Exercise 3 Solution

1. smdem attributes
Cell size: 100 m
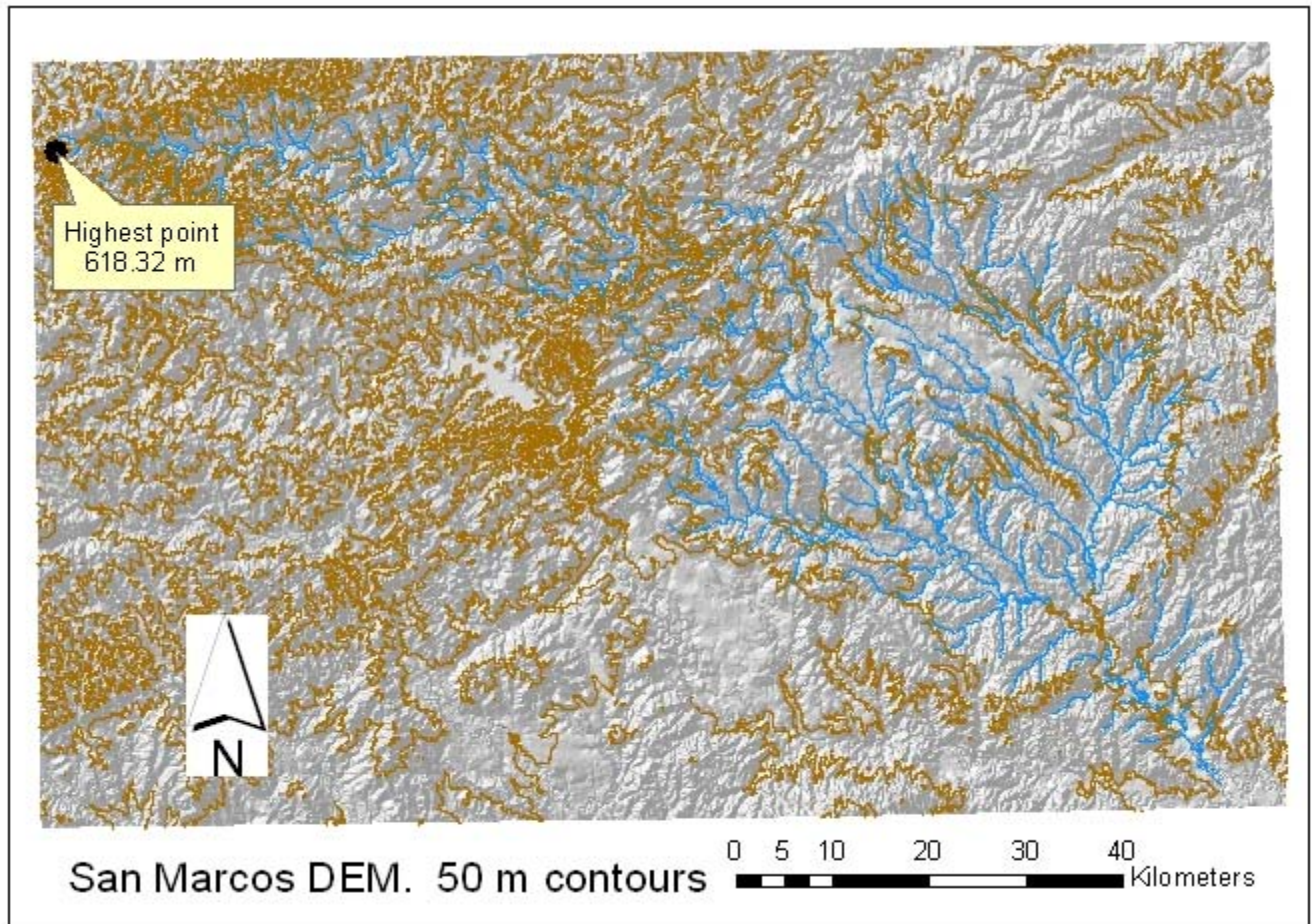Number of rows: 818
Number of columns: 1300
Maximum elevation: 618.32 m
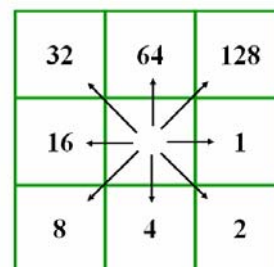Minimum elevation: 69.82 m

2. Layout of San Marcos Topography.

San Marcos DEM. 50 m contours

3. Fdr attribute table. The numbers in the value field depict the encoding of flow directions according to the scheme given on the right.

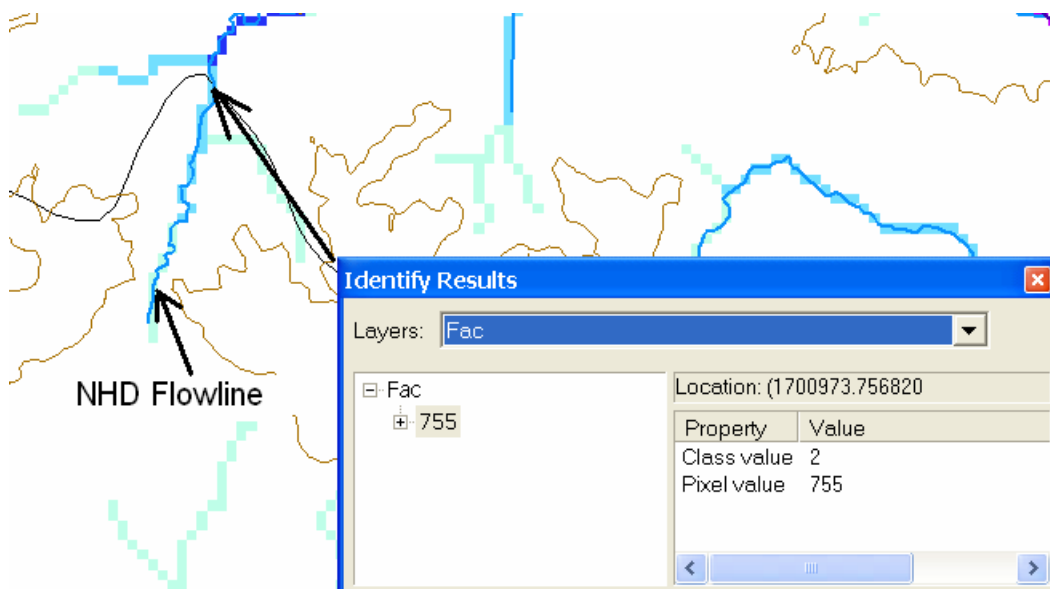| ObjectID	Value	Count
0	1	189743
1	2	134252
2	4	174298
3	8	101050
4	16	136003
5	32	71578
6	64	116943
7	128	101140

32	64	128
16		1
8	4	2

4. Flow accumulation at the outlet is **353159 grid cells**. This corresponds to a drainage area of $353159 \times 100 \times 100 = 3.532 \times 10^9 \ m^2 = \mathbf{3532 \ km^2}$.
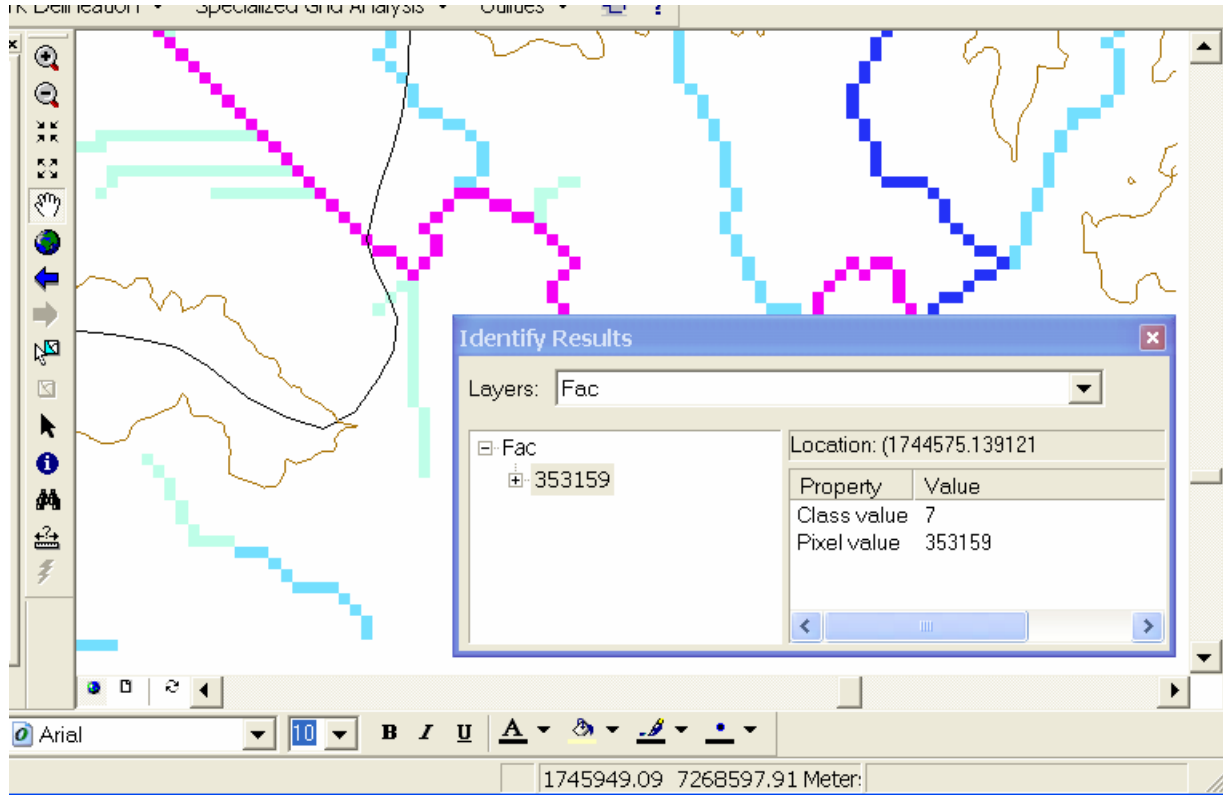

Flow accumulation entering the omitted area on the south edge is **755 grid cells** corresponding to **7.55 km ^{2}**

Note that the NHD flow line – a dataset independent of the DEM also crosses the Subbasin boundary suggesting that the discrepancy is most likely in the subbasin boundary because it disagrees with two other datasets.

5. Comparison of DEM derived Drainage Lines with NHD flowlines. The density of DEM derived drainage lines is small due to the large drainage area threshold (~36 km^2) used to delineate streams from the DEM. The match between them could be improved by reducing the drainage area threshold used to define drainage lines.

San Marcos Basin. 50 m contours

Legend
— Drainage Line
— NHD Flowline
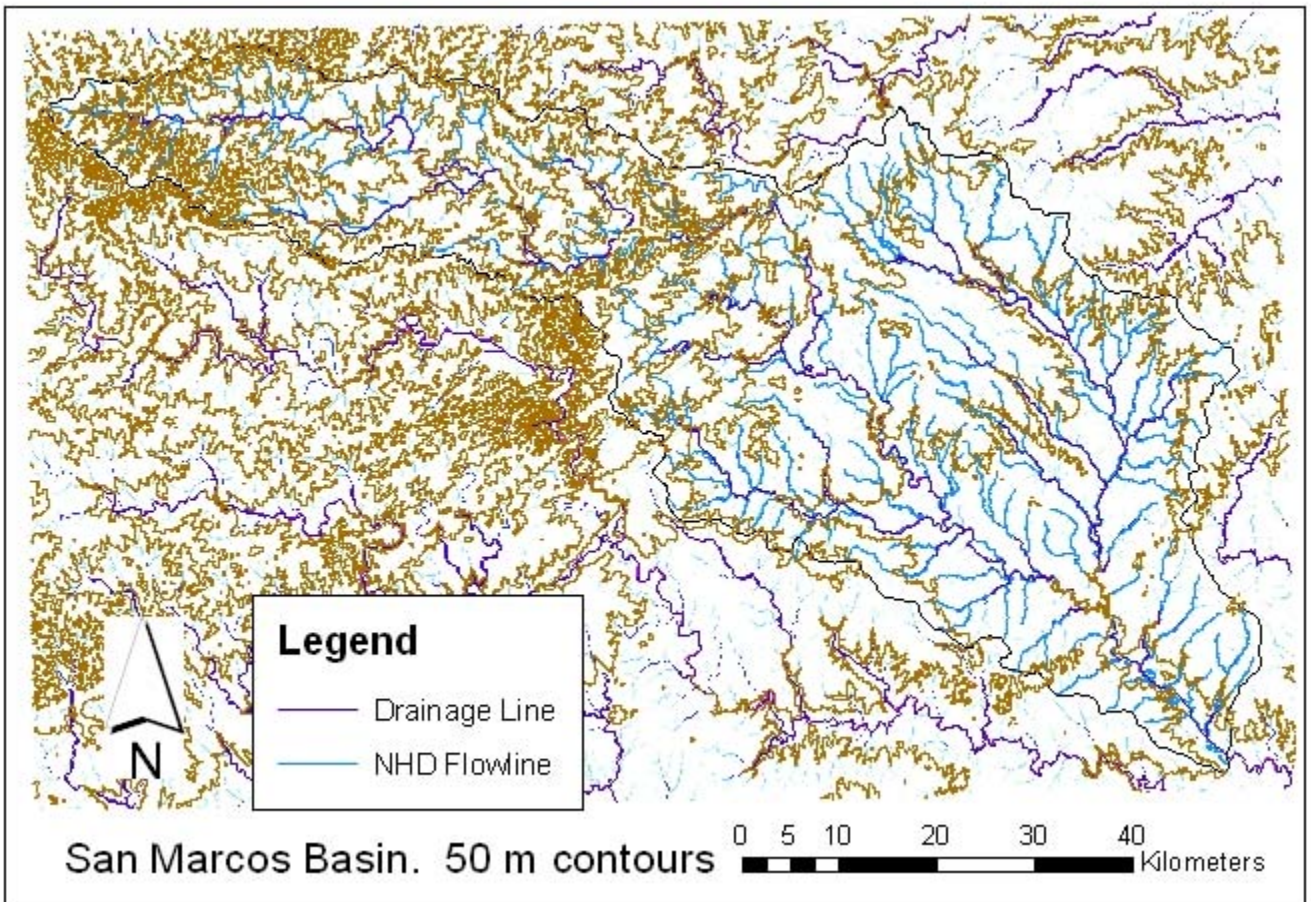
6. Drainage area from DEM flow accumulation: **3532 km^2** (calculated above)
Drainage area from San Marcos 8 digit HUC subbasin: **3538 km^2**. This is the shape area in the attribute table after the feature class was imported into the geodatabase feature dataset to have it in a consistent spatial reference.
Length of DEM derived Drainage Line feature class: **559 km.** This is the sum of the shape length in the attribute table of the Drainage Line feature class for drainage lines selected that intersect with the SanMarcos subbasin HUC evaluated using the statistics command (see below). There is a small error in this length due to the extension of the last Drainage line outside of the subbasin.
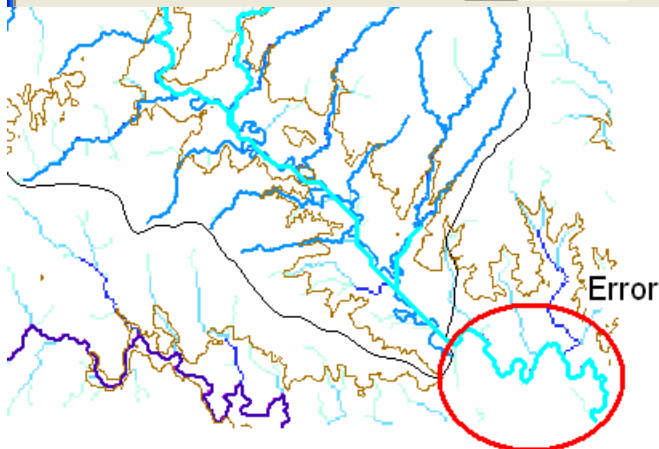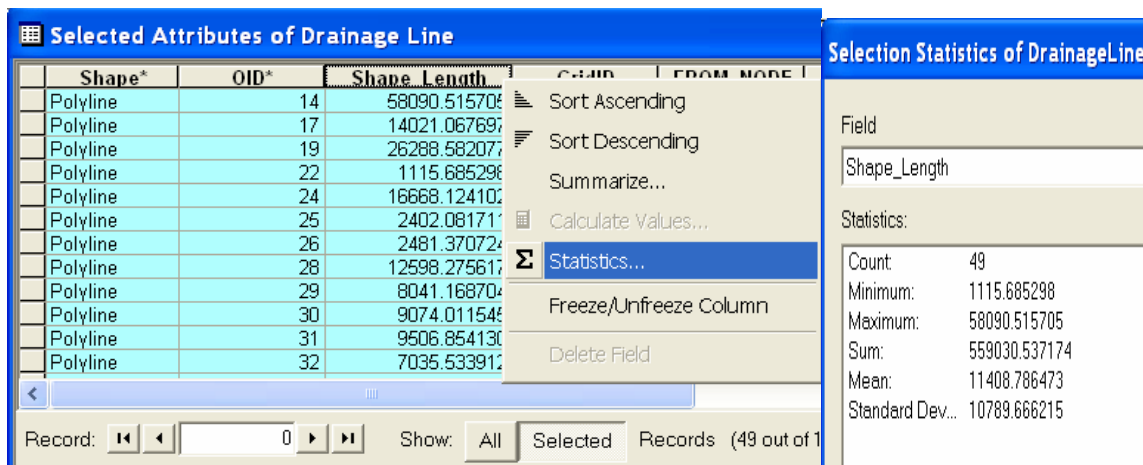
Length of NHD Flowlines for San Marcos Subbasin HUC: **1891 km**. This is also evaluated using the statistics tool, although here no selection is necessary.

Drainage density of DEM derived Drainage lines: 559/3532 = **0.158 km^{-1}**.
Drainage density of NHD flowlines: 1891/3532 = **0.535 km^{-1}**.
This difference is also due to the large threshold used to delineate DEM derived drainage lines. The DEM derived area was used because it is felt to be more reliable following examination of the boundary and discrepancy between the subbasin boundary and DEM and NHD flowlines noted above.