



GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

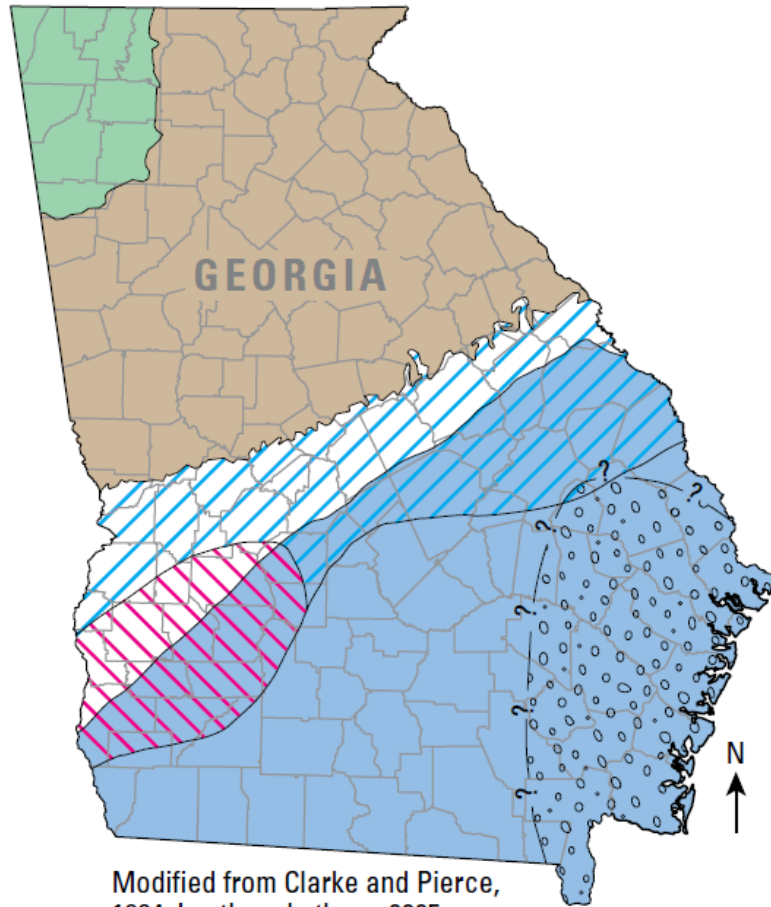
Update of the Groundwater Resource Assessment for the Middle Chattahoochee Region

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**Middle Chattahoochee
Regional Council Meeting**
4 February 2020



GEORGIA'S AQUIFERS



Modified from Clarke and Pierce, 1984; Leeth and others, 2005

EXPLANATION

Coastal Plain aquifers

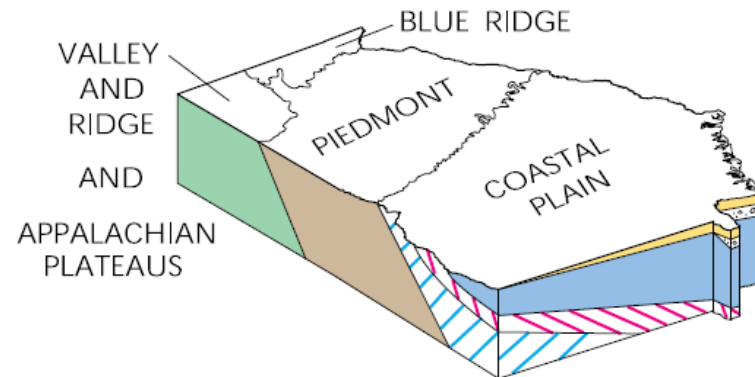
- Surficial aquifer system (not a principal aquifer)
- Brunswick aquifer system
- Floridan aquifer system
- Claiborne, Clayton, and Providence aquifers
- Cretaceous aquifer system

Piedmont and Blue Ridge aquifers

- Crystalline-rock aquifers

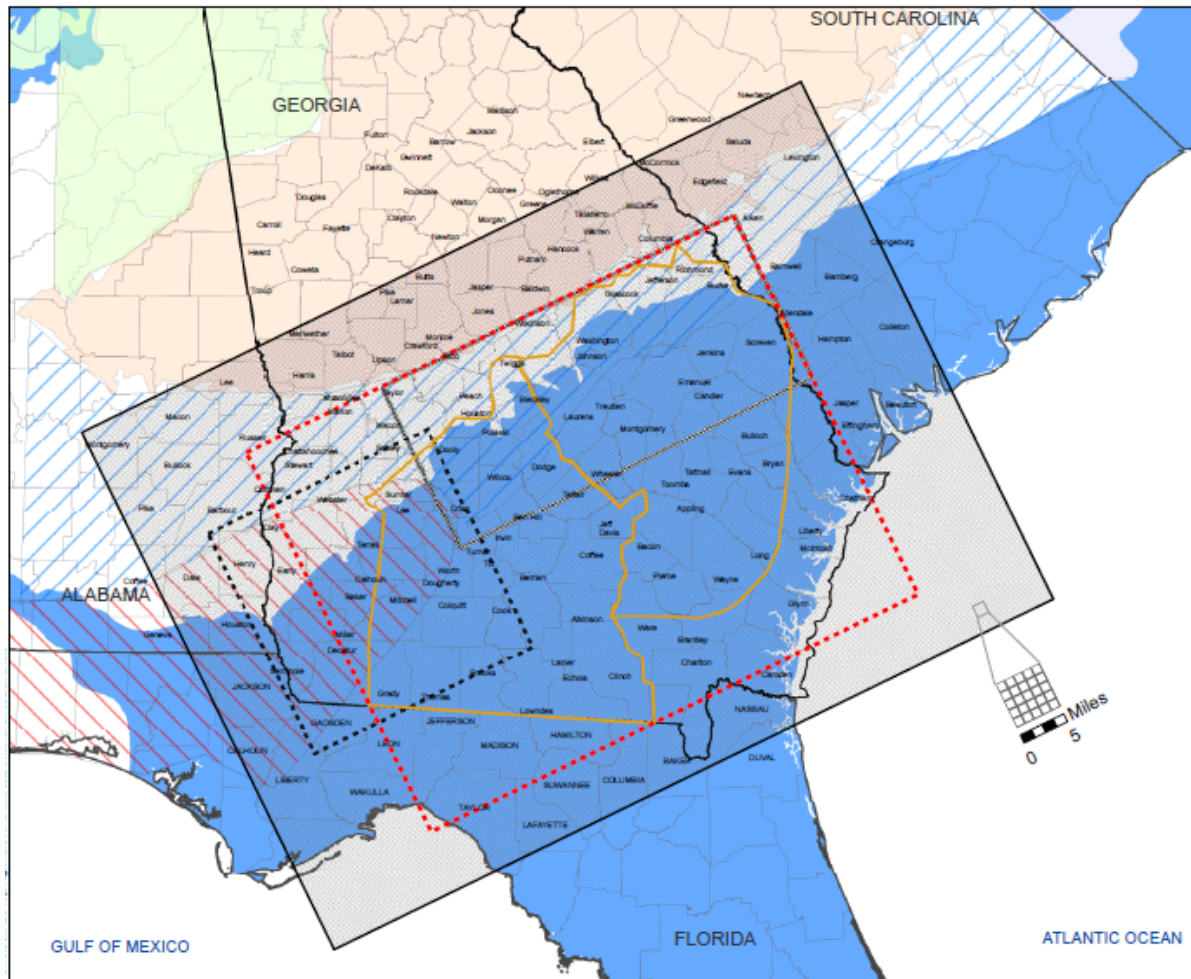
Valley and Ridge and Appalachian Plateau aquifers

- Paleozoic-rock aquifers





PREVIOUS STATE WATER PLAN REGIONAL AND SUB-REGIONAL MODELS



These are the domains of the 2010 State Water Plan regional and sub-regional models; use the same domain for recent models.

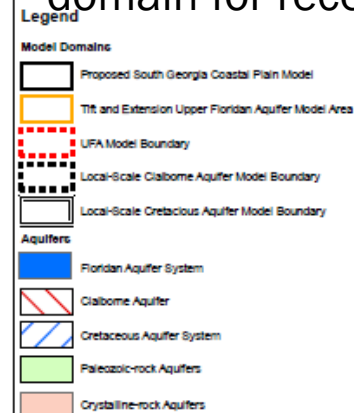


Figure 1
Proposed Regional
Groundwater Flow Model Domain
and Model Grid System

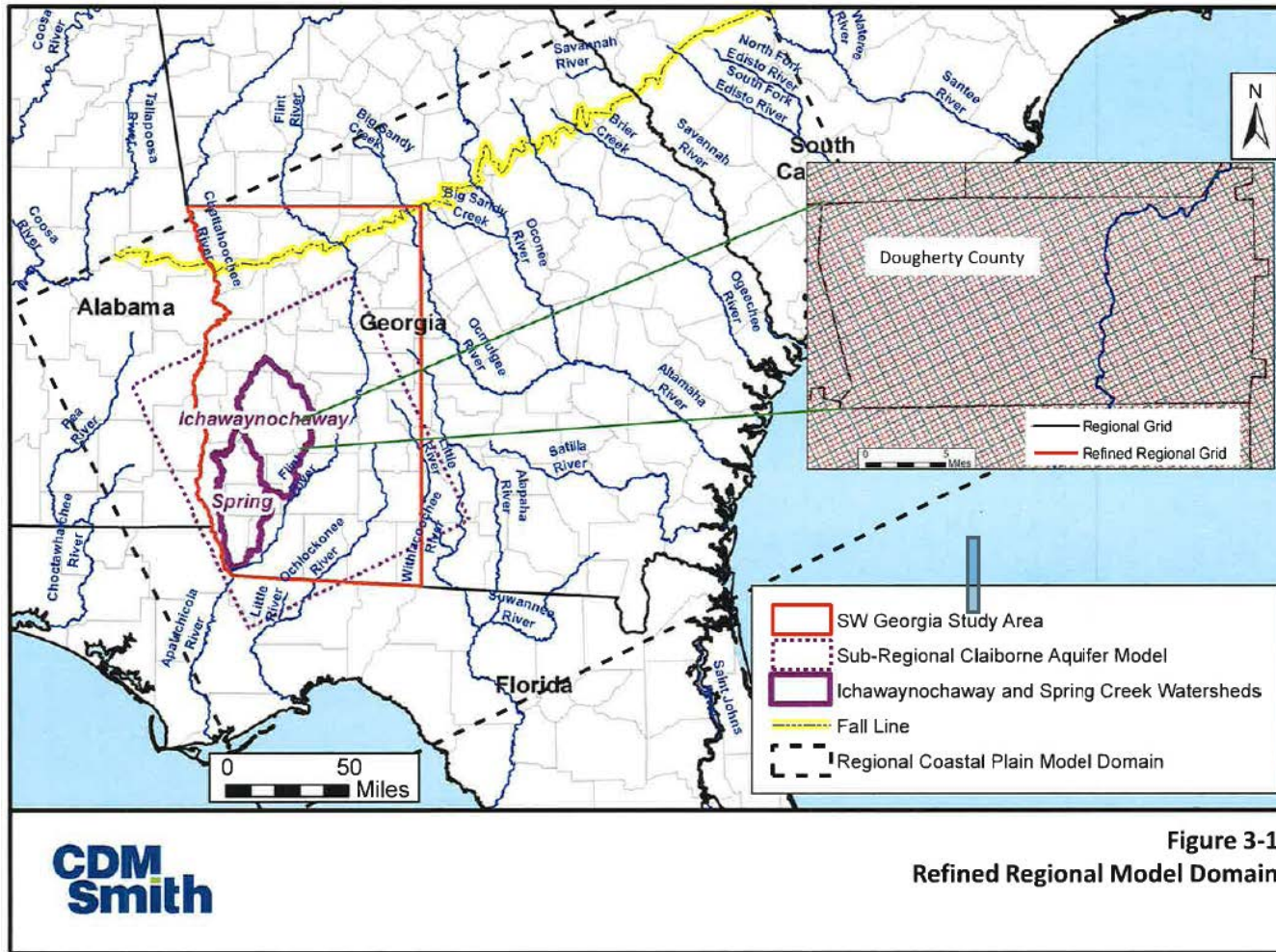


OVERVIEW OF THE UPDATED GROUNDWATER RESOURCE ASSESSMENT OF THE MIDDLE CHATTAHOOCHEE REGION

- The model was re-written with a smaller grid size which produced more data with which to contour model results
- The revised CDM Smith model was made entirely a transient model, not just the area of southwestern Georgia in the original CDM Smith model
- Modeling was done of increased groundwater withdrawals where additional drawdowns from the withdrawals would not extend to rivers and drains in the aquifer outcrop areas; such drawdowns may decrease surface water flows
- Conducted model simulations of increasing the withdrawal from model Layer 6 (the Cretaceous aquifer) by two times (+8 MGD) and five times (+20 MGD) the CDM Smith baseline pumping rates
- Additional pumping of Layer 6 may result in residual drawdowns that do not recover and should be monitored



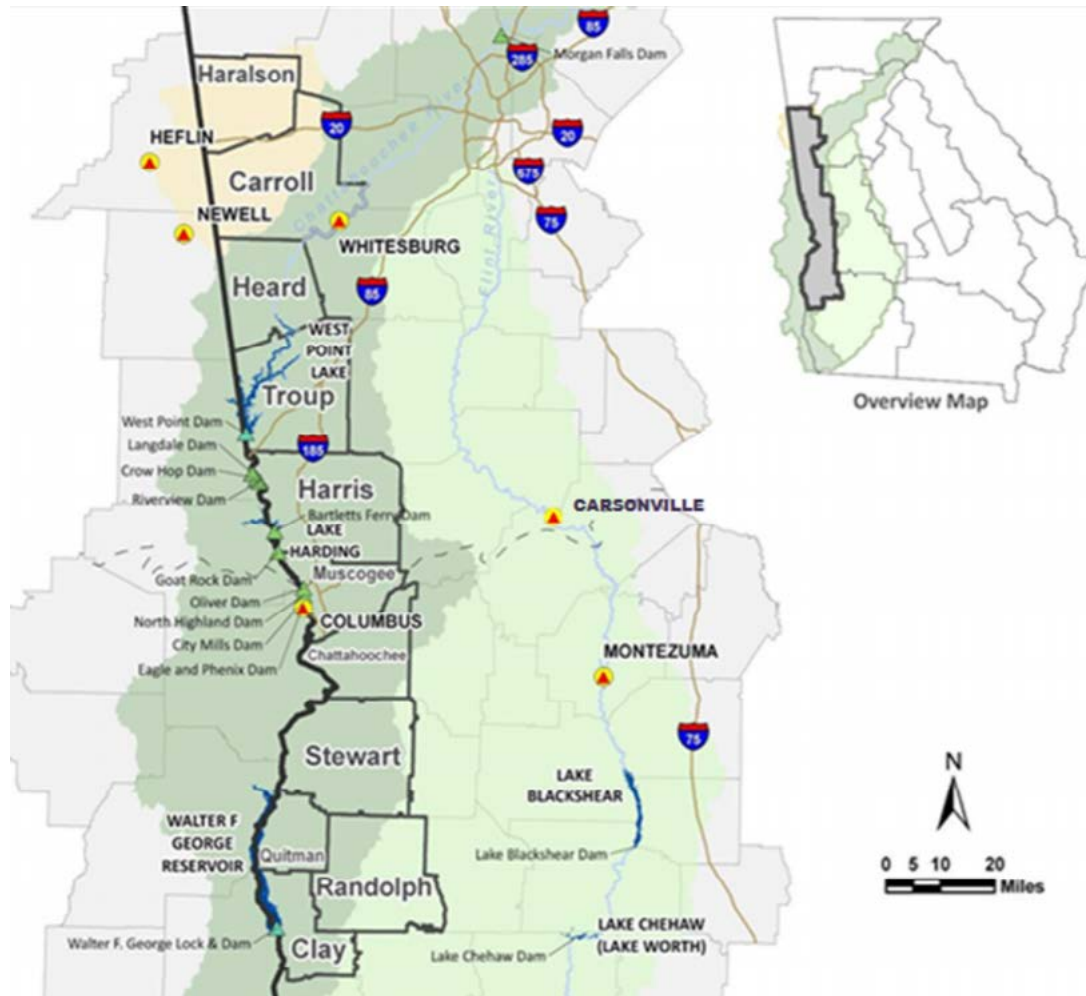
CDM SMITH REFINED GRID SPACING AND COVERAGE FOR TRANSIENT MODELING OF CLAIBORNE AND CRETACEOUS AQUIFERS (PART 2)



Grid spacing in the original regional model was 5,280 feet (one mile). Grid spacing in the revised model is 1,760 feet (1/3 mile) so that each of the original grid squares is now occupied by nine grid squares ($3 \times 3 = 9$). The grid spacing of 1,760 feet in the revised model is less than the 2,000 feet grid spacing used in the original sub-regional models.

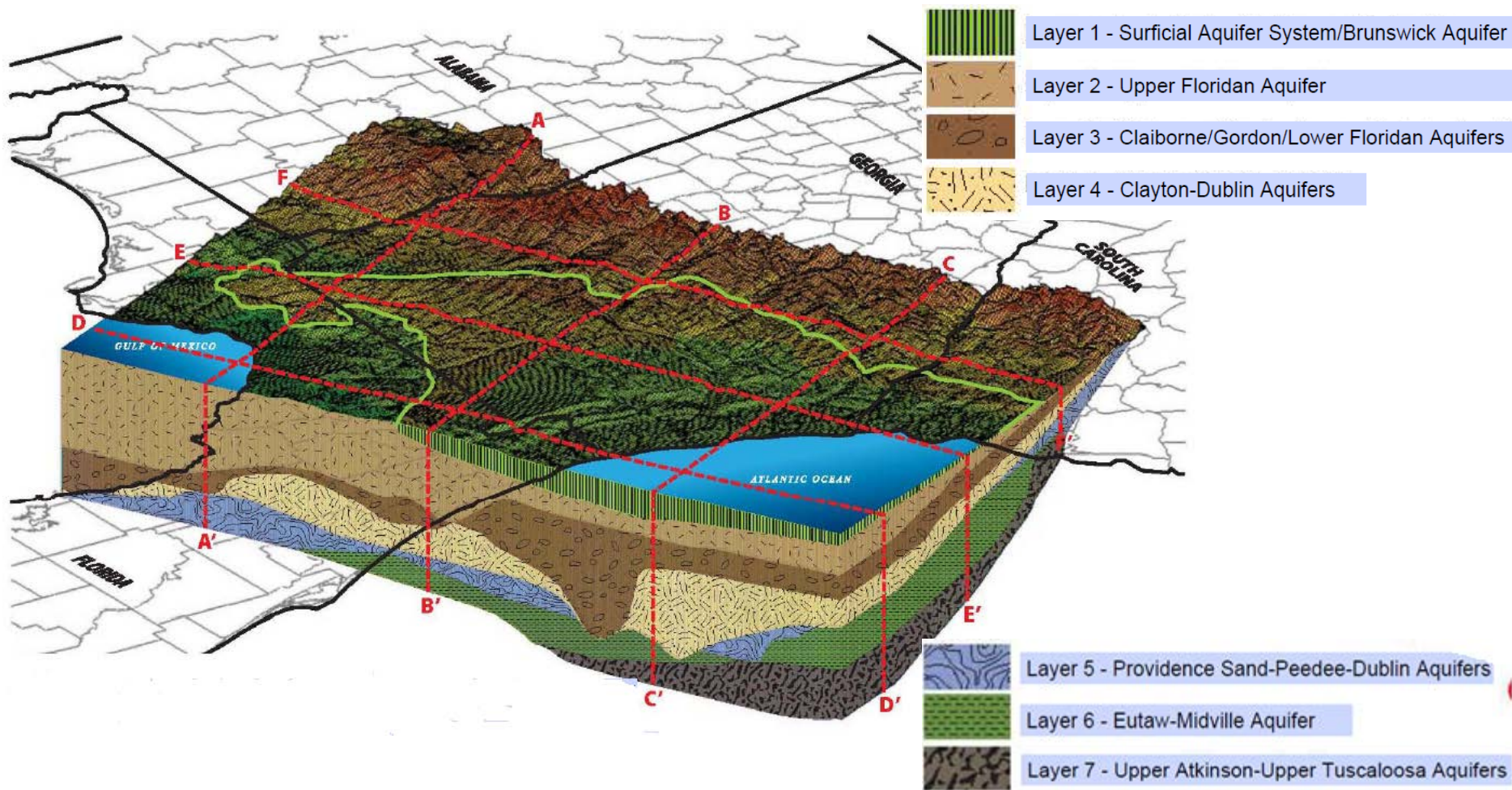


MIDDLE CHATTAHOOCHEE WATER PLANNING REGION



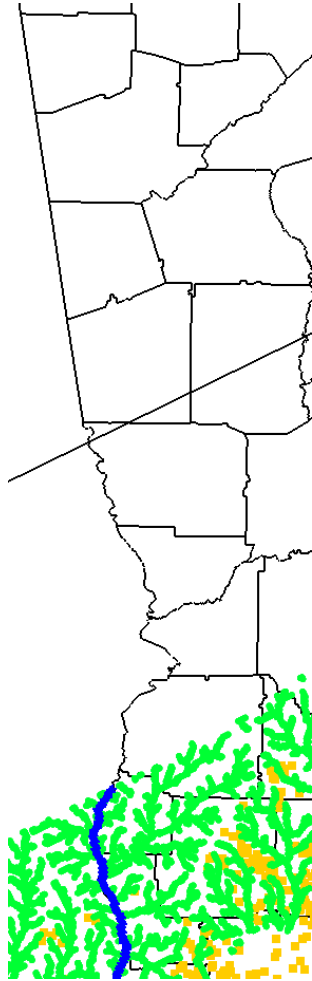


SEVEN LAYERS IN THE REGIONAL COASTAL PLAIN STATE WATER PLAN MODEL





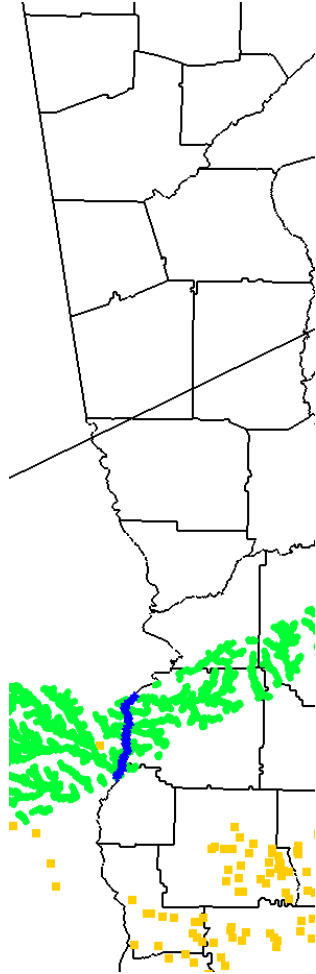
LAYER 3 CLAIBORNE AQUIFER RIVERS AND DRAINS MODELED IN THE MIDDLE CHATTAHOOCHEE REGION



Most of the Layer 3 wells are near the rivers and drains in the Layer 3 out crop area and therefore pumping of the wells may directly affect surface water flow in the rivers and drains. For this reason increased groundwater withdrawal from the Layer 3 wells was not simulated.



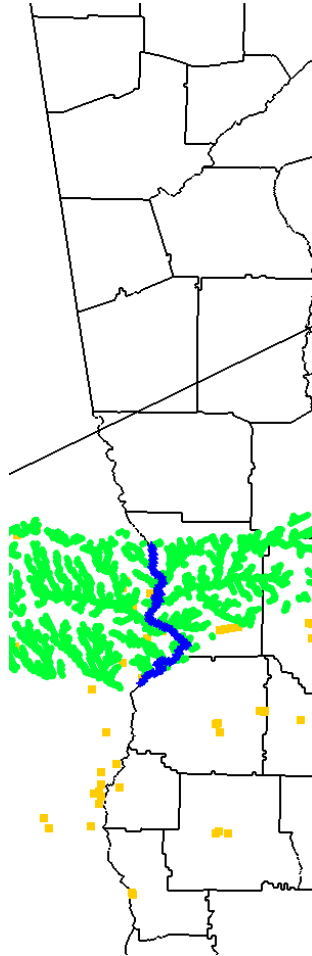
LAYER 4 CLAYTON AQUIFER RIVERS AND DRAINS MODELED IN THE MIDDLE CHATTAHOOCHEE REGION



Simulation of increased groundwater withdrawal for Layer 4 (the Clayton aquifer) was not done due to a current Georgia Environmental Protection Division (EPD) moratorium on increased pumping from the Clayton aquifer.



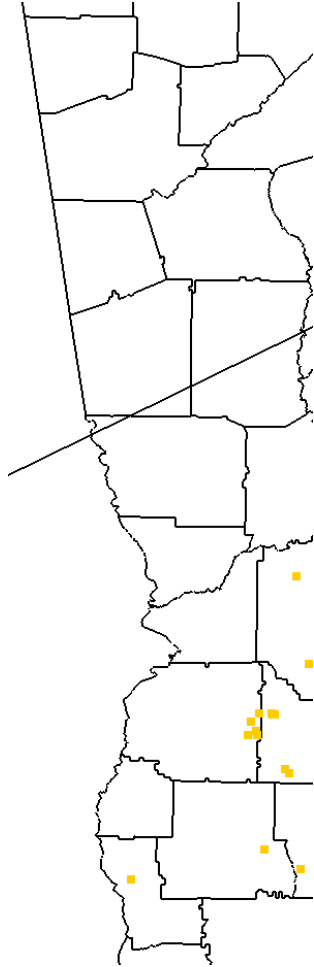
LAYER 5 CRETACEOUS AQUIFER RIVERS AND DRAINS MODELED IN THE MIDDLE CHATTAHOOCHEE REGION



The Layer 5 wells in Chattahoochee County were near the rivers and drains in the Layer 5 out crop area and therefore pumping of the wells in Chattahoochee County may directly affect surface water flow in the rivers and drains.



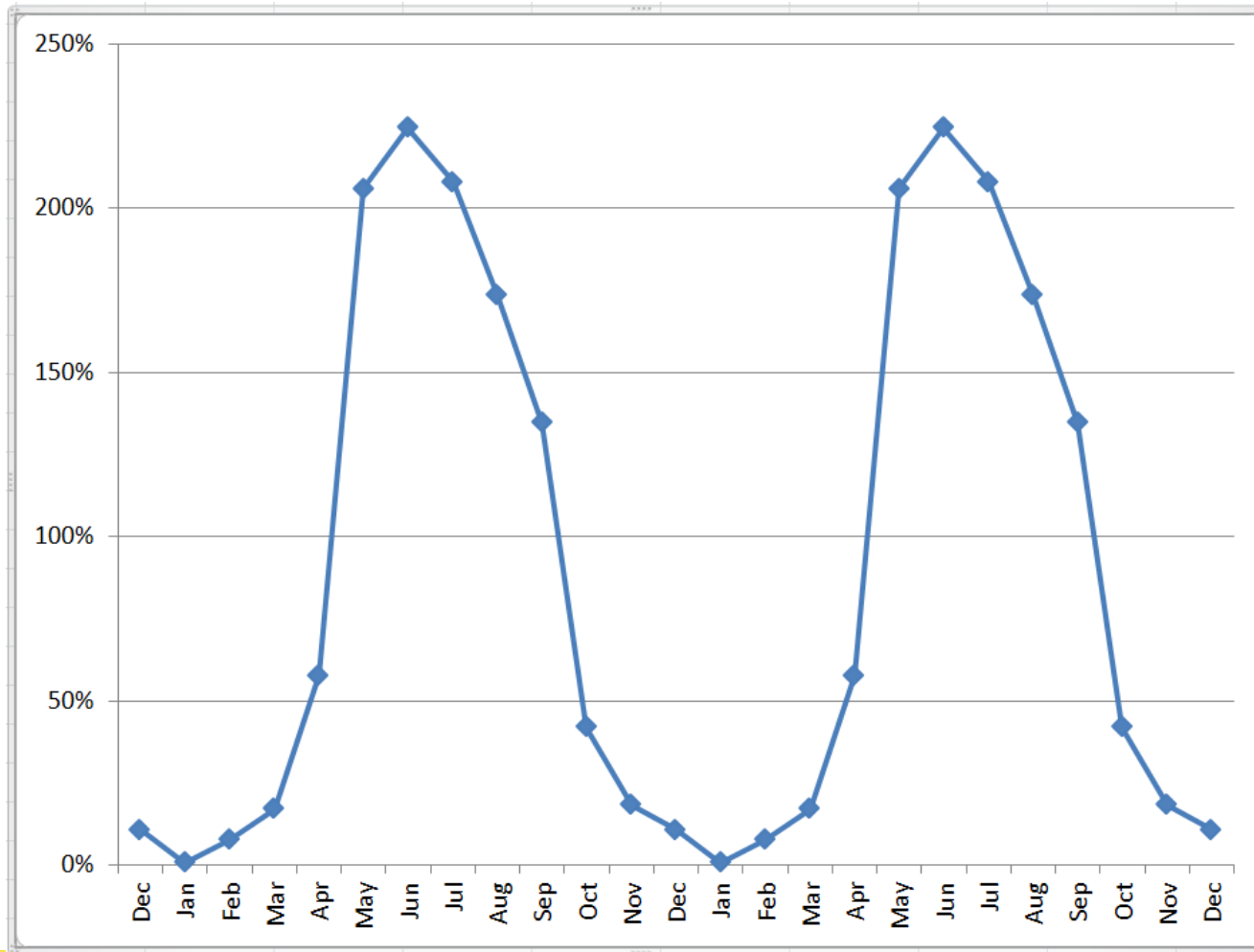
LAYER 6 CRETACEOUS AQUIFER RIVERS AND DRAINS MODELED IN THE MIDDLE CHATTAHOOCHEE REGION



None of the Layer 6 wells were near the rivers and drains in the Layer 6 out crop area and therefore pumping of the wells may not directly affect surface water flow in the rivers and drains. For this reason the simulations were done with increased groundwater withdrawals from all the Layer 6 wells.



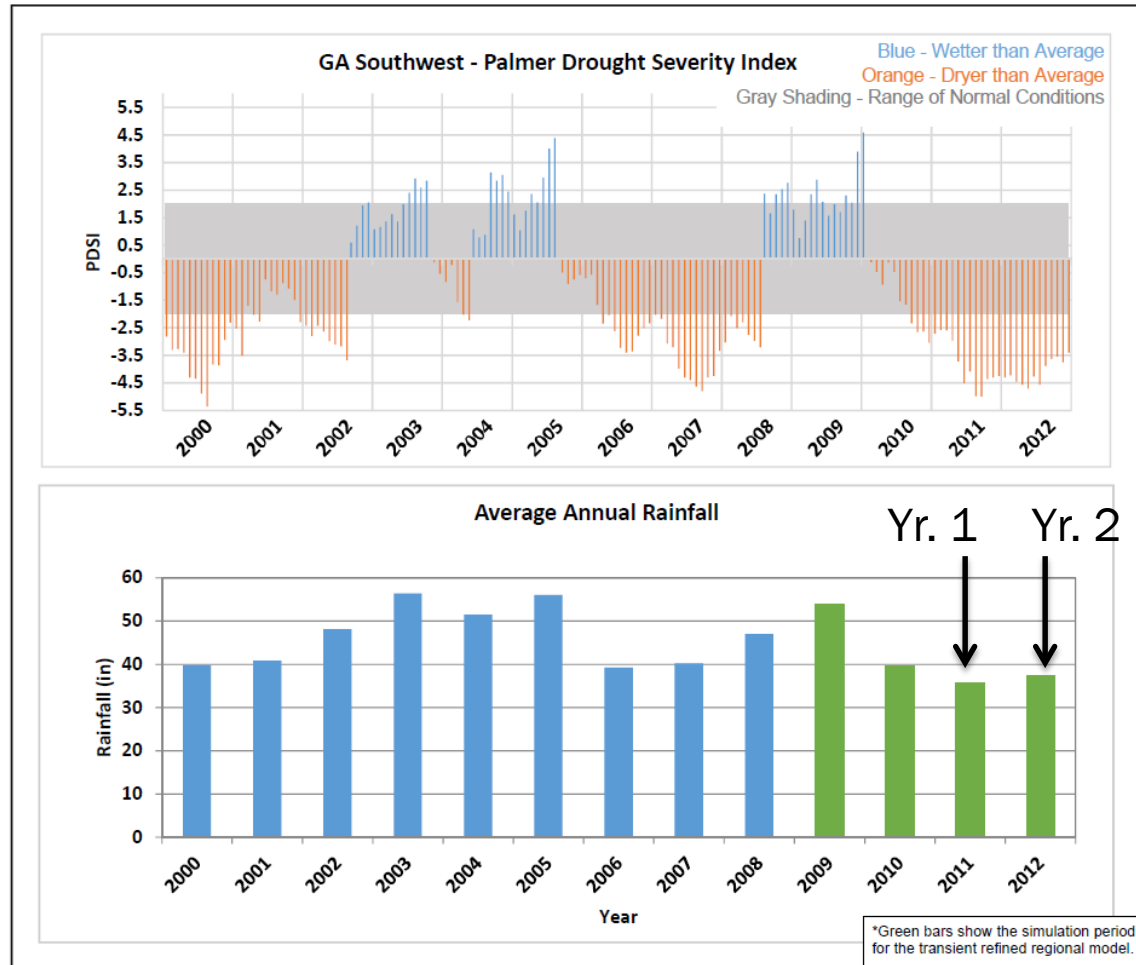
TRANSIENT WELL PUMPING IRRIGATION RATES AS PERCENT OF STEADY STATE PUMPING RATE



Transient monthly pumping rate as a percentage of the 100% steady state pumping rate. During the growing season the pumping rates are more than the 100% steady state pumping rate and during the non-growing season pumping rates are less than the 100% steady state pumping rate

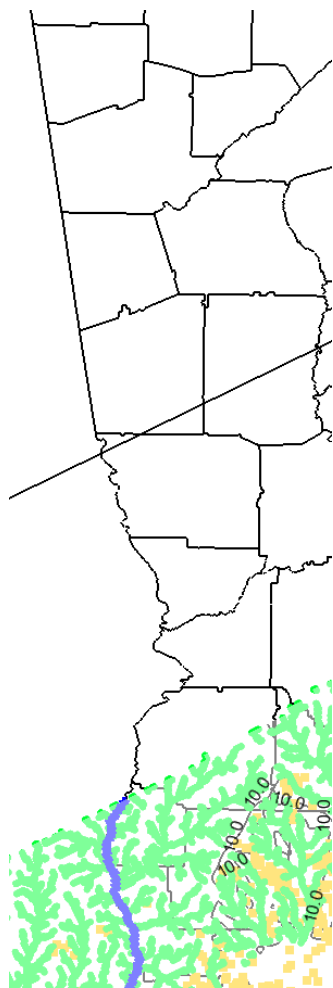


ANNUAL PRECIPITATION AND TWO OF THE FOUR YEARS CHOSEN FOR THE TRANSIENT SIMULATIONS





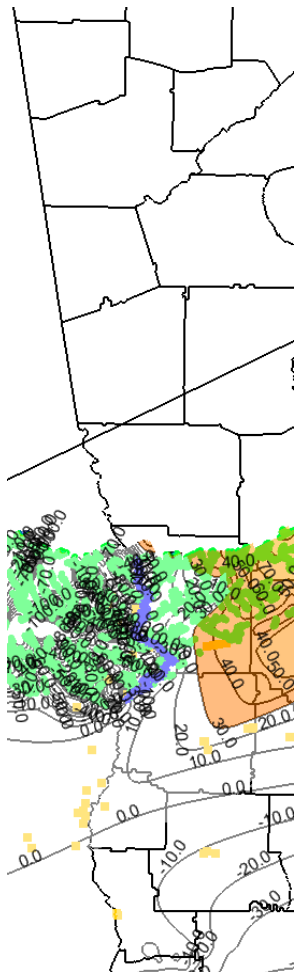
MIDDLE CHATTAHOOCHEE REGION LAYER 3 CLAIBORNE AQUIFER DRAWDOWN CDM SMITH MODEL BASELINE PUMPING RATES – 25 JULY 2021



The aquifer groundwater level drawdown simulated for baseline pumping rate in the CDM Smith model during July 2021 (time step 95) was about 10 feet in the area of drains in the Layer 3 outcrop area. The simulated groundwater level drawdown of 10 feet may directly affect stream flow. There is a Georgia Environmental Protection Division (EPD) moratorium on increased pumping from the Clayton aquifer (Layer 4 of the model).



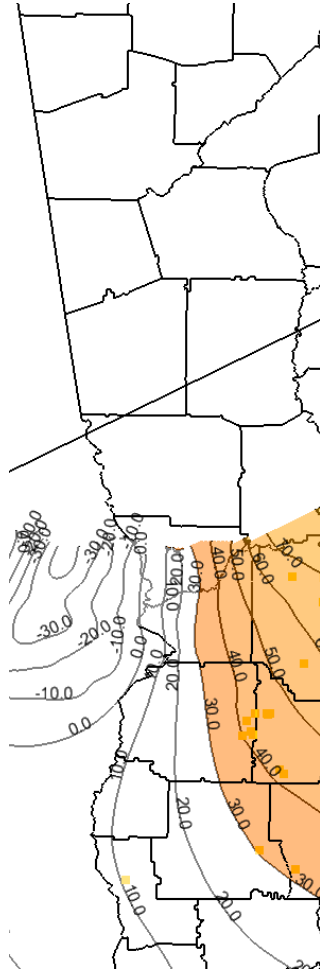
MIDDLE CHATTAHOOCHEE REGION LAYER 5 CRETACEOUS AQUIFER DRAWDOWN CDM SMITH MODEL BASELINE PUMPING RATES – 25 JULY 2021



There is more than 30 feet of groundwater level drawdown caused by CDM Smith baseline pumping of Middle Chattahoochee region wells. The more than 30 feet of groundwater level drawdown occurs in northeastern Stewart County and eastern Chattahoochee and Muscogee Counties on 25 July 2021 (time step 95). The more than 30 feet of drawdown on 25 July 2021 occurs in Chattahoochee County where wells are located near to Layer 5 outcrop area with rivers and drains and this drawdown may directly affect stream flow.



MIDDLE CHATTAHOOCHEE REGION LAYER 6 CRETACEOUS AQUIFER DRAWDOWN CDM SMITH MODEL BASELINE PUMPING RATES – 25 JULY 2021



There is more than 30 feet of groundwater level drawdown caused by CDM Smith baseline pumping of Model Chattahoochee region wells. The more than 30 feet of groundwater level drawdown occurs in eastern Randolph, Stewart, Chattahoochee, and Muscogee Counties on 25 July 2021 (time step 95). There are no rivers and drains in the Layer 6 outcrop area and therefore any groundwater level drawdown may not directly affect stream flow.



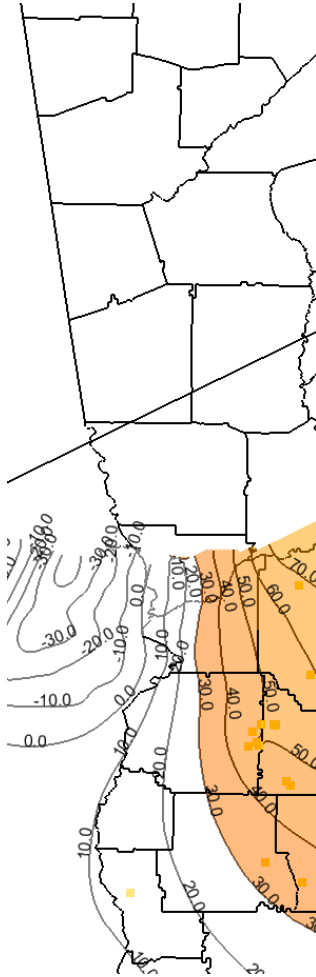
METHODOLOGY USED TO SELECT WELLS FOR SIMULATED INCREASED WITHDRAWAL IN THE MIDDLE CHATTAHOOCHEE REGION

Because of the transient simulated drawdowns using the baseline withdrawal rates in the CDM Smith model:

- There are no Layer 2 wells in the Middle Chattahoochee region
- Do not simulate increased groundwater withdrawal from any well in Layer 3 due to the wells being located in the outcrop area with rivers and drains and increased pumping from well may directly affect stream flow
- Do not simulate increased groundwater withdrawal from any well in Layer 4 due to the Georgia EPD moratorium on increased pumping from the Clayton aquifer (layer 4 of the model)
- Do not simulate increased groundwater withdrawal from any well in Layer 5 (Cretaceous aquifer) due to more than 30 feet of drawdown in outcrop areas of Layer 5 which may directly affect surface water flow caused by baseline pumping of wells south of the outcrop area
- In layer 6 there is no limitation on increased groundwater withdrawals as there are no wells near rivers and drains in outcrop areas of Layer 6 and changing groundwater levels will not directly affect stream flow



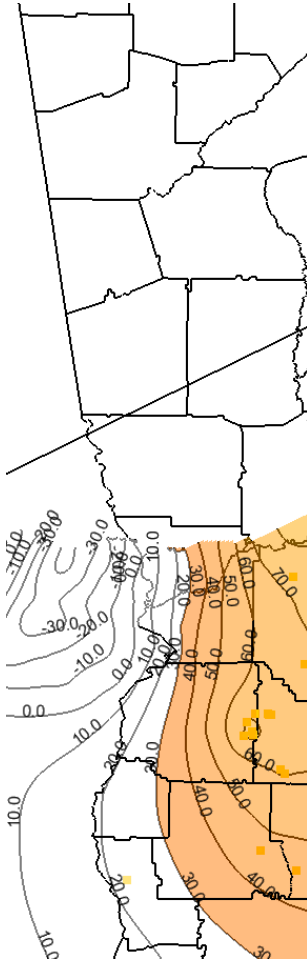
MIDDLE CHATTAHOOCHEE REGION LAYER 6 CRETACEOUS AQUIFER DRAWDOWN X 2.00 BASELINE PUMPING RATES (+8 MGD)– 25 JULY 2021



There is more than 30 feet of groundwater level drawdown caused by CDM Smith 2.00 x baseline pumping of Middle Chattahoochee region wells. The more than 30 feet of groundwater level drawdown occurs in eastern Randolph, Stewart, Chattahoochee, and Muscogee Counties on 25 July 2021 (time step 95). There are no rivers and drains in the Layer 6 outcrop area and therefore any groundwater level drawdown will not directly affect stream flow. The 30 feet of simulated drawdown could cause well pumps which are set within 30 feet of the static water level to go dry.



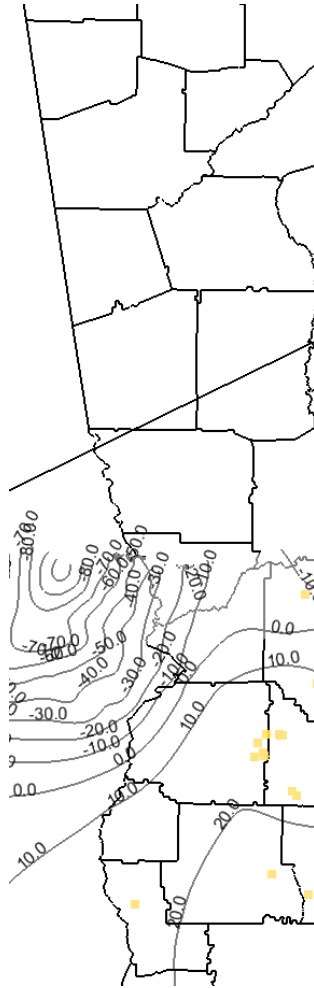
MIDDLE CHATTAHOOCHEE REGION LAYER 6 CRETACEOUS AQUIFER DRAWDOWN X 5.00 BASELINE PUMPING RATES (+20 MGD) – 25 JULY 2021



There is more than 30 feet of groundwater level drawdown caused by CDM Smith baseline pumping of Middle Chattahoochee region wells. The more than 30 feet of groundwater level drawdown occurs in almost all of Randolph County, part of Quitman County, and eastern Stewart, Chattahoochee, and Muscogee Counties on 25 July 2021 (time step 95). There are no rivers and drains in the Layer 6 outcrop area and therefore any groundwater level drawdown will not directly affect stream flow. The 30 feet of simulated drawdown could cause well pumps which are set within 30 feet of the static water level to go dry.



MIDDLE CHATTAHOOCHEE REGION LAYER 6 CRETACEOUS AQUIFER DRAWDOWN X 5.00 BASELINE PUMPING RATES (+20 MGD) – 1 JANUARY 2022



By 1 January 2022 (time step 121) with 5.00 x the baseline pumping the groundwater levels in Layer 6 do not fully recover to what they were in time step 1 on 1 January 2020 (-30 to -40 feet on 1 January 2020 versus 10 feet to -20 feet on 1 January 2022). There is no Layer 6 outcrop area rivers and drains so the simulated change in groundwater level drawdown would not directly affect stream flow. The fact that the simulated groundwater level on 1 January 2022 did not return to what it was on 1 January 2020 indicates that the groundwater in Layer 6 was dewatered (mined) from January 2020 to January 2022.

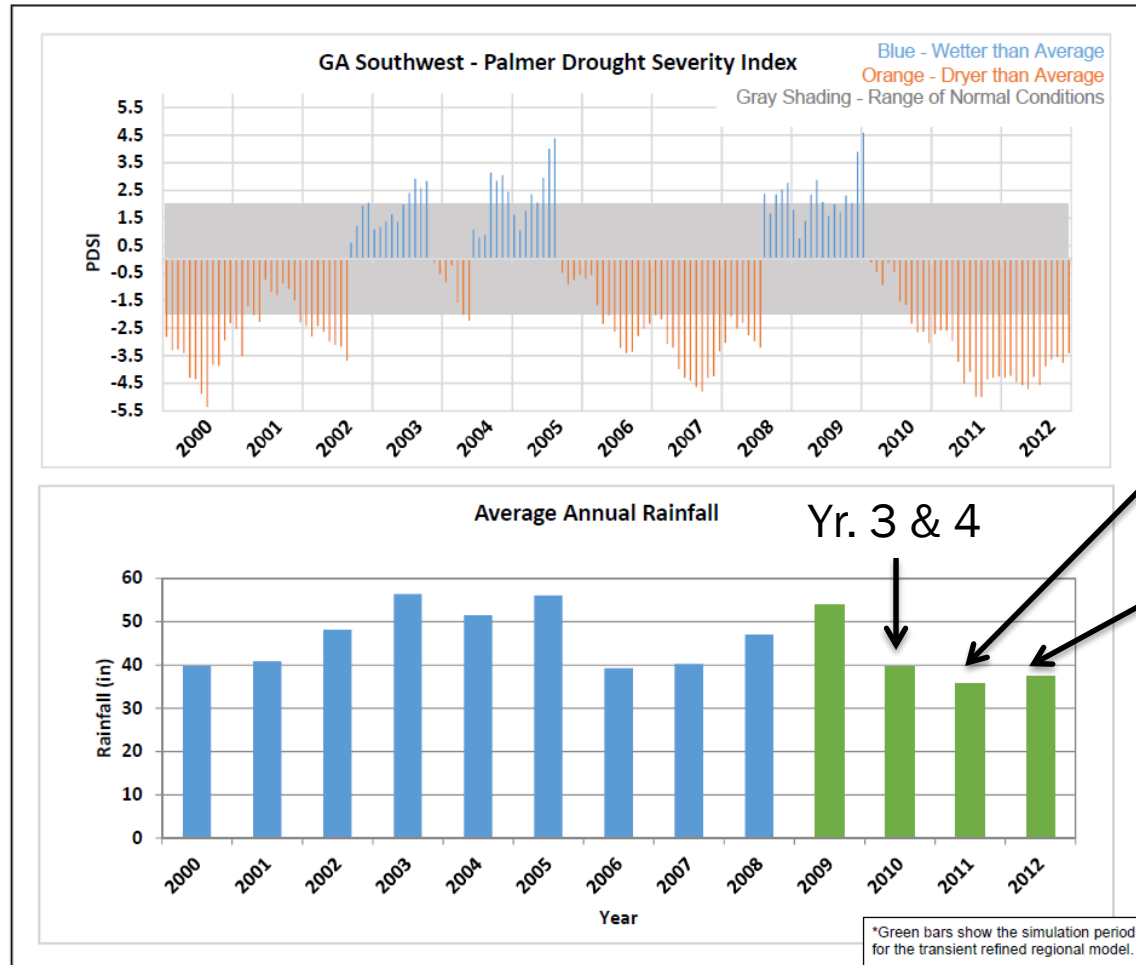


EXTEND TIME OF INCREASED PUMPING FROM TWO YEARS TO FIVE YEARS

- The Layer 6 (Cretaceous aquifer) simulated groundwater level on 1 January 2022 did not return to what it was on 1 January 2020
- This indicates that the groundwater in Layer 6 was dewatered (mined) from January 2020 to January 2022.
- Extend the time of pumping x 5.00 the baseline pumping to five years to 31 December 2024 to see if drawdown in Layer 6 reaches a new base level or if the drawdown in Layer 6 continues over time
- Use the CDM Smith recharge rates for the five year simulation with years 1 and 2 using the CDM Smith dry year recharge, years 3 and 4 using the CDM Smith average year recharge, and year 5 using the CDM Smith dry year recharge (may be a drought sequence of five year recharge)

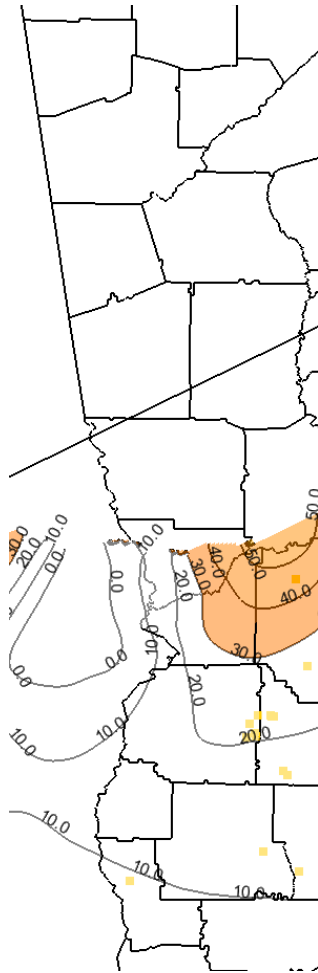


ANNUAL PRECIPITATION AND THE FIVE YEARS OF RECHARGE CHOSEN FOR THE FIVE YEAR SIMULATION





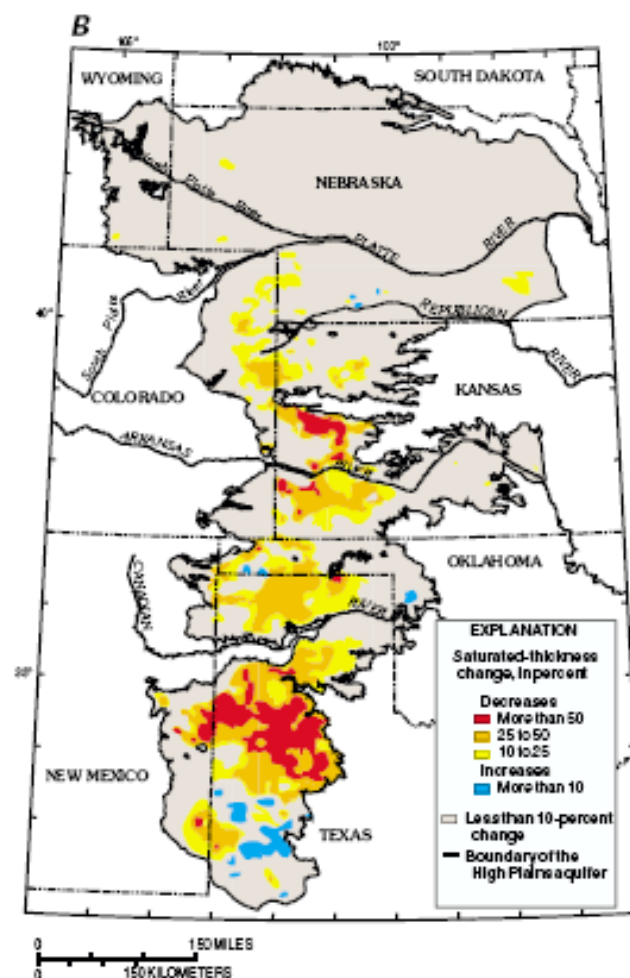
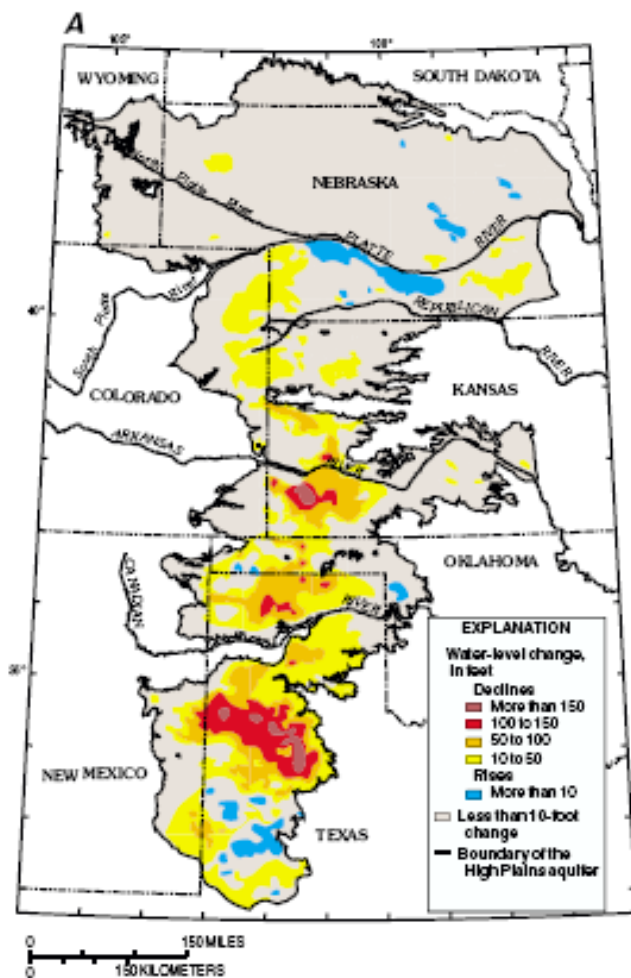
MIDDLE CHATTAHOOCHEE REGION LAYER 6 CRETACEOUS AQUIFER DRAWDOWN X 5.00 BASELINE PUMPING RATES (+20 MGD) – 31 DECEMBER 2024



With year five of the simulation including CDM Smith's dry year recharge rate the simulated groundwater levels on 31 December 2024 (time step 301) with 5.00 x the baseline pumping shows groundwater levels down from those on 7 January 2024 (time step 242). This was possibly due to year five of the simulation including CDM Smith's dry year recharge rate. The simulated groundwater level on 31 December 2024 did not return to what it was on 1 January 2020 (time step 1) which indicates that the groundwater in Layer 6 was dewatered (mined) from January 2020 to December 2024.

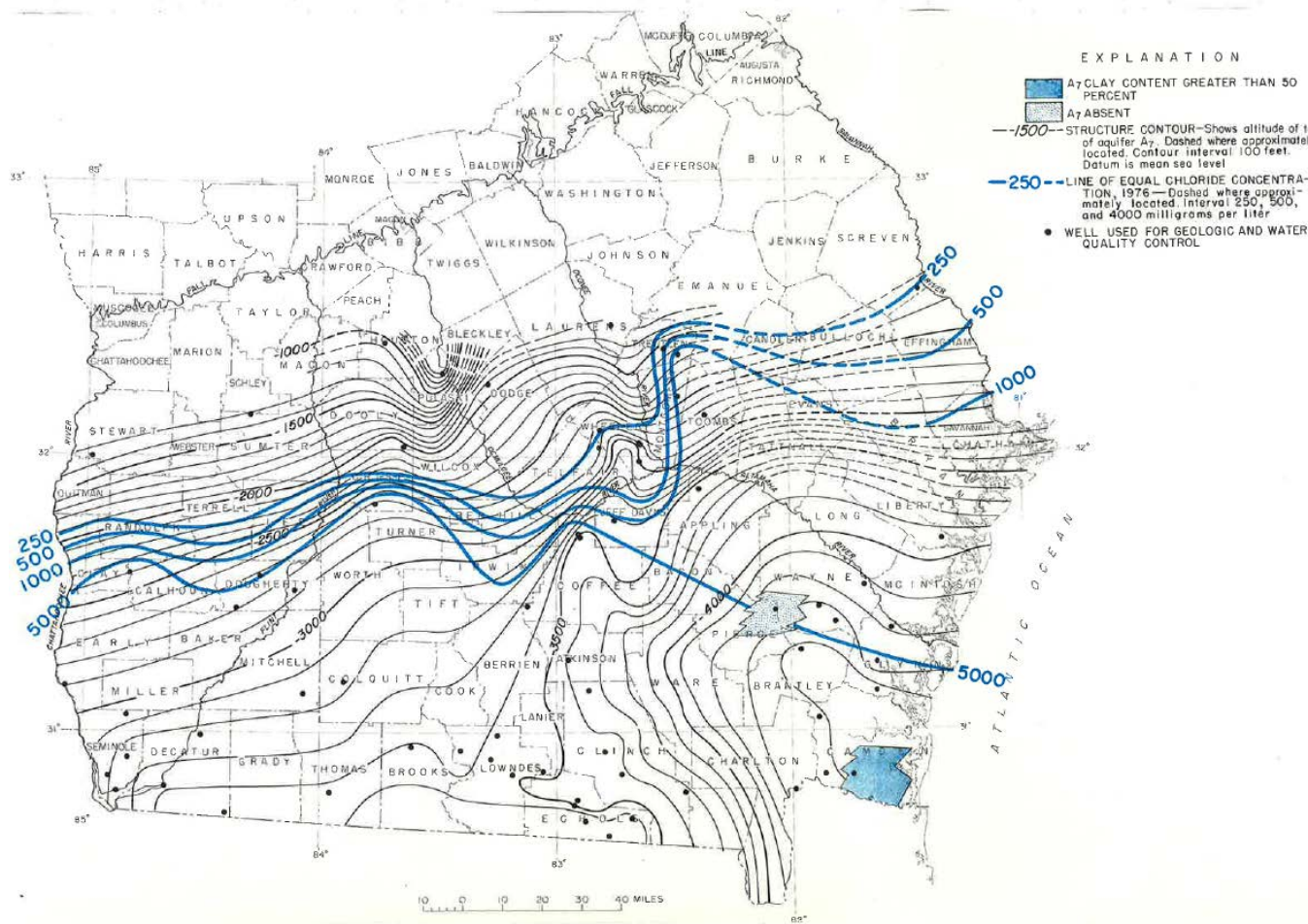


DEWATERING (MINING) OF THE HIGH-PLAINS OGALLALA AQUIFER





BRACKISH GROUNDWATER IN THE LOWER UNIT OF THE CRETACEOUS AQUIFER



The lower unit of the Cretaceous aquifer has been mapped to have some brackish groundwater (USGS defines brackish as Total Dissolved Solids (TDS) = 1,000 to 10,000 mg/L) in Clay and Randolph Counties, Georgia (from former GGS Hydrologic Atlas 3)



CAUTIONS ABOUT INCREASED PUMPING FROM AQUIFERS IN THE MIDDLE CHATTAHOOCHEE REGION

- Increased pumping from Layer 3 (Claiborne aquifer) may cause drawdowns that extend to rivers and drains in the Layer 3 outcrop area which may decrease surface water flows
- Increased pumping from Layer 4 (Clayton aquifer) is not permitted due to the Georgia EPD moratorium on increased pumping from the Clayton aquifer
- Increased pumping from Layer 5 (Cretaceous aquifer) may cause drawdowns that extend to rivers and drains in the Layer 5 outcrop area which may decrease surface water flows



OPTIONS FOR INCREASED PUMPING FROM AQUIFERS IN THE MIDDLE CHATTAHOOCHEE REGION

- Could pump up to 8 MGD (x 2.00 baseline pumping) to 20 MGD (x 5.00 baseline pumping) from Layer 6 (Cretaceous aquifer) possibly without affecting surface water flow due to the lack of rivers and drains in the Layer 6 outcrop area
- Groundwater levels in Layer 6 do not recover from increased pumping over a two year simulation and Layer 6 was simulated with x 5.00 baseline pumping and the aquifer is dewatered (mined) over a five year simulation
- If there is increased pumping from Layer 6, monitoring wells (not pumping wells) should be installed to determine if the aquifer is dewatered (mined) over the long term and adjustments should be made to pumping if the aquifer is mined
- The lower unit of the Cretaceous aquifer (Layer 6) has been mapped to have some brackish groundwater that may be captured by increased pumping