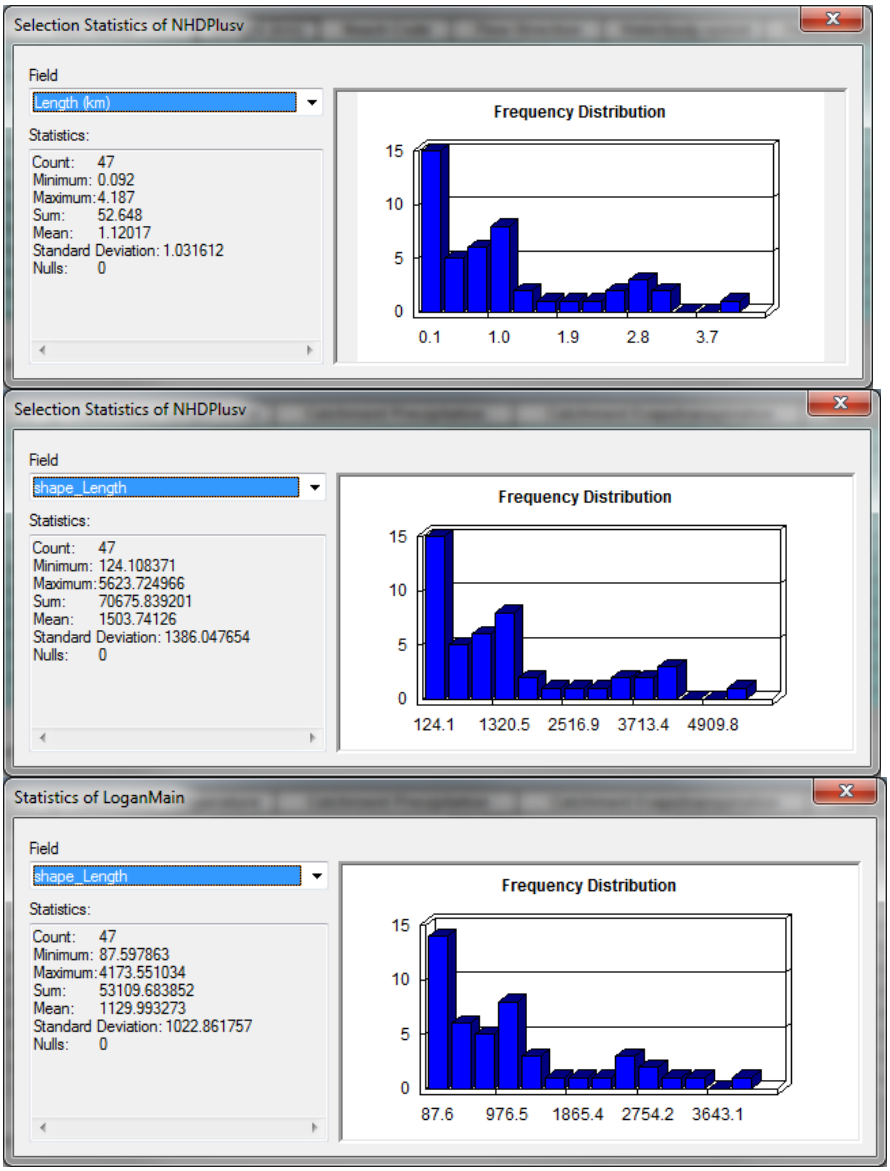
GIS in Water Resources Exercise #4 Solution

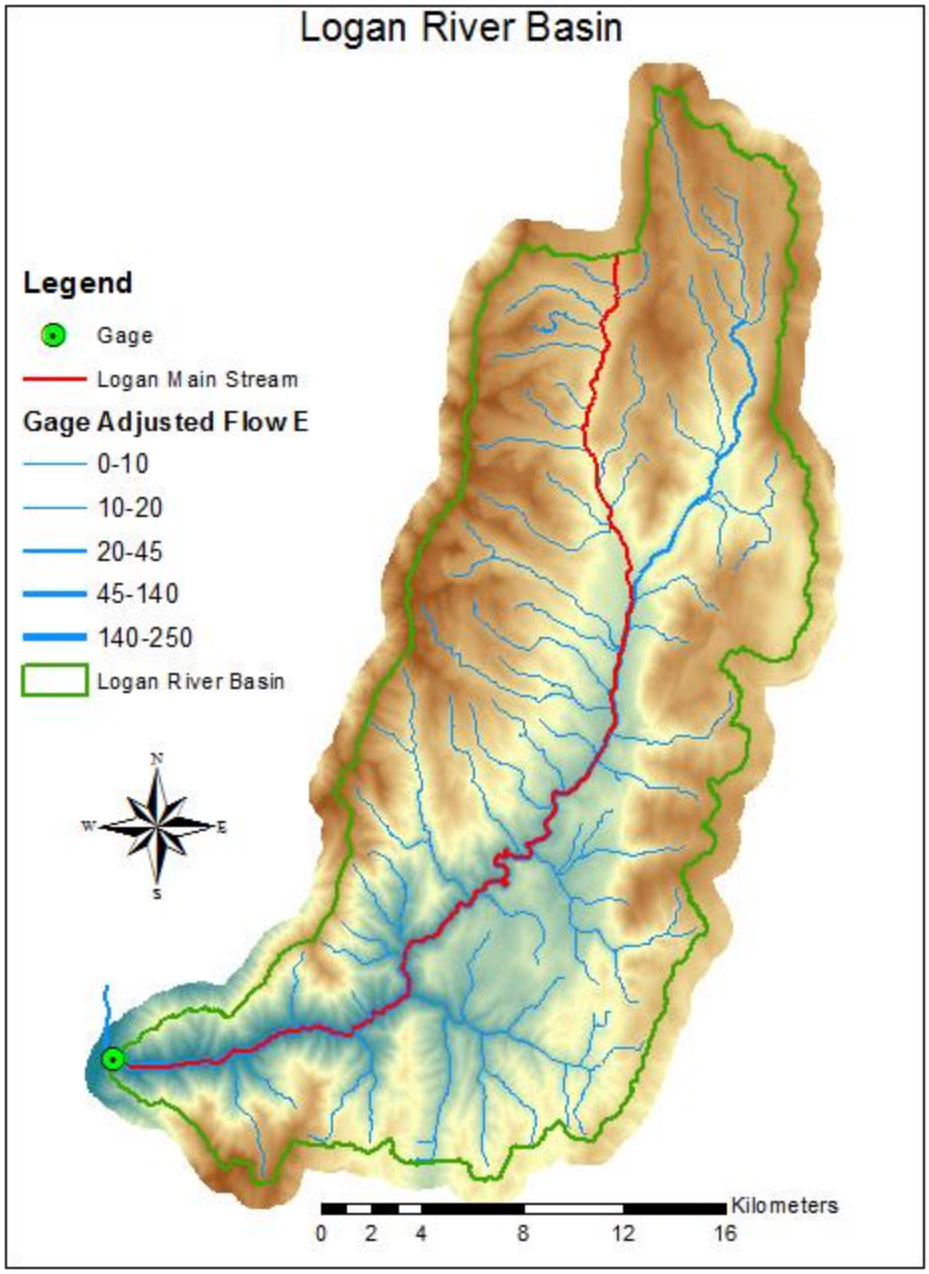
1. *Table giving the length of the Logan River main stream from NHDPlus Length (km) column, Landscape.gdb\NHDPlusv shape_length and Logan.gdb\Basemap\LoganMain shape_length. Explain the differences. Comment on which you think is more reliable. [Hint the answer has to do with the coordinate systems used to represent each of these feature classes.]*



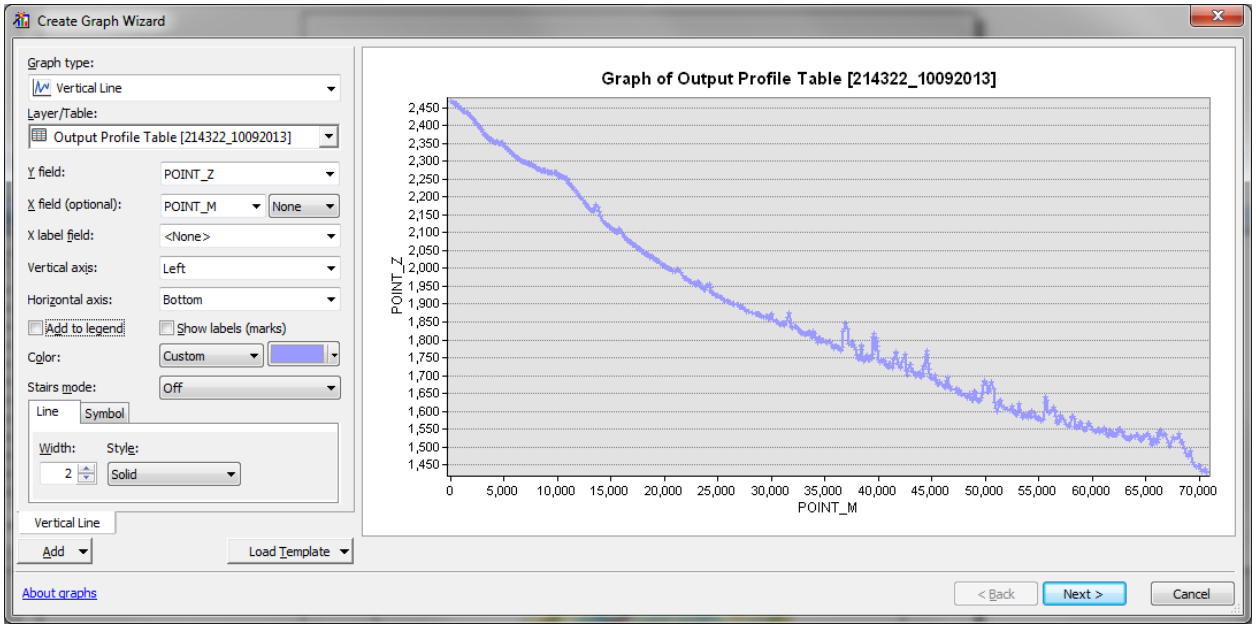
Length from NHD Plus Length Values (km)	52.65
Length from shape length in NHD Plus (km)	70.68
Length from shape length in LoganMain (Projected into Albers coordinate system) (km)	53.11

The first and third lengths are within 0.5 km of each other and are consistent. Differences may be due to slight differences in coordinate system and generalization of the lines. The NHD plus shape length is distorted due to being evaluated in the Web Mercator coordinate system which artificially expands lengths (evidently).

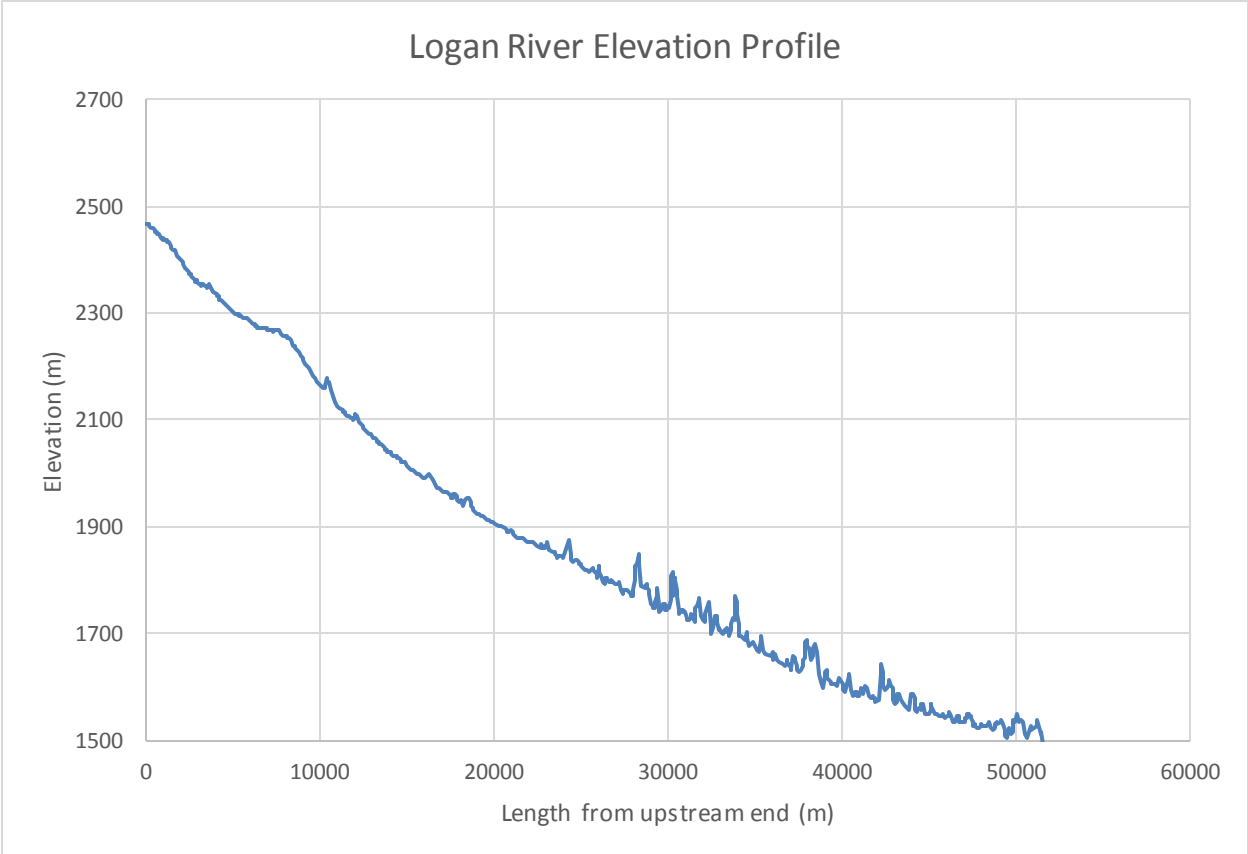
2. *Prepare a layout showing the topography, Basin Outline, NHDPlusv streams and Logan River Main stem stream for the Logan River Basin. Include a scale bar and North arrow and appropriate title, labeling and legend so that the map is self-describing.*



3. *A graph giving the elevation profile of the Logan River main stem.*



Profile from ArcGIS. Note that lengths on the X axis are inflated.

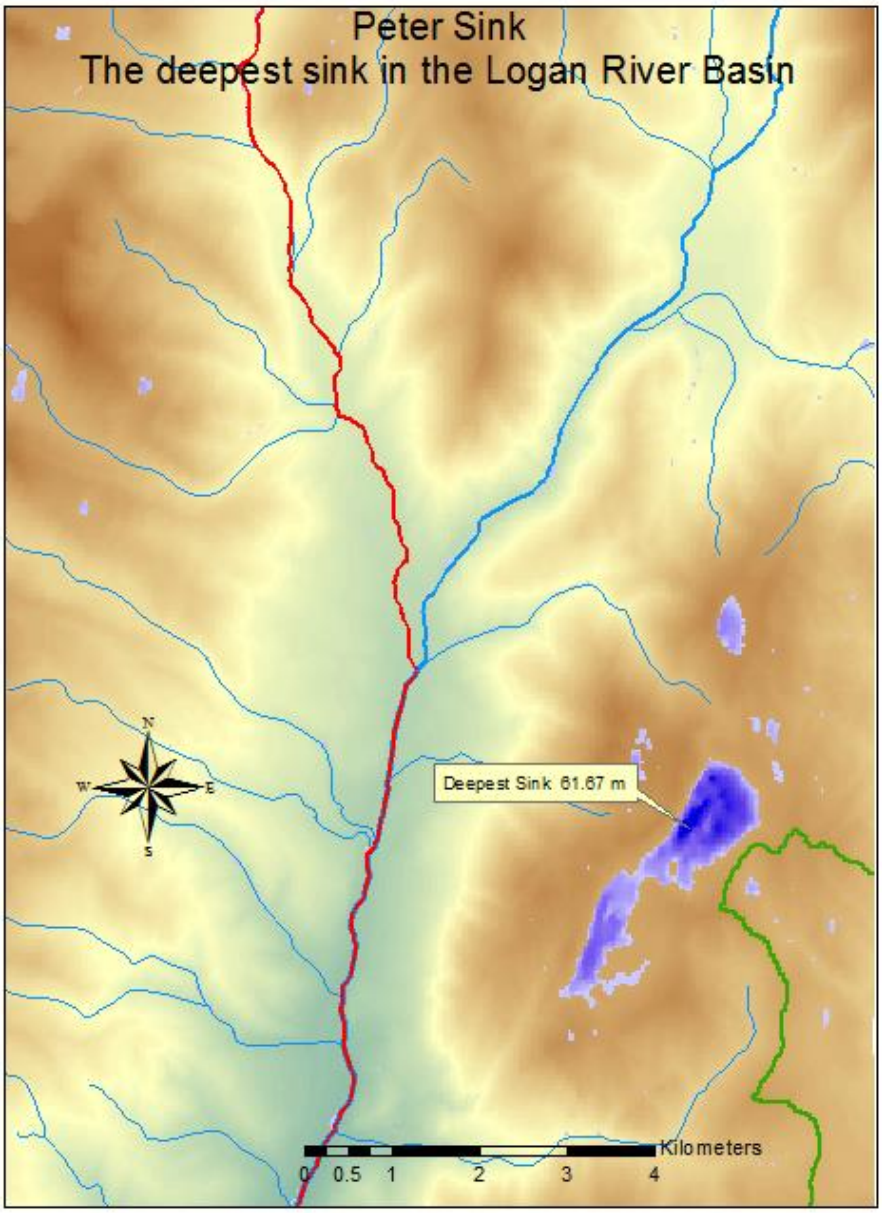


Elevation Profile prepared using Excel. Note that lengths were computed from the coordinates and scale to the total of 53 km.

4. *The number of columns and rows, and grid cell size in the Logan DEM. The minimum and maximum elevation values in the Logan DEM.*

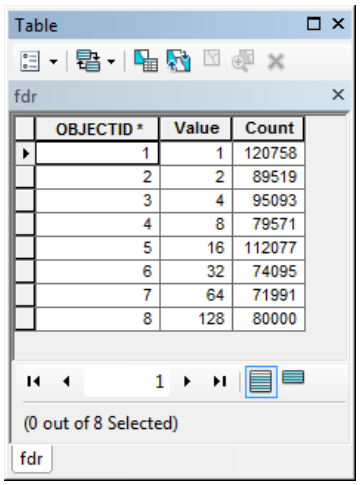
Number of rows: 1466
Number of columns: 968
Cell Size: 30.922 m
Min Elevation: 1411.2 m
Max Elevation 3037.6 m

5. *A layout showing the deepest sink in the Logan River basin. Report the depth of the deepest sink as determined by fil-dem.*

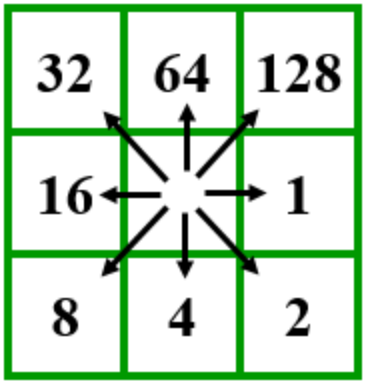


The depth of Peter Sink, the deepest sink is 61.67 m

6. *Make a screen capture of the attribute table of fdr and give an interpretation for the values in the Value field using a sketch.*



OBJECTID *	Value	Count
1	1	120758
2	2	89519
3	4	95093
4	8	79571
5	16	112077
6	32	74095
7	64	71991
8	128	80000



Interpretation of flow directions encoded in the Value Field

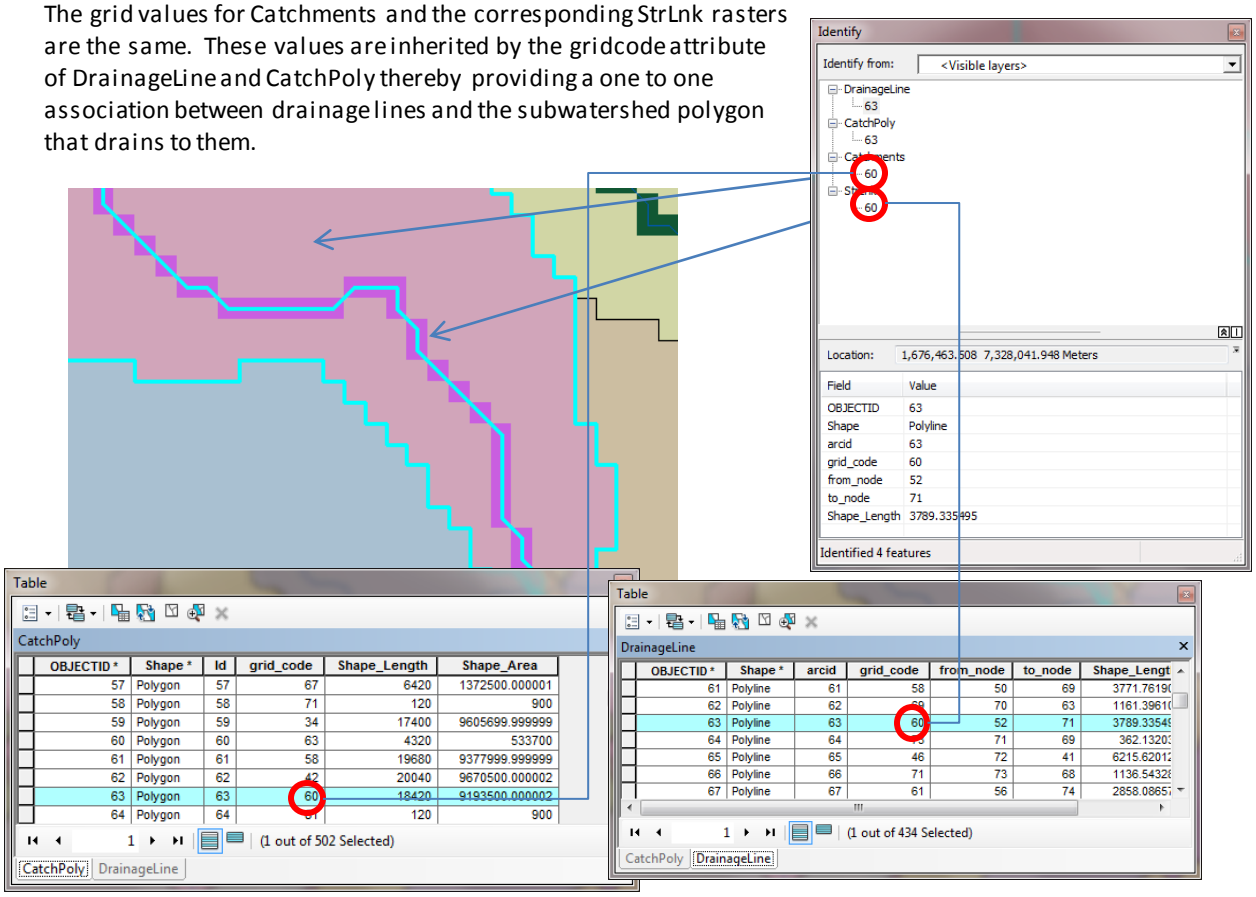
7. *Report the drainage area of the Logan River basin in both number of 30.92 m grid cells and km² as estimated by flow accumulation. Report the area of the Logan River basin in km² as calculated by the arcgis.com watershed function. Report the area of the Logan River basin in km² as reported by the USGS for the Logan River stream site. Discuss reasons for any differences.*

Flow accumulation: 583809 grid cells = 558.14 km^2
AreaSqKm reported by ArcGIS.com watershed function = 555.38 km^2
USGS Area 214 mi^2 = 554 km^2

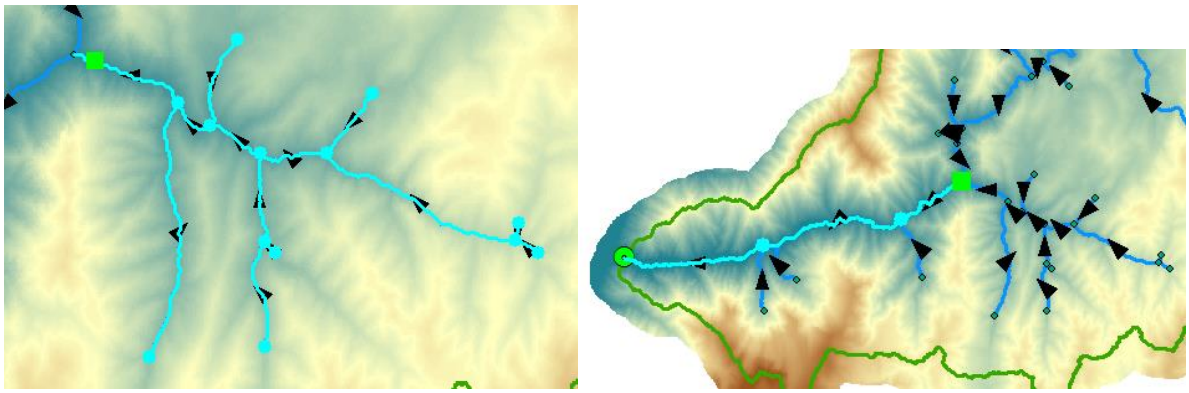
These differences are small and arise due to rounding and small difference in flow directions along the edges of the watershed.

8. *Describe (with simple illustrations) the relationship between StrLnk, DrainageLine, Catchment and CatchPoly attribute and grid values. What is the unique identifier in each that allows them to be relationally associated?*

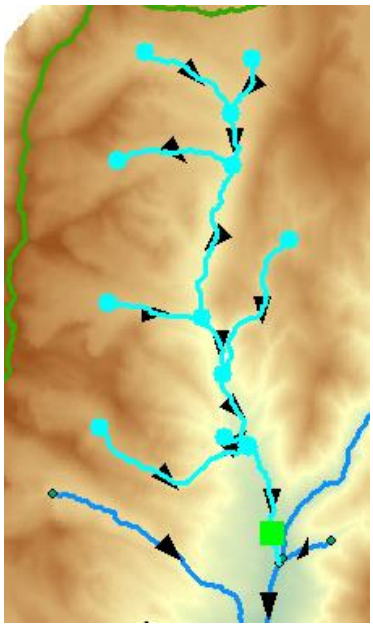
The grid values for Catchments and the corresponding StrLnk rasters are the same. These values are inherited by the gridcode attribute of DrainageLine and CatchPoly thereby providing a one to one association between drainage lines and the subwatershed polygon that drains to them.



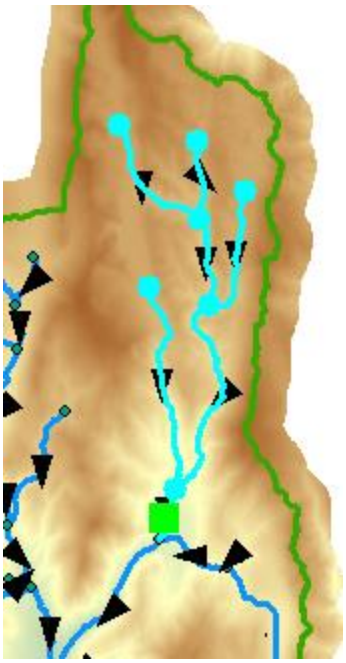
9. *A table giving for each of the tributaries identified above the number of upstream stream links, the total length of upstream stream links, the total upstream area, drainage density (total length/total area), number of downstream links along path to outlet, distance to outlet along the streams.*



Right hand fork traces. For upstream (left), I used edge flag. For downstream (right) I used junction flag so as not to get the extra length in the tributary stream.



Franklin Basin



Beaver Mountain

	Right Hand Fork	Franklin Basin	Beaver Mountain
Number of upstream links	13	13	7
Length Upstream (km)	23.7	52	30.99
Area Upstream (km^2)	65.8	89.97	67.1
Drainage Density (km/km^2)	0.360	0.578	0.46
Number of downstream links	3	16	18
Length Downstream (km)	17.45	50.08	56.21

10. *A layout illustrating the longest flow path in the Logan River Basin and giving the length in km.*