discharge	🗖 Water Quality	🗆 Measureme	nts 🗖 Ground	d Water	
Data Values from US (Geological Survey Na	ational Water Info	rmation System –		
Station Locations mus	t be selected on the i	map before data	value download		
National Land Cover E)ata 2001				
Land Cover	🗆 Impervious	🗆 Canopy	🗖 1992 Land	Cover	
EPA STORET Water (Quality				
Stations	Results				
🗖 Merge	Clip to Region		Cancel	Downloa	d)

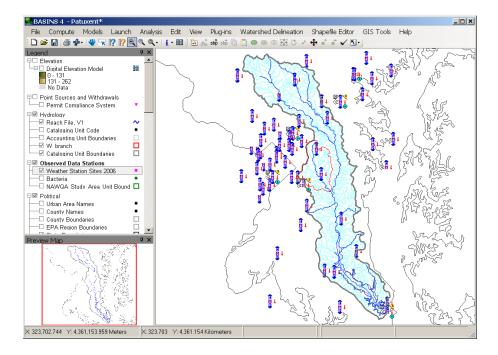
3. Click DOWNLOAD. While the data is downloading, you will see a progress message at the bottom of the main BASINS window. When the download has finished, the following window will appear.

Download Complete
Downloaded Layer: Weather Station Sites 2006Downloaded Data file: C:\BASINS\data\02060006\met\met.wdm
ОК

4. Click OK. The following 'Data Sources' window will appear showing us the timeseries files available within this project. The 'met.wdm' file shown in this window was just added during the previous download step. We will discuss this window more in a later exercise.

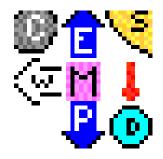


- 5. Close the 'Data Sources' window by clicking the 'X' in the top right corner.
- 6. The *Weather Station Sites 2006* layer will be added to your "Table of Contents" under the "Observed Data Stations" group.



The symbols on the map indicate the locations of the new met data and the types of data available at each location. The location of each station is represented by a fuchsia box marked with the letter 'M', surrounded by icons representing the meteorological constituents available at that location.

The icon below shows a station with all of the possible meteorological constituents available.



Where:

- Blue arrow containing a 'P' and pointing down = precipitation
- Blue arrow containing an 'E' and pointing up = potential evapotranspiration
- White arrow containing a 'W' and pointing sideways = wind speed
- Grey cloud containing a 'C' = cloud cover
- Yellow sun containing an 'S' = solar radiation
- Red (thermometer) icon = air temperature
- Cyan water drop containing a 'D' = dewpoint temperature

The resulting WDM file containing the actual time-series data is named met.wdm and is stored in the BASINS project directory (e.g., \BASINS\Data\02060006\). We will discuss details of the BASINS met WDM files in another exercise, and as we set up the watershed model.

- 7. Turn "off" the *Weather Station Sites 2006* layer.
- 8. From the **File** menu select **Save** to save the project.