

The Plains of San Augustin

Should any of this worry you?

2/6/16

The San Augustin Plains or watershed is a closed basin 1,993 square miles in size. Closed basin means that there is no outlet or surface stream draining the basin. Therefore, the watershed gets no water from outside sources. There are no perennial streams within the basin. The only water it receives is from rain and snow that falls directly on the watershed. The water that is in the basin is considered ancestral water mainly from the past Pleistocene ice age. The recent water additions in the last couple of centuries has been less than evapotranspiration rate and the leakage rate along fracture and faults, as water has not accumulated to form a lake as it did in past Pleistocene Era. That large ancient lake has long since evaporated.

Two counties share the watershed; Catron County's portion is approximately 1,551 square miles in size, a little over $\frac{3}{4}$ of the watershed, while Socorro County is about 441 square miles in size. Land ownership within the basin is approximately as follows: Bureau of Land Management (BLM) 222.4 square miles, Forest Service (FS) 438.8 square miles, private land 830.7 square miles, and state land 500.1 square miles. The actual plains portion of the watershed is approximately 603 square miles in size or about 30% of the watershed. The Blodgett and Titus report of, 1973 at the time of their study concluded that the basin was receiving approximately 100,000 acre feet of water per year from rain and snow; however the basin seemed to be losing that same amount from evapotranspiration and leakage. They assumed that the main source of leakage was along the southern boundary. Since the time of that study New Mexico has been in an extended drought and probably not receiving anywhere near that amount of water annually. The New Mexico state geologic map shows many faults that cross the watershed boundary and more recent geologic mapping have identified even more faults.

The San Augustin Plains is a topographically high area which means that groundwater in the basin will seek to flow in all direction away from the basin. The gradient flows from the basin have been calculated by a report done by R. G. Myers, J.T. Everheart, and C. A. Wilson in 1994 titled 'Geohydrology of the San Augustin Basin, Alamosa Creek Basin upstream from Monticello Box, and upper Gila Basin in parts of Catron, Socorro, and Sierra Counties, New Mexico.' This is an excellent publication and should be read if you are interested in the groundwater resources in this area.

The basin is made up of mainly volcanic rocks and sediments. The underlying geologic rocks are from the Cretaceous Period. The basin deposits are approximately 4,000 feet thick in the graben or trough is approximately $\frac{3}{4}$ of a mile thick. These are not typical grabens or down dropped blocks: they are asymmetrical or tipped, being deeper on western and northwest boundary. Outside of the graben structure the sediments are considerably shallower. As the volcanic rocks were being erupted the basin was being pulled apart by basin and range tectonic activity.

This formed the grabens, down-dropped blocks of the earth's crust, that resulted in the San Augustin Plains. The grabens are complex in their structure, with a northeast, southwest block and a north-south block; approximately 495 square miles in size which is about 25% of the overall watershed. The western part of the graben is approximately 268 square miles in size and the eastern block is about 216 square miles in size. The southwestern end of the western graben is mainly saline in nature and takes up about 45% of this structure. The graben is highly faulted with many of the faults crossing the watershed boundary. Some of the faults cross into Alamosa drainage, some into The Gila drainage, and some into the Tularosa drainage. It is believed that the San Augustin watershed is the source for the Tularosa River.

Much of the sediment now filling the graben or basin is volcanic ash. The ash deposits over time have been turned into silt/clay layers; these layers do not hold a large quantity of extractable water. The materials nearer the watershed margins are generally coarser in nature and therefore have a higher porosity to yield more water but the water tables are much shallower. Wells along the watershed boundary in the upland areas would not have consistent water production, because of the massive volcanic bedrock. Wells in the interior of the basin are not consistent in water production either as the inter fingering of coarse materials with the finer materials creates perched aquifers. There are currently 1,025 wells within the basin and in excess of 9,327 acre feet have been allocated under the state permit system.

The Augustin Plains Ranch, LLC which is totally within Catron County but abuts Socorro County, has proposed 37 wells along the northwest graben structure of the North Plains and would like to pump 54,000 acre feet of water annually. The ranch is approximately 18,199 acres in size and is about 1.4 % of the private land within the watershed or only 0.01% of the whole watershed. They have drilled one well south of US 60 to depth 3,510 feet, the resulting well log is inconclusive as to whether or not they hit groundwater. Since they plugged the well I would guess that it was not a successful well. They drilled another exploratory well north of US 60 to a depth of 1,510 feet and hit water at 510 feet, a pump test was performed and it yielded 2,000 gallons per minute. The test lasted 9 days and water table dropped 87 feet or about a ½ a foot per hour. They did not record a recovery time for the well to get back to equilibrium. This well is developed with a 2 foot diameter well casing.

The ranch even though it is a small part of the total private land within the basin, with this proposal would extract well over half of the annual recharge of the groundwater to the basin per year. If the LLC is granted this permit to extract 54,000 acre feet of water annually; it opens the door for other large requests for this finite amount of water. It has been suggested that if the Office of the State Engineer does grant this permit it will have a profound adverse effect on the groundwater level within 10 years of the start of pumping. The LLC has admitted that its pumping would cause neighboring existing wells to go dry. The well field as proposed is definitely targeting the graben structure in hopes of the same results from the other proposed wells. As of this time they are only hitting 50% with their drilling efforts. The LLC is proposing to place infiltration structures across many of the ephemeral draws that cross through their land, in an effort to recharge their well field. These structures would require permits from the state as they would be considered points of

diversion. When these draws flow water during extreme runoff events they will only be able to capture a very small percentage of any rainfall that occurs within the basin. Most snow melt would never reach their recharge basins, unless there is a rare rain on snow weather event. This effort would cut off any water that might reach other downstream users. As of this date the their permit application has continued to be denied as of the last court hearing.

A recent study of existing wells in Alamosa and San Augustin watersheds looked at the age of the water in these wells. The carbon 14 analysis which is shown in the following chart indicates that the San Augustin water on average is 4 times older than the Alamosa water. There are a couple of anomalies such as the spring water in the San Augustin Plain which is very young by comparison, but its travel time is very short along a fracture on Polona Mountain. Another anomaly is well SA-0195 which I put in the San Augustin Plains, because it is right on the boundary and is associated with a recently mapped fault. Its age is more consistent with the others in the San Augustin Plains.

The reason for the age discrepancy is that The Alamosa watershed is drained. It has much steeper water gradients than does the San Augustin Plains. The San Augustin watershed only has the head pressure from its static water table to push water along fractures and faults.

OWNERSHIP CHART

	ACRES	SQUARE MILES	PERCENT
Watershed Size	1,275,319.7	1,992	
Socorro County	281,294.9	441	22%
Catron County	991,143.0	1,551	78%
BLM	142,313.6	222.4	11%
FS	280,803.4	438.8	22%
Private	531,621.4	830.7	42%
State	320,581.4	500.1	25%
APR,LLC	≈18,199.0	28.125	1.4%

San Augustin / Alamosa Water Well Age Dates

Point ID	Watershed	Elevation	Date Collected	Type	C14 % to moder carbon	C14- years	
SA-0103	A	6618		well	58.11	4,360	
SA-0128	A	6638		well	71.1	2,740	
SA-0068	A	6635		well	55.22	4,770	
SA-0135	A	5259		well	51.12	5,390	Avg. age 2,914 yrs.
SA-0156	A	6333		well	98.76	100	
SA-0164	A	7136		well	77.86	2,010	
SA-0211	A	5874		well	70.57	2,800	
SA-0217	A	6979		well	86.77	1,140	
SA-1010	A	6263		spring	25.21	11,070	Monticello Box
SA-0017	SA	7143		well	45.59	6,310	
SA-0027	SA	7123		well	28.34	10,130	
SA-0043	SA	6914		well	17.94	13,800	
SA-0084	SA	7340		well	28.58	10,060	Avg. age 12,173 yrs.
SA-0124	SA	6948		well	20.99	12,540	
SA-0195	SA	7241		well	5.78	22,900	Divide Well
SA-0205	SA	7541		well	26.3	10,730	
SA-0209	SA	7002		well	60.25	4,070	
SA-0210	SA	7086		well	9.37	19,020	
SA-1016	SA	7497		spring	88.08	1,020	Palona Mtn.

The lower the % of C14 to modern carbon the older the water.

Dennis Inman

Geologist

dennisinman43@gmail.com