# Groundwater Management Area 9

# 2022 DFC Joint Planning Cycle

*December 14, 2020*

Blanton & Associates, Inc.
Environmental Consulting • Planning • Project Management

wsp

# GMA 9 2022 DFC Joint Planning Cycle

***For Today's Meeting:***

1. Receive report on status of 2022 DFC Joint Planning Cycle, including revised and schedule. *(Agenda Item 8)*

2. Review and discuss non-relevant aquifer classifications adopted by GMA 9 in last round of DFC Joint Planning and discuss possible revisions. *(Agenda Item 9)*

3. Review and discuss DFC statements adopted by GMA 9 in last round of DFC Joint Planning and discuss possible revisions. *(Agenda Item 10)*

4. Receive presentations on, and discussion of, Texas Water Code §§ 36.108(d)(1) – 36.108(d)(5) regarding aquifer uses and conditions, State Water Plan water supply needs and water management strategies, hydrological conditions, other environmental impacts, and impacts on subsidence factors as they relate to DFC consideration and adoption. *(Agenda Item 11)*

# GMA 9 2022 DFC Joint Planning Cycle – Process/Schedule Update

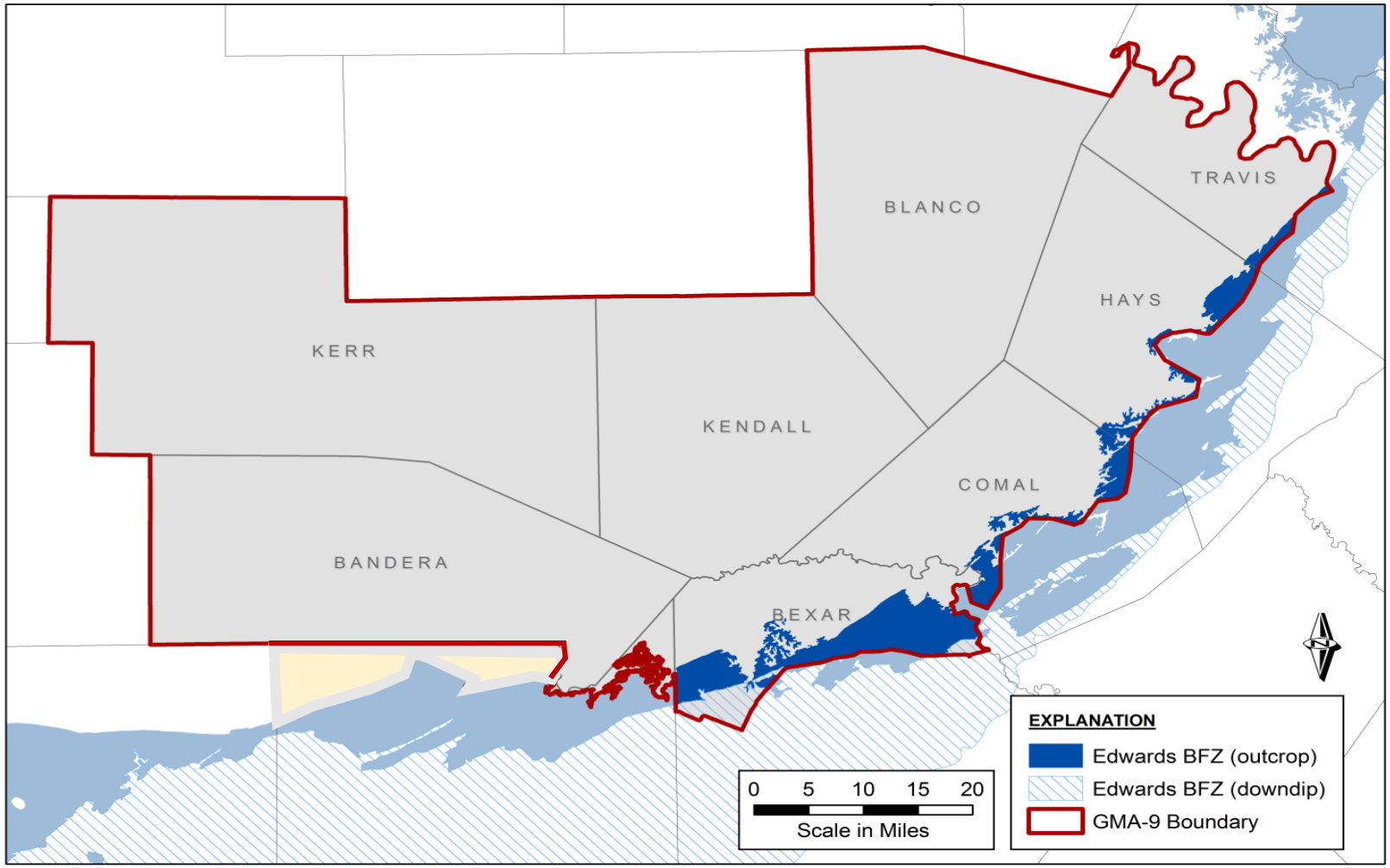
**GMA 9 Joint Planning Process Schedule – Revised 12/14/20**

| Task | Estimated Completion |
|---|---|
| GMA 9 meeting – Review project approach and timeline; present report on requirements of Texas Water Code § 36.108; and review previous GAM runs and DFCs and proposed non-relevant aquifer classifications. | November 18, 2019 |
| GMA 9 meeting – Provide project update; discuss DFC statements; discuss possible non-relevant aquifer classifications; and present report regarding Texas Water Code §§ 36.108(d)(1) – 36.108(d)(5) and discuss first five of nine factors. | December 14, 2020 |
| GMA 9 meeting – Provide project update; discuss possible proposed non-relevant aquifer classifications; discuss and identify DFCs to be proposed by GMA 9; and present report regarding Texas Water Code §§ 36.108(d)(6) – 36.108(d)(9) and discuss four remaining factors. | January 2021 |
| GMA 9 meeting – Consider action to approve proposed non-relevant aquifer classifications and proposed DFCs, and to distribute both to the GCDs in GMA 9. *Action to approve proposed DFCs for distribution to GCDs must be by 2/3 vote of GMA 9.* | March 2021 |
| 90-day public comment period on proposed non-relevant aquifers and DFCs – Hold public hearings and make available information used to develop these proposals including how nine factors considered in developing proposed DFCs. | April 2021 – July 2021 |
| **Texas Water Code § 36.108(d) deadline to adopt proposed DFCs.** | **May 1, 2021** |
| GCDs compile public comments received during public comment period and prepare GCD summary reports. | August 2021 |
| GMA 9 meeting – Review GCD public comment summaries and GCD suggestions to modify proposed revisions to DFCs, if applicable, based upon public comments. | September 2021 |
| First GMA 9 Meeting – Review and discuss complete draft explanatory report. | October 2021 |
| Second GMA 9 meeting – Consider action to adopt final DFCs, non-relevant aquifer classification proposals, and explanatory report. *Action to approve proposed DFCs must be resolution adopted by 2/3 vote of GMA 9.* | |
| Prepare and submit DFCs and explanatory report to TWDB and to each GCD. *Submission packet due to TWDB within 60 days of action to adopt DFCs.* | November 2021 |
| **Texas Water Code § 36.10 (d-3) deadline to adopt final DFCs.** | **January 5, 2022** |

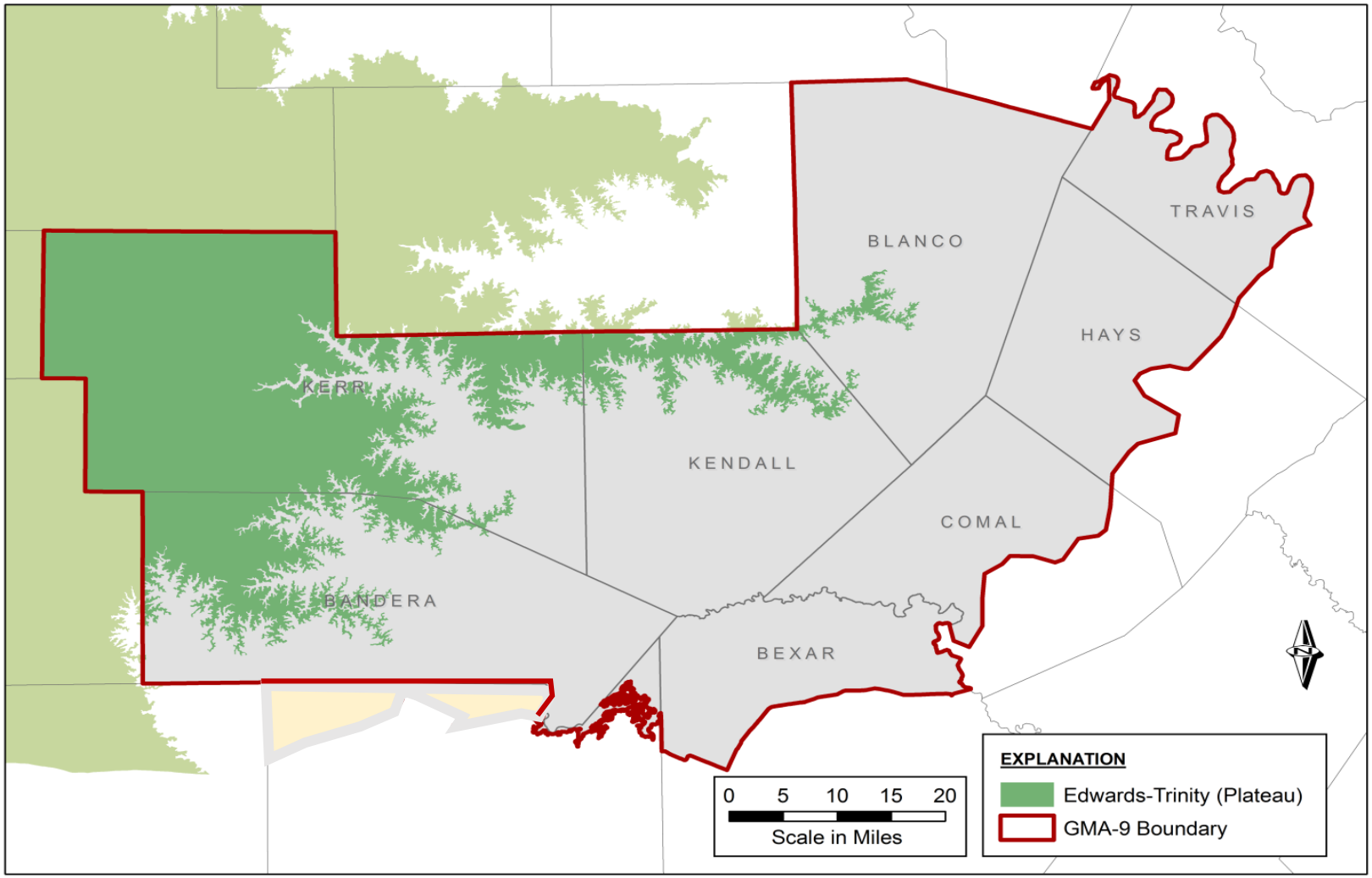
# GMA-9 Non-Relevant Aquifer Classifications

| Possible Non-Relevant Aquifer Classification | Applicable Areas Within GMA-9 (All or Portions of the Following Counties, as applicable) |
|---|---|
| Edwards Aquifer (Balcones Fault Zone) | Bexar, Comal, Hays and Travis counties |
| Edwards-Trinity (Plateau) | Blanco and Kerr counties |
| Ellenburger-San Saba | Blanco and Kerr counties |
| Hickory | Blanco, Hays, Kerr, and Travis counties |
| Marble Falls | Blanco County |

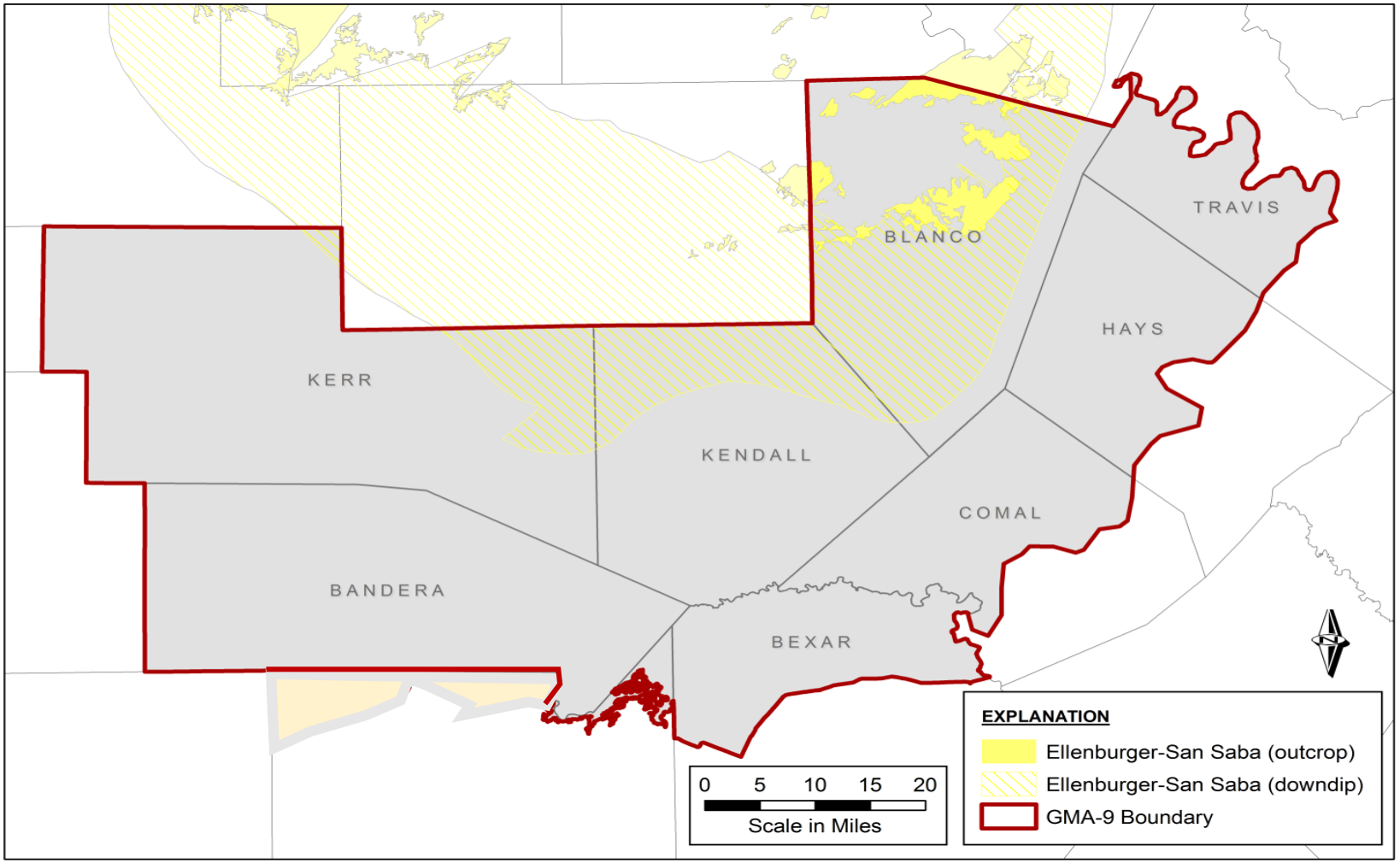
# GMA-9 Non-Relevant Aquifer: Edwards BFZ



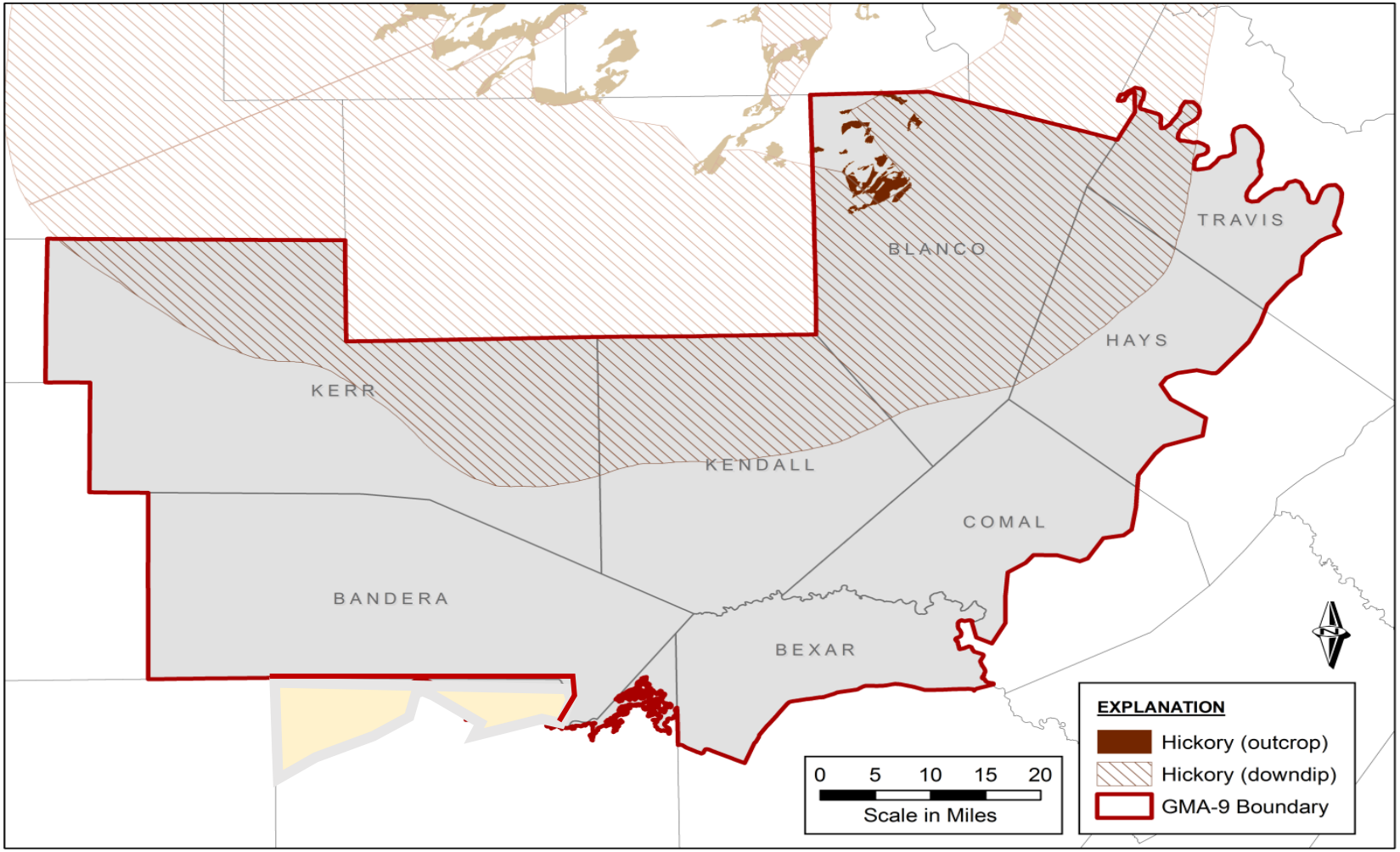
# GMA-9 Non-Relevant Aquifer: Edwards-Trinity (Plateau)



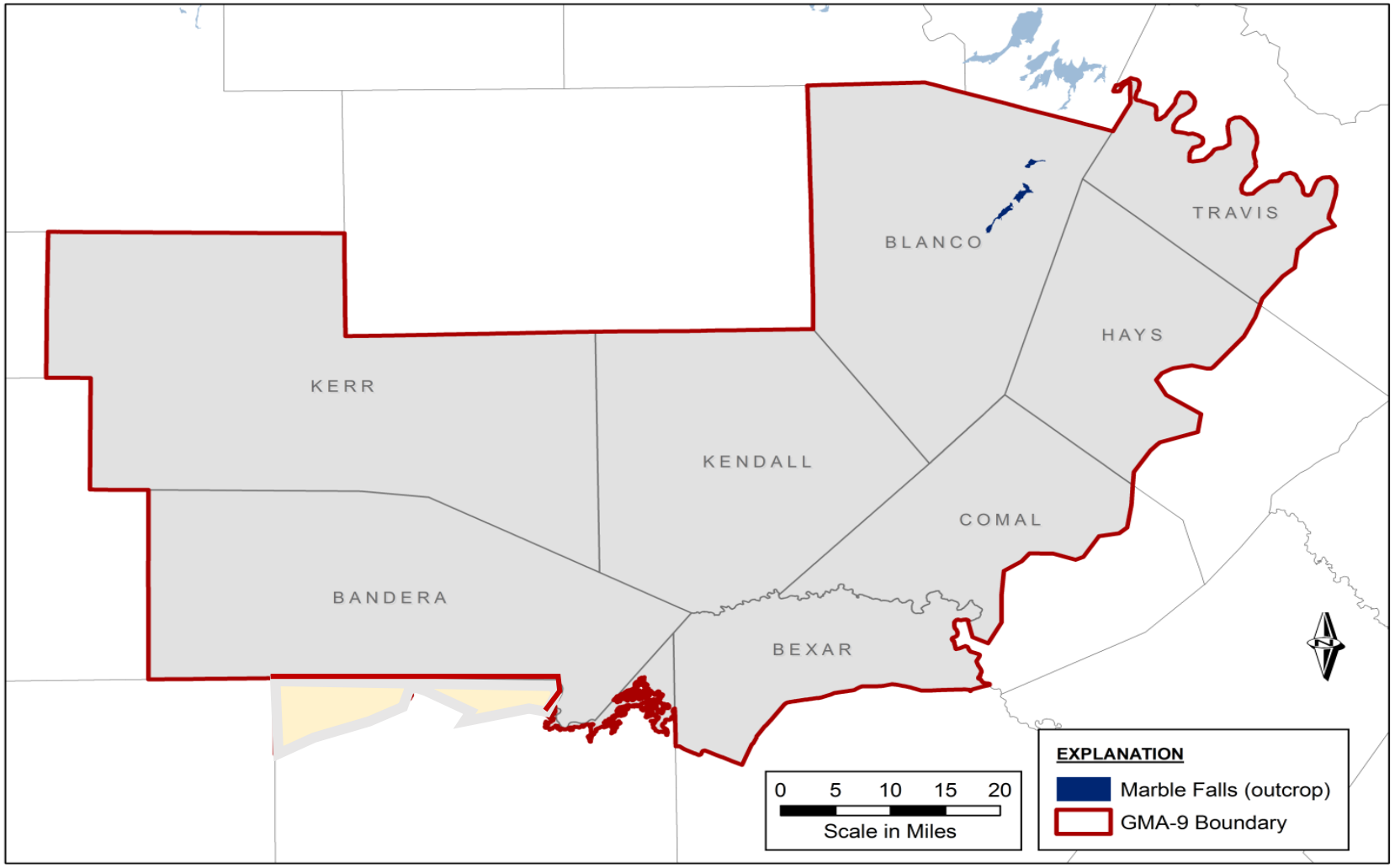
# GMA-9 Non-Relevant Aquifer: Ellenburger-San Saba



# GMA-9 Non-Relevant Aquifer: Hickory



# GMA-9 Non-Relevant Aquifer: Marble Falls



# Review and Discuss DFC Statements – DFCs and TWDB Discussions

| Aquifer | Desired Future Condition | Date Adopted |
|---|---|---|
| Trinity | Increase in average drawdown of approximately 30 feet through 2060 | 4/18/2016 |
| Edwards Group of Edwards-Trinity (Plateau) | No net increase in average drawdown in Kendall and Bandera counties through 2070 | 4/18/2016 |
| Ellenburger-San Saba | Increase in average drawdown of no less than 7 feet in Kendall County through 2070 | 10/17/2016 |
| Hickory | Increase in average drawdown of no more than 7 feet in Kendall County through 2070 | 4/18/2016 |

TWDB recommended items to include in DFC statements:

1. Average drawdown geographical extent – For MAG calculations, make clear whether DFC geographical extent is entire GMA or only certain counties.
2. DFC Variance – For example, tolerance of 5 percent or up to one foot when comparing DFCs to average drawdown calculations from model files.
3. Year of initial water level values – Identify initial year for water level values to compare drawdown.

# Review and Discuss DFC Statements – TWDB Discussions

## GMA 9 Sub-committee Discussion (8/25/20):

- DFC variance or tolerance statements added as a footnote in explanatory report
  - Example: 5 percent or up to one foot when comparing DFCs to average drawdown calculations from model files
- Year of initial water level values – 2008
- Possibility of no changes to DFCs for 2022 DFC Joint Planning Cycle

## TWDB Staff Follow-up Discussion (9/3/20):

- No concerns with keeping GMA 9 DCF statements as currently written
- TWDB can provide a model run on 30-foot DFC for Ellenburger-San Saba Aquifer
  - Results not until fall 2021 – but before GMA 9 final DFC adoption

# Review and Discuss DFC Statements – TWDB Discussions

## *GMA 9 Modeled Available Groundwater Amounts for Trinity Aquifer by Groundwater Conservation District and County for Each Decade Between 2010 and 2060*

| DISTRICT | COUNTY | DISTRICT TOTALS (acre-feet/year) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 |
| Bandera County River Authority & Groundwater District | Bandera | 7,284 | 7,284 | 7,284 | 7,284 | 7,284 | 7,284 |
| Barton Springs/Edwards Aquifer Conservation District | Hays | 22 | 22 | 22 | 22 | 22 | 22 |
| Blanco-Pedernales Groundwater Conservation District | Blanco | 2,573 | 2,573 | 2,573 | 2,573 | 2,573 | 2,573 |
| Comal Trinity Groundwater Conservation District | Comal | 10,076 | 10,076 | 10,076 | 10,076 | 10,076 | 10,076 |
| Cow Creek Groundwater Conservation District | Kendall | 10,622 | 10,622 | 10,622 | 10,622 | 10,622 | 10,622 |
| Hays Trinity Groundwater Conservation District | Hays | 9,109 | 9,098 | 9,095 | 9,094 | 9,094 | 9,094 |
| Headwaters Groundwater Conservation District | Kerr | 16,435 | 14,918 | 14,845 | 14,556 | 14,239 | 14,223 |
| Medina County Groundwater Conservation District | Medina | 2,500 | 2,500 | 2,500 | 2,500 | 2,500 | 2,500 |
| Trinity Glen Rose Groundwater Conservation District | Total – Bexar, Comal and Kendall Counties | 25,511 | 25,511 | 25,511 | 25,511 | 25,511 | 25,511 |
| | Bexar | 24,856 | 24,856 | 24,856 | 24,856 | 24,856 | 24,856 |
| | Comal | 138 | 138 | 138 | 138 | 138 | 138 |
| | Kendall | 517 | 517 | 517 | 517 | 517 | 517 |
| Southwestern Travis County Groundwater Conservation District – "No District" | Travis | 8,920 | 8,672 | 8,655 | 8,643 | 8,627 | 8,598 |
| GMA 9 TOTALS | | 93,052 | 91,276 | 91,183 | 90,881 | 90,548 | 90,503 |

Source: TWDB GAM Run 16-023, 2017

# Review and Discuss DFC Statements – TWDB Discussions

***GMA 9 Modeled Available Groundwater Amounts for other Major and Minor Aquifers by Groundwater Conservation District and County for Each Decade Between 2010 and 2070***

*Edwards Group of Edwards-Trinity (Plateau) Aquifer*

| DISTRICT | COUNTY | DISTRICT TOTALS (acre-feet/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| Bandera County River Authority & Groundwater District | Bandera | 2,009 | 2,009 | 2,009 | 2,009 | 2,009 | 2,009 | 2,009 |
| Cow Creek Groundwater Conservation District | Kendall | 199 | 199 | 199 | 199 | 199 | 199 | 199 |
| GMA 9 TOTALS | | 2,208 | 2,208 | 2,208 | 2,208 | 2,208 | 2,208 | 2,208 |

*Ellenburger-San Saba Aquifer*

| DISTRICT | COUNTY | DISTRICT TOTALS (acre-feet/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| Cow Creek Groundwater Conservation District | Kendall | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| GMA 9 TOTALS | | 75 | 75 | 75 | 75 | 75 | 75 | 75 |

*Hickory Aquifer*

| DISTRICT | COUNTY | DISTRICT TOTALS (acre-feet/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| Cow Creek Groundwater Conservation District | Kendall | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| GMA 9 TOTALS | | 140 | 140 | 140 | 140 | 140 | 140 | 140 |

Source: TWDB GAM Run 16-023, 2017

## Trinity and Edwards Group of Edwards-Trinity (Plateau) Aquifer DFC Statements – *Policy Justifications*

- DFCs long-term targets (50-year time period)
- Severe drought most of five years since DFCs adopted and need to assess DFCs over time and re-evaluate
- 2010 – 2015: GCDs assessed water level changes and information on DFCs
- Practical and cost-efficient methodology to review/refine new DFCs with sufficient/relevant data
- 2012: Study comparing actual groundwater level data to GAM predictions (Trinity)
- Refine how GAM results relate to actual water level data and data sets considered (Trinity)
- Update Hill Country Trinity GAM (Trinity)

## Ellenburger-San Saba and Hickory Aquifer DFC Statements – *Policy Justifications*

- Ellenburger DFC modified in October 2016 after initial adoption
- GMA 9 declared Ellenburger and Hickory "relevant" in Kendall County at CCGCD request
- Recognized local control, and reflected cooperation and consensus among GCDs
- DFCs long-term targets (50-year time period)
- After initial DFC adoption assess water level changes and other data and information (e.g., comparing actual groundwater use to MAGs)
- Assess DFC over time and re-evaluate

# Trinity and Edwards Group of Edward-Trinity (Plateau) Aquifer DFC Statements – *Technical Justifications*

## Data Assessment Justifications

- In 2014 GCDs assessed water level changes
  - Actual water levels (in Trinity Aquifer) were higher than modeled water levels – "*Comparison of Groundwater Monitoring Data with Groundwater Model Results GMA 9"*
- Assess DFCs over time with sufficient (collected under varying conditions) data and re-evaluate

## Groundwater Availability Model Justifications

- 1st planning cycle: GAM Task 10-005 used to evaluate relationship between pumping versus drawdown, spring, and base flow and outflow in Trinity Aquifer
  - Committee selected Scenario 6 (about 92,000 acre-feet/year pumping) to balance competing water demands and determined DFC meets the "Balance Test"
- 1st planning cycle: MAG estimates extracted from previous GAM run 08-90 meets DFC for Edwards-Trinity Plateau Aquifer and allow for no net increase in average drawdown in Kendall and Bandera counties
- Hill Country Trinity GAM last updated in 2009 – wait on update

# Review and Discuss DFC Statements – Policy and Technical Justifications

## Trinity and Edwards Group of Edward-Trinity (Plateau) Aquifer DFC Statements – *Technical Justifications (continued)*

- "These two elements (*data assessment and GAM justification*) combined will enable the GCDs to develop and implement a practical and cost-efficient methodology for reviewing and refining new DFCs based on sufficient and relevant data gathered over a longer, more representative period of time and to use the best available science to support the DFC decisions to ensure they are reasonable and achievable." (GMA 9 Explanatory Report for DFCs, Major and Minor Aquifers. April 2016. p. 74)

- 3rd Round Planning Cycle Discussion
  - Data Assessment – *"Groundwater Management Area 9: Proposed DFC Monitoring Methodology."* Fieseler and Hunt. November 2019 – Trinity Aquifer only
  - GAM Run 16-023 MAG: Modeled Available Groundwater for GMA 9 relevant major aquifers:
    - 2010 – 2060: Trinity Aquifer: 93,052 – 90,503 acre-feet/year
    - 2010 – 2070: Edwards Group of Edwards-Trinity Plateau Aquifer: 2,208 acre-feet/year
  - Hill Country Trinity GAM Update – by 2027

# Review and Discuss DFC Statements – Policy and Technical Justifications

## Ellenburger-San Saba and Hickory Aquifer DFC Statements – *Technical Justifications*

- Data Assessment Justifications
  - Initial years after DFC adoption; assess water level changes; gather and review other data and information such as comparing actual groundwater use to MAGs
  - DFCs For Ellenburger and Hickory aquifers in Kendall County are a 50-year target
- Groundwater Availability Model Justifications
  - Assess DFC over time, re-evaluate during next planning round, and consider new model runs
- 3rd Round Planning Cycle Discussion
  - GAM Run 16-023 MAG: Modeled Available Groundwater for GMA 9 relevant minor aquifers (2010 – 2070):
    - Ellenburger-San Saba Aquifer: 75 acre-feet/year (Kendall County only)
    - Hickory Aquifer: 140 acre-feet/year (Kendall County only)

# TWC § 36.108(d) Nine Factor Consideration

***B&A Team Approach to Presenting Information on Nine Factors:***

- Goal to have focused discussions on nine factors – December 2020 and January 2021 meetings
- Present summary of how proposed DFC impact on each factor when proposed DFCs considered for adoption – March 2021
- B&A Team presentations available during 90-day public comment period
- Factor presentation content will be reflective of explanatory report content

# TWC § 36.108(d) Nine Factor Consideration

| | | |
|---|---|---|
| Aquifer Uses or Conditions | Supply Needs and Management Strategies | Hydrological Conditions |
| Environmental Impacts | Subsidence Impacts | Socioeconomic Impacts |
| Private Property Rights | DFC Feasibility | Other Relevant Information |

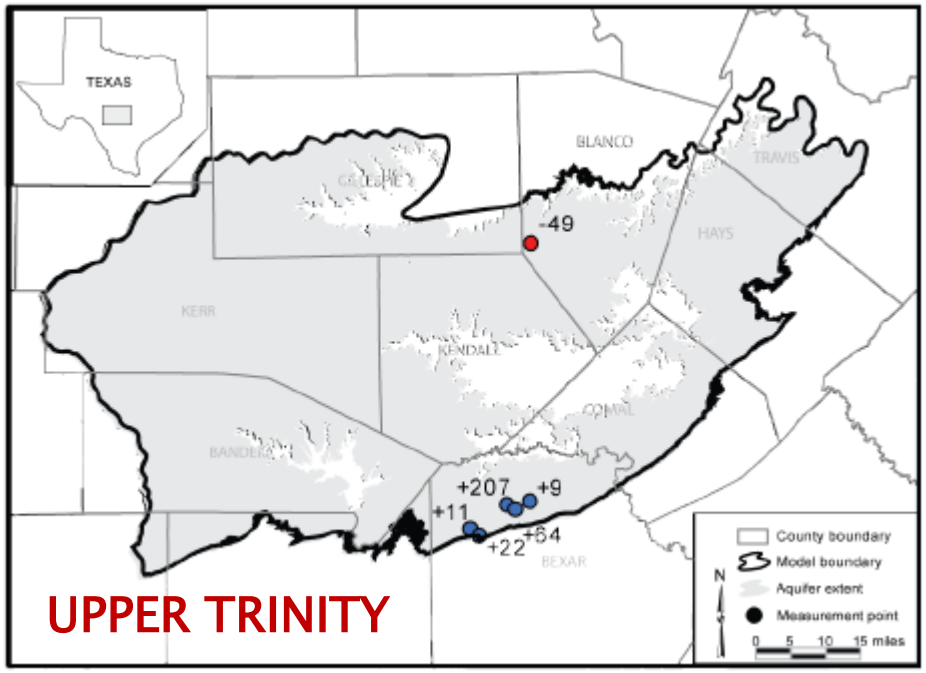
*COURTESY: WSP USA, INC.*

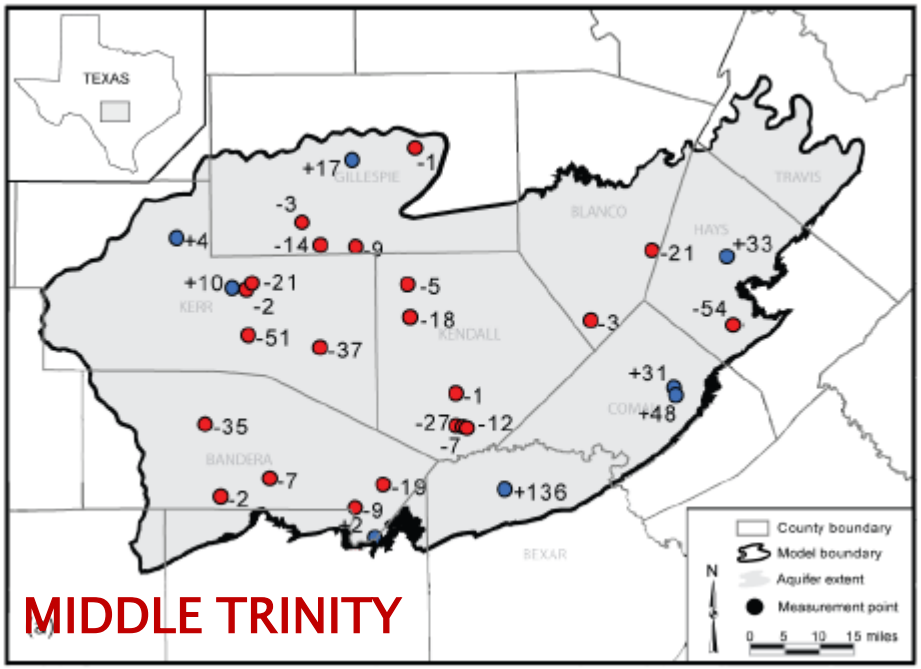
# Aquifer Uses and Conditions

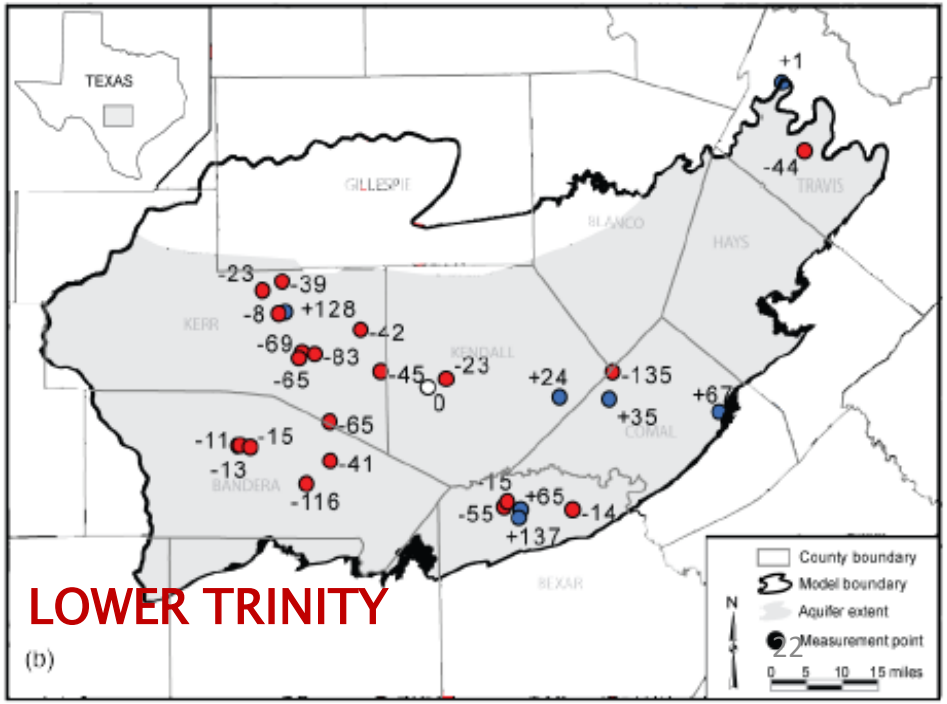
- Pumping from Trinity Aquifer estimated by Groundwater Conservation District for 2008 (Acre-feet per year)

| County | Edwards Group of the Edwards-Trinity (Plateau) Aquifer | Upper Trinity Aquifer | Middle Trinity Aquifer | Lower Trinity Aquifer | Total Pumping (County) |
|---|---|---|---|---|---|
| Bandera | 631 | 288 | 3567 | 515 | **5,000** |
| Bexar | 0 | 693 | 14110 | 197 | **15,000** |
| Blanco | 0 | 77 | 1,477 | 0 | **1,554** |
| Comal | 0 | 398 | 5,788 | 0 | **6,186** |
| Hays | 0 | 416 | 4,800 | 449 | **5,665** |
| Kendall | 315 | 300 | 6,060 | 325 | **7,000** |
| Kerr | 1,035 | 213 | 6,263 | 5,534 | **13,045** |
| Medina | 0 | 0 | 500 | 1000 | **1,500** |
| Travis | 0 | 551 | 4,967 | 0 | **5,518** |
| **Total pumping (aquifer)** | **1,981** | **2,936** | **47,532** | **8,020** | **60,468** |

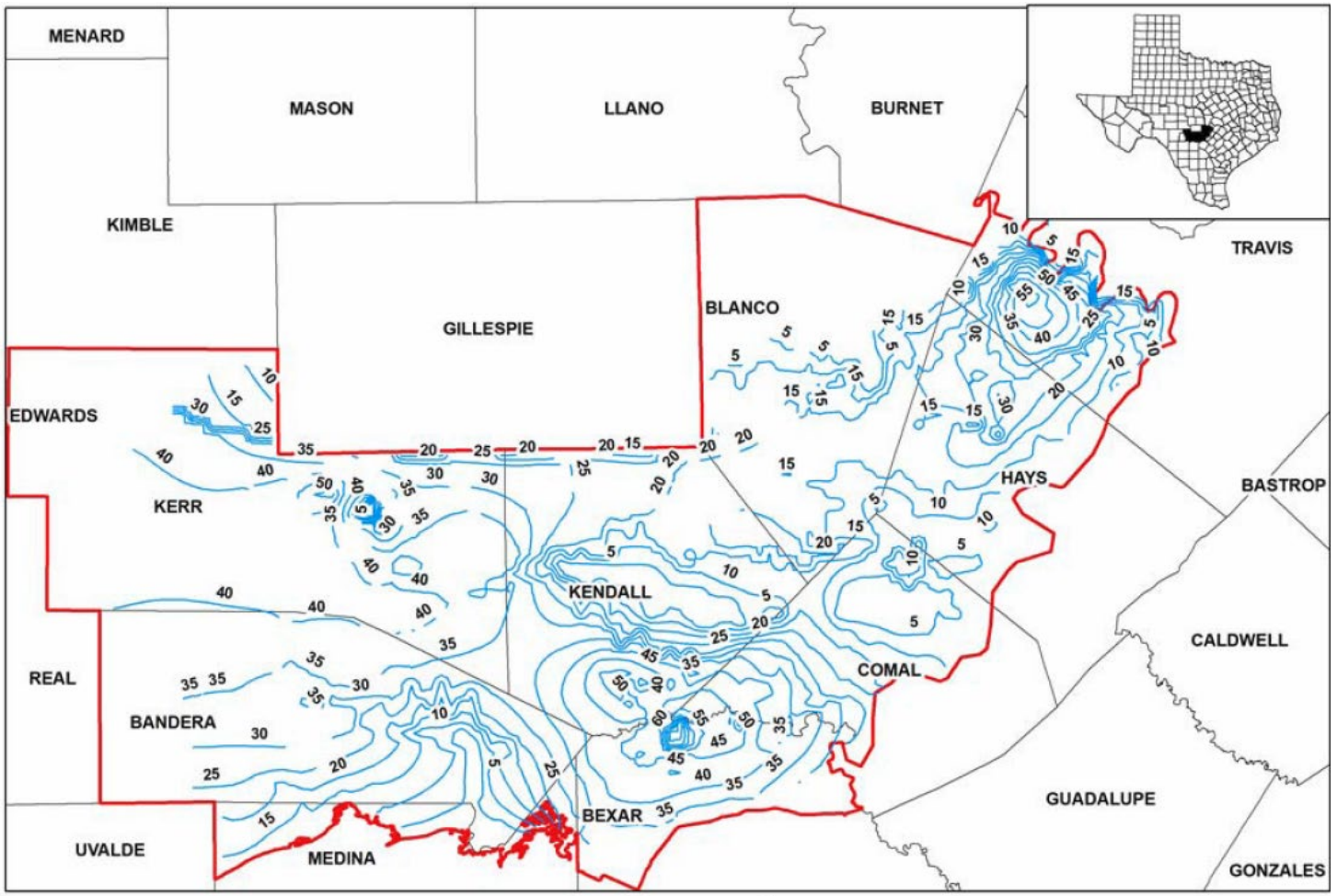
# Net Water Level Change: 1980 – 1997



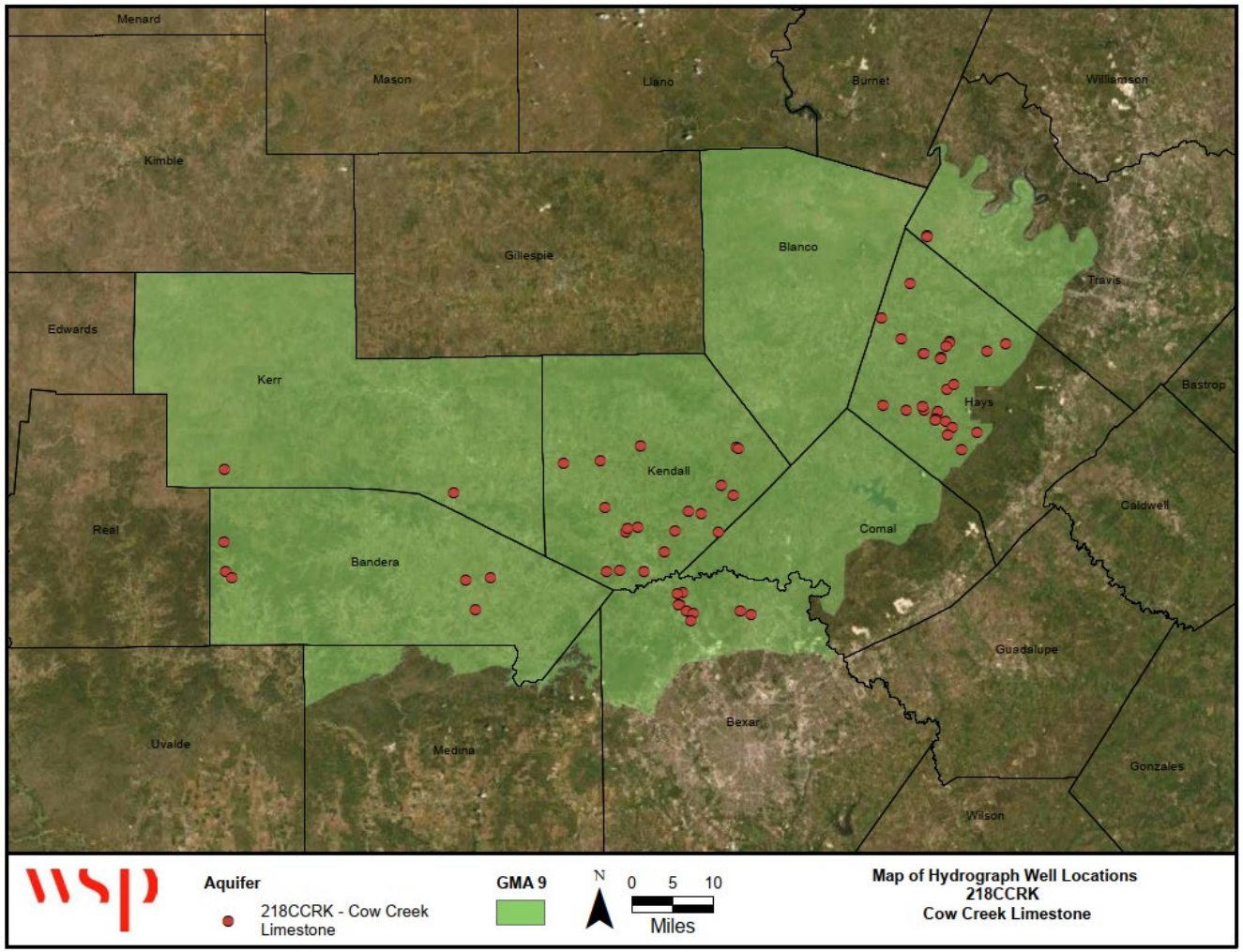



# Resulting Average Water Level Decline in All Layers of Trinity after 50 years (from 387 simulations)



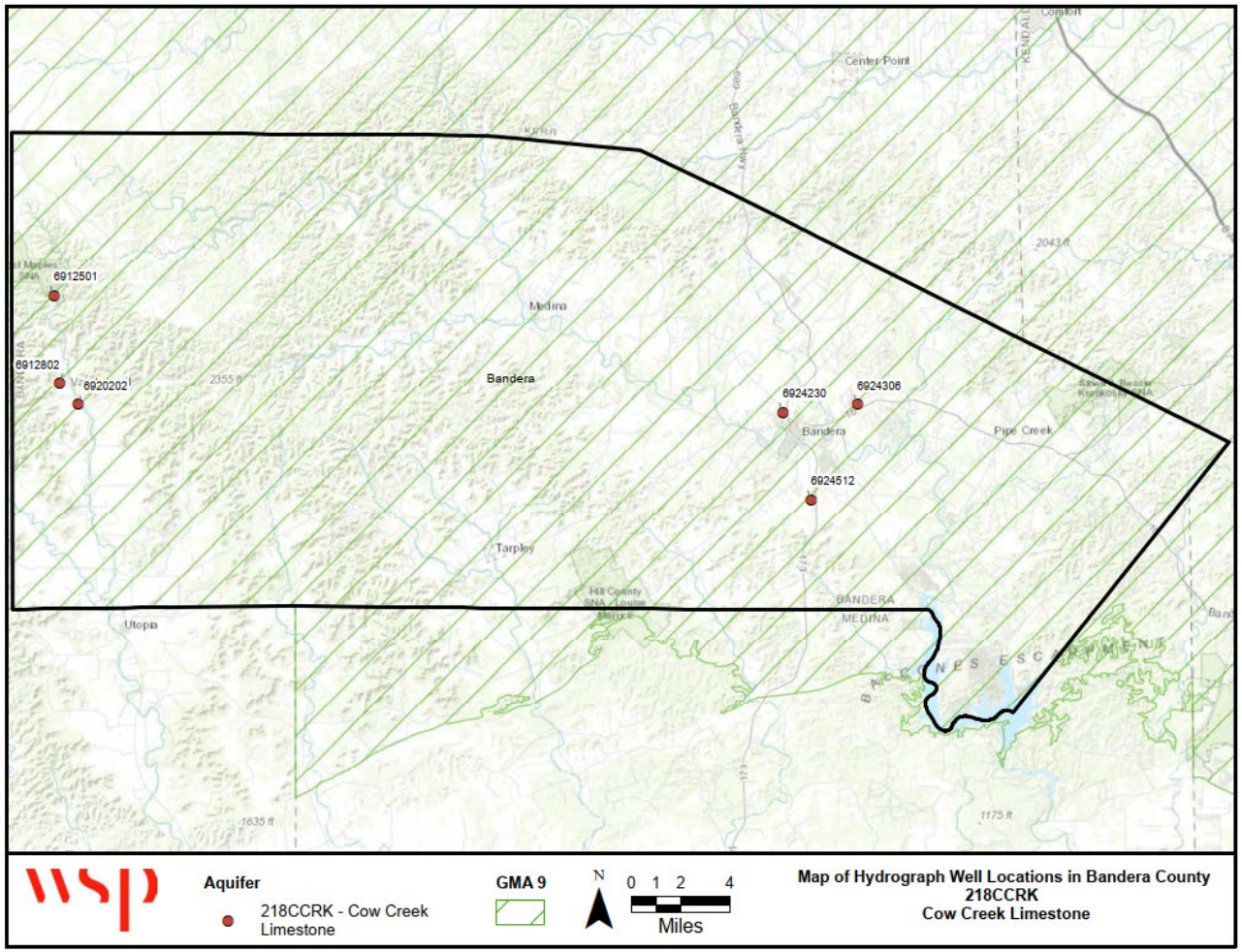
# GMA 9 2022 DFC Joint Planning Cycle

Hydrographs Available for Review by County



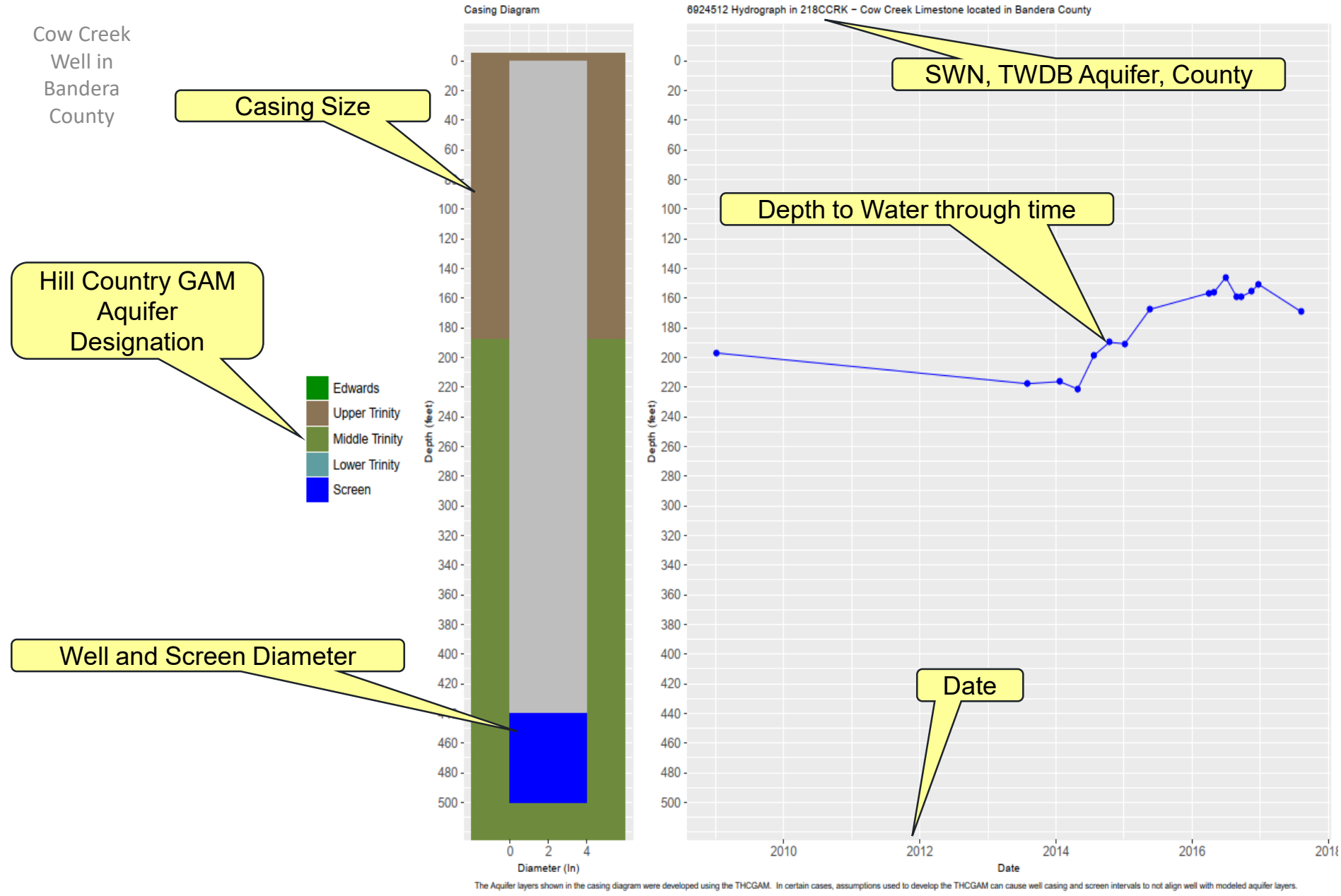
# GMA 9 2022 DFC Joint Planning Cycle

Hydrographs Available for Review by County



# Hydrographs

Cow Creek Well in Bandera County



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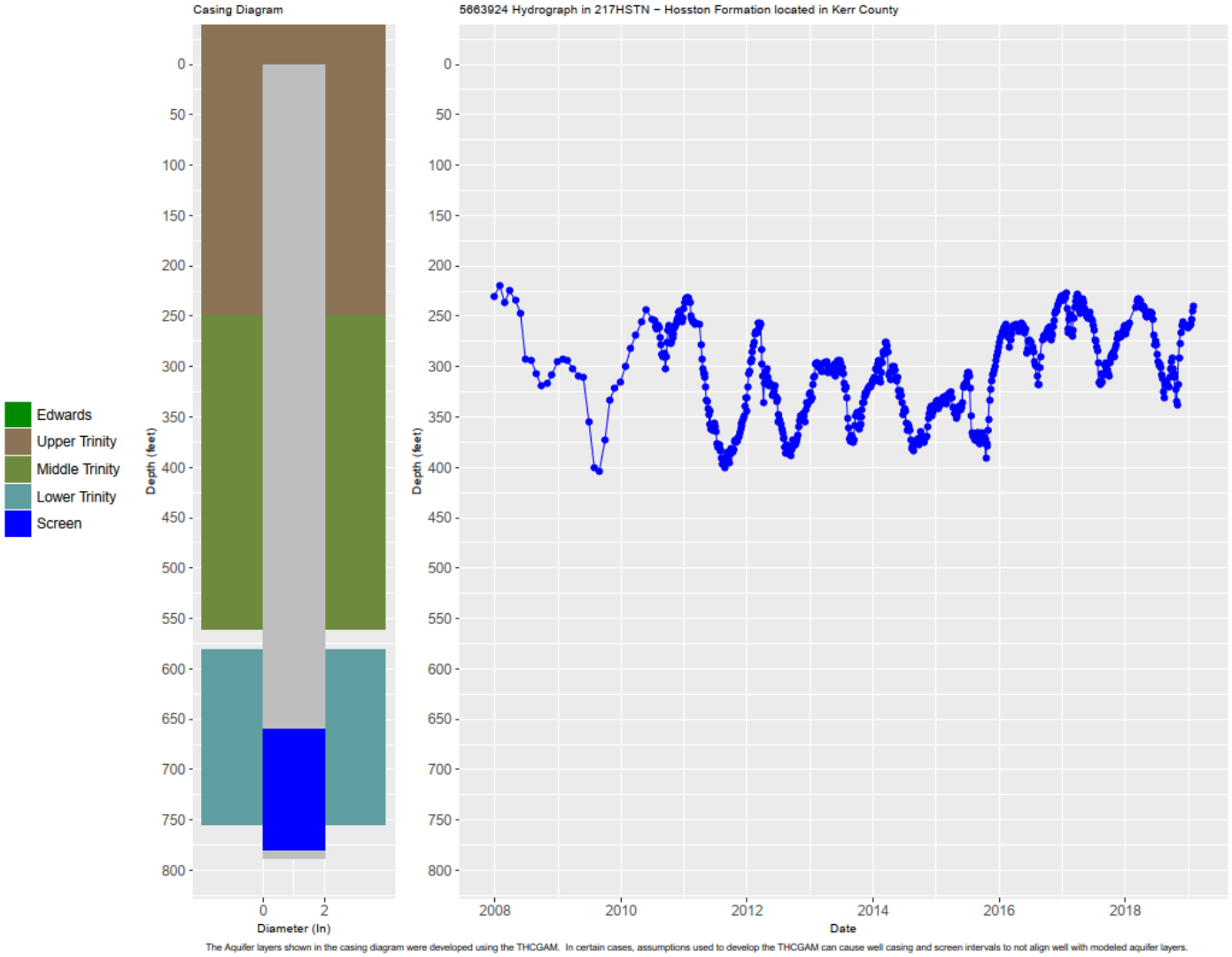


# Water level changes since 2008

## Blanco County

### Trinity Aquifer DFC Compliance Analysis for Blanco County

| Monitor Well Name | Calendar Year Average Water Level Below Land Surface | | | | | | | | | | | | Average Well Drawdown Change in feet From 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2008 (Baseline Year) | 2009 Avg. | 2010 Avg. | 2011 Avg. | 2012 Avg. | 2013 Avg. | 2014 Avg. | 2015 Avg. | 2016 Avg. | 2017 Avg. | 2018 Avg. | 2019 Avg. | |
| Stanton | 216.5 | 216.1 | 205.5 | 215.5 | 216.8 | 216.4 | 215.9 | 209.3 | 208.7 | 212.6 | 217.6 | 211.0 | 3.29 |
| Rocking J Well #2 | 216.1 | 216.0 | 195.5 | 214.8 | 215.8 | 219.9 | 221.5 | 209.0 | 195.9 | 197.1 | 229.1 | 199.8 | 5.71 |
| Pedernales Falls | 191.6 | 179.3 | 141.9 | 187.2 | 173.6 | 182.1 | 173.1 | 173.3 | 178.2 | 179.2 | 185.6 | 181.2 | 15.72 |
| Amil Baker | 310.6 | 323.2 | 288.8 | 321.7 | 323.7 | 319.3 | 313.4 | 306.6 | 279.6 | 284.9 | 304.2 | 297.3 | 4.90 |
| Rosa Winn | 88.7 | 92.6 | 70.7 | 88.8 | 78.1 | 80.0 | 80.6 | 68.9 | 70.4 | 74.7 | 85.4 | 74.5 | 10.09 |
| City of Blanco | 41.8 | 72.7 | 21.9 | 46.5 | 25.2 | 25.5 | 24.7 | 21.8 | 21.9 | 23.8 | 36.0 | 23.2 | 10.60 |
| Blanco River Well | 84.9 | 108.8 | 66.3 | 89.7 | 91.5 | 80.8 | 80.9 | 65.2 | 44.3 | 50.6 | 77.3 | 50.6 | 11.63 |
| **Total Average Change in Trinity Aquifer Drawdown for all of Blanco County** | | | | | | | | | | | | | **8.8** |

NOTE: a positive number indicate a higher aquifer level than the 2008 Baseline Year, while a negative number indicate a lower aquifer level than the 2008 Baseline Year

# Aquifer Uses and Conditions

- Pumping from Edwards-Trinity (Plateau) Aquifer Estimated by the Texas Water Development Board in 2013 (Acre-feet per year)

| County | Municipal | Manufacturing | Mining | Steam Electric Power | Irrigation | Livestock | Total Use |
|---|---|---|---|---|---|---|---|
| BANDERA | 66 | 0 | 0 | 0 | 0 | 69 | 135 |
| KENDALL | 53 | 0 | 0 | 0 | 0 | 17 | 70 |

# Aquifer Uses and Conditions

- Ellenburger-San Saba
  - There are No Ellenburger-San Saba wells in Kendall County
  - There is No Water Level Data in Kendall County for the Ellenburger-San Saba Aquifer

- Hickory
  - There are no Hickory wells in Kendall County
  - There is No Water Level Data in Kendall County for the Hickory Aquifer

# TWC § 36.108(d) Nine Factor Consideration
## *SWP Water Supply Needs/Water Management Strategies*

***Water Supply Needs/Water Management Strategies included in the State Water Plan***

Before adoption of DFCs, GCDs consider groundwater availability models and other data or information for the management area and consider nine factors including water supply needs and water management strategies included in state water plan (Texas Water Code § 36.108(d)(2)).

***Other Requirements***

- Texas Water Code § 36.1071(e) requires GCDs consider SWP WSNs and WMS in developing Management Plans.
  - GMA 9 GCD adopted Management Plans include consideration of SWP WSNs and WMSs with detailed tables summarizing WSNs and WMSs.
  - GMA 9 GCD adopted Management Plans have various deadlines.

***Presentation Focuses on 2017 SWP WSNs and WMSs in GMA 9 counties***

# TWC § 36.108(d) Nine Factor Consideration

## *SWP Water Supply Needs/Water Management Strategies*

### Year 2070 Projected Demands for Counties in GMA 9: Comparison of 2017 State Water Plan Versus 2021 Regions J, K, and L Regional Water Plans

| County | 2070 Demands 2017 State Water Plan (acre-feet/year) | 2070 Demands 2021 Regional Water Plans (acre-feet/year) | Differences |
|---|---|---|---|
| Bandera | 3,998 | 4,629 | 631 |
| Bexar | 543,989 | 471,297 | -72,692 |
| Blanco | 3,231 | 4,032 | 801 |
| Comal | 83,562 | 84,763 | 1,201 |
| Hays | 115,037 | 107,760 | -7,277 |
| Kendall | 15,950 | 16,310 | 360 |
| Kerr | 9,433 | 10,166 | 733 |
| Medina | 61,252 | 74,822 | 13,570 |
| Travis | 509,035 | 430,760 | -78,275 |
| TOTALS | 1,345,487 | 1,204,539 | -140,948 |

*All values are reported for entire county.*

*Source: 2017 State Water Plan Datasets and Regions J, K, and L 2021 Regional Water Plans*

- Revised demand projections for current planning cycle indicate decrease in projected demand of 140,948 acre-feet per year for GMA 9 counties.
- Decrease could be due to reduction in population projections, changes in per capita use, or an increase from conservation strategies.

# TWC § 36.108(d) Nine Factor Consideration

## *SWP Water Supply Needs/Water Management Strategies*

### Year 2070 Projected Demands, Supplies, Needs and Groundwater Strategies: Summary of 2017 State Water Plan for Counties in GMA 9

| County | 2070 Demands | 2070 Existing Supplies | 2070 Needs (Potential Shortages) | 2070 Strategy Supplies | 2070 Groundwater Strategy Supplies | % Groundwater Strategy Supplies |
|---|---|---|---|---|---|---|
| Bandera | 3,998 | 4,202 | 635 | 1,928 | 1,011 | 52% |
| Bexar | 543,989 | 354,936 | 199,085 | 304,681 | 40,112 | 13% |
| Blanco | 3,231 | 4,275 | 230 | 1,162 | 285 | 25% |
| Comal | 83,562 | 50,200 | 35,022 | 51,406 | 23,906 | 47% |
| Hays | 115,037 | 59,679 | 57,222 | 88,522 | 47,984 | 54% |
| Kendall | 15,950 | 14,331 | 2,613 | 5,643 | 1,000 | 18% |
| Kerr | 9,433 | 10,149 | 3,678 | 13,218 | 5,841 | 44% |
| Medina | 61,252 | 40,768 | 23,445 | 4,918 | 3,540 | 72% |
| Travis | 509,035 | 392,060 | 134,438 | 338,831 | 3,800 | 1% |
| TOTALS | 1,345,487 | 930,600 | 456,368 | 810,309 | 127,479 | 16% |

*All values are reported for entire county in acre-feet/year.*

*Source: 2017 State Water Plan datasets*

- Majority of projected demand and potential shortages are in Bexar and Travis counties.
- Projected supplies from strategies exceeds potential shortages.
- Groundwater strategies are 16% of strategy supplies.
- In seven of nine counties in GMA 9, the majority (>50%) estimated historical water use is from groundwater resources.

# TWC § 36.108(d) Nine Factor Consideration

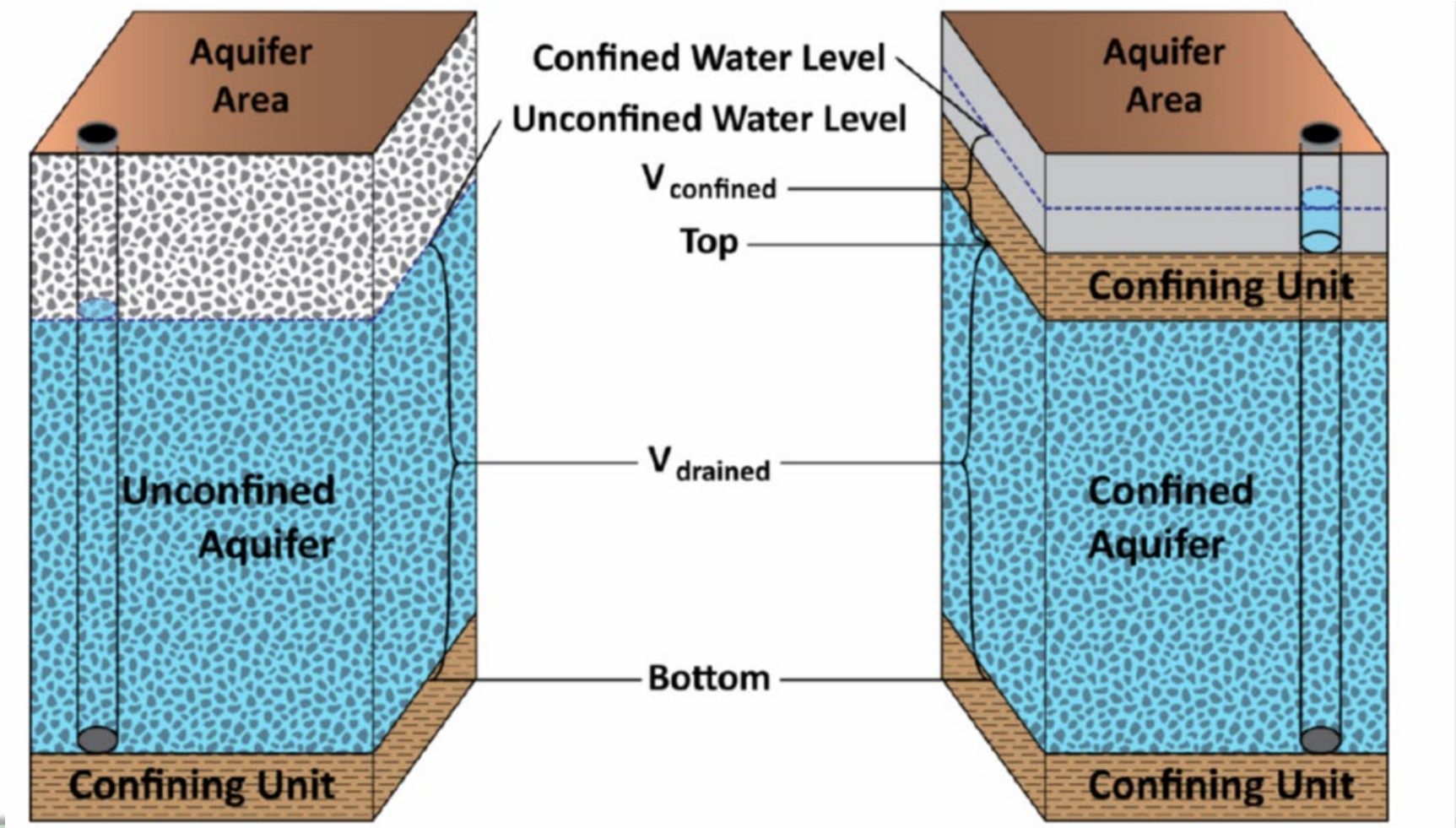
## *SWP Water Supply Needs/Water Management Strategies*

### 2017 State Water Plan Selected Groundwater Strategies for GMA 9 Counties

| County | Groundwater Strategies |
|---|---|
| Bandera | City of Bandera - additional Middle Trinity wells within city |
| Bexar | Most strategies are using Carrizo-Wilcox Aquifer |
| Blanco | Expansion of current groundwater supplies - Ellenburger-San Saba Aquifer |
| Comal | Local Trinity Aquifer development – outside of GMA 9 in Garden Ridge |
| Hays | Vista Ridge project – Carrizo-Wilcox Aquifer |
| Kendall | City of Boerne - local Trinity Aquifer development |
| Kerr | City of Kerrville - increased water treatment and ASR capacity |
| Medina | Edwards Transfers - outside of GMA 9 in City of Hondo |
| Travis | Expansion of Trinity Aquifer supplies – outside of GMA 9 in Pflugerville and Manville WSC |

TWDB Guidance Document – Planning groups may not recommend groundwater WMS supply volumes resulting in exceeding MAG volumes.

# Total Estimated Recoverable Storage



# Total Estimated Recoverable Storage
## Trinity Aquifer

| *County* | *Total Storage (acre-feet)* | *25 percent of Total Storage (acre-feet)* | *75 percent of Total Storage (acre-feet)* |
|---|---|---|---|
| Bandera | 1,200,000 | 300,000 | 900,000 |
| Bexar | 680,000 | 170,000 | 510,000 |
| Blanco | 420,000 | 105,000 | 315,000 |
| Comal | 620,000 | 155,000 | 465,000 |
| Hays | 550,000 | 137,500 | 412,500 |
| Kendall | 770,000 | 192,500 | 577,500 |
| Kerr | 340,000 | 85,000 | 255,000 |
| Medina | 370,000 | 92,500 | 277,500 |
| Travis | 330,000 | 82,500 | 247,500 |
| Total | 5,280,000 | 1,320,000 | 3,960,000 |

# Ellenburger-San Saba Aquifer

- Total Estimated Recoverable Storage
- No Wells Producing in Kendall County

| County | Total Storage (acre-feet) | 25% of Total Storage (acre-feet) | 75% of Total Storage (acre-feet) |
|---|---|---|---|
| Kendall | 3,500,000 | 875,000 | 2,625,000 |

# Hickory Aquifer

- Total Estimated Recoverable Storage
- No Wells Producing in Kendall County

| County | Total Storage (acre-feet) | 25% of Total Storage (acre-feet) | 75% of Total Storage (acre-feet) |
|---|---|---|---|
| Kendall | 2,100,000 | 525,000 | 1,575,000 |

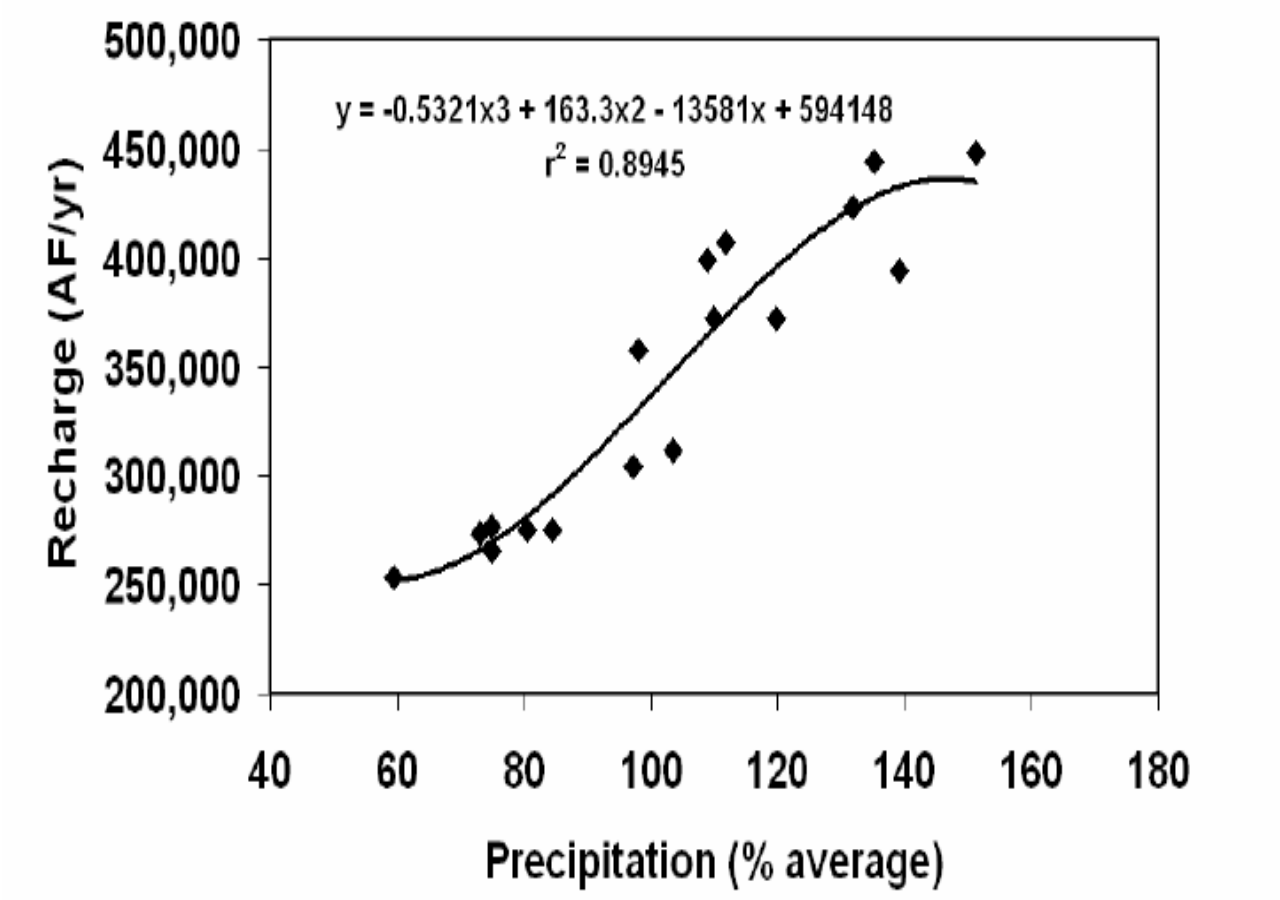
# Edwards-Trinity Plateau Aquifer
# Kendall County

- Aquifer Budget Estimates from DFC Simulation

| Table: Kendall County (Edwards Aquifer. 2008 to 2060) | | | | |
|---|---|---|---|---|
| INFLOW | Scen 4 | Scen 5 | Scen 6 | Scen 7 |
| RECHARGE FROM PRECIPITATION | 5,446 | 5,364 | 5,350 | 5,333 |
| INFLOW FROM KERR COUNTY | 101 | 101 | 101 | 101 |
| TOTAL INFLOW | 5,547 | 5,465 | 5,451 | 5,434 |
| | | | | |
| OUTFLOW | | | | |
| PUMPING | 311 | 311 | 311 | 311 |
| OUTFLOW TO SURFACE WATER | 4,879 | 4,833 | 4,838 | 4,820 |
| OUTFLOW TO OTHER AREA | 217 | 216 | 216 | 215 |
| OUTFLOW TO TRINITY AQUIFER | 153 | 153 | 153 | 152 |
| TOTAL OUTFLOW | 5,560 | 5,513 | 5,518 | 5,498 |
| | | | | |
| TOTAL INFLOW- TOTAL OUTFLOW | -13 | -48 | -67 | -64 |
| STORAGE CHANGE | -13 | -47 | -66 | -65 |
| MODEL ERROR | 0 | -1 | -1 | 1 |

# Trinity Aquifer

- Aquifer Recharge (1981-1997)



# Trinity Aquifer

- Aquifer Budget Estimates from DFC Simulation

| | | |
|---|---|---|
| **Pumping (AF/yr)** | Minimum | 90,727 |
| | Exceeded 95% of years | 91,479 |
| | Average | 92,261 |
| | Exceeded 5% of years | 94,042 |
| | Maximum | 94,042 |
| **Spring and River Base Flow (AF/yr)** | Minimum | 115,641 |
| | Exceeded 95% of years | 125,017 |
| | Average | 150,359 |
| | Exceeded 5% of years | 175,822 |
| | Maximum | 193,276 |
| **Outflow Across the Balcones Fault Zone (AF/yr)** | Minimum | 34,904 |
| | Exceeded 95% of years | 39,036 |
| | Average | 50,163 |
| | Exceeded 5% of years | 60,524 |
| | Maximum | 68,380 |

## *Other Environmental Impacts*

Before adoption of DFCs, GCDs districts to consider groundwater availability models and other data or information for the management area and consider nine factors including other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water (Texas Water Code § 36.108(d)(4)).

### *Other Requirements*

- Texas Water Code § 36.1071(3)(D) requires GCDs consider annual volume of water discharging from aquifer to springs and any surface water bodies including lakes, streams and rivers in developing Management Plans.
  - GMA 9 GCD adopted Management Plans include consideration of volumes from TWDB GAM runs.
  - GMA 9 GCD adopted Management Plans have various deadlines for adoption.

***Presentation Focuses on the Texas Aquifers Study and GCD Management Plan GAM Results***

# TWC § 36.108(d) Nine Factor Consideration
## *Other Environmental Impacts*

### *New Information: "Texas Aquifers Study Groundwater Quantity, Quality, Flow, and Contributions to Surface Water"*

- Presents information on geology and hydrogeology of Texas aquifers, including volume of flows from aquifers to surface waters – not from models.
- New analysis of historical baseflow data from U.S. Geological Survey gaging stations.
- "Baseflow is defined as the component of sustained natural streamflow in the absence of direct runoff from precipitation and attributed to natural groundwater discharge from the underlying outcrops of major and minor aquifers."

| County | Outcrop Area (square miles) | Average baseflow (acre-feet per year) | Median baseflow (acre-feet per year) |
|---|---|---|---|
| Bandera | 587 | 59,148 | 18,896 |
| Bexar | 178 | 30,045 | 1,810 |
| Blanco | 571 | 41,700 | 10,787 |
| Comal | 322 | 30,045 | 10,570 |
| Hays | 353 | 41,483 | 9,412 |
| Kendall | 573 | 52,850 | 17,013 |
| Kerr | 274 | 30,769 | 14,262 |
| Medina | 121 | 8,615 | 2,172 |
| Travis | 393 | 36,995 | 5,937 |

*All values are reported for entire county*

**Trinity Aquifer** – "Discharges to a large number of springs, with most discharging less than 10 cfs."

***Source: Texas Aquifers Study Groundwater Quantity, Quality, Flow, and Contributions to Surface Water, Anaya et al, TWDB, December 31, 2016***

# TWC § 36.108(d) Nine Factor Consideration
## *Other Environmental Impacts*

***New Information: "Texas Aquifers Study Groundwater Quantity, Quality, Flow, and Contributions to Surface Water"***

**Edwards-Trinity (Plateau) Aquifer** – "Natural discharge from the Edwards-Trinity (Plateau) Aquifer to surface water occurs mostly from springs along the margins of the aquifer where the water table intersects the ground surface."

| County | Outcrop Area (square miles) | Average baseflow (acre-feet per year) | Median baseflow (acre-feet per year) |
|---|---|---|---|
| Bandera | 209 | 24,253 | 8,760 |
| Blanco | 19 | 1,448 | 434 |
| Kendall | 90 | 7,457 | 2,606 |
| Kerr | 833 | 85,645 | 40,904 |

**Ellenburger-San Saba and Hickory Aquifers** – "Precipitation and runoff contribute recharge to the Ellenburger-San Saba Aquifer in upland areas with discharge occurring as stream baseflow at lower elevations."

| Aquifer/County | Outcrop Area (square miles) | Average baseflow (acre-feet per year) | Median baseflow (acre-feet per year) |
|---|---|---|---|
| Ellenburger-San Saba/Blanco | 36 | 1,448 | 362 |
| Hickory/Blanco | 18 | 724 | 145 |

***Source: Texas Aquifers Study Groundwater Quantity, Quality, Flow, and Contributions to Surface Water, Anaya et al, TWDB, December 31, 2016***

# TWC § 36.108(d) Nine Factor Consideration
## *Other Environmental Impacts*

### *New Information: GCD Management Plan GAM Results*

Estimated Annual Discharge from Aquifer to Springs and any Surface Waterbody

| Groundwater Conservation District | Trinity Aquifer (acre-feet/year) | Edwards-Trinity (Plateau) Aquifer (acre-feet/year) |
|---|---|---|
| Bandera County River Authority and Groundwater District | 32,750 | 4,141 |
| Blanco-Pedernales GCD | 25,448 | 0 |
| Cow Creek GCD | 31,131 | 3,061 |
| Comal Trinity GCD | 15,601 | - |
| Headwaters GCD | 18,473 | 17,697 |
| Hays Trinity GCD | 22,439 | - |
| Medina County GCD | 6,412 | - |
| Southwestern Travis GCD | 12,654 | - |
| Trinity Glen Rose GCD | 10,347 | - |

Sources: GAM Run 17-004 (2017), GAM Run 18-003 (2018), GAM Run 19-011 (2019), GAM Run 16-022 (2016), GAM Run 16-109 (2016), GAM Run 19-026 (2020), GAM Run 20-003 (2020), GAM Run 19-027 (2019), GAM Run 19-025 (2019)

- There was no estimated annual discharge from the Ellenburger-San Saba or Hickory Aquifers to springs or any surface waterbodies.

## *Highlighted GMA 9 GCD Management Plan Environmental-Related Objectives*

- Actively participate in Texas Clean Rivers Program. (Bandera County River Authority & Groundwater District)
- Evaluate effectiveness of rules to discourage use of Edwards-Trinity (Plateau) and Upper Glen Rose (Upper Trinity) aquifers and prevent leakage to other aquifers to help extend period of springs and seeps from aquifer outcrop. (Blanco-Pedernales GCD)
- Maintain ongoing District spring flow monitoring program. (Cow Creek GCD)
- Monitor data collected from U.S. Geological Survey water-flow monitoring stations on Blanco River, Pedernales River, Onion Creek, and at Jacob's Well each year. (Hays Trinity GCD)
- Assess availability of surface water resources that may be used as alternative to groundwater. (Headwaters GCD)
- Extend period of spring and seep flow during times of drought or limited rainfall, evaluate effectiveness of District Rules to discourage use of the Upper Trinity Aquifer and prevent leakage from aquifer into other aquifers, and consider how District may increase current effectiveness. (Southwestern Travis County GCD)
- Implement the measures of the District Habitat Conservation Plan and Incidental Take Permit from the USFWS for the covered species and covered activity to support the biological goals and objectives of the HCP. (Barton Springs/Edwards Aquifer CD)

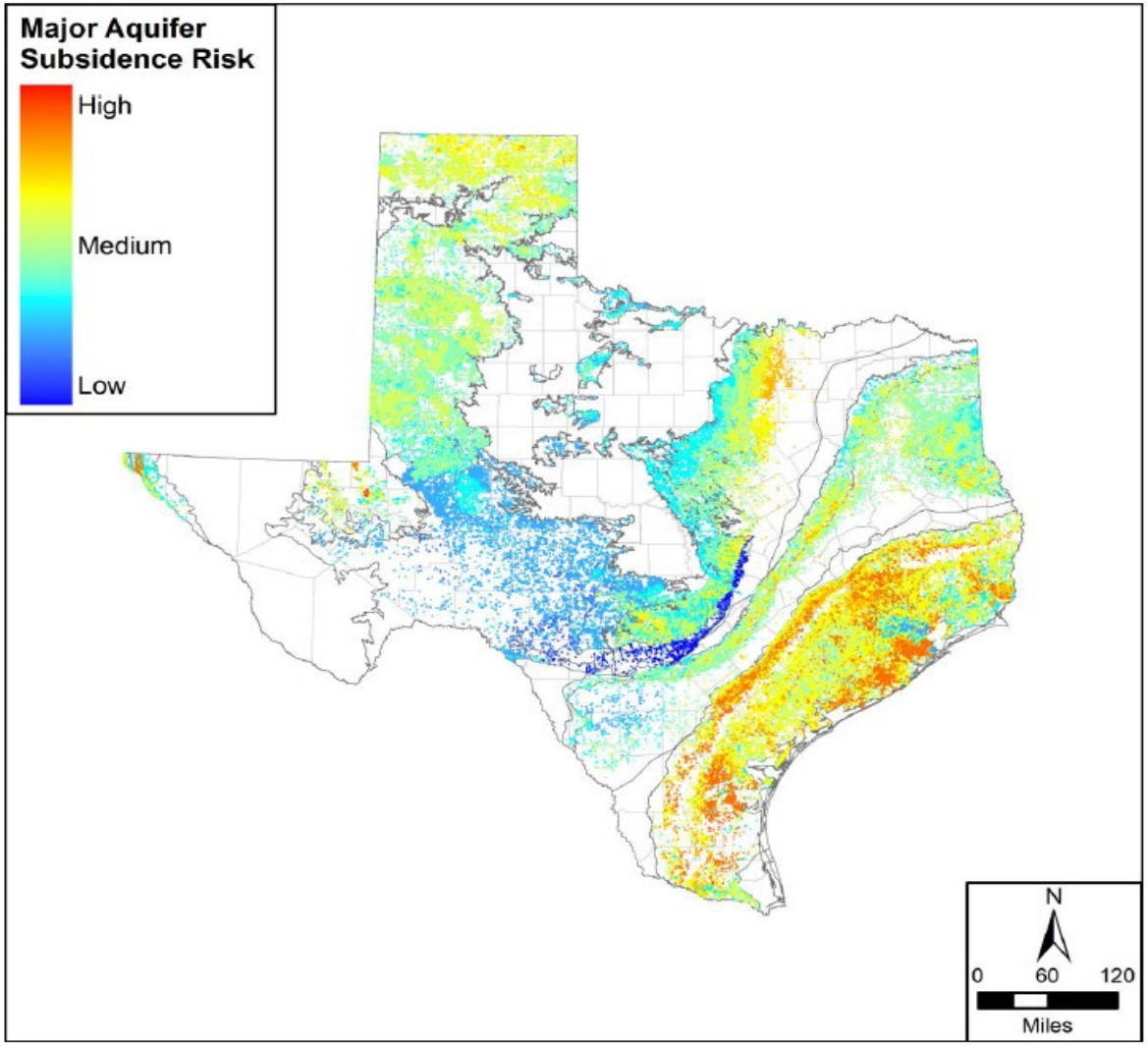
# TWC § 36.108(d) Nine Factor Consideration
## Impacts on Subsidence

- There are no expected impacts from subsidence in GMA-9 aquifers.

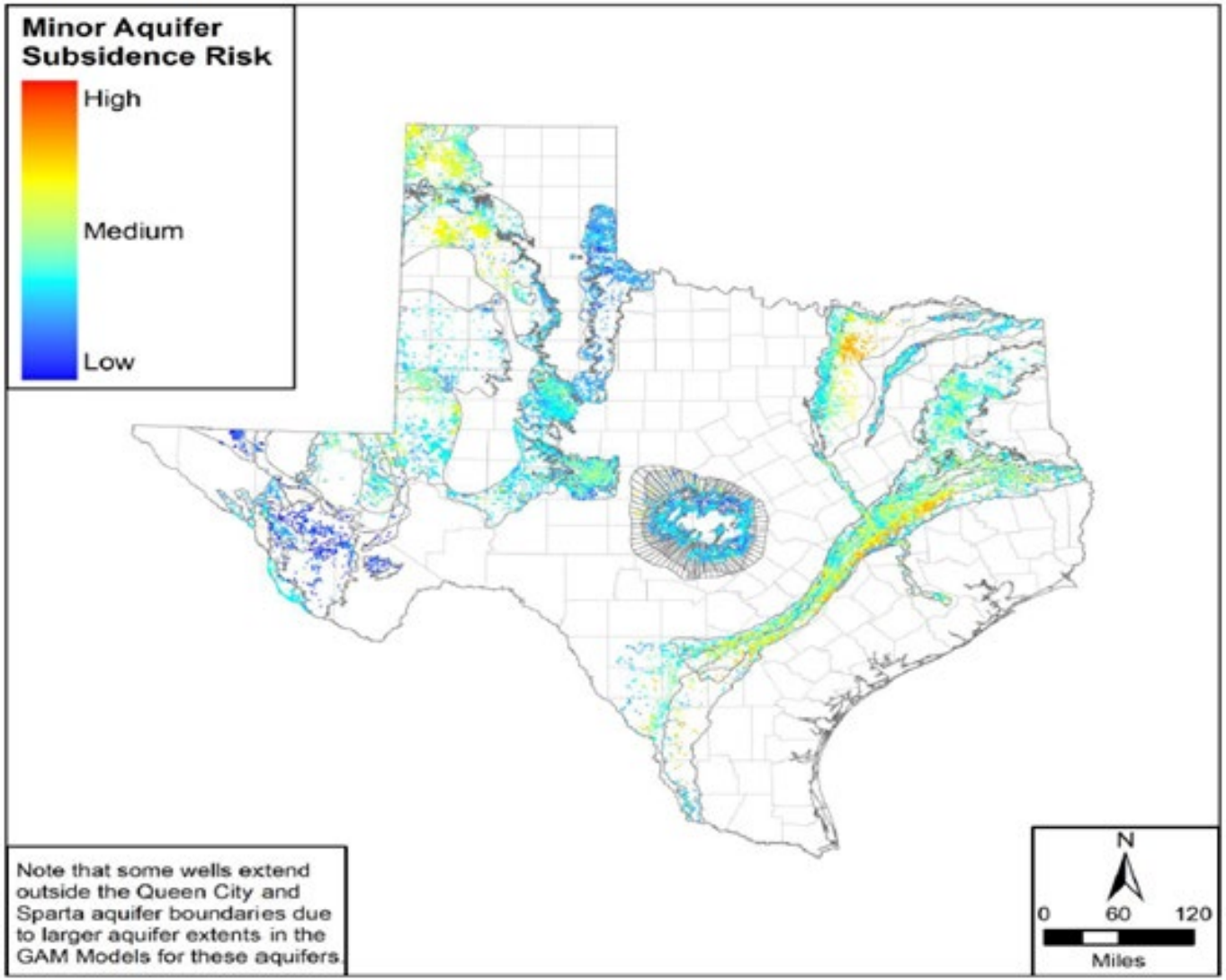
- All aquifers occur in structurally sound geologic formations that do not exhibit significant compaction due to pumping.

- Previous studies in the Trinity in north Texas where 800-1000 feet of water level decline has occurred indicate that subsidence was less than the measurement accuracy of USGS instruments (0.2 feet) (Mace and others, 1994).

# Visualizing the Subsidence Risk



# Visualizing the Subsidence Risk



# GMA 9 2022 DFC Joint Planning Cycle – Next Steps

**January 2021 –**

- GCDs review/revised draft non-relevant aquifer information.
- GCDs review/revise references for DFC Joint Planning.

**January 2021 GMA 9 Meeting –**

- Possible DFC policy and technical justifications, and "balance test" discussion.
- Receive presentations on, and discussion of, Texas Water Code §§ 36.108(d)(6) - 36.108(d)(9) regarding socioeconomic impacts, private property rights impacts, DFC feasibility, and other relevant information factors as they relate to DFC consideration and adoption.

**March 2021 GMA 9 Meeting –**

- Consider action to approve proposed non-relevant aquifer classifications and proposed DFCs, and to distribute both to the GCDs in GMA 9, including summary presentation on proposed DFCs impacts on nine factors.

# Questions and Discussion