Within this document, the term NHDPlus is used when referring to NHDPlus Version 2.1 (unless otherwise noted).

Using ArcCatalog we begin by creating a new personal geodatabase and a geometric network from the NHDFlowlines:

- 1. Start ArcCatalog.
- 2. Right-click on the \NHDPlus06 folder, go to New, File Geodatabase. The database will be added to the left and right windows. Rename the database to NHDPlusFGDB.



3. Right-click on NHDPlusFGDB in the left window, go to New, Feature Dataset. In the New Feature Dataset dialog, Name the feature dataset Hydrography.

| ſ | New Feature Da | itaset | - a | 22 |
|---|----------------|-------------|-----|----|
| | Name: | Hydrography | | |
| | | | | |
| | | | | |
| | | | | |

- 4. Click Next.
- 5. The next screen prompts you to choose a coordinate system.

Click then click "import". In the NHDPlus06\NHDSnapshot\Hydrography directory search for the nhdflowline.shp and add it.

| Browse for Data | sets or Coordinate Systems |
|-----------------|--|
| Look in: | Iydrography 🔹 🔁 📩 🔹 🖓 🧊 |
| NHDArea.sł | ۹۲ ۱ |
| MHDAreaEv | entFC.shp |
| NHDFlowlin | e.shp |
| HDLine.sh | p |
| NHDLineEv | entFC.shp |
| NHDPoint.s | hp rantEC chin |
| | ventret.snp |
| | ody.snp |
| | |
| | |
| Name: | NUDEleviline cho |
| | |
| Show of type: | Datasets and Coordinate Systems Cancel |
| | |

6. Click next.

| New Feature Dataset | 23 |
|--|----------|
| Choose the coordinate system that will be used for Z coordinates in this data. Vertical coordinate systems define the origin and linear unit of z coordinates. They als define the positive direction of values in order to model heights or depths. | 50 |
| Europe Ireland and United Kingdom North America CGVD 1928 IGLD 1955 IGLD 1985 NAD 1983 NAVD 1988 NGVD 1929 | ▲ III |
| Current coordinate system: NAVD_1988 WKID: 5703 Authority: EPSG Linear Units: Meter Direction: positive up Vertical Shift: 0.0 | * |
| Vertical Datum: North_American_Vertical_Datum_1988 | Ŧ |
| < Back Next > Car | ncel |

7. Choose the coordinate system that will be used for Z coordinates (NAVD 1988 under North America) and click Next.

8. Leave XY, Z and M Tolerance field defaults and click Finish.

| New Feature Dataset |
|---|
| XY Tolerance The XY tolerance is the minimum distance between coordinates before they are considered equal. The XY tolerance is used when evaluating relationships between features. |
| 0.00000008983153 Degree |
| Z Tolerance |
| 0.001 Meter |
| M Tolerance |
| 0.001 Unknown Units |
| Reset To Default About spatial reference properties |
| Accept default resolution and domain extent (recommended) |
| |
| |
| |
| |
| < Back Finish Cancel |

9. The new feature dataset called Hydrography is now created and appears in the left window of ArcCatalog under the NHDPlusFGDB personal geodatabase. Next we add the data to the geodatabase.



- 10. Right-click on the Hydrography feature dataset in the left window. Go to Import, Feature Class (single). In the Feature Class to Feature Class dialog.
- 11. Use the Folder button to browse to \NHDPlus06\NHDSnapshot\Hydrography and select NHDFlowline.shp for Input Features
- 12. Leave Output Location as: ...\NHDPlus06\NHDPlusFGDB.mdb\Hydrography
- 13. Enter NHD_KnownFlow in Output Feature Class.

14. Use the SQL button to build an Expression as shown below. This expression extracts from all the NHDFlowlines, only those with known flow direction. The expression should read: "FLOWDIR" = 'With Digitized' Note the single quotes around the 'With Digitized'. Click on Get Unique Values in order to select 'With Digitized'. Click OK.

| Query Builder |
|--|
| GNIS_NAME LENGTHKM REACHCODE FLOWDIR WBAREACOMI |
| = <> Like 'Uninitialized' > > And 'With Digitized' < |
| "FLOWDIR" = "With Digitized" |
| OK Cancel |

15. Returning to the Feature Class to Feature Class dialog, scroll down in the Field Map box and right click ENABLED and select properties. Change the name to ENABLED_CHAR. Click OK.

| ſ | Output Field Prope | rties | × |
|---|--------------------|-------------------|-----------|
| | Name: | ENABLED_CHAR | |
| | Alias: | ENABLED | |
| | Type: | Text | |
| | | Properties | |
| | | Length | 6 |
| | | Allow NULL values | Yes |
| | | | |
| | | | |
| | | | |
| | Merge Rule: | First | • |
| | Delimiter: | | |
| | | | |
| | | | OK Cancel |

16. Leave the remaining items in the dialog at their default values and click OK.

| K Feature Class to Feature Class | | |
|--|------------------|---|
| Input Features E:\\HDP\usV2_1Data\\HDP\usMS\\HDP\us06\\HDShapshot\\Hydrography\\HDF\owline.shp Output Location E:\\HDP\usV2_1Data\\HDP\usMS\\HDP\us06\\HDP\usFGDB.gdb\\Hydrography Output Feature Class NHD_KnownFlow Expression (optional) "FLOWDIR" = 'With Digitized' Field Map (optional) COMID (Long) G: FDATE (Date) G: RESOLUTION (Text) G: GNIS_ID (Text) G: GNIS_ID (Text) G: LDNGTHKM (Double) G: REACHCODE (Text) G: HDWDIR (Text) G: HDWDIR (Text) G: FTYPE (Text) G: FTYPE (Text) G: FTYPE (Text) G: GNIS_NBR (Long) C: GNIS_NBR (Long) C: Geodatabase Settings (optional) | | Field Map (optional) The fields and field contents chosen from the input feature class. You can add, rename, or delete output fields as well as set properties such as data type and merge rule. |
| OK Cancel Environments | s << Hide Help | Tool Help |

- 17. Click OK back in the Feature Class to Feature Class dialog box.
- 18. The import Feature Class to Feature Class operation will execute. Wait until the import is complete. Then click "close".

19. The new feature class called NHD_KnownFlow is now created and appears in the left window of ArcCatalog under the Hydrography feature dataset (if the + next to Hydrography is clicked).

| Catalog Tree | ι× | Contents Preview Description | |
|---------------------------|----|------------------------------|--------------------------------|
| 🗆 🚞 NHDPlusV2_1Data | | Name | Turne |
| 🖃 🚞 NHDPlusMS | | Name | туре |
| 🖃 🚞 NHDPlus06 | | - NHD_KnownFlow | File Geodatabase Feature Class |
| 🕀 🚞 NHDPlusAttributes | | | |
| 🗄 🚞 NHDPlusBurnComponents | | | |
| 🕀 🚞 NHDSnapshot | | | |
| 🖃 🧊 NHDPlusFGDB.gdb | | | |
| 🛛 🕀 🗗 Hydrography | | | |

20. Right-click on the Hydrography feature dataset in the left window. Go to New, Geometric Network. Proceed through the Build Geographic Network Wizard, taking <u>all the defaults</u>. The geometric network called hydrography_net will be created.

| New Geometric Network | × |
|----------------------------|--|
| | This wizard will help you build a geometric network. A geometric network allows you to model the behavior of utility networks such as electrical or water networks. A geometric network is composed of features from one or more feature classes in a feature dataset. When you build a geometric network you specify the topological relationships between its features. |
| Skip this screen in the fu | ture Sack Next > Cancel |

21. The last step of the wizard will build the new geometric network from the NHD_KnowFlow feature class.

| Build Geometric Network | × |
|--------------------------------|--------|
| Creating new geometric network | |
| | Cancel |
| | |

22. The geometric feature classes, Hydrography_net and Hydrography_Junction will appear in the left window of ArcCatalog under the Hydrography feature dataset.

You may receive a "Build Geometric Network" at this point. It reads: 'The geometric network has been created with n build errors. The build errors are stored in the Hydrography_Net_BUILDER_table'. For the purposes of this tutorial, you may ignore the network errors.

| Catalog Tree 4 | × | Contents Preview Description | |
|----------------|---|---|--|
| | * | Name A Hydrography_Net Hydrography_Net_Junctions NHD_KnownFlow | Type File Geodatabase Geometric Network File Geodatabase Feature Class File Geodatabase Feature Class |

- 23. Close ArcCatalog.
- 24. Start ArcMap.
- 25. Use the File, Add Data menu. In the Add Data dialog, navigate to the \NHDPlus06 folder, under the NHDPlusFGDB, select Hydrography and then Hydrography_Net. Click Add.

| Add Data | | | | | | | x |
|---|--|---|--|-----------|--------------|--------------|---|
| Look in: Hydrograph Hydrograph NHD_Known | Hydrography IV_Net IV_Net_Junctions nFlow | 企 | | • 🖻 | 1 E | | |
| Name: Show of type: | Hydrography_Net Datasets, Layers and Results | | | • | | Add ancel | |

26. At this point, the content of your map should contain the NHD_KnownFlow and the Hydrography_Net_Junctions layers.



- 27. Before navigation can be accomplished, one last operation is needed. The flow direction on the network must be established. An easy way to establish flow direction is to use the ArcToolbox a.
- 28. Under Data Management Tools select "Geometric Network", then click on "Set flow Direction".



29. In the dialog box that appears set the Geometric Network as "Hydrography.net", and the flow option to "WITH_DIGITIZED_DIRECTION". Then click OK.

| Set Flow Direction | 20 | 1 | 100 | 7 |
|------------------------------|---------------------------|------------|-----|---|
| Geometric Network | | | | _ |
| E:WHDPlusV2WHDPlus06WHDPlusF | GDB.gdb\Hydrography\Hydro | graphy_Net | | 2 |
| Flow Option | | | | _ |
| WITH_DIGITIZED_DIRECTION | | | | • |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

30. The Following box should appear.



- 31. Use the zoom in tool, 🤷 , to zoom into an area in the NHD_KnownFlow layer.
- 32. From the ArcMap Customize/Toolbars menu, check on the Utility Network Analyst toolbar. Use the Analysis - Flag tool, to place a flag on a junction or place a Flag tool on a network line.



33. Use the Find Upstream Accumulation
on the right side of the Utility Network Analyst toolbar and click the solve button .



- 34. The trace results will be displayed in red. The navigation goes to the headwaters of the network.
- 35. Right click on the NHD_KnownFlow layer and select Zoom to Layer to see the results of the trace.



36. You may also have the results return a selected set of flowlines. To do this using the "Utility network Analysis toolbar" you then click on "analysis" and then "options"



37. And then under the results tab click the "selection" button and hit OK.

| Analysis Options | 23 | | | |
|---|------|--|--|--|
| General Weights Weight Filter Results | | | | |
| Results format Return results as: © Drawings | | | | |
| Draw individual elements of complex edges Trace task result color Selection | | | | |
| Results content Results include: | | | | |
| OK Cancel Ap | oply | | | |

38. Now when you use the Find Upstream Accumulation
and click the solve button
you get a selected set of flowlines.



- 39. The selected flowlines may then be used to create a new layer by right clicking on NHD_KnownFlow in the table of contents and then clicking "selection" and then "Create Layer From Selected Features"..
- 40. A cautionary note about geometric navigations: NHDPlus contains logical connections between streams that flow out of the U.S. into Canada or Mexico and the streams where those waters flow back into the U.S. Since these are logical connections and there is no geometry connection, the use of geometric navigations in these areas will not work correctly.