Technical Memo 2020—0603

Proposed Revision to the Desired Future Condition of the Trinity Aquifer, BSEACD Portion of Groundwater Management Area 10

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Introduction

Water-resource management is essential to ensuring the socio-economic and environmental viability of Texas for decades to come. With the state's projected population growth and drought conditions, it is essential to develop effective plans to meet future water needs. Every five years the state water plan is developed by the Texas Water Development Board (TWDB). Based on the assimilation of 16 regional water plans, the plan accounts for water demand and availability during a repeat of the 1950s drought of record. Groundwater Management Areas (GMAs) are tasked with providing an accounting of the regional availability of groundwater supply to the regional water plans through the Desired Future Condition (DFC) process. DFCs are expressions of regional consensus management objectives for relevant Texas aquifers for 50 years (Title 31, Part 10, §356.10 (6) of the Texas Administrative Code). DFCs are defined as "the desired, quantified condition of groundwater resources (such as water levels, spring flow, or volumes) at one or more specified times or in perpetuity" and as the term suggests, DFCs are part of a management goal that expresses what you want your aquifer to look like in the future. The DFC expression is then used to estimate an equivalent volume of water known as the Modeled Available Groundwater (MAG) by the TWDB. The MAG is determined by a Groundwater Availability Model (GAM), or other analyses, and is the amount of groundwater production, on an average annual basis, that is estimated to achieve the DFC. The MAG is then provided to the regional water planning groups for the state water plan and can be used as a factor in permitting considerations by Groundwater Conservation Districts (GCDs). GCDs are required to issue permits and manage groundwater production to achieve the DFC. Effective planning requires an accurate assessment of water availability and policymakers need an estimated available volume in order to make sound management decisions for the future.

MAGs are modeled estimates and with any model there are inherent uncertainties in knowing if a MAG will result in achieving a DFC over a 50-year time frame. However, only by monitoring the DFC can a GMA or GCD know if they are in compliance with the DFC expression. DFC monitoring data are also important to ensuring that actual data are available, analyzed, and documented so that the data can be used for policy decisions and to make any necessary adjustments. Thus, monitoring the DFC is a critical factor in the process. MAGs and DFC compliance should be evaluated together to make sound policy and permitting decisions for managing future water needs.

The BSEACD is within GMA 10 and is in the third round of DFC planning. A proposed DFC expression is due by May 1, 2021, which requires the development of any changes to the expression by the end of 2020. GMAs must provide policy and technical justification and must consider socio-economic, environmental, and hydrogeological factors when choosing a DFC. The policy and technical justification are documented in a statutorily required Explanatory Report (ER) submitted to the TWDB addressing nine factors. The ER is due to be submitted to the TWDB on May 2021.

The purpose of this technical memorandum is to describe issues with the current DFC expression and provide recommendations to the Board of Directors of the BSEACD to make the DFC expression a more meaningful tool for groundwater management. The primary goals of this memo are to describe a recommended pathway to the BSEACD Board of Directors that includes:

1. Document the rationale for the subdivision of GMA 10 for BSEACD;
2. Refine the DFC expression for the Middle and Lower Trinity Aquifers in the BSEACD portion of GMA 10;
3. Declare the Upper Trinity as non-relevant for regional water planning purposes;
4. Provide a framework methodology for monitoring the proposed refined DFC; and
5. Work with the TWDB to develop tools to provide a better estimate of the MAG for the aquifers in the absence of a regional GAM model.

Current DFC Expression

GMA 10 has defined a DFC for the Trinity Aquifer (undifferentiated) in the hydrologically confined zone downdip of the Trinity outcrop (Bradley and Boghici, 2018):

- Outside of Uvalde and Bexar counties: average regional well drawdown not exceeding 25 feet during average recharge conditions (including exempt and non-exempt use);
- In Uvalde County: no (zero) regional well drawdown (including exempt and non-exempt use); [and]
- In Bexar County: non-relevant for joint planning purpose.

Issues with Current DFC expression

Although monitoring the DFC compliance is critical to the process, it is our opinion that the current DFC expression is too vague and open to interpretation for meaningful DFC compliance monitoring. This means that the DFC expression is difficult to use for permit considerations and the application of BSEACD rules related to unreasonable impacts. Specific problems include:

- **Regional extent of expression**
  The expression indicates that an average regional drawdown is not to exceed 25 feet. Therefore, it could be interpreted that that this average must be applied throughout the entirety of GMA 10. Measuring and evaluating the regional drawdown could be difficult due to the limited distribution of other monitoring points in GMA 10. Most importantly, the drawdown could be very heterogeneous. Thus, drawdown could be hundreds of feet in some areas that is balanced by minimal drawdown in other areas, and GMA 10 could still be in compliance with the DFC. Such heterogeneity of drawdown is not the intent of the DFC and makes the utility of the DFC problematic for the BSEACD.

- **Vertically undifferentiated Trinity (Upper, Middle and Lower)**
  The Trinity Aquifer is regionally defined to be composed of three aquifers (Upper, Middle, and Lower) that each have different properties and uses. However, in the BSEACD, the Trinity is composed of just two aquifers—the Middle and Lower Trinity Aquifers. The Upper Trinity Aquifer is not a regional aquifer within the BSEACD and is

either an aquitard or part of the overlying Edwards Aquifer (Wong et al., 2014). The current DFC expression does not differentiate between the aquifers and complicates the overall management. Developing a specific DFC for each will make the expression a better tool for management of the systems because it based on the best available science and hydrogeology. The BSEACD already has management zones that define the Middle and Lower Trinity management zones.

- **Sparse monitor wells and data**
  As described above, currently there is a very sparse network of monitor wells throughout GMA 10. This is true geographically and hydrostratigraphically for the Trinity in GMA 10.

- **No reference point defined for drawdown**
  The current DFC expression does not define a reference point from which to measure drawdown. The assumption is that the drawdown is from an average water level, but that is subject to interpretation. In GMA 9, the expression relates drawdown from average levels in 2008.

- **No defined or accepted method for monitoring the DFC**
  This is a common issue throughout the state and within GMAs. No guidance is given as to the approach or method for monitoring compliance with a DFC. This is made more problematic with an ill-defined DFC expression. With a better-defined DFC expression, as we propose, a monitoring approach and methodology can be more readily designed.

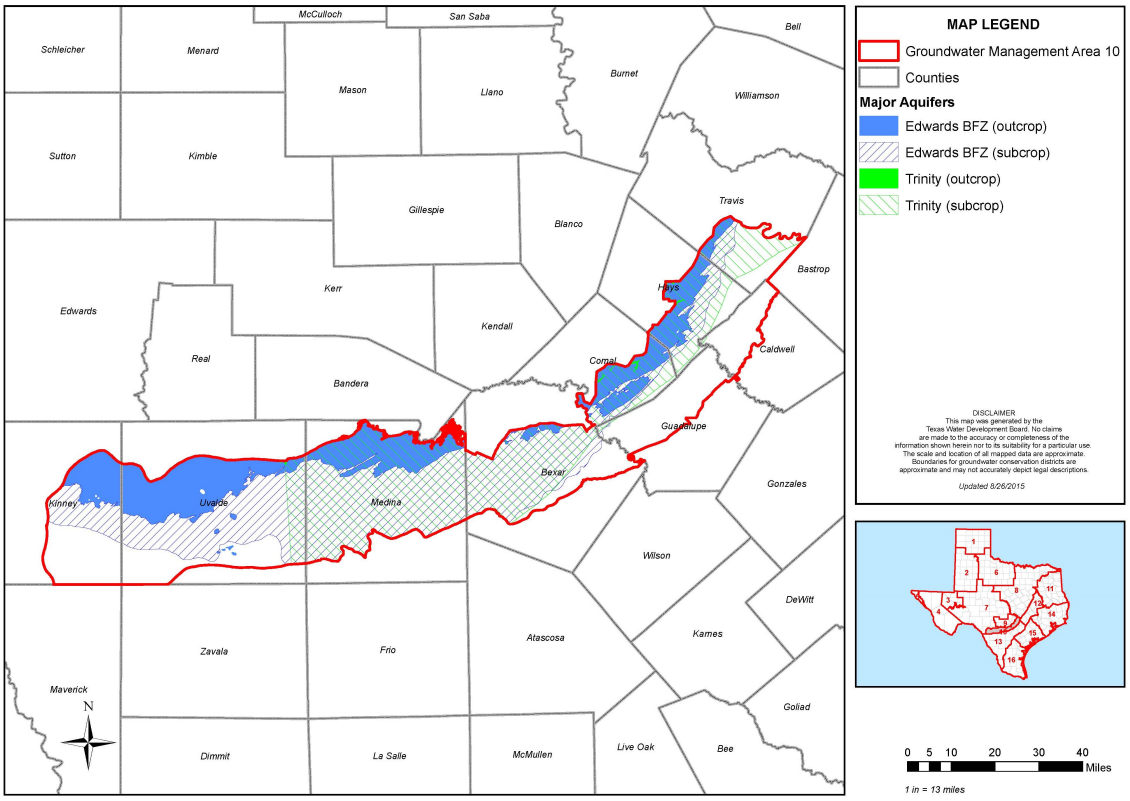

Figure 1. *GMA 10 and the Trinity Aquifer. Source: TWDB*

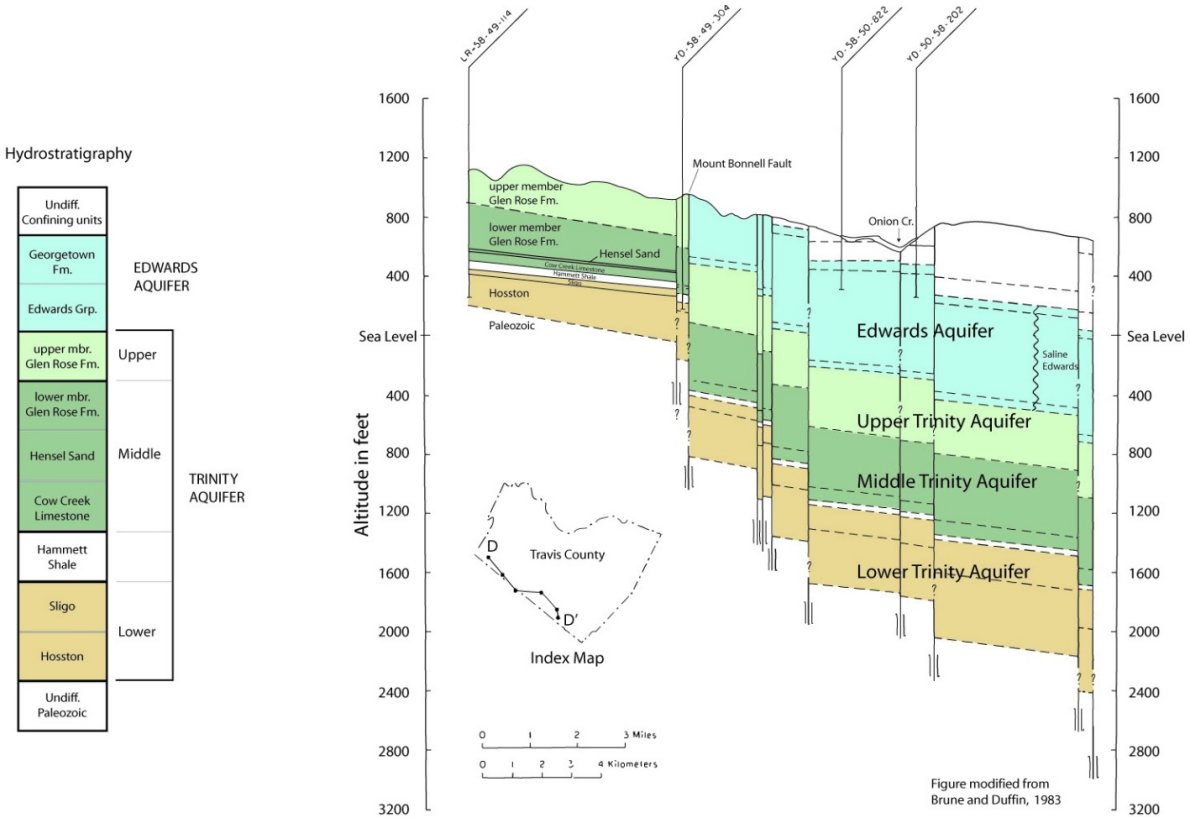

Figure 2. *Cross section through Travis County showing the hydrostratigraphic units.*

Recommendations

Below are a number of recommendations that will address the issues with the current DFC expression and make the DFC a more meaningful tool for aquifer management and permit considerations. These changes would also bring the DFC closer in alignment with the BSEACD rules that recognize management zones and have the DFC as a measure of unreasonable impacts.

1. Creation of GMA 10 subdivision for the BSEACD portion of GMA 10

By creating a subdivision of GMA 10 the expression will avoid potential significant heterogeneities of drawdown and will allow BSEACD to establish specific DFC compliance within its boundaries. In addition, this will allow the expression of DFCs that differ from the other GCS in GMA 10 that might want to keep the current expression.

The southern boundary of the proposed subdivision is based on the potentiometric contours presented in Hunt et al. (2019) that indicates that a hydrologic boundary can be drawn normal to the potentiometric contours parallel to the southwestern Hays County boundary with Comal County (**Figure 3**). Based on other potentiometric maps (Hunt et al., 2020), the Lower Trinity Aquifer likely has a similar pattern to the Middle Trinity. Such a designation does not affect any other GCDs as the Plum Creek GCD will declare the Trinity non-relevant, and the Edwards Aquifer Authority does not have jurisdiction of the Trinity Aquifer.

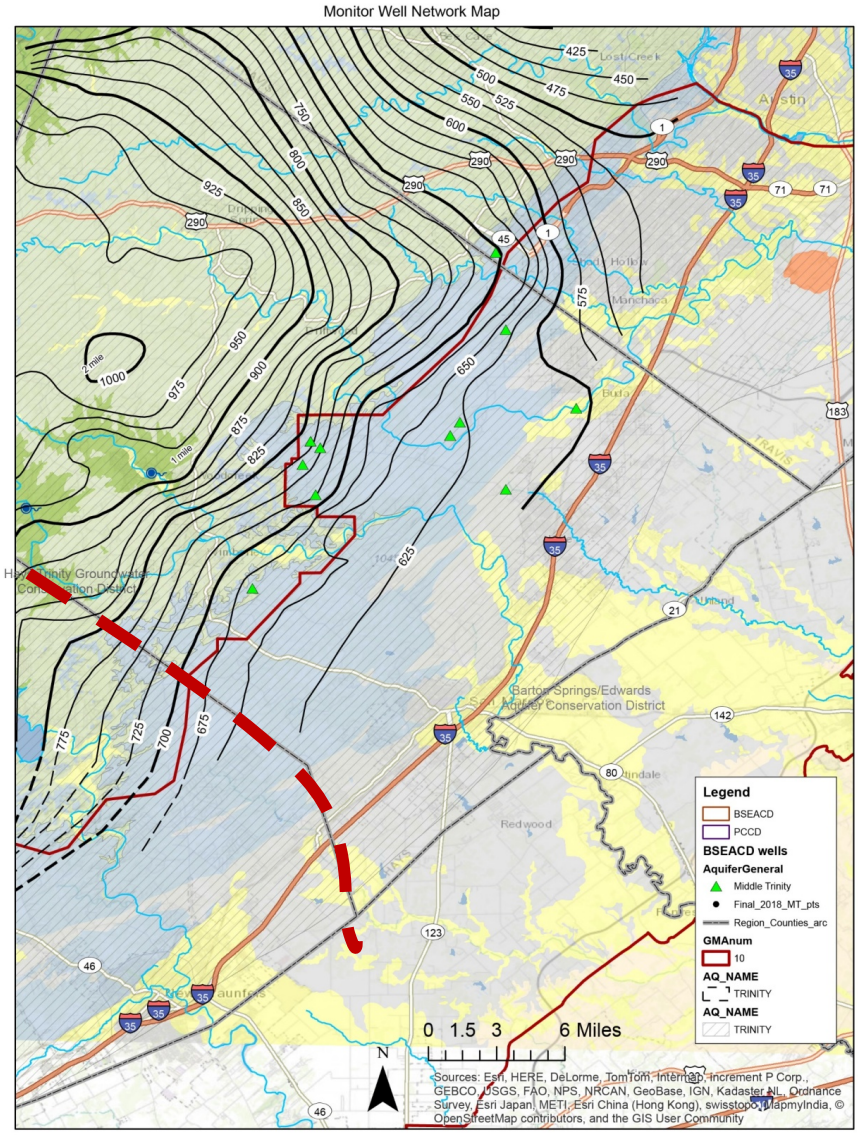

Figure 3. *Potentiometric map of the Middle Trinity Aquifer. Red line indicates the hydrologic division separating the Hays and Travis Counties subdivision within GMA 10.*

2. Define the Upper Trinity Aquifer as non-relevant for regional water planning purposes.

In the BSEACD, the Upper Trinity is either an aquitard (barrier to flow and not an aquifer) or is hydrologically part of the Edwards Aquifer (Wong et al., 2014). The BSEACD management plan and rules already reflect the concept of the uppermost portion of the Upper Trinity as part of the Edwards Aquifer. Note that non-relevance does not affect a GCD's ability to manage the aquifer and all GCD rules still apply. A DFC expression is therefore not developed for a non-relevant aquifer.

3. Express a unique DFC for the Middle and Lower Trinity Aquifers.

The overall guiding principles of a revised DFC expression for both aquifers include:

- Consistent with current expression of 25 ft of drawdown;
- Representative of vertical and geographic areas of management; and
- DFC can be easily measured and monitored and simple to implement and communicate.

- Provides "the highest practical level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater and control of subsidence in the management area," (TWC §36.108 (d-2), p. 50).

Proposed Middle Trinity DFC

Average[1] drawdown among DFC-designated monitor wells[2] is not to exceed 25 feet within BSEACD from the reference water level surface[3] over the next 50 years.

Footnotes:

1- *Running 12-month average water level.*
2- *Designated DFC wells by BSEACD, generally wells with less than 3,000 mg/L total dissolved solids (TDS).*
3- *A reference surface derived from 2018 MT potentiometric surface (Hunt et al., 2019).*

Proposed Lower Trinity DFC

Average[1] drawdown among DFC-designated monitor wells[2] is not to exceed 25 feet within Hays and Travis counties from the reference water level [3] over the next 50 years.

Footnotes:

1- *Running 12-month average water level.*
2- *Designated DFC wells by BSEACD, generally wells with less than 3,000 mg/L TDS.*
3- *A reference median static water level determined from three years of data collection.*

4. Development of monitoring methodology

The monitoring methodology will be developed concurrently with the DFC adoption process and documented in a technical memorandum. Methods and approaches to compliance will be evaluated from guiding principles such as:

- A method involving measured data;
- Compliance evaluated through simple statistics;
- Representative monitor wells of the Middle and Lower Trinity Aquifers.
- Network of monitor wells subject to the addition, or possibly omission, of wells as the opportunity and data indicate.

5. Work with TWDB on the estimated Modeled Available Groundwater (MAG)

The Modeled Available Groundwater (MAG) is the amount of water that may be produced on an average annual basis to achieve the desired future conditions. Presently there is no numerical model that can be used to derive those values. The current estimate is derived from a spreadsheet model (Thorkildsen and Backhouse, 2010; Bradley and Boghici, 2018). The MAG estimate is currently determined by the assumed lateral inflows from GMA 9 into GMA 10. This conceptual model difference, and modeling tools needs to be discussed with the TWDB for future MAG evaluations. The best tools for estimating the MAG are numerical models. Until a revised numerical groundwater model for the region is developed, the MAG estimate will be uncertain, however additional tools can provide a better estimate in the interim.

BSEACD staff have developed additional tools, such as analytical models, that would provide better estimates of the MAG until a fully calibrated GAM is available. Establishing a MAG is a component for making permitting decisions. Staff recommend working with the TWDB staff on the conceptual model and additional modeling tools that could help improve the estimates for the MAG.

Discussion

By modifying the current DFC expression and delineating a northern subdivision of the Trinity Aquifer, the BSEACD will be able to better consider large-scale permit requests and to plan for a significant increase in pumping from both permitted and exempt wells.

The northern subdivision will allow for the development of a DFC for each aquifer and allows it to not be subject to the regional influence of geographic averaging. Preliminary discussions with neighboring GCDs and GMA 10 indicate support of the BSEACD's efforts to delineate a northern subdivision. The only GCD that the northern subdivision would directly impact is the Plum Creek GCD (**Figure 4**), which is planning to declare the Trinity as non-relevant for regional water planning purposes.

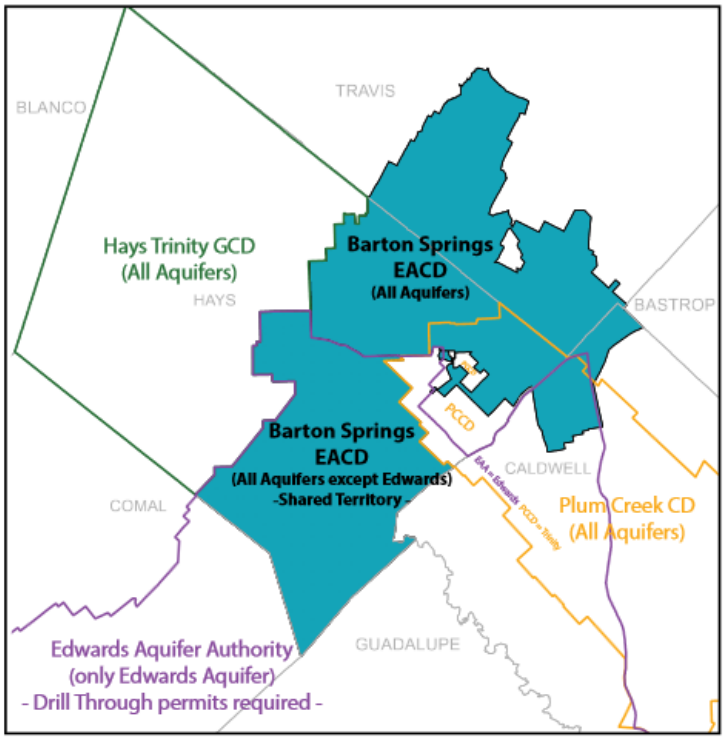

Figure 4. *Location map of GCD's.*

Describing a specific DFC for each aquifer in the northern subdivision of GMA 10 is an important step to making the DFC expression and resulting MAG more applicable to the increases in pumping the BSEACD is anticipating. The Upper Trinity is not considered a regional aquifer in the BSEACD and is more accurately described as non-relevant for regional water planning purposes. The Middle and Lower Trinity are both independent aquifer units and have unique characteristics and hydrologic separation. It is our opinion that distinct aquifer units should have distinct DFCs that reflect the hydrogeology of the system. Those DFCs could be adjusted in the future to reflect changes in our understanding of the aquifers and consensus management objectives.

Water levels in the Middle Trinity have generally been declining over many years and permits for large-scale production are pending. The Middle Trinity Aquifer is a confined, karstic, fractured, carbonate aquifer that is partially compartmentalized by faulting, but has hydrologic connection to its recharge zone in western Hays County. The source

of water to pumping wells in this area will be partly derived from drawdown (storage) but then will be dominated by capture in the long term leading to reduced springflow and induced recharge.

In contrast the Lower Trinity has no large-scale pumping wells at this time. The Lower Trinity is a fractured sand and gravel aquifer that is also likely compartmentalized by faulting without a known hydrologic connection to recharge areas to the west in Hays County. The source of water to pumping wells in this area would be mostly derived from drawdown (storage) with possibly a lesser amount from capture. The significant drawdown of water levels observed in the Lower Trinity in southwestern Travis County is a likely analogue to the response to long-term pumping (Hunt et al., 2020).

The refined DFCs will also allow the development of a more transparent and simple methodology for monitoring compliance.

Conclusions

The recommendations within this memo will make the DFC a more meaningful tool for aquifer management, particularly when considering permits for large-scale pumping. The revised DFC will be more specific geographically and hydrostratigraphically and allow for the development of a simple and transparent method for monitoring compliance.

Acknowledgments

Discussions about potential revisions to the DFC have been ongoing over the past two years. These include numerous internal presentations and discussions and external meetings at GMA 10, Plum Creek GCD, Comal County GCD, TWDB, and the BSEACD Board of Directors (1/6/2020).

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