

Preparing a NFIE-Geo Database for Travis County

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Introduction

The National Flood Interoperability Experiment (NFIE) is being undertaken by the academic community and the National Weather Service and its federal partners to demonstrate how a high spatial resolution flood forecasting system for the United States could be developed at the National Water Center, newly opened on the Tuscaloosa campus of the University of Alabama. It is assumed that this new system will cover the continental United States and be based on a high spatial resolution geospatial database that is being assembled to support the NFIE by federal agencies coordinated by the Subcommittee on Spatial Water Data.

The purpose of this exercise is to assemble a local copy called NFIE-Geo of this federal information for Travis County, Texas. More local information about Travis County will later to be added to NFIE-Geo to support flood emergency response planning.

Original data sources for the federal information include:

1. National Hydrography Dataset Plus:
http://www.horizon-systems.com/NHDPlus/NHDPlusV2_data.php
2. National Flood Hazard Layer: <https://msc.fema.gov/portal>

Some of this information has been assembled into packaged datasets at:

<https://www.arcgis.com/home/webmap/viewer.html?webmap=2c30160429984a59873f26b9d118dbfe>

which can also be found under the title “ArcGIS NFIE Hydro Regions Map” at

<http://www.cuahsi.org/NFIE>

This procedure requires at least 5GB of free space on your computer and access to ArcGIS version 10.2.2. It also requires a good internet connection!

Step 1. Download and unzip the NFIE data package for the Texas-Gulf Region.

Go to

<https://www.arcgis.com/home/webmap/viewer.html?webmap=2c30160429984a59873f26b9d118dbfe>

and select the Texas-Gulf region



Click on “Get the Data from HydroShare” and use “Export All” to get everything in one zipped package

Content	
NHD_Catchments.zip	Download (206.1 MB)
NHD_DamEvents.zip	Download (3.4 MB)
NHD_Flowlines.zip	Download (59.0 MB)
NHD_StreamGageEvents.zip	Download (9.0 MB)
RAPID_Parameters.zip	Download (1.4 MB)
WBD_Subwatersheds.zip	Download (25.1 MB)
Weight_table.zip	Download (3.9 MB)
Export all ▾	

The **NHD Catchments**, **DamEvents**, **Flowlines**, **StreamGageEvents**, and **Subwatersheds** are what we’ll use for this assignment. Unzip those files. The **RAPID Parameters** and **Weight Table** are for hydrologic computations and we’ll cover those later.

This PC > maidment (\\austin.utexas.edu\disk\caee\wwwroot\prof) (Z:) > CE397Flood > Assignment2 > TexasGulf > 2015.01.08.05.06.59 > data > contents >

Name	Date modified	Type	Size
NHD_Catchments	1/28/2015 11:08 A...	File folder	
NHD_DamEvents	1/28/2015 11:09 A...	File folder	
NHD_Flowlines	1/28/2015 11:09 A...	File folder	
NHD_StreamGageEvents	1/28/2015 11:10 A...	File folder	
WBD_Subwatersheds	1/28/2015 11:10 A...	File folder	
NHD_Catchments	1/8/2015 5:07 AM	Compressed (zipp...	211,008 KB
NHD_DamEvents	1/8/2015 5:07 AM	Compressed (zipp...	3,495 KB
NHD_Flowlines	1/8/2015 5:07 AM	Compressed (zipp...	60,413 KB
NHD_StreamGageEvents	1/8/2015 5:07 AM	Compressed (zipp...	9,192 KB
RAPID_Parameters	1/8/2015 5:07 AM	Compressed (zipp...	1,419 KB
WBD_Subwatersheds	1/8/2015 5:07 AM	Compressed (zipp...	25,680 KB
Weight_table	1/8/2015 5:07 AM	Compressed (zipp...	3,964 KB

Step 2. Download the National Flood Hazard Layer for Texas and Travis County

Go to the FEMA Map Service Portal <https://msc.fema.gov/portal> and click on "Search All Products"

Flood Map Service Center

MSC Home | MSC Search | MSC Products and Tools | MSC How-To | MSC Email Subscriptions

Welcome to FEMA's Flood Map Service Center

Looking for a Flood Map? [?](#)

Enter an address, a place, or longitude/latitude coordinates:

[Search All Products](#)

About Flood Map Service Center

The FEMA Flood Map Service Center (MSC) is the official public source for flood hazard information produced in support of the National Flood Insurance Program (NFIP). Use the MSC to find your official flood map, access a range of other flood hazard products, and take advantage of tools for better understanding flood risk.

Select the State as **Texas** and County as **Travis** in and select a community within that county as **Austin, City of**

Search All Products

Choose one of the three search options below and optio

Jurisdiction

State

County

Community

Jurisdiction

Jurisdiction

(Ex. Fairfax)

And hit "Search". Expand the search results to find the most recent National Flood Hazard Layer (NFHL) for your county **NFHLData-County** and download it. Do the same for your **NFHLData-State**. These downloads take a while.

Search
Clear All Fields

Search Results for AUSTIN, CITY OF

Click [subscribe](#) to receive email notifications when products are updated.

- Effective Products (168)
 - FRM Panels (42) DL ALL
 - FIS Reports (11) DL ALL
 - LOMC (112)
 - NFHL Data-State (1)
 - NFHL Data-County (2)

Product ID	Latest Study Effective Date	Latest LOMR Effective Date	Size	Download
NFHL_48453C	08/18/2014	10/17/2014	61MB	DL
NFHL_48491C	09/26/2008	04/10/2014	73MB	DL

- Preliminary Products (38)
- Pending Product (0)
- Historic Products (314)
- Flood Risk Products (0)

Unzip the resulting files. The first is for Travis County, the second for the state of Texas.

48453C_20141020	1/28/2015 12:19 PM	File folder
NFHL_48_20150121	1/28/2015 12:19 PM	File folder

Step 3. Get the 24K NHD for Region 1209

Go to <http://nhd.usgs.gov/> and select "Go to Pre-Staged Subregions"

Hydrograph

Home

News

Get Data

Stewardship

User Resources

Hydrograph
National Hydrography Data
Watershed Boundary Datas

Hydrography Data Overview

Go to the Hydrography Viewer

Go to The National Map - Service Endpoints

Go to Pre-staged Subregions

Select “File Geodatabase” and “High Resolution” to locate the following list of files. Within this list, select **NHD1209_931v220.zip**

01/25/2015 06:53AM	20,291,690	NHDH1205_931v220.zip
01/25/2015 09:24AM	73,040,352	NHDH1206_931v220.zip
01/25/2015 08:43AM	72,732,492	NHDH1207_931v220.zip
01/25/2015 07:44AM	17,834,806	NHDH1208_931v220.zip
01/25/2015 08:25PM	86,367,630	NHDH1209_931v220.zip
01/25/2015 03:49AM	58,765,019	NHDH1210_931v220.zip

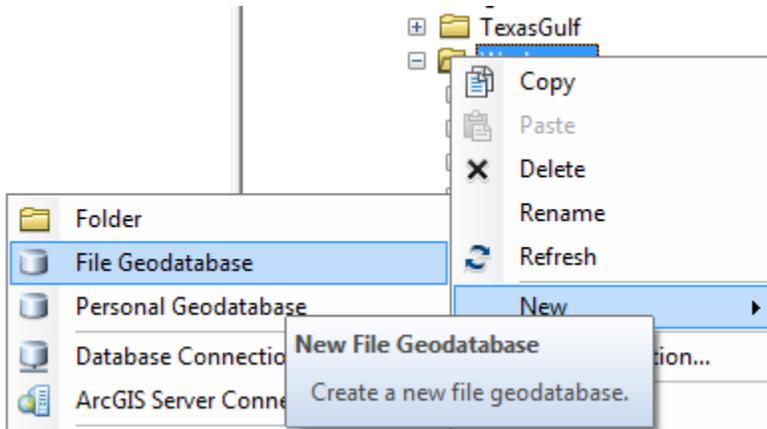
Unzip this file to show the **NHDH1209.gdb** as a geodatabase

Step 4. Create a NFIE-Geo Database for Travis County

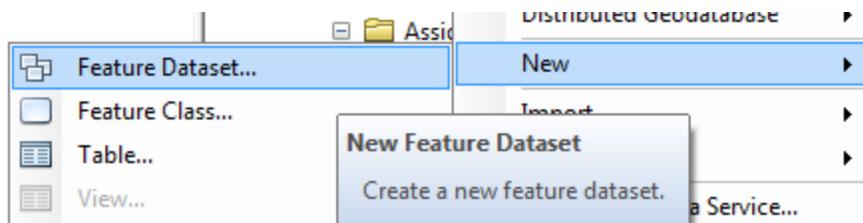
48453C_20141020	2/1/2015 11:57 PM	File folder
NFHL_48_20150121	2/2/2015 12:25 AM	File folder
NHD_Catchments	2/1/2015 11:18 PM	File folder
NHD_DamEvents	2/1/2015 11:19 PM	File folder
NHD_Flowlines	2/1/2015 11:22 PM	File folder
NHD_StreamGageEvents	2/1/2015 11:23 PM	File folder
NHDH1209.gdb	2/2/2015 12:10 AM	File folder
WBD_Subwatersheds	2/2/2015 12:13 AM	File folder

Ok, now we’ve got all the required data, lets proceed with building our geodatabase.

Open ArcMap and in the Catalog tab, within the Workspace Directory, Create a New File Geodatabase



And call this **NFIEGeo**



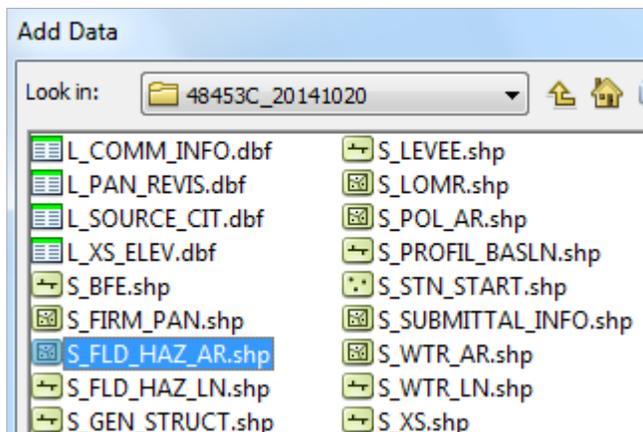
And name it **Travis**. Choose the NAD 1983 (2011) StatePlane coordinate system Texas Central zone.

- ⊕ NAD 1983 (2011) StatePlane South Dakota S FIPS 4002 (US F...
- ⊕ NAD 1983 (2011) StatePlane Tennessee FIPS 4100 (US Fe...
- ⊕ **NAD 1983 (2011) StatePlane Texas Central FIPS 4203 (US F...**
- ⊕ NAD 1983 (2011) StatePlane Texas N Central FIPS 4202 (U...
- ⊕ NAD 1983 (2011) StatePlane Texas North FIPS 4201 (US F...

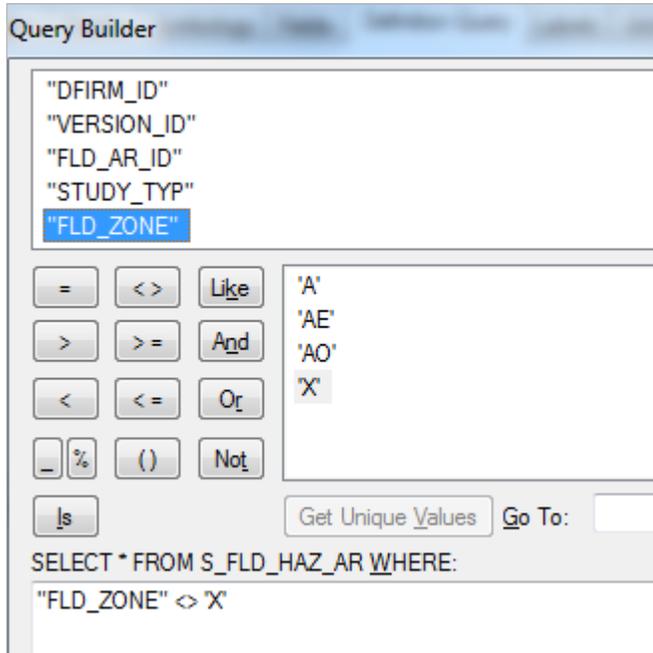
This will be the repository and provide a common coordinate system for the information that we've acquired.

Step 5. Flood Hazard Zone for Travis County

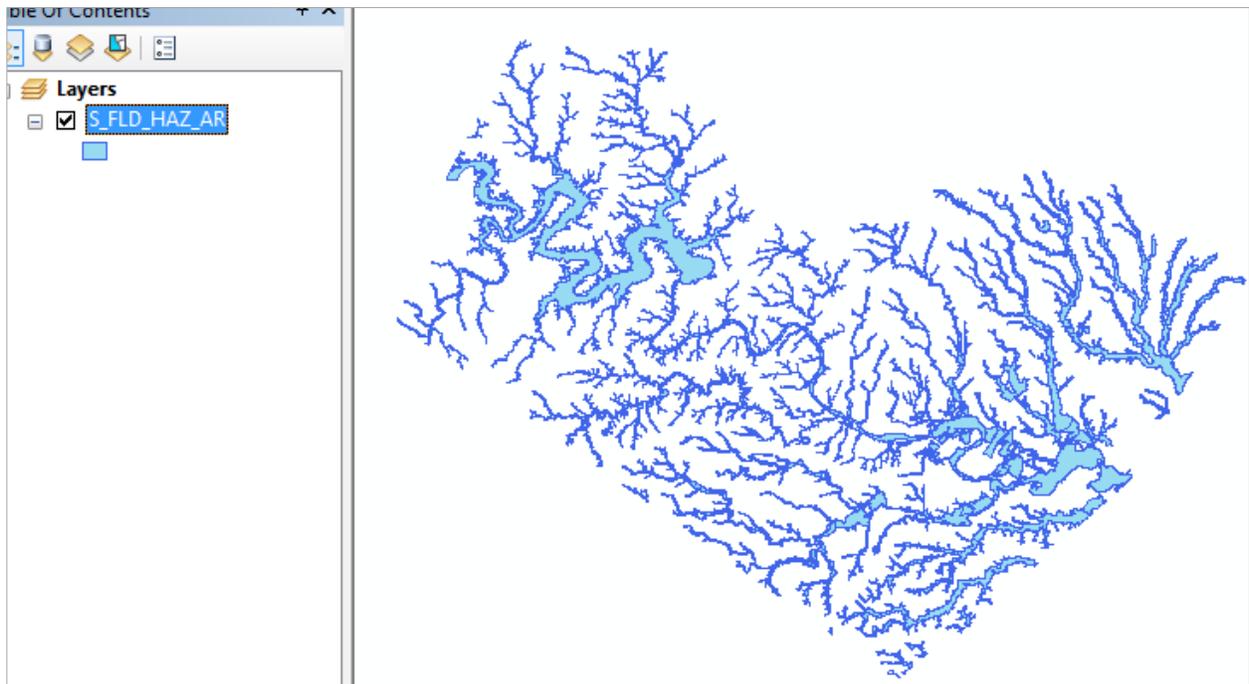
From folder **48453C_20141020**, add the feature class **S_FLD_HAZ_AR.shp** to ArcMap



Under Definition Query, use the Query Builder to select out the "FLD_Zone <> 'X' which deletes the zone of minimal flood risk

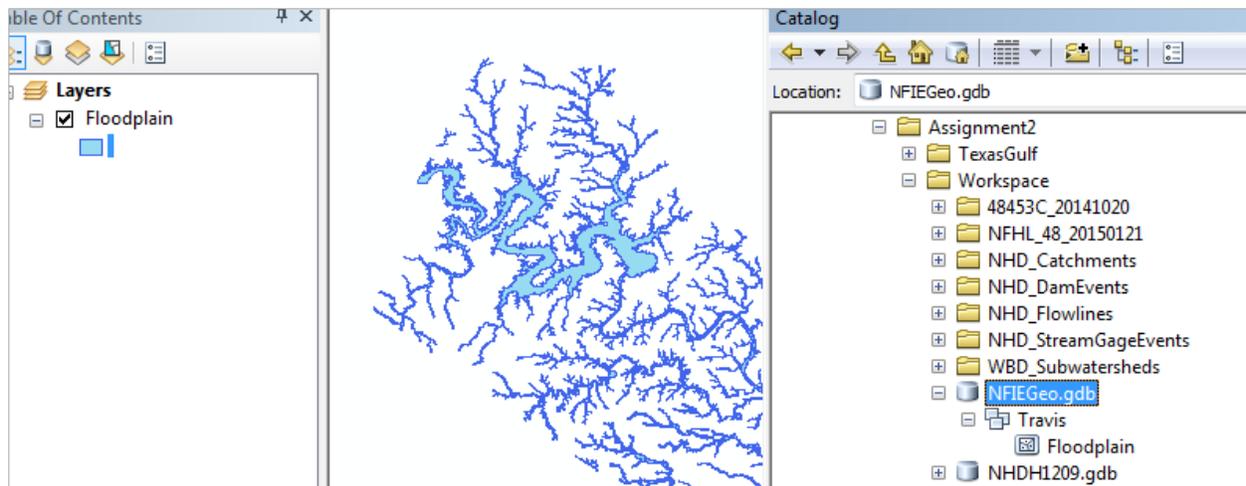


Which leaves just the areas of flood risk for Travis County



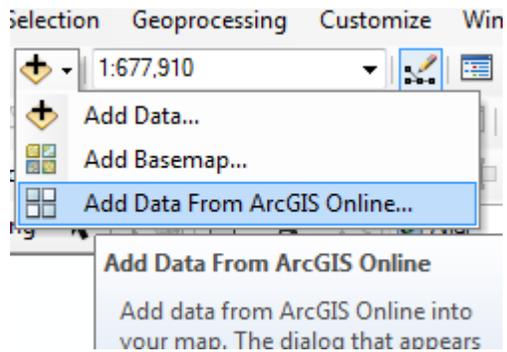
Export these data to your Travis geodatabase and give the resulting feature class the name **Floodplain**. Symbolize this with the symbol for Lake.

Save your ArcMap Document as **Travis.mxd**

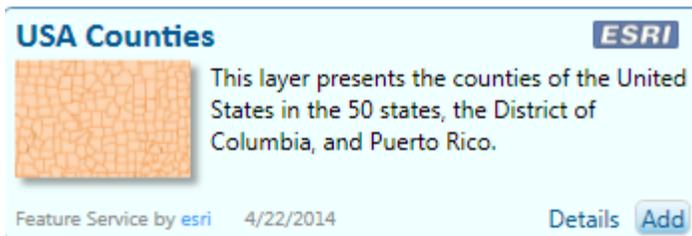


Step 6. Add a County Boundary

In ArcMap, add data from ArcGIS Online



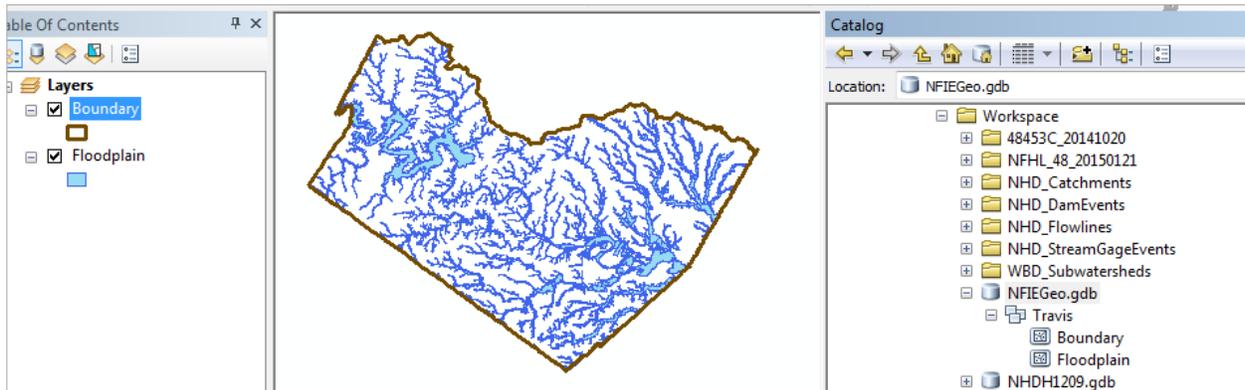
Search for "USA Counties" and add this layer to your map display



Select the outline for Travis County, and export it to the NFIEGeo geodatabase as **Boundary**

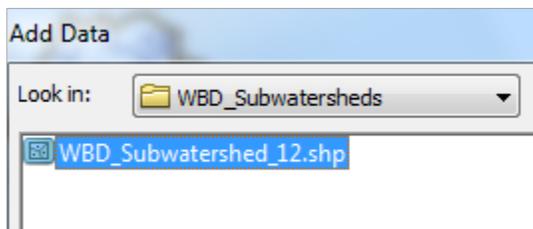


Now your NFIEGeo database contains both the Boundary and the Floodplain feature classes. Symbolize the boundary as hollow with a Brown color 2pt line weight.

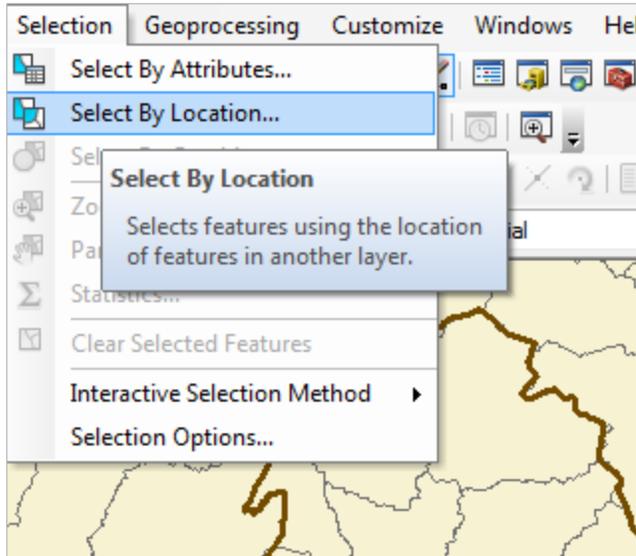


Step 7. Add your Subwatersheds

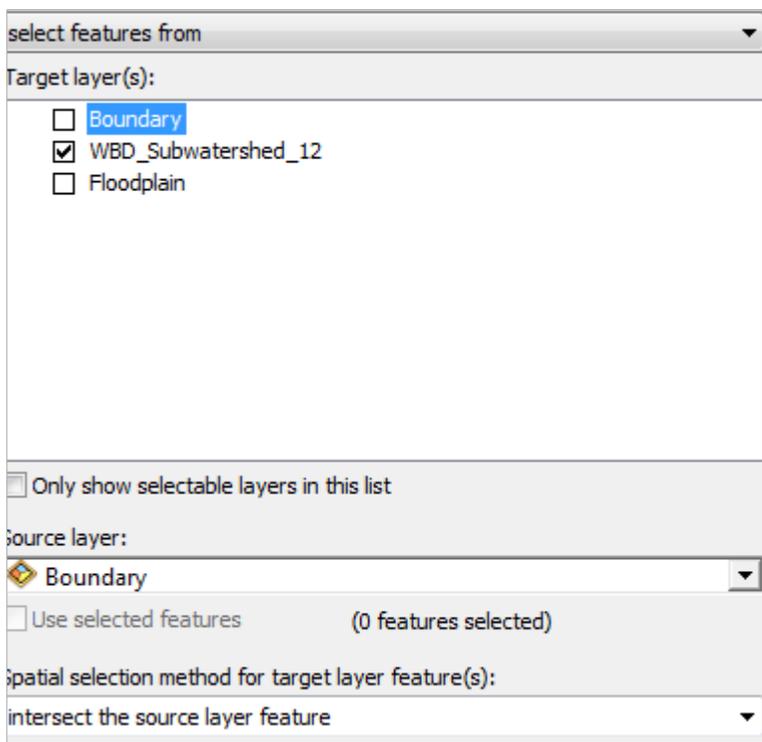
From the **WBD_Subwatersheds** folder, add the **WBD_Subwatersheds_12.shp** to ArcMap. This information is from the Watershed Boundary Dataset of the United States. These are also called the HUC12 Subwatersheds because they are uniquely identified by a 12-digit code.



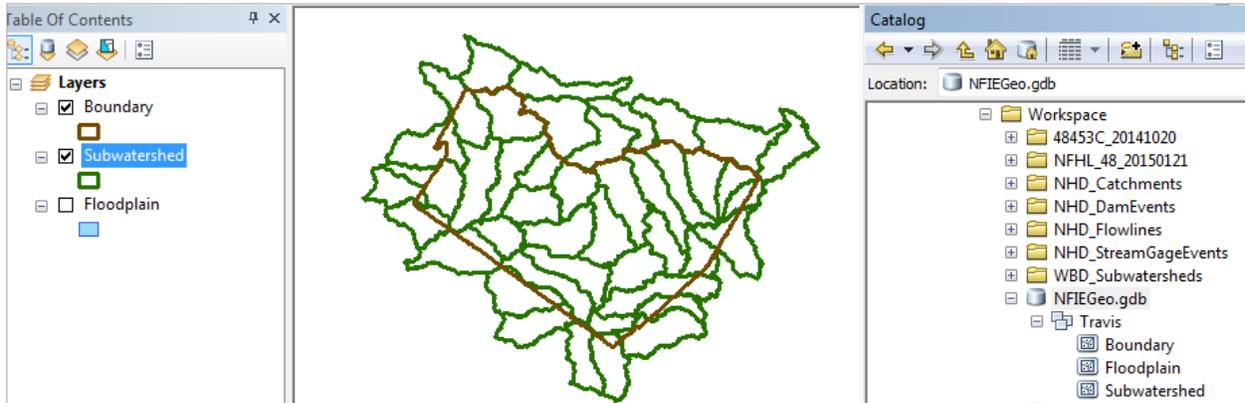
Use **Selection/Select by Location**



To select those Subwatersheds that **Intersect** the **Boundary** of Travis County

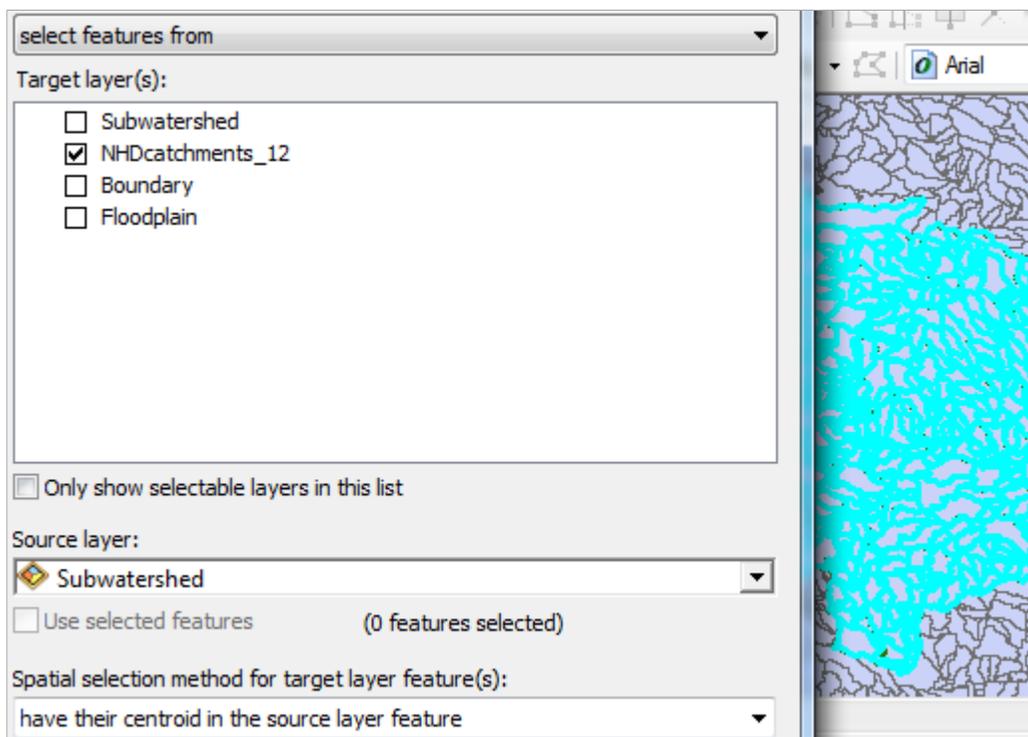


Export the selected features to the NFIEGeo geodatabase as **Subwatershed**. Symbolize them hollow with a Green outline, 2 pt line weight.

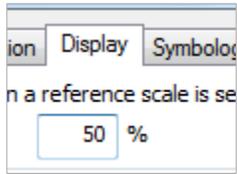


Step 8. Add your Catchments

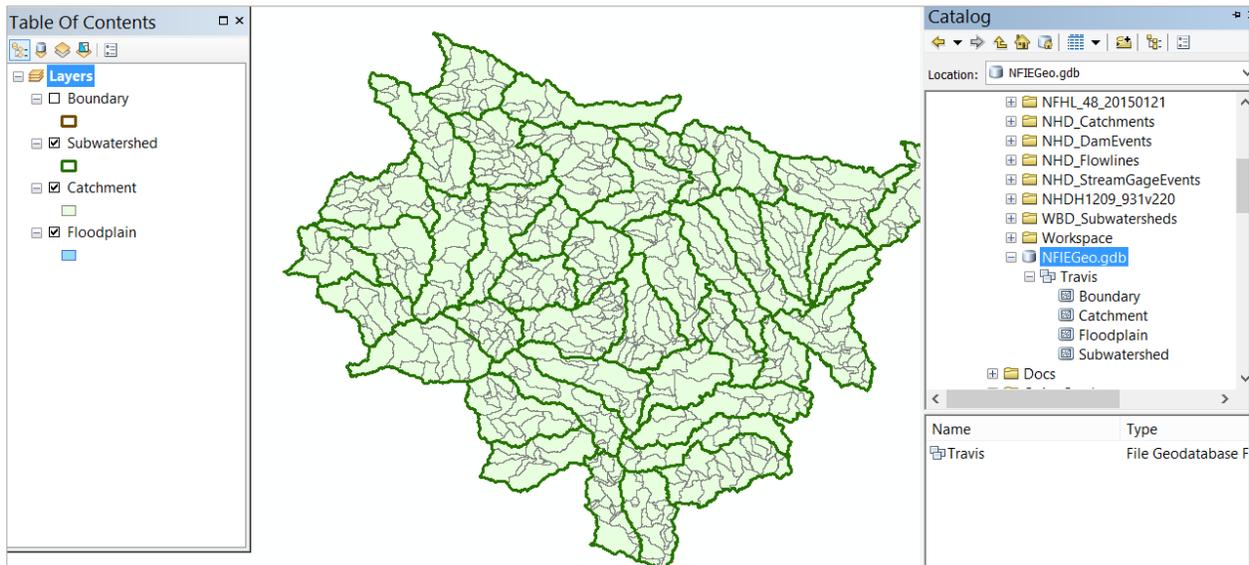
From the **NHD_Catchments** folder, add the **NHDCatchments_12.shp** shape file to ArcMap. Use Select by Location to select from the **NHDCatchments_12** feature class those catchments that “**have their centroid in the source layer feature**” (right at the bottom of the available selection options) the **Subwatershed** feature class.



And Export these to the NFIEGeo geodatabase as **Catchment**. Color them green and make the display visibility 50%.

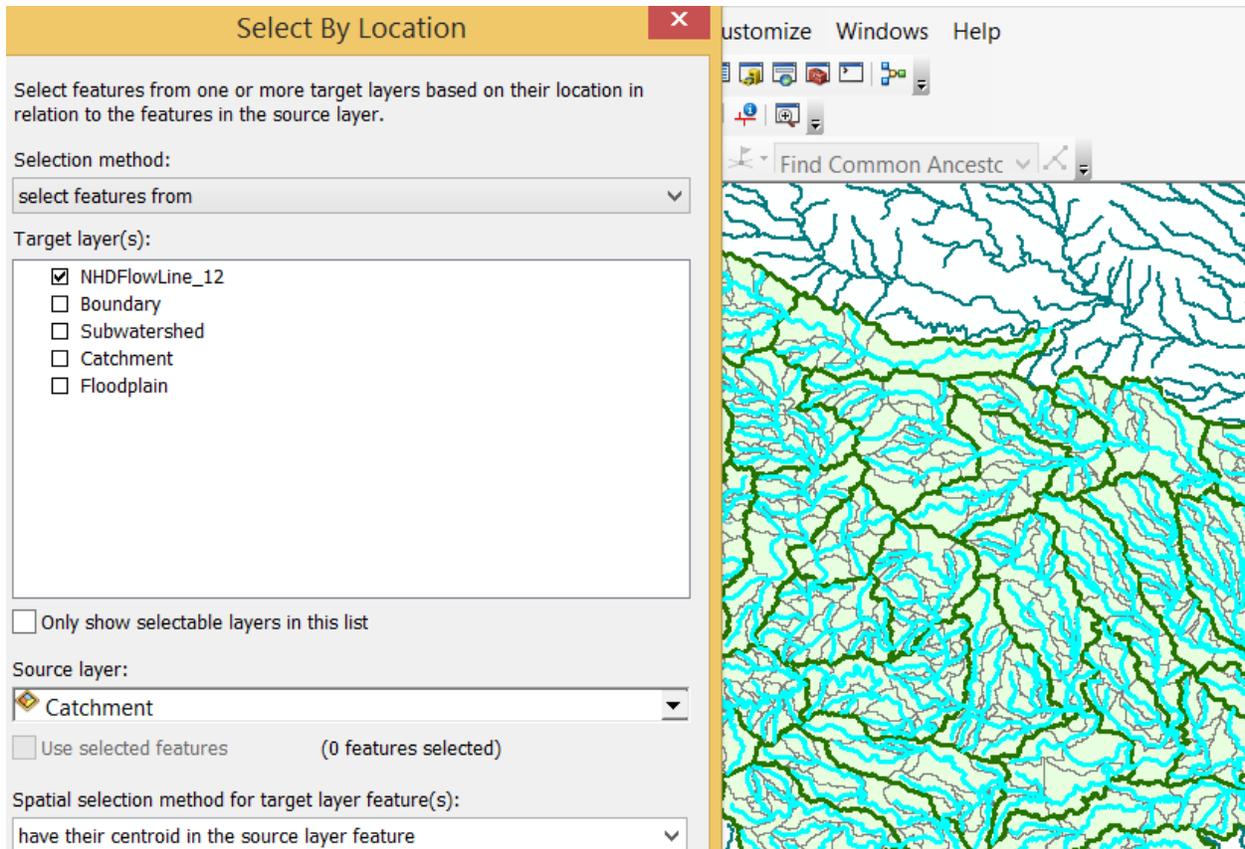


The result should appear something like this:

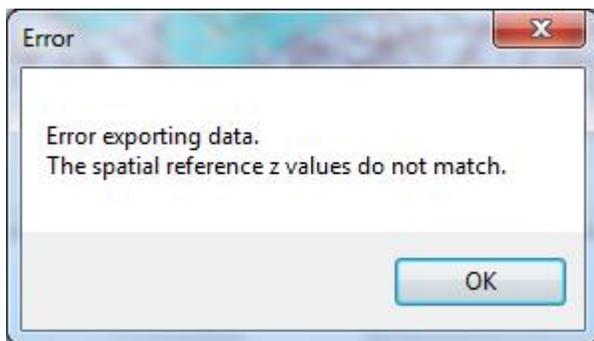


Step 9. Add your Flowlines

From the **NHD_Flowlines** folder, add the **NHDFlowLine_12.shp** shape file to ArcMap. Use same Select by Location method as for Catchments to get the flowlines whose centroid lie within the Catchments coverage:

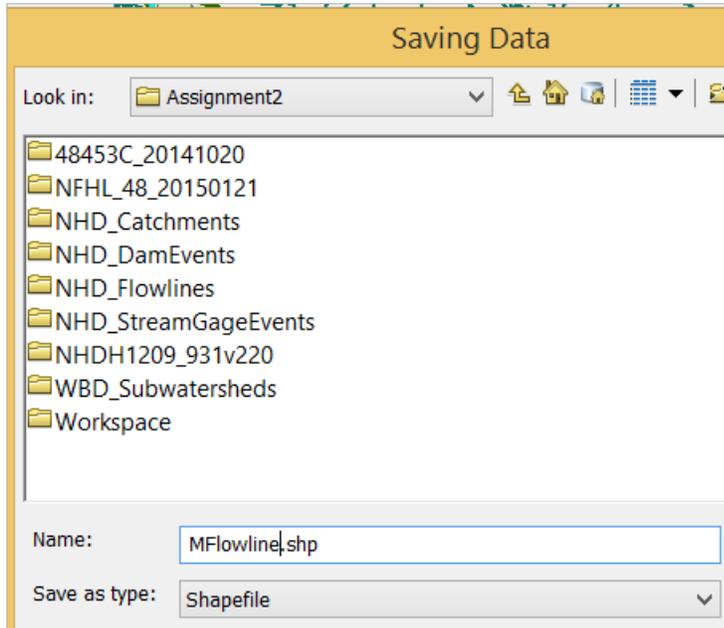


When you try to export the selected flowlines you get an error message:

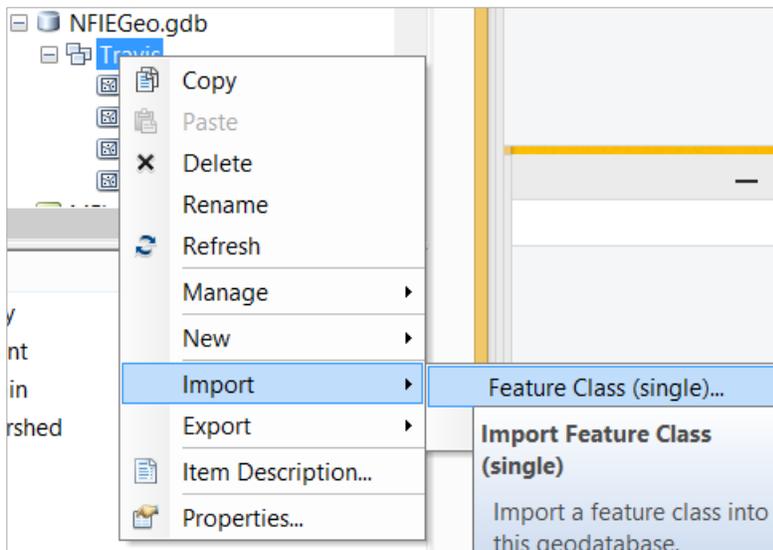


This is an annoying issue and requires two steps to get around it.

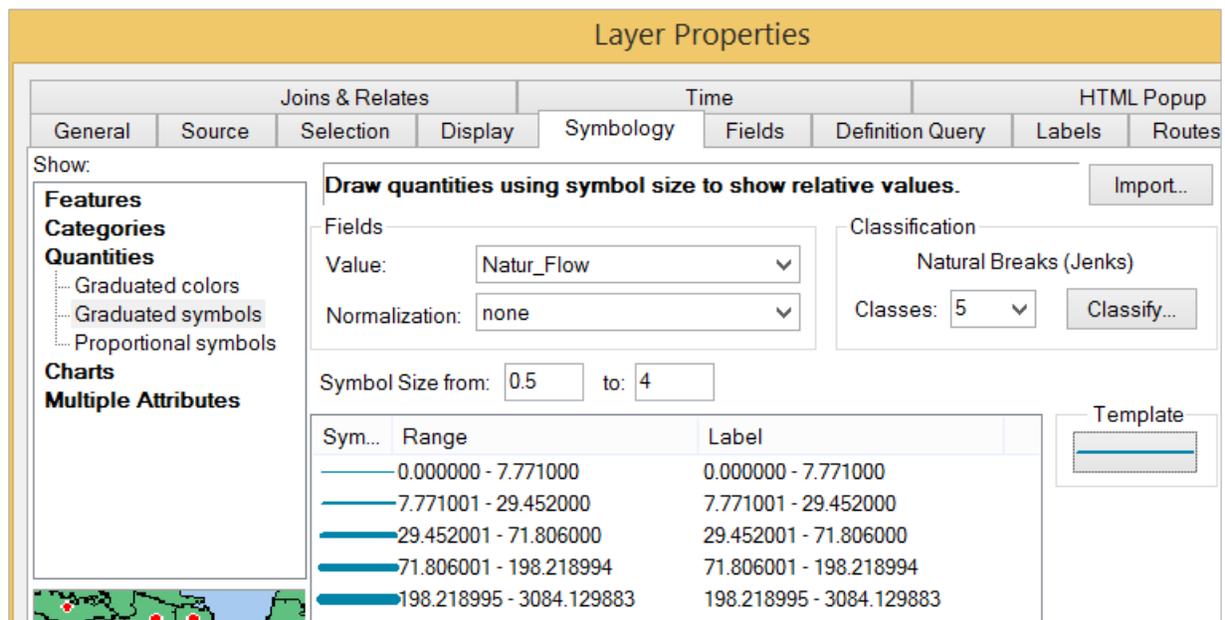
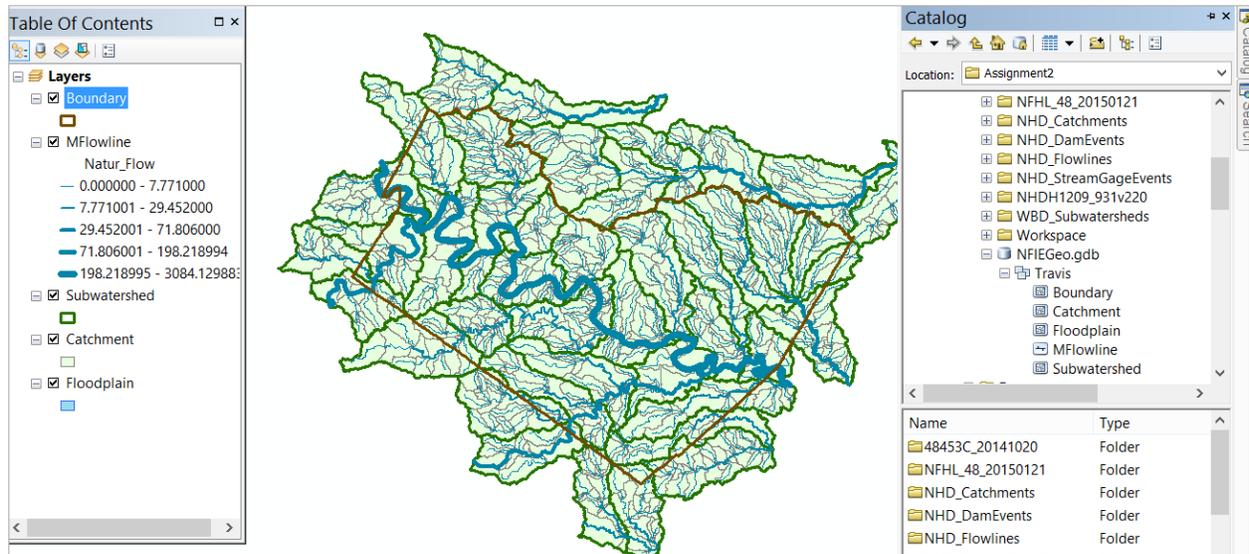
Export the selected flowlines to a shape file called **MFlowline.shp** The prefix “M” is used because these are the flowlines from the **Medium Resolution** or 100K National Hydrography Dataset Plus. Later we’ll get the comparable flowlines from the High Resolution National Hydrography Dataset.



Then import this into the NFIEGeo geodatabase



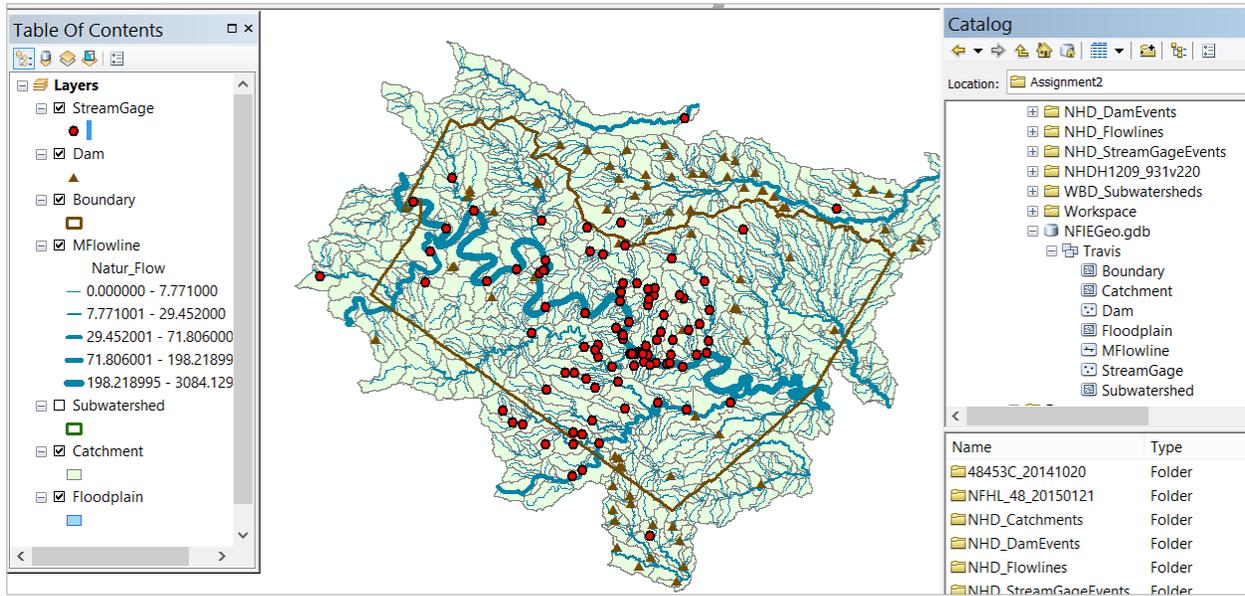
Symbolize the resulting **MFlowline** layer using Graduate Symbols in blue for the attribute **Natur_Flow** which is an estimate of the Mean Annual Flow in cfs. You can get a sense from this map of the main drainage features of this area – the Colorado River and its tributaries flowing through Austin, and Brushy Creek to the north of Travis County that flows through Williamson County and Round Rock, TX.



Step 10. Add your Dams and Streamgages

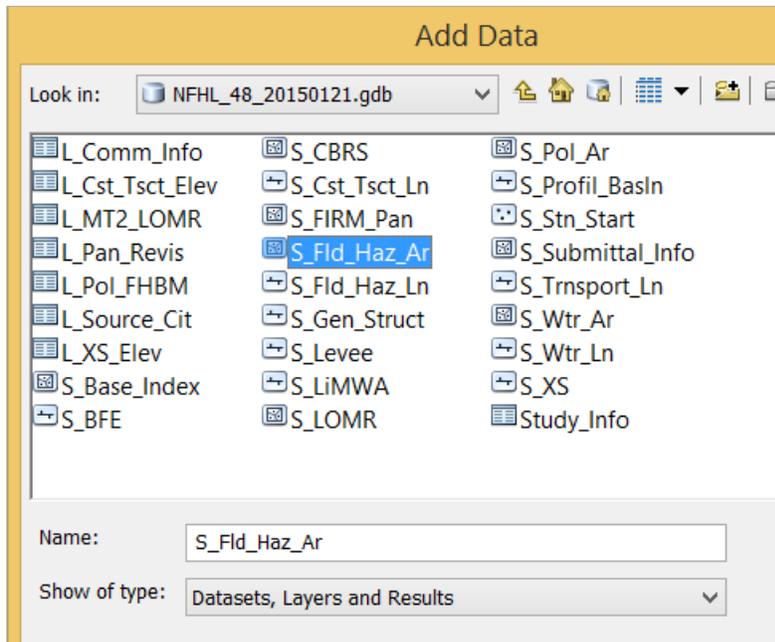
Use the same process as just described to add **NHD_DamEvents** and **NHD_StreamGageEvents** to the map, select the features within the Subwatershed domain, and add them to the NFIEGeo Geodatabase as feature classes **Dam** and **StreamGage**, respectively. The word “Event” is used in the title of these files because when points are located exactly on a flow line, a method called “Linear Referencing” is used in which a point such as a Stream Gage located near a flowline becomes a “Point Event” on the flowline.

Symbolize the Dams as brown triangles and the StreamGages as red dots. Notice how many dams there are in Williamson County – these are flood control dams built by the USDA Natural Resources Conservation Service when this was rural land, but now it is urbanized so these large structures are providing flood protection to a large urban population.

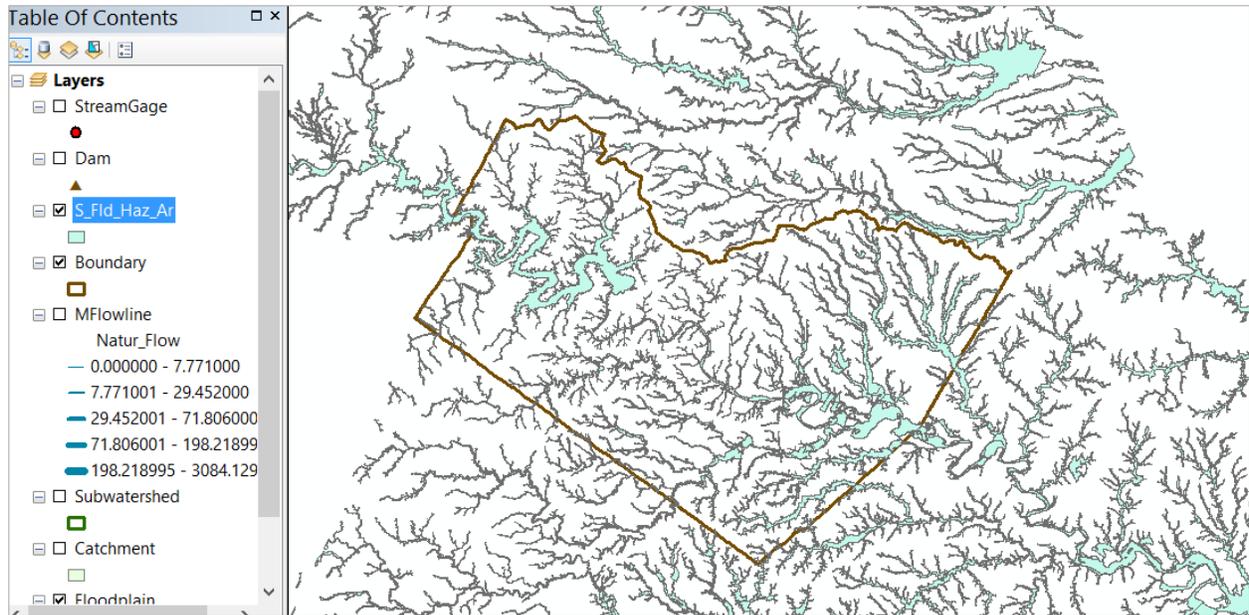


Step 11. Form the Reach Flood Warning Zones

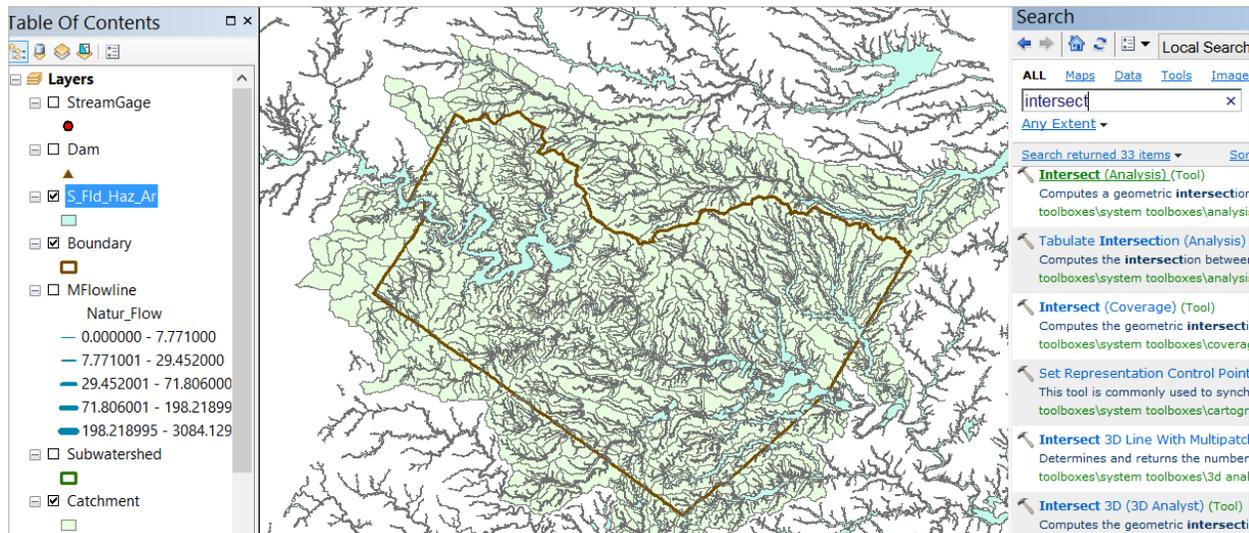
Now we're going to use the National Flood Hazard Layer for Texas to create reach flood warning zones for each catchment. From **NFHL_48_20150210.gdb**, add the **S_Fld_Haz_Ar** layer.



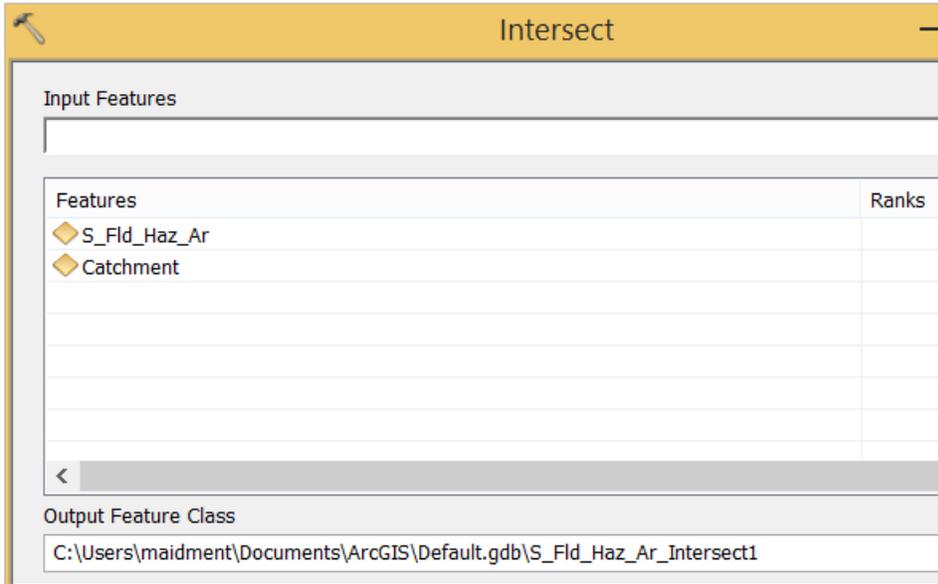
Use a Definition Query to select out the 'X' zone as in Step 6. Notice that the map is blank to the west of Travis County, in Blanco County, and to the east, in Milam County. These counties do not yet have approved Flood Insurance Rate Maps in the National Flood Hazard Layer.



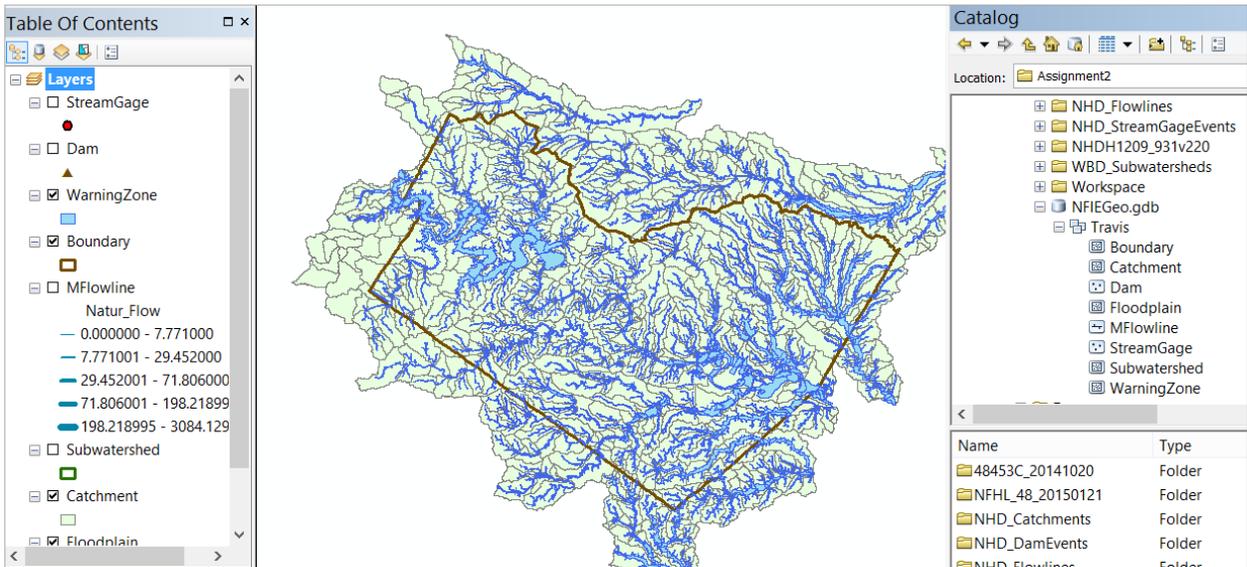
Use **Search** to find the **Intersect** tool, and select the **Intersect (Analysis)** version



Select **S_Fld_Haz_Ar** and **Catchment** as the layers to be intersected. Leave the output feature class at its designated default location.



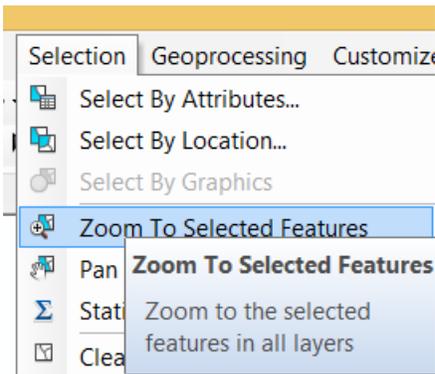
Export the resulting intersected layer to the NFIEGeo geodatabase as **WarningZone**.



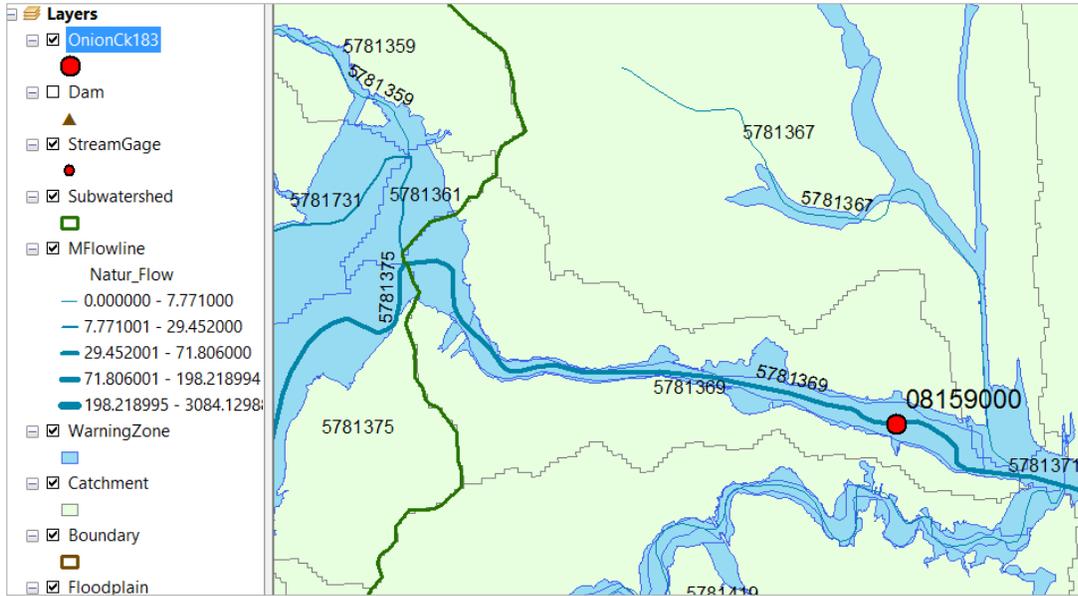
Now, let's take a look and see what we have got. Open the attribute table for the StreamGages, and select the stream gage with **Source_Fea = 08159000**, which is the gage on Onion Creek at Highway 183.

	FEATURECLA	SOURCE_ORI	SOURCE_DAT	SOURCE_FEA
	0	United States Geological Survey (USGS)	National Water Information System (NWIS)	08159150
	0	United States Geological Survey (USGS)	National Water Information System (NWIS)	08105886
	0	United States Geological Survey (USGS)	National Water Information System (NWIS)	08105900
	0	United States Geological Survey (USGS)	National Water Information System (NWIS)	08104900
	0	United States Geological Survey (USGS)	National Water Information System (NWIS)	08158400
	0	United States Geological Survey (USGS)	National Water Information System (NWIS)	08158806
	0	United States Geological Survey (USGS)	National Water Information System (NWIS)	08158824
	0	United States Geological Survey (USGS)	National Water Information System (NWIS)	08158900

Use **Selection/Zoom to Selected Features** to zoom to that location.

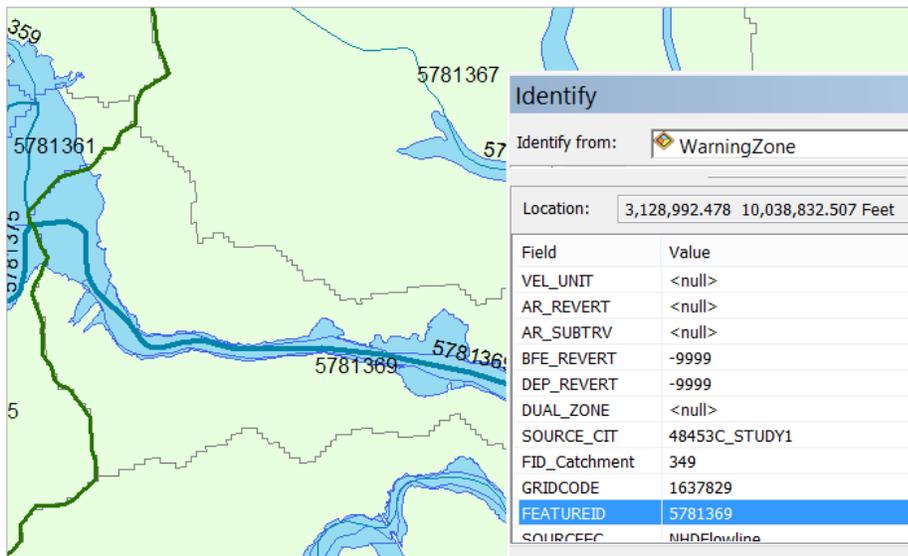


Export the selected gage to NFIEGeo as OnionCk183, and in the map label it with its Source_Fea attribute at 14pt type. Similarly label the **Catchment** feature class with **FeatureID** and the **MFlowline** feature class with **COMID** at 10pt type. You'll see that Gage 08159000 is located in Catchment 5781369 which has MFlowline 5781369, which is connected upstream and downstream with similarly labeled flowlines. If you click on the WarningZone feature class, you'll see that its features are particular to this Catchment.



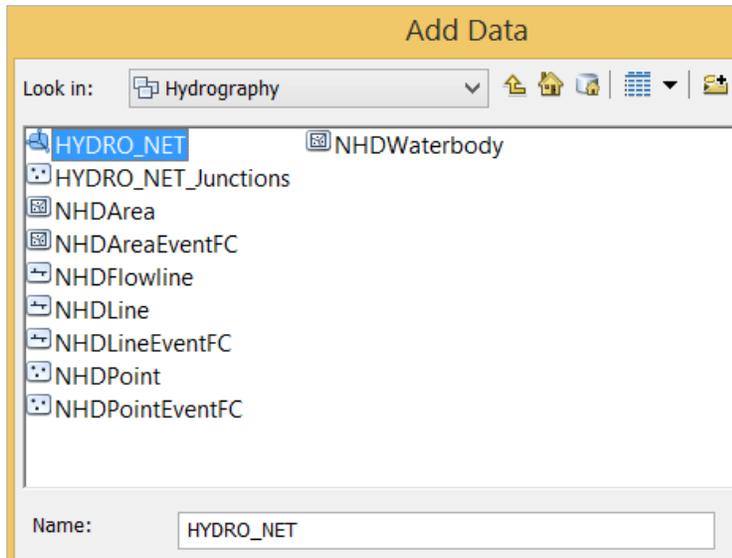
And if you use the Identify tool on the WarningZone, you'll see that it carries the identifier FeatureID = 5781369 that links it to the Catchment containing it.

Ok, that is pretty cool. We have a NFIE-Geo database that can be linked to the NFIE-Hydro flood forecasting model, and we can assess flood risk and color in the WarningZone accordingly.

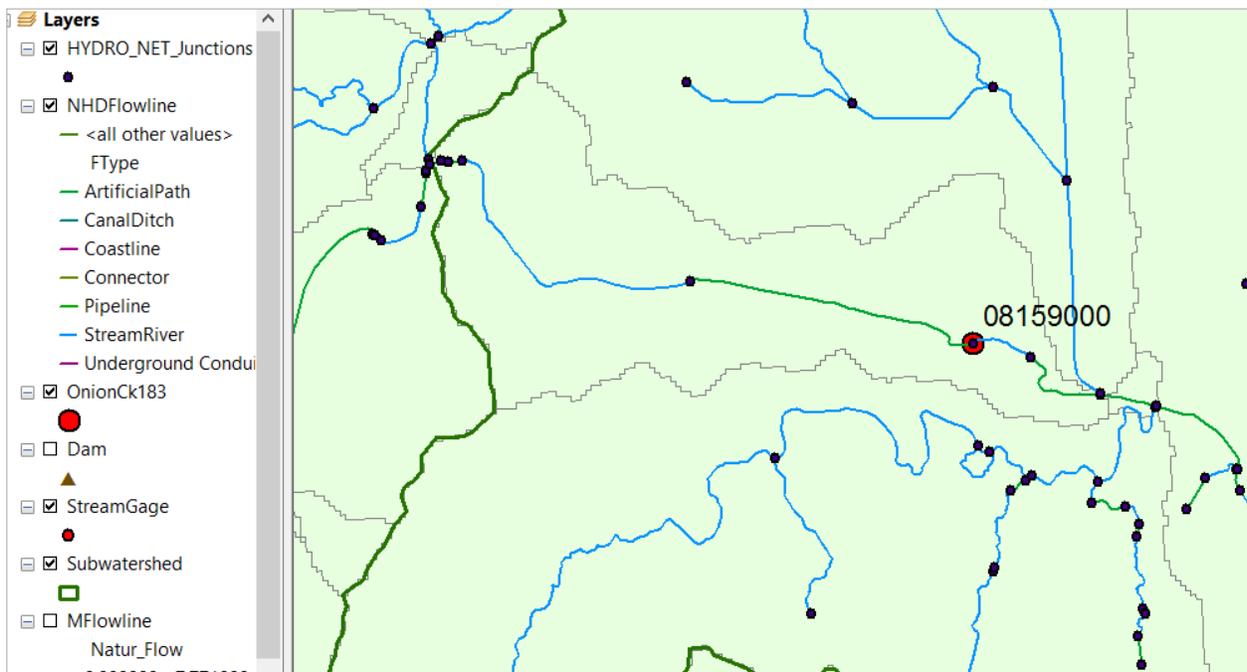


Step 12. Adding the 24K NHD Flow Network

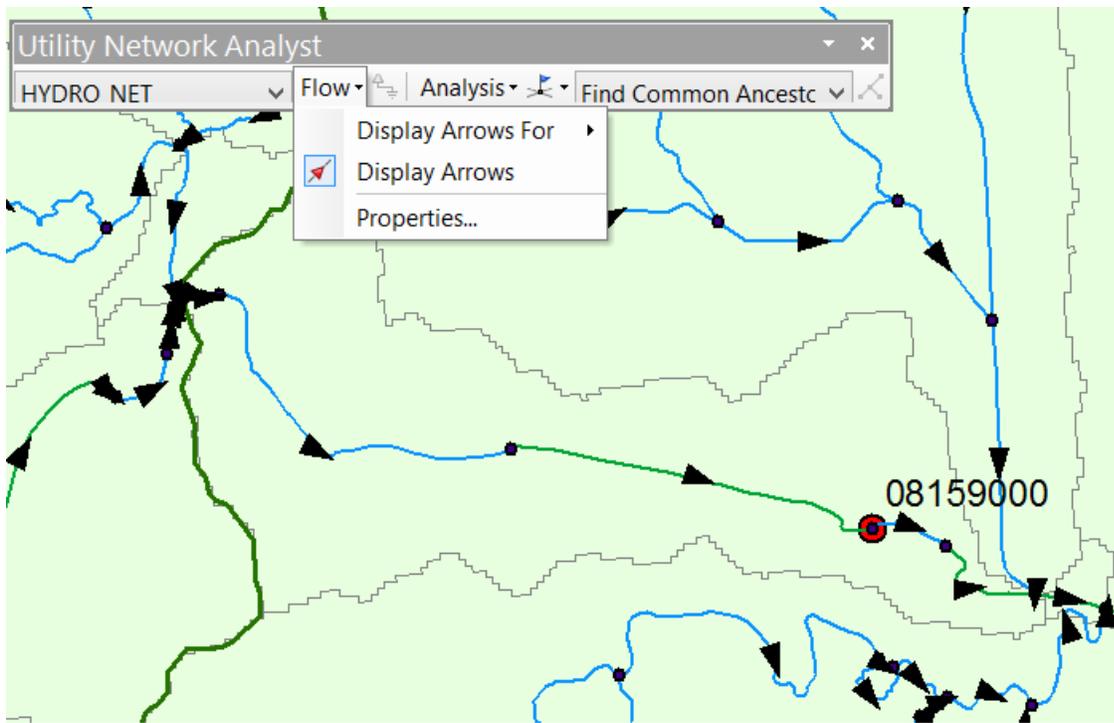
What you have just processed for 100K NHDPlus data is adequate for hydrologic computations and forecasting. If we want to add hydraulic modeling, the 24K NHD HydroNetwork is helpful. Go to the NHDH1209_v31v220 folder, the NHDH1209.gdb geodatabase, Hydrography feature dataset and add the Hydro_Net geometric network.



This provides a more detailed flow network where the lines are joined by junctions, and the lines are Subtyped to give a sense of their function in the network. **StreamRiver** is the one we'll mostly be concerned with. **ArtificialPath** goes through waterbodies and streams represented as polygons.



Right click in the gray area at the top of the ArcMap display and add the Utility Network Analyst toolbar. Use Show Arrows, to indicate the flow direction on the network. This is a more sophisticated and detailed view of the flow network that we'll explore further when we study NFIE-River.



To be turned in:

(1) Prepare a nice map showing the Travis County NFIE-Geo database.

(2) How many Subwatersheds are in this database? How many Catchments? How many Flowlines? How many catchments are there in a Subwatershed, on average?

(3) What is the average area (km^2) of the Subwatersheds and of the Catchments? The map units are in feet so you'll need to do some conversions here.

(4) What is the average length of the MFlowlines (km)?

