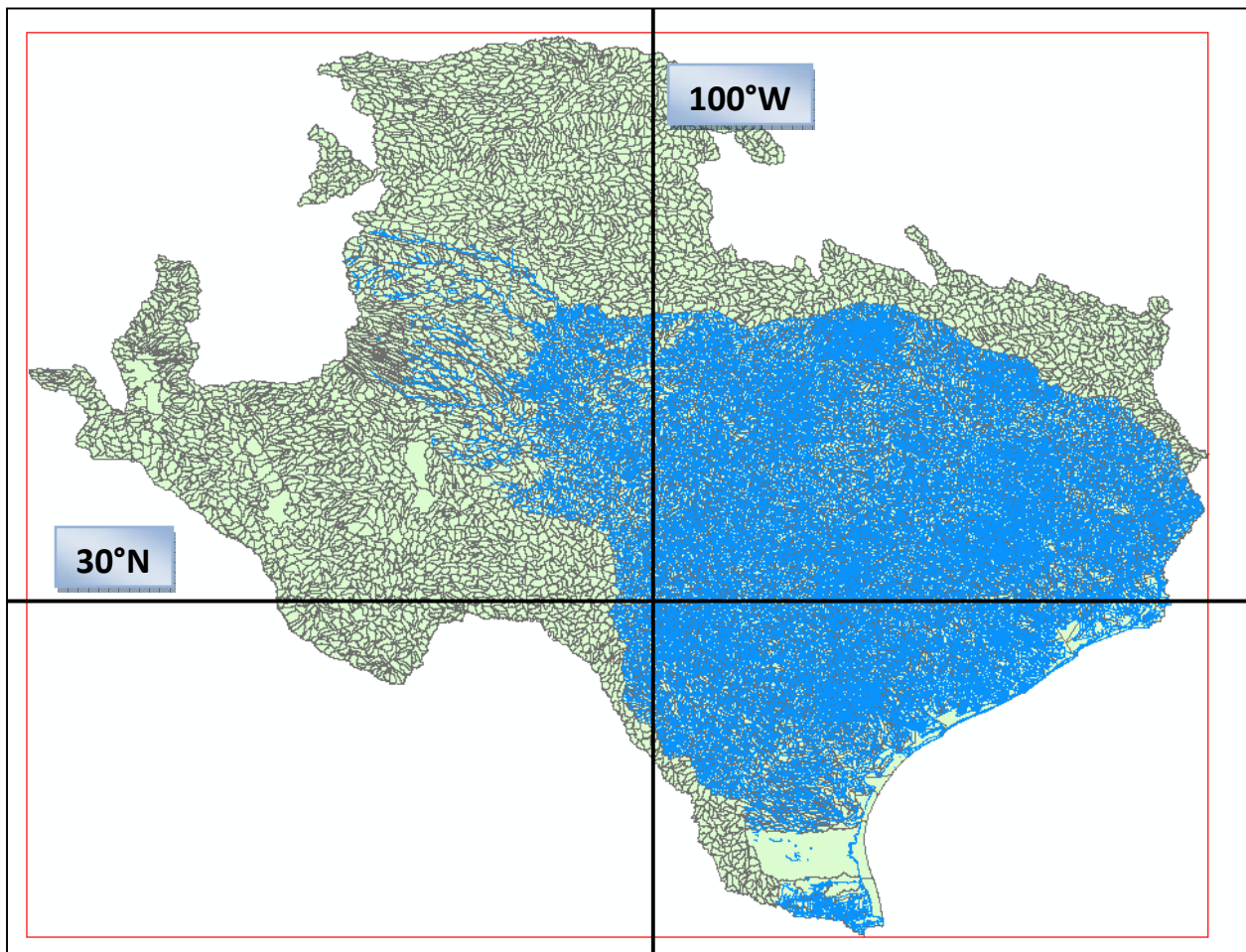


Exercise 2 Solution Key – Building a Base Map of the San Marcos Basin

What is the approximate map extent in decimal degrees of these data? Use the Draw Tools in ArcMap to draw lines on the map showing the 100° W Meridian and the 30° N Parallel. Screen capture the resulting map display and include it in your solution.

The approximate map extent of the data for this exercise is indicated below by the red box. The NW corner of this box is at latitude/longitude **(37.078, -107.83)** and the SE corner is at **(25.878, -93.081)**.

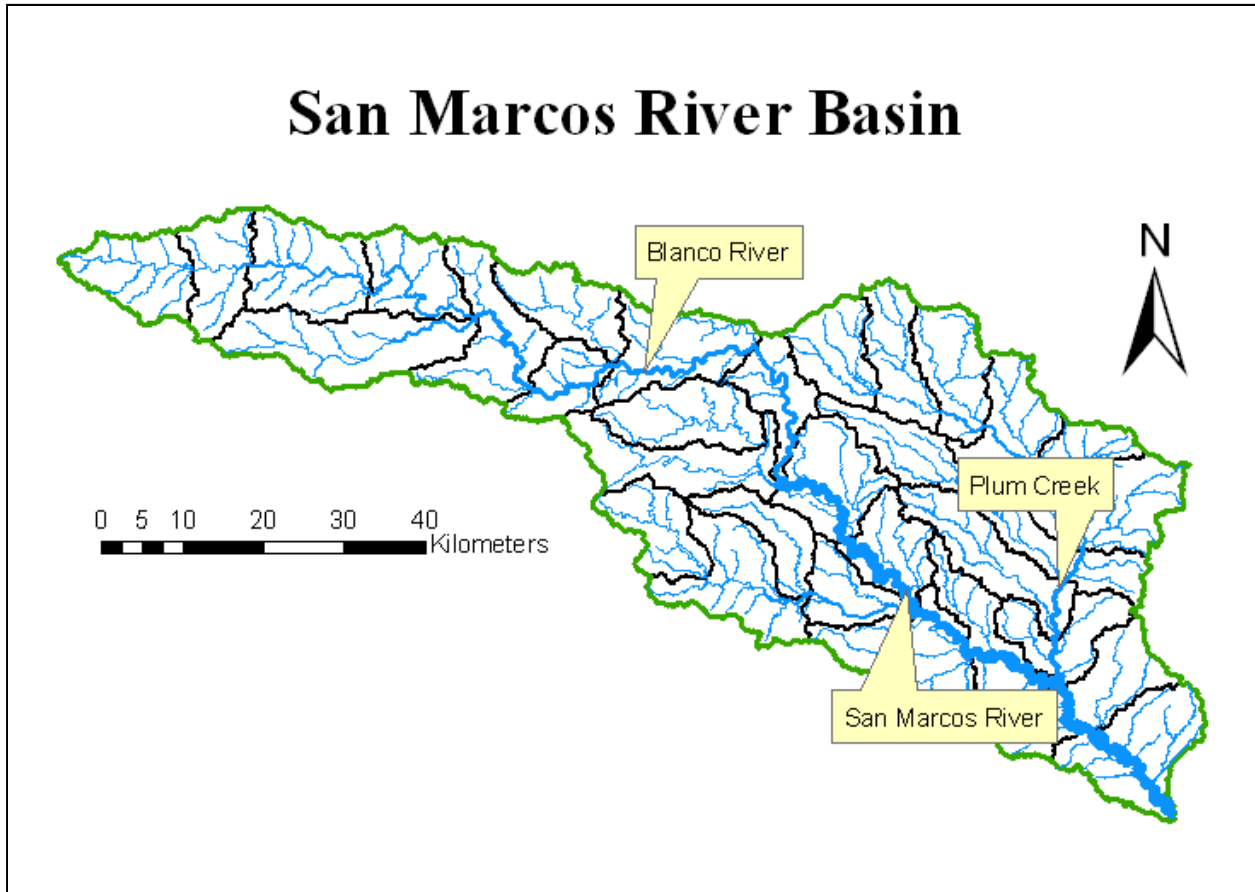


How many HUC12 watershed are there in the San Marcos Basin? What is their average area in acres and in km²? What is the total area of this basin in km²? What is the ratio of the length of the streamlines to the area of the catchments (called the drainage density) in km⁻¹?

There are **32** HUC12 watersheds in the San Marcos Basin.
Mean area in acres: 27180.84375 acres = 109.996972 km²
Total area: 869787 acres = 3,519.90311 km²
Total streamline length in basin: 1890.448 km

Drainage density = $(1890.448 \text{ km}) / (3519.90311 \text{ km}^2) = 0.537 \text{ km}^{-1}$

To be turned in: The layout of the San Marcos Basin and streams. Add labels to show the San Marcos River, the Blanco River and Plum Creek.



To be turned in: a layout showing the base map, chart and data table for the San Marcos River flows.

Please see attached page for the San Marcos River Flows map.

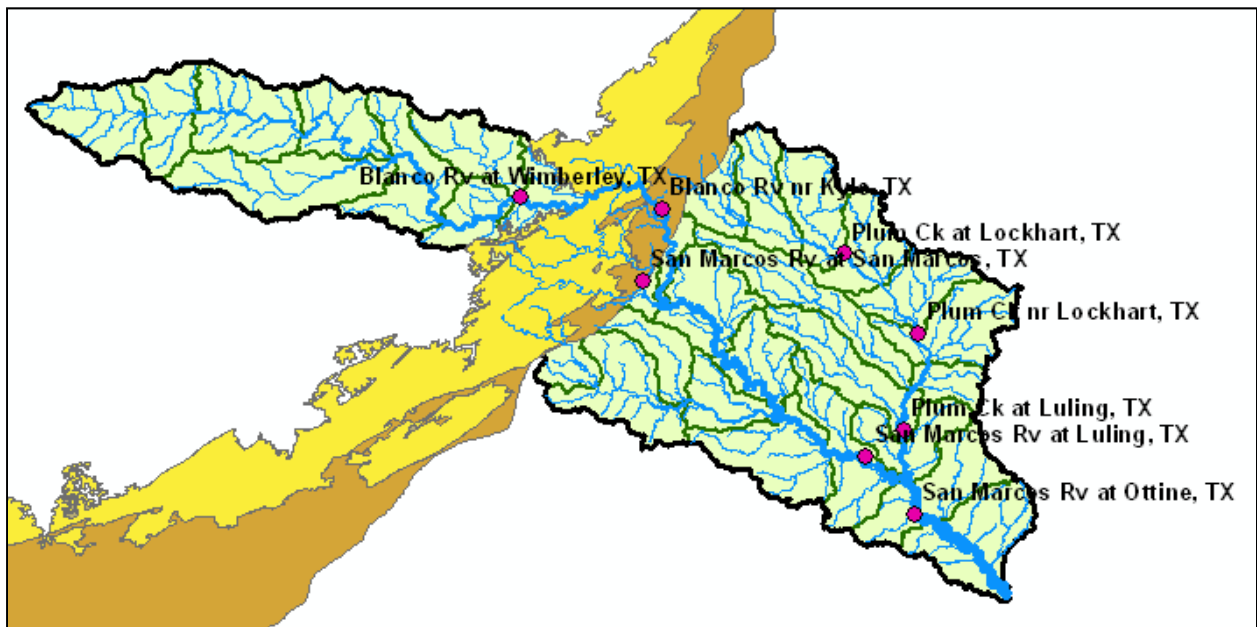
To be turned in: Between which two gauging stations does the Edwards aquifer outcrop area occur? What is the difference in mean annual flow at these two gauges? Comment on these data. Do they seem correct to you?

The outcrop occurs between Blanco Rv at Wimberly, TX (142 cfs) and Blanco Rv near Kyle, TX (165 cfs). The difference in mean annual flow between these two gauges is 23 cfs. It makes sense that the discharge at the downstream location is greater because it is gaining water from the aquifer outcrop; its flow is a combination of upstream surface water and springflow from the aquifer. This does seem correct to me.

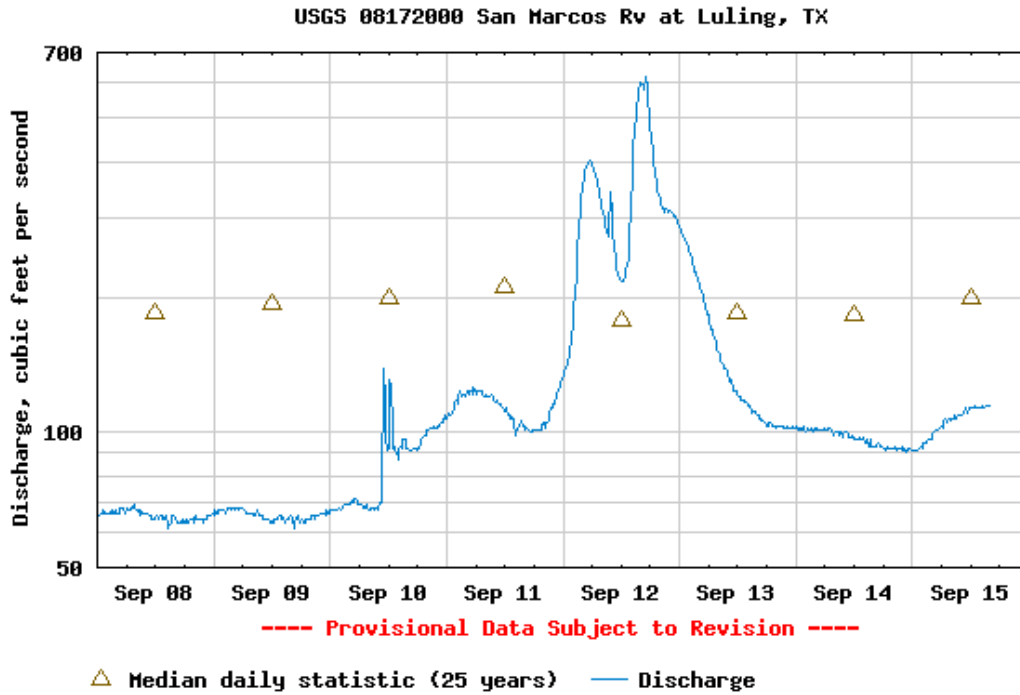
Note: Although the Blanco River passes through the “recharge zone” of the Edwards Aquifer between Wimberley and Kyle, the gauge near Kyle is at the border of the “recharge zone” and the “artesian

zone". Because of this, one can postulate that the gauge at Kyle is accumulating flow from the natural springs which occur in the Edwards Aquifer in addition to surface water runoff.

Examining the mean annual flow values in NHD+ the reach including the Kyle gage has 248 cfs, while the reach with the Wimberly gage has 213 cfs. These values computed from the drainage area and a mean runoff field are about 50% larger than the measured flows. The net gain from these values (35 cfs) is also about 50% larger than the measured gain of 35cfs. This indicates that the net gain is consistent with increase in drainage area and it is difficult to, from this data, attribute any of the gain to interaction with the Edwards aquifer. The Edwards aquifer does however appear to be responsible for the flow observed in the San Marcos River at San Marcos where the contributing area is a lot smaller and NHD+ flow only estimated to be 30 cfs, compared to the observed mean annual flow of 176 cfs.



To be turned in: The graph of flow of the San Marcos River at Luling printed from the NWIS website. What are the 20%, 50%, and 80% cumulative probability flows for the calendar day on which you do the download? Approximately what % cumulative probability is the flow currently?

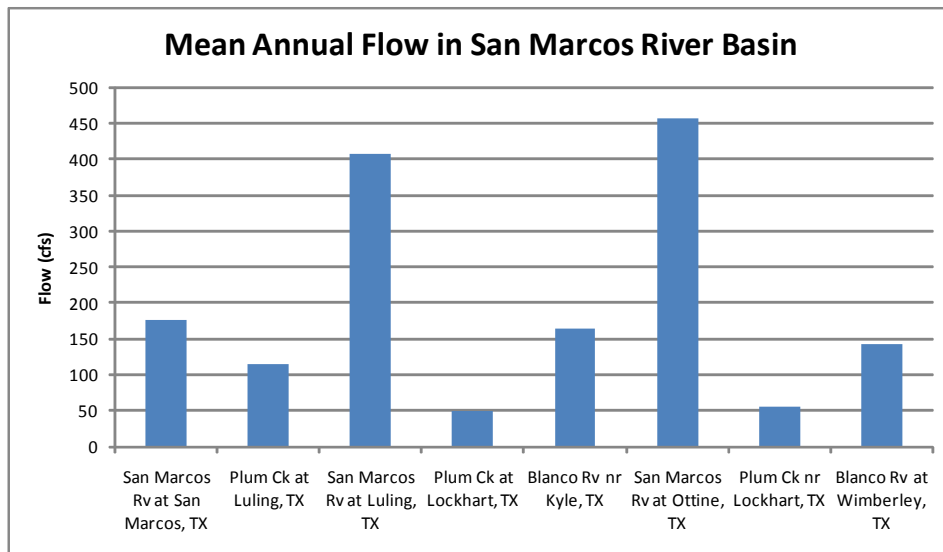
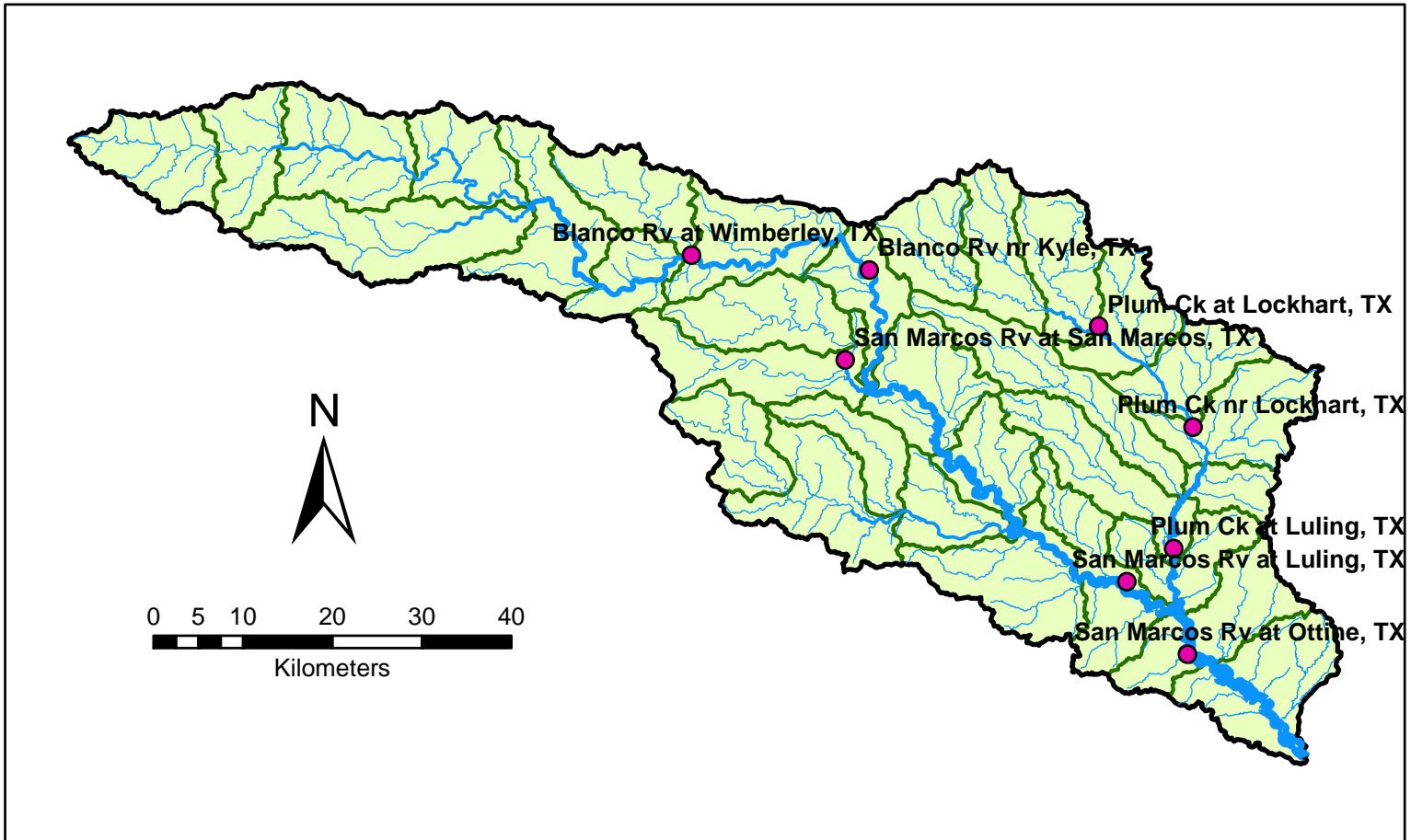


Percentile Discharge Values (cfs): 20%ile: 103 | 50%ile: 200 | 80%ile: 423

Current (9/15/09) Flow: 114 cfs

The cumulative probability of the current (9/15/09) flow is approximately 20%.

Flow in the San Marcos Basin



Station #	Station Name	Mean Annual Flow (cfs)
08170500	San Marcos Rv at San Marcos, TX	176
08173000	Plum Ck at Luling, TX	114
08172000	San Marcos Rv at Luling, TX	408
08172400	Plum Ck at Lockhart, TX	49
08171300	Blanco Rv nr Kyle, TX	165
08173500	San Marcos Rv at Ottine, TX	456
08172500	Plum Ck nr Lockhart, TX	56
08171000	Blanco Rv at Wimberley, TX	142