Exercise 1 – Adding Data to a New BASINS Project

BASINS/HSPF Application Steps

Study Definition/ Modeling Strategy	Timeseries Data Management	Parameter Development/Model Setup	Hydrologic Calibration/ Validation	Water Quality Calibration/ Validation	Scenario Analysis
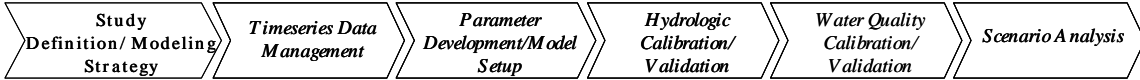
Question addressed in this section:

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?

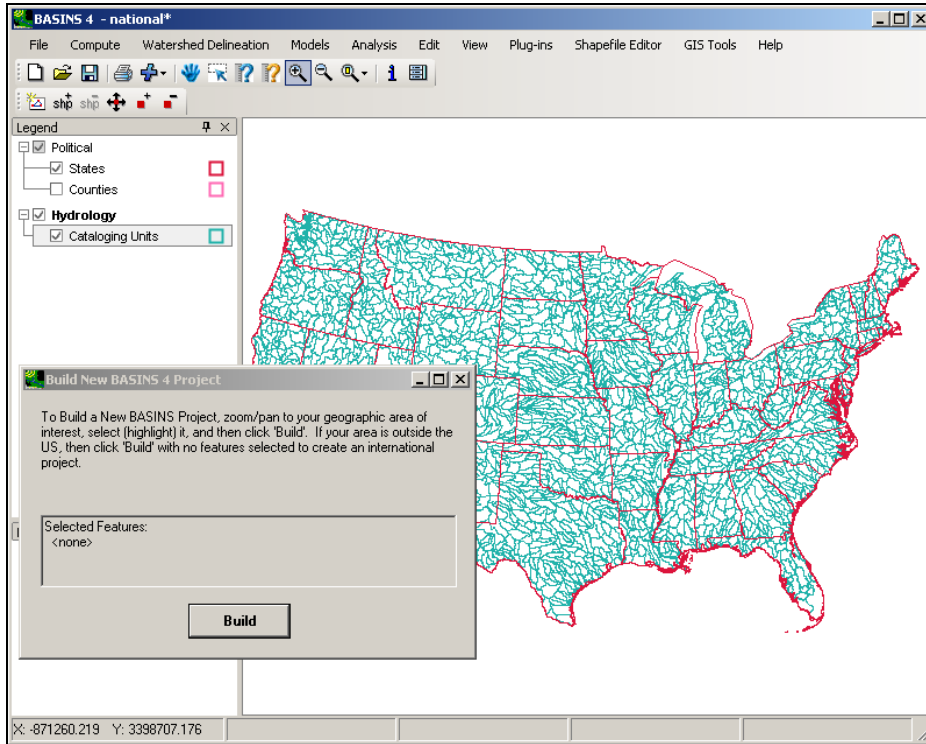## A. Building a BASINS Project

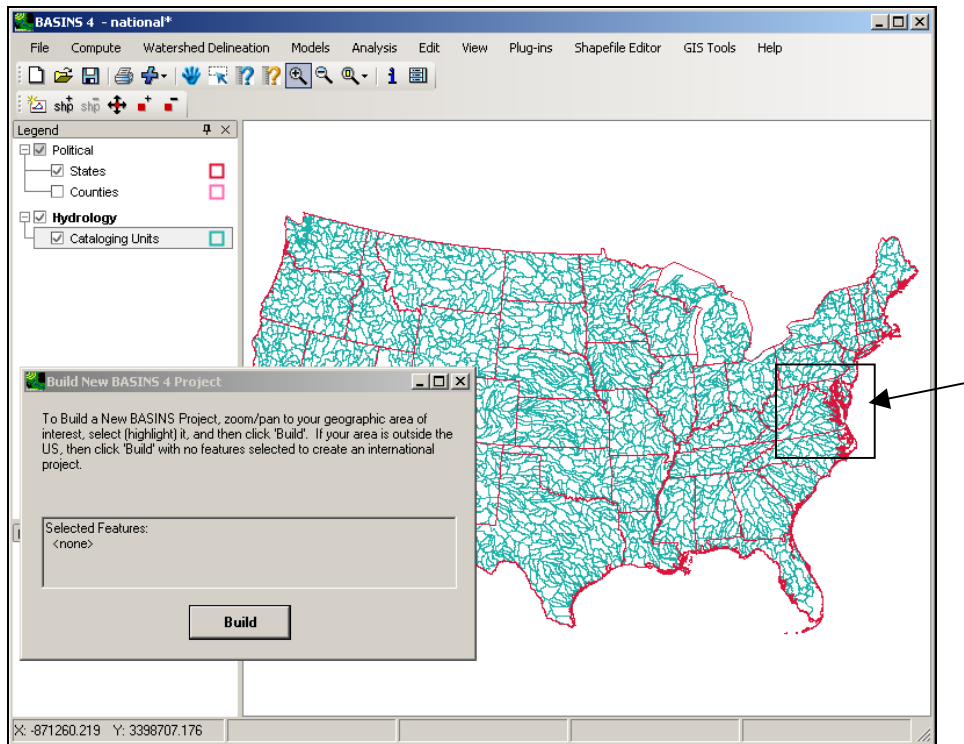*QUESTION ANSWERED:*
1) How do I build a BASINS project?

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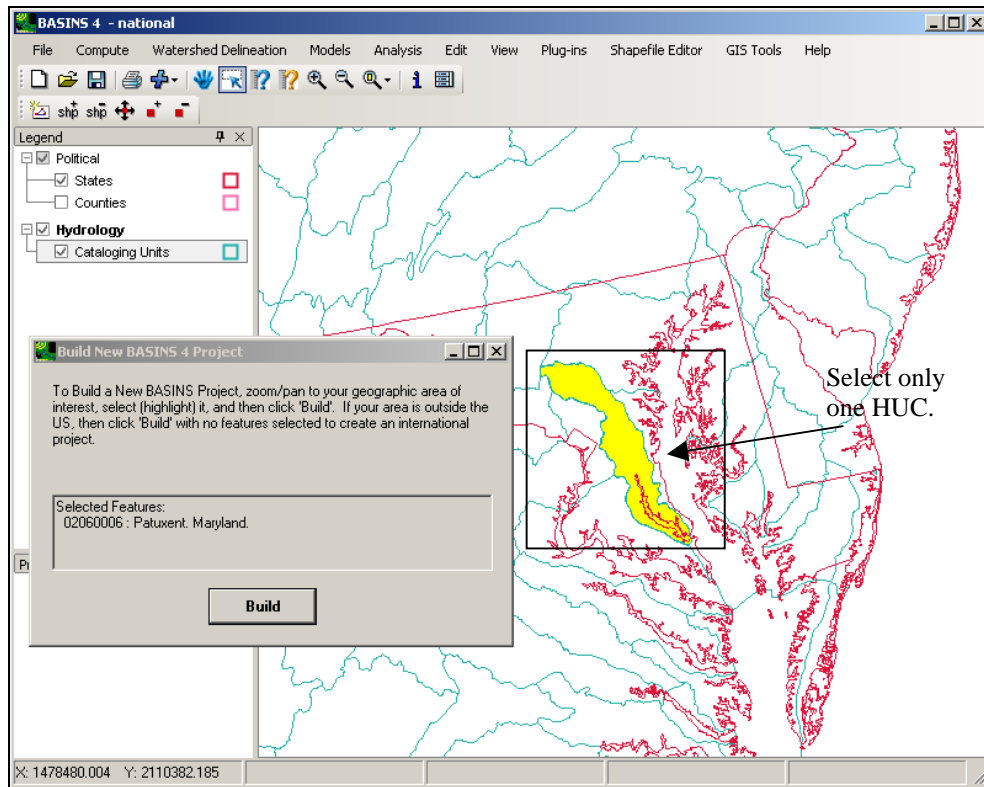

2.   Click the "Build BASINS Project." The following window will open.

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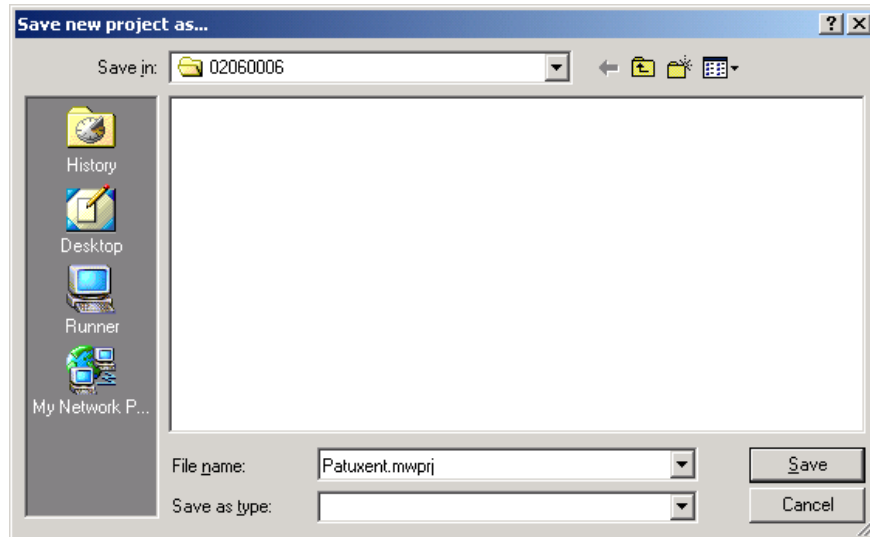
4.   Click ⬚ (Select Feature tool).

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.
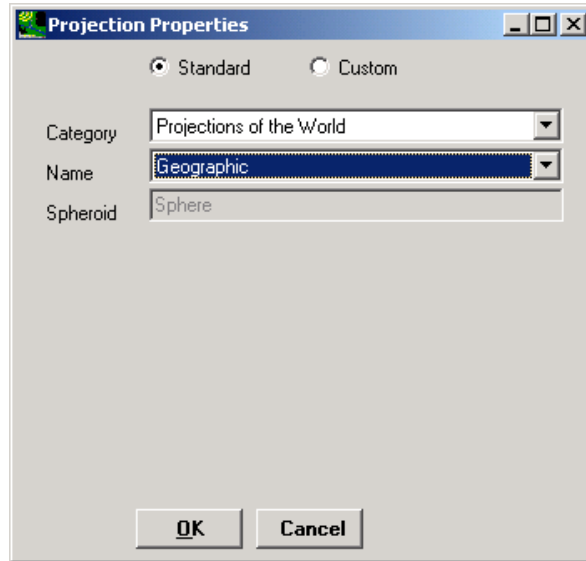

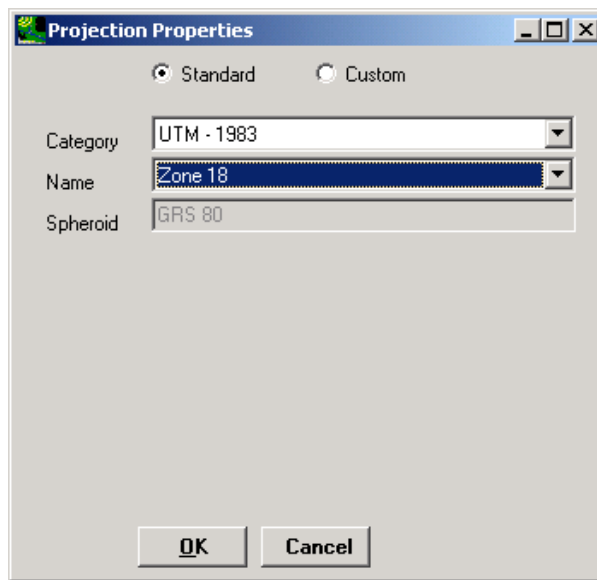6.   Click BUILD in the "Build New BASINS 4 Project" window.
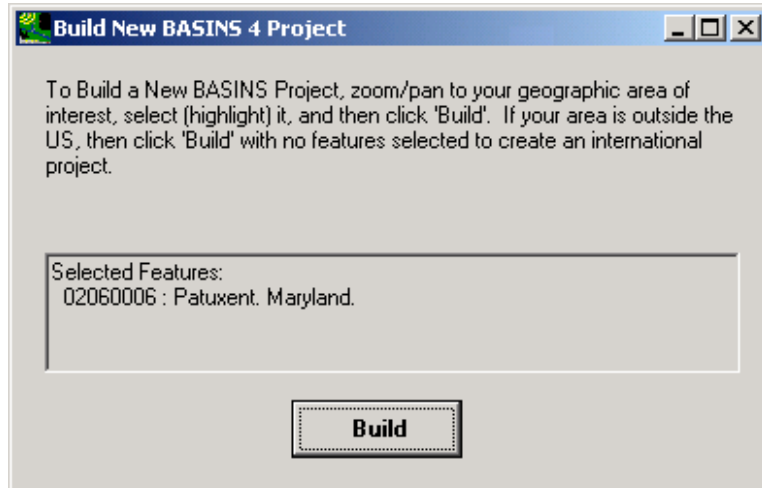
7.   Enter "Patuxent.mwprj" as the file name.
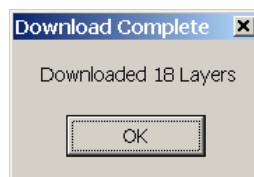

8.   Click SAVE. The "Projection Properties" window will open.
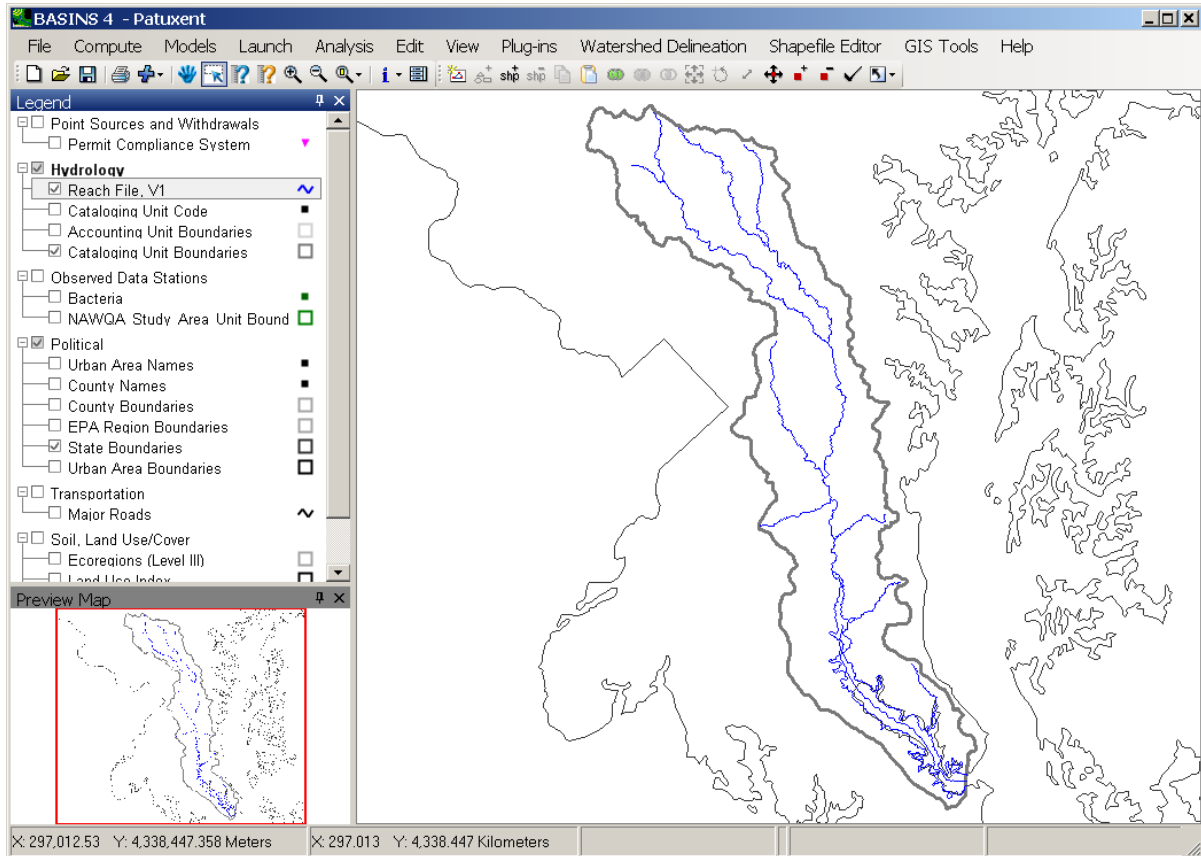
9. From the "Category" menu, select "UTM – 1983."

10. From the "Type" menu, select "Zone 18."

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

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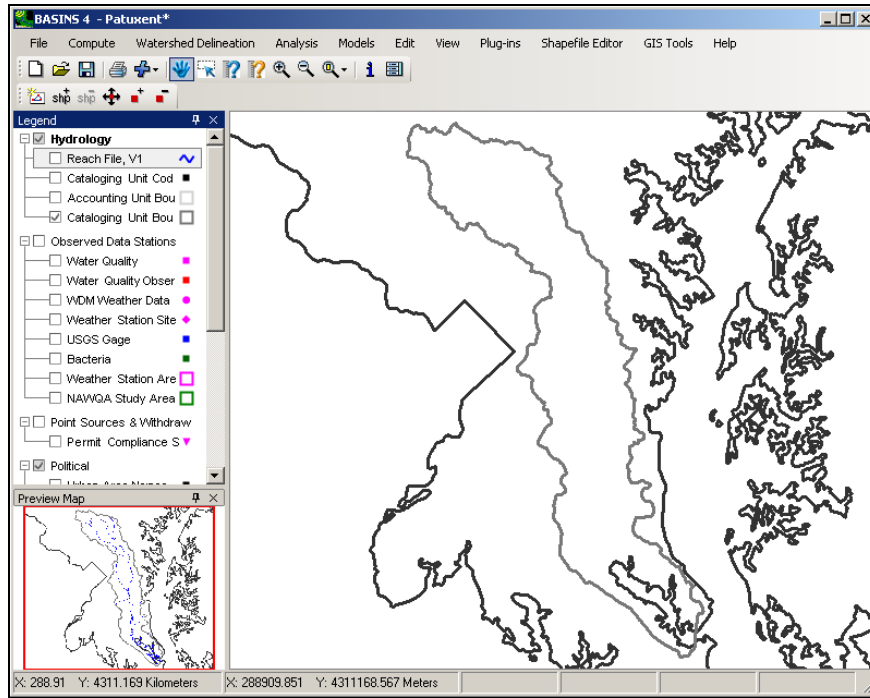
2.   Now turn it back "on" by clicking the check box again. Notice that the *Reach File, V1* name in the "Table of Contents" is shaded and surrounded by a box (see figure below). This means the layer is "active."
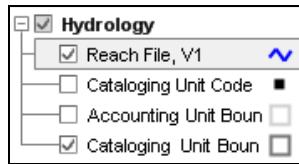
Zooming Tools

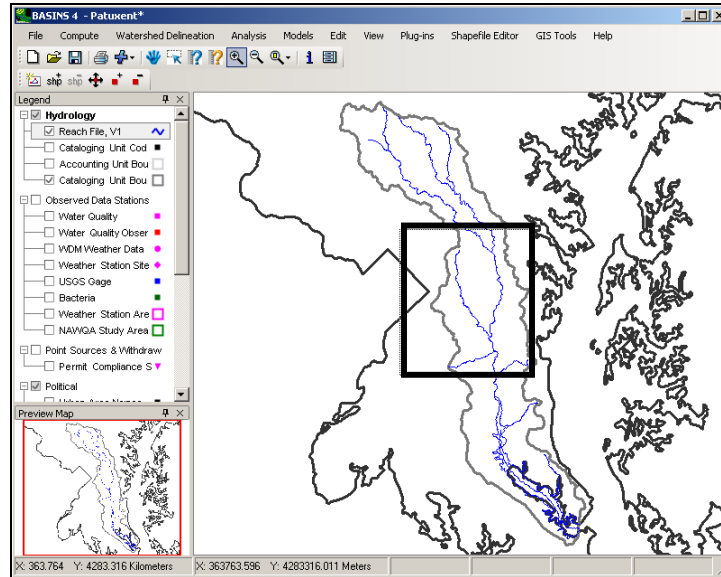BASINS 4.0 has typical GIS tools for zooming in and out.
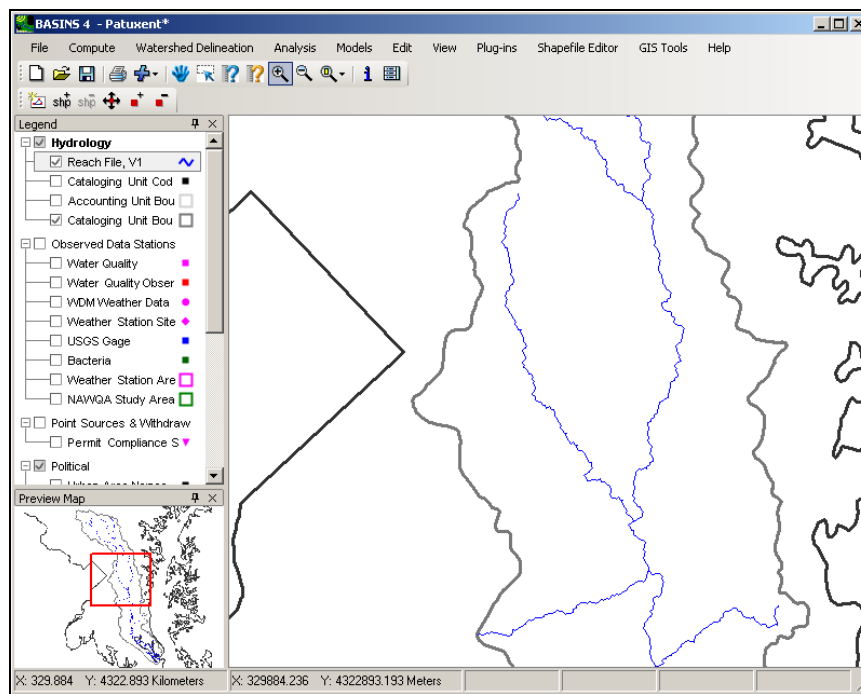
 (Zoom In tool)

 (Zoom Out tool)

1.   Click (Zoom In tool).

2.   Drag a box on the map around the area you would like to zoom to.
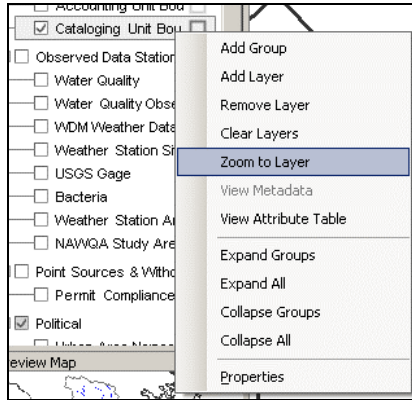
Notice that the map zooms into that area.

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.

Table Editor Tool

BASINS 4.0 has a "Table Editor tool", , that allows you to view and edit 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.

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.
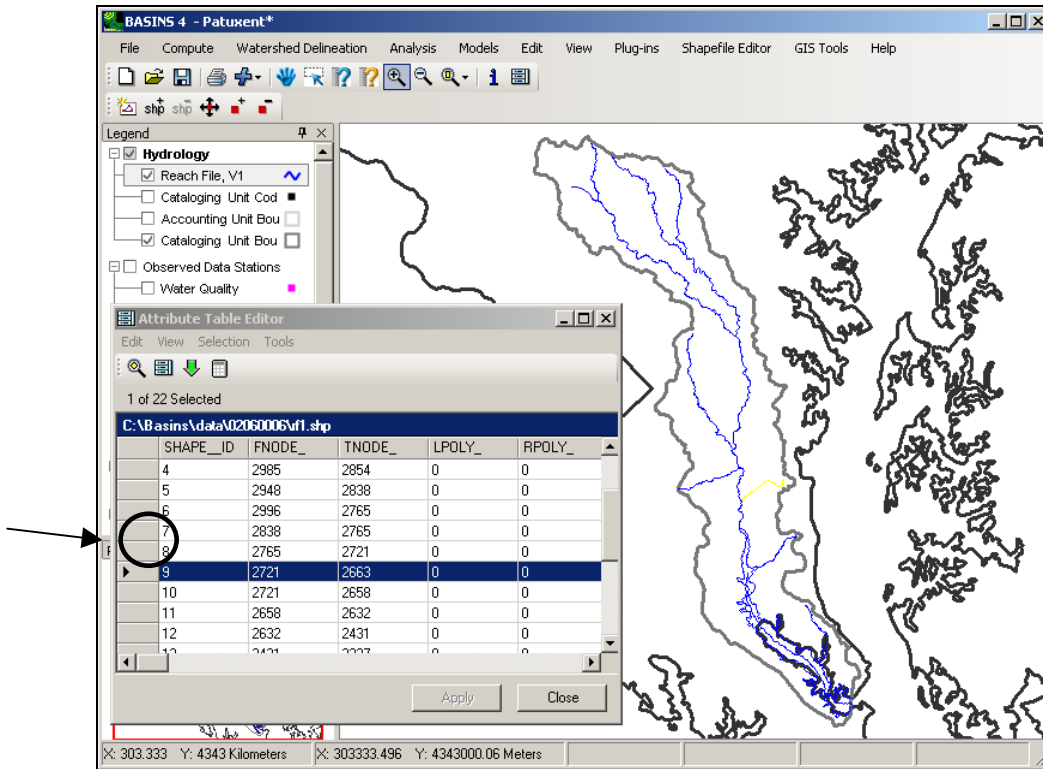
4.   Close the "Attribute Table Editor" window.

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."
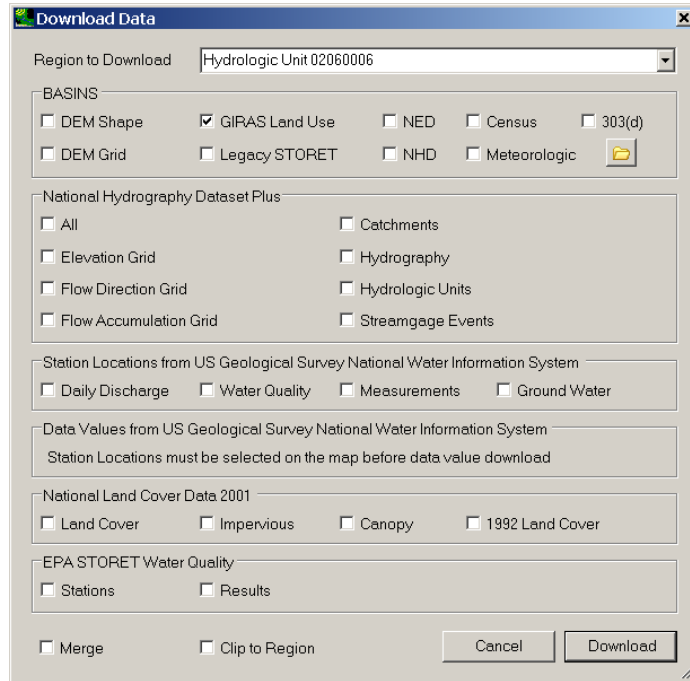
3.   Click DOWNLOAD.

4.   Click OK when the data has been downloaded.
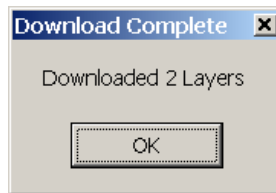
> **Note**: The GIRAS Land use data comes in tiles. There are two land use tiles that
> contribute to the Patuxent watershed: *"l_baltmd.shp"* and "*l_washdc.shp*,"
> corresponding to Baltimore, Maryland, and Washington DC, respectively.
> We added both of these layers to the Patuxent project.

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.
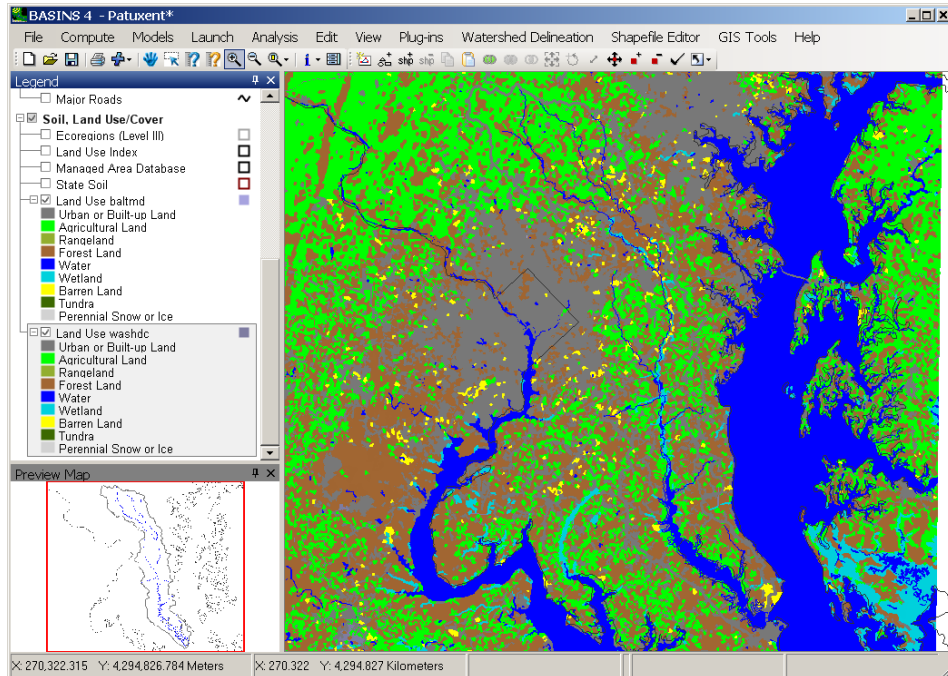
> **Note:** You probably can not see the outline of your watershed very well. If you
> want, you can change the color and/or thickness of the boundary by double
> clicking on the *Cataloging Unit Boundaries* layer and changing the line
> thickness.

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.
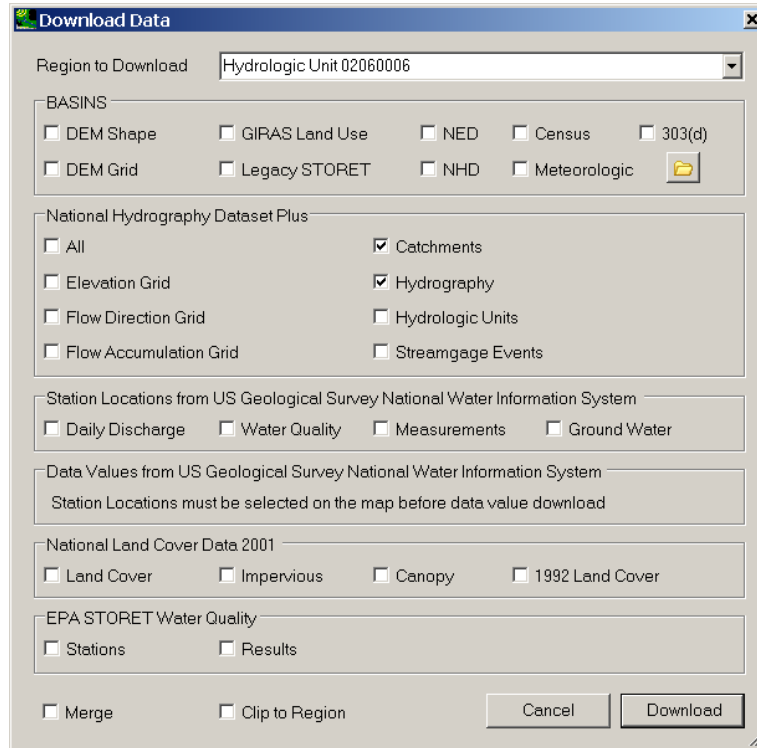
3.   Click DOWNLOAD. When the download has finished, the following window will appear.
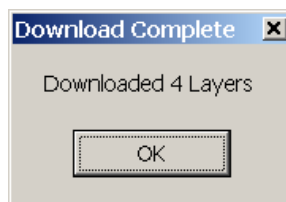
4.   Click OK. Turn off the *RF1* layer, and scroll down the table of contents until you see the NHDPlus *Flowlines, Catchments, Area Features,* and *Waterbody Features* in a group entitled 'Hydrology-NHDPlus'. You may wish to zoom closer to examine these new layers.
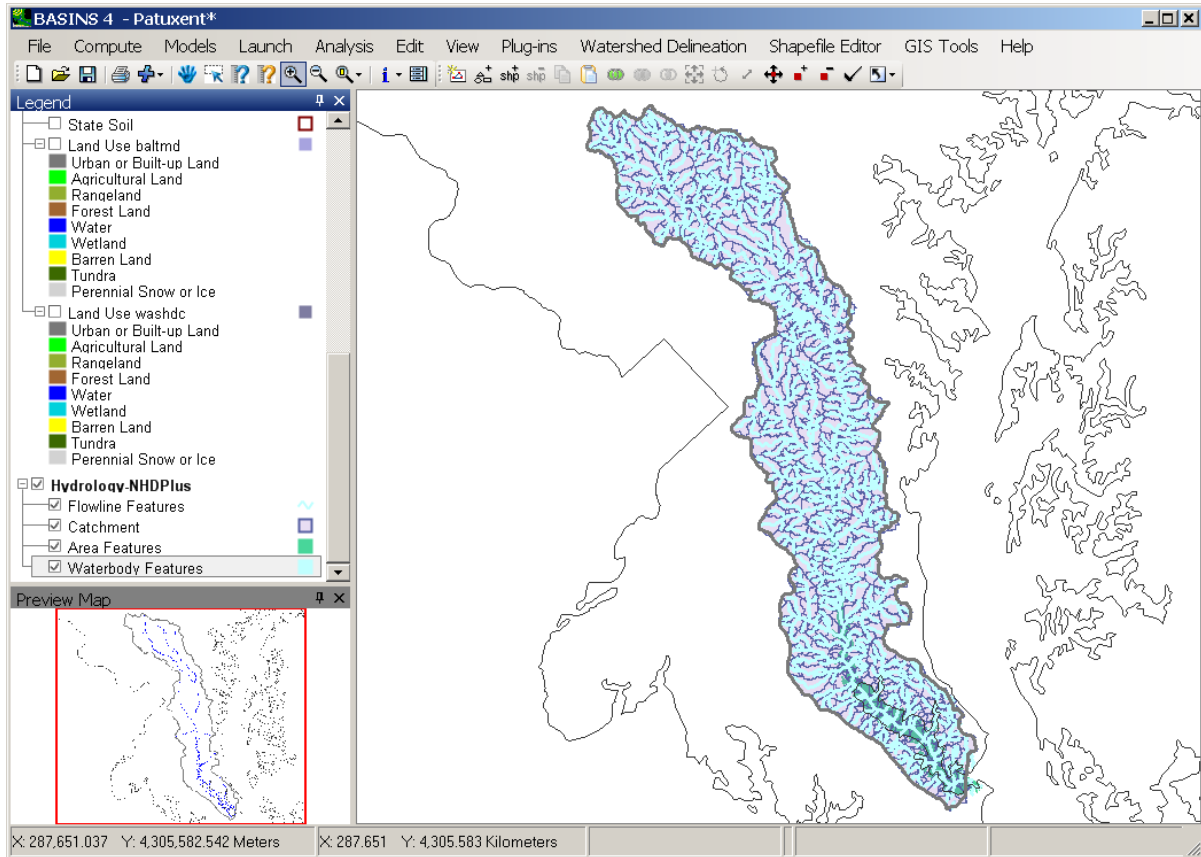
5.   Turn "off" the NHDPlus layers, and turn "on" the *RF1* layer again.

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.
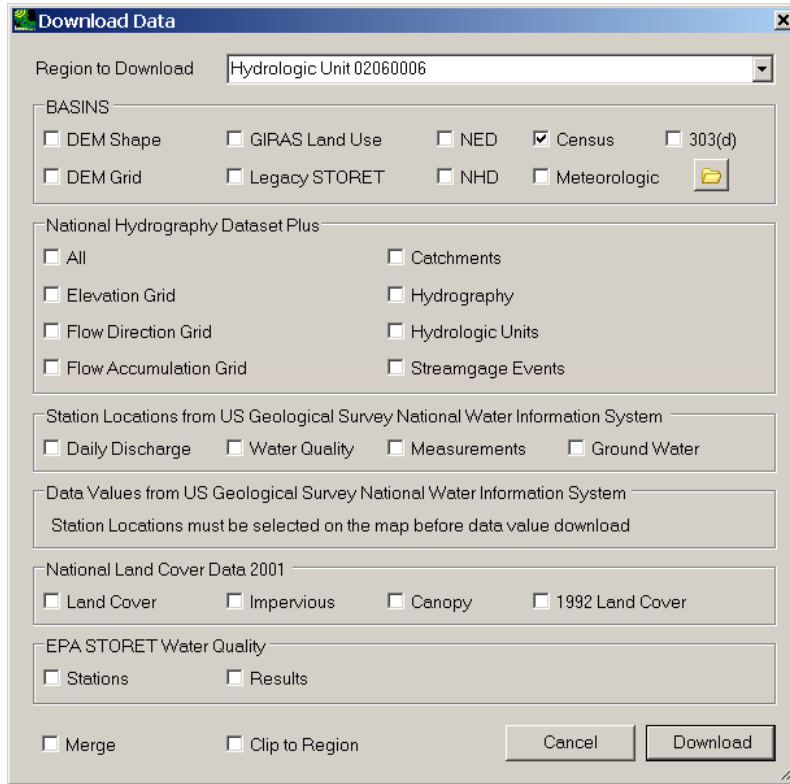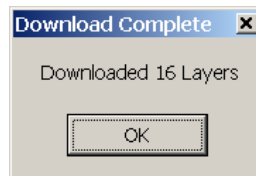

1.   From the **File** menu, select **Download Data**.

2.   Check the box next to "Census."

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

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.
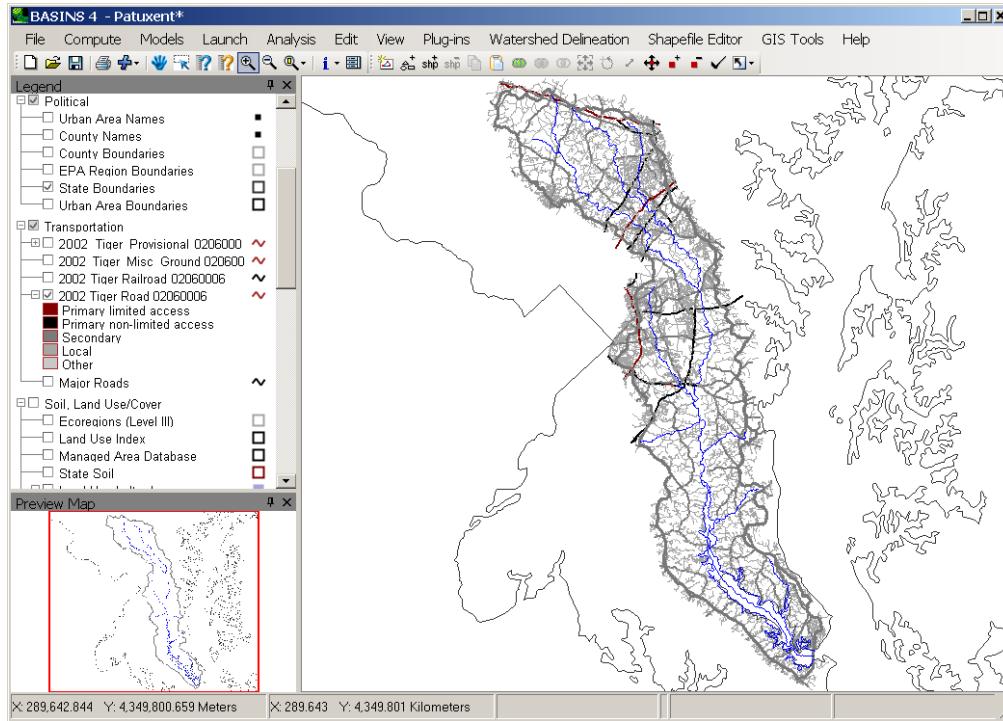
7.   Click the '+' next to *2002 Tiger Road 02060006* layer to see the different types of
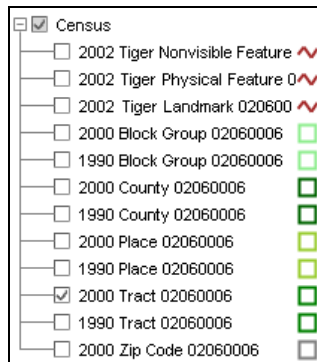   roads.

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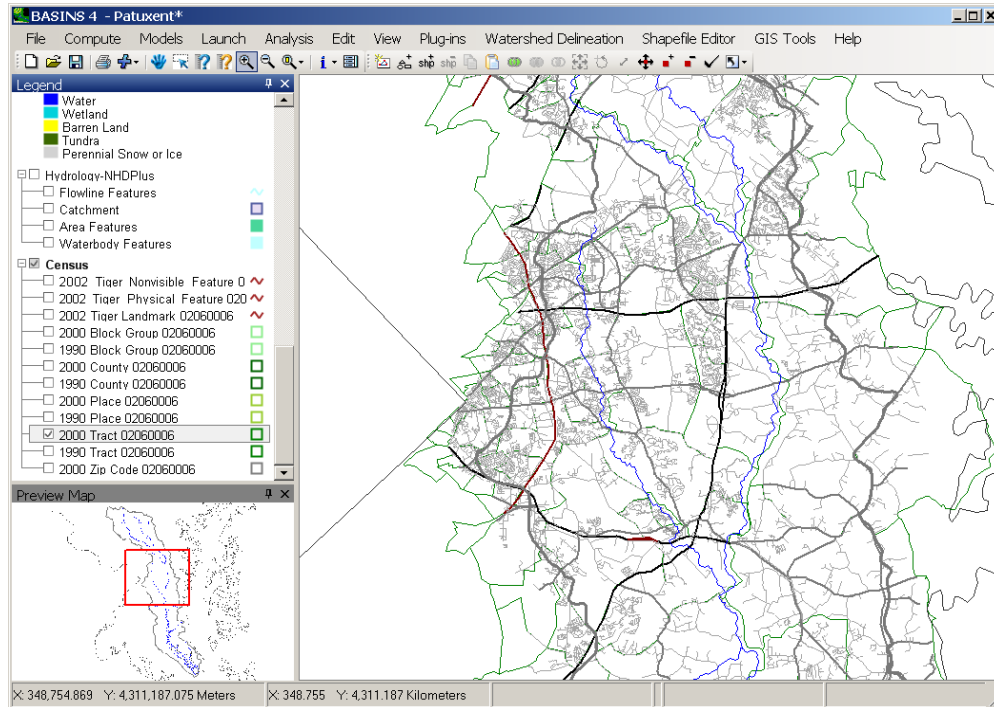
10.   Turn "off" *2002 Tiger Road 02060006* and *2000 Census Tract 02060006*. **Right click** on the *Cataloging Unit Boundaries* layer and use the "Zoom to Layer" feature to return to the full extent of the Cataloging Unit.

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".

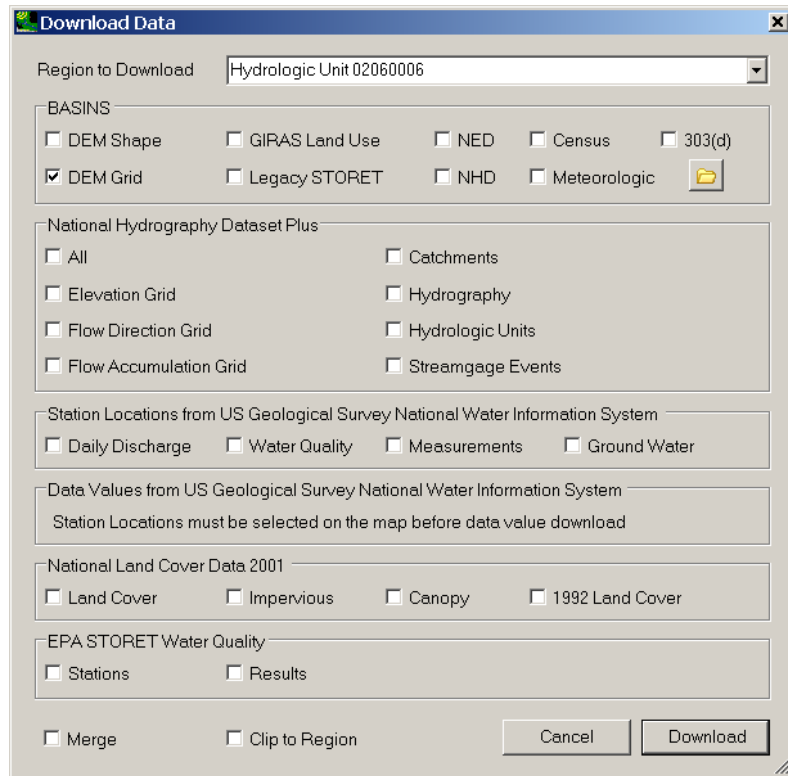3.   Click DOWNLOAD. When the download has finished, the following window will appear.
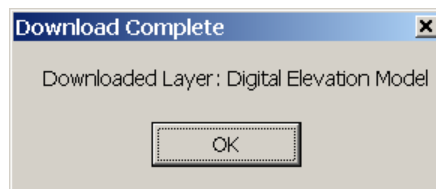
4.   Click OK. The *Digital Elevation Model* layer will be added to your "Table of Contents" under the "Elevation" group.

5.   Turn "on" the *Digital Elevation Model* layer, and click the '+' next to the layer in the "Table of Contents."
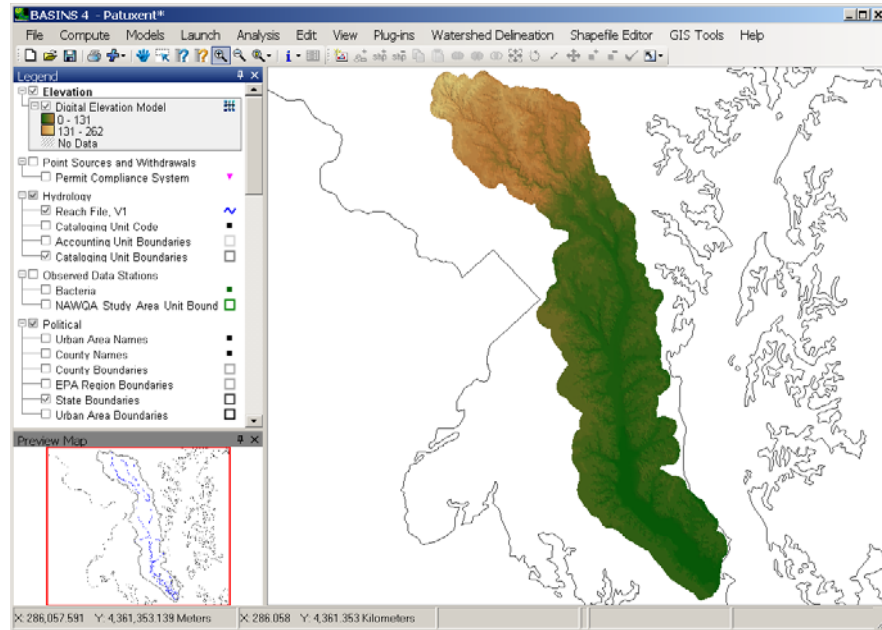
6.   Zoom into a section of the Cataloging Unit.

7.   Click [i] (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.
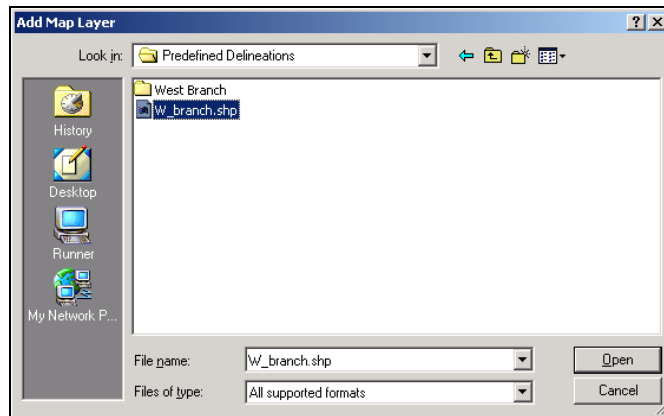
4.   The layer *W_branch* will be added to the "Table of Contents" and turned "on." This layer appears filled in. We want to change it so that only the outline is visible.
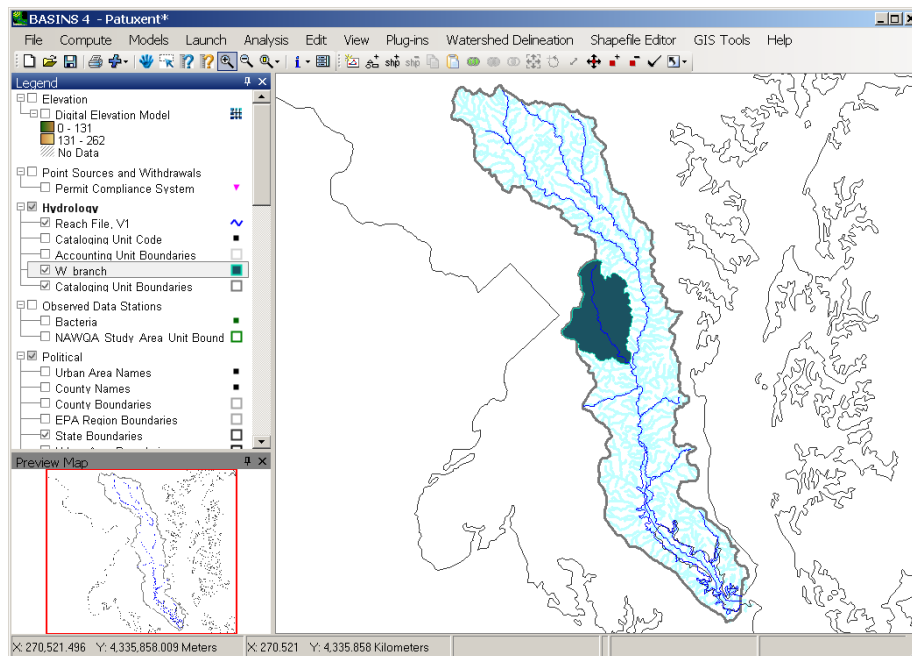
5.   **Double click** *W_branch* in the "Table of Contents." The "Legend Editor" will appear.
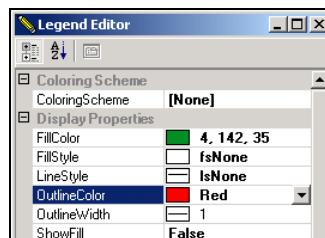
6.   In the "Legend Editor," change the "OutlineColor" to "Red" and "ShowFill" to "False."

7.   Close the "Legend Editor." The layer will appear as shown below.

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

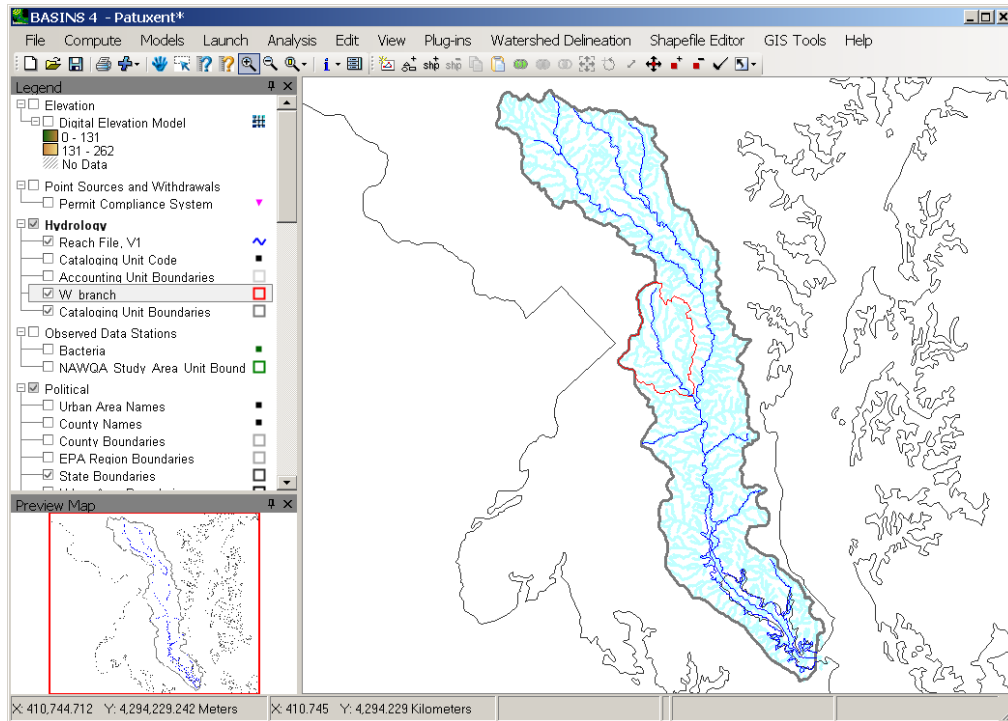## H. Adding Timeseries Data to our Project

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".
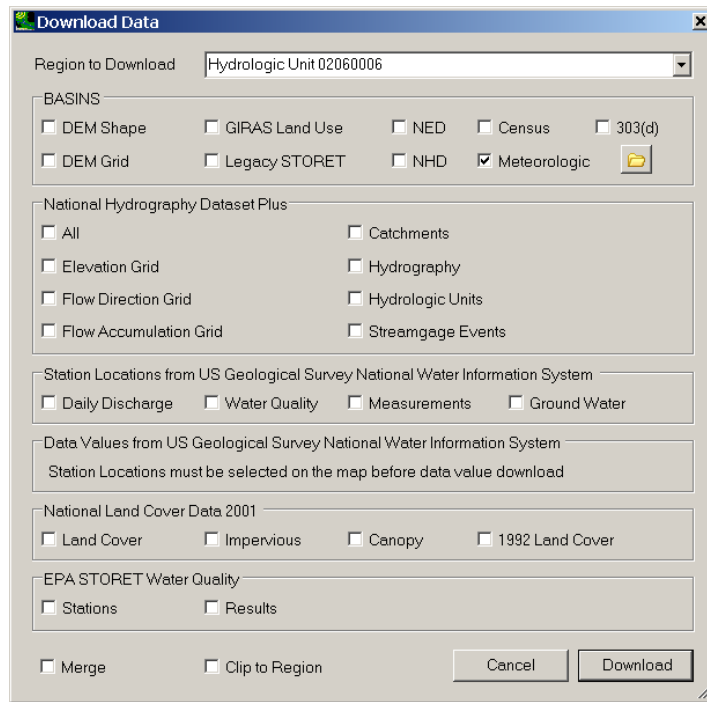
3.   Click DOWNLOAD. While the data is downloading, you will see a progress message at the bottom of the main BASINS window. When the download has finished, the following window will appear.
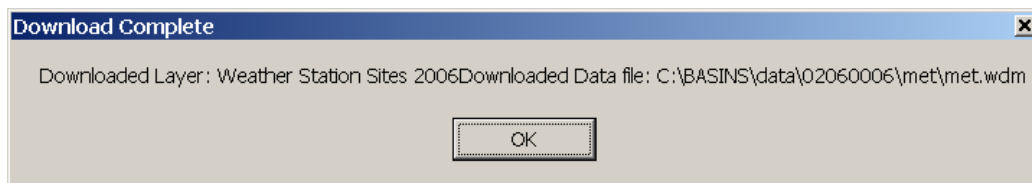
4.   Click OK. The following 'Data Sources' window will appear showing us the timeseries files available within this project. The 'met.wdm' file shown in this window was just added during the previous download step. We will discuss this window more in a later exercise.
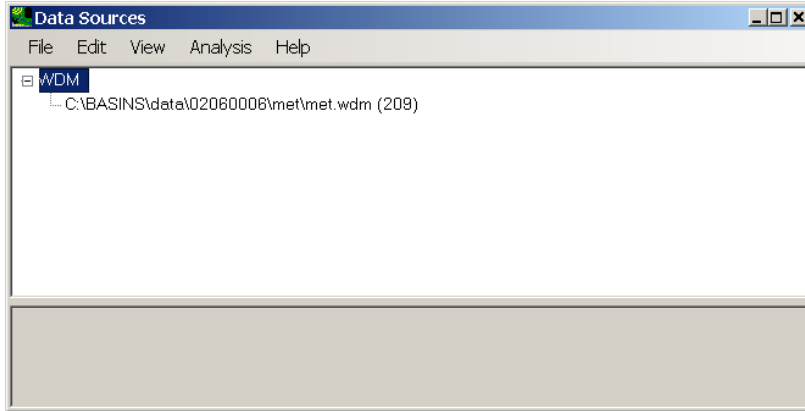
5.   Close the 'Data Sources' window by clicking the 'X' in the top right corner.

6.   The *Weather Station Sites 2006* layer will be added to your "Table of Contents" under the "Observed Data Stations" group.
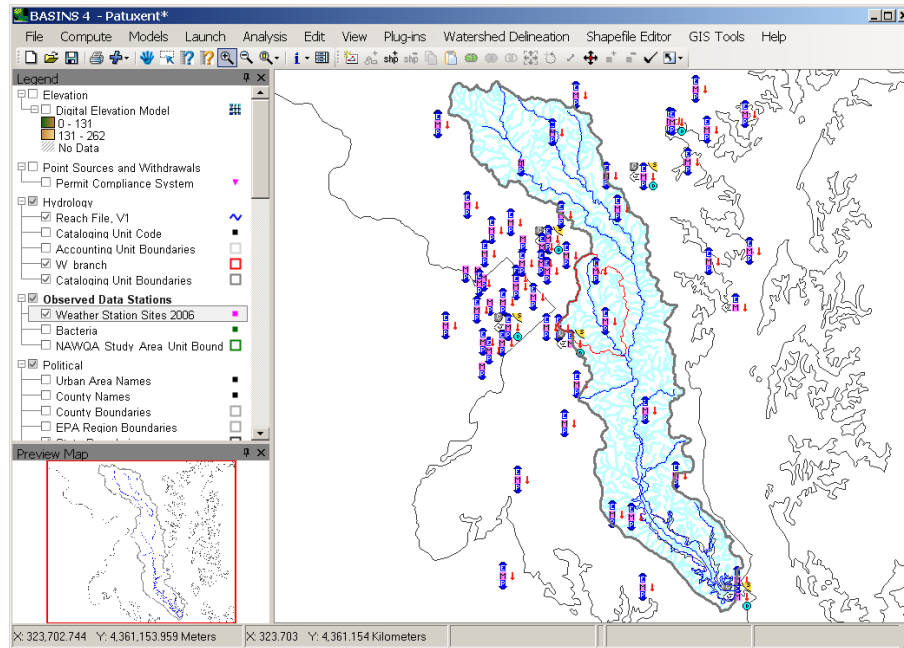
The symbols on the map indicate the locations of the new met data and the types of data available at each location. The location of each station is represented by a fuchsia box marked with the letter 'M', surrounded by icons representing the meteorological constituents available at that location.

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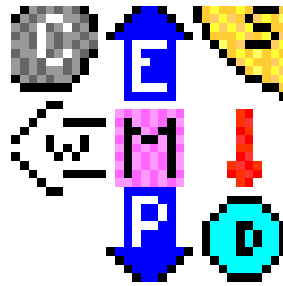
Where:

- 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.