Exercise 2 — Linking Data to the NHD – Last Updated on 3/12/2014

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

The NHDSnapshot component of NHDPlus contains a linear referencing system in NHDFlowline.shp. The route identifier is NHDFlowline.Reachcode and the route measures are stored as m-values with the coordinates. Additional information about linear referencing is contained in the ArcGIS documentation.

In Steps 1-3 of this exercise, you will create a point dataset. In Step 4, you will reference to NHDSnapshot Reachcode and measures. An existing point dataset may be used instead of creating a new one. The input point dataset should be in geographic coordinates using the datum and other projection parameters of the NHDSnapshot\Hydrography\NHDFlowline.shp. The results will be reviewed and saved in steps 5 and 6.

Step 7 provides instructions for rendering the NHDPlus linear event table, BurnLineEvents.dbf, as linear events on NHDSnapshot.

- 1. Using ArcCatalog, create a new point shapefile.
 - Right-click on the NHDPlusMS\NHDPlus06 folder, go to New, Shapefile. In the Create New Shapefile dialog,
 - i. Give the shapefile a Name of PointsOfInterest.
 - ii. Use the Feature Type pull down to select Point.
 - iii. Click Edit to create a Spatial Reference for the shapefile.

cate ivew shapeine			
Name:	PointsOfInterest		
Feature Type:	Point		•
Spatial Reference			
Description:			
Unknown Coordina	ate System		*
			Ŧ
Show Details		Edit.	
Coordinates will	contain M values. Used contain Z values. Used	d to store route d to store 3D data	ata. a.

iv. In the **Spatial Reference Properties** window, click **Import** from the Add Coordinate System pull-down menu.

Spatial Reference Properties	×
XY Coordinate System	
Type here to search ■ Image: Second seco	® Import Clear
Current coordinate system: <unknown></unknown>	
	Ŧ
	OK Cancel

v. In the **Browse For Datasets or Coordinate Systems** window, browse to the NHDPlusMS\NHDPlus06\NHDSnapshot\Hydrography folder and select NHDFlowline.shp. Click **Add**.

Browse for Data	isets or Coordinate Systems	×
Look in: 🛅	Hydrography 🔹 🗲 🔛 🔁	1) Q Q
NHDArea.sl NHDAreaEv NHDElowlin NHDLine.sh NHDLineEv NHDPoint.s NHDPointEv NHDPointEv NHDPointEv	hp ventFC.shp ne.shp hp ventFC.shp shp sventFC.shp body.shp	
Name:	NHDFlowline.shp	Add
Show of type:	Datasets and Coordinate Systems	Cancel

vi. The **Spatial Reference Properties** dialog will now contain the same spatial reference as the NHDFlowlines. Click **OK**.



vii. The Create New Shapefile dialog is now complete. Click OK.

b. Close ArcCatalog.

- 2. In ArcMap:
 - a. Use the **File**, **Add Data** menu. In the **Add Data** dialog, navigate to the NHDPlusMS\NHDPlus06\NHDSnapshot\Hydrography folder, select NHDFlowline.shp, and click **Add**.
 - b. Use the File, Add Data menu. In the Add Data dialog, navigate to the NHDPlusMS\NHDPlus06 folder, select PointsofInterest.shp and click Add.
 - c. At this point, the content of your map should look like this:



- 3. Use the ArcMap editor to create point features in PointsOfInterest.
 - Add the Editor toolbar if it is not present in ArcMap. Click on Editor and select Start Editing. In the top window of the Start Editing dialog, the \NHDPlus06 directory should be selected and PointsOfInterest should appear in the bottom window. Click OK.

Start Editing	×
This map contains data from more than one database Please choose the layer or workspace to edit.	e or folder.
Source	Туре
E: WHDPlusV2_1Data WHDPlusMS WHDPlus06	Shapefiles / dBase Files
E: WHDPlusV2_1Data WHDPlusMS WHDPlus0	Shapefiles / dBase Files
About editing and workspaces	OK Cancel

b. Use the zoom-in tool (, to zoom in to an area in the NHDFlowline layer.

c. On the **Editor toolbar**, Open the **Create Features** window **E**. From the Create Features window, choose **PointsOfInterest** and **Point** from the Construction Tools.

Create Features
VE - E Point
PointsOfInterest PointsOfInterest
Construction Took
Point Point
Point at end of line

d. It's convenient to snap the new points to the NHDFlowlines. To set the snapping environment, select **Snapping On** in the Snapping Toolbar window (Editor pulldown menu > Snapping).

Snap	Snapping 🚽 🗙 🗸		
Snap	pping 🕶 🖸 🔟		
~	Use Snapping		
-	Intersection Snapping		
À.	Midpoint Snapping		
σ	Tangent Snapping		
	Snap To Sketch		
	Snap To Topology Nodes		
	Options		

e. With **Point** selected in the Construction Tools of the Create Features window. Point at various locations on NHDFlowlines and click to create point features in the PointsOfInterest layer. Also, add some points that do not snap to a flowline.



f. Click on Editor and select Stop Editing and click Yes on the Save dialog.

4. Making an Event Table

To turn PointsOfInterest into a point event table, From ArcToolbox Window, Expand the Linear Referencing Tools list.



- a. Double click on Locate Features Along Routes to open the dialog. In the dialog,
 - i. Use the **Input Features** pull down to select **PointsOfInterest** as the feature class that will be located along routes.
 - ii. Use the **Input Route Features** pull down to select **NHDFlowline** which is the route class of the NHD.
 - iii. Use the **Route Identifier Field** pull down to select **Reachcode** which is the route identifier for the NHD.
 - iv. Set the **Search Radius** to **.001 decimal degrees** (approx. 370 ft). This will make sure that PointsOfInterest that are not located exactly on an NHDFlowline will be snapped to the nearest NHDFlowline within the search radius.
 - v. In the options listed at the bottom of the dialog, make sure "Include distance field on output table" is toggled on
 - vi. Output Event Table: NHDPlusMS\NHDPlus06\PointsOfInterest_Events.dbf
 - vii. Type **ReachCode into** the Route Identifier Field
 - viii. Click OK and the Locate Features Along Routes tool will execute

SLocate Features Along Routes		
Input Features	×	Output Event Table
PointsOfInterest	I 🖻	
Input Route Features		The table to be created.
NHDFlowline	- E	
Route Identifier Field		
REACHCODE	•	
Search Radius		
	0.001 Decimal degrees 🔻	
Output Event Table		
D:\NHDPlusV21\NHDPlusMS\NHDPlus06\PointsOfInterest_Events.dbf		
Output Event Table Properties		
Route Identifier Field		
ReachCode	-	
Event Type		
POINT	•	
Measure Field		
MEAS	*	
To-Measure Field		
	×	

- b. There now exists an event table called PointsOfInterest_Events.dbf. Use **File**, **Add Data**, to add this event table to the map if it has not already been added automatically.
- c. Right click on PointsOfInterest_Events in the Layers list and select **Open** to display the attribute table for PointsOfInterest_Events. Note the ReachCode field which tells us which reach each point is located on and the Meas field which tells us where along the reach the point is located. The Distance field tells us how far (in decimal degrees), the point was moved in order to snap it to the nearest NHDFlowline.

Notice that points added and snapped to a flowline in the Create features step, have a distance value of zero, meaning no snapping occurred during the Locate Route Features. If any of the input points are beyond the linear referencing tool search radius (0.001 decimal degrees), those points are not snapped by the tool and not listed in the event table.

Table						
0	🗄 - 🖶 - 🖫 🚮 🖾 🐠 🗙					
Po	intsOfI	nterests_Events				
	OID	ReachCode	MEAS	Distance	ld	
Þ	0	06010104000073	6.56693	0	0	
	1	06010104000971	36.50938	0	0	
	2	06010104000652	32.16033	0	0	
Ϊ.						
	(0 out of 3 Selected)					
P	PointsOfInterests_Events					

- d. Render (draw) the events using the Reachcodes and measures to determine a point shape for each event. Open the ArcToolbox Linear Referencing Tools, "Make Route Event Layer"
 - i. Specify the routes referenced by the events in the table: For Input Route Features select **NHDFlowline** and Route Identifier Field: **REACHCODE**
 - ii. Specify the table containing the route events: Input Event Table: **PointsofInterest_Events.** Route Identifier Field: **ReachCode**
 - iii. Select **Point** for Event Type.
 - iv. Measure Field: MEAS
 - v. Provide a Layer Name for the rendered points. For this example, Layer Name is **PointsSnappedToNHD**
 - vi. Leave the remaining items at their default values.
 - vii. Click **OK**.

coding Tools			
Make Route Event Layer			
Input Route Features			Layer Name or Table
NHDFlowline		- 🖻	View
Route Identifier Field			
REACHCODE		-	The layer to be created.
Input Event Table			memory so a path is not
PointsOfInterests_Events		I 🖆 🗉	necessary.
Event Table Properties			
Route Identifier Field			
ReachCode		•	
EventType			
POINT		• L	
Measure Field			
MEAS		-	
To-Measure Field			
Laver Name or Table View			
PointsSnappedToNHD		-	
			,
	OK Cancel Environments	<< Hide Help	Tool Help

5. Reviewing Results

 a. Change the symbol for the PointsOfInterest to Circle 2 by double-clicking on the symbol in the Table of Contents window. Select Circle 2 and click OK. Make sure PointsSnapped to NHD is also turned on.

To examine the results, zoom very close to some of the points. Note that in some cases, even though the PointsOfInterest point may be slightly off of the NHDFlowline, the snapped point in PointsSnappedtoNHD is exactly on the NHDFlowline.



b. If we use the Identify tool to click on a point in PointsSnappedtoNHD, we see that the point is on a specific Reachcode at a specific measure.

Identify		ų ×
Identify from	: <top-most layer=""></top-most>	-
PointsSn	appedToNHD 0 1040000 73	
		×1
Location:	-82.886965 36.518494 Decimal Degrees	3
Field	Value	
OID	0	
ReachCode	06010104000073	
MEAS	6.56693	
Distance	0	
Id	0	
Shape	Point ZM	

6. Saving Results as a Shapefile

PointsSnappedtoNHD is a layer file in memory. To save these results as a shapefile, right click the name of the layer in the Table of Contents and choose **Data > Export Data.**

7. Linear Events

Linear events, ones that are linked to a stretch along a reach, can be created in a similar manner as points.

NHDPlus provides a linear event table that represents a version of the networked NHDFlowlines used for building the HydroDEM and catchments. This table named BurnLiveEvent.dbf is found in the NHDPlus BurnComponents folder for a given VPU. Below is an example of using **Make Route Event Layer** to render BurnLineEvent.

Make Route Event Layer	
Input Route Features	Event Table
NHDFlowline 🗹 🖻	Properties
Route Identifier Field	
REACHCODE	Parameter consisting of the
Input Event Table	route location fields and the
E:\NHDPlusV2_1Data\NHDPlusMS\NHDPlus06\NHDPlusBurnComponents\BurnLineEvent.dbf	event table
Event Table Properties	
Dauta Idaatifaa Gald	Route Identifier
	Field—The field
	containing values
Event Type	that indicate along
LINE	which route each
From Mesoure Field	event is. This field
FROMMEAS	character
	Event Type—The
To-Measure Field	type of events in the
TOMEAS	input event table
Laver Name or Table View	(POINT or LINE).
BurnLineEvent Events	• POINT—
	Point events
OK Cancel Environments << Hide Help	Tool Help