GROUNDWATER MANAGEMENT AREA 9

2021 EXPLANATORY REPORT FOR DESIRED FUTURE CONDITIONS FOR MAJOR AND MINOR AQUIFERS

Prepared by:

GROUNDWATER MANAGEMENT AREA 9

JOINT PLANNING COMMITTEE

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and

AGS

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Approved by the GMA 9 Joint Planning Committee on

NOVEMBER 15, 2021

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Meaning
ac-ft	acre-feet/acre-foot
ac-ft/year	acre-foot (feet) per year
BCRAGD	Bandera County River Authority and Groundwater District
BFZ	Balcones Fault Zone
bgl	below ground level
BPGCD	Blanco-Pedernales Groundwater Conservation District
BSEACD	Barton Springs/Edwards Aquifer Conservation District
cfs	cubic feet per second/cubic foot per second
CCGCD	Cow Creek Groundwater Conservation District
GMA 9 Committee	Groundwater Management Area 9 Joint Planning Committee
CTGCD	Comal Trinity Groundwater Conservation District
DFC(s)	Desired Future Condition(s)
DOR	drought of record
EA	Texas Water Development Board Executive Administrator
EAA	Edwards Aquifer Authority
Edwards	Edwards Aquifer
Edwards Group	Edwards Group of Edwards-Trinity (Plateau) Aquifer
ER	Explanatory Report
ERLS	GMA 9 Explanatory Report Liaison Subcommittee
ft	feet/foot
GAM	Groundwater Availability Model
GMP	Groundwater Management Plan
gpd	gallons per day
gpd/ft	gallons per day per foot (or feet)
gpm	gallons per minute
GMA(s)	Groundwater Management Area(s)
GMA 9	Groundwater Management Area 9
GCD(s)	Groundwater Conservation District(s)
H.B. No.	House Bill Number
HCT GAM	Hill Country Trinity GAM
HGCD	Headwaters Groundwater Conservation District
Hickory	Hickory Aquifer
HTGCD	Hays Trinity Groundwater Conservation District
MAG	Modeled Available Groundwater
Marble Falls	Marble Falls Aquifer
MCGCD	Medina County Groundwater Conservation District
mg/l	milligrams per liter
PGMA	Priority Groundwater Management Area
Region J	Plateau Water Planning Group
Region K	Lower Colorado Regional Water Planning Group
Region L	South Central Texas Regional Water Planning Group
RWP(s)	Regional Water Plan(s)
RWPA(s)	Regional Water Planning Area(s)
RWPG(s)	Regional Water Planning Group(s)
S.B. No.	Senate Bill Number
SOAH	State Office of Administrative Hearings
SWP	State Water Plan
SWTCGCD	Southwestern Travis County Groundwater Conservation District
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TD	total depth
TDS	total dissolved solids
TERS	Total Estimated Recoverable Storage

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

Acronym/Abbreviation	Meaning
TGRGCD	Trinity Glen Rose Groundwater Conservation District
Trinity	Trinity Aquifer
TWDB	Texas Water Development Board
UWCD	Underground Water Conservation District
WPG(s)	Water Planning Group(s)

EXECUTIVE SUMMARY

Introduction and Overview

The Groundwater Management Area 9 (GMA 9) Joint Planning Committee (GMA 9 Committee) prepared this *Groundwater Management Area 9 2021 Explanatory Report for Desired Future Conditions for Major and Minor Aquifers* to comply with the requirements of Texas Water Code Section 36.108 (Joint Planning in Management Area). This Explanatory Report (ER) was prepared as a summary of the 2021 Desired Future Condition (DFC) joint-planning cycle as required by the Texas Water Code.

The ten[1] GMA 9-member Groundwater Conservation Districts (GCDs) are the following:

- Bandera County River Authority and Groundwater District (BCRAGD),
- Barton Springs/Edwards Aquifer Conservation District (BSEACD),
- Blanco-Pedernales Groundwater Conservation District (BPGCD),
- Comal Trinity Groundwater Conservation District (CTGCD),
- Cow Creek Groundwater Conservation District (CCGCD),
- Hays Trinity Groundwater Conservation District (HTGCD),
- Headwaters Groundwater Conservation District (HGCD),
- Medina County Groundwater Conservation District (MCGCD),
- Southwestern Travis County Groundwater Conservation District (SWTCGCD), and
- Trinity Glen Rose Groundwater Conservation District (TGRGCD).

GMA 9's voting-member GCDs operate as a planning entity for the purposes of conducting joint planning for their management area as required by the Texas Water Code Section 36.108. Some of the GMA 9 GCDs are also assigned to other GMAs. In the 2021 DFC joint-planning cycle, the SWTCGCD became a member of GMA 9 when it was confirmed by voters in the 2019 general election. SWTCGCD represents the geographic area covered by GMA 9 in western Travis County that was designated in 1990 as a part of the Hill Country Priority Groundwater Management Area (PGMA). In most of this 2021 planning cycle, the Edwards Aquifer Authority (EAA) continued to participate in the GMA 9 Committee as a non-voting member.

During this planning cycle, the GMA 9 Committee requested altering the boundary between GMA 9 and GMA 10 to coincide, to the greatest extent feasible, with the actual boundaries of the major and minor aquifer systems. Additionally, the GMA 9 Committee supported the reassignment of the boundaries

[1] As a result of a TWDB-approved boundary amendment between GMA 9 and GMA 10, the BSEACD is no longer a member of GMA 9.

between GMA 9 and GMA 8 to amend the boundaries based on the delineation of SWTCGCD's boundaries. On May 19, 2021, the Texas Water Development Board (TWDB) determined that these changes qualified as administrative corrections and approved the amendments to the boundary changes between GMA 9 and GMA 10 and between GMA 9 and GMA 8. The TWDB letter notifying the GMA 9 Committee Chairman of these approvals is included as an appendix in this ER. These amendments resulted in the BSEACD no longer being a part of GMA 9 and the SWTCGCD being contained wholly within GMA 9. However, the BSEACD agreed to continue to participate in the 2021 DFC joint-planning cycle.

GMA 9 encompasses all or parts of Bandera, Bexar, Blanco, Comal, Hays, Kendall, Kerr, Medina, and Travis counties, and includes three major Texas river basins – the Colorado, Guadalupe, and Nueces river basins. The area is also divided among three of the state's 16 Regional Water Planning Areas (RWPAs) charged with developing Regional Water Plans (RWPs) for their RWPAs to become part of the State Water Plan (SWP). The three RWPAs that overlay GMA 9 are Region J, Region K, and Region L. The TWDB provides modeled available groundwater (MAG) amounts to these three Regional Water Planning Groups (RWPGs), based upon the DFCs adopted by the GMA 9 Committee, for incorporation in their RWPs and ultimately the SWP. In addition, the MAGs are provided to the GMA 9 GCDs to consider in managing these groundwater water resources as one of the considerations in making permitting decisions.

There are three major and three minor aquifers that underlie the geographic area that the GMA 9 Committee must consider in the DFC joint-planning process. Those aquifers are:

Major Aquifers

- Trinity Aquifer,
- Edwards Group of the Edwards-Trinity (Plateau) Aquifer, and
- Edwards Aquifer (Balcones Fault Zone).

Minor Aquifers:

- Ellenburger-San Saba Aquifer,
- Hickory Aquifer, and
- Marble Falls Aquifer.

GMA 9 2021 DFC Joint-Planning Cycle Process

The GMA 9 Committee began 2021 DFC joint-planning cycle discussions in November 2018 after the TWDB issued MAG amounts based on the DFCs adopted by the GMA 9 Committee in the 2016 DFC joint-planning cycle. Those MAG amounts were issued on February 28, 2017 for the relevant aquifers of the GCDs in GMA 9 and by county for the Trinity, Edwards Group of the Edwards-Trinity (Plateau), Ellenburger-San Saba, and Hickory aquifers. The GMA 9 Committee held ten meetings (three of which were virtual) during the 2021 DFC joint-planning cycle.

The BPGCD was responsible for maintaining copies of meeting notices and minutes. Meeting notices and presentations are included as an appendix in this ER. Each meeting agenda included reports by TWDB staff and the GMA 9 representatives to the RPWGs for Regions J, K, and L. The inclusion of these representatives from other relevant water planning entities provided for greater coordination between DFC joint planning and regional water planning throughout the 2021 DFC joint-planning cycle. Additionally, the GMA 9 Committee discussed and reviewed each GMA 9-member GCD's Groundwater Management Plan on an annual basis.

On March 22, 2021, the GMA 9 Committee voted to approve proposed classifications of aquifers or portions of aquifers managed by GCDs as non-relevant for the purposes of joint planning only (pursuant to Title 31 Section 356.31 of the Texas Administrative Code) and to adopt proposed DFC statements for major and minor aquifers in applicable areas. Following these actions, GMA 9 Committee Chairman Ron Fieseler sent a letter to all ten of the GMA 9 GCDs on March 31, 2021 informing the GCDs of the GMA 9 Committee's actions, the 90-day public comment period regarding the GMA 9 proposals (Thursday, April 1, 2021 through Wednesday, June 30, 2021), and the need to hold a GCD public hearing on the proposals relevant to each GCD. A summary of the written and oral comments that resulted from this public comment period and the public hearings held by each the GMA 9-member GCDs is included as an appendix in this ER.

During this DFC joint-planning cycle, the GMA 9 Committee's DFC deliberations were based on the existing scientific data and information established for the management area through the 2010 and 2016 DFC joint-planning cycles. The GMA 9 Committee also considered the depth to water through time for wells in the Edwards and Trinity aquifers through hydrographic data included as an appendix in this ER. Additionally, at its September 27, 2021 meeting, the GMA 9 Committee conducted their annual review and discussion of individual GCD reports on evaluating water level measurements in comparison with the DFCs. This discussion included the methodology used to analyze water level measurements collected from monitoring wells within the reporting GCD.

GMA 9 2021 DFC Joint-Planning Cycle Results

On November 15, 2021, the GMA 9 Committee voted to approve proposing the classifications of certain GCD-managed major and minor aquifers within GMA 9 as non-relevant for the purposes of joint planning only, (pursuant to Title 31, Section 356.31 (b) of the Texas Administrative Code), and to adopt the DFC statements for the relevant aquifers pursuant to the Texas Water Code Section 36.108. The resolution adopted by the GMA 9 Committee to approve the DFC statements is included as an appendix in this ER. **Table ES-1** and **Table ES-2** identify the GMA 9 adopted proposed non-relevant classifications and DFCs, respectively, for the major and minor aquifers in the management area.

Table ES-1. Adopted GMA 9 Proposed Classifications of GCD-Managed Aquifers as Non-Relevant for Joint-Planning Purposes Only Pursuant to Chapter 31 Section 356.31 of the Texas Administrative Code

Proposed Classification as Non-Relevant	Applicable Areas Within GMA 9 (All or Portions of the Following Counties)
Edwards Aquifer (BFZ)	Bexar, Comal, Hays, and Travis counties
Edwards Group of 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

Table ES-2. GMA 9 Adopted DFC Statements for Relevant Major and Minor Aquifers

Major or Minor Aquifer	Desired Future Condition
Trinity	Allow for an increase in average drawdown of approximately 30 feet through 2060 (throughout GMA 9) consistent with "Scenario 6" in TWDB GAM Task 10-005
Edwards Group of Edwards-Trinity (Plateau)	Allow for no net increase in average drawdown in Bandera and Kendall Counties through 2080
Ellenburger-San Saba	Allow for an increase in average drawdown of no more than 7 Feet in Kendall County through 2080
Hickory	Allow for an increase in average drawdown of no more than 7 Feet in Kendall County through 2080

The GMA 9 Committee determined that the aquifer characteristics, groundwater demands, and current groundwater uses for all or portions of the aquifers specified in **Table ES-1** do not warrant adopting a DFC. In such cases, the Texas Administrative Code allows that a DFC is not required and identifies certain information that must be submitted to the TWDB regarding the proposed classifications.

To develop DFC statements for the aquifers that the GMA 9 Committee deemed to warrant DFCs, the GMA 9 Committee considered:

1) the policy and technical justifications for the DFCs,
2) how the DFCs satisfied the "balance test" outlined in the Texas Water Code Section 36.108(d-2),
3) the nine factors set out in Texas Water Code Section 36.108(d),
4) other DFCs that may have been considered by the GMA 9 Committee, and
5) a discussion of other recommendations offered in relevant public comments and the GMA 9 Committee's response to those recommendations.

In developing the DFC statements for this 2021 DFC joint-planning cycle, the GMA 9 Committee followed the TWDB recommendations to specify geographic areas for each DFC and to specify the initial year to be 2008 for drawdown comparison. The following variance statement is provided to comply with TWDB staff's request for such a statement to use as a guide when determining the MAGs that are based upon the adopted DFCs: Solely for the purposes of calculating the MAGs, the GMA 9 Committee assumes the model results are consistent with the proposed DFCs if the average drawdowns calculated by the TWDB are within five percent of the proposed DFCs drawdown values.

GMA 9 DFC Joint-Planning Process Next Steps

The GMA 9 Committee will submit the approved non-relevant classifications, adopted DFCs, this ER, and all other documentation to the TWDB and each GCD in GMA 9 as required by the Texas Administrative Code. The TWDB will then determine whether the information submitted to the TWDB is deemed to be administratively complete. The TWDB DFC Submission Packet Checklist, which is used by TWDB staff in this review process, is included as an appendix in this ER.

Once the information submitted by the GMA 9 Committee is deemed to be administratively complete by the TWDB, each of the GMA 9 GCDs will then adopt the corresponding GMA 9 DFC(s) and this ER. The

TWDB will also provide MAG amounts to the three RWPGs identified above to be considered in the regional and state water planning processes, and to the GCDs to consider in managing their aquifers and as one element in making permitting decisions.

GMA 9 2021 Explanatory Report for DFCs for Major and Minor Aquifers Content Summary

This ER includes the following chapters:

Chapter 1 introduces the GMA 9-member GCDs comprising the management area and provides an overview of the aquifers managed by the member GCDs.

Chapter 2 describes the DFC joint-planning process that the GMA 9 Committee followed for the 2021 DFC joint-planning cycle, including discussion of the regulatory requirements for DFC joint planning, and the considerations by the GMA 9 Committee during the 2010 and the 2016 DFC joint-planning cycles that provided an informational basis for this 2021 cycle.

Chapter 3 presents the GCD-managed aquifers proposed for classification as non-relevant for joint-planning purposes only (pursuant to the Texas Administrative Code Chapter 356). This chapter includes discussion of the aquifer characteristics, groundwater demands, and current groundwater uses for these aquifers that formed the basis for the GMA 9 Committee's determinations. These proposed classifications pertain to the DFC joint-planning process and do not impact the local GCDs' continuing ability or authority to manage these portions of these aquifers within their jurisdictional boundaries.

Chapter 4 presents the DFCs adopted by the GMA 9 Committee for major and minor aquifers in the management area, including discussion of: 1) the policy and technical justifications for the four DFCs; 2) how the DFCs satisfy the "balance test" outlined in the Texas Water Code Section 36.108(d-2); 3) the nine factors set out in Texas Water Code Section 36.108(d); 4) other DFCs that may have been considered by the GMA 9 Committee; and 5) a discussion of other recommendations offered in relevant public comments and the GMA 9 Committee's response to those recommendations.

Chapter 5 lists the scientific, technical, and other references consulted for this ER, as well as a second list of additional technical references corresponding to the aquifers in the management area.

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1.0 INTRODUCTION AND OVERVIEW

The Groundwater Management Area 9 (GMA 9) Joint Planning Committee (GMA 9 Committee) prepared this *Groundwater Management Area 9 2021 Explanatory Report for Desired Future Conditions for Major and Minor Aquifers* to comply with the requirements of the Texas Water Code Section 36.108 (Joint Planning in Management Area). This Explanatory Report (ER) was prepared as a summary of the 2021 Desired Future Condition (DFC) joint-planning cycle as required by the Texas Water Code. The discussion in this chapter is an introduction to GMA 9, the GMA 9-member Groundwater Conservation Districts (GCDs), and the aquifers in the management area.

The ten[2] GMA 9-member GCDs are the following:

- Bandera County River Authority and Groundwater District (BCRAGD),
- Barton Springs/Edwards Aquifer Conservation District (BSEACD),
- Blanco-Pedernales Groundwater Conservation District (BPGCD),
- Comal Trinity Groundwater Conservation District (CTGCD),
- Cow Creek Groundwater Conservation District (CCGCD),
- Hays Trinity Groundwater Conservation District (HTGCD),
- Headwaters Groundwater Conservation District (HGCD),
- Medina County Groundwater Conservation District (MCGCD),
- Southwestern Travis County Groundwater Conservation District (SWTCGCD), and the
- Trinity Glen Rose Groundwater Conservation District (TGRGCD).

On November 15, 2021, the GMA 9 Committee voted to propose that portions of certain GMA 9 GCD-managed aquifers be classified as non-relevant for the purposes of joint planning only (Texas Administrative Code Section 356.31(b)), and to adopt DFCs for the relevant aquifers pursuant to Texas Water Code Section 36.108. **Table 1** lists the GMA 9 GCD-managed aquifers proposed for classification as non-relevant for joint-planning purposes only.

[2] As a result of a TWDB-approved boundary amendment between GMA 9 and GMA 10, the BSEACD is no longer a member of GMA 9.

Table 1. Adopted GMA 9 Proposed GCD-Managed Aquifers for Classification as Non-Relevant for Joint-Planning Purposes Only Pursuant to Chapter 31 Section 356.31 of the Texas Administrative Code

Proposed Classification as Non-Relevant	Applicable Areas Within GMA 9 (All or Portions of the Following Counties)
Edwards Aquifer (Balcones Fault Zone)	Bexar, Comal, Hays, and Travis counties
Edwards Group of 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

Table 2 lists the adopted GMA 9 DFCs for the major and minor aquifers within the GMA with the following variance statement included in this ER for these DFCs: Solely for the purposes of calculating the managed available groundwater (MAGs), the GMA 9 Committee assumes the model results are consistent with the proposed DFCs if the average drawdowns calculated by the Texas Water Development Board (TWDB) are within five percent of the proposed DFCs drawdown values.

Table 2. GMA 9-Adopted DFCs (Major and Minor Aquifers)

Major or Minor Aquifer	Desired Future Condition
Trinity	Allow for an increase in average drawdown of approximately 30 feet through 2060 (throughout GMA 9) consistent with "Scenario 6" in TWDB GAM Task 10-005
Edwards Group of Edwards-Trinity (Plateau)	Allow for no net increase in average drawdown in Bandera and Kendall counties through 2080
Ellenburger-San Saba	Allow for an increase in average drawdown of no more than 7 Feet in Kendall County through 2080
Hickory	Allow for an increase in average drawdown of no more than 7 feet in Kendall County through 2080

To formally submit the above-stated GMA 9 DFCs to the TWDB, the GMA 9 Committee is required to prepare and submit this ER, along with other documentation, as outlined in Texas Water Code Section 36.108(d-3).

1.1 Background

Texas Water Code Section 36.108 requires GCDs to jointly develop and submit DFCs for the groundwater resources within their management area to the TWDB. As part of the process to develop DFCs, Texas Water Code Section 36.108(d-3) requires district representatives to produce an ER for their management area that, in summary, identifies each DFC and provides certain technical and policy considerations and justifications for the adopted DFCs.

Texas Water Code Section 36.108 and Title 31, Chapter 356 of the Texas Administrative Code (Groundwater Management) contain, among other provisions, substantive and procedural requirements regarding development of the DFCs and ER. Specifically, Texas Water Code Sections 36.108(d) and 36.108(d-1) through 36.108(d-5) provide guidance to GCDs and GMAs regarding DFC consideration and adoption, and ER content and deadlines. Title 31, Chapter 356, Subchapter C provides of the Texas

Administrative Code provides similar direction regarding TWDB requirements for submitting the DFCs and ER.

Texas Water Code Section 36.108(d-3) requires GMAs to prepare a DFC ER to be submitted to the TWDB and each GCD, submit it along with proof the GMA meeting notice was posted, and a copy of the GMA resolution adopting the DFCs. This section of the Texas Water Code also states the ER must address five required elements for each adopted DFC.

Table 3 is a summary of the five elements for each GMA 9-adopted DFC, and where those discussions are located in this GMA 9 ER.

Table 3. Locations in ER of the Required Elements for each adopted DFC

	ER-Required Elements and ER Locations				
GMA 9 DFC	**Identification of Each DFC**	**DFC Policy and Technical Justifications**	**Documentation of Nine Factors Considered and Adopted DFC Impact on Each Factor**	**Other DFC Options Considered, and Reasons Not Adopted**	**Reasons Recommendations by Advisory Committee Members and Relevant Public Comments Were or Were Not Incorporated into DFCs**
Trinity Aquifer	Table ES–2, Table 2, Table 35	Chapter 4.0, Section 4.1.1	Chapter 4.0, Section 4.1.3 Meeting Documents (Appendix E)	Chapter 4.0, Section 4.1.4, Public Comment Summary (Appendix C)	Chapter 4.0, Section 4.1.5, Public Comment Summary (Appendix C)
Edwards Group of Edwards-Trinity (Plateau) Aquifer	Table ES–2, Table 2, Table 35	Chapter 4.0, Section 4.1.2	Chapter 4.0, Section 4.1.3, Meeting Documents (Appendix E)	Chapter 4.0, Section 4.1.4, Public Comment Summary (Appendix C)	Chapter 4.0, Section 4.1.5, Public Comment Summary (Appendix C)
Ellenburger -San Saba Aquifer	Table ES–2, Table 2, Table 35	Chapter 4.0, Section 4.2.1	Chapter 4.0, Section 4.2.2, Meeting Documents (Appendix E)	Chapter 4.0, Section 4.2.3, Public Comment Summary (Appendix C)	Chapter 4.0, Section 4.2.4, Public Comment Summary (Appendix C)
Hickory Aquifer	Table ES–2, Table 2, Table 35	Chapter 4.0, Section 4.2.1	Chapter 4.0, Section 4.2.2, Meeting Documents (Appendix E)	Chapter 4.0, Section 4.2.3, Public Comment Summary (Appendix C)	Chapter 4.0, Section 4.2.4, Public Comment Summary (Appendix C)

In addition to the elements required by Texas Water Code Section 36.108(d-3) listed above, this ER also addresses the adopted proposed portions of certain major and minor aquifers, managed locally by GCDs, to be classified as non-relevant for the purposes of joint planning only pursuant to Title 31, Section 356.31 of the Texas Administrative Code. See further discussion in **Chapter 3.0.**

1.2 Scope of the GMA 9 Explanatory Report

The GMA 9 ER represents a collective and cooperative effort by the GMA 9 Committee to comply with the requirements of Texas Water Code Section 36.108. The results of this 2021 cycle of DFC joint planning represent a coordinated effort by the GMA 9 GCDs to establish long-term goals for managing the groundwater resources within the management area. Additionally, the results of the 2021 cycle of DFC joint planning provide DFCs to the TWDB to determine modeled available groundwater (MAG) amounts considered in the regional and state water plans and to the GCDs in managing their aquifers as one element in making their permitting decisions.

The GMA 9 Committee's goals for the ER were to prepare a report that would comply with the requirements of the Texas Water Code and Texas Administrative Code, prepare and submit a report documenting GMA 9's DFC joint-planning process and development of the DFCs, and establish an administrative record for this process. The GMA 9 Committee will submit the adopted DFCs, the ER, and all other documentation to the TWDB and each GCD as required by the Texas Water Code and Texas Administrative Code. The TWDB will then determine whether the information submitted is administratively complete. Once it is deemed to be administratively complete by the TWDB, each of the GMA 9 GCDs will then adopt the GMA 9 DFCs that are relevant to each GCD. The TWDB will also provide MAG amounts to the three Regional Water Planning Groups (RWPGs) that cover some portion of GMA 9 and to the GMA 9 GCDs.

TWDB staff developed the "Desired Future Condition Submission Packet Checklist – Administrative Completeness (Part 1 through Part 6)" to review the ERs submitted by all GMAs. To aid in the TWDB staff's review of this ER, the GMA 9 Committee partially completed the TWDB checklist for Part 1 through Part 3 and Part 6 only - only those checklist items where the GMA 9 Committee could assist. The GMA 9 Committee did not complete the TWDB checklist for Part 4 and Part 5 because the GMA 9 Committee did not perform any new Groundwater Availability Model (GAM) runs or prepare any new aquifer assessments in this 2021 cycle of DFC joint planning. **Appendix A** of this ER provides the partially completed TWDB Checklist related to this GMA 9 ER.

Development of the ER was made possible through a joint funding agreement between the BCRAGD and each of the GMA 9 GCDs. This ER was developed using publicly available information and materials.

Lastly, it is not within the purview of either this ER, the joint-planning process, or the GMA 9 Committee to address or resolve local GCD management issues as they may relate to a GCD's rules, management plan, or programs. GMAs and the DFC joint-planning process are the results of Chapters 35 and 36 of the Texas Water Code – statutes passed by the state legislature. GMAs and GCDs do not have the authority to work around the requirements of the Texas Water Code. Any proposed changes to the joint-planning process may be initiated by the public and must be passed as statute by the state legislature.

1.3 GMA 9 Description

GMA 9 is one of 16 GMAs created in the State of Texas (Added to the Texas Water Code Section 35.004 by Acts 1995, 74th Leg., Ch. 933, Sec. 2, eff. Sept. 1, 1995. Amended by Acts 2001, 77th Leg., Ch. 966, Sec. 2.22, eff. Sept. 1, 2001).

Figure 1 shows the current boundary designations for the 16 GMAs in the state (TWDB 2021a). **Figure 2** shows the GCDs in GMA 9 encompassing all or parts of the following counties: Bandera, Bexar, Blanco, Comal, Hays, Kendall, Kerr, Medina, and Travis counties (TWDB 2021b).

As previously stated, GMA 9's ten voting-member GCDs operate as a planning entity for the purposes of conducting joint planning for their management area as required by Texas Water Code Section 36.108. Some of the GMA 9 GCDs are also assigned to other GMAs. The SWTCGCD became a member of GMA 9 when it was confirmed by voters in the 2019 general election. SWTCGCD represents the geographic area covered by GMA 9 in western Travis County that was designated in 1990 as a part of the Hill Country Priority Groundwater Management Area (PGMA). With the creation of the SWTCGCD, all of the Hill Country PGMA is now under the jurisdiction of a local GCD.

During this DFC joint-planning cycle, the GMA 9 Committee requested altering the boundary between GMA 9 and GMA 10 to coincide, to the greatest extent feasible, with the actual boundaries of the major and minor aquifer systems. Additionally, the GMA 9 Committee supported the reassignment of the boundaries between GMA 9 and GMA 8 to amend the boundaries based on the delineation of SWTCGCD's boundaries. On May 19, 2021, the TWDB determined that these changes qualified as administrative corrections and approved the amendments to the boundary changes between GMA 9 and GMA 10 and between GMA 9 and GMA 8. The TWDB letter notifying the GMA 9 Committee Chairman Ron Fieseler of these approvals is included in **Appendix B** of this ER. These amendments resulted in the BSEACD no longer being a part of GMA 9 and the SWTCGCD being contained wholly within GMA 9. However, the BSEACD agreed to continue to participate in the 2021 DFC joint-planning cycle. In most of this 2021 DFC joint-planning cycle, the EAA continued to participate in GMA 9 as a non-voting member.

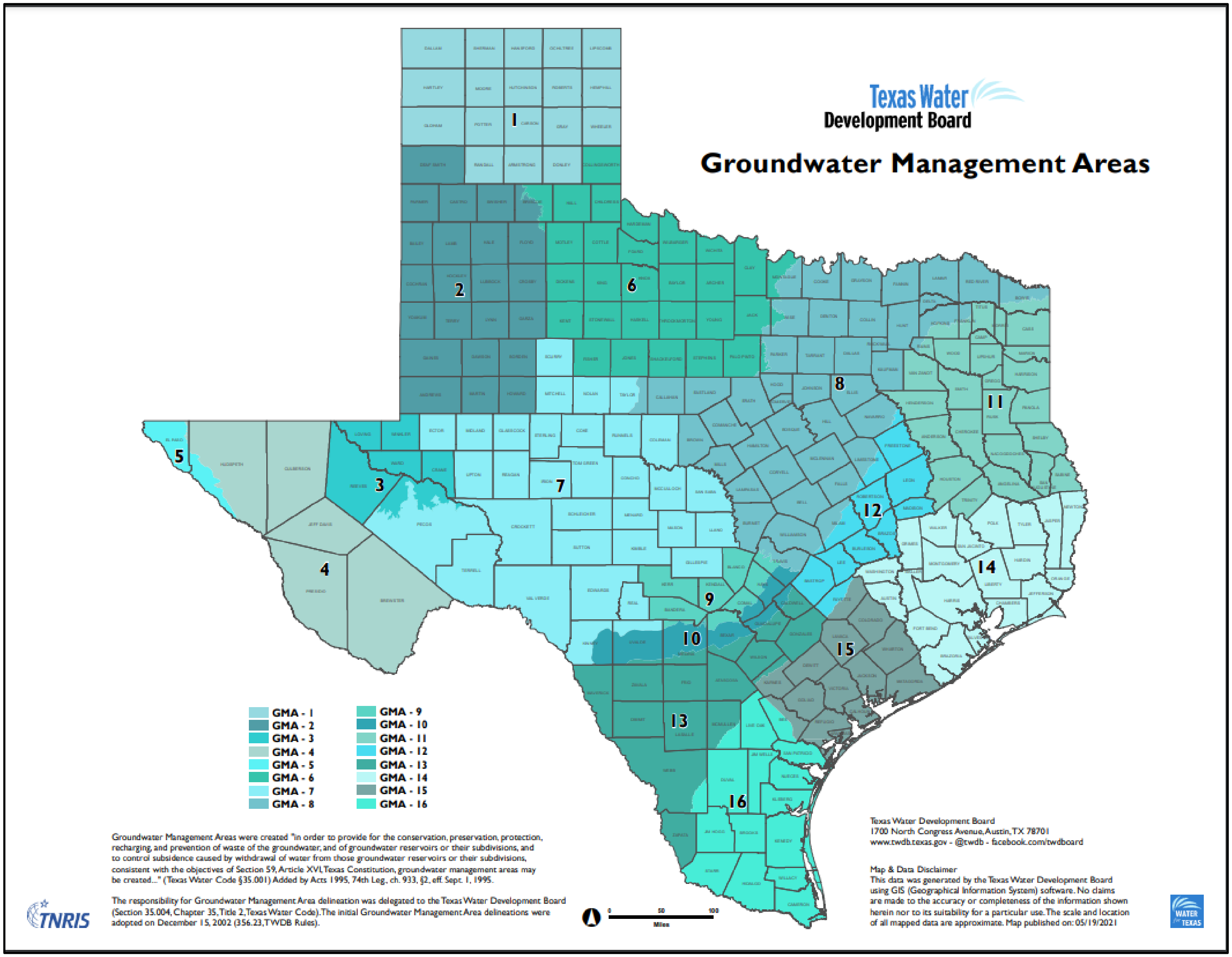

Figure 1. Sixteen GMAs in the State of Texas.

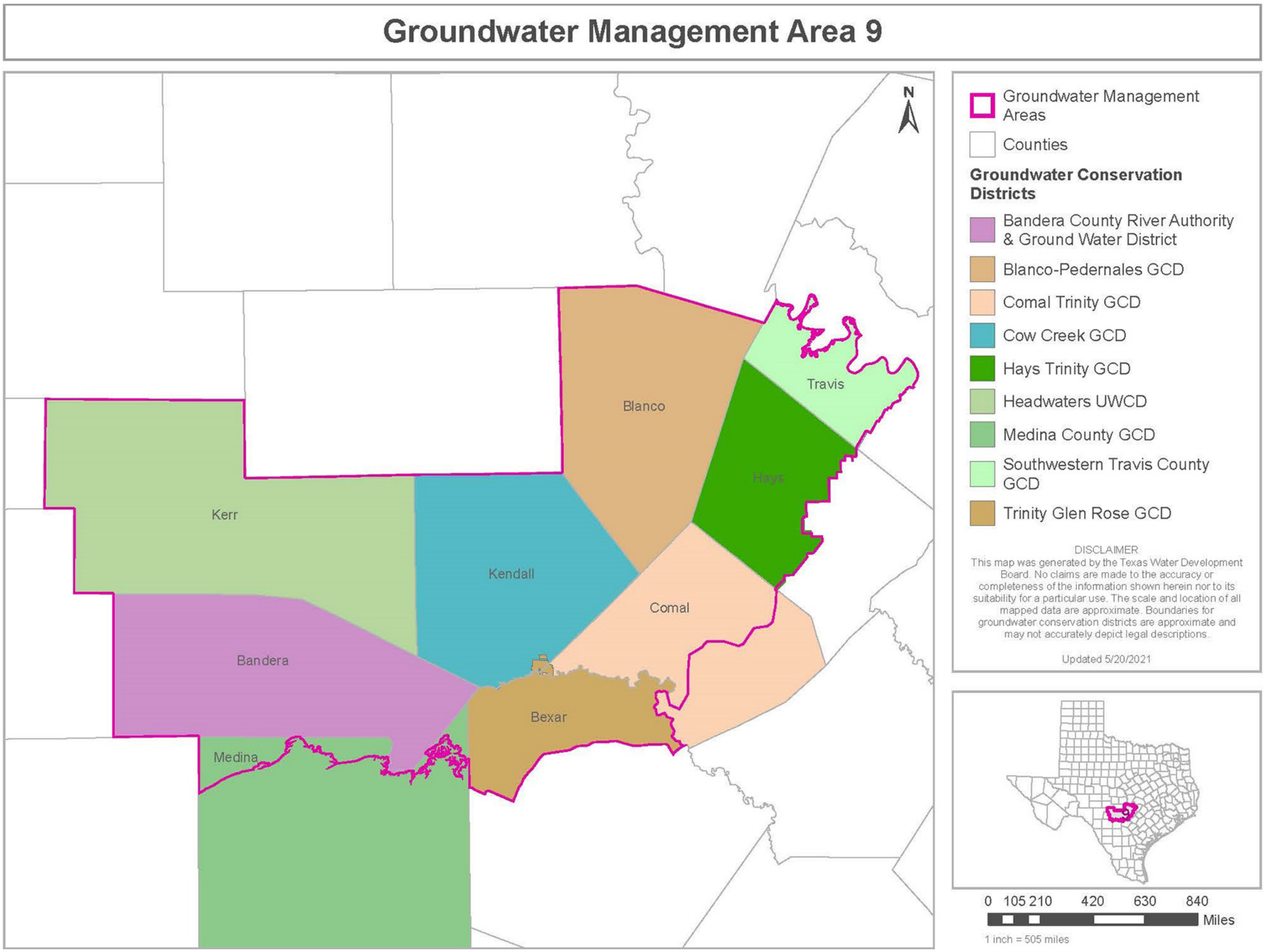

Figure 2. Groundwater Conservation Districts within GMA 9.

For more information regarding each GCD, please refer to the most recently approved Groundwater Management Plans (GMPs) adopted by each GCD and summarized in **Table 4**.

Table 4. GMA 9 GCD GMP Summary

GMA 9 GCD	GMP Adoption or Amendment Date	TWDB Approval Date
BCRAGD	February 8, 2018	March 15, 2018
BSEACD	September 28, 2017	November 21, 2017
BPGCD	October 25, 2018	January 23, 2019
CCGCD	January 13, 2020	February 27, 2020
CTGCD	March 19, 2018	April 25, 2018
HTGCD	December 3, 2020	February 19, 2021
HGCD	December 7, 2016	February 15, 2017
MCGCD	February 17, 2016	June 17, 2016
TGRGCD	December 10, 2020	January 20, 2021
SWTCGCD	June 10, 2020	September 15, 2020

Sources: BCRAGD 2018; BSEACD 2017; BPGCD 2018; CCGCD 2020; CTGCD 2018; HTGCD 2020; HGCD 2016; MCGCD 2016; TGRGCD 2020; SWTCGCD 2020; TWDB 2008, 2016a, 2020a-c.

The geographic area covered by GMA 9 also includes three major Texas river basins – the Colorado, Guadalupe, and Nueces river basins, and is also divided among three of the state's 16 RWPGs, charged with developing Regional Water Plans (RWPs) for their Regional Water Planning Areas (RWPAs) to become part of the State Water Plan (SWP). **Figure 3** illustrates the three RWPGs that overlay GMA 9 are the Plateau Water Planning Group (WPG) (Region J), the Lower Colorado RWPG (Region K), and the South Central Texas RWPG (Region L) (TWDB 2019).

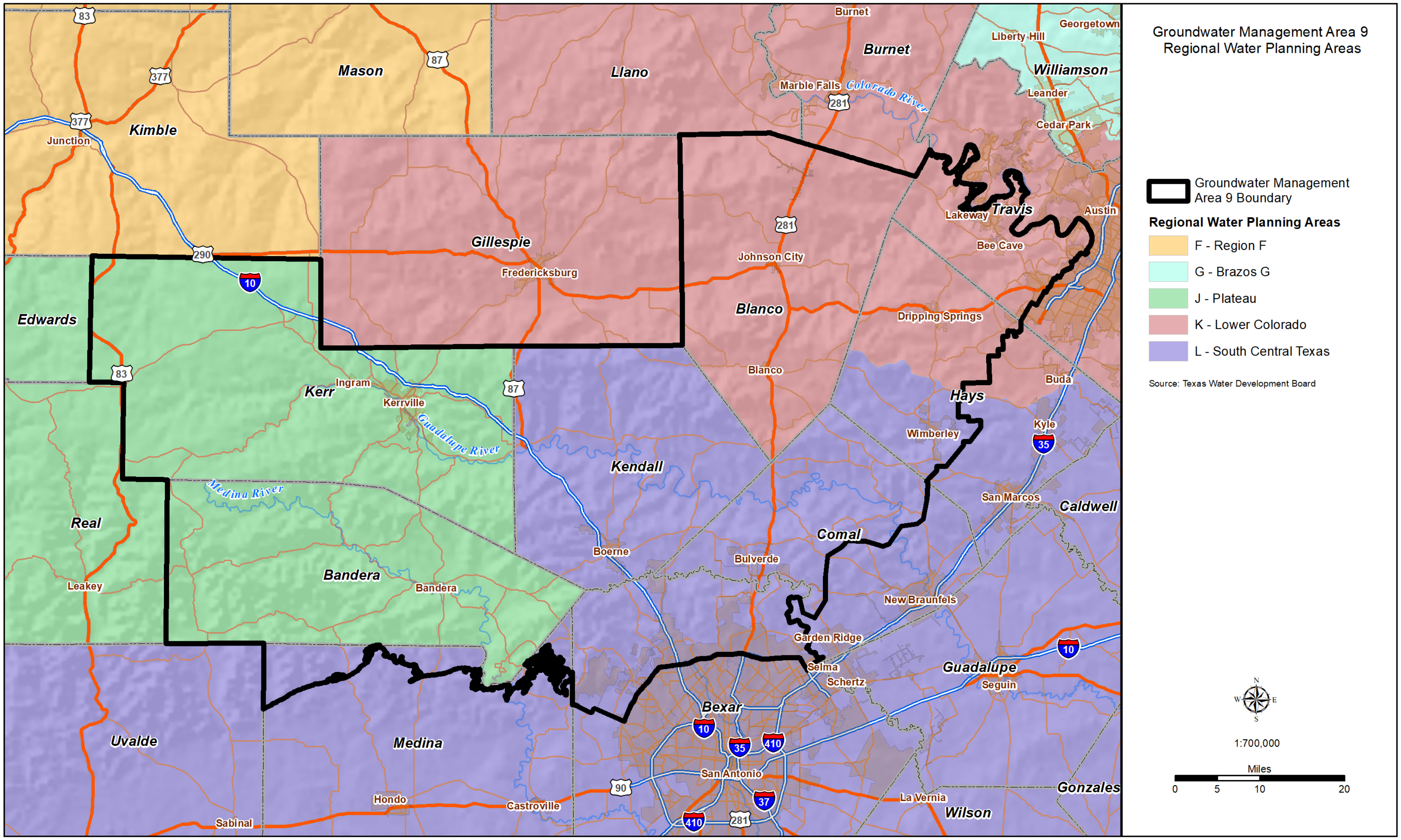

Figure 3. Portions of the Regional Water Planning Areas in GMA 9.

Regions J, K, and L cover all or parts of 41 counties in central Texas. For GMA 9, all of two counties (Bandera and Kerr counties) are among the six counties in Region J, all or parts of three counties (Blanco, Hays, and Travis counties) are among the 14 counties in Region K, and all or parts of five counties (Bexar, Comal, Hays, Kendall, and Medina counties) are among the 21 counties in Region L. The TWDB provides MAG amounts to these three RWPGs based upon the DFCs adopted by the GMA 9 Committee to incorporate them into their RWPs, and ultimately the SWP. The RWPGs consider the GMA 9 MAGs, as well as other MAGs established for the RWPAs, surface water availability and other supplies, as available water to meet water supply needs and water management strategies to be included in the RWPs. The implications of these groundwater availability amounts as part of the RWP process will be discussed later in this ER under **Chapter 4.0**.

1.4 Aquifer Descriptions

There are three major and three minor aquifers that underlie GMA 9. The following is a list of these groundwater resources within GMA 9:

Major Aquifers

- Trinity Aquifer,
- Edwards Group of the Edwards-Trinity (Plateau) Aquifer, and
- Edwards Aquifer (Balcones Fault Zone).

Minor Aquifers

- Ellenburger-San Saba Aquifer,
- Hickory Aquifer, and
- Marble Falls Aquifer.

A brief description and map of each of these aquifers is provided in the following discussion.

1.4.1 Major Aquifers

Trinity Aquifer

The Trinity Aquifer system is composed of deposits of sand, clay, and limestone of the Glen Rose and Travis Peak formations of the Lower Cretaceous Trinity Group. The Trinity Aquifer is divided into the Upper, Middle, and Lower Trinity units. The water-bearing units include, in descending order, the Glen Rose Limestone, Hensell Sand, Cow Creek Limestone, Sligo Limestone, and Hosston Sand (**Table 5**). The Glen Rose formation is divided informally into upper and lower members. Based on their hydrologic relationships, the water-bearing rocks of the Trinity Group collectively referred to as the Trinity Aquifer system, are organized into the aquifer units described in **Table 5**.

Table 5. Water-Bearing Rocks of the Trinity Group

Aquifer	Formations
Upper Trinity	Upper Glen Rose Limestone
Middle Trinity	Lower Member of the Glen Rose Limestone, Hensell Sand, and Cow Creek Limestone
	Pine Island/Hammett Shale (confining bed)
Lower Trinity	Sligo Limestone and Hosston Sand

Source: Ashworth 1983.

Because of fractures, faults, and other hydrogeological factors, the Upper, Middle, and Lower Trinity Aquifer units often are in hydraulic communication with one another and collectively should be considered a locally leaky aquifer system (Plateau Water Planning Group 2021). However, water-level and water-quality data in Travis and Hays counties suggest the Upper, Middle, and Lower Trinity Aquifer units are hydrologically isolated (Hunt et al. 2020). A map of the Trinity Aquifer relative to GMA 9 is shown in **Figure 4**.

A list of Trinity Aquifer technical references that are recommended for further reading are listed in **Chapter 5.0** of this ER.

Edwards Group of the Edwards-Trinity (Plateau) Aquifer

The Edwards Group of the Edwards-Trinity (Plateau) Aquifer consists of lower Cretaceous-age saturated limestone and dolomite of the Edwards Group and underlying sediments of the Trinity Group. These strata are relatively flat lying and located atop relatively impermeable pre-Cretaceous rocks. The upper Edwards portion of the aquifer system is generally more porous and permeable than the underlying Trinity, and where exposed at the land surface, the Edwards-Trinity (Glen Rose) interface gives rise to numerous springs that form the headwaters of several eastward and southerly flowing rivers (Plateau Water Planning Group 2021). A map of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer relative to GMA 9 is shown in **Figure 5**.

For clarity in this ER, the GMA 9 Committee has modified the nomenclature of the Edwards-Trinity (Plateau) Aquifer as defined by the TWDB, as the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in order to limit the discussion to the formations that are part of the Edwards Group (**Figure 6**). The GMA 9-modified nomenclature is used throughout this ER and consists of references to this aquifer as either the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, or the Edwards Group.

A list of Edwards Group of the Edwards-Trinity (Plateau) Aquifer technical references recommended for further reading are listed in **Chapter 5.0** of this ER.

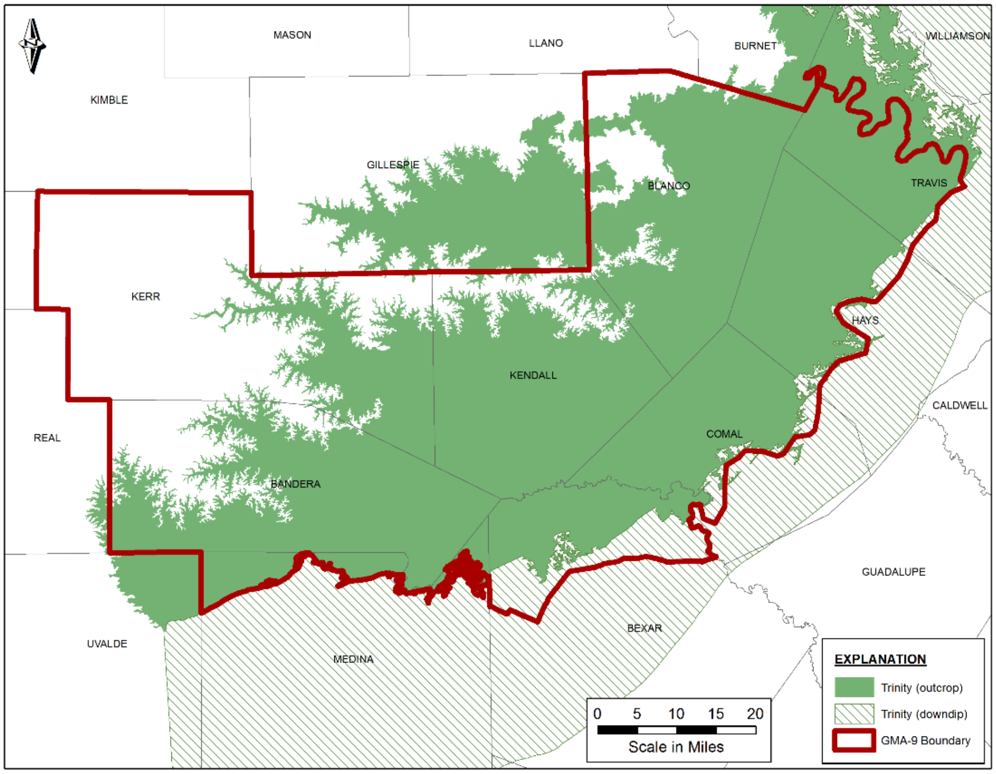

Figure 4. Trinity Aquifer within GMA 9 boundaries.

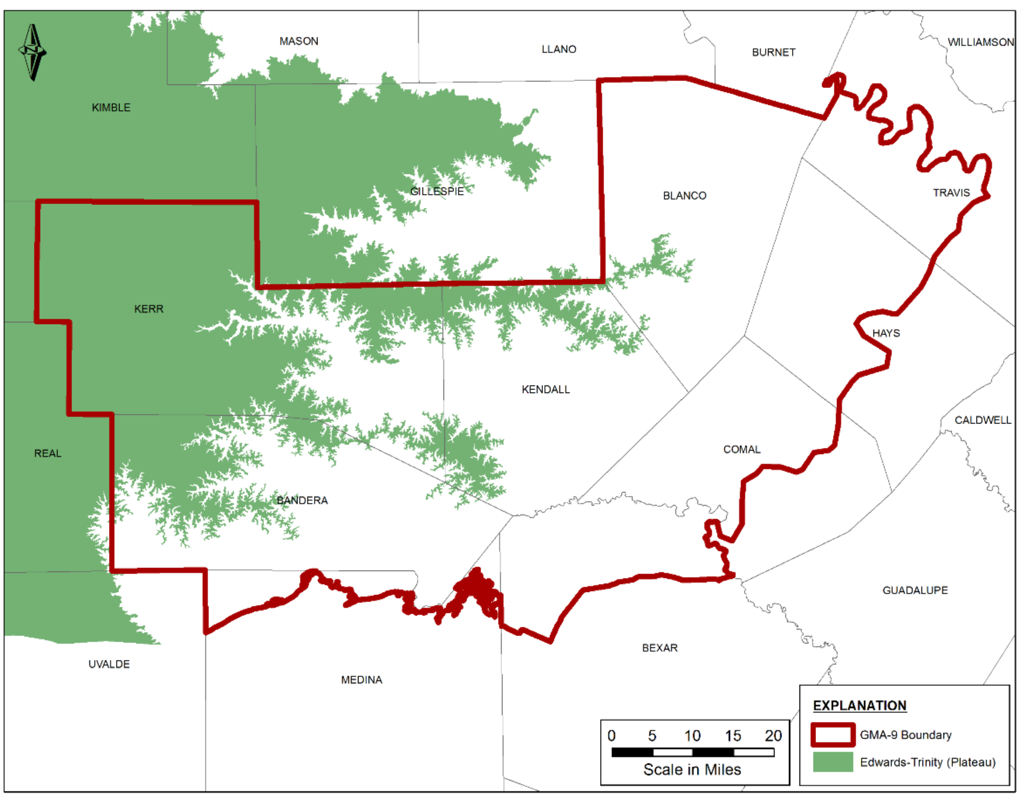

Figure 5. Edwards Group of the Edwards-Trinity (Plateau) Aquifer within GMA 9 boundaries.

Simplified Geological Column

Edwards-Trinity (Plateau) Aquifer

Regional Aquifer Name	Aquifer Name	Hydrologic Unit	Geologic Formation
Edwards - Trinity (Plateau) Aquifer	Edwards Group	Edwards Group	Edwards Limestone Comanche Peak LS Walnut Clay
	Trinity Aquifer	Upper Trinity	Upper Glen Rose Member of Glen Rose Fm
		Middle Trinity	Lower Glen Rose Member of Glen Rose Fm
			Hensell Sandstone Cow Creek Limestone
		Confining Zone	Hammett Shale
		Lower Trinity	Sligo Limestone Hosston/Sycamore Sandstone

Source: Ronald G. Fieseler, P.G.

Figure 6. Simplified geological column, Edwards-Trinity (Plateau) Aquifer.

Edwards Aquifer (Balcones Fault Zone [BFZ])

The Edwards Aquifer BFZ consists of highly faulted, cavernous, highly transmissive Cretaceous-age limestone. The aquifer is present in 11 counties in central to south-central Texas, from Kinney County in the west to Bell County in the northeast. Groundwater from the Edwards Aquifer has been extensively produced for decades. In 2018, 370,570 acre-feet (ac-ft) were pumped from the Edwards Aquifer. Approximately 23 percent was used for irrigation and about 67 percent for municipal use and the remaining 10 percent was for domestic and industrial use. Spring discharge from the Edwards Aquifer was about 393,000 ac-ft in 2018 (EAA 2019).

The Edwards Aquifer is a typical karst aquifer, characterized by conduit flow that allows significant amounts of water to flow rapidly through the aquifer. Transmissivities in the Edwards Aquifer can be in the millions of gallons per day per foot (gpd/ft), and porosities are typically between five and 15 percent. Wells drilled into the Edwards Aquifer can be some of the most productive wells in the world, with one well producing a reported 24,000 gallons per minute (gpm) from a flowing artesian well 30 inches in diameter (Ashworth and Hopkins 1995). Because of the karstic nature of the Edwards Aquifer, it responds very quickly both to pumpage and recharge. Water levels in wells and spring flows coming from the aquifer can change very rapidly in response to large changes in pumpage and especially from significant rainfall/recharge events. However, these characteristics are for the freshwater section of the aquifer, which may differ significantly from the saline section. Aquifer characteristics for the saline section of the Edwards Aquifer are poorly understood because this portion of the aquifer contains few completed wells (LBG-Guyton Associates 2003). A map of the Edwards Aquifer (BFZ) and aquifer segments relative to GMA 9 is shown in **Figure 7**.

A list of Edwards Aquifer (BFZ) technical references recommended for further reading are listed in **Chapter 5.0** of this ER.

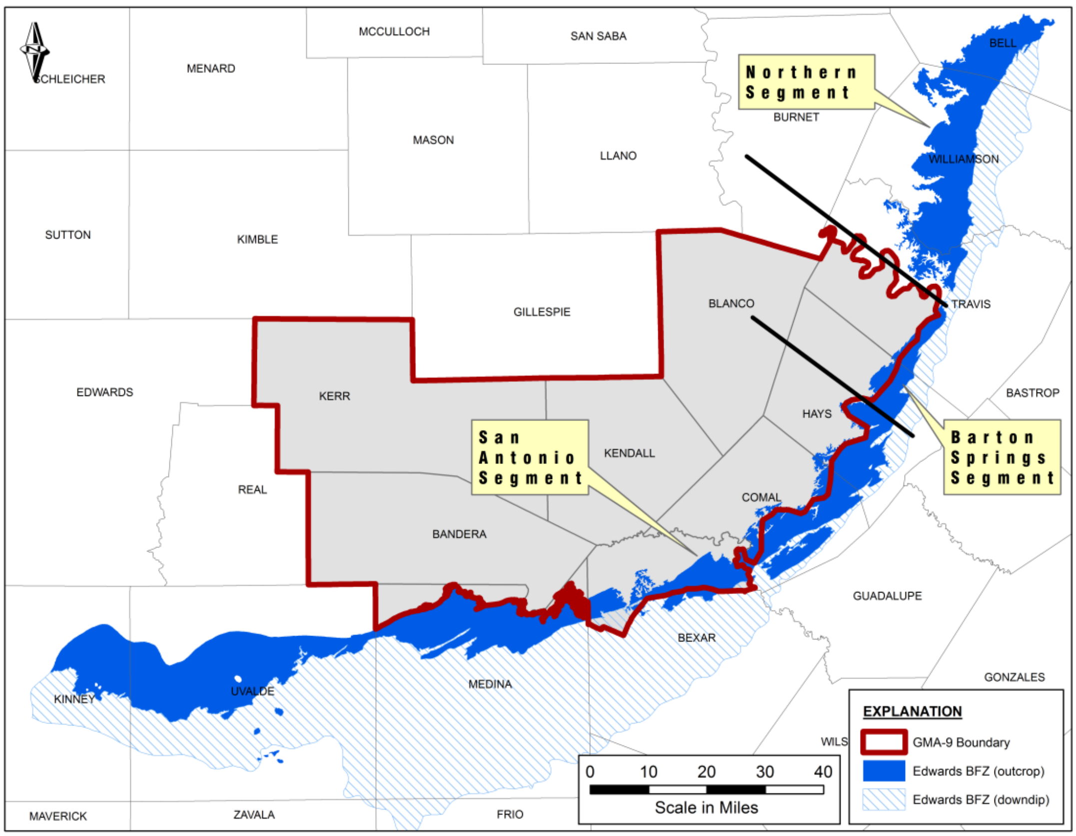

Figure 7. Edwards Aquifer (BFZ) within GMA 9 boundaries.

1.4.2 Minor Aquifers

Ellenburger-San Saba Aquifer

The Ellenburger-San Saba Aquifer is unconfined, a massive, thickly-bedded, complexly fractured and faulted mix of limestone and dolomite present in the north central portions of Blanco County. From the outcrop areas, the aquifer dips predominately southeastward into the subsurface at angles up to 10 degrees in some areas. It is either absent or deeply subsurface in a broad area extending from the central portion of the county toward the southern and eastern parts of the county. Well yields vary greatly depending on local geological conditions. Many Ellenburger-San Saba Aquifer wells are known for pumping rates between 3 to 45 gpm. In some areas though, significant localized development of subsurface solution features has occurred within the Ellenburger-San Saba resulting in groundwater production capabilities greater than 200 gpm. Water quality in the Ellenburger-San Saba is almost always very good, with the only concern being the low to moderate hardness. The Ellenburger-San Saba Aquifer is utilized extensively by the City of Johnson City and many domestic and livestock users in northern and northwestern Blanco County. Recharge to the Ellenburger-San Saba is mainly through outcrops and porous areas in the beds of rivers and tributaries, with some cross-formational flow contributions from overlying members of other aquifers.

In Kerr County, the HGCD in 2019 completed a public water supply well in the Ellenburger-San Saba Aquifer for the City of Kerrville. The well tested at approximately 800 gpm. Additionally, in 2016 the HGCD completed a monitoring well in the Ellenburger-San Saba Aquifer in northeastern Kerr County. There is no additional reported pumping from the Ellenburger-San Saba Aquifer in other counties located within GMA 9 (BPGCD 2018). A map of the Ellenburger-San Saba Aquifer relative to GMA 9 is shown in **Figure 8**.

A list of Ellenburger–San Saba Aquifer technical references recommended for further reading are listed in **Chapter 5.0** of this ER.

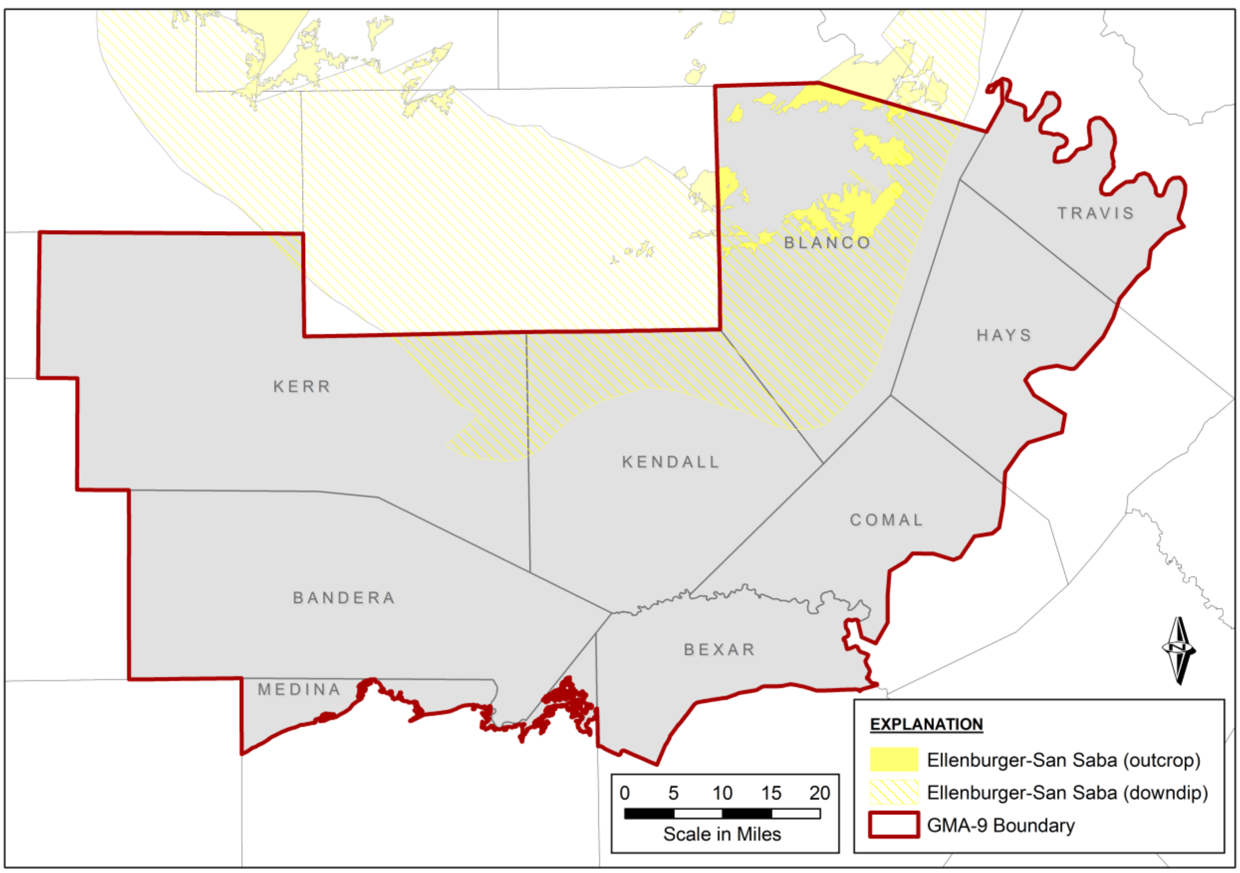

Figure 8. Ellenburger-San Saba Aquifer within GMA 9 boundaries.

Hickory Aquifer

The Hickory Aquifer is comprised of sandstone and outcrops in northwestern Blanco County. Exposures are highly irregular in shape, due to both faulting and the overlap of Cretaceous-age rocks. This aquifer dips predominantly southeastward from the outcrop areas at angles of about 10 degrees in some areas. Well depths are highly dependent on local geology, with well depths varying between 100 ft deep to over 1,000 ft deep. The Hickory Aquifer yields low to moderate quantities of water and water quality is almost always very good. Well drillers have reported some wells capable of producing up to 50 gpm or more. Recharge to the Hickory occurs from local precipitation on its outcrop and through fractures and faults in overlying units and/or cross-formational flow where the Hickory is in the subsurface. There is no reported pumping from the Hickory Aquifer in other counties located within GMA 9 (BPGCD 2018). A map of the Hickory Aquifer relative to GMA 9 is shown in **Figure 9**.

A list of Hickory Aquifer technical references recommended for further reading are listed in **Chapter 5.0** in this ER.

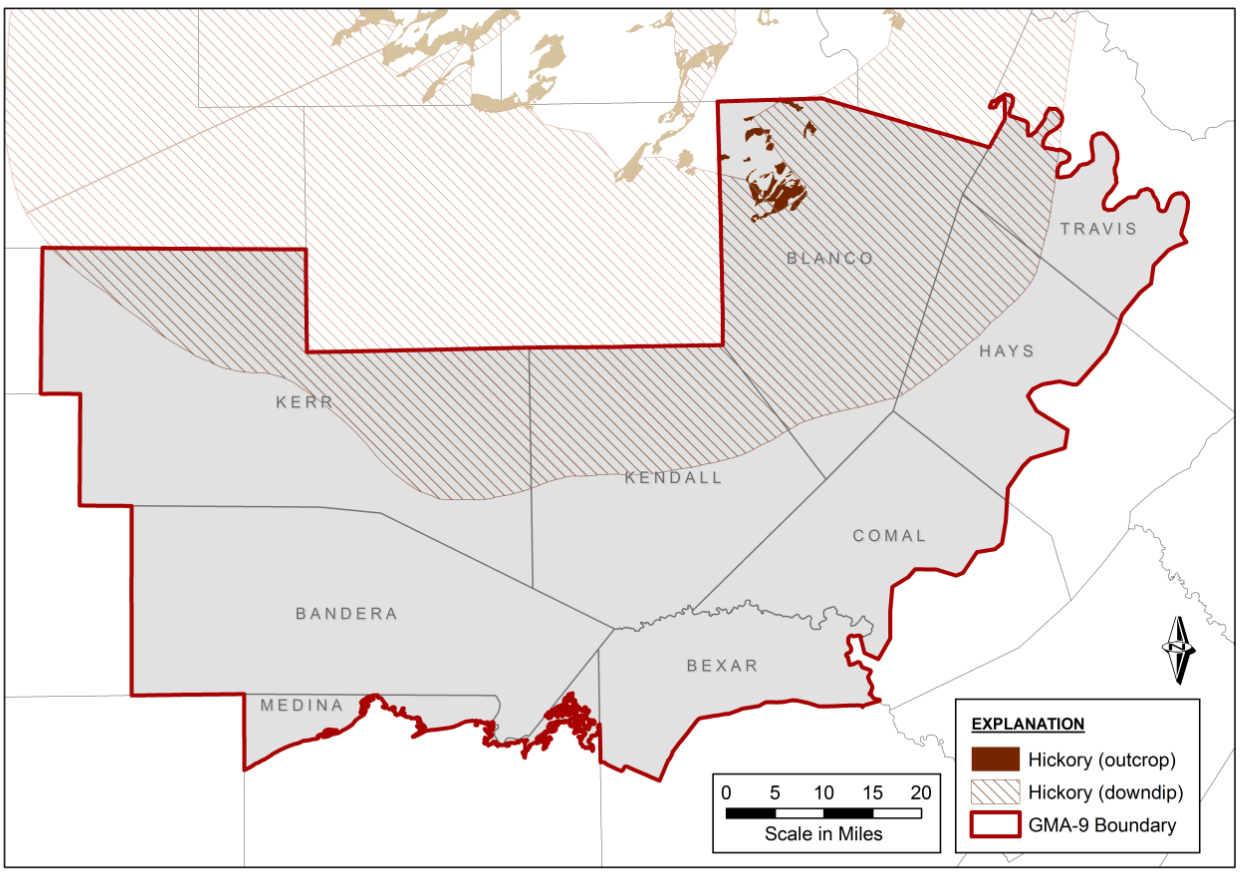

Figure 9. Hickory Aquifer within GMA 9 boundaries.

Marble Falls Aquifer

The Marble Falls Aquifer is an unconfined limestone aquifer located in the general vicinity of Pedernales Falls State Park and Cypress Mill. It is reported to be highly fractured with extensive development of subsurface solution features. This rather isolated and minor aquifer yields low to moderate quantities of water. Some wells in Blanco County have produced water with high nitrate concentrations. Due to its small surface extent, groundwater usage is limited to local domestic, and livestock needs. No non-exempt wells producing from the Marble Falls Aquifer have been identified by the BPGCD (2018). A map of the Marble Falls Aquifer relative to GMA 9 is shown in **Figure 10**.

A list of Marble Falls Aquifer technical references recommended for further reading are listed in **Chapter 5.0** in this ER.

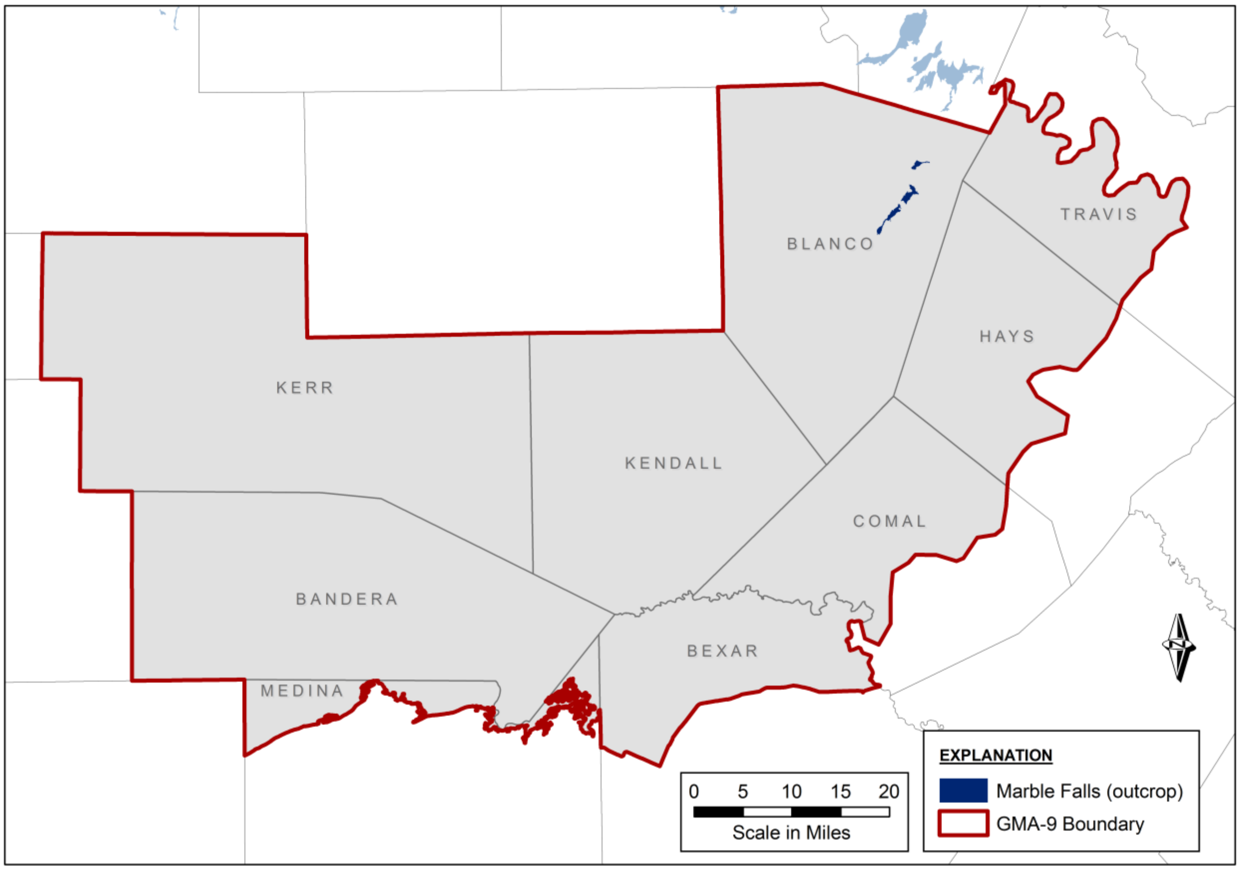

Figure 10. Marble Falls Aquifer within GMA 9 boundaries.

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2.0 GMA 9 2021 DESIRED FUTURE CONDITION JOINT-PLANNING PROCESS

This chapter describes the DFC joint-planning process that the GMA 9 Committee followed for this 2021 DFC joint-planning cycle. The chapter begins with a summary of the statutory and regulatory requirements that direct DFC joint planning. This summary is then followed by a description of the process that the GMA 9 Committee followed to identify the GMA 9 GCD-managed aquifers proposed for classification as non-relevant for joint-planning purposes only pursuant to Title 31, Section 356.31 of the Texas Administrative Code, and to develop the 2021 DFCs presented in this ER.

This DFC joint-planning cycle was significantly impacted by the COVID-19 global pandemic, which required the GMA 9 Committee to meet virtually for three of its ten meetings. Despite this challenge, the GMA 9 Committee was nevertheless able to consider the factors and other relevant scientific and hydrogeological data required to determine DFCs for this 2021 DFC joint-planning cycle.

In addition to the updated information considered for this DFC joint-planning cycle, the GMA 9 Committee's 2021 DFC deliberations build on the existing base of scientific data and information established through GMA 9's 2010 and 2016 DFC joint-planning cycles. A summarized account of the 2010 and 2016 DFC joint-planning cycles, including the information that the GMA 9 Committee considered in these planning periods, is also provided in this chapter. For a detailed account of the 2010 and 2016 DFC joint-planning cycles, refer to the "*Groundwater Management Area 9 Explanatory Report for Desired Future Conditions for Major and Minor Aquifers (2016 ER)* (GMA 9 2016a).

2.1 GMA DFC Joint Planning Statutory and Regulatory Requirements Overview

The basis for the GMA 9 DFCs presented in this ER begins with Texas Water Code Section 36.108. Section 36.108 sets forth the rules that direct the state's 16 GMAs on how to periodically reevaluate and update groundwater management objectives within their boundaries.

These groundwater management objectives are specifically defined as DFCs. DFCs are intended to provide targets to guide the management of groundwater in the state (e.g., as amounts of drawdown, or levels of flow to be maintained, for a given groundwater unit). As part of the Section 36.108 DFC joint-planning process, the member GCDs that comprise each GMA are required to adopt the DFCs at the individual district level. Under Texas Water Code Sections 36.1071 and 36.1085, GCDs are then required to address the DFCs in their GMPs through the inclusion of goals and objectives "consistent" with achieving the DFCs.

Under Section 36.108, determining DFCs must be based on an assessment of data and information relevant for the GMA. Specifically, Section 36.108(d) explains that the GMAs "shall consider groundwater availability models and other data or information for the management area." Additionally, Section 36.108(d) specifies nine factors that must be considered in the development of DFCs. These nine factors are:

> "(1) aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another;

(2) the water supply needs and water management strategies included in the state water plan;

(3) hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge;

(4) other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water;

(5) the impact on subsidence;

(6) socioeconomic impacts reasonably expected to occur;

(7) the impact on the interests and rights in private property, including ownership and the rights of management area landowners and their lessees and assigns in groundwater as recognized under Section 36.002;

(8) the feasibility of achieving the desired future condition; and

(9) any other information relevant to the specific desired future conditions."

Upon reaching a set of proposed DFCs by at least two-thirds vote, Section 36.108(d-2) states that the GMA joint-planning committee will mail the proposed DFCs to its member GCDs. This triggers a 90-day public comment period for each member GCD. During this public comment period, each district is required to both make information available to the public and hold a public hearing on any proposed DFCs relevant to that district. To respond to public comments received during this period, Section 36.108(d-2) states that each "district shall compile for consideration at the next joint planning meeting a summary of relevant comments received, any suggested revisions to the proposed desired future conditions, and the basis for the revision." GMA 9 Committee Chairman Ron Fieseler prepared a summary of these questions and comments (both oral and written) for the GMA 9 Committee's consideration (**Appendix C**). This summary includes the GMA 9 Committee response to questions and/or comments and explains why a comment was or was not incorporated into the DFCs. The questions and/or comments were consolidated into similar comment groupings to allow for a more efficient review of the public comments.

Additionally, the Texas Water Code Section 36.3011 allows for landowners, GCDs, RWPGs, permit applicants, individuals with legal groundwater interests, and others affected by the Texas Commission on Environmental Quality (TCEQ) rule to petition the TCEQ to launch inquiries into instances in which GCDs are reportedly not fulfilling their duties. This section enforces several GCD duties associated with the DFC joint-planning process including the failure to participate in the DFC joint-planning process, adopt DFCs, update management plan before the second anniversary of the adopted DFCs, update rules to implement the DFCs before the first anniversary of the updated management plan, and the failure to design rules to achieve the adopted DFCs.

In addition to the Texas Water Code, Title 31, Chapter 356 of the Texas Administrative Code also sets out the TWDB's rules related to groundwater management by the GMAs. This chapter includes rules related to the development and submittal of the DFCs and ER.

2.2 GMA 9 DFC Joint Planning and DFC Development Process

As stated, this chapter describes the process that the GMA 9 Committee followed for this 2021 DFC joint-planning cycle. It also describes the GMA 9 Committee's deliberations from the 2010 and 2016 DFC joint-planning cycles. Because the GMA 9 Committee considered and adopted the same DFCs for the 2021 DFC joint-planning cycle as they did in the prior two cycles of DFC joint planning, discussions of those cycles are also included in this ER as they provide important information to support the development and selection of the DFCs.

2021 DFC Joint-Planning Process

The GMA 9 Committee began the 2021 DFC joint-planning cycle discussions in November 2018 after the TWDB issued MAG amounts based on the DFCs adopted by the GMA 9 Committee in the 2016 DFC joint-planning cycle. Those MAG amounts were issued on February 28, 2017 for the relevant aquifers of the GCDs in GMA 9 and by county for the Trinity, Edwards Group of the Edwards-Trinity (Plateau), Ellenburger-San Saba, and Hickory aquifers.

The GMA 9 Committee met ten times during the 2021 DFC joint-planning cycle. Three of the GMA 9 Committee meetings were held virtually. These meetings were held in accordance with the Governor's order to temporarily suspend certain provisions of the Texas Open Meetings Act in response to the COVID-19 global pandemic. Meeting notices included both links to WebEx or Zoom video web conference platforms as well as telephone numbers for the GMA 9 Committee and the public to participate in the GMA 9 joint-planning meetings. Samples of public notices for both the in-person and virtual GMA 9 Committee meetings are included in an appendix of this ER. The GMA 9 Committee meeting dates and locations for the 2021 DFC joint-planning cycle are listed below in **Table 6**.

Table 6. GMA 9 Joint-Planning Meetings - 2021 DFC Joint-Planning Cycle

Date	Location
Monday, November 5, 2018	Dripping Springs City Hall, Dripping Springs, Texas
Monday, February 4, 2019	Upper Guadalupe River Authority, Kerrville, Texas
Monday, April 22, 2019	Bee Cave City Hall, Bee Cave, Texas
Monday, June 17, 2019	Cow Creek Groundwater Conservation District, Boerne, Texas
Monday, November 18, 2019	Mammen Family Public Library, Bulverde, Texas
Monday, December 14, 2020	Virtual GMA 9 Public Meeting
Monday, January 25, 2021	Virtual GMA 9 Public Meeting
Monday, March 22, 2021	Virtual GMA 9 Public Meeting
September 27, 2021	Bandera Electric Cooperative, Bandera, Texas
November 15, 2021	Cow Creek Groundwater Conservation District, Boerne, Texas

The BPGCD was responsible for maintaining copies of all meeting notices and minutes. Each meeting agenda included reports by TWDB staff and the GMA 9 representatives to RPWGs for Regions J, K, and L. The inclusion of these representatives from other relevant water planning entities provided for greater coordination between DFC joint planning and regional water planning throughout the 2021 DFC joint-planning cycle. Additionally, the GMA 9 Committee discussed and reviewed each GMA 9-member GCD's GMP on an annual basis.

The GMA 9 Committee's activities and discussions for the 2021 DFC joint-planning cycle are summarized below.

At the November 5, 2018 meeting, the GMA 9 Committee began discussions on the possible need to revise the DFCs that were adopted in the 2016 DFC joint-planning cycle. As a result of this discussion, the GMA 9 Committee decided to support maintaining the existing DFCs that had been established in the 2016 DFC joint-planning cycle.

In 2019, the GMA 9 Committee met four times - February 4, April 22, June 17, and November 18 – and in August the GMA 9 Explanatory Report Liaison Subcommittee (ERLS) held a pre-planning meeting with TWDB staff to initiate the 2021 DFC joint-planning cycle. At this pre-planning meeting, TWDB staff summarized three items that should be included in all DFC statements in the 2021 DFC joint-planning cycle:

- The average drawdown geographical extent – the GMA 9 Committee is to state whether the DFC geographical extent is the entire GMA, or just certain counties;
- DFC variance – the GMA 9 Committee is to include a statement declaring the level of tolerance when comparing DFCs to average drawdown calculations from model files;[3]
- Year of initial water level values - the GMA 9 Committee is to define the initial year for the water level values to compare the drawdown.

Additionally, TWDB staff informed the ERLS members of the recent completion of the aquifer subsidence vulnerability report for use when considering the subsidence factor in setting DFCs in the 2021 DFC joint-planning cycle.

At the regular GMA 9 meetings, in 2019, the GMA 9 Committee conducted the following business:

- Discussed the work of the GMA 9 Technical Advisory Group to develop the standardization of monitor well analysis to determine DFC compliance throughout GMA 9;
- Initiated a contract with Blanton & Associates (B&A) and WSP USA, Inc. (WSP) (the Consultant team[4]) and determined work products;
- Designated the BCRAGD as the GCD to serve as the contracting entity with the Consultant team.

At the November meeting, the GMA 9 Committee was presented with an overview of the DFC joint-planning process and the requirements of Texas Water Code Chapter 36 related to DFCs, factor considerations, and the schedule for the 2021 DFC joint-planning cycle. Additionally, the GMA 9 Committee received an overview of the technical considerations for the 2021 DFC joint-planning cycle.

[3] This item was subsequently clarified by the TWDB staff that the variance statement was not required as part of the DFC statement, but to just be included in the ER.

[4] In January 2021, James Beach, formerly with WSP, formed a separate company, Advanced Groundwater Solutions. Mr. Beach remained as sub-consultant to B&A for the remainder of the 2021 DFC joint-planning cycle.

This included information concerning the development of the update to the Hill Country Trinity Groundwater Availability Model (HCT GAM), which indicated that the model update would not be available for the 2021 DFC joint-planning cycle.

Also, at the November meeting, GMA 9 Committee Chairman Ron Fieseler and Brian Hunt, P.G. presented a proposed method of reporting DFC compliance based on averaging monitoring well water level measurements. The GMA 9 GCDs were encouraged to incorporate this method in their annual compliance reports.

In 2020, the GMA 9 ERLS met on August 25, 2020 and the GMA 9 Committee met on December 14, 2020. Both meetings were held virtually via the WebEx video web conferencing platform. At the August meeting, the ERLS reviewed the TWDB's new requirements for DFC statements and other issues related to the 2021 DFC joint-planning cycle, including a project update and schedule.

At the December meeting, the GMA 9 Committee was provided a report on the status of the 2021 DFC joint-planning cycle and received a presentation on the aquifers proposed for classification as non-relevant (pursuant to Title 31, Section 356.31 of the Texas Administrative Code) in the last joint-planning cycle. The aquifers of interest included the Edwards (BFZ), Edwards-Trinity, Ellenburger-San Saba, Hickory, and Marble Falls aquifers. During a discussion on possible revisions, the SWTCGCD noted that they considered both the Hickory and Edwards BFZ aquifers to be non-relevant for joint-planning purposes within their district.

Additionally, the GMA 9 Committee received a presentation on the DFC statements adopted by the GMA 9 Committee in the 2016 DFC joint-planning cycle. The GMA 9 Committee discussed potential revisions to the DFC statements, including the TWDB recommendations for inclusion of additional language in the DFC statements, as had been discussed with the ERLS in 2019.

This presentation was followed by a review of the policy and technical justifications for the DFCs from the 2016 DFC joint-planning cycle. For the Trinity and Edwards-Trinity (Plateau) aquifers DFCs, the policy and technical justifications discussed included the following: DFCs are long-term targets, compliance with the DFCs should be determined over time with sufficient (collected under varying conditions) data, GAM results from the 2010 DFC joint-planning cycle that were used to evaluate the relationship between pumping versus drawdown, spring, and baseflow to balance competing water demands, determined the DFCs met the "balance test," and that DFCs should be reevaluated with the updated HCT GAM. Similarly, for the Ellenburger-San Saba and Hickory aquifers DFCs, the policy and technical justifications discussed included the following: DFCs are long-term targets, Ellenburger-San Saba and Hickory considered relevant in Kendall County, and DFCs should be assessed over time and reevaluated with new model runs.

During this discussion, the representative for SWTCGCD stated that the DFCs that were previously established by the GMA 9 Committee for the Trinity Aquifer were not applicable to SWTCGCD, because the district was created after these DFCs were established. Additionally, the SWTCGCD representative noted that a hydrogeologic study performed by BSEACD and Travis County, titled the *Hydrogeologic Atlas of Southwest Travis County, Central Texas* (Hunt et al. 2020) established two different aquifer characteristics for the Middle Trinity Aquifer on either side of the Bee Creek fault. According to the study, the Middle Trinity Aquifer east of the Bee Creek fault is not being recharged. As a result, the hydrologic behavior of the Middle Trinity Aquifer in that area differs from the overall behavior of the aquifer in GMA 9. Additionally, the SWTCGCD representative stated that the GMA 9 Committee needs to address localized aquifer characteristics that vary from the broader GMA 9 aquifer conditions.

The representative for HTGCD raised the question regarding the use of local models to develop future DFCs to ensure the protection of spring flow around Jacob's Well and Pleasant Valley Springs. In particular, the GMA 9 Committee and the other meeting participants discussed the use of the Blanco River Aquifer Tool for Water and Understanding Resiliency and Sustainability Trends (BRATWURST)[5] model as a supplement to the HCT GAM. It was pointed out that currently only a conceptual model and not a numerical model of BRATWURST was available. Once available, the numerical model could be folded into the DFC joint-planning process to address local issues in future DFC joint-planning cycles.

Representatives for the HGCD and the CCGCD stated that a seven-ft drawdown (as provided in the DFC statement) was acceptable for the Ellenburger-San Saba Aquifer but expressed their interest in the TWDB running a model scenario for a 30-ft drawdown. Further discussion addressed that more refined models should be included in the process of joint planning. Finally, the discussion on the DFC statements concluded with the decision to add a variance or tolerance statement as a footnote in the ER.[6]

Additionally, GMA 9 Committee members discussed five of the nine factors, including the following: aquifer uses and conditions, water supply needs and water management strategies, hydrological conditions, other environmental impacts, and impact on subsidence factors, as they relate to DFC consideration and adoption.

Finally, the GMA 9 Committee discussed amending the boundaries between GMA 9 and GMA 8 and between GMA 9 and GMA 10. The resolution of the boundary amendment between GMA 9 and GMA 8 was proposed to relocate the boundary to the centerline of the Colorado River and the resolution of the boundary amendment between GMA 9 and GMA 10 was proposed to remove the BSEACD from GMA 9. Regarding the GMA 9 and GMA 10 boundary amendment, the GMA 9 Committee Chairman requested more information from the BSEACD and the TWDB to ensure that the proposed change was appropriate for GMA 9. Consideration of both resolutions was tabled to the March 2021 meeting.

In 2021, the GMA 9 Committee met four times – January 25, March 22, September 27, and November 15. The January and March meetings were held in accordance with the Governor's order related to the COVID-19 pandemic. Both meetings were held virtually via the Zoom video web conferencing platform. At the January meeting, the GMA 9 Committee continued discussions on the DFC factor considerations including impacts on socioeconomic conditions and private property rights, and other relevant information. The

[5] Once completed, BRATWURST will model how the Blanco River watershed interacts with the underlying Trinity and Edwards aquifers.

GMA 9 Committee received presentations on the summaries of these factors that included a summary of the other relevant information from the 2016 DFC joint-planning cycle.

Additionally, during the January 25, 2021 meeting, the GMA 9 Committee passed the resolution of the boundary amendment between GMA 9 and GMA 8, which relocates the boundary to the centerline of the Colorado River. After hearing a report from the TWDB regarding the boundary amendment between GMA 9 and GMA 10, the GMA 9 Committee discussed how the boundary would be relocated along the BSEACD, SWTCGCD, and HTGCD boundaries. This resolution to amend the boundary between GMA 9 and GMA 10 also passed. Both boundary changes received approval from the TWDB on May 19, 2021 **(Appendix B)**.

At the March 22, 2021 meeting, the GMA 9 Committee received a presentation on the summaries of the DFC feasibility factor and a review of other relevant information identified in previous meetings. After discussing and considering the information presented, the GMA 9 Committee approved to propose certain aquifers or portions of aquifers managed by GCDs to be classified as non-relevant for the purposes of joint planning only (pursuant to Title 31, Section 356.31 of the Texas Administrative Code) and adopted proposed DFC statements for major and minor aquifers in applicable areas (**Table 7** and **Table 8,** respectively).

Table 7. GMA 9 GCD-Managed Aquifers Proposed for Classification as Non-Relevant for Joint-Planning Purposes Only Pursuant to Chapter 31 Section 356.31 of the Texas Administrative Code (Approved by the GMA 9 Committee on March 22, 2021)

Proposed Classification as Non-Relevant	Applicable Areas Within GMA 9 (All or Portions of the Following Counties)
Edwards Aquifer (Balcones Fault Zone)	Bexar, Comal, Hays, and Travis counties
Edwards Group of 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

Table 8. Adopted as Proposed DFCs for GMA 9 Major or Minor Aquifers and Applicable Areas within GMA 9 (Approved by the GMA 9 Committee on March 22, 2021)

Major or Minor Aquifer	Desired Future Condition
Trinity	Allow for an increase in average drawdown of approximately 30 feet through 2060 (throughout GMA 9) consistent with “Scenario 6” in TWDB GAM Task 10-005
Edwards Group of Edwards-Trinity (Plateau)	Allow for no net increase in average drawdown in Bandera and Kendall counties through 2080
Ellenburger-San Saba	Allow for an increase in average drawdown of no more than 7 feet in Kendall County through 2080
Hickory	Allow for an increase in average drawdown of no more than 7 feet in Kendall County through 2080

Finally, there were concerns expressed regarding a possible variance inclusion statement. After discussion, the GMA 9 Chairman requested for the Consultant team to review a possible variance inclusion statement with TWDB staff. In that discussion, the TWDB staff recommended using a simpler, shorter statement and was given direction that the variance statement does not need to be included in the GMA's DFC resolution nor as a footnote to the DFC statement table. The variance statement can just be included in the discussion of the DFC statements in the ER.

Following the March 22nd meeting, the GMA 9 Committee Chairman sent a letter to all ten of the GMA 9 GCDs on March 31, 2021 informing the GCDs of the GMA 9 Committee's actions, the 90-day public comment period regarding these GMA 9 proposals (Thursday, April 1, 2021 through Wednesday, June 30, 2021), and the need to hold a GCD public hearing on these proposals relevant to each GCD. A copy of this letter to the GCDs is located in the GMA 9 files maintained at the BPGCD offices. In addition, the GMA 9 GCDs made a public comment form available during this period to assist the public in submitting comments to the GCDs. A copy of that form can also be found in the GMA 9 files maintained at the BPGCD offices.

Table 9 provides a summary of GCD public hearing dates, relevant public comments received by either a GMA 9 GCD or the GMA 9 Committee Chairman regarding the proposed non-relevant classifications and DFCs either during the required 90-day public comment period, or during a GCD public hearing held during the public comment period. All GMA 9 member districts received one or more written comments during the 90-day public comment period. The BPGCD, CTGCD, and HTGCD also received verbal public comments at their GCD public hearings. In addition, written comments were also submitted during this period to the GMA 9 Chairman and three local governments (Hays County Commissioners Court, City of Blanco, City of Wimberley) submitted resolutions regarding the proposed DFCs.

Table 9. GCD Public Hearing Dates, and Public Comments Received During 90-Day Public Comment Period (April 1, 2021 through June 30, 2021)

GCD or GMA 9	Proposed Non-Relevant Classification and DFC Public Hearing Date	Written Public Comments Received During 90-Day Public Comment Period	Verbal Public Comments Received at GCD Public Hearing
BCRAGD	May 20, 2021	✓	
BPGCD	June 17, 2021	✓	✓
BSEACD	May 13, 2021	✓	
CTGCD	May 17, 2021	✓	✓
CCGCD	June 14, 2021	✓	
HTGCD	June 3, 2021	✓	✓
HGCD	May 12, 2021	✓	
MCGCD	June 16, 2021	✓	
SWTCGCD	June 9, 2021	✓	
TGRGCD	May 13, 2021	✓	
GMA 9	Not Applicable	✓	

As required by Section 36.108(d-3) of the Texas Water Code, each GMA 9 GCD prepared a summary of the relevant public comments they received during the public hearings and submitted those summaries to the GMA 9 Chairman. As a result of this public comment process and the public hearings held by the GCDs, no GCD board of directors voted to recommend changes to either the proposed non-relevant classifications or the DFC statements.

Copies of all GCD public hearing notices, public comments they received, and GCD public comment summaries are located in the files of the corresponding GCDs. Copies of written public comments submitted directly to the GMA 9 Committee are located in the GMA 9 files maintained in the BPGCD offices.

At the September 27, 2021 meeting, the GMA 9 Committee Chairman presented a summary of questions and comments (both oral and written), for the GMA 9 Committee's consideration (**Appendix C**). This summary includes either a response by the GMA 9 Committee to the question, or a GMA 9 Committee response to the comment that explains why it was or was not incorporated into the DFCs. The questions and/or comments were consolidated into similar comment groupings to allow for more efficient review of the public comments. After the presentation of the public comments summary, the GMA 9 Committee approved by consensus not to make changes to the DFC statements.

Additionally, at the September 27th meeting, the GMA 9 Committee presented and discussed its annual evaluation of the Trinity Aquifer DFC. Their presentations included the methodology used for analyzing water level measurements collected in 2020 from Middle Trinity Aquifer monitoring wells within their GCD, and comparisons of those measurements to their baseline year (2008) measurements. The following is a summary of this discussion.

- BPGCD determined that the total average change in water levels measured from their monitoring wells was nine feet above the water levels measured in the 2008 baseline year.
- TGRGCD determined that the total average change in water levels measured from their monitoring wells was 15 feet below the water levels measured in the 2008 baseline year.
- HTGCD determined that the average change in water levels measured from their monitoring wells was 1.3 feet below the water levels measured in the 2008 baseline year.
- CCGCD determined that the average change in water levels measured from their monitoring wells in the Middle Trinity Aquifer was 18.32 feet below the water levels measured in the 2008 baseline year, when spatially averaged across the county.
- HGCD determined that the average change in water levels measured from their monitoring wells in the Middle Trinity Aquifer was three feet below the water levels measured in the 2008 baseline year and from wells in the Lower Trinity Aquifer was 14 feet below 2008 levels.
- BCRAGD determined that the average change in water levels measured from their monitoring wells was 6.89 feet below the water levels measured in the 2008 baseline year.
- MCGCD provided the following summary of water levels measured from its two monitoring wells: water level values have ranged from 700 feet above mean sea level to 1,000 feet above mean sea level. The current level is approximately 850 feet above mean sea level.
- SWTCGCD is developing a monitoring network to provide data for the Upper, Middle, and Lower Trinity aquifers in SWTCGCD but have a few wells with data from the 2008 baseline year. The water level measured in a single Lower Trinity Aquifer monitoring well in September 2021 was 72 feet below water levels measured in the 2008 baseline year.

Both CTGCD and SWTCGCD lack water level measurements due to being relatively new GCDs. CTGCD stated they have five Middle Trinity Aquifer monitoring wells. SWTCGCD stated they do not have any monitoring wells.

At the November 15, 2021 meeting, the GMA 9 Committee reviewed and discussed the individual GCD GMPs, including how the GCDs were achieving the applicable DFCs. Subsequently, after considering all of the information presented, and further discussion regarding the proposed non-relevant classifications and DFCs, GMA 9 Committee members voted to: 1) approve the *Summarization of Public Comments Received and GMA 9 Responses*; 2) reconfirm the GMA 9 Committee's consensus decision to not make changes to the DFC statements because of the public hearing comments; 3) adopt GMA 9 Resolution No. 111521-01 Adopting the Groundwater Management Area 9 Joint Planning Committee's Proposed Classification of Locally Managed Aquifers as Non-Relevant for Joint-Planning Purposes and the Desired Future Conditions for Relevant Major or Minor Aquifers in GMA 9, and authorizing the GMA 9 Chairman to formally submit them and all other required information to the TWDB; and 4) approve the *Groundwater Management Area 9 2021 Explanatory Report for Desired Future Conditions for Major and Minor Aquifers.*

The GMA 9 Resolution No. 111521-01 adopted on November 15, 2021 is found in **Appendix D** and a copy of the posted meeting notice for the November 15, 2021 meeting, as well as public notices for all in-person and virtual GMA 9 Committee meetings for the 2021 DFC joint-planning cycle are found in **Appendix E** of this ER.

2016 DFC Joint-Planning Process

During the 2016 DFC joint-planning cycle, the GMA 9 Committee undertook detailed consideration of DFCs and non-relevant classifications that subsequently supported the 2021 DFC joint-planning cycles. As stated previously, because the DFCs considered in the 2021 DFC joint-planning cycle are the same as those approved in the 2016 and 2010 DFC joint-planning cycles, it is important to review those DFC joint-planning processes and the considerations that informed the GMA 9 Committee's determinations. The 2016 ER contains a complete discussion of those processes and considerations (GMA 9 2016a).

The 2016 DFC joint-planning cycle began shortly after the TWDB issued MAG amounts in response to the original DFCs adopted by the GMA 9 Committee. Those MAGs were issued on June 22, 2011 for the Ellenburger-San Saba, Hickory, and Marble Falls aquifers, on March 28, 2012 for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, and on March 30, 2012 for the Trinity Aquifer.

The GMA 9 Committee immediately began 2016 DFC joint-planning cycle discussions in the fall of 2011 and continued a methodical and thoughtful approach to conducting joint planning. Two new significant issues, however, impacted the discussions in the 2016 DFC joint-planning cycle: 1) the TWDB would no longer provide GMAs with groundwater availability modeling services and technical support; and 2) the new requirements in Chapter 36 of the Texas Water Code, including a more detailed process to consider and adopt DFCs, and to prepare and submit an ER to support the GMA DFC decisions.

In total, the GMA 9 Committee met 19 times throughout the GMA 9 area during the 2016 DFC joint-planning cycle and continued to obtain the assistance of a Technical Advisory Group, as it had in the preceding DFC joint-planning cycle. Copies of all meeting notices and minutes are located in the GMA 9 files maintained at the BPGCD offices. All GMA 9 Committee meetings were open to the public, and the public was offered an opportunity to provide input at all meetings. Each meeting agenda also included reports by TWDB staff and RWPG representatives on activities for Regions J, K, and L, to ensure communication and coordination between these entities and GMA 9 throughout this process. Lastly, the GMA 9 Committee extended offers to the Comal and Travis counties commissioner's courts, as the two areas in GMA 9 that were without GCDs, to appoint non-voting members to serve on the GMA 9 Committee. Highlights of GMA 9 activities and discussions during the 2016 DFC joint-planning cycle are summarized below.

In the early phases of the 2016 DFC joint-planning cycle, the GMA 9 Committee prepared responses to two petitions challenging the reasonableness of the DFCs that the GMA 9 Committee had adopted for the Edwards Group of the Edwards-Trinity (Plateau) and Trinity aquifers. These petitions are discussed in more detail in the 2016 ER (GMA 9 2016a). The TWDB ultimately issued MAG amounts for these GMA 9 DFCs in March 2012.

From the outset of the 2016 DFC joint-planning cycle, the GMA 9 Committee discussions focused on developing cooperative methods, strategies, organization, and funding to successfully complete the process, given the significant changes both in the Texas Water Code and at the TWDB, for the 2016 DFC joint-planning cycle and future DFC joint-planning cycles.

The GMA 9 Committee also discussed the Committee's review of individual GCD GMPs, including how the GCDs were achieving the applicable DFCs, monitoring strategies, and methodologies for complying with the DFCs and appointing a subcommittee to review various proposals to accomplish this task and agreeing on a methodology and annual schedule for individual GCD and GMA 9 Committee review of GMPs, as required by Chapter 36 of the Texas Water Code.

The GMA 9 Committee spent a great deal of time during this DFC joint-planning cycle considering whether the Ellenburger-San Saba, Hickory, and Marble Falls aquifers should be proposed for classification as non-relevant for joint-planning purposes only pursuant to Title 31, Section 356.31 of the Texas Administrative Code. After much discussion and consideration, in recognition of two GMA 9 GCDs' local priorities, and in an effort to strike a balance in the management area, the GMA 9 Committee voted to declare the Ellenburger-San Saba and Hickory aquifers as relevant in Kendall County only (in GMA 9), and to declare the Ellenburger-San Saba, Hickory, and Marble Falls aquifers non-relevant for the purposes of joint planning in all other parts of GMA 9. The local GCD positions mentioned here are summarized in a May 24, 2013 report prepared by Ronald G. Fieseler, P.G., General Manager of the BPGCD, and Tommy Mathews, P.G., REM, Board President, CCGCD (Fieseler and Mathews 2013). These considerations by the GMA 9 Committee were also discussed in the 2016 ER.

In conjunction with discussions related to the Ellenburger-San Saba, Hickory, and Marble Falls aquifers, the GMA 9 Committee discussed establishing separate DFCs for the Middle Trinity and Lower Trinity aquifers. The GMA 9 Committee previously discussed this DFC proposal during the 2010 DFC joint-planning cycle. Discussions during the 2016 DFC joint-planning cycle included: 1) how much time it might take to analyze these proposals; 2) how the DFCs would be divided locally and regionally; 3) how these DFCs might require new monitoring strategies; and 4) how the new DFCs might affect local GCDs' rules and local GMPs. There were also concerns expressed about whether the current model, the HCT GAM, was capable of accurately defining MAG amounts for these two aquifers. The GMA 9 Committee would keep this item as ongoing and would continue discussions. The GMA 9 Committee also considered whether to classify the Upper Trinity as non-relevant for the purposes of joint planning and decided by consensus to maintain the Upper Glen Rose Aquifer's (Upper Trinity) classification as relevant throughout GMA 9.

Early in the 2016 DFC joint-planning cycle, the GMA 9 Committee voted to conduct a voluntary study to compare actual groundwater level data with groundwater model predictions for the Trinity Aquifer on a well-by-well basis to refine how the model results related to actual water level data, and how these two data sets could be considered and evaluated in future joint-planning efforts. This study was completed in February 2014 with the publication of the final report titled *A Comparison of Groundwater Monitoring Data with Groundwater Model Results Groundwater Management Area 9* efforts (Hutchison and Beach 2014). In summary, the report provided insights into the use of the GAM versus actual well data to advance future planning.

The GMA 9 Committee also received technical presentations, such as a presentation on the TWDB's Total Estimated Recoverable Storage (TERS) amounts for the aquifers in GMA 9, the EAA's *Edwards Aquifer-Trinity Aquifer Inter-Formational Flow Study*, the CCGCD's inter-relationship between spring flow and groundwater levels study, and the BSEACD's hydrogeological studies and atlas updates in eastern GMA 9.

GCD members ultimately agreed to participate in a cost sharing arrangement to retain a consultant to prepare any reports or submissions required by Chapter 36 of the Texas Water Code and the TWDB in the 2016 DFC joint-planning cycle DFC adoptions and issued a request for qualifications to prepare an ER and other submissions that might be required in the joint-planning cycle. The team of Blanton & Associates, Inc. and LBG-Guyton Associates was selected to perform this work on behalf of the GMA 9 Committee. The CCGCD agreed to serve as the contracting district, and costs were split evenly between the GCDs. During discussion related to developing the scope of work for the contract, the GMA 9 Committee members discussed using the existing DFCs as the best starting point for planning purposes. The GMA 9 Committee formed a subcommittee, the ERLS, to work with the team of Blanton & Associates, Inc. and LBG-Guyton Associates on the project. To initiate the ER project, the ERLS and the team of Blanton & Associates, Inc. and LBG-Guyton Associates met with TWDB representatives on January 12, 2015 to review the Texas Water Code and Texas Administrative Code requirements, TWDB checklists, and proposed project schedule and report outline.

As previously mentioned, the GMA 9 Committee received a presentation on the statutory and regulatory requirements related to the 2016 DFC joint-planning cycle in February 2015. For the early stages of ER preparation, GMA 9 Committee discussions included maintaining the same DFCs for the Trinity and Edwards Group of the Edwards-Trinity (Plateau) aquifers that were adopted in the 2010 DFC joint-planning cycle. The rationale also expressed for this proposal consisted of the following: 1) these DFCs were long-term targets; 2) the GCDs had only just begun to assess the water level changes during the first five years of implementing the current DFCs; 3) drought conditions prevailed for most of the five-year period since the DFCs were adopted; and 4) the GCDs believed it would be more effective to assess the DFCs over a longer period.

The GMA 9 Committee also developed a process and form for use during the period before the required 90-day public comment period as stated in Section 36.108(d-2) of the Texas Water Code, and for use during the required 90-day public comment. The public comment process for the period before the required public comment period and the form developed by the GMA 9 Committee to assist the public in submitting comments to the GMA 9 Committee during that time were approved by the GMA 9 Committee on April 27, 2015. One public comment was received by the GMA 9 Committee regarding the proposed non-relevant classifications and/or DFCs before the required 90-day public comment period began. Copies of the meeting notices, minutes, and public comment form are located in the GMA 9 files maintained at the BPGCD offices.

On April 27, 2015, the GMA 9 Committee also authorized the following DFCs and proposed classifications of aquifers as non-relevant for joint-planning purposes only (pursuant to Title 31, Section 356.31 of the Texas Administrative Code) for the purposes of preliminary ER analysis **(Table 10).**

Table 10. GMA 9 Major and Minor Aquifers and Authorized DFC and Non-Relevant Designations for Preliminary ER Analysis Purposes (Pursuant to Title 31, Section 356.31 of the Texas Administrative Code)

Major or Minor Aquifer	Possible Authorized DFC or Non-Relevant Designation for Preliminary ER Analysis Purposes (Authorized by the GMA 9 Committee on April 27, 2015)
Edwards Aquifer (Balcones Fault Zone)	Non-Relevant Designation (throughout GMA 9)
Edwards Group of Edwards-Trinity (Plateau)	Allow for no net increase in average drawdown in Bandera and Kendall counties
	Non-Relevant Designation (throughout GMA 9 except for Bandera and Kendall counties)
Ellenburger-San Saba	Allow for an increase in average drawdown of no more than 2 Feet in Kendall County
	Non-Relevant Designation (throughout GMA 9 except for Kendall County)
Hickory	Allow for an increase in average drawdown of no more than 7 Feet in Kendall County
	Non-Relevant Designation (throughout GMA 9 except for Kendall County)
Marble Falls	Not Applicable (see discussion below)
	Non-Relevant Designation (throughout GMA 9)
Trinity	Allow for an increase in average drawdown of approximately 30 Feet through 2060 (throughout GMA 9)

Throughout the 2016 DFC joint-planning cycle, coordination with TWDB staff was integral. The GMA 9 Committee or its representatives requested and received clarification and assistance with a variety of questions related to this process, and TWDB consideration of the DFCs and DFC statements, proposed non-relevant classifications, GAM issues, and development of the 2016 ER. The GMA 9 Committee also met on June 8, 2015 to discuss the RWP process and potential impacts on the DFCs and resulting MAGs.

On September 28, 2015, the GMA 9 Committee received a comprehensive presentation from Blanton & Associates, Inc. and LBG-Guyton Associates providing them with an overview of the GMA 9 DFC development process, the GMA 9 Committee's proposed non-relevant classifications, possible proposed GMA 9 DFCs including policy and technical justifications for each DFC, and consideration of the nine factors identified in Section 36.108(d) of the Texas Water Code. The GMA 9 Committee was given the opportunity to discuss the nine factors and to consider them in the context of joint planning and the proposed DFCs. A sample copy of the posted meeting notice, and the meeting minutes are located in Appendix A of the 2016 ER. A copy of the presentation is located in the GMA 9 files maintained at the BPGCD offices.

After discussing and considering all of the information presented, including the nine factors listed in Section 36.108(d) of the Texas Water Code, the GMA 9 Committee voted to propose the following aquifers or portions of aquifers be classified as non-relevant for joint-planning purposes only in all or portions of the following specified GMA 9 counties (pursuant to Title 31, Section 356.31 of the Texas Administrative Code) (**Table 11)**.

Table 11. Adopted Proposed Non-Relevant Classifications and Applicable Areas within GMA 9 Pursuant to Title 31, Section 356.31 of the Texas Administrative Code (Approved by the GMA 9 Committee on September 28, 2015)

Proposed Non-Relevant Classification	Applicable Areas Within GMA 9 (All or Portions of the Following Counties)
Edwards Aquifer (Balcones Fault Zone)	Bexar, Comal, Hays, and Travis Counties
Edwards Group of 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

In addition, GMA 9 Committee members voted to adopt the following as proposed DFCs (**Table 12**):

Table 12. Adopted as Proposed DFCs for GMA 9 Major or Minor Aquifers and Applicable Areas within GMA 9 (Approved by the GMA 9 Committee on September 28, 2015)

Major or Minor Aquifer	DFC
Trinity	Allow for An Increase in Average Drawdown of Approximately 30 Feet Through 2060 (throughout GMA 9) Consistent With "Scenario 6" in TWDB GAM Task 10-005
Edwards Group of Edwards-Trinity (Plateau)	Allow for No Net Increase in Average Drawdown in Bandera and Kendall Counties Through 2070
Ellenburger-San Saba	Allow for An Increase in Average Drawdown of No More Than 2 Feet in Kendall County Through 2070
Hickory	Allow for An Increase in Average Drawdown of No More Than 7 Feet in Kendall County Through 2070

Subsequent to these actions, GMA 9 Chairman Ron Fieseler sent a letter to all ten of the GMA 9 GCDs on September 30, 2015 informing them of the GMA 9 Committee's actions, the 90-day public comment period to extend from Thursday, October 1, 2015 through Thursday, December 31, 2015 (a total of 92 days) regarding these GMA 9 proposals, and the need to hold a GCD public hearing on these proposals relevant to each particular GCD. A copy of this letter to the GCDs is located in the GMA 9 files maintained at the BPGCD offices.

In addition, the GMA 9 GCDs made a public comment form available to assist the public in submitting comments to the GCDs during this period. A copy of that form can also be found in the GMA 9 files maintained at the BPGCD offices.

The GMA 9 Committee met again on Monday, October 13, 2015, for additional discussion and consideration of the issues submitted by some of the GMA 9 GCDs on the ninth factor enumerated in Section 36.108(d) of the Texas Water Code. Because they had considered the ninth factor at the previous meeting on September 28th and opted to have more discussion on October 13th, the GMA 9 Committee voted to take an action re-validating all discussions, actions, and votes taken at their September 28, 2015 meeting, including any additional discussion and action taken on the ninth factor as a result of the meeting on October 13th. GMA 9 Committee members also discussed notice requirements and process considerations for holding the required public hearings and received a presentation from the BSEACD on DFC monitoring considerations. As a result of the DFC monitoring discussion, Committee Chairman Fieseler appointed a Technical Advisory Group to meet and develop an approach for this type of assessment. A sample copy of the posted meeting notice, and the meeting minutes for the October 13th GMA 9 joint-planning meeting are included in Appendix A of the 2016 ER.

Table 13 provides a summary of GCD public hearing dates for the 2016 DFC joint-planning cycle, relevant public comments received by either a GMA 9 GCD or the GMA 9 Committee regarding the proposed non-relevant classifications and DFCs either during the required 90-day public comment period, or during a GCD public hearing held during the public comment period. Only the CTGCD, HTGCD, and the GMA 9 Committee received written comments during the 90-day public comment period in the 2016 DFC joint-planning cycle. The BCRAGD, BSEACD, CCGCD, CTGCD, HTGCD, and TGRGCD received verbal public comments at their GCD public hearings.

Table 13. Relevant Public Comments Received by Either GMA 9 GCDs or the GMA 9 Committee During Required 90-Day Public Comment Period (October 1, 2015 Through December 31, 2015)

GCD or GMA 9	Proposed Non-Relevant Classification and DFC Public Hearing Date	Public Comments Received During 90-Day Public Comment Period	Public Comments Received at GCD Public Hearing
BCRAGD	November 5, 2015	None	Yes – H. Bussey
BPGCD	November 19, 2015	None	None
BSEACD	November 19, 2015	None	Yes – B. Bunch/Save Our Springs
CTGCD	December 21, 2015	Yes – J. Madden	Yes – R. Maurer
CCGCD	November 9, 2015	None	Yes – T. Pfeiffer
EAA	December 8, 2015	None	None
HTGCD	November 18, 2015	Yes (8) - M. Heinemann, P. Jones, S. Buse, S. Langenkamp, R. Barker, R. Shoemaker and J. Beal, Wimberley Valley Watershed Association, and R. Slade	Yes – R. Shoemaker-Beal and J. McMeans
HGCD	December 9, 2015	None	None
MCGCD	November 18, 2015	None	None
TGRGCD	November 12, 2015	None	Yes – B. Fenstermaker

Table 13. Relevant Public Comments Received by Either GMA 9 GCDs or the GMA 9 Committee During Required 90-Day Public Comment Period (October 1, 2015 Through December 31, 2015)

GCD or GMA 9	Proposed Non-Relevant Classification and DFC Public Hearing Date	Public Comments Received During 90-Day Public Comment Period	Public Comments Received at GCD Public Hearing
GMA 9	N/A	Yes (4) – Flying L Ranch, Wimberley Valley Watershed Association, Hill Country Alliance, et. al, and R. Barker	N/A

In addition to public hearings noted above, the BCRAGD and the MCGCD each held one additional hearing, as listed in **Table 14**, regarding the GMA 9 Committee's proposed non-relevant classifications and DFCs because of technicalities related to their original public hearing notice postings. The BCRAGD posted notice of a second public hearing and held this hearing on February 26, 2016. The MCGCD also posted notice of a second hearing and held their hearing on February 17, 2016.

Table 14. Relevant Public Comments Received by BCRAGD or MCGCD at Second Public Hearing

GCD or GMA 9	Second Proposed NRAC AND DFC Public Hearing Date	Public Comments Received at Public Hearing
BCRAGD	February 26, 2016	None
MCGCD	February 17, 2016	None

With regard to written public comments received by either the CTGCD, HTGCD, or the GMA 9 Committee during the 90-day public comment period in the 2016 DFC joint-planning cycle, some of this input was provided in the form of a question rather than a comment on a specific DFC. Other input provided to either a GCD or the GMA 9 Committee was related to DFCs in general or an alternative DFC for either the proposed Trinity or Edwards Group of the Edwards-Trinity (Plateau) aquifer DFCs.

GMA 9 Committee Chairman Ron Fieseler prepared a summary of these questions and comments (both oral and written), for GMA 9 Committee consideration (Appendix B of the 2016 ER). This summary included either a response by the GMA 9 Committee to the question, or a GMA 9 Committee response to the comment that explained why it was or was not incorporated into the DFCs. The questions and/or comments were consolidated into similar comment groupings to allow for a more efficient review of the public comments. The members of the GMA 9 ERLS met on two occasions in March 2016 to discuss and review the public comments and draft responses prior to presenting the summary to the GMA 9 Committee for review and consideration.

In addition, as required by Section 36.108(d-3) of the Texas Water Code, each GMA 9 GCD prepared a summary of the relevant public comments they received during the public hearings and submitted those summaries to the GMA 9 Committee. As a result of this public comment process and the public hearings held by the GCDs, no GCD board of directors voted to recommend changes to either the proposed non-relevant classifications or the DFCs.

Copies of all GCD public hearing notices, public comments they received, and GCD public comment summaries are located in the files of that particular GCD. Copies of written public comments submitted directly to the GMA 9 Committee are located in the GMA 9 files maintained in the BPGCD offices.

The GMA 9 Committee met on April 4, 2016 and April 18, 2016, to review and consider the relevant public comments received during the GCD public hearings provided in the GCD summaries, and to review and consider a summary of oral and written comments and/or questions received by either the GCDs or the GMA 9 Committee, and GMA 9 Committee responses.

On April 18, 2016, after considering all of the information presented, and further discussion regarding the proposed non-relevant classifications and DFCs, the GMA 9 Committee members voted to: 1) approve the *Summarization of Public Comments Received and GMA 9 Responses*; 2) adopt GMA 9 Resolution No. 041816-1 – Adopting the Groundwater Management Area 9 Joint Planning Committee's (GMA 9) Classifications of Non-Relevant Aquifers for Joint Planning Purposes and Desired Future Conditions for Relevant Aquifers in GMA 9; and 3) approve the *Groundwater Management Area 9 Explanatory Report for Desired Future Conditions for Major and Minor Aquifers.*

A sample copy of the posted meeting notice for the April 18, 2016 meeting, and GMA 9 Resolution No. 041816-1 adopted on April 18, 2016, were included in Appendix A of the 2016 ER.

Resulting from the DFCs adopted from the 2016 DFC joint-planning cycle, **Table 15** and **Table 16** list the current MAG amounts (in ac-ft) for the Ellenburger-San Saba, Hickory, Edwards Group of the Edwards-Trinity (Plateau), and Trinity aquifers, and the applicable river basins and GMA 9 counties. These MAG amounts were considered in the 2021 RWPs for Regions J, K, and L.

Table 15. Current GMA 9 MAG Amounts for the Ellenburger-San Saba, Edwards Group of the Edwards-Trinity (Plateau), and Hickory Aquifers (2010 through 2070)

Aquifer	County	Regional Water Planning Area	River Basin	Modeled Available Groundwater (in ac-ft)							TWDB Report No.
				2010	2020	2030	2040	2050	2060	2070	
Ellenburger-San Saba	Kendall	L	Guadalupe	64	64	64	64	64	64	64	GR 16-023 MAG
Ellenburger-San Saba	Kendall	L	Colorado	10	10	10	10	10	10	10	GR 16-023 MAG
Edwards Group of the Edwards –Trinity (Plateau)	Bandera	J	Guadalupe	81	81	81	81	81	81	81	GR 16-023 MAG
Edwards Group of the Edwards –Trinity (Plateau)	Bandera	J	Nueces	38	38	38	38	38	38	38	GR 16-023 MAG
Edwards Group of the Edwards –Trinity (Plateau)	Bandera	J	San Antonio	1,890	1,890	1,890	1,890	1,890	1,890	1,890	GR 16-023 MAG
Edwards Group of the Edwards –Trinity (Plateau)	Kendall	L	Colorado	69	69	69	69	69	69	69	GR 16-023 MAG
Edwards Group of the Edwards –Trinity (Plateau)	Kendall	L	Guadalupe	130	130	130	130	130	130	130	GR 16-023 MAG
Hickory	Kendall	L	Colorado	12	12	12	12	12	12	12	GR 16-023 MAG
Hickory	Kendall	L	Guadalupe	128	128	128	128	128	128	128	GR 16-023 MAG

Sources: Jones 2017; Region K 2020; Region L 2020.

Table 16. Current GMA 9 MAG Amounts for the Trinity and Edwards (BFZ) Aquifers (2010 through 2060)

Aquifer	County	Regional Water Planning Area	River Basin	Modeled Available Groundwater (in ac-ft)						TWDB Report No.
				2010	2020	2030	2040	2050	2060	
Trinity	Bandera	J	Guadalupe	76	76	76	76	76	76	GR 16-023 MAG
Trinity	Bandera	J	Nueces	903	903	903	903	903	903	GR 16-023 MAG
Trinity	Bandera	J	San Antonio	6,305	6,305	6,305	6,305	6,305	6,305	GR 16-023 MAG
Trinity	Bexar	L	San Antonio	24,856	24,856	24,856	24,856	24,856	24,856	GR 16-023 MAG
Trinity	Blanco	K	Colorado	1,322	1,322	1,322	1,322	1,322	1,322	GR 16-023 MAG
Trinity	Blanco	K	Guadalupe	1,251	1,251	1,251	1,251	1,251	1,251	GR 16-023 MAG
Trinity	Comal	L	Guadalupe	6,906	6,906	6,906	6,906	6,906	6,906	GR 16-023 MAG
Trinity	Comal	L	San Antonio	3,308	3,308	3,308	3,308	3,308	3,308	GR 16-023 MAG
Trinity	Hays	K	Colorado	4,721	4,710	4,707	4,706	4,706	4,706	GR 16-023 MAG
Trinity	Hays	L	Guadalupe	4,410	4,410	4,410	4,410	4,410	4,410	GR 16-023 MAG
Trinity	Kendall	L	Colorado	135	135	135	135	135	135	GR 16-023 MAG
Trinity	Kendall	L	Guadalupe	6,028	6,028	6,028	6,028	6,028	6,028	GR 16-023 MAG
Trinity	Kendall	L	San Antonio	4,976	4,976	4,976	4,976	4,976	4,976	GR 16-023 MAG
Trinity	Kerr	J	Colorado	318	318	318	318	318	318	GR 16-023 MAG
Trinity	Kerr	J	Guadalupe	15,646	14,129	14,056	13,767	13,450	13,434	GR 16-023 MAG
Trinity	Kerr	J	Nueces	0	0	0	0	0	0	GR 16-023 MAG
Trinity	Kerr	J	San Antonio	471	471	471	471	471	471	GR 16-023 MAG
Trinity	Medina	L	Nueces	1,575	1,575	1,575	1,575	1,575	1,575	GR 16-023 MAG
Trinity	Medina	L	San Antonio	925	925	925	925	925	925	GR 16-023 MAG
Trinity	Travis	K	Colorado	8,920	8,672	8,655	8,643	8,627	8,598	GR 16-023 MAG
Edwards (BFZ)	EAA Jurisdiction	—	—	572,000	572,000	572,000	572,000	572,000	572,00 0	*See footnote

*** Edwards Aquifer Authority (EAA Jurisdiction)**

The MAG volume for the Edwards Aquifer (BFZ) within the jurisdiction of the EAA is set by the Texas Legislature in the EAA Act (May 28, 2007, 8th Leg.). Section 1.14 (c) of the EAA Act states "the amount of per permitted withdrawals from the aquifer may not exceed or be less than 572,000 ac-ft per of water for each calendar year."

Counties within EAA's jurisdiction include all of Uvalde, Medina, and Bexar counties, and parts of Atascosa, Comal, Guadalupe, Caldwell, and Hays counties. The EAA is part of GMAs 7,9,10 and 13. The available groundwater reflected here includes the amounts available for all GMAs within the EAA jurisdiction.

Sources: Jones 2017; Region J 2020; Region K 2020; Region L 2020.

2010 DFC Joint-Planning Process

During the 2010 DFC joint-planning cycle, the GMA 9 Committee undertook detailed consideration of DFCs and non-relevant classifications that subsequently supported the 2016 and 2021 DFC joint-planning cycles. Therefore, a summary of the DFC adoptions resulting from the 2010 DFC joint-planning cycle is included as part of this ER.

The GMA 9 Committee used a methodical process during the 2010 DFC joint-planning cycle to engage and obtain public and stakeholder input. The GMA 9 Committee first met on September 20, 2005 in response to the passage of House Bill Number (H.B. No.) 1763 that amended Chapter 36 of the Texas Water Code to require GCD joint planning. Following this initial meeting, the GMA 9 Committee met numerous times each year and also established a Technical Advisory Group that met several times.

All of these meetings were open to the public who were offered an opportunity to provide input at many of these meetings. During these meetings, the GMA 9 Committee considered a wide variety of issues and viewpoints. The GMA 9 Committee also cooperated with a University of Texas graduate student class that, over a period of approximately one year, conducted stakeholder interviews and prepared a report titled *What do Groundwater Users Want? Desired Future Conditions for Groundwater in the Texas Hill Country* (University of Texas at Austin LBJ School of Public Affairs 2008). This report covered topics such as resource management policy, water use demands, population growth, and potential impacts within GMA 9. The report concluded that public awareness of groundwater planning was critical and that sharing information among the GCDs, TWDB, and other governmental entities would require greater communication. The report also noted that the GCDs within GMA 9 meet regularly and communicate across political and geographic boundaries, and that these GMA 9 meetings are open to the public. All interviewed stakeholders concurred that population growth and withdrawals of groundwater will continue to increase for the foreseeable future within GMA 9, and that DFCs are likely to reflect projected population growth and potential groundwater use, including exempt wells. A subsequent Ph.D. dissertation titled *Finding a Reasonable Aquifer Yield: Decision Support Methods for Groundwater Policy Development in Texas* affirmed the results of the 2008 study (Petrossian 2013). In addition, six public meetings were held to receive stakeholder input on the DFC process, and public hearings were held prior to the GMA 9 Committee taking action to adopt the DFCs.

The most prevalent stakeholder comments GMA 9 Committee members received addressed the desire and need to manage aquifers in such a way as to “protect spring flow and base flow to creeks and rivers” and that the GMA 9 Committee “did not allow mining of the aquifers.” These sentiments were expressed by a diverse group of stakeholders, including landowners, state and local government representatives, environmental organizations, recreational interests, local businesses, and wildlife organizations. Another concern heard most often by the GMA 9 Committee related to not rushing into setting a DFC, giving due consideration to all aspects of the aquifer system, and doing what is best to provide for sustainable water for those who rely on groundwater from GMA 9. During the course of developing and evaluating possible DFCs and through public involvement, the members of the GMA 9 Committee gave due consideration to all of this input.

Throughout the entire process, the members of the GMA 9 Committee were committed to completing this process as required by Chapter 36 of the Texas Water Code and worked together cooperatively to accomplish this effort. As the GMA 9 Committee moved forward, the GMA 9 Committee considered potential impacts of various DFC scenarios on the following:

- Water supply to meet current demands and future development;
- demographic trends;
- RWPs for Regions J, K, and L;
- environmental needs;
- permitted and exempt uses;
- geologic conditions;
- hydrologic characteristics;
- balancing demands and conservation;
- socioeconomic issues; and
- drought.

In addition to the various issues discussed above, the GMA 9 Committee requested and the TWDB prepared numerous technical reports to analyze various DFC scenarios, some of which consisted of hundreds of individual GAM simulations, to provide thorough technical analyses of the issues. **Table 17** lists the TWDB GAM Runs, Tasks, or Aquifer Assessments performed specifically for GMA 9 in the 2010 DFC joint-planning cycle. These documents are available on the TWDB website or in the GMA 9 files maintained at the BPGCD offices.

Table 17. TWDB GMA 9 GAM Runs, Tasks, or Aquifer Assessments

GAM Run, Task, or Aquifer Assessment	Date (In Date Order)	Aquifer	Issues Considered
GAM Run 03-02	March 21, 2003	Trinity	Average well yield in Kendall County
GAM Runs 02-01,-02	March 21, 2003	Trinity	Steady-state water budget in GAM
GAM Run 03-12	July 18, 2003	Trinity	Water budget, storage, and drawdown
GAM Run 03-25	September 2, 2003	Trinity	Recharge, leakage, and total storage for Bandera County
GAM Run 04-18	October 7, 2004	Trinity	Recharge rate in Hays Trinity GCD
GAM Run 05-35	September 12, 2005	Trinity	Impact of pumping on Guadalupe River
GAM Run 07-03	June 13, 2007	Edwards Group of Edwards-Trinity (Plateau)	Impacts from historic and specified baseline pumping
GAM Run 7-18	July 13, 2007	Trinity	Spring flow discharge, 2002 SWP pumping
GAM Run 7-23	August 31, 2007	Trinity	90% spring flow maintenance under drought of record (DOR)

Table 17. TWDB GMA 9 GAM Runs, Tasks, or Aquifer Assessments

GAM Run, Task, or Aquifer Assessment	Date (In Date Order)	Aquifer	Issues Considered
GAM Run 08-15 (unpublished report)	July 8, 2008	Trinity	35 ft drawdown, revised pumpage in Hays and Travis counties
		Edwards Group of Edwards-Trinity (Plateau)	Zero drawdown in Edwards Group of Edwards-Trinity (Plateau) Aquifer
GAM Run 08-20	July 28, 2008	Trinity	15 ft drawdown, revised pumpage in Hays and Travis counties
		Edwards Group of Edwards-Trinity (Plateau)	Zero drawdown in Edwards Group of Edwards-Trinity (Plateau) Aquifer
GAM Run 08-30	August 19, 2008	Trinity	• 35 ft drawdown in Blanco, Bandera, Kerr, and Kendall counties • 15 ft drawdown in Comal, Hays, and Travis counties • 55 ft drawdown in Bexar and Medina counties
		Edwards Group of Edwards-Trinity (Plateau)	Zero drawdown in Edwards Group of Edwards-Trinity (Plateau) Aquifer
GAM Run 08-70	December 2, 2008 (Draft)	Trinity	Increase baseline pumping by (A) 25% and (B) 50% from GAM runs 08-15 and 08-20 • No pumping increase in Edwards or Upper Trinity • Also run the steady-state simulation with no pumping
		Edwards Group of Edwards-Trinity (Plateau)	Zero drawdown in Edwards Group of Edwards-Trinity (Plateau) Aquifer
GTA Aquifer Assessment 08-90mag	March 6, 2009	Edwards Group of Edwards-Trinity (Plateau)	Managed Available Groundwater amounts (by county): • Bandera = 683 ac-ft/year • Kendall = 318 ac-ft/year • Kerr = 1,263 ac-ft/year
GTA Aquifer Assessment 08-09mag	October 1, 2009	Ellenburger-San Saba	Managed Available Groundwater amounts (by county): • Blanco = 2,661 ac-ft/year • Kendall = 9 ac-ft/year • Kerr = 6 ac-ft/year
GTA Aquifer Assessment 08-10mag	October 1, 2009	Hickory	Managed Available Groundwater amounts (by county): • Blanco = 1,163 ac-ft/year • Travis = 1 acre-foot (ac-ft)/year • Hays = 1 ac-ft/year • Kendall = 2 ac-ft/year • Kerr = 4 ac-ft/year
GTA Aquifer Assessment 08-11mag	October 2, 2009	Marble Falls	Managed Available Groundwater amounts (by county): • Blanco = 261 ac-ft/year

Table 17. TWDB GMA 9 GAM Runs, Tasks, or Aquifer Assessments

GAM Run, Task, or Aquifer Assessment	Date (In Date Order)	Aquifer	Issues Considered
GAM Runs 09-011, 09-012 and 09-24	September 14, 2010	Trinity	• 46 years average recharge and 1.5x 2008 pumping + 7 year DOR and 2008 pumping • 46 years average recharge and 1.5x 2008 pumping + 7 year average recharge and 2008 pumping • 46 years average recharge and 1.5x 2008 pumping + 7 year average recharge and 1.5x 2008 pumping • Pumping that would result in up to 45 ft drawdown in Lower Trinity
GAM Runs 09-011, 09-012 and 09-24, Supplement	September 3, 2010	Trinity	DOR assessment based on precipitation estimates from tree-ring study
GAM Task 10-005	September 3, 2010	Trinity	Seven pumping scenarios with pumping ranging from zero to 2x 2008 pumping via 387 50-year simulations incorporating precipitation estimates tree-ring study
GAM Task 10-031: Supplement to GAM Task 10-005	January 25, 2011	Trinity	Additional results and water level contour maps related to four of the seven pumping scenarios (ranging from 2008 pumping, to 2x 2008 pumping) analyzed in GAM Task 10-005 for the Trinity Aquifer
GTA Aquifer Assessment 10-01 MAG	June 22, 2011	Ellenburger-San Saba	MAG amounts (by county) from TWDB for Ellenburger-San Saba Aquifer by GMA 9 County
GTA Aquifer Assessment 10-02 MAG	June 22, 2011	Hickory	MAG amounts (by county) from TWDB for Hickory Aquifer by GMA 9 County
GTA Aquifer Assessment 10-14 MAG	June 22, 2011	Marble Falls	MAG amounts (by county) from TWDB for Marble Falls Aquifer by GMA 9 County
GAM Run 10-049 MAG, Version 2	March 28, 2012	Edwards Group of Edwards-Trinity (Plateau)	MAG amounts (by county) from TWDB Edwards Group of Edwards-Trinity (Plateau) Aquifer by GMA 9 County
GAM Run 10-050 MAG, Version 2	March 30, 2012	Trinity	MAG amounts (by county) from TWDB for Trinity Aquifer by GMA 9 County

Sources: Bradley 2011a-b; Hutchison and Hassan 2011; TWDB 2016f.

In addition, the GMA 9 Committee conducted other technical analysis through the LBJ School of Public Affairs research project as discussed.

To help ensure that the best available information was used, the GMA 9 Committee developed and updated pumping and usage estimates for each GCD within the GMA before adopting the DFCs and used sound scientific principles to help guide their evaluations and decisions.

The GMA 9 Committee ultimately reached its consensus-based decisions on the DFCs after carefully weighing all of the facts discussed at numerous meetings and public forums where the GMA 9 Committee solicited public comments and input. The results of these efforts were reasonable, achievable, scientifically based, and technically-sound DFCs that reflected all of the policy and technical considerations presented to, or discussed by, the GMA 9 Committee. This process underlies all of the DFC actions taken by the GMA 9 Committee in the 2010 DFC joint-planning cycle and is discussed further in Chapter 6.0 of the 2016 ER.

Table 18 lists the DFCs for GMA 9, and **Table 19** lists the MAG amounts (in ac-ft) for the Ellenburger-San Saba, Hickory, Marble Falls, Edwards Group of the Edwards-Trinity (Plateau), and Trinity aquifers, and the applicable river basins and GMA 9 counties, resulting from the 2010 DFC joint-planning cycle.

Table 18. GMA 9 2010 DFC Joint-Planning Desired Future Conditions

Aquifer	DFC Summary	Date DFC Adopted
Edwards Group of Edwards-Trinity (Plateau)	No net increase in average drawdown in Kendall and Bandera counties. Not relevant in Kerr and Blanco counties.	July 26, 2010
Ellenburger-San Saba	Allow for an increase in average drawdown of no more than 2 feet [in Blanco County].	August 29, 2008
Hickory	Allow for an increase in average drawdown of no more than 7 feet [in Blanco County].	August 29, 2008
Marble Falls	Allow for no net increase in average drawdown [in Blanco County].	August 29, 2008
Trinity	Allow for an increase in average drawdown of approximately 30 feet through 2060.	July 26, 2010

Source: TWDB 2016b.

Table 19. GMA 9 2010 DFC Joint-Planning MAG Amounts

Aquifer	County	Regional Water Planning Area	River Basin	MAG (in ac-ft)						TWDB Report No.
				2010	2020	2030	2040	2050	2060	
Marble Falls	Blanco	K	Colorado	261	261	261	261	261	261	AA 10-14 MAG
Ellenburger-San Saba	Blanco	K	Colorado	2,655	2,655	2,655	2,655	2,655	2,655	AA 10-01 MAG
Ellenburger-San Saba	Blanco	K	Guadalupe	6	6	6	6	6	6	AA 10-01 MAG
Hickory	Blanco	K	Colorado	1,162	1,162	1,162	1,162	1,162	1,162	AA 10-02 MAG
Hickory	Blanco	K	Guadalupe	1	1	1	1	1	1	AA 10-02 MAG
Edwards –Trinity (Plateau)[7]	Bandera	J	Guadalupe	21	21	21	21	21	21	GR 10-049 MAG

[7] These MAG amounts are for the Edwards-Trinity (Plateau) Aquifer as listed on the TWDB website. For clarification purposes, GMA 9 adopted the DFC statement for this aquifer on July 26, 2010 and defined it for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer. See Table 18 for GMA 9 DFC adopted statement.

Table 19. GMA 9 2010 DFC Joint-Planning MAG Amounts

Aquifer	County	Regional Water Planning Area	River Basin	MAG (in ac-ft)						TWDB Report No.
				2010	2020	2030	2040	2050	2060	
Edwards –Trinity (Plateau)	Bandera	J	Nueces	101	101	101	101	101	101	GR 10-049 MAG
Edwards –Trinity (Plateau)	Bandera	J	San Antonio	561	561	561	561	561	561	GR 10-049 MAG
Edwards –Trinity (Plateau)	Kendall	L	Colorado	46	46	46	46	46	46	GR 10-049 MAG
Edwards –Trinity (Plateau)	Kendall	L	Guadalupe	103	103	103	103	103	103	GR 10-049 MAG
Edwards –Trinity (Plateau)	Kendall	L	San Antonio	169	169	169	169	169	169	GR 10-049 MAG
Trinity	Bandera	J	Guadalupe	76	76	76	76	76	76	GR 10-050 MAG
Trinity	Bandera	J	Nueces	903	903	903	903	903	903	GR 10-050 MAG
Trinity	Bandera	J	San Antonio	6,305	6,305	6,305	6,305	6,305	6,305	GR 10-050 MAG
Trinity	Bexar	L	San Antonio	24,856	24,856	24,856	24,856	24,856	24,856	GR 10-050 MAG
Trinity	Blanco	K	Colorado	1,322	1,322	1,322	1,322	1,322	1,322	GR 10-050 MAG
Trinity	Blanco	K	Guadalupe	1,251	1,251	1,251	1,251	1,251	1,251	GR 10-050 MAG
Trinity	Comal	L	Guadalupe	6,906	6,906	6,906	6,906	6,906	6,906	GR 10-050 MAG
Trinity	Comal	L	San Antonio	3,308	3,308	3,308	3,308	3,308	3,308	GR 10-050 MAG
Trinity	Hays	K	Colorado	4,721	4,710	4,707	4,706	4,706	4,706	GR 10-050 MAG
Trinity	Hays	L	Guadalupe	4,410	4,410	4,410	4,410	4,410	4,410	GR 10-050 MAG
Trinity	Kendall	L	Colorado	135	135	135	135	135	135	GR 10-050 MAG
Trinity	Kendall	L	Guadalupe	6,028	6,028	6,028	6,028	6,028	6,028	GR 10-050 MAG
Trinity	Kendall	L	San Antonio	4,976	4,976	4,976	4,976	4,976	4,976	GR 10-050 MAG
Trinity	Kerr	J	Colorado	318	318	318	318	318	318	GR 10-050 MAG
Trinity	Kerr	J	Guadalupe	15,646	14,129	14,056	13,767	13,450	13,434	GR 10-050 MAG
Trinity	Kerr	J	Nueces	0	0	0	0	0	0	GR 10-050 MAG
Trinity	Kerr	J	San Antonio	471	471	471	471	471	471	GR 10-050 MAG
Trinity	Medina	L	Nueces	1,575	1,575	1,575	1,575	1,575	1,575	GR 10-050 MAG
Trinity	Medina	L	San Antonio	925	925	925	925	925	925	GR 10-050 MAG
Trinity	Travis	K	Colorado	8,920	8,672	8,655	8,643	8,627	8,598	GR 10-050 MAG
Edwards (BFZ)	EAA Jurisdiction	__	__	572,000	572,000	572,000	572,000	572,000	572,000	*See footnote

*** Edwards Aquifer Authority (EAA Jurisdiction)**

The MAG volume for the Edwards Aquifer (BFZ) within the jurisdiction of the EAA is set by the Texas Legislature in the EAA Act (May 28, 2007, 8th Leg.). Section 1.14 (c) of the EAA Act states "the amount of per permitted withdrawals from the aquifer may not exceed or be less than 572,000 ac-ft per of water for each calendar year."

Counties within EAA's jurisdiction include all of Uvalde, Medina, and Bexar counties, and parts of Atascosa, Comal, Guadalupe, Caldwell, and Hays counties. The EAA is part of GMAs 7,9,10 and 13. The available groundwater reflected here includes the amounts available for all GMAs within the EAA jurisdiction.

Sources: Hassan 2012(a), Hassan(b), Region K 2017, Region L 2017.

These MAG amounts were contained in the 2016 RWPs for Regions J, K, and L.

As the result of DFCs adopted by the GMA 9 Committee in the 2010 DFC joint-planning cycle, three petitions were filed challenging the reasonableness of the adopted DFC for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, and two petitions were filed challenging the reasonableness of the adopted DFC for the Trinity Aquifer. The appeals process regarding the Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFC was resolved during the five-year joint-planning cycle, and the GMA 9 Committee adopted a DFC for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer on July 26, 2010. While the GMA 9 Committee also adopted a DFC for the Trinity Aquifer on July 26, 2010, the two appeals related to the Trinity Aquifer DFC extended finalizing this DFC to February 2012, at which time the TWDB determined this DFC to be reasonable.

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3.0 GMA 9 GCD-MANAGED AQUIFERS PROPOSED FOR CLASSIFICATION AS NON-RELEVANT FOR JOINT-PLANNING PURPOSES ONLY PURSUANT TO TITLE 31, CHAPTER 356 OF THE TEXAS ADMINISTRATIVE CODE

Title 31, Chapter 356 of the Texas Administrative Code provides the district representatives in a GMA the ability to propose an aquifer or portion of an aquifer be classified as non-relevant if the districts determine that aquifer characteristics, groundwater demands, and current groundwater uses do not warrant adoption of a DFC (Title 31, Section 356.31 of the Texas Administrative Code (b)). Pursuant to this rule, GMA 9 Committee members voted on March 22, 2021 to propose portions of certain major and minor aquifers managed locally by GCDs within the management area be classified as non-relevant for the purposes of joint planning for the 2021 DFC joint-planning cycle. **Table 20** below lists the GMA 9 approved proposed non-relevant classifications for portions of the major and minor locally managed aquifers within GMA 9.

Table 20. Approved GMA 9 GCD Managed Aquifers Proposed for Classification as Non-Relevant for Joint-Planning Purposes Only, Pursuant to Title 31, Section 356.31 of the Texas Administrative Code

Proposed Classification as Non-Relevant	Applicable Areas Within GMA 9 (All or Portions of the Following Counties)
Edwards Aquifer (Balcones Fault Zone)	Bexar, Comal, Hays, and Travis Counties
Edwards Group of 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

As detailed in the following discussion, the GMA 9 Committee determined that the aquifer characteristics, groundwater demands, and current groundwater uses for all or portions of these aquifers in GMA 9 do not warrant adopting a DFC. In this ER, the GMA 9 Committee elected to include the required documentation for these portions of major and minor relevant aquifers within the management area for the proposed non-relevant classifications.

These proposed classifications do not impact each local GCD's ability or authority to manage these portions of these aquifers within their jurisdictional boundaries. These aquifers continue to be subject to the GCD's enabling statutes, rules, management plans, and programs, and a GCD's authorities and legal responsibilities can only be amended by an act of the Texas Legislature. Lastly, these aquifers can continue to be addressed in the GCD's rules and management plans that can then be provided to the applicable RWPG to be incorporated into that region's RWP. If all or a portion of an aquifer is proposed for classification as non-relevant, and therefore no DFC or MAG are available, a groundwater availability amount could be determined by either the local GCD working with the RWPG to develop a quantity and incorporate that amount into the RWP or developed by the TWDB for regional water planning purposes.

The following ER sections, reflecting the elements contained in Title 31, Section 356.31 of the Texas Administrative Code (b), provide discussions regarding the GMA 9 Committee's justifications for proposing these classifications and determining that no DFC is required.

3.1 Major Aquifers

The GMA 9 Committee is proposing to classify portions of the Edwards Aquifer (BFZ) managed by the EAA and the Edwards Group of the Edwards-Trinity (Plateau) Aquifer managed by the BPGCD and HGCD located within GMA 9 as non-relevant for the purposes of joint planning.

3.1.1 Edwards Aquifer (BFZ)

The GMA 9 Committee is classifying the Edwards Aquifer (BFZ) as non-relevant for the purposes of joint planning within the GMA 9. The Edwards Aquifer (BFZ) is located within portions of Bexar, Comal, Hays, and Travis counties of GMA 9. This classification does not impact either the BSEACD's authority or ability to manage that portion of Edwards Aquifer's "Barton Springs segment" located in portions of Hays and Travis counties, or the EAA's authority or ability to manage the Edwards Aquifer's "San Antonio segment" located in portions of Bexar, Comal, and Hays counties, as this aquifer remains within these GCDs' jurisdictional boundaries and continues to be subject to their enabling statutes, rules, management plans, and programs.

Aquifer Portion Description, Location, and Map

The following describes the portion of the Edwards Aquifer (BFZ) that the GMA 9 Committee is proposing to classify as non-relevant.

The Edwards Aquifer (BFZ) is a major aquifer in the south-central part of Texas. The Balcones Escarpment defines the southern and eastern edges of the Edwards Plateau. Total area of outcrop for the aquifer is 1,560 square miles, with a 2,314 square mile subsurface area. Thirteen Texas counties contain portions of the aquifer, with 90 percent of the aquifer located within a GCD. Within GMA 9, the Edwards Aquifer is located within the BSEACD and EAA[8]. The total area of the aquifer within GMA 9 is 124,185 acres; the outcrop area is 107,206 acres, or 86 percent of the total area.

The San Antonio segment is located along the southern and southeastern portions of GMA 9 within Bexar, Comal, and Hays counties. The San Antonio segment of the Edwards Aquifer in its entirety extends through parts of Kinney, Uvalde, Zavala, Frio, Medina, Atascosa, Bexar, Comal, Guadalupe, and Hays counties, and covers an area approximately 180 miles long and five to 40 miles wide. The total surface area overlying the aquifer is approximately 3,600 square miles. In addition to GMA 9, the San Antonio segment of the Edwards Aquifer is geographically located within GMAs 7, 10, and 13.

The Edwards Aquifer (BFZ) Barton Springs segment is located in portions of Hays and Travis counties. The southern extent is located between Bear Creek and the Blanco River and the northern extent is the Colorado River in Travis County. The northern segment of the Edwards Aquifer (BFZ) is located north of the Colorado River in Travis, Williamson, and southern Bell counties within GMA 8. The portion located

[8] While a portion of the Edwards Aquifer in Hays County is geographically located within the HTGCD's boundaries, this GCD does not have jurisdiction over the Edwards Aquifer (BFZ).

in Bell County lies within the jurisdiction of the Clearwater Underground Water Conservation District (UWCD).

The proposed non-relevant portions (outcrop and downdip) of the Edwards Aquifer (BFZ) within the boundaries of GMA 9 are depicted in **Figure 11** below.

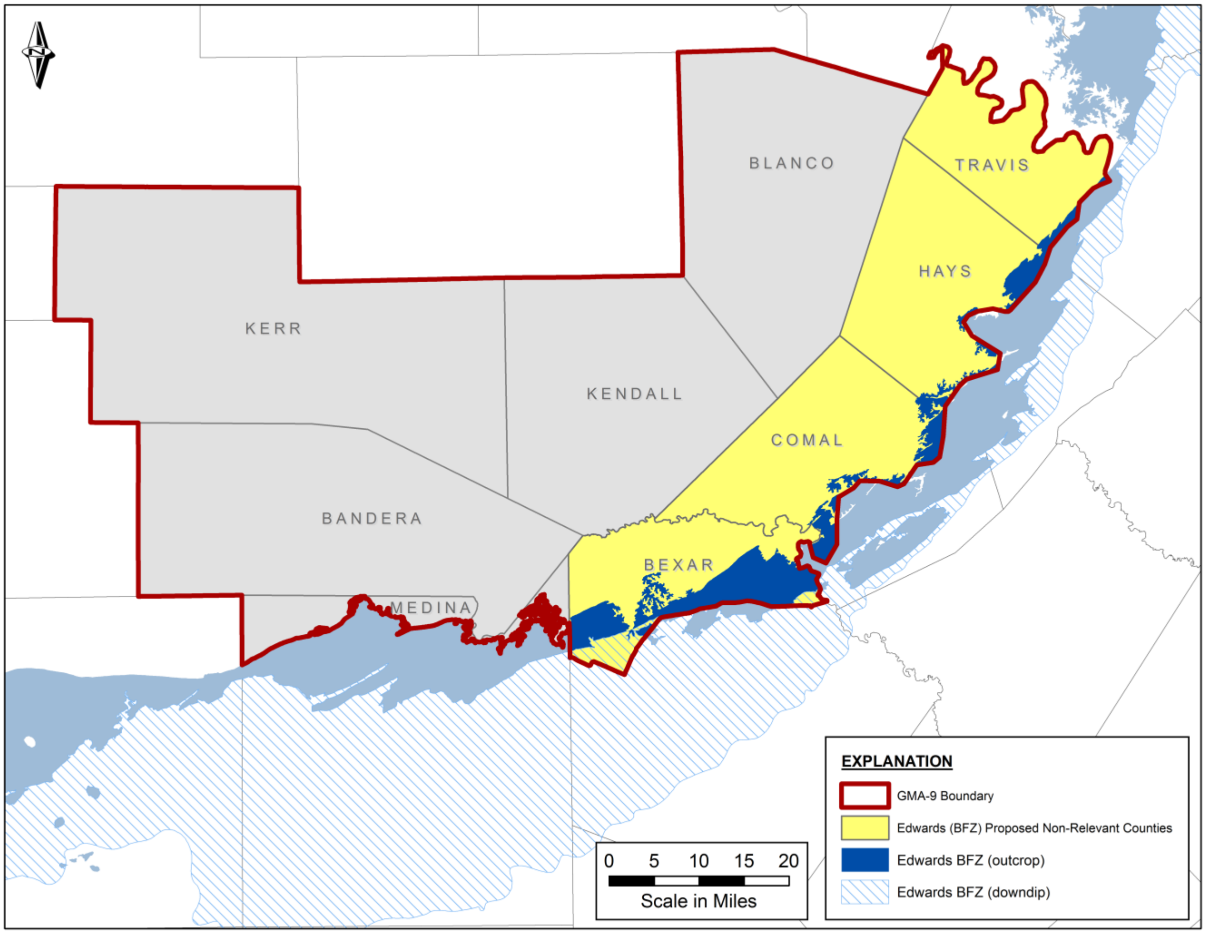

Figure 11. Proposed non-relevant classification of the Edwards Aquifer (BFZ) within GMA 9.

Aquifer Characteristics, Groundwater Demands, Current Groundwater Uses, Including Total Estimated Recoverable Storage

The following describes the aquifer characteristics, groundwater demands, and current groundwater uses, including the TERS amounts calculated by the TWDB, for the portion of the Edwards Aquifer (BFZ) that the GMA 9 Committee is proposing to classify as non-relevant that support the conclusion that DFCs in adjacent or hydraulically connected relevant aquifer(s) will not be affected.

Aquifer Characteristics

The Edwards Aquifer (BFZ) consists of the limestone of the Edwards Group as wells as the Georgetown Formation and the Comanche Peak Limestone, where present. The Edwards Aquifer is between 200 and

600 ft thick and is a limestone karst aquifer with much of the groundwater flow occurring along solution-enlarged openings along joints, faults, and fractures.

Groundwater is present in the Edwards Aquifer (BFZ) under water table conditions in the outcrop area and under confined or artesian conditions in the downdip portion of the formation. It is in the artesian section that most of the groundwater is produced from the Edwards Aquifer. A groundwater divide present near Kyle, Texas in Hays County divides the aquifer into two separate hydrologic regions.

The Edwards Aquifer (BFZ) is a karst aquifer and is characterized by the presence of sinkholes, sinking streams, caves, large springs, and highly productive water wells. Karst aquifers are considered triple permeability aquifers - water is contained in the rock matrix, in fractures and faults, and in caves and conduits. Conduits or solution channels within the aquifer range from the size of a finger to tens of feet in diameter. The interconnected fractures and conduits in the Edwards Aquifer account for its extremely high yielding wells and springs. As is characteristic of many karst aquifers, the aquifer exhibits extremely high (cavernous) porosity and permeability, allowing for the transmission of large volumes of water and enabling groundwater levels within the aquifer to respond quickly to rainfall events (known as recharge). The large-interconnected openings in the rock also exhibit a diverse fauna of more than 40 species including eyeless salamanders, shrimp, and two species of catfish.

Because of the karstic nature of the Edwards Aquifer (BFZ), it generally responds very quickly both to pumping and to recharge. Recharge occurs mainly through the infiltration of precipitation that runs off into local streams and rivers. Much of the recharge occurs in very short periods of time that occur with high precipitation events or via steady loss from streams that cross the outcrop of the aquifer. Discharge from the aquifer is to several very large springs emanating from the aquifer and to pumping from the aquifer. The largest springs in Texas flow from the Edwards Aquifer.

The Edwards Aquifer (BFZ) feeds several well-known springs, including Comal Springs in Comal County, which is the largest spring in Texas, and San Marcos Springs in Hays County, which is the second largest. Hueco, San Pedro, San Antonio, and Leona springs also discharge from the aquifer. Because of the aquifer's highly permeable nature, water levels and spring flows respond quickly to rainfall, drought, and pumping.

Groundwater Demands

The EAA reported that as of January 2021, there were 263 Edwards Aquifer wells regulated by the EAA located within GMA 9's boundaries. Of those wells, 101 were classified as non-exempt (municipal, industrial, or irrigation use) and 162 were exempt (domestic or livestock use). The non-exempt wells were permitted to produce no more than 6,374.134 ac-ft annually[9], and the exempt wells were assumed to produce a total of approximately 102 ac-ft annually. **Figure 12** and **Figure 13**, respectively, show the locations of all non-exempt and exempt wells located within the San Antonio segment of the Edwards Aquifer in GMA 9 in the EAA's boundaries.

[9] The total permitted amount of 6,374.134 ac-ft does not include permits associated with five of the 101 wells. Those five wells are associated with the San Antonio Water System's infrastructure, and when combined, produce less than 2,000 ac-ft/year.

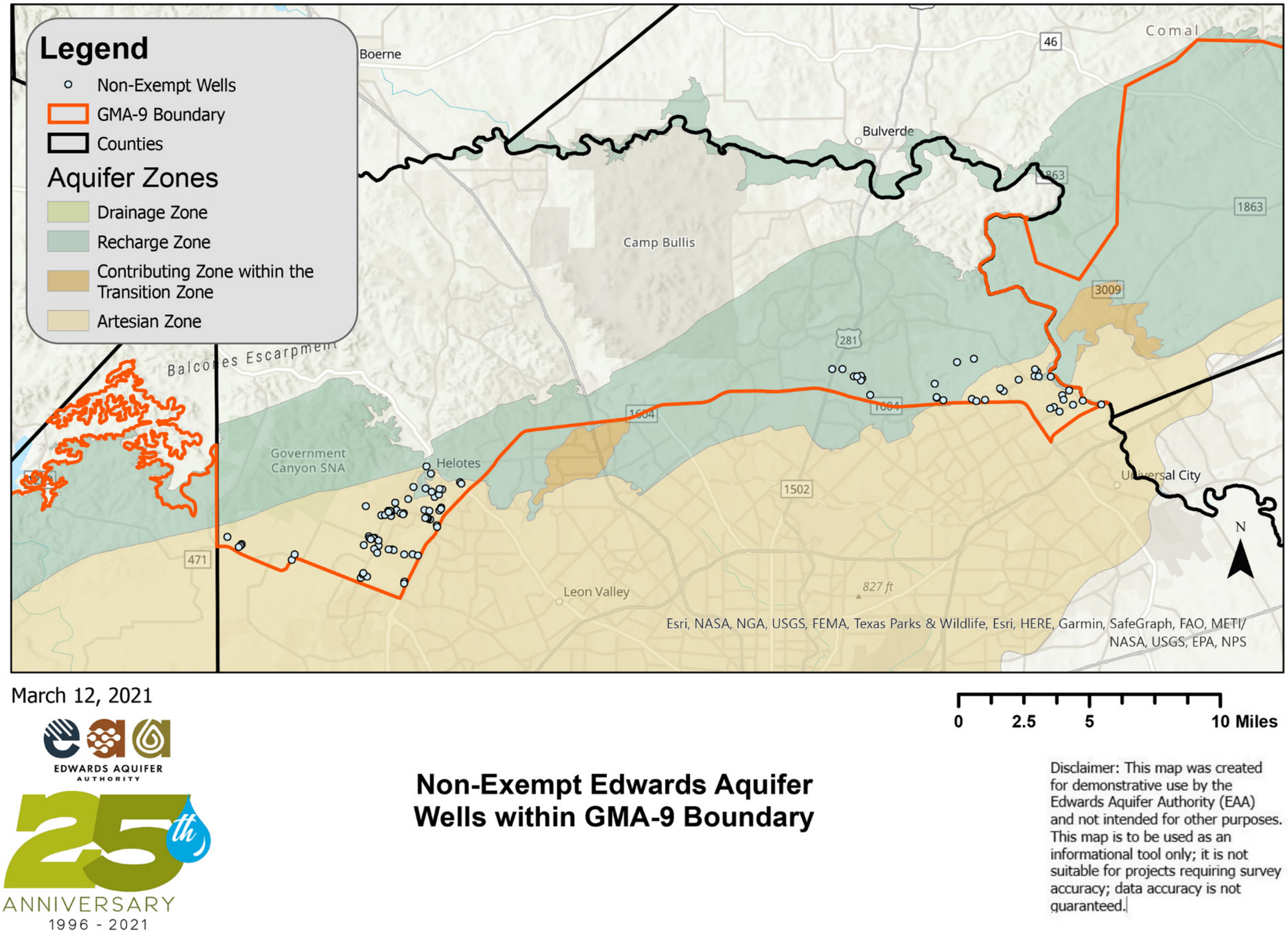

Figure 12. Edwards Aquifer (BFZ) EAA non-exempt wells within GMA 9.

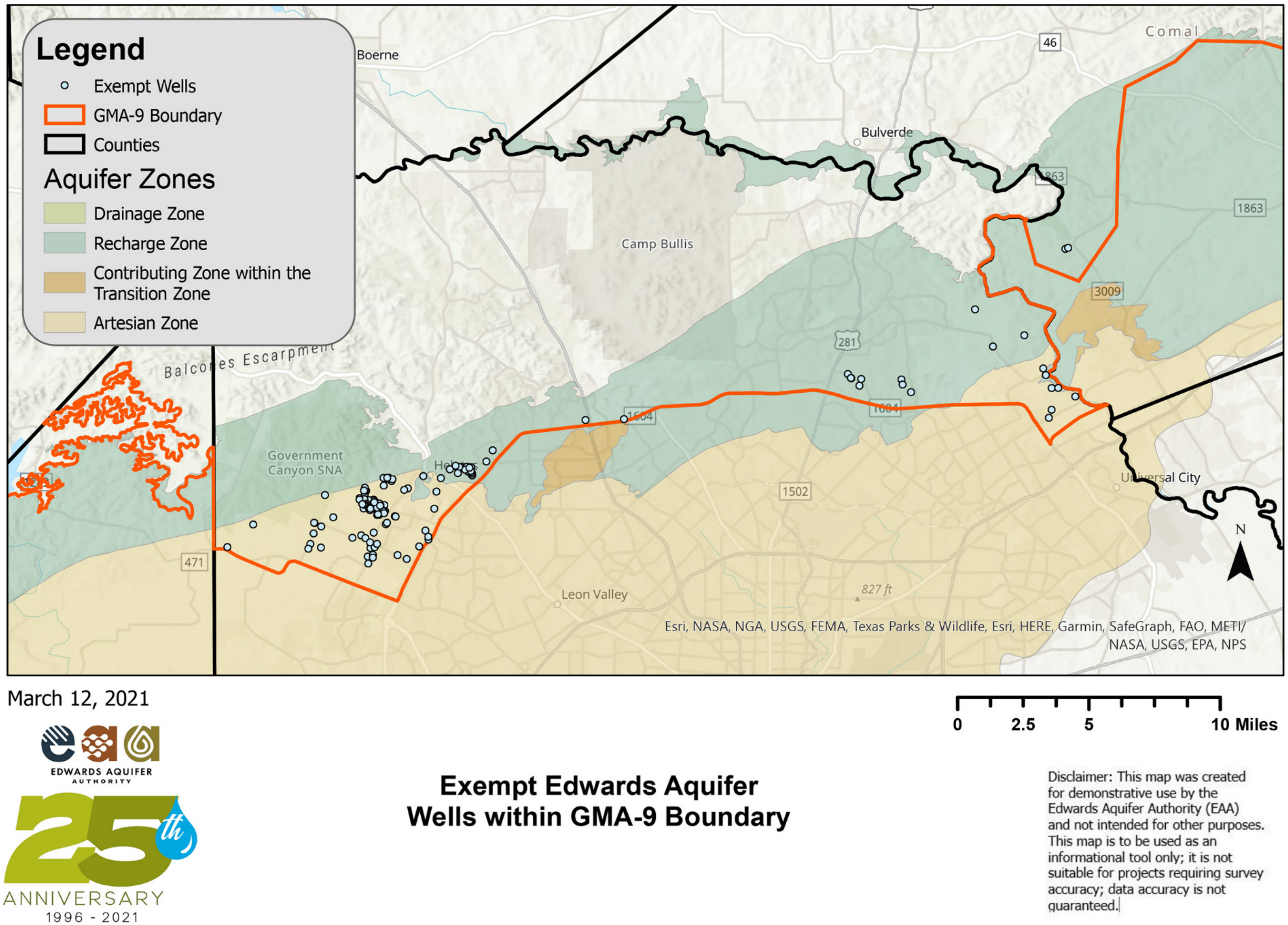

Figure 13. Edwards Aquifer (BFZ) EAA exempt wells within GMA 9.

Current Groundwater Uses

Water from the aquifer is primarily used for municipal, irrigation, industrial, and recreational purposes. The City of San Antonio obtains the majority of its water supply from the Edwards Aquifer (BFZ). There are three main uses for groundwater within the Edwards Aquifer: municipal, irrigation, and industrial.

Total Estimated Recoverable Storage

GCDs are required to consider the TERS volume prior to proposing a DFC. The TERS is defined as a porosity-adjusted volume of groundwater that might be recovered from the aquifer assuming 25 percent or 75 percent recovery. The numbers should be considered as a simplistic approach to estimating an upper limit volume of available groundwater on a volumetric basis only. The TERS numbers are based on porosity-adjusted volumetric calculations of geologic formations without detailed local subsurface data. The TERS is an estimate of total "water-in-place," but there are many other factors that must be considered in assessing groundwater availability, including water quality, producibility via wells, and environmental impacts.

Table 21 presents the TERS volume estimates calculated by the TWDB for the Edwards Aquifer (BFZ).

Table 21. Edwards Aquifer (BFZ) – TERS Amounts within GMA 9 (by GCD)[10]

GMA 9 GCD	Total Storage (ac-ft)	25% of Total Storage (ac-ft)	75% of Total Storage (ac-ft)
No GCD	24,000	6,000	18,000
BSEACD	15,000	3,750	11,250
EAA	220,000	55,000	165,000
HTGCD	4,500	1,125	3,375
Totals	**263,500**	**65,875**	**197,625**

Source: Jones and Bradley 2013.

In addition, the GMA 9 Committee believes the TERS values shown above for the Edwards Aquifer (BFZ) in Hays County and southern Travis County are small compared to previous mapping conducted by the BSEACD in 2004 (Hunt and Smith 2004).

Conclusions Regarding Non-Impacts to Adjacent or Connected Aquifers

Due to the overriding regulatory authority of the EAA, the portion of the Edwards Aquifer located within GMA 9 has been essentially rendered non-relevant for GCDs participating in GMA 9 joint planning. EAA rules require any well completion that penetrates the Edwards Aquifer must seal off and isolate the Edwards section of the well. The GCDs have no rules that allow for permitted wells to be drilled in the Edwards Aquifer. Generally, any production from the Edwards Aquifer is within rural areas and is designated as exempt use. The non-relevant designation of the portions of the Edwards Aquifer (BFZ) within GMA 9 in

[10] Even though the TWDB TERS table for the Edwards Aquifer (BFZ) lists the HTGCD, this GCD does not have jurisdiction to manage that portion of this aquifer located within its boundaries.

Bexar, Comal, Hays, and Travis counties will have no significant impact on joint planning efforts for this resource.

Edwards Aquifer (Balcones Fault Zone) Classified as Non-Relevant for Joint-Planning Purposes within GMA 9

The following is an explanation of why the GMA 9 Committee has proposed to classify the Edwards Aquifer (BFZ) as non-relevant for the purposes of joint planning in those portions of Bexar, Comal, Hays, and Travis counties within GMA 9:

- The Edwards Aquifer is under the regulatory and management jurisdiction of the EAA and the BSEACD;
- Protective aquifer conditions and potential pumping amounts were set for the entirety of the EAA-regulated portion of the Edwards Aquifer (BFZ) (San Antonio segment), when they were adopted by statute during the 80th Regular Session of the Texas Legislature, and can only be amended through subsequent legislative actions;
- Specifically, Sections 1.14(a), (f) and Section 1.26 of the EAA Act serve as the current DFCs, and Section 1.14(c) of the EAA Act serves as the de facto MAG amount (equating to 572,000 ac-ft of permitted withdrawals each calendar year to be used for municipal, industrial, and irrigation purposes, for the San Antonio segment of the Edwards Aquifer (BFZ)) (EAA 2019);
- The language contained in the EAA Act reflects the legislature's determination of the appropriate balance between the highest practicable use of groundwater production and the conservation, preservation, recharging, and prevention of waste within the San Antonio segment, and precludes the use of a GAM for purposes of quantification;
- This statutory language prohibits the GMA 9 Committee from subdividing the San Antonio segment for the purposes of establishing different, GMA-specific DFCs, and precludes the GMA 9 Committee from considering any alternative DFCs;
- These DFCs and MAG for the San Antonio segment cannot be changed during this or any joint planning process and can only be changed by amending the EAA Act, and any public comment or concerns regarding the established DFC and MAG for the San Antonio segment should ultimately be expressed to the Texas Legislature rather than the GMA 9 Committee. Therefore, it is not possible for the GMA 9 Committee to have a meaningful vote on the management of this segment of the aquifer;
- The TWDB has concurred that this language and production limitation in the EAA Act function as the DFCs and MAG amount for the San Antonio segment of the Edwards Aquifer;
- Both the DFC and MAG amount are considered overarching, applying equally to all portions of the San Antonio segment of the Edwards Aquifer, regardless of which GMA the area happens to be located in, with the vast majority of it being located within GMA 10, and under the jurisdiction of the EAA and the BSEACD;

- The portion of the Edwards Aquifer located in GMA 9 in the BSEACD contains a very small amount of water. The BSEACD rules only allow exempt wells to be drilled in this portion of the Edwards Aquifer;
- The amount of pumping in the Edwards Aquifer occurring within GMA 9 is under the management of the EAA and BSEACD, and no other GCDs within GMA 9 have any jurisdiction over this aquifer. The proposed designation for these portions of the Edwards Aquifer (BFZ) as non-relevant will have no significant effect on users located in the downdip sections of the aquifer because the EAA regulates all pumping from the San Antonio segment of Edwards Aquifer (BFZ) within GMA 9, and the BSEACD regulates all pumping from the Barton Springs segment of the aquifer within GMA 9;
- The Edwards Aquifer will continue to be managed locally by the EAA and the BSEACD.

Due to these many unique issues, the EAA was removed from the joint-planning process by legislative action in 2015 with the passage of Senate Bill Number (S.B.) 1336 and is not required to formally participate in joint planning. For region-wide planning purposes only, the Region L RWPG considered both the above-mentioned MAG and additional, mandated reductions in groundwater availability related to conservation measures within the Edwards Aquifer Habitat Conservation Plan and its associated Incidental Take Permit issued by the U. S. Fish & Wildlife Service in 2013.

In summary, the GMA 9 Committee determined that the aquifer characteristics, groundwater demands, and current groundwater uses for that portion of the Edwards Aquifer (BFZ) located in GMA 9 do not warrant adopting a DFC. Therefore, the GMA 9 Committee is proposing that this aquifer located within its boundaries, specifically in parts of Bexar, Comal, Hays, and Travis counties, be classified as non-relevant for joint-planning purposes.

3.1.2 Edwards Group of the Edwards-Trinity (Plateau) Aquifer

The GMA 9 Committee is proposing to classify the Edwards Group of the Edwards-Trinity (Plateau) Aquifer located within those portions of Blanco and Kerr counties within the GMA 9 boundaries as non-relevant for the purposes of joint planning. This proposed classification does not impact either the BPGCD's authority or ability to manage that portion of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer located in Blanco County, or the HGCD's authority or ability to manage that portion of the aquifer located in Kerr County, as these portions of this aquifer remain within these GCDs' jurisdictional boundaries and continue to be subject to their enabling statutes, rules, management plans, and programs.

Aquifer Portion Description, Location, and Map

The following describes the portion of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer that the GMA 9 Committee is proposing to classify as non-relevant.

The Edwards Group of the Edwards-Trinity (Plateau) Aquifer is a major aquifer extending across much of the southwestern part of Texas. Total area of outcrop for the aquifer is 32,294 square miles, with a 2,988 square mile subsurface area. Forty Texas counties contain portions of the aquifer, with 71 percent of the aquifer located within GCDs. Within GMA 9, the Edwards Group is located within the BCRAGD, BPGCD, CCGCD, and HGCD. The total area of the aquifer within GMA 9 is 736,472 acres, and all of this acreage is outcrop area. The total area of the non-relevant portion of the aquifer that is located in Kerr and Blanco counties is 456,791 acres, or approximately 714 square miles.

The proposed non-relevant classification of portions of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer within the boundaries of GMA 9 are depicted in **Figure 14**.

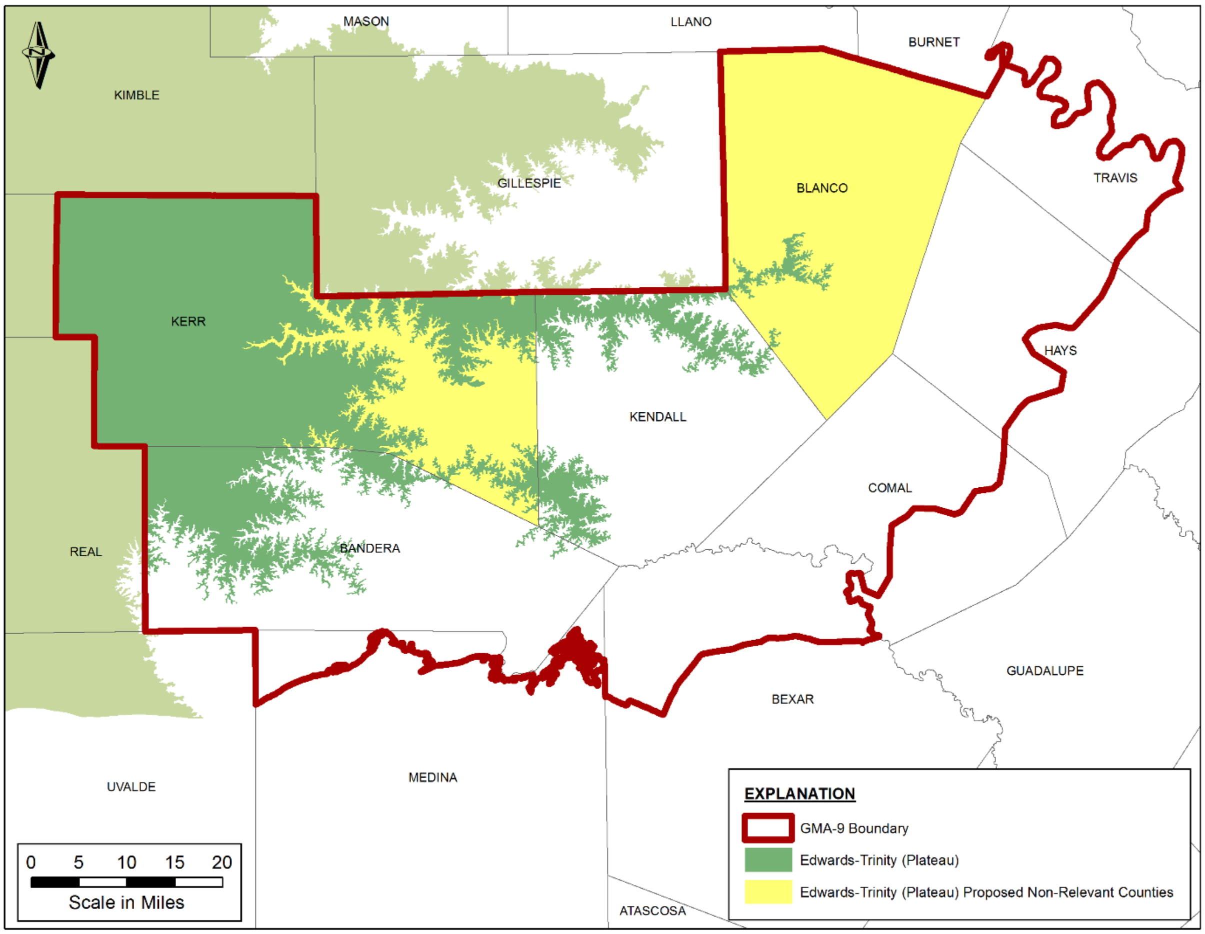

Figure 14. Proposed non-relevant classification of portions of Edwards Group of Edwards-Trinity (Plateau) Aquifer within GMA 9.

Aquifer Characteristics, Groundwater Demands, Current Groundwater Uses, Including Total Estimated Recoverable Storage

The following describes the aquifer characteristics, groundwater demands, and current groundwater uses, including the TERS amounts, for the portion of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer that the GMA 9 Committee is proposing to classify as non-relevant that support the conclusion that DFCs in adjacent or hydraulically connected relevant aquifer(s) will not be affected.

Aquifer Characteristics

The Edwards Group of the Edwards-Trinity (Plateau) Aquifer within GMA 9 is located at higher elevations. It is comprised of relatively thin layers of limestone and dolomite that is an extension of the Edwards Plateau from the west. The upper Edwards portion of the aquifer system is generally more porous and permeable than the underlying Trinity, and where exposed at the land surface, the Edwards-Trinity (Glen Rose) interface gives rise to numerous springs that form the headwaters of several eastward and southerly flowing rivers. In general, yields from the aquifer are low (less than 20 gpm) and the water is used occasionally for rural domestic and livestock demands.

Groundwater in the Edwards Group occurs under both confined and unconfined conditions. Recharge is primarily through the infiltration of precipitation on the outcrop, in particular where the limestone formations outcrop. Discharge is to wells and to the Frio, Medina, Nueces, and Guadalupe rivers in the Hill Country area. Groundwater flow in the Edwards Group is generally in a south-southeasterly direction but may vary locally. The hydraulic gradient averages about 10 ft/mile.

The water-bearing units of the Edwards Group portion in the Edwards-Trinity (Plateau) Aquifer are composed predominantly of limestone and dolomite of the Edwards. The aquifer crops out in a small portion of western Blanco County, in northern Kendall County, and in a majority of Kerr County.

The Edwards Group of the Edwards-Trinity (Plateau) Aquifer within Blanco County is scattered across the west-central part of the county and is located at higher elevations along ridges. It is comprised of relatively thin layers of limestone and dolomite that is an extension of the Edwards Plateau into Blanco County from the west. The Edwards Group in Blanco County exists in an unconfined condition. Recharge is solely from local precipitation occurring over the outcrop. Water not pumped from wells will generally discharge from small seeps and springs at the base of the Edwards outcrop and provides base flow to small streams within the county.

Groundwater Demands

Well yields from the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Blanco County are low (<20 gpm) and the water, if used at all, is used occasionally for rural domestic and livestock demands. No non-exempt wells producing from the Edwards Group were identified by the BPGCD as of May 2021.

Total Estimated Recoverable Storage

Table 22 presents the TERS volume estimates calculated by the TWDB for the Edwards Group.

Table 22. Edwards Group of Edwards-Trinity (Plateau) Aquifer – TERS Amounts within GMA 9 (by GCD)

GMA 9 GCD	Total Storage (ac-ft)	25% of Total Storage (ac-ft)	75% of Total Storage (ac-ft)
BCRAGD	450,000	112,500	337,500
BPGCD	12,000	3,000	9,000
CCGCD	96,000	24,000	72,000
HGCD	1,800,000	450,000	1,350,000
Totals	**2,358,000**	**589,500**	**1,768,500**

Source: Jones and Bradley 2013.

<u>*Current Groundwater Uses*</u>

The following estimates in **Table 23** are from the TWDB water use database for the year 2018. Only those counties that are located within GMA 9 that have estimated use are included. If a county is not listed, then there is no estimated use in TWDB water use surveys.

Table 23. Edwards Group of Edwards-Trinity (Plateau) Aquifer Estimated 2018 Groundwater Use (by GMA 9 County)

GMA 9 County	Type of Use and Estimated Use Amount for 2018 (in ac-ft)						
	Municipal[1]	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Totals
Bandera	49	0	0	0	0	66	**115**
Blanco	0	0	0	0	0	2	**2**
Hays	0	0	0	0	0	3	**3**
Kendall	44	0	0	0	0	19	**63**
Kerr	767[1]	0	0	0	64	138	**969**
Totals	**860**	**0**	**0**	**0**	**64**	**228**	**1,152**

Source: TWDB 2018.

1 HGCD knows of only one Edwards-Trinity (Plateau) public water supply well in the county that was drilled before HGCD passed the rule prohibiting non-exempt wells in the Edwards-Trinity Plateau Aquifer. That well produces approximately 8-acre feet a year and HGCD does not consider it municipal use. The district believes the 767 ac-ft is for domestic and livestock use.

TWDB recently derived exempt use estimates based on Texas State Demographic Center Data, TWDB Water Use Survey data, TWDB water demand projections, and the TWDB Groundwater Database. The exempt use estimates for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer **(Table 24)** are as follows:

Table 24. Edwards Group of Edwards-Trinity (Plateau) Aquifer Estimated Exempt Use (by GMA 9 GCD)

GMA 9 GCD	Estimated Exempt Use by Year (in ac-ft)						
	2020	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**
BCRAGD	153	160	164	165	166	166	166
BSEACD	n/a	n/a	n/a	n/a	n/a	n/a	n/a
BPGCD	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CTGCD	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CCGCD	43	48	54	60	66	73	73
EAA	n/a	n/a	n/a	n/a	n/a	n/a	n/a
HTGCD	n/a	n/a	n/a	n/a	n/a	n/a	n/a
HGCD	1,180	1,368	1,562	1,761	1,979	2,197	2,220
MCGCD	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TGRGCD	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Estimated Exempt Use Totals	**1,333**	**1,528**	**1,726**	**1,926**	**2,145**	**2,363**	**2,386**

Source: TWDB 2020.

Based on these estimates, most exempt use pumping in the Edwards Group in GMA 9 occurs in Kerr County.

<u>*Conclusions Regarding Non-Impacts to Adjacent or Connected Aquifers*</u>

Based on the relatively small volumes used from the Edwards group of the Edwards Trinity Plateau Aquifer in Kerr and Blanco Counties, the proposed non-relevant status of this aquifer in Blanco and Kerr counties will not significantly affect other users, proximal GCDs, or other entities involved in the joint-planning purposes for the Edwards portions of this aquifer that exists within the GMA 9 boundary.

Portions of the Edwards Group of Edwards-Trinity (Plateau) Aquifer Classified as Non-Relevant for Joint-Planning Purposes within GMA 9

The following is an explanation of why the GMA 9 Committee is proposing to classify the Edwards Group of the Edwards-Trinity (Plateau) Aquifer as non-relevant for the purposes of joint planning in those portions of Blanco and Kerr counties within GMA 9.

The TWDB calculated the following possible MAG volumes in GMA 9 for this aquifer during the 2016 DFC joint-planning cycle: Bandera County – 2,009 ac-ft; and Kendall County – 199 ac-ft (Jones 2017). The GMA 9 Committee has proposed to set a DFC for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Bandera and Kendall counties. The aquifer does not extend into Medina, Bexar, Comal, Hays, or Travis counties.

The GMA 9 Committee has proposed to classify the Edwards Group of the Edwards-Trinity (Plateau) Aquifer as non-relevant for the purposes of joint planning in Blanco and Kerr counties for the following reasons:

- The Trinity Aquifer is the principal source of groundwater in Kerr County. No significant pumping occurs from the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Blanco and Kerr counties. Any pumping that does occur is likely designated for exempt wells in rural portions of the counties;

- The proposed non-relevant status of this aquifer in Blanco and Kerr counties will not affect other users, proximal GCDs, or other entities involved in joint planning for the Edwards portions of this aquifer that exists within the GMA 9 boundary or in other GMAs;
- The BPGCD has no record of any well producing water from this aquifer, which was limited to an approximate thickness of 30-60 ft and capped some of the hills in west-central Blanco County;
- For the HGCD, this aquifer should be declared as not relevant in Kerr County because: 1) the Edwards Group of the Edwards-Trinity (Plateau) Aquifer is considered to be less than 10 percent of groundwater use in Kerr County; 2) their rules prohibit non-exempt wells to be drilled into this aquifer; and 3) pumping from this aquifer is from exempt wells primarily used for domestic and livestock purposes, and the GCD's ability to regulate these wells was limited;
- The Edwards Group of the Edwards-Trinity (Plateau) Aquifer will continue to be managed locally by the individual GCDs that have jurisdiction.

In summary, the GMA 9 Committee determined that the aquifer characteristics, groundwater demands, and current groundwater uses for that portion of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer located in GMA 9 do not warrant adopting a DFC. Therefore, the GMA 9 Committee is proposing that this aquifer located within its boundaries, specifically in parts of Blanco and Kerr counties, be classified as non-relevant for joint-planning purposes.

3.2 Minor Aquifers

The GMA 9 Committee is proposing to classify portions of the Ellenburger-San Saba Aquifer, Hickory, and Marble Falls aquifers located within GMA 9 and managed by the BPGCD, HGCD, HTGCD, and SWTCGCD as non-relevant for the purposes of joint planning.

3.2.1 Ellenburger-San Saba Aquifer

The GMA 9 Committee is proposing to classify the Ellenburger-San Saba Aquifer located within Blanco and Kerr counties within GMA 9 as non-relevant for the purposes of joint planning. This proposed classification does not impact either the BPGCD's authority or ability to manage this portion of the aquifer located in Blanco County, or the HGCD's authority or ability to manage the portion of this aquifer located in Kerr County, as these portions of the aquifer are within these GCDs' jurisdictional boundaries and continue to be subject to their enabling statutes, rules, management plans, and programs. In Kerr County, exploration has begun in the Ellenburger-San Saba Aquifer. A possible DFC will be considered in the next cycle of joint planning.

Aquifer Portion Description, Location, and Map

The following describes the portion of the Ellenburger-San Saba Aquifer that the GMA 9 Committee is proposing to classify as non-relevant.

The Ellenburger-San Saba Aquifer is a minor aquifer that is found in the Llano Uplift area of central Texas. Total area of outcrop for the aquifer is 1,147 square miles, with a 4,262 square mile subsurface area. Sixteen Texas counties contain portions of the aquifer, with 84 percent of the aquifer located within a GCD. Within GMA 9, the Ellenburger-San Saba Aquifer is located within the BPGCD, CCGCD, and HGCD. The total area of the aquifer within GMA 9 is 479,619 acres; the outcrop area is 47,890 acres, or 11 percent of the total area.

The proposed non-relevant classification of portions of the Ellenburger-San Saba Aquifer within GMA 9 are depicted in **Figure 15**.

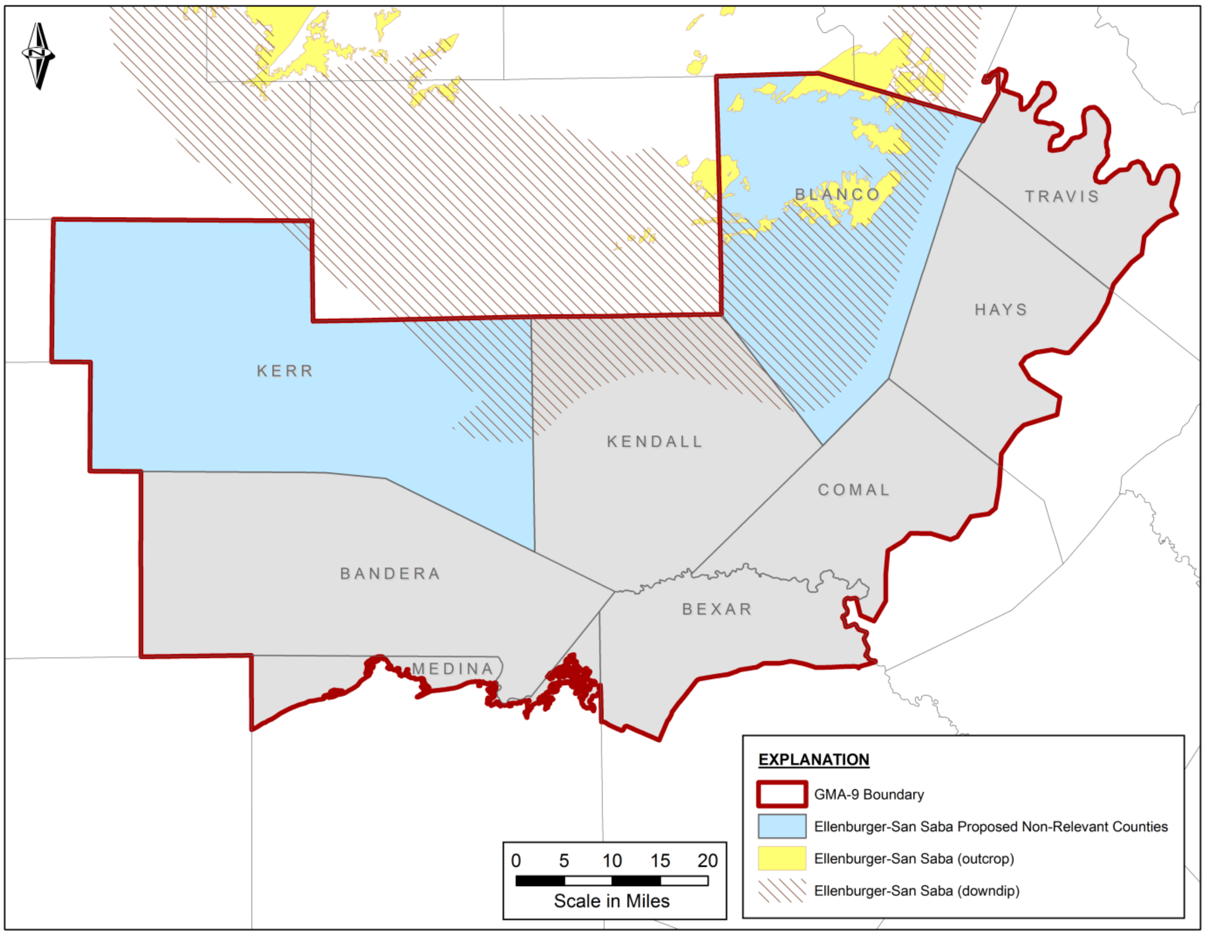

Figure 15. Proposed non-relevant classification of portions of Ellenburger-San Saba Aquifer within GMA 9.

Aquifer Characteristics, Groundwater Demands, Current Groundwater Uses, Including Total Estimated Recoverable Storage

The following describes the aquifer characteristics, groundwater demands, and current groundwater uses, including the TERS amounts, for the portion of the Ellenburger-San Saba Aquifer that the GMA 9 Committee is proposing to classify as non-relevant that support the conclusion that DFCs in adjacent or hydraulically connected aquifer(s) will not be affected.

Aquifer Characteristics

The Ellenburger-San Saba Aquifer is a Cambrian age limestone and dolomite aquifer that occurs in parts of 15 counties in the Llano Uplift area of central Texas. Most of the water produced from this aquifer is used for municipal water supply purposes, mainly in Mason, McCulloch, and Menard counties. The cities of Fredericksburg, Johnson City, Bertram, and Richland Springs have all used the Ellenburger-San Saba Aquifer as a public water supply.

The Ellenburger-San Saba Aquifer consists of limestones and dolomites of the San Saba Member of the Wilberns Formation and the Ellenburger Group. The Ellenburger-San Saba Aquifer was highly eroded prior to being covered by sediments, which results in a large variation in thickness, ranging from 0 to 1,000 ft.

The aquifer generally encircles the Llano Uplift, and the downdip portion extending to depths of approximately 3,000 ft below land surface. In some areas the overlying beds are thin or absent, and here the Ellenburger-San Saba Aquifer may be hydrologically connected to the Marble Falls Aquifer. Local and regional block faulting has significantly compartmentalized the Ellenburger-San Saba, but dissolution along such faulting and related fractures has formed various sized cavities, which are the major water-bearing features of the aquifer.

Average effective recharge from precipitation is estimated to be two percent of annual precipitation (Preston et al. 1996) and is only applied to outcrop areas. Groundwater in the Ellenburger-San Saba Aquifer primarily occurs in the dissolution cavities formed along faults and related fractures. Groundwater is found mostly under artesian conditions, even in much of the outcrop area. The depth to groundwater varies from 30 to over 200 ft below ground surface. Transmissivity estimates range from 56,000 to 126,000 gpd/ft, and the coefficient of storage has been estimated at 0.0022. Production from public supply and irrigation well yields range from 200 to 1,500 gpm, although most other wells generally yield less than 100 gpm. The average well yield from all types of wells is about 65 gpm.

Groundwater Demands

Most of the groundwater in the Ellenburger-San Saba Aquifer is used for municipal purposes, and the remainder for irrigation and livestock. The aquifer is used by the City of Johnson City, and many domestic and livestock users in that part of Blanco County. A large portion of water flowing from San Saba Springs, which is the water supply for the City of San Saba (outside of the GMA 9 boundaries), is thought to be from the Ellenburger-San Saba and Marble Falls aquifers.

Current Groundwater Uses/Total Estimated Recoverable Storage

Table 25 presents the TERS volume estimates calculated by the TWDB for the Ellenburger-San Saba Aquifer.

Table 25. Ellenburger-San Saba Aquifer – TERS Amounts within GMA 9 (by GCD)

GMA 9 GCD	Total Storage (ac-ft)	25% of Total Storage (ac-ft)	75% of Total Storage (ac-ft)
BPGCD	8,300,000	2,075,000	6,225,000
CCGCD	3,500,000	875,000	2,625,000
HGCD	2,100,000	525,000	1,575,000
Totals	**13,900,000**	**3,475,000**	**10,425,000**

Source: Jones and Bradley 2013.

Table 26 contains numbers from the most recent year of available data from the TWDB water use database. It lists only those counties with a reported use from the aquifer.

Table 26. Ellenburger-San Saba Aquifer 2018 Groundwater Use (by GMA 9 County)

GMA 9 County	Type of Use and Estimated Use Amounts for 2018 (in ac-ft)						
	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Totals
Blanco	175	0	0	0	1,367	87	**1,629**
Totals	**175**	**0**	**0**	**0**	**1,367**	**87**	**1,629**

Source: TWDB 2018.

The TWDB recently derived exempt use estimates based on Texas State Demographic Center Data, TWDB Water Use Survey data, TWDB water demand projections, and the TWDB Groundwater Database. The exempt use estimates are shown below in **Table 27.**

Table 27. Ellenburger-San Saba Aquifer Estimated Exempt Use (by GMA 9 GCD)

GMA 9 GCD	Estimated Exempt Use by Year (in ac-ft)						
	2020	2030	2040	2050	2060	2070	2080
BPGCD	267	295	310	320	327	331	331
Estimated Exempt Use Totals	**267**	**295**	**310**	**320**	**327**	**331**	**331**

Source: TWDB 2020.

Based on these estimates, primary use of the Ellenburger-San Saba Aquifer in GMA 9 is for irrigation in Blanco County (1,367 ac-ft). Annually, about 267 ac-ft is pumped for exempt uses.

Conclusions Regarding Non-Impacts to Adjacent or Connected Aquifers

Due to minimal current pumping and geological and hydrogeological characteristics, none of the production from the Ellenburger-San Saba Aquifer has any effect on other GCDs within GMA 9.

Portions of the Ellenburger-San Saba Aquifer Classified as Non-Relevant for Joint-Planning Purposes within GMA 9

The following is an explanation of why the GMA 9 Committee has proposed to classify the Ellenburger-San Saba Aquifer as non-relevant for the purposes of joint planning in those portions of Blanco and Kerr counties within GMA 9. The aquifer does not extend into Bandera, Medina, Bexar, Comal, Hays, or Travis counties.

The GMA 9 Committee approved to propose classification of the Ellenburger-San Saba Aquifer as non-relevant for the purposes of joint planning in Blanco and Kerr counties for the following reasons:

- There is no known production of groundwater from the Ellenburger-San Saba Aquifer in Kendall County;
- There are two wells completed in the Ellenburger-San Saba in Kerr County. One well is a monitoring well in the northern portion of the county, and the other well is a permitted public water supply well (2,420 ac-ft/year) in Kerrville. These two wells indicate that the Ellenburger-San Saba can produce reasonable quantities of water in Kerr County in some locations;
- The largest Ellenburger-San Saba Aquifer permitted well system (460 ac-ft/year) in Blanco County is owned by the City of Johnson City, and this public water supply system is already regulated by both the Texas Commission on Environmental Quality (TCEQ) and the BPGCD. Except for a few small-volume permitted wells, the rest of Ellenburger-San Saba production is from exempt domestic and/or livestock watering wells;
- The Ellenburger-San Saba Aquifer will continue to be managed locally by the individual GCDs that have jurisdiction; and
- Due to geological and hydrogeological characteristics, none of the production from the Ellenburger-San Saba Aquifer has any effect on other GCDs within GMA 9, and classifying the Ellenburger-San Saba Aquifer as non-relevant in Blanco and Kerr counties will have no significant impact on surrounding entities or the joint planning process.

The GMA 9 Committee determined that the aquifer characteristics, groundwater demands, and current groundwater uses for that portion of the Ellenburger-San Saba Aquifer located in GMA 9 do not warrant adopting a DFC. Therefore, the GMA 9 Committee is proposing that portions of this aquifer located within its boundaries, specifically in parts of Blanco and Kerr counties, be classified as non-relevant for joint-planning purposes.

3.2.2 Hickory Aquifer

The GMA 9 Committee is proposing to classify the Hickory Aquifer located within Blanco, Hays, Kerr, and Travis counties within the GMA 9 boundaries as non-relevant for the purposes of joint planning. This proposed classification does not impact the BPGCD's authority or ability to manage that portion of the Hickory Aquifer in Blanco County, the HTGCD's authority or ability to manage that portion of the Hickory Aquifer in Hays County, the HGCD's authority or ability to manage that portion of the aquifer in Kerr County, the SWTCGCD's authority or ability to manage that portion of the aquifer in Travis County, or the BSEACD's ability or authority as it relates to the aquifer located in Hays and Travis counties, as these portions of this aquifer remain within these GCDs' jurisdictional boundaries and continue to be subject to their enabling statutes, rules, management plans, and programs.

Aquifer Portion Description, Location, and Map

The following describes the portion of the Hickory Aquifer that the GMA 9 Committee is proposing to classify as non-relevant.

The Hickory Aquifer is a minor aquifer found in the central part of the state, consisting of the water-bearing parts of the Hickory Sandstone Member of the Riley Formation. Total area of outcrop for the aquifer is 271 square miles, with an 8,193 square mile subsurface area. Within GMA 9, the Hickory is located within the BPGCD, BSEACD, CCGCD, HTGCD, HGCD, and SWTCGCD. The total area of the aquifer within GMA 9 is 1,056,750 acres; the outcrop area is 11,597 acres, or one percent of the total area.

The proposed non-relevant classification of portions of the Hickory Aquifer within GMA 9 are shown in **Figure 16**. Except for some outcrop areas in Blanco County, the Hickory Aquifer extends downdip below other hydrogeologic units in Kerr, Hays, and Travis counties.

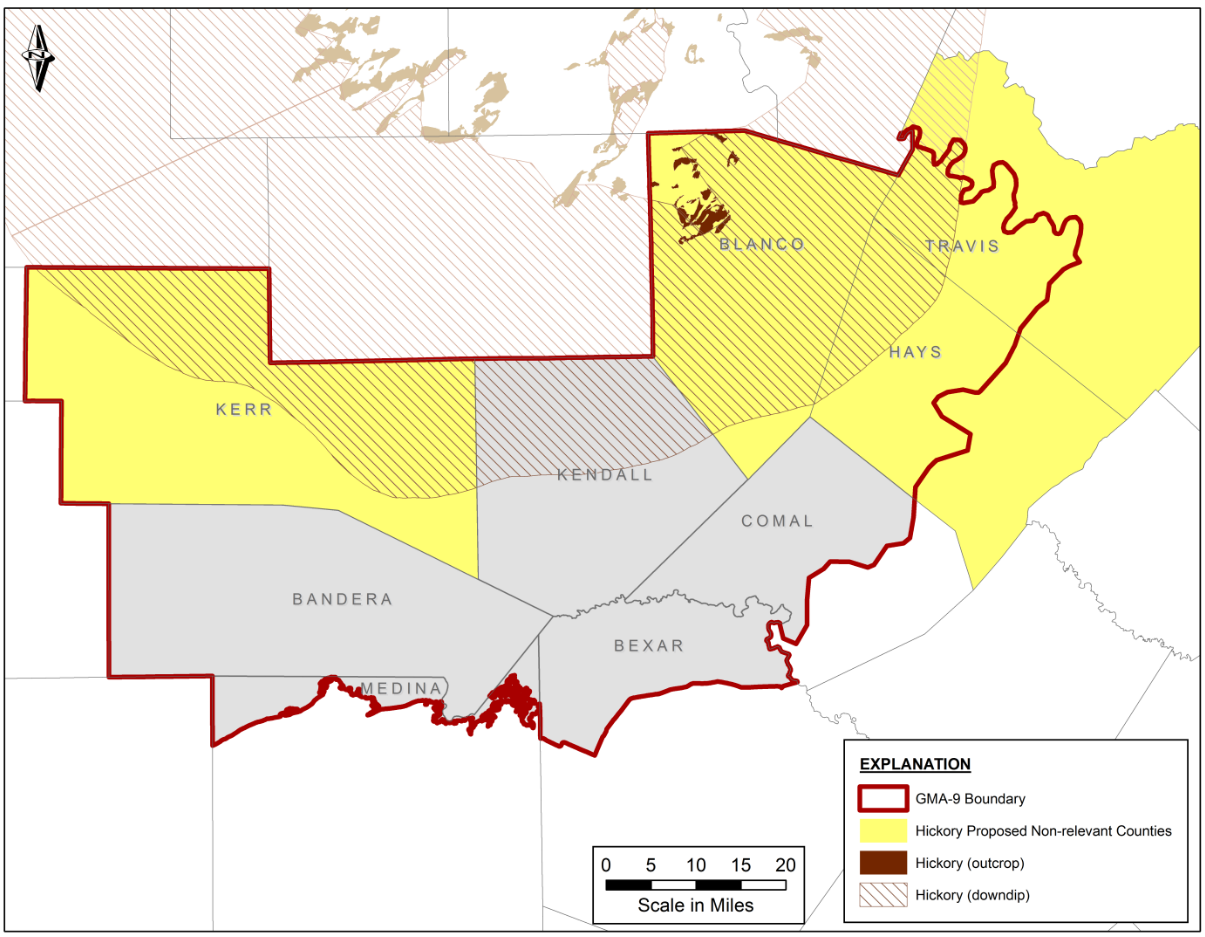

Figure 16. Proposed non-relevant classification of portions of Hickory Aquifer within GMA 9.

Aquifer Characteristics, Groundwater Demands, Current Groundwater Uses, Including Total Estimated Recoverable Storage

The following describes the aquifer characteristics, groundwater demands, and current groundwater uses, including the TERS amounts, for the portion of the Hickory Aquifer that the GMA 9 Committee is proposing to classify as non-relevant that support the conclusion that DFCs in adjacent or hydraulically connected relevant aquifer(s) will not be affected.

Aquifer Characteristics

The Hickory Aquifer is a Cambrian age sandstone aquifer that occurs in 19 counties in the Llano Uplift region of central Texas. Most of the water currently pumped from the Hickory is used for irrigation and livestock purposes, with a smaller amount used for municipal supply purposes. Most of the pumping from the Hickory occurs in Mason County, where almost all is used for irrigation.

The Hickory Sandstone is located around the exposed Precambrian rocks that form the Llano Uplift. Outcrops of the Hickory are discontinuous, and block faulting has compartmentalized much of the Hickory aquifer, and these restrict groundwater flow in some areas. The downdip, confined portion of the aquifer encircles the uplift and extends to maximum depths greater than 4,500 ft.

Groundwater in the Hickory Aquifer occurs under both water table and artesian conditions. Groundwater is generally found under water table conditions in the outcrop area, and under artesian conditions downdip. A majority of the groundwater production occurs in the outcrop area. Transmissivity estimates range from 5,000 to over 40,000 gallons/day/foot (gpd/ft) and confined storage values range from 0.0001 to 0.00004. Yields of large-capacity wells usually range between 200 and 500 gpm, although some wells have yields in excess of 1,000 gpm. The highest well yields are typically found northwest of the Llano Uplift, where the aquifer has the greatest saturated thickness. The depth to groundwater in the Hickory Aquifer varies from 10 to over 300 ft below ground surface, and typical well depths near the Hickory outcrop area range from 50 to 200 ft but can be as deep as 2,000 to 5,000 ft deep at the outer downdip extents of the aquifer.

Recharge to the Hickory Aquifer is from the infiltration of precipitation on the outcrop and from the downward leakage from the overlying Trinity Aquifer. Average effective recharge from precipitation is estimated to be 2.7 percent of annual precipitation and is only applied to outcrop areas. The amount of recharge from the Trinity is unknown. Groundwater flow is from the recharge areas to downdip areas. Exact groundwater flow directions and rates are not known due to the lack of available data and the complexity of the system. However, in general, groundwater flows radially downdip away from the central part of the Llano Uplift. Discharge from the Hickory is to wells and through cross-formational leakage to overlying units.

The Hickory Aquifer is comprised of sandstone with outcrop found in northwestern Blanco County and subcrop in western Hays County, western Travis County, northern Kendall County, and north and eastern Kerr County.

Exposures are highly irregular in shape, due to both faulting and overlapping by rocks of Cretaceous age. This aquifer dips predominantly southeastward from the outcrop areas at angles of about 10 degrees in some areas. The Hickory yields low to moderate quantities of water. Well drillers have reported new wells producing up to 30 gpm. Recharge to the Hickory occurs from local precipitation on its outcrop and through the overlying units, where it is in the subsurface.

The extent of the Hickory in Hays County is defined by an interpretation of the Ouachita Fold Belt thrust front and the Ouachita Facies (Flawn et al. 1961). The Hickory Aquifer within the HTGCD is limited to the Paleozoic Foreland Facies within the western edge of Hays County.

Groundwater Demands

Groundwater is used for irrigation throughout the extent of the Hickory Aquifer and for municipal supply in the cities of Brady, Mason, and Fredericksburg. Each of these cities are located northwest and outside of GMA 9.

There are currently no known drilled wells in the Hickory Aquifer in Hays, Kerr, and Travis counties; there is no historic pumping or aquifer level data. Water demand in western Hays County is primarily for residential use and livestock use. This rural demand is met by Middle Trinity Aquifer wells producing from the Lower Glen Rose and the Cow Creek formations. HTGCD has no known Hickory wells in its database. Additionally, while the downdip extent of the Hickory Aquifer extends into western Travis County, the aquifer's considerable depth prevents it from being economically viable for production in the SWTCGCD. The overlying Trinity aquifers (Lower and Middle) serve as the primary source of groundwater throughout the SWTCGCD.

Current Groundwater Uses/Total Estimated Recoverable Storage

Table 28 presents the TERS volume estimates calculated by the TWDB for the Hickory Aquifer.

Table 28. Hickory Aquifer – TERS Amounts within GMA 9 (by GCD)

GMA 9 GCD	Total Storage (ac-ft)	25% of Total Storage (ac-ft)	75% of Total Storage (ac-ft)
No GCD	24,000	6,000	18,000
BPGCD	4,700,000	1,175,000	3,525,000
CCGCD	2,100,000	525,000	1,575,000
HTGCD	58,000	14,500	43,500
HGCD	4,700,000	1,175,000	3,525,000
Totals	**11,582,000**	**2,895,500**	**8,686,500**

Source: Jones and Bradley 2013.

The following groundwater use estimates from the Hickory Aquifer (**Table 29**) are from the TWDB water use database for the 2018.

Table 29. Hickory Aquifer 2018 Groundwater Use (by GMA 9 County)

GMA 9 County	Type of Use and Estimated Use Amounts for 2018 (in ac-ft)						
	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Totals
Blanco	53	0	0	0	273	33	**359**
Totals	**53**	**0**	**0**	**0**	**273**	**33**	**359**

Source: TWDB 2018.

The TWDB recently derived exempt use estimates based on Texas State Demographic Center Data, TWDB Water Use Survey data, TWDB water demand projections, and the TWDB Groundwater Database. TWDB estimates of exempt use are shown in **Table 30.**

Table 30. Hickory Aquifer Estimated Exempt Use (by GMA 9 GCD)

GMA 9 GCD	Estimated Exempt Use by Year (in ac-ft)						
	2020	2030	2040	2050	2060	2070	2080
BPGCD	84	93	97	100	102	104	104
Estimated Exempt Use Totals	**84**	**93**	**97**	**100**	**102**	**104**	**104**

Source: TWDB 2020.

According to TWDB water use estimates, the greatest amount of recent pumping from the Hickory Aquifer in GMA 9 is for irrigation in Blanco County. Exempt use pumping is about 90 ac-ft annually.

To date, there is no known water production from Paleozoic rocks in Hays County. Pre-Cretaceous (geologic picks from geophysical log correlations) cuttings samples examined from water wells drilled within the HTGCD all appear to be semi-metamorphosed, Ouachita Facies. The Harwell No. 1 well (Shell) drilled in Hays County (1956) spudded in the Trinity and encountered Pennsylvanian shale at 820'. The well total depth (TD) was 4661' in limestone and dolomite. No fresh water was reported, and the well bottomed in the Paleozoic Foreland Facies.

<u>*Conclusions Regarding Non-Impacts to Adjacent or Connected Aquifers*</u>

Due to geological and hydrogeological characteristics, none of the production from the Hickory Aquifer has any effect on other GCDs within GMA 9.

Portions of the Hickory Aquifer Classified as Non-Relevant for Joint-Planning Purposes within GMA 9

The following is an explanation of why the GMA 9 Committee is proposing to classify the Hickory Aquifer as non-relevant for the purposes of joint planning in those portions of Blanco, Hays, Kerr, and Travis counties within GMA 9.

The TWDB calculated the following MAG volumes for this aquifer in GMA 9 during the second cycle of joint planning: Kendall County – 140 ac-ft. The GMA 9 Committee has proposed to set a DFC for Kendall County. The aquifer does not extend into Bandera, Medina, Bexar, or Comal counties.

The GMA 9 Committee is proposing to classify the Hickory Aquifer as non-relevant for the purposes of joint planning in Blanco, Hays, Kerr, and Travis counties for the following reasons:

- There is no known groundwater use from the Hickory Aquifer in Hays, Kerr, or Travis counties. Because the aquifer[11] typically exists at significant depth, it is generally considered to be less economically viable and therefore less likely to be developed in these counties;
- Blanco County is the only county in GMA 9 with relatively larger quantities of Hickory groundwater production, and that is only in the northwestern portion of Blanco County;
- Hays County has no known water production from Paleozoic rocks, and no subsurface verification of assumptions regarding the aquifer properties of the Hickory exist;
- With no Hickory encountered in the subsurface and no Paleozoic groundwater production in western Hays County, this aquifer has not been included in planning by the HTGCD;
- Production from Hickory Aquifer wells in Blanco County is almost all for exempt use. There are a few non-exempt wells that pump into ranch ponds, and even those are generally located on large ranch tracts and have little or no off-site effects;
- Due to geological and hydrogeological characteristics, none of the production from the Hickory Aquifer has any effect on other groundwater districts within GMA 9, and with the uncertainty regarding water quality in portions of Blanco, Hays, Kerr, and Travis counties, classifying the Hickory Aquifer as non-relevant in these counties will have no impact on surrounding entities or the joint-planning process;
- The Hickory Aquifer will continue to be managed locally by the individual GCDs that have jurisdiction.

The GMA 9 Committee determined that the aquifer characteristics, groundwater demands, and current groundwater uses for that portion of the Hickory Aquifer located in GMA 9 do not warrant adopting a DFC. Therefore, the GMA 9 Committee is proposing that this aquifer located within its boundaries, specifically in parts of Blanco, Hays, Kerr, and Travis counties, be classified as non-relevant for joint-planning purposes.

3.2.3 Marble Falls Aquifer

The GMA 9 Committee is proposing to classify the Marble Falls Aquifer located within Blanco County within the GMA 9 boundaries as non-relevant for the purposes of joint planning. This proposed classification does not impact the BPGCD's authority or ability to manage this aquifer in Blanco County as it remains within this GCD's jurisdictional boundaries and continues to be subject to its enabling statutes, rules, management plans, and programs.

[11] HTCGD noted that it does not consider the Hickory Aquifer an aquifer in Hays County.

Aquifer Portion Description, Location, and Map

The following describes the portion of the Marble Falls Aquifer that the GMA 9 Committee is proposing to classify as non-relevant.

The Marble Falls Aquifer is a minor aquifer, occurring in several separated outcrops along the northern and eastern flanks of the Llano Uplift region of central Texas. The subsurface extent of the aquifer is unknown. Eight Texas counties contain portions of the aquifer, with 78 percent of the aquifer located within GCDs. Within GMA 9, the Marble Falls Aquifer is located within the BPGCD. The total area of the aquifer is 214 square miles, 1,923 acres of which is located within GMA 9 (all of this is outcrop area).

The proposed non-relevant classification of portions of the Marble Falls Aquifer within GMA 9 are depicted in **Figure 17**.

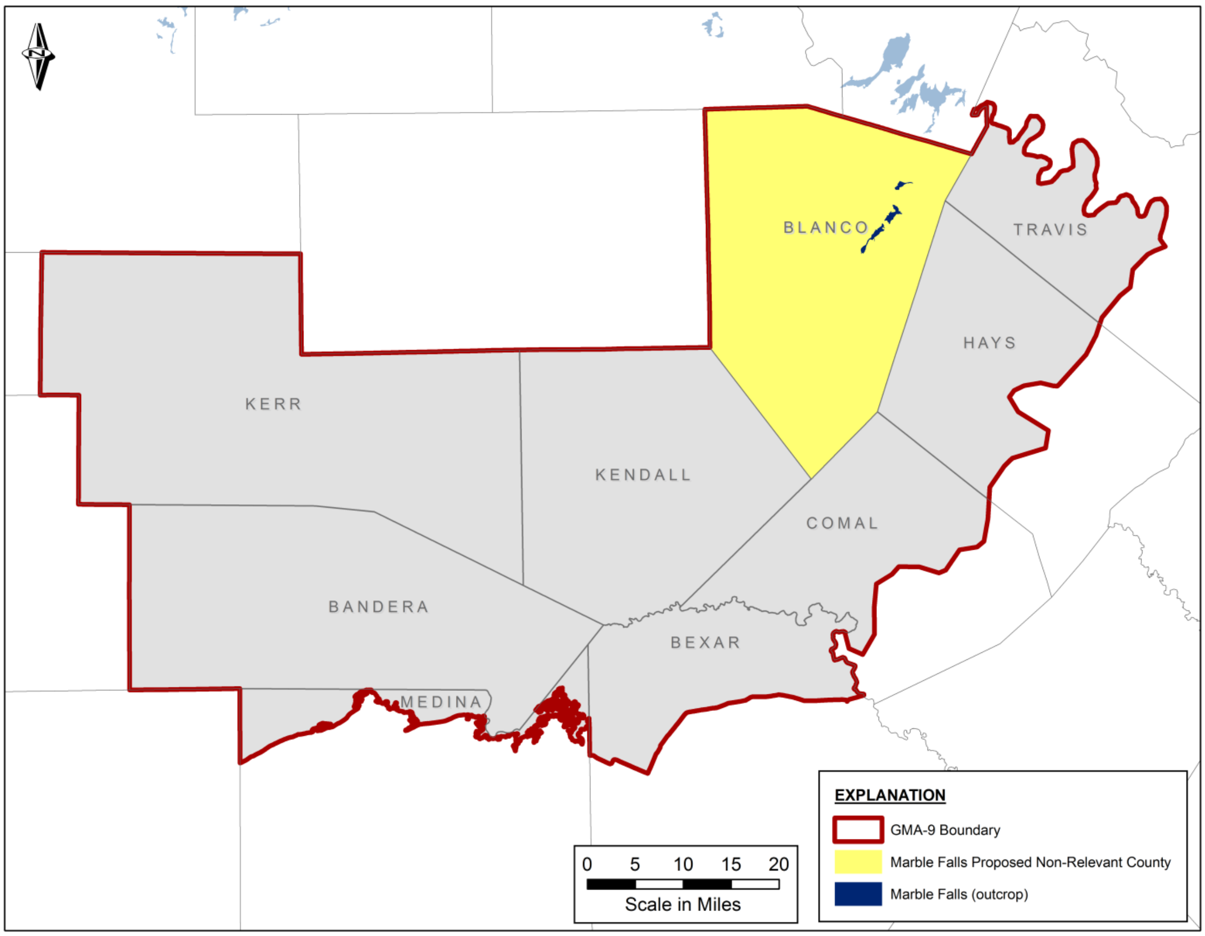

Figure 17. Proposed non-relevant classification of portions of Marble Falls Aquifer within GMA 9.

Aquifer Characteristics, Groundwater Demand, Current Groundwater Uses, Including Total Estimated Recoverable Storage

The following describes the aquifer characteristics, groundwater demands, and current groundwater uses, including the TERS amounts, for the portion of the Marble Falls Aquifer that the GMA 9 Committee is proposing to classify as non-relevant that support the conclusion that DFCs in adjacent or hydraulically connected relevant aquifer(s) will not be affected.

Aquifer Characteristics

The Marble Falls Aquifer occurs in eight counties in the Llano Uplift area in central Texas. Groundwater from the Marble Falls Aquifer is currently used mostly for livestock purposes, although small amounts are also used for municipal purposes. The towns of San Saba and Rochelle are the two largest communities that have historically withdrawn groundwater from the Marble Falls Aquifer for public supply use. Most of the production from the Marble Falls Aquifer occurs in Mason County.

The Marble Falls Formation is a Pennsylvanian age, fine-grained, thinly to thickly bedded limestone, with some interbedded shale. It occurs in several separate outcrops, primarily along the northern and eastern flanks of the Llano Uplift region. The Marble Falls Formation is up to 600 ft thick, although the downdip extent of the aquifer is unknown.

Recharge to the Marble Falls Aquifer is from precipitation on the outcrop areas. Average effective recharge from precipitation is estimated to be 5 percent of annual precipitation based on spring flow data and is estimated to be 261 ac-ft per year in GMA 9. Discharge is mainly to springs emanating from the aquifer, and to wells. Groundwater flow is generally from the outcrop areas in a downdip direction. Groundwater occurs in solution cavities that have formed along fractures and faults in the limestone. Where underlying beds are thin or absent, the Marble Falls and Ellenburger-San Saba aquifers may be hydrologically connected. The aquifer is capable of producing small to moderate quantities of water to wells, with well yields increasing significantly with acidizing. Wells completed in the Marble Falls Aquifer generally produce less than 50 gpm. Very few data exist on the overall aquifer characteristics of the Marble Falls Aquifer.

Groundwater Demands

Water from the Marble Falls Aquifer is used in Blanco County for domestic, agricultural, and industrial uses, and no significant water level declines have occurred in wells measured by the TWDB.

Current Groundwater Uses/Total Estimated Recoverable Storage

Table 31 presents the TERS volume estimates calculated by the TWDB for the Marble Falls Aquifer.

Table 31. Marble Falls Aquifer – TERS Amounts within GMA 9 (by GCD)

GMA 9 GCD	Total Storage (ac-ft)	25% of Total Storage (ac-ft)	75% of Total Storage (ac-ft)
BPGCD	1,300	325	975
Totals	**1,300**	**325**	**975**

Source: Jones and Bradley 2013.

The following numbers (**Table 32**) are from the TWDB water use database for year 2018.

Table 32. Marble Falls Aquifer 2018 Groundwater Use (by GMA 9 County)

GMA 9 County	Type of Use and Estimated Use Amounts for 2018 (in ac-ft)						
	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Totals
Blanco	6	0	0	0	0	2	**8**
Totals	**6**	**0**	**0**	**0**	**0**	**2**	**8**

Source: TWDB 2018.

TWDB recently derived exempt use estimates based on Texas State Demographic Center Data, TWDB Water Use Survey data, TWDB water demand projections, and the TWDB Groundwater Database. The exempt use estimates (**Table 33**) are as follows:

Table 33. Marble Falls Aquifer Estimated Exempt Use (by GMA 9 GCD)

GMA 9 GCD	Estimated Exempt Use by Year (in ac-ft)						
	2020	2030	2040	2050	2060	2070	2080
BPGCD	7	8	9	9	9	9	9
Estimated Exempt Use Totals	**7**	**8**	**9**	**9**	**9**	**9**	**9**

Source: TWDB Projected Exempt Groundwater Use Estimates, GMA 9, May 2020.

The primary use of groundwater pumped recently from the Marble Falls Aquifer in GMA 9 was for domestic and livestock use. Approximately seven ac-ft annually was pumped for exempt uses.

Conclusions Regarding Non-Impacts to Adjacent or Connected Aquifers

Due to limited aerial extent, minimal groundwater pumping, and geological and hydrogeological characteristics, none of the production from the Marble Falls Aquifer has any effect on other GCDs within GMA 9.

Marble Falls Aquifer Classified as Non-Relevant for Joint-Planning Purposes within GMA 9

The TWDB did not calculate a MAG volume for Blanco County as a result of the 2016 DFC joint-planning cycle. The aquifer does not extend into any other county within GMA 9.

The GMA 9 Committee has proposed to classify the Marble Falls Aquifer as non-relevant for the purposes of joint planning in Blanco County for the following reasons:

- Blanco County has only 12 to 15 wells producing from the Marble Falls Aquifer, and those are all exempt wells;
- Due to geological and hydrogeological characteristics, none of the production from the Marble Falls Aquifer has any effect on other groundwater districts within GMA 9, and classifying the Marble Falls Aquifer as non-relevant for the purposes of joint planning in Blanco County, as well as all other GMA 9 counties, will have no effect on current water users, other GCDs, or other entities involved in the joint planning process;
- The Marble Falls Aquifer will continue to be managed locally by the BPGCD that has jurisdiction.

In summary, the GMA 9 Committee determined that the aquifer characteristics, groundwater demands, and current groundwater uses for that portion of the Marble Falls Aquifer located in GMA 9 do not warrant adopting a DFC. Therefore, the GMA 9 Committee is proposing that this aquifer located within its boundaries, specifically in Blanco County, be classified as non-relevant for joint-planning purposes.

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4.0 GMA 9 DESIRED FUTURE CONDITIONS

On November 15, 2021, the GMA 9 Committee adopted the following DFC statements for certain major and minor aquifers within the GMA 9 boundaries summarized in **Table 34**. In developing the DFC statements, the GMA 9 Committee followed the TWDB recommendations to specify geographic areas for each DFC and to specify the initial year to be 2008 for drawdown comparison. Solely for the purposes of calculating the MAGs, the GMA 9 Committee assumes the model results are consistent with the proposed DFCs if the average drawdowns calculated by the TWDB are within five percent of the proposed DFCs drawdown values.

Table 34. GMA 9 Adopted Desired Future Conditions (Major and Minor Aquifers)

Major or Minor Aquifer	Desired Future Condition
Trinity	Allow for an Increase in Average Drawdown of Approximately 30 Feet Through 2060 (throughout GMA 9) Consistent With "Scenario 6" in TWDB GAM Task 10-005
Edwards Group of Edwards-Trinity (Plateau)	Allow for No Net Increase in Average Drawdown in Bandera and Kendall Counties through 2080
Ellenburger-San Saba	Allow for an Increase in Average Drawdown of No More Than 7 Feet in Kendall County through 2080
Hickory	Allow for an Increase in Average Drawdown of No More Than 7 Feet in Kendall County through 2080

On November 15, 2021, the GMA 9 Committee also approved the proposed classifications of all or portions of certain major and minor aquifers managed by GCDs within the management area as non-relevant for the purposes of joint planning. **Table 35** below lists the GMA 9 approved proposed non-relevant classifications. For a complete discussion of the GMA 9 proposed non-relevant classifications, refer to **Chapter 3.0.**

Table 35. Approved GMA 9 GCD Managed Aquifers Proposed for Classification as Non-Relevant for Joint-Planning Purposes Only Pursuant to Title 31, Section 356.31 of the Texas Administrative Code

Proposed Classification as Non-Relevant	Applicable Areas Within GMA 9 (All or Portions of the Following Counties)
Edwards Aquifer (Balcones Fault Zone)	Bexar, Comal, Hays, and Travis Counties
Edwards Group of 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

The following is a discussion of the GMA 9 Committee's policy and technical justifications for the four DFCs, how these DFC satisfy the "balance test" and the discussion of the nine factors outlined in the Texas Water Code Section 36.108(d-2), other DFCs that may have been considered by the GMA 9 Committee, and a discussion of other recommendations offered in relevant public comments and the GMA 9 Committee's response to those recommendations. The following discussion of the four DFCs is divided into the two DFCs for the major aquifers, and the two DFCs for the minor aquifers. The discussion also reflects information used to prepare the December 14, 2020, January 25, 2021, and March 22, 2021 presentations **(Appendix E)** and other supplemental information.

4.1 Major Aquifers: Trinity Aquifer DFC - Throughout GMA 9, and Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFC – Bandera and Kendall Counties Only

The DFCs stated above in **Table 35** for the Trinity Aquifer and the Edwards Group of the Edwards-Trinity (Plateau) Aquifer are the same DFCs the GMA 9 Committee adopted for these major aquifers on April 18, 2016 and July 26, 2010, during the 2016 and 2010 DFC joint-planning cycles, respectively.

4.1.1 Policy and Technical Justifications – Trinity Aquifer

The following discussion sets out the GMA 9 Committee's policy and technical justifications in the 2021 DFC joint-planning cycle for the above-stated Trinity Aquifer DFC. This subsection also includes the GMA 9 Committee's policy and technical justifications from the 2016 and 2010 DFC joint-planning cycles, which support the justifications for this current cycle of joint planning and it also provides a summary of how the adopted DFC for the Trinity Aquifer achieves the "balance test" as described in the Texas Water Code Section 36.108(d-2).

2021 DFC Joint Planning

As stated, the DFC statement for the Trinity Aquifer is the following - *"Allow for an Increase in Average Drawdown of Approximately 30 Feet Through 2060 (throughout GMA 9) Consistent With "Scenario 6" in TWDB GAM Task 10-005."* This statement is the same DFC statement that the GMA 9 Committee adopted for the Trinity Aquifer in the 2016 and 2010 DFC joint-planning cycles. With this understanding, the GMA 9 Committee reviewed and discussed the policy and technical justifications for the DFCs from the 2016 DFC joint-planning cycle. For the Trinity and Edwards-Trinity (Plateau) aquifers DFCs, the policy and technical justifications discussion included the following:

- DFCs are long-term targets;
- Compliance with the DFCs should be determined over time with sufficient (collected under varying conditions) data;
- GAM results from the 2010 DFC joint-planning cycle that were used to evaluate the relationship between pumping versus drawdown, spring, and baseflow to balance competing water demands, determined the DFCs met the "balance test;" and
- DFCs should be reevaluated with an updated HCT GAM.

Early in the 2021 DFC joint-planning cycle, the GMA 9 Committee members hoped to have worked with the TWDB on an updated HCT GAM, which had not been updated since 2009. Because the update to the HCT GAM was delayed and will not be available until the next DFC joint-planning cycle, the GMA 9 Committee proposed to maintain the current DFC statement, including maintaining the 2060 planning horizon, for the Trinity Aquifer for this 2021 DFC joint-planning cycle. In 2020, the TWDB began to develop a regional GAM for the Edwards-Trinity (Plateau), Pecos Valley, Hill Country Trinity, and Edwards aquifers. A final report and model will be released in early 2023. When the updated HCT GAM becomes available, the GMA 9 Committee believes it will provide the best available science to develop a revised DFC statement that is achievable and balanced.

Additionally, in this 2021 DFC joint-planning cycle, the GCD members continued to collect data in the designated Trinity Monitor Well Network to observe water level changes. A GMA 9 technical subcommittee developed an approach to compare water level measurements with model predictions made during the development of the DFC for the Trinity Aquifer in GMA 9 (Hunt and Fieseler 2019). This method allows GMA 9 to regularly assess water level measurements across the entire GMA and gain insight into the status of the aquifers compared to the DFCs and the assess the feasibility of achieving the DFCs. Like the update to the HCT GAM, this analysis of water level measurements will provide the information needed to manage the Trinity Aquifer for the long-term. For further information, refer to **Section 4.1.3.8** of this ER.

2016 DFC Joint Planning

The DFC set by the GMA 9 Committee for the Trinity Aquifer in July 2010 in the 2010 DFC joint-planning cycle was based on a long-term target (50-year period). During the initial five-year period (2010-2015), the GCDs were in the early stages of assessing the water level changes that occurred in these five years and gathering and reviewing other data and information related to implementing the DFC, such as comparing actual groundwater use to the MAG amounts for this aquifer. In the fall of 2012, the GMA 9 Committee retained Dr. William Hutchison, Ph.D., P.E., P.G., Independent Groundwater Consultant, and James Beach, P.G., LBG-Guyton Associates, to compare actual groundwater level data with groundwater model predictions, on a well-by-well basis, that were developed during the process to consider the first Trinity Aquifer DFC set by the GMA 9 Committee. The members of the GMA 9 Committee decided to conduct this analysis to refine how the model results relate to actual water level data, and how these two data sets could be considered in future joint-planning efforts.

The report was completed in February 2014 with the publication of the final report titled *A Comparison of Groundwater Monitoring Data with Groundwater Model Results Groundwater Management Area 9*. The analysis showed there were differences between simulated and actual groundwater elevations throughout the area, and the actual groundwater elevations were higher than the simulated groundwater elevations in some locations, and lower than the simulated groundwater elevations in other locations. Some of the differences were attributed to the relative assumptions of wet years and dry years in the overall DFC estimates. However, comparing individual model scenarios that had similar rainfall and recharge conditions from 2009 to 2011 also had simulated groundwater elevations that were higher than actual groundwater elevations. This difference was attributed to apparent differences in actual pumping and the pumping assumed in the DFC simulations.

Severe drought conditions prevailed in the 2016 DFC joint-planning cycle and the members of the GMA 9 Committee determined it was more beneficial to assess the DFC over a longer period, to include more normal or average weather patterns.

2010 DFC Joint Planning

During the 2010 DFC joint-planning cycle, the GMA 9 Committee undertook detailed consideration of DFCs and non-relevant classifications that subsequently supported the 2016 and 2021 DFC joint-planning cycles. On July 26, 2010, the GMA 9 Committee adopted the following DFC for the Trinity Aquifer - "Allow for an increase in average drawdown of approximately 30 feet through 2060 consistent with Scenario 6 in TWDB Draft GAM Task 10-005." At that same time, the GMA 9 Committee adopted a DFC for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Kendall and Bandera counties and declared the Edwards Group of the Edwards-Trinity (Plateau) Aquifer to be "not relevant" in Kerr and Blanco counties. The GMA 9 Committee officially submitted notice of these actions to the TWDB on August 26, 2010. Although two petitions were subsequently filed in 2011 challenging the reasonableness of GMA 9's Trinity Aquifer DFC, the TWDB determined that the adopted DFC was reasonable. Copies of the GMA 9 August 26, 2010 letter to the TWDB, and the GMA 9 Committee's prepared response for the TWDB hearing held on November 16, 2011, are on file in the GMA 9 files maintained in the BPGCD offices (GMA 9 2011).

The policy and technical justifications originally stated in both documents are still applicable during this 2021 DFC joint-planning cycle. Highlights from both documents are summarized below.

The GMA 9 Committee used a methodical process during the 2010 DFC joint-planning cycle, as discussed previously in **Chapter 2.0** of this ER. In addition to discussing the process and information they used to develop, consider and ultimately approve the Trinity Aquifer DFC, in the November 16, 2011 hearing response before the TWDB, the GMA 9 Committee members pointed out that the Committee developed the adopted Trinity Aquifer DFC according to the guidelines and laws governing the process, and attempted to set a DFC that *"...provides a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater in the management area"* (GMA 9 2016a, p. 75). In so doing, the GMA 9 Committee re-iterated their commitment to the goal of striking an equitable balance between all stakeholders and each of the areas in GMA 9.

The GMA 9 Committee determined that, consistent with stakeholder input, the most appropriate way to preserve base flow was to protect the primary source water (e.g., spring flow). Because the primary threat to spring flow was increased pumping, the GMA 9 Committee decided it was *"prudent, conservative and appropriate to set a DFC that would meet current demand, projected exempt demands, and have a bit left over for non-exempt use"* (GMA 9 2016a, p. 75).

After many public meetings and discussions in the 2010 DFC joint-planning cycle, the GMA 9 Committee elected to set a DFC expressed as a regional average 30-ft drawdown, which was not the largest decline discussed and considered by the group. The DFC was established because it was the "best fit" to provide for current demands, a reasonable accommodation for projected future demands, and impact creek and spring flow as little as possible. Based on the model runs and best available data, the GMA 9 Committee believed that a DFC based on a drawdown of less than 30 ft may be unachievable and not reasonable because it would not likely provide sufficient water for current and projected demands.

With the majority of current and future pumping produced from exempt wells, the Trinity Aquifer DFC both acknowledged the effects of exempt pumping and allowed for some level of reasonable pumping from non-exempt wells. This was the type of consensus yield (and resulting impacts) that the GMA 9 Committee was striving to achieve when they adopted the DFC.

The DFC was an attempt to strike a balance and consensus among the GCDs. The GMA 9 Committee would continue to review the DFC expression, along with its geographic extent, as more information and management strategies were developed to further refine both. Lastly, the GMA 9 Committee noted the group was compiling data and reporting average annual water level changes resulting from pumping and climatic variations. The data would be invaluable in the refinement, monitoring, and long-term management of the Trinity Aquifer.

The GMA 9 Committee selected the Trinity Aquifer DFC for the benefit of the entire region, as well as the good of the local GCDs and counties. Under the new requirements of GMA and DFC planning set by the Texas Legislature in 2011, the DFC approved by the GMA 9 Committee for the Trinity Aquifer met the latest mandate to *"provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater in the management area"* (Texas Water Code Section 36.108(d-2), p. 50).

There were other policy and technical considerations that factored into the GMA 9 Committee's July 26, 2010 Trinity Aquifer DFC decision. The DFC that the GMA 9 Committee approved would yield a MAG amount wherein each GCD and each county would be provided with a specific drawdown for each subdivision of the Trinity Aquifer essentially resulting in individual DFCs, and pumpage calculations for the Trinity Aquifer as a whole. This was one of the reasons the GMA 9 Committee designated the DFC as it did, referencing Scenario 6 in TWDB Draft GAM Task 10-005 (Hutchison 2010). The local GCDs would then be able to develop rules and GMPs that could address local pumping demands for each subdivision of the Trinity or any designated hydrogeological unit or area. Keeping the entire MAG amount in a total "Trinity Aquifer" classification would allow the GCDs more flexibility in developing management strategies for the groundwater in each individual Trinity Aquifer subdivision.

The GMA 9 Committee also considered the Drought of Record (DOR) and with the assistance of the TWDB, conducted a large number of trial GAM runs, many of which included DOR conditions. In every case where the GMA 9 Committee attempted to incorporate DOR conditions, the model yielded either unusable or impractical results because the DOR skewed them dramatically and would require setting a DFC with a very high drawdown in order to meet current demands during the DOR, or it failed to function due to an excessive number of dry model cells. During this process, therefore, the GMA 9 Committee determined that the DOR could not be incorporated into the current predictive models. Given the limitations of the modeling, the GMA 9 Committee determined that a reasonable approach was to set a DFC using average climatic and recharge conditions for the 50-year planning horizon. It was also clear that drought, being so unpredictable in location, duration, and severity, would be more appropriately and effectively managed by local GCDs through their drought rules and GMPs.

Groundwater Availability Model Considerations (Update)

After the TWDB's determination that the Explanatory Report from the 2016 DFC joint-planning cycle was administratively complete and at the request of the GMA 9 Committee, the TWDB used the HCT GAM to update the simulation of the 50-year DFC for the Trinity Aquifer - GAM Run 16-023 MAG (Jones 2017), (**Table 36**). From this model run, the MAG for the Trinity Aquifer that achieves the adopted DFC decreases from 93,052 to 90,503 ac-ft/year between 2010 and 2060. As stated in the GAM Run 16-023 MAG report, this decline is attributable to the occurrence of increasing numbers of dry model cells over time in parts of Hays, Kerr, and Travis counties (Jones 2017).

Table 36. GMA 9 MAG Amounts for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Kendall and Bandera Counties by GCD and County for Each Decade Between 2010 and 2060

GCD	County	GCD Totals (ac-ft/year)					
		2010	2020	2030	2040	2050	2060
BCRAGD	Bandera	7,284	7,284	7,284	7,284	7,284	7,284
BSEACD	Hays	22	22	22	22	22	22
BPGCD	Blanco	2,573	2,573	2,573	2,573	2,573	2,573
CTGCD	Comal	10,076	10,076	10,076	10,076	10,076	10,076
CCGCD	Kendall	10,622	10,622	10,622	10,622	10,622	10,622
HTGCD	Hays	9,109	9,098	9,095	9,094	9,094	9,094
HGCD	Kerr	16,435	14,918	14,845	14,556	14,239	14,223
MCGCD	Medina	2,500	2,500	2,500	2,500	2,500	2,500
TGRGCD	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
SWTCGCD	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: Jones 2017.

During the 2010 DFC joint-planning cycle and at the request of the GMA 9 Committee, the TWDB prepared several technical reports in the form of either GAM Runs or Tasks, to assist the GMA 9 Committee with their analysis using the HCT GAM. The Trinity Aquifer DFC was set using the model simulations defined in GAM Task 10-005 that included the following probabilistic approach used to assess the 50-year DFC:

> *"The simulations completed as part of this task include seven pumping scenarios of the Trinity Aquifer that range from zero pumping to about twice current pumping. Each scenario included running 387 50-year simulations. The 387 50-year simulations were developed based on tree-ring precipitation estimates from 1537 to 1972 for the Edwards Plateau (Cleaveland 2006). The results were used to evaluate the relationships between pumping versus drawdown, spring and base flow and outflow across the Balcones Fault Zone"* (Hutchison 2010, p. 3).

The seven scenarios in GAM Task 10-005 were based on the following varying 2008 pumping amounts:

Scenario 1 – 0 ac-ft/year
Scenario 2 – 20,000 ac-ft/year
Scenario 3 – 40,000 ac-ft/year
Scenario 4 – 60,000 ac-ft/year *(estimated 2008 conditions)*
Scenario 5 – 80,000 ac-ft/year
Scenario 6 – 100,000 ac-ft/year
Scenario 7 – 120,000 ac-ft/year

One feature of the simulation was that recharge estimates based on tree-ring data changed annually, which acknowledged the natural variability in the recharge and response of the aquifer, including variations in water levels, spring flows, recharge, and droughts. The initial conditions were based on 2008 pumping and resulting water levels, and the approach accounted for significant variability in aquifer recharge and pumping that provided for a longer-term perspective to the water level declines in the Trinity Aquifer. Lastly, this modeling approach was similar to the approach typically used to assess impacts on spring flows for the Edwards Aquifer by implementing historical estimates of recharge and simulating different pumping scenarios.

GMA 9 Committee members had extensive discussions and selected Scenario 6 in the 2010 DFC joint-planning cycle (about 92,000 ac ft/year pumping) based on balancing competing water demands, such as supply needs, recreation, and environmental demands. With updates to the HCT GAM pending, the GMA 9 Committee members still considered this analysis by Hutchison appropriate to maintain the DFC for the Trinity Aquifer.

Achieving Section 36.108(d-2) of the Texas Water Code "Balance Test" – Trinity Aquifer

The Texas Water Code Section 36.108(d-2) states:

> *"The desired future conditions proposed under Subsection (d) must provide a balance between the highest practicable level of production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater and control of subsidence in the management area."*

As in the previous two rounds of joint planning, in the 2021 DFC joint-planning cycle, the GMA 9 Committee adopted the Trinity Aquifer DFC "*according to the guidelines and laws governing the process"* and attempted to set a DFC that *"...provides a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater in the management area"* (GMA 9 2016a, p. 77). In so doing, the GMA 9 Committee re-iterated their commitment to the goal of striking an equitable balance between all stakeholders and each of the areas in GMA 9.

The GMA 9 Committee determined that, consistent with stakeholder input, the most appropriate way to preserve base flow was to protect the primary source water (e.g., spring flow). Because the primary threat to spring flow was increased pumping, the GMA 9 Committee decided it was *"prudent, conservative and* *appropriate to set a DFC that would meet current demand, projected exempt demands, and have a bit left over for non-exempt use"* (GMA 9 2016a, p. 77).

The DFC was established to help manage the resource, pumping and resulting impacts, while allowing some water for future growth. With the majority of current and future pumping produced from exempt wells, the Trinity Aquifer DFC both acknowledged the effects of exempt pumping and allowed for some level of reasonable pumping from non-exempt wells. This was the type of consensus yield and resulting impacts that the GMA 9 Committee was striving to achieve when they adopted the DFC.

Lastly, the DFC for the Trinity Aquifer was an attempt to strike a balance and consensus among the GCDs. The GMA 9 Committee selected this DFC with the good of the entire region in mind, as well as the good of the local GCDs and counties. Under the new requirements of GMA and DFC planning set by the Texas Legislature in 2011, the GMA 9 Committee believed the DFC approved by the GMA 9 Committee for the Trinity Aquifer met the "balance test" mandate.

For these policy and technical reasons, the GMA 9 Committee re-adopted the DFC for the Trinity Aquifer – "Allow for an Increase in Average Drawdown of Approximately 30 Feet Through 2060 (throughout GMA 9) Consistent With "Scenario 6" in TWDB GAM Task 10-005" in the 2021 DFC joint-planning cycle.

4.1.2 Policy and Technical Justifications – Edwards Group of the Edwards-Trinity (Plateau) Aquifer

The following discussion sets out the GMA 9 Committee's policy and technical justifications in the 2021 DFC joint-planning cycle for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFC. This subsection also includes the policy and technical justifications from the 2016 and 2010 DFC joint-planning cycles, which support the justifications for this current cycle of joint planning, and it also provides a summary of how the adopted DFC for the Edwards Group of the Edward-Trinity (Plateau) Aquifer achieves the "balance test" described in Section 36.108(d-2) of the Texas Water Code.

2021 DFC Joint Planning

The DFC statement for the Edwards Group of the Edwards–Trinity (Plateau) Aquifer is the following - *"Allow for No Net Increase in Average Drawdown in Bandera and Kendall Counties through 2080."* This statement is the same DFC statement that the GMA 9 Committee adopted for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in the 2016 and 2010 DFC joint-planning cycles, but with an updated 2080 planning horizon. As with the Trinity Aquifer, the GMA Committee reviewed and discussed the policy and technical justifications for the DFCs from the 2016 DFC joint-planning cycle. For the Trinity and Edwards-Trinity (Plateau) aquifers DFCs, the policy and technical justifications discussion included the following:

- DFCs are long-term targets;
- Compliance with the DFCs should be determined over time with sufficient (collected under varying conditions) data;

- GAM results from the 2010 DFC joint-planning cycle that were used to evaluate the relationship between pumping versus drawdown, spring and baseflow to balance competing water demands, determined the DFCs met the "balance test;" and
- DFCs should be re-evaluated with an updated HCT GAM.

As stated above, in 2020, the TWDB began to develop a regional GAM for the Edwards-Trinity (Plateau), Pecos Valley, Hill Country Trinity and Edwards aquifers. A final report and model will be released in early 2023. When the updated model becomes available, the GMA 9 Committee will look to the TWDB for guidance as to whether the GMA 9 Committee is to use the Edwards-Trinity Plateau GAM or the updated HCT GAM for assessments for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer. The GMA 9 Committee will use the GAM designated by the TWDB and other more current technical data to possibly setting a new DFC or new DFCs.

2016 DFC Joint Planning

The DFC set by the GMA 9 Committee for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in July 2010 was based on a long-term target (50-year time-period). During the initial five-year period since the DFC was adopted (years 2010-2015), the GCDs were in the early stages of assessing the water level changes that occurred in these five years and gathering and reviewing other data and information related to implementing the DFC, such as comparing actual groundwater use to the MAG amounts for this aquifer. Since severe drought conditions prevailed for most of the 2016 DFC joint-planning cycle, the GMA 9 Committee determined that it is more beneficial to assess the DFC over a longer time-period.

2010 DFC Joint Planning

During the 2010 DFC joint-planning cycle, the GMA 9 Committee undertook detailed consideration of DFCs and non-relevant classifications that supported the cycle of planning. Therefore, a summary of the first cycle of DFC adoptions is included as part of this ER.

On July 26, 2010, the GMA 9 Committee adopted the following DFC for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer - "*Allow no net increase in average drawdown in the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Kendall and Bandera Counties.*" In addition, the GMA 9 Committee declared the Edwards Group of the Edwards-Trinity (Plateau) Aquifer to be "not relevant" in Kerr and Blanco counties. The GMA 9 Committee submitted a record of this action, along with an adopted DFC for the Trinity Aquifer, to the TWDB on August 26, 2010. A copy of this letter is located in the GMA 9 files maintained in the BPGCD offices. The policy and technical justifications originally stated in this letter and summarized below are still applicable at this time.

Because the above DFC differed from the one recommended by the TWDB ("*Allow up to 9 feet of drawdown in the Edwards Group*" – which was the result of an appeal process related to the original DFC), the GMA 9 Committee, as required by the TWDB rules, included a discussion of their process and policy and technical rationale for these decisions in their August 26, 2010 letter to the TWDB. Highlights of the August 2010 letter discussion follow.

Rationale for Kendall and Bandera Counties – Adopted DFC

The two most common themes expressed to GMA 9 Committee members throughout the 2010 DFC joint-planning cycle were to ensure that the final DFCs did not mine the aquifers, and that spring flows, which sustain the Hill Country's creeks, streams, and rivers, be considered and reasonably protected. Many of these springs originate from the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, including those from this aquifer in Kendall and Bandera counties.

The GMA 9 Committee discussed the differences in the physical characteristics of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Kendall and Bandera counties as compared to the portion of the aquifer in Kerr County. This technical discussion included comparisons of unit thicknesses and location, productions zones and resource viability for exempt wells, and recharge zones. The GMA 9 Committee concluded that due to the thinner section of the aquifer and limited recharge zones in Kendall and Bandera counties, the Edwards Group of the Edwards-Trinity (Plateau) Aquifer would be more sensitive to even limited increases in pumping withdrawals than the aquifer in Kerr County. Finally, and most importantly, the GMA 9 Committee noted that the aquifer in Kendall and Bandera counties did not share a significant hydrologic connection with the aquifer in Kerr County. Given these geologic considerations, the GMA 9 Committee determined the two resource areas, the Kendall and Bandera counties' portion of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer and the Kerr County portion of the aquifer could be managed differently. Blanco County has no known production from the Edwards Group of the Edwards-Trinity (Plateau) Aquifer and can also be managed on a local basis.

The GMA 9 Committee also stressed the significance of these spring flows to the base flow for Cibolo Creek and their contribution to the Guadalupe River and Canyon Lake, the impact of these spring flows to Cibolo Creek, impacts on Boerne City Lake and other surface water supplies in the region, their effects on other aquifers, and their impacts on numerous creeks and streams, including spring flow to the Medina River and base flow contributions to Medina Lake. The Committee also provided a detailed discussion of the impacts of reduced spring flows to the City of Boerne and negative impacts on the city's ability to conjunctively manage its groundwater and surface water resources. Potential impacts resulting in increased costs to the City of Boerne for water supply replacement and water treatment expansion were also discussed. The GMA 9 Committee also pointed out possible impacts leading to reduced downstream environmental flows, diminished nutrients for aquatic systems, and diminished recharge in southern Kendall and northern Bexar counties. Lastly, the GMA 9 Committee noted that reductions in flows to Canyon and Medina lakes could necessitate changes in the management of both lakes that were obligated to provide water for municipal, agricultural, industrial, recreational, and environmental uses, and depended on the base flow provided by springs many of which originate from the aquifer in Kendall and Bandera counties.

There were also other policy and technical considerations that factored into the GMA 9 Committee's July 26, 2010 Edwards Group of the Edwards-Trinity (Plateau) Aquifer decision. Throughout the five-year process of developing DFCs, the GMA 9 Committee consistently maintained that a DFC of "allowing for no net increase in average drawdown" provided the best chance of maintaining spring flow and base flow to creeks and rivers as close to current average levels as possible. Many local GCDs, such as the BPGCD and the HGCD, prohibited the completion of new non-exempt wells in the Edwards Group of the Edwards-

Trinity (Plateau) Aquifer. The CCGCD rules also prohibited any new wells drilled into the Edwards Group of the Edwards-Trinity (Plateau) Aquifer and provided for protection of the aquifer particularly that portion where its springs feed Boerne City Lake.[12] The DFC contemplated by the GMA 9 Committee would help to support those management strategies.

Exempt well use was considered minimal and expansion of this type of demand was expected to be slow and spread out over the 50-year planning period. The GMA 9 Committee reasoned that this timeframe would allow the GCDs to develop and implement various management strategies and incentives, such as water conservation, reuse, and rainwater harvesting that could further reduce demand on the aquifer and help to achieve the DFC. Any additional demand could be provided by the underlying Trinity Aquifer (GMA 9 2016a).

In summary, the Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFC would:

- Comply with the requirements of the Texas Water Code, Chapter 36;
- Address the concerns expressed by a significant number of stakeholders in a variety of public forums to "protect spring flow and base flow to creeks and rivers;"
- Provide a DFC that provides maximum, reasonable, and achievable protection for springs and base flow to creeks and rivers;
- Result in a possible MAG quantity that could allow for some future additional demand on the Edwards Group; and
- Result in a possible MAG quantity that local GCDs could implement, measure, and achieve using a variety of water management strategies available to GCDs (GMA 9 2016a).

Groundwater Availability Model Considerations (Update)

After the TWDB's determination that the Explanatory Report from the 2016 DFC joint-planning cycle was administratively complete and at the request of the GMA 9 Committee, the TWDB used the HCT GAM to update the simulation of the 60-year DFC for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Kendall and Bandera counties - GAM Run 16-023 MAG (Jones 2017) (**Table 37**). From this model run, the total MAG for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Bandera and Kendall counties is 2,208 ac-ft/year between 2010 and 2070.

[12] The BCRAGD rules also prohibit new non-exempt wells into the Edwards Group of the Edwards-Trinity Aquifer. Production from this aquifer is from exempt wells on large tracts of land in western Bandera County. All "drill-through" wells must seal off the Edwards Group of the Edwards-Trinity (Plateau) Aquifer.

Table 37. GMA 9 MAG Amounts for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Kendall and Bandera counties by GCD and County for Each Decade Between 2010 and 2070

GCD	County	GCD Totals (ac-ft/year)						
		2010	2020	2030	2040	2050	2060	2070
BCRAGD	Bandera	2,009	2,009	2,009	2,009	2,009	2,009	2,009
CCGCD	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**

Source: Jones 2017.

In the first planning cycle using the GAM Run 08-90 MAG, the TWDB developed "Managed Available Groundwater" estimates to meet the DFC adopted earlier in the planning cycle to "Allow for no net increase in average drawdown in the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Kendall and Bandera counties." Those MAG estimates resulted in a groundwater availability amount of approximately 1,000 ac-ft for both Bandera and Kendall counties (Chowdhury 2009).

Achieving Section 36.108(d-2), Texas Water Code – "Balance Test" – Edwards Group of the Edwards-Trinity (Plateau) Aquifer

As in the first two cycles of joint planning, in the 2021 DFC joint-planning cycle, the GMA 9 Committee adopted the Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFC to ensure that the final DFCs did not mine the aquifers, and that spring flows be considered and reasonably protected.

In the 2010 DFC joint-planning cycle, GMA 9 Committee representatives acknowledged in the November 2, 2009 TWDB hearing on the petitions challenging the reasonableness of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFC that all non-exempt and exempt wells are managed to varying degrees by the individual GCDs through rules developed in compliance with their enabling legislation and Chapter 36 of the Texas Water Code.

Also as stated previously, the GMA 9 Committee believed this DFC would:

- Comply with the requirements of the Texas Water Code Chapter 36;
- Address the concerns expressed by a significant number of stakeholders in a variety of public forums to "protect spring flow and base flow to creeks and rivers;"
- Provide a DFC with maximum, reasonable, and achievable protection for springs and base flow to creeks and rivers;
- Result in a possible MAG quantity that could allow for some future additional demand on the Edwards Group; and
- Result in a possible MAG quantity that local GCDs could implement, measure, and achieve using a variety of water management strategies available to GCDs (GMA 9 2016a).

For these policy and technical justifications, the GMA 9 Committee re-adopted the DFC for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer - *"Allow for no net increase in average drawdown in the Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Kendall and Bandera counties through 2080."*

4.1.3 GMA 9 Section 36.108(d) of Texas Water Code Factor Considerations, and Impacts of Trinity and Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFCs on Each Factor

As previously discussed in **Chapter 2.0** of this ER, on December 14, 2020, January 25, 2021, and March 22, 2021, the Committee received detailed presentations on all nine factors and considered them as they related to the four DFC statements. Copies of these presentations are located in **Appendix E**.

The following provides a discussion of the GMA 9 Committee's consideration of each factor as they relate to the GMA 9 major aquifer DFCs and their impacts on each factor.

4.1.3.1 Aquifer Uses or Conditions within the Management Area, Including Conditions That Differ Substantially from One Geographic Area to Another

GMA 9 Trinity Aquifer Uses and Conditions

The Trinity Aquifer is commonly subdivided into three discrete hydrostratigraphic units: Upper, Middle, and Lower Trinity aquifers. Additionally, depth to the water-bearing Trinity Group formations is determined by the underlying structural elements and depositional environments.

The Upper Glen Rose Formation, which forms the Upper Trinity Aquifer, often contains water with relatively high concentrations of sulfate. Total dissolved solids (TDS) often exceed 1,000 milligrams per liter (mg/l), especially in wells that penetrate "gyp" (evaporite) beds. Water in evaporite beds has a tendency to be high in sulfate and generally should be sealed off in a well. Upper Trinity wells are generally shallow and are mostly used for domestic and livestock purposes.

The Middle Trinity Aquifer, consisting of lower Glen Rose, Hensell, and Cow Creek formations, generally contains TDS of less than 1,000 mg/l. In the Hill Country region, the primary contribution to poor water-quality occurs in wells that do not adequately case off water from evaporite beds in the upper part of the Glen Rose (Upper Trinity Aquifer). Water levels in Upper and Middle Trinity wells fluctuate with seasonal precipitation and are highly susceptible to declines during drought conditions.

The Lower Trinity Aquifer is composed of sandy limestone, sand, clay, and shale of the Sligo and Hosston. The Lower Trinity thins toward the northeast and is completely missing or coalesces with upper Trinity units near the Llano Uplift. Yields from wells completed into the Lower Trinity are generally unpredictable and vary greatly. In some areas, the Lower Trinity has higher yields and better water quality than shallower aquifers. Recharge to the Lower Trinity in Bandera and Kerr counties likely occurs primarily by lateral underflow from the north and west. The overlying Hammett Shale mostly prevents vertical movement of water downward except possibly in highly fractured or faulted areas.

TWDB Trinity Aquifer water use estimates from 2018 (non-exempt) and 2020 (exempt) are tabulated in **Table 38** and **Table 39**, respectively. The first table (**Table 38)** provides estimates for entire counties, so they may not be representative of GMA 9 use in partial counties. Additionally, the "county – other" user group is not included in this table. The second table (**Table 39)** is grouped by GCD and should give the best currently available estimate of exempt use. The third table (**Table 40)** shows 2008 Trinity Aquifer pumping estimates provided by the GCDs. While the data in this table is dated, it is relevant in that it was the information the GCDs had to consider when the model runs were completed to assess drought and pumping on future aquifer conditions. Although each data set has its own unique data gaps, the estimates align relatively well with each other.

Table 38. TWDB Trinity Aquifer Groundwater Pumping Estimates by Use for 2018 (by GMA 9 County)

GMA 9 County	Type of Use and Estimated Use Amounts for 2018 (in ac-ft)						
	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Totals
Bandera	1,960	0	0	0	1,626	80	**3,666**
Bexar	20,091	0	907	0	599	30	**21,627**
Blanco	680	0	0	0	702	129	**1,511**
Comal	6,331	63	2,060	0	176	63	**8,693**
Hays	2,625	0	0	0	263	18	**2,906**
Kendall	3,562	3	0	0	228	288	**4,081**
Kerr	3,172	0	14	0	983	88	**4,257**
Medina	159	0	559	0	0	162	**880**
Travis	4,828	31	0	0	472	46	**5,377**
Totals	**43,408**	**978**	**3540**	**0**	**5,049**	**904**	**52998**

Source: TWDB 2018.

Table 39. TWDB Trinity Aquifer Estimated Exempt Use for 2020 (by GMA 9 GCD)

GMA 9 GCD	Exempt Use Estimates (in ac-ft)
BCRAGD	1,391
BSEACD	266
BPGCD	618
CTGCD	1,063
CCGCD	3,265
EAA	n/a
HTGCD	3,716
HGCD	1,551
MCGCD	1,471
TGRGCD (excludes municipal exempt)	1,686
SWTCGCD	1,437
Estimated Exempt Use Total	**16,464**

Source: TWDB 2020.

Table 40. Estimated 2008 Trinity Aquifer Pumping Provided by GMA 9 GCDs (by County)

County	Upper Trinity Aquifer (in ac-ft)	Middle Trinity Aquifer (in ac-ft)	Lower Trinity Aquifer (in ac-ft)	Total Pumping (in ac-ft)
Bandera	288	3,567	515	**4,370**
Bexar	693	14,110	197	**15,000**
Blanco	77	1,477	0	**1,554**
Comal	398	5,788	0	**6,186**

Table 40. Estimated 2008 Trinity Aquifer Pumping Provided by GMA 9 GCDs (by County)

County	Upper Trinity Aquifer (in ac-ft)	Middle Trinity Aquifer (in ac-ft)	Lower Trinity Aquifer (in ac-ft)	Total Pumping (in ac-ft)
Hays	416	4,800	449	**5,665**
Kendall	300	6,060	325	**6,685**
Kerr	213	6,263	5,534	**12,010**
Medina	0	500	1,000	**1,500**
Travis	551	4,967	0	**5,518**
Totals	**2,936**	**47,532**	**8,020**	**58,488**

Source: Hutchison 2010.

Table 40 estimates indicated that in 2008, about 81 percent of GMA 9 pumping was from the Middle Trinity Aquifer, about 14 percent was from the Lower Trinity Aquifer, and approximately five percent of Trinity pumping came from the Upper Trinity Aquifer. **Table 40** is not representative of the current understanding of production in SWTCGCD, where Hunt and others (2020) report Lower Trinity Aquifer production to be 2,754 ac-ft in 2019. For the Middle and Upper Trinity aquifers, they reported 1,607 and 63 ac-ft, respectively. GMA 9 Committee members considered many drought and pumping scenarios with the TWDB GAM during the 2010 DFC joint-planning cycle. Since that time, the TWDB has not updated the HCT GAM and the GMA 9 Committee has not completed new runs to assess impacts of various pumping assumptions. As noted above, in the 2010 DFC joint-planning cycle, there was limited understanding of pumping from Travis County outside of the BSEACD. However, more recent research by Hunt and others (2020) estimated the total groundwater use in southwest Travis County from the Trinity Aquifer is about 4,424 ac-ft in 2019. It is unclear how this difference will impact simulated water level declines or MAGs.

On December 14, 2020, the GMA 9 Committee received an updated summary of maps showing wells with water level measurements and the plotted hydrographs in GMA 9. The wells included in the summary were those with sufficient water level measurements in the TWDB database.[13] The plotted hydrographs were provided via a ShareFile site **(Appendix F).** An example of the information provided is shown in **Figure 18,** which is a map containing wells with hydrographs in the Cow Creek Limestone in GMA 9 and **Figure 19** that is an example of a hydrograph from a well in Bandera County.

[13] Missing from this map are several Middle Trinity Cow Creek monitoring wells with hydrographs in Blanco County. These wells date back to 2008.

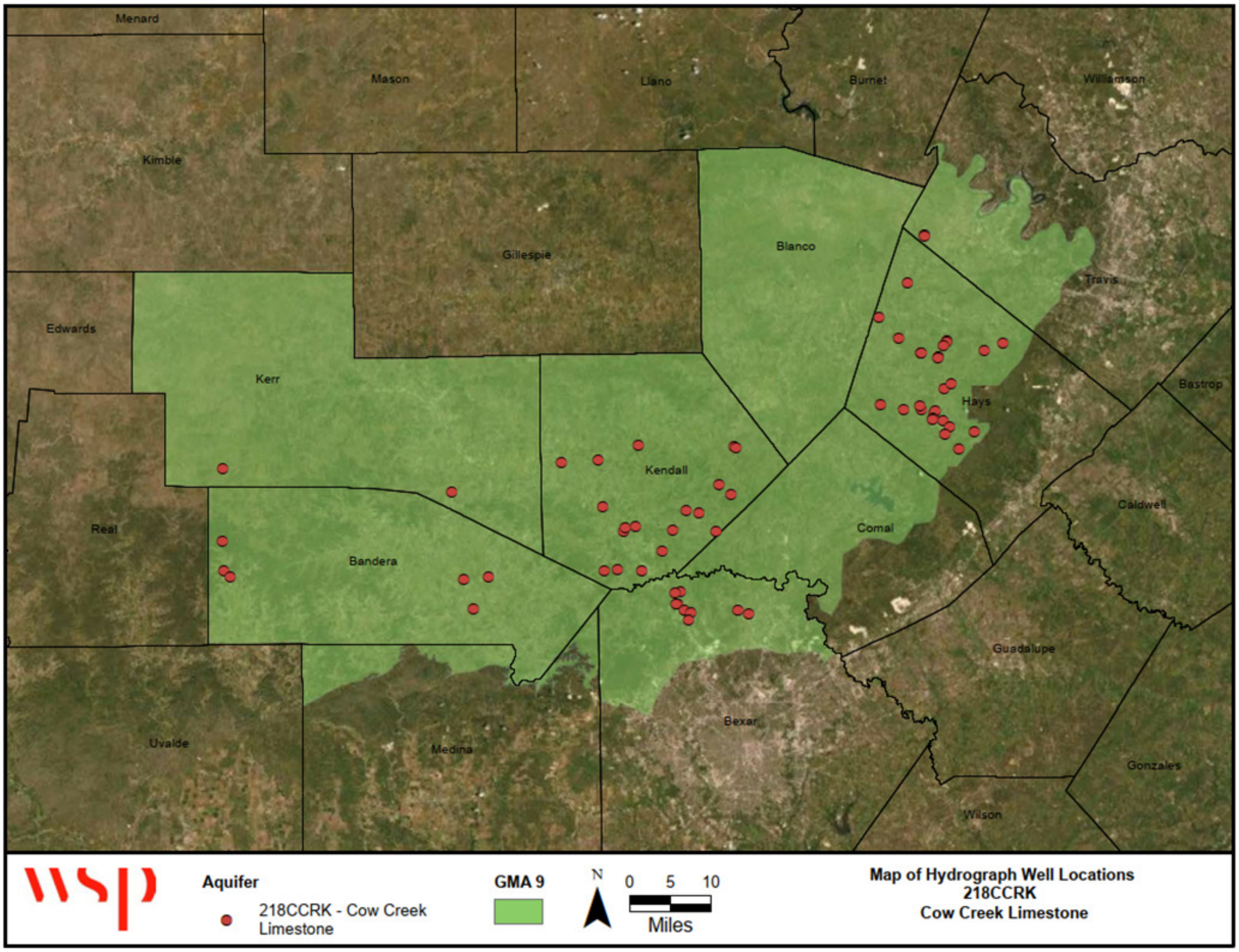

Figure 18. Hydrograph Well Locations for the Cow Creek Limestone.

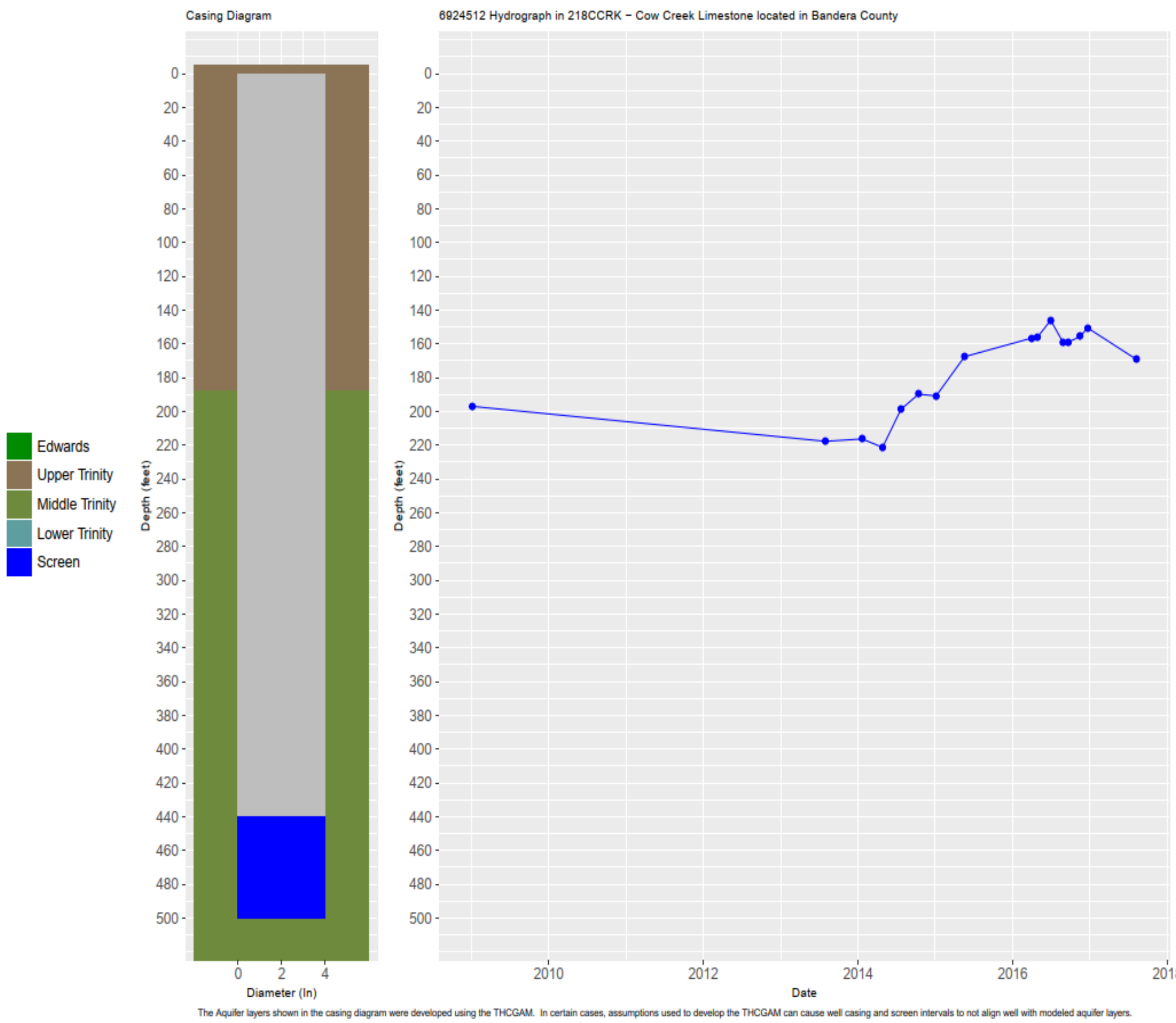

Figure 19. Hydrograph from well in Bandera County.

GMA 9 Edwards Group of the Edwards-Trinity (Plateau) Aquifer Uses and Conditions

A discussion of general characteristics of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer can be found in **Chapter 1.0** and in **Chapter 3.0** of this ER.

TWDB Edwards Group of the Edwards-Trinity (Plateau) Aquifer water use estimates from 2018 (non-exempt) and 2020 (exempt) are tabulated in the tables below. The first table (**Table 41**) estimates are for entire counties, so these amounts may not be representative of GMA 9 use in partial counties. Additionally, the "county – other" user group is not included in this table. Estimates are shown for all aquifers to give a relative idea of what percent of pumping can be attributed to the Edwards Group within these counties. The second table (**Table 41)** is grouped by GCD and should give the currently available best estimate of exempt use. The third table (**Table 42**) shows 2008 Edwards Group of the Edwards-Trinity (Plateau) Aquifer pumping estimates provided by the GCDs.

Table 41. TWDB Edwards Group of the Edwards-Trinity (Plateau) Aquifer Estimated Exempt Use for 2020 (by GMA 9 GCD)

GMA 9 GCD	Exempt Use Estimates (in ac-ft)
BCRAGD	153
BPGCD	0
CCGCD	43
HGCD	1,180
Total Estimated Exempt Use	**1,376**

Source: TWDB 2020.

Table 42. Estimated 2008 Edwards Group of the Edwards Trinity (Plateau) Aquifer Pumping Provided (by GMA 9 GCD)

County	Edwards Group of Edwards-Trinity (Plateau) Aquifer (in ac-ft)
Bandera	631
Kendall	315
Kerr	1,035
Total	**1,981**

Source: Hutchison 2010.

4.1.3.2 The Water Supply Needs and Water Management Strategies Included in the State Water Plan

The Texas Water Code Section 36.1071(e) requires that GCDs consider the water supply needs and water management strategies included in the SWP, among other considerations, in developing and adopting their GMPs. To comply with this requirement, the GMA 9 GCDs have adopted GMPs that include consideration of the water supply needs and water management strategies identified in the most recently adopted SWP. Given the various GCD deadlines for adopting GMPs, this factor discussion focuses on the water supply needs and water management strategies contained in the 2017 SWP, as well as the 2021 RWPs.

2017 State Water Plan Water Supply Needs and GMA 9

Chapter 7 (Water Supply Needs) of the 2017 SWP contains a summary of water supply needs information for the 16 RWPGs across the State of Texas. This chapter summarizes the RWPG information related to comparing existing water supplies with current and projected water demands to identify where and when additional water supplies would be needed (TWDB 2017a).

Table 7.2 of the 2017 State Water Plan provides a summary of water needs identified by the RWPGs by region (in ac-ft/year). The information for Regions J, K, and L, since those RWPGs include counties located within GMA 9, are contained in **Table 43** and **Table 44** below. The SWP further breaks out this information by use category for each region in ac-ft/year.

Table 43. 2017 SWP Water Supply Needs for Regions J, K, and L

Region	Amounts by Decade (in ac-ft/year)					
	2020	2030	2040	2050	2060	2070
J	4,000	4,000	4,000	4,000	5,000	5,000
K	374,000	384,000	387,000	400,000	450,000	512,000
L	200,000	256,000	297,000	356,000	425,000	483,000

Source: TWDB 2017a.

Table 44. 2017 SWP Water Supply Needs by Use Category for Regions J, K, and L

Region	Amounts by Decade (in ac-ft/year)						
	Category	2020	2030	2040	2050	2060	2070
J	Irrigation	143	143	142	142	141	141
	Manufacturing	0	0	0	0	0	0
	Mining	38	98	112	76	47	43
	Municipal	3,462	3,768	3,925	4,033	4,143	4,228
	Steam-electric	0	0	0	0	0	0
	Livestock	214	214	214	214	214	214
K	Irrigation	335,489	319,584	304,106	289,044	274,387	260,124
	Manufacturing	570	692	810	913	1,059	1,216
	Mining	4,260	8,618	9,747	10,719	12,153	14,164
	Municipal	7,881	28,176	45,883	67,359	119,888	182,173
	Steam-electric	25,363	26,751	26,775	31,974	42,212	54,627
	Livestock	0	0	0	0	0	0
L	Irrigation	105,799	97,325	89,057	81,302	73,968	67,383
	Manufacturing	6,308	9,897	13,453	18,929	28,871	40,034
	Mining	10,822	10,481	8,694	5,138	2,073	666
	Municipal	72,636	108,068	148,627	197,279	249,846	304,164
	Steam-electric	4,506	29,778	37,178	53,599	70,696	70,696
	Livestock	0	0	0	0	0	0

Source: TWDB 2017a.

2017 State Water Plan Water Management Strategies and GMA 9

On December 14, 2020, the GMA 9 Committee members were provided with, and considered, a detailed listing of all water supply needs contained in the 2017 SWP for the counties covered by the GMA 9 GCDs within Regions J, K, and L. **Table 45** lists by county, that are wholly within or in part of GMA 9, the projected demands, existing supplies, needs or potential shortages, supplies from proposed strategies, and the amount of water coming from proposed groundwater strategies for the planning year 2070. The table indicates that most of the projected demand and potential shortages are in Bexar and Travis counties, but that projected supplies from strategies exceeds potential shortages. Additionally, groundwater strategies represent 16 percent of strategy supplies.

Table 45. 2017 SWP Projected Demands, Supplies, and Potential Shortages by GMA 9 County

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%

Table 45. 2017 SWP Projected Demands, Supplies, and Potential Shortages by GMA 9 County

County	2070 Demands	2070 Existing Supplies	2070 Needs (Potential Shortages)	2070 Strategy Supplies	2070 Groundwater Strategy Supplies	% Groundwater Strategy Supplies
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%**

Source: TWDB 2017a.

The 2017 SWP includes potential management strategy supply volumes by type of strategy, and the strategies related to groundwater include municipal conservation, irrigation conservation, other conservation related to manufacturing, mining and steam-electric power, groundwater, reuse, groundwater desalination, conjunctive use, aquifer storage and recovery, weather modification, drought management, and brush control. **Table 46** below is a summary of the water management strategy types by county listed in the 2017 SWP.

Table 46. Types of Water Management Strategies by GMA 9 County

County	Water Management Strategy Type
Bandera	Groundwater Wells & Other, Municipal Conservation, Other Direct Reuse, Drought Management, Other Strategies
Bexar	Groundwater Desalination, Groundwater Wells & Other, Other Direct Reuse, Direct Potable Reuse, Other Surface Water, Drought Management, Direct Potable Reuse
Blanco	Groundwater Wells and Others, Drought Management, Municipal Conservation, Other Strategies
Comal	Groundwater Desalination, Groundwater Wells & Other, Direct Potable Reuse, Other Surface Water, Drought Management, Conjunctive Use, Other Direct Reuse, Aquifer Storage and Recovery
Hays	Drought Management, Groundwater Wells and Others, Other Direct Reuse, Other Strategies, Aquifer Storage and Recovery, New Major Reservoir, Municipal Conservation, Groundwater Desalination, Direct Potable Reuse, Other Surface Water, Conjunctive Use
Kendall	Other Surface Water, Municipal Conservation, Groundwater Wells and Other
Kerr	Groundwater Wells and Others, Municipal Conservation, Other Surface Water, Aquifer Storage and Recovery, Other Strategies
Medina	Groundwater Desalination, Other Direct Reuse, Drought Management, Municipal Conservation, Groundwater Wells and Other, Irrigation Conservation
Travis	Drought Management, Municipal Conservation, Other Surface Water, Other Strategies, Aquifer Storage and Recovery, Other Direct Reuse, Indirect Reuse, Groundwater Wells and Others, New Major Reservoir

Source: TWDB 2017a.

Impacts of Trinity Aquifer and Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFCs on Water Supply Needs and Water Management Strategies Included in the State Water Plan

The GAM Run 16-023 MAG (Jones 2017) was used in the development of the water management strategies contained in the 2021 RWPs for Regions J, K, and L and GAM Run 10-049 MAG, version 2 (Hassan 2012a) and GAM Run 10-050 MAG, version 2 (Hassan 2012b) and GTA Aquifer Assessments 10-01, 10-

02 and 10-14 MAG (Wuerch and Backhouse 2011) were used in the development of the water management strategies contained in the 2017 RWPs for Regions J, K, and L.

None of the water management strategies in the 2021 RWPGs with either the Trinity Aquifer or the Edwards Group of the Edwards-Trinity (Plateau) Aquifer as the water source and within GMA 9 have been identified as MAG-limited. With regard to the role of the MAG in regional water planning, the TWDB's guidance documents state that RWPGs cannot include water management strategy supply volumes that exceed the MAGs (TWDB 2014 and TWDB 2015).

The DFC statements are a long-term planning goal, and are reviewed at least every five years, or sooner if necessary, during joint planning. GCDs can re-evaluate the DFCs in light of changed circumstances including any potential impacts on the SWP and may do so as needed. RWPs could also be amended if the DFCs and resulting MAGs are revised, causing some water management strategies with previously shown "0" yield as becoming recommended water management strategies in the RWP. It is also important to note that GCD representatives serve as members of the RWPGs to increase coordination and communication on regional and state water planning issues.

4.1.3.3 Hydrological Conditions, Including for Each Aquifer in the Management Area the TERS as Provided by the EA, and the Average Annual Recharge, Inflows, and Discharge

Total Estimated Recoverable Storage

GCDs are required to consider the TERS volume prior to determining a DFC. The TERS is defined as a porosity-adjusted volume of groundwater that might be recovered from the aquifer assuming 25 percent or 75 percent recovery. Realistically, the numbers should be considered as a very simplistic approach to determining an upper limit volume of available groundwater. The TERS volumes estimated for the Trinity Aquifer are included in **Table 47.** The TERS volumes for both the Trinity and Edwards Group of the Edwards-Trinity (Plateau) aquifers are presented in **Chapter 3.0** of this ER.

Table 47. Trinity Aquifer – TERS Amounts within GMA 9 (by GCD)

GMA 9 GCD	Total Storage (ac-ft)	25% of Total Storage (ac-ft)	75% of Total Storage (ac-ft)
No GCD	910,000	227,500	682,500
BCRAGD	1,200,000	300,000	900,000
BSEACD	2,200	550	1,650
BPGCD	420,000	105,000	315,000
CCGCD	760,000	190,000	570,000
EAA	37,000	9,250	27,750
HTGCD	550,000	137,500	412,500
HGCD	340,000	85,000	255,000
MCGCD	370,000	92,500	277,500
TGRGCD	680,000	170,000	510,000
Totals	**5,269,200**	**1,317,300**	**3,951,900**

Source: Jones and Bradley 2013.

Estimates of average annual recharge, inflows, and discharge to springs and other waters were compiled from GAM runs that were performed to support the GCD GMPs. For the Trinity Aquifer, these data are included **Table 48.** For the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, these estimates are shown in **Table 49**. The estimates used for GAM Task 10-005 Scenario 6 for the HCT GAM for the Trinity Aquifer are summarized in **Table 50.**

Table 48. Trinity Aquifer Recharge, Inflows, and Discharge to Other Waters within GMA 9

GMA 9 GCD	Estimated Annual Recharge from Precipitation (ac-ft/year)	Estimated Annual Volume Discharge to Springs and Surface Water (ac-ft/year)	Estimated Annual Volume Flow into GCD within Aquifer (ac-ft/year)	Estimated Annual Volume Flow Out of GCD within Aquifer (ac-ft/year)	Estimated Net Annual Flow between Aquifers in the GCD (ac-ft/year)
BCRAGD	47,239	32,750	9,561	31,028	12,910 (Edwards-Trinity (Plateau) to Trinity)
BPGCD	44,470	25,448	4,468	19,490	188 (Trinity to Edwards-Trinity (Plateau))
CCGCD	50,110	31,131	7,917	30,915	6,429 (Edwards-Trinity (Plateau) to Trinity) 58 (Edwards Group into Trinity)
HTGCD	26,105	22,439	17,716	11,610	7,440 (Trinity to Edwards (BFZ))
HGCD	21,331	18,473	2,229	7,861	5,438 (Edwards-Trinity (Plateau) to Trinity)
MCGCD	6,918	6,412	21,749	6,268	15,911 (Trinity to Edwards BFZ
TGRGCD	44,992	10,347	36,079	26,417	39,006 (Trinity to Edwards (BFZ))
SWTCGCD	12,167	12,654	10,024	9,205	2,333 (Trinity to Edwards (BFZ))
Totals	**253,332**	**159,654**	**NA**	**NA**	**24,835 (into Trinity from Edwards-Trinity (Plateau) and Edwards Group) 34,878 (from Trinity to Edwards (BFZ) and Edwards-Trinity (Plateau))**

Source: Jones 2016; Anaya 2017; Ballew 2018; Jones 2019; Bond 2019; Bond 2020; Wade 2019; Wade et al. 2020.

Table 49. Edwards Group of the Edwards-Trinity (Plateau) Aquifer Recharge, Inflows, and Discharge to Other Waters within GMA 9

GMA 9 GCD	Estimated Annual Recharge from Precipitation (ac-ft/year)	Estimated Annual Volume Discharge to Springs and Surface Water (ac-ft/year)	Estimated Annual Volume Flow into GCD within Aquifer (ac-ft/year)	Estimated Annual Volume Flow Out of GCD within Aquifer (ac-ft/year)	Estimated Net Annual Flow between Aquifers in the GCD (ac-ft/year)
BCRAGD	7,596	4,141	8,538	4,033	12,910 (Edwards-Trinity (Plateau) to Trinity)
BPGCD	571	0	0	206	188 (Trinity to Edwards-Trinity (Plateau))
CCGCD	6,046	3,061	4,020	290	6,429 (Edwards-Trinity (Plateau) to Trinity)
HGCD	26,454	17,697	8,305	20,483	5,438 (From Edwards-Trinity (Plateau) to Trinity)
Totals	**40,667**	**24,899**	**NA**	**NA**	**24,777 (into Trinity from Edwards-Trinity (Plateau)) 188 (from Trinity to Edwards-Trinity (Plateau)))**

Source: Jones 2016; Anaya 2017; Ballew 2018; Jones 2019.

Table 50. Trinity Aquifer Water Budget Components - GAM Task 10-005 Scenario 6 (all estimates are average values)

County	Pumping (ac-ft/year)	Spring and River Base Flow (ac-ft/year)	Outflow Across the BFZ (ac-ft/year)	Edwards Group Drawdown after 50 years (ft)	Overall Trinity Drawdown after 50 years (ft)	Upper Trinity Drawdown after 50 years (ft)	Middle Trinity Drawdown after 50 years (ft)	Lower Trinity Drawdown after 50 years (ft)
Bandera	7,910	30,620	535	0.8	29.3	12.6	37.8	37.8
Bexar	24,856	10,319	28,131	n/a	46.0	15.1	58.6	58.6
Blanco	2,573	16,312	n/a	n/a	19.2	14.8	20.6	20.7
Comal	10,214	1,477	33,948	n/a	23.9	15.4	25.5	25.5
Hays	9,115	18,025	3,995	n/a	19.2	11.4	22.4	22.4
Kendall	11,450	24,753	n/a	2.0	28.6	26.3	29.3	29.4
Kerr	15,952	37,559	n/a	0.2	39.2	6.7	56.8	58.2
Medina	2,500	5,395	6,647	n/a	16.1	6.4	21.0	21.1
Travis	8,697	9,050	670	n/a	27.6	28.2	27.6	27.6
GMA 9	**92,261**	**150,359**	**50,163**	**0.5**	**29.8**	**13.9**	**36.4**	**36.7**

Source: Hutchison 2010.

Average Annual Recharge

According to TWDB GAM estimates, the estimated average annual recharge for the Trinity Aquifer in GMA 9 is approximately 253,000 ac-ft/year. Most of this recharge is attributed to Kendall, Blanco, northern Bexar, and a portion of Bandera counties. For the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, it is estimated to be about 40,670 ac-ft/year, and most of this occurs in Kerr County.

Recharge for GAM Task 10-005 Scenario 6 was based upon tree ring data and average precipitation. Numerous recharge estimates were utilized to calibrate the model based upon the potential variability inherent in the precipitation-recharge relationship. Generally, recharge varied between 250,000 and 450,000 ac-ft/year depending on annual precipitation data.

Inflows and Outflows

According to **Table 48**, the estimated annual volume flows into and out of the Trinity Aquifer for the HTGCD, HGCD, MCGCD, TGRGCD, and SWTCGCD vary with each GCD. Similarly, **Table 49** illustrates variability in the estimated annual volume flows into and out of the Edwards Group of the Edward-Trinity (Plateau) for the BCRAGD, BPGCD, CCGCD, and HGCD.

Management plan estimates suggest 155,400 ac-ft/year flow out of GMA 9 within the Trinity Aquifer, and just over 50,200 ac-ft/year flows out of GMA 9 within the Edwards Group of the Edwards-Trinity (Plateau) Aquifer.

Impact of Trinity Aquifer DFC on Hydrological Conditions

Pumping under GAM Task 10-005 Scenario 6 was assigned to be near 92,000 ac-ft/year. Year 2008 pumping estimates from the GCDs totaled about 60,000 ac-ft/year. The additional 32,000 ac-ft/year of pumping primarily impacts discharge to springs and rivers, with a reduction of 14,000 ac-ft/year. Impacts to outflow are also significantly impacted as a result of pumping set at 92,000 ac-ft/year. The increased pumping under Run 5 or Scenario 6 would result in a decrease of outflow across the BFZ of approximately 12,000 ac-ft/year. The model indicates that increased pumping would not impact the Upper Trinity as much as the Middle and Lower Trinity aquifers. This is likely due to buffering from recharge and the fact that it is the least utilized portion of the Trinity Aquifer system within GMA 9.

Impact of Edwards Group of Edwards-Trinity (Plateau) Aquifer DFC on Hydrological Conditions

The Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFC of zero drawdown, applicable only to Bandera and Kendall counties, will have no detrimental impact on the hydrogeological conditions of the aquifer. The DFC is intended to minimize impact upon flow to springs and base flow to streams that are primarily affected by pumping from exempt wells.

4.1.3.4 Other Environmental Impacts, Including Impacts on Spring Flow and Other Interactions between Groundwater and Surface Water

The Texas Water Code Section 36.071 also requires that GCDs consider: 1) the annual amount of recharge to the aquifers, 2) discharge from the aquifers to springs and any surface water bodies, including lakes, streams, and rivers, and 3) flow into and out of the GCD within each aquifer and between aquifers in the GCD, if a GAM is available, in developing their GMPs. To comply with this requirement, the GCDs in GMA 9 all have adopted GMPs for their GCDs that include consideration of these three elements.

2021 DFC Joint Planning

In the 2021 DFC joint-planning cycle, at the December 14, 2020 meeting, the GMA 9 Committee received, and considered results from the *Texas Aquifer Study - Groundwater Quantity, Quality, Flow and Contributions to Surface Water* (Anaya et al. 2016). This study provides information on the geology and hydrogeology of Texas aquifers, including volume of flows from aquifers to surface waters. According to this study, the Trinity Aquifer discharges to several springs in GMA 9 counties, with most discharging less than 10 cfs. The median baseflow ranges from 2.5 cfs (Bexar County) to 26 cfs (Bandera County). Additionally, the GMA 9 Committee received and considered the comparison of the empirical discharge results from this study to the modeled spring flow results from the GCD GMP GAM runs.

As with the Trinity Aquifer DFC, it is difficult to assess the environmental impacts of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFC because of factors affecting instream flows and outflows from this aquifer, such as pumping and rainfall. According to Anaya and others (2016), the Edwards Group of the Edwards-Trinity (Plateau) Aquifer discharges to surface water occurring mostly from springs along the margins of the aquifer where the water table intersects the ground surface. Due to the difference in methodology, spring flow discharge results from Anaya and others (2016) differ from those seen in the GCD GAM runs. The presentation from this meeting is included in **Appendix E.**

Also, in the 2010 and 2016 DFC joint-planning cycles, the GMA 9 Committee extensively considered impacts on spring flow. For a complete summary of these discussions, refer to Section 6.1.3.4 in the 2016 ER. Additionally, refer to Table 13 in the 2016 ER for a listing of all of the TWDB GAM Runs, Tasks, and Aquifer Assessments performed for GMA 9 to thoroughly analyze various DFC scenarios. This information is also found in **Table 17** of this ER.

Impact of Trinity Aquifer and Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFCs on Other Environmental Impacts, Including Impacts on Spring Flow and Other Interactions between Groundwater and Surface Water

The GMA 9 GCDs continue to improve science, monitoring networks, data and information, and to develop and implement various management strategies and incentives, such as water conservation, reuse, and rainwater harvesting, to further reduce aquifer demand and help to achieve the DFCs. As the GMA 9 GCDs move forward with efforts to manage their aquifers, the GCDs continue to consider potential DFC impacts to aquifer users, along with environmental and other impacts. Through mandatory joint planning, the GCDs can discuss new or emerging issues that may involve re-evaluating, re-considering and/or revising a DFC.

Any management strategy or DFC other than prohibiting all pumping could have detrimental environmental impacts. However, significantly restricting or prohibiting well drilling and pumping would have negative impacts on private property rights. Therefore, this type of DFC would restrict the GMA 9 Committee's ability to meet the "balance test" required of DFCs in the Texas Water Code Section 36.108(d-2). By setting a DFC for the Trinity and the Edwards Group of the Edwards-Trinity (Plateau) aquifers that protects spring flow, meets current demand and provides some water availability for growth, the GMA 9 Committee believes the DFCs meets the "balance test" prescribed by the Texas Water Code Section 36.108(d-2) and recognizes the "balance test" affirmed by the Texas Supreme Court's ruling in the *Edwards Aquifer Authority and State of Texas v. Burrell Day and Joel McDaniel* case regarding groundwater ownership and management.

4.1.3.5 The Impact on Subsidence

Land subsidence can be triggered by excessive pumping from an aquifer. Water level and pressure declines reduce the hydrostatic pressure within the aquifer system and subsequently increases the effective stress upon the aquifer materials. The increase in effective stress can exacerbate compaction of the materials in aquifers with compressible characteristics. Over time, this can cause land subsidence.

Impact of Trinity Aquifer and Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFCs on Subsidence

In 2017, the TWDB completed a study to identify and characterize areas within Texas' major and minor aquifers that are susceptible to land subsidence related to groundwater pumping (Furnans et al. 2017). The report was used to assess potential subsidence related to estimated pumping associated with DFCs. The district representatives reviewed results from the subsidence report across the GMA 9 for all major and minor aquifers. Based on the geologic and hydrogeologic characteristics of the aquifers in GMA 9, the predicted water level decline, and the estimates of subsidence risk in the TWDB report, the adopted DFCs were deemed to be reasonable in regard to the impact they would have on subsidence.

4.1.3.6 Socioeconomic Impacts Reasonably Expected to Occur

On January 25, 2021, the GMA 9 Committee was provided an analysis of the socioeconomic impacts of unmet water needs in the 2017 SWP (TWDB 2017a) and the 2021 RWPs for Regions J, K, and L (Ellis 2019). Also, in the 2021 DFC joint-planning cycle, the GMA 9 Committee reviewed the considerations and conclusions from the previous planning cycles and discussed the impacts of the DFCs on the socioeconomic factor. The presentation from this meeting is included in **Appendix E.**

2021 DFC Joint Planning

In the 2021 DFC joint-planning cycle, the GMA 9 Committee considered the TWDB estimated socioeconomic impacts from unmet water supply needs (TWDB 2017a). The estimates are based in the water needs not met in a single year during a drought of record condition in each planning decade. Impacts are derived from the unmet water needs of the irrigation, livestock, manufacturing, mining, municipal, and steam-electric power water user groups. Economic impacts include income and job losses, as well as tax losses, water trucking costs, and utility revenue losses. Social impacts include population and school enrollment losses, in addition to consumer wellbeing.

According to the 2017 SW, statewide income losses from unmet water needs during drought conditions are estimated to be $73 billion in 2020 and more than $151 billion in 2070 (TWDB 2017a). Additionally, job losses from unmet water needs during drought conditions are estimated to be 424,000 in 2020 and 1.3 million in 2070. Unmet water needs in the 2017 plans for Regions J, K, and L are primarily within the irrigation water use category.

Table 51 includes the estimated income, job, and population losses for the years 2020 and 2070 due to unmet water needs (Ellis 2019). According to the TWDB analysis, the Region K plan identified an estimated increase in income, job, and population losses over the 50-year planning period. These losses are due to unmet irrigation water needs in counties outside of GMA 9 - Colorado, Matagorda, Mills, and Wharton counties. The Region K plan identified that the limiting factors for irrigation in these counties was water availability and the cost of new infrastructure.

Region L's plan shows a decrease in income losses, with stable job and population losses over the 50-year planning period. However, the TWDB analysis estimates that the fastest growing counties in Region L, Bexar, Guadalupe, Comal, and Hays counties, will see an increase in income loss over the 50-year planning period. It is important to note that while the analysis estimates how unmet water needs impact the economy and the social fabric of communities, where it does not evaluate socioeconomic impacts from proposed DFCs at the GMA level.

Table 51. Estimated Socioeconomic Impacts from Unmet Water Supply Needs

	Income Losses		Job Losses		Population Losses	
	2020	2070	2020	2070	2020	2070
Region J	$233 Million	$257 Million	2,300	3,000	417	539
Region K	$1.282 Billion	$2.609 Billion	5,018	27,413	921	5,033
Region L	$16.57 Billion	$9.38 Billion	100,514	94,978	18,454	17,438

Source: Ellis 2019.

Because the DFCs result in groundwater availability amounts for potential water management strategies to meet some of the water supply needs, it is helpful to consider the TWDB RWP socioeconomic analyses to understand the importance of meeting projected water needs in the regional and state water planning context. This process, however, does not evaluate the socioeconomic impacts of the proposed DFCs at the GMA DFC joint-planning level. Because a similar quantitative tool does not exist to assess the socioeconomic impacts of the proposed DFCs, these discussions during DFC joint-planning are qualitative considerations. In addition to the socioeconomic impacts discussed during the previous two joint-planning cycles summarized below, the GMA 9 Committee discussed the following potential qualitative socioeconomic impacts:

- Impacts of lowering water levels on costs of production;
- Decreasing well yields and potential need for additional wells;
- Potential for and additional costs of developing alternative supplies; and
- Need to meet water supply needs to avoid impacts of water shortages.

The GMA 9 Committee has and will continue to consider socioeconomic impacts while moving forward in the joint-planning process, as more data and information regarding how DFCs are being implemented at the local level become available. GMA 9 GCDs will continue to work with their various communities and users to be better able to anticipate potential socioeconomic impacts.

Considerations from the 2016 and 2010 DFC Joint-Planning Cycles

The GMA 9 Committee also discussed the previous socioeconomic impact considerations from the two previous DFC joint-planning cycles because they were relevant to the 2021 DFC joint-planning cycle. These considerations included the following:

- Regional DFCs establish a framework for setting long-term water management programs and practices;
- Regional DFCs are not a singular factor in evaluating potential economic or social impacts of water planning on user community;

- Localized implementation of water management initiatives at GCD level more likely to result in direct economic impacts on user community;
- Positive and negative socioeconomic impacts may occur from DFCs being too lax or too restrictive;
- Two petitions challenging DFCs due to socioeconomic impacts from petitions in the 2010 DFC joint-planning cycle, the GMA 9 Committee responded 1) that DFCs define management approach to reach desirable, achievable and acceptable level of use, 2) DFC was not guarantee of social or economic stability, and 3) that short-term fluctuations in water levels in private wells are not a direct result of a DFC, but more result of localized pumping demands, weather patterns and hydrogeological characteristics.

Impacts of Trinity and Edwards Group of the Edwards-Trinity Plateau Aquifer DFCs on Socioeconomic Impacts Reasonably Expected to Occur

It is difficult to assess direct socioeconomic impacts likely to occur for the Trinity and Edwards Group of the Edwards-Trinity (Plateau) aquifer DFCs. These regional DFCs are important variables in establishing a framework for setting long-term water management programs and practices, and considering outcomes, but they are not the singular factor in evaluating potential economic or social impacts of water planning on the user community. Other factors, including drought and demographic shifts, are equally influential to the economic and social outcomes of water management practices. Localized implementation of water management initiatives at the GCD level may be more likely to result in direct economic impacts on the user community. At that level, GCDs may be better positioned to anticipate and address these issues through program implementation. The DFC is also not a guarantee of social or economic stability, development opportunities, or prosperity to any user. There would not be any impacts to exempt well owners as they are only required to register their wells, and most do not pay fees.

4.1.3.7 The Impact on Interests and Rights in Private Property, Including Ownership and the Rights of Management Area Landowners and Their Lessees and Assigns in Groundwater as Recognized Under Texas Water Code Section 36.002

In the 2021 DFC joint-planning cycle, on January 25, 2021, the GMA 9 Committee received a presentation summarizing the considerations and conclusions regarding the private property rights factor from the 2010 and 2016 DFC joint-planning cycles and discussed other GMA and GCD considerations as they relate to private property rights impacts. The presentation from this meeting is included in **Appendix E.**

2021 DFC Joint Planning

In the current DFC joint-planning cycle, the GMA 9 Committee reviewed and considered Texas Water Code Section 36.002, which defines the ownership of groundwater. According to the Texas Water Code, the legislature recognizes that a landowner owns the groundwater below the surface of the landowner's land as real property. The groundwater ownership and rights described by this section entitle the landowner, including the landowner's lessees, heirs, or assigns, to drill for and produce the groundwater below the surface of real property, without causing waste or malicious drainage of other property or negligently causing subsidence and have any other right recognized under common law. However, the groundwater ownership and rights described by this section do not entitle a landowner, including a landowner's lessees, heirs, or assigns to the right to capture a specific amount of groundwater below the surface of that landowner's land or affect the existence of common law defenses or other defenses to liability under the rule of capture. The Texas Water Code also states that "nothing in this code shall be construed as granting the authority to deprive or divest a landowner, including a landowner's lessees, heirs, or assigns of the groundwater ownership and rights described by this section."

With this understanding, the GMA 9 Committee discussed how potential private property rights impacts are considered in management plans, rule updates and permit decisions, including: 1) the impacts on property rights of landowners and their lessees, 2) expectations of existing and future well owners to recover reasonable investments in their water wells and properties, 3) availability of affordable water of sufficient yield to all properties overlying the aquifer, 4) the availability of affordable water from alternative water supplies and 5) how the DFC joint-planning process is an attempt to protect private property rights for the long-term.

Additionally, in this planning cycle, the GMA 9 Committee reviewed the considerations of the private property rights factor from the first and second rounds of joint planning and concluded they were still relevant in the 2021 DFC joint-planning cycle. The GMA 9 Committee also discussed the following:

- The DFC process is iterative in that GCDs, through annual and DFC joint planning, can discuss new or emerging issues that may involve re-evaluating, revising, or reconsidering the DFCs;
- GCDs are actively engaged in activities and programs to manage aquifers through strategies that improve overall management and sharing of these resources; and
- GCD enabling statutes and Texas Water Code Chapter 36 provide flexibility for the GCDs to develop locally responsive management programs and strategies to help achieve the DFCs.

In summary, the GMA 9 Committee acknowledged the iterative nature of the DFC process and during annual and DFC joint planning, new or emerging issues may involve re-evaluating, revising, and/or reconsidering DFCs. Additionally, the GMA 9 Committee noted that GCDs actively engage in management activities and programs to carry out statutory missions and manage aquifers through strategies that address aquifer management issues to improve and share resources. Lastly, the GMA 9 Committee considered the flexibility of statutes and Texas Water Code Chapter 36, allowing GCDs to develop locally responsive management programs and management strategies and incentives. Such strategies or incentives may include management zones, water conservation, reuse and rainwater harvesting. These actions may further reduce demand, help achieve DFCs, and consider potential impacts.

Considerations from the 2016 and 2010 DFC Joint-Planning Cycles

The GMA 9 Committee also discussed the private property rights considerations from the previous DFC joint-planning cycles because they were relevant to the 2021 DFC joint-planning cycle. These considerations included the following:

- DFC impacts depend upon on how GCDs incorporate MAGs into management plans, rules and use them in permit decisions;

- DFCs established to accommodate groundwater users and to strike a "balance" between use and preservation of the resource;
- DFCs offer positive implications by setting regional long-term goals to manage and preserve groundwater resources for the benefit to all; and
- Two petitions in the 2010 DFC joint-planning cycle challenging the reasonableness of DFCs, the GMA 9 Committee responded that 1) any management strategy could have an impact of private property rights, 2) the Trinity Aquifer DFC was based on actual pumping versus authorized pumping, short-term fluctuations in well levels were not direct result of the DFC, and 3) the DFC is a description of maximum average lowering of water levels acceptable over the next 50 years.

Impacts of Trinity Aquifer and Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFCs on Interests and Rights in Private Property, Including Ownership and Rights of Management Area Landowners and Their Lessees and Assigns in Groundwater as Recognized Under Texas Water Code Section 36.002

The GMA 9 Committee noted that the impact of the Trinity and the Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFCs with regard to personal property rights will depend upon the way in which the GMA 9 GCDs incorporate the resulting MAGs into their GMPs, rules, and permitting decisions. Because of the inherent conflict in private property rights interests, it is important that GMA 9 established these DFCs to accommodate all groundwater users, and in doing so, strike the balance required by the Texas Water Code Section 36.108(d-2). While some may view these two DFCs as having potentially negative impacts on private property rights, GMA 9 would also offer that there are positive implications for private property rights that result from setting regional, long-term goals to actively aid in planning for and managing these groundwater resources to provide all users with their fair share of groundwater, and to preserve these resources for the benefit of all who rely upon them.

4.1.3.8 The Feasibility of Achieving the DFC

The feasibility of achieving any particular DFC is not a static event in time or perpetual milestone that once surpassed remains constant. It is a condition that will evolve with the changing demands and hydrologic conditions of an aquifer system. Something that is feasible today may not be feasible ten years from now, due to the confluence of many variables beyond the control of those who make groundwater management decisions.

Chapter 36 of the Texas Water Code gives GCDs the authority to manage aquifers within their jurisdiction. As part of their efforts to manage these groundwater resources, the GCDs continue to collect water level data and meter data and expand existing monitoring networks in an effort to improve the science and knowledge required to continually evaluate hydrologic conditions, manage the groundwater resources, and adapt to the ongoing challenges that may compromise DFC feasibility. One example is the implementation of monitoring plans and well networks to track the status of aquifer levels compared to the DFCs. Utilization of the best available science and implementation of the tools necessary to assess compliance with DFC goals is critical to ongoing assessment and achievement feasibility.

The DFCs are based on the best available science through the use of the approved GAM or other quantitative tools to determine whether they are physically possible, reasonable, and achievable. Once adopted and submitted to the TWDB, they are used to determine the MAG amounts, and are then considered to be the maximum available groundwater supply for that aquifer for RWPG purposes only and are used by the GCDs to manage their aquifers and to be considered as one of five factors in making decisions regarding permits.

Through joint-planning efforts, the GCDs conduct joint groundwater planning that includes annual reviews of the DFCs and the GMPs. Also, to ensure coordination with other water planning efforts, the GCDs are voting members of the RWPGs. Lastly, the GCDs are empowered with rule-making authority to implement and achieve the DFCs, authority to limit production and implement well spacing, and enforcement capabilities.

Trinity Aquifer and Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFCs Achievement Feasibility

The feasibility of achieving DFCs is commonly viewed from two perspectives. The first is from the standpoint of physical achievability and the second is that of regulatory achievability. One way of assessing the physical feasibility of DFCs is to assess them using TWDB GAMs. Because the GAMs are based on the physical aquifer structure and calibrated to aquifer conditions, they are a reasonable tool for assessing the physical achievability of DFCs. When assessing the regulatory feasibility of achieving the DFCs, the authority of GCDs and their coverage in a GMA should be considered. GCDs cover a large portion of the aquifers in GMA 9, and each of these districts has reasonable regulatory authority to monitor DFCs and implement rules to achieve the DFCs. Therefore, it is feasible to conclude that GMA 9 is in a position to achieve the DFCs.

The GCDs in GMA 9 have developed methods of comparing water level measurements with the 2008 baseline year and model predictions made during the development of the DFC for the Trinity Aquifer in GMA 9 (Hunt and Fieseler 2019). The methods use water level measurements from wells in the Trinity aquifer. Factors that are considering in well selection include availability and accessibility of wells that are monitored by the GCDs or TWDB, the well completion information, the representativeness of the well for the purposes of DFC evaluation, the frequency of data collection, and potential interference from other wells. These methods consider various ways of determining trends in each well and two methods for determining an average water level decline across GMA 9 for comparison to the 2008 baseline year and the Trinity Aquifer DFC statement. The methods allow for consideration of new monitoring wells to be incorporated over time and provides an objective and scientific approach for assessing aquifer conditions across GMA 9. The GMA 9 Committee has reviewed these methods and determined that they offer a reasonable preliminary approach to assessing aquifer conditions in GMA 9 and to gaining insight into the status of the aquifers and feasibility of achieving the DFCs. Two presentations related to these methodologies are found in **Appendix G**.

As stated in **Section 2.2** of this ER, the GMA 9 GCD members presented and discussed their annual evaluation of the Trinity Aquifer DFC at the September 2021 meeting. Their presentations included their methodology of analyzing water level measurements collected in 2020 from Middle Trinity Aquifer monitoring wells within their GCD and comparing those measurements to their baseline year (2008) measurements. Aside from SWTCGCD, each GCD member has a monitoring well system to evaluate DFCs.

Impacts of Trinity Aquifer and Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFCs on DFC Achievement Feasibility

With diligent monitoring and expansion of toolsets and knowledge needed to manage aquifers, the GMA 9 Committee will be better able to assess challenges that may require DFC modification. If the DFCs become either too stringent or not conservative enough, and become no longer feasible, the DFCs can be adjusted accordingly (toward more reasonableness) in future DFC joint-planning cycles.

4.1.3.9 Any Other Information Relevant to the Specific DFCs

In the 2021 joint-planning cycle, the GMA 9 Committee members considered other information related to the Trinity Aquifer that was presented during the 2016 joint-planning cycle. The first concerned potential large-scale pumping of the Trinity Aquifer east of GMA 9 in the jurisdiction of the BSEACD. At the time of the writing of this report, this large-scale pumping project is being re-evaluated by the applicant.

A second concern regarding the Trinity aquifer involved the drawdown from contiguous, unregulated areas that had taken place prior to the formation of SWTCGCD. It was noted that excessive growth in Travis, Hays, and Comal counties was causing an increased demand on groundwater in those high growth areas. This increased demand leads to the lowering of local water levels in those counties that causes a subsequent "cone of depression" and an increase of groundwater flow from upgradient Blanco County. This impact results in a decline in Blanco County groundwater resources and a corresponding negative impact on groundwater and property rights of Blanco County well and property owners.

Differences in the hydrogeology of the Trinity Aquifer also served as a potential factor that the GMA Committee considered again from the 2016 joint-planning cycle. During the 2016 joint-planning cycle, the GMA 9 Committee concluded that the Trinity Aquifer does not function uniformly across the extent of the GMA 9, and an update to the HCT GAM was needed to include these differences to develop multiple, achievable DFCs.

The GMA 9 Committee also considered issues regarding drought and pumping in Kerr County that were relevant during the 2016 joint-planning cycle. The GMA 9 Committee considered the drought the region experienced for the past five years since the GMA 9 Committee adopted the DFCs. They also assessed the effect of the City of Kerrville's pumping of the Lower Trinity during the drought.

Lastly, GMA 9 Committee members considered targeted and specific exemptions that could affect the Trinity MAG. The TGRGCD's enabling legislation creates limitations in preserving and protecting groundwater resources as addressed in the Texas Water Code Chapter 36. According to language within its enabling legislation, the TGRGCD must recognize all public water supply wells drilled or completed prior to September 1, 2002 as exempt from TGRGCD regulation, which is a departure from the Texas Water Code Chapter 36. This exemption to regulations for these public water supply wells creates a projection in which groundwater production within the TGRGCD could possibly exceed the MAG in the future. The TGRGCD continues to strive to protect existing wells as empowered by the Texas Legislature. Additionally, the HTGCD enabling statute exempts agricultural use wells, which are also normally considered non-exempt under the Texas Water Code Chapter 36. The GMA 9 GCDs will monitor and consider these issues in future DFC joint-planning cycles.

Impacts of Trinity and Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFCs on Any Other Information Relevant to the Specific DFCs

The comments and issues summarized above only relate to the Trinity Aquifer within GMA 9. The GCDs raised issues that could potentially be impacted by this DFC at some point in the future. The potential for these and other changed circumstances to the extent they can be identified and quantified may be considered in future DFC joint-planning efforts by the GMA 9 Committee.

None of the comments or issued raised above relate to the Edwards Group of the Edwards-Trinity (Plateau) Aquifer DFC. Therefore, no potential impacts have been identified.

4.1.4 Other DFCs Considered by GMA 9

Texas Water Code Section 36.108(d-3)(4) requires that the ER, among other things, list other DFC options that were considered, if any, and the reasons why these other DFCs were not adopted. The GMA 9 Committee did not consider or discuss any other specific DFCs during the 2021 DFC joint-planning cycle than the ones they adopted as proposed DFCs for the Trinity and Edwards Group of the Edwards-Trinity (Plateau) aquifers on March 22, 2021.

Regarding the Trinity Aquifer DFC, GMA 9 Committee members had conceptual discussions throughout the DFC joint-planning cycle about setting separate DFCs for the Middle Trinity and Lower Trinity aquifers. However, for the reasons discussed earlier in **Chapter 2.0**, the GMA 9 Committee decided to adopt only one DFC for the Trinity Aquifer.

4.1.5 Consideration of Other DFCs Recommendations

The Texas Water Code Section 36.108(d-3)(5) requires that the ER also include a discussion of the reasons why recommendations made by either advisory committees and in relevant public comments received by the GCDs were or were not incorporated into the DFCs. Some of the input GMA 9 GCDs received was in the form of a question rather than a comment on a specific DFC. Other input provided to either a GCD or the GMA 9 Committee was related to DFCs in general, or an alternative DFC for either the proposed Trinity or Edwards Group of the Edwards-Trinity (Plateau) aquifer DFCs.

GMA 9 Chairman Ron Fieseler prepared a summary of these questions and comments (both oral and written) for GMA 9 Committee consideration (**Appendix C**). This summary includes either a response by the GMA 9 Committee to the question, or a GMA 9 Committee response to the comment that explains why the comment was or was not incorporated into the DFCs. The questions and/or comments were consolidated into similar comment groupings to allow for a more efficient review of the public comments.

4.2 Minor Aquifers: Ellenburger-San Saba and Hickory Aquifer DFCs – Kendall County Only

The DFC adopted by the GMA 9 Committee for the Hickory Aquifer is the same as the DFC adopted in the 2016 DFC joint-planning cycle, and the DFC adopted for the Ellenburger-San Saba Aquifer is the same as the DFC that was adopted on October 17, 2016.[14] As a reminder, the GMA 9 Committee also voted to propose classifying portions of the Ellenburger-San Saba and Hickory aquifers as non-relevant for the purposes of joint planning in Blanco, Hays, Kerr, and Travis counties.

4.2.1 Policy and Technical Justifications – Ellenburger-San Saba and Hickory Aquifers

The following discussion sets out the GMA 9 Committee's policy and technical justifications in the 2021 DFC joint-planning cycle for the Ellenburger-San Saba and Hickory aquifers DFCs. This section restates the GMA 9 Committee's policy and technical justifications during the 2010 and 2016 DFC joint-planning cycles, and how the adopted DFCs for the Ellenburger-San Saba and Hickory aquifers achieve the "balance test" in Section 36.108(d-2) of the Texas Water Code.

2021 DFC Joint Planning

The DFC statement for the Ellenburger-San Saba is the following - *"Allow for an Increase in Average Drawdown of No More Than 7 Feet in Kendall County through 2080"* and the DFC statement for the Hickory Aquifer is the following - "*Allow for an Increase in Average Drawdown of No More Than 7 Feet in Kendall County through 2080.*" The GMA 9 Committee re-adopted the existing DFC statements for these aquifers with updated 2080 planning horizons. With this understanding, the GMA 9 Committee reviewed and discussed policy and technical justifications for the DFC statements for Ellenburger-San Saba and Hickory aquifers in Kendall County only including the following:

- Ellenburger-San Saba and Hickory aquifers were declared relevant in Kendall County by the request of CCGCD;
- DFCs are long-term targets and as such need to be assessed over an extended period; and
- The DFC can be re-evaluated during next DFC joint-planning cycle, and updated model runs can be considered.

Additionally, the GMA 9 Committee was reminded that the original DFC for the Ellenburger-San Saba Aquifer was not feasible using the TWDB's 2016 GAM for minor aquifers in the Llano Uplift Area. The CCGCD agreed to the seven-ft drawdown but requested that for the next DFC joint-planning cycle, the TWDB use this model to run a simulation using a 30-ft drawdown. The TWDB stated it was possible to provide the results of this requested model run early in the next cycle of the DFC joint-planning process.

[14] In the 2016 DFC joint-planning cycle, the GMA 9 Committee initially adopted the following DFC statement for the Ellenburger-San Saba Aquifer: "*Allow for an Increase in Average Drawdown of No More Than 2 Feet in Kendall County through 2070.*"

2016 DFC Joint Planning

In early 2013, the GMA 9 Committee began to discuss classifying certain aquifers as non-relevant for the purposes of the 2016 DFC joint-planning cycle, including the Ellenburger-San Saba and Hickory aquifers. The GMA 9 Technical Advisory Group proposed that the Ellenburger, Hickory, Marble Falls, and Upper Glen Rose aquifers be designated as non-relevant for regional groundwater planning purposes within GMA 9. This proposal would have reiterated the GMA 9 Committee's November 30, 2009 action in the 2010 DFC joint-planning cycle but would have made the aquifers non-relevant throughout GMA 9, including in Blanco County, where a DFC had previously been adopted.

In anticipation of this discussion and possible decision, on March 21, 2013, the BPGCD Board of Directors approved a resolution asking that the "GMA 9 Committee consider declaring the Ellenburger, Hickory, Marble Falls, and Upper Glen Rose aquifers 'Not Relevant' for regional groundwater planning purposes within GMA 9" for the reasons considered in the 2010 DFC joint-planning cycle and noted below, and for other reasons, such as concerns about new requirements under the Texas Water Code Section 36.108 and associated potential complexities and related expenses (Fieseler and Mathews 2013).

Those GMA 9 Committee members supporting this possible action also pointed to: 1) the lack of a significant regional basis, interaction, availability, or accessibility of the Ellenburger-San Saba or Hickory aquifers throughout GMA 9, except in Blanco County, which was limited; 2) the largest Ellenburger permitted well in Blanco County was owned by the City of Johnson City, and it was regulated by the TCEQ and the BPGCD, and with this exception, most of the production from these aquifers was from exempt wells; 3) the fact that no GAMs existed for the Ellenburger and Hickory aquifers, and only two-dimensional spreadsheet calculations were used, which were very localized; 4) the fact that non-relevant aquifers could still be managed locally by the individual GCDs; and 5) the GCDs might avoid certain complex, time-consuming, and costly tasks required by the Texas Water Code Chapter 36 by declaring these aquifers non-relevant. Some of these points were also considered during the 2010 DFC joint-planning cycle and are discussed below. Other points in favor of this position were the small groundwater availability amounts for these aquifers generated during the 2010 DFC joint-planning cycle, the lack of producing wells, and the likelihood of actual future production.

In addition, GMA 9 Committee members reiterated that declaring an aquifer non-relevant only had meaning for regional groundwater planning purposes and did not mean that the aquifer would be considered non-relevant for local GCD purposes. If a local aquifer was declared non-relevant and no MAG amount was available, the groundwater availability for that aquifer would be determined by the local GCD working cooperatively with the RWPG to incorporate a realistic water availability quantity into the RWP. MAG quantities derived from the DFC process had to be accepted and used by the RWPGs, but there was less certainty about whether the RWPGs would accept the local GCD recommendations. A small MAG amount may not be significant when comparing "water availability" to the "water demand" categories in the RWP. On April 14, 2014, the GMA 9 Committee adopted Resolution No. 041414-01 declaring the Ellenburger-San Saba and Hickory aquifers, along with the Marble Falls Aquifer, to be "non-relevant" for regional groundwater planning purposes in Blanco County.

However, in response to the Technical Advisory Group's proposed recommendation, the CCGCD requested the GMA 9 Committee continue considering all aquifers within GMA 9, including the Ellenburger-San Saba and Hickory aquifers, as relevant for regional groundwater planning purposes. The CCGCD reasoned that while several of the aquifers existed in some of the GCDs within GMA 9, were absent, or had not yet been fully delineated in others, all were all valuable groundwater resources that should be considered in the DFC process, with the local GCD boards and the GMA 9 Committee fulfilling their responsibilities and ultimately weighing in as to what the available groundwater amounts should be for regional and state water-planning purposes. To not do so would result in the GMA 9 Committee "ceding" its authority and responsibility for groundwater planning to the RWPGs, who would then develop these amounts and place them into the regional and state water plans. They urged the GMA 9 Committee to continue working together as a collective body to set DFCs for these aquifers that would result in MAG amounts to become the responsibility of the local GCDs and their elected boards. Regarding potential increased expenses related to the "unfunded mandates" now required by Section 36.108 of the Texas Water Code, the CCGCD noted that as water policy would continue to evolve in Texas, the GCDs could pool their limited funding resources to accomplish their legislative mandates (Fieseler and Mathews 2013).

In 2014, the CCGCD Board of Directors subsequently voted to request that all aquifers in Kendall County be considered relevant. The primary reasons for the CCGCD board's request were that they wanted some say in regional planning considerations for these aquifers, even if the MAG amounts were determined to be zero ac-ft. It was also the intention of the CCGCD to go through whatever technical process was required to set these DFCs, at the same time the GMA 9 Committee would consider DFCs for the other aquifers in the 2016 DFC joint-planning cycle.

The CCGCD request was then forwarded to each GMA 9 GCD board of directors for their consideration. On July 14, 2014, in recognition of local control and to achieve cooperation and consensus among the GCDs, the GMA 9 Committee unanimously voted to declare the Ellenburger and Hickory aquifers relevant in Kendall County. Both GMA 9 Committee actions regarding the BPGCD and CCGCD requests reflected the group's commitment to work together, respect local priorities, and find solutions that work for the good of each GCD and the region as a whole.

The DFCs adopted on April 18, 2016 for the Ellenburger-San Saba and Hickory aquifers in Kendall County were based on a long-term target (50-year period). The members of the GMA 9 Committee believed it was beneficial to assess any DFC over a longer period and re-evaluate it during future rounds of DFC joint planning.

2010 DFC Joint Planning

During the 2010 DFC joint-planning cycle, the GMA 9 Committee undertook detailed consideration of DFCs and non-relevant classifications that subsequently informed the 2016 and the 2021 DFC joint-planning cycles. Therefore, a summary of the DFC adoptions resulting from the 2010 DFC joint-planning cycle is included as part of this ER.

When the GMA 9 Committee adopted the DFCs for the 2010 DFC joint-planning cycle, the Committee recognized the general limitation of these aquifers to only Blanco County within GMA 9 and the following

DFCs were recommended to the GMA 9 Committee with the coordination of Hill Country UWCD and Hickory UWCD, both in GMA 7:

- Ellenburger-San Saba Aquifer – Allow for an increase in average drawdown of no more than two feet;
- Hickory Aquifer – Allow for an increase in average drawdown of no more than seven feet; and
- Marble Falls Aquifer – Allow for no net increase in average drawdown.

The rationale for these GMA 9 Committee actions was generally based upon:

- No known groundwater production from either the Ellenburger-San Saba or Hickory aquifers in Kendall or Kerr counties. Those aquifers involved such small quantities, and are at such great depths, that they are neither economically viable, nor likely to be developed in either of these two counties;
- Blanco County was the only county in GMA 9 with manageable quantities of Ellenburger-San Saba or Hickory groundwater production, and that only occurred in the northwestern portion of Blanco County;
- The largest Ellenburger-San Saba permitted well system (460 ac-ft/year) in Blanco County was owned by the City of Johnson City, and this public water supply system was regulated by both the TCEQ and the BPGCD. Except for a few small-volume permitted wells, the rest of the Ellenburger Aquifer production was from exempt domestic and/or livestock watering wells;
- Production from Hickory Aquifer wells in Blanco County was almost all for exempt use. There were a few non-exempt wells that pump into ranch ponds, and even those were generally located on large ranch tracts and had little or no off-site effects;
- Blanco County had perhaps less than 12 to 15 wells producing from the Marble Falls Aquifer, and those were all exempt wells;
- Because of the aquifers' geological and hydrogeological characteristics, none of the production from the Ellenburger-San Saba, Hickory, or Marble Falls aquifers had any effect on the other GCDs within GMA 9;
- At their November 30, 2009 meeting, the GMA 9 Committee voted unanimously to declare the Ellenburger-San Saba, Hickory, and Marble Falls aquifers to be not relevant for areas of GMA 9 outside of Blanco County.

Therefore, while portions of these aquifers might be significant in some areas within the BPGCD, they were clearly not relevant for regional groundwater management and planning purposes. The GMA 9 Committee believed that the local relevance and management of these aquifers would be best addressed by the local GCDs through their rules and GMPs. Both documents could then be provided to the applicable RWPGs to be incorporated into their RWPs.

Groundwater Availability Model Considerations

Based upon the DFCs adopted for the 2016 DFC joint-planning cycle, the TWDB calculated the following MAG amounts for the Ellenburger-San Saba and Hickory aquifers as shown in **Table 52** and **Table 53**.

Table 52. GMA 9 MAG Amounts for the Ellenburger-San Saba Aquifer in Kendall County by GCD for Each Decade Between 2010 and 2070

GCD	County	GCD Totals (ac-ft/year)						
		2010	2020	2030	2040	2050	2060	2070
CCGCD	Kendall	75	75	75	75	75	75	75
GMA 9 TOTALS		**75**	**75**	**75**	**75**	**75**	**75**	**75**

Source: Jones 2017.

Table 53. GMA 9 Modeled Available Groundwater Amounts for the Hickory Aquifer in Kendall County by GCD for Each Decade Between 2010 and 2070

GCD	County	GCD Totals (ac-ft/year)						
		2010	2020	2030	2040	2050	2060	2070
CCGCD	Kendall	140	140	140	140	140	140	140
GMA 9 TOTALS		**140**	**140**	**140**	**140**	**140**	**140**	**140**

Source: Jones 2017.

Achieving Section 36.108(d-2) of the Texas Water Code "Balance Test" – Ellenburger and Hickory Aquifer DFCs

While the potential groundwater availability amounts resulting from these Ellenburger-San Saba and Hickory aquifer DFCs in Kendall County may be small amounts, the GMA 9 Committee supports the CCGCD in their efforts to balance this possible groundwater production with efforts to conserve, preserve, and protect those water resources. The resulting MAGs may also inform the RWP process and allow the CCGCD to manage and monitor these resources in a manner, that from a policy perspective, is important to the citizens of Kendall County.

For these policy and technical reasons, the GMA 9 Committee adopted the DFCs for the Ellenburger-San Saba and Hickory aquifers as stated in **Table 34.**

4.2.2 GMA 9 Section 36.108(d) of the Texas Water Code Factor Considerations, and Impacts of Ellenburger-San Saba and Hickory Aquifer DFCs on Each Factor

As previously discussed in **Chapter 2.0** of this ER, on December 14, 2020, January 25, 2021, and March 22, 2021, the members of GMA 9 received detailed presentations on all nine factors as they related to DFCs in general, and the four DFCs being considered by GMA 9 (**Appendix E**).

The following provides a discussion of the GMA 9 Committee's consideration of each of the nine factors as they relate to the GMA 9 minor aquifer DFCs, and their impacts on each factor.

4.2.2.1 Aquifer Uses or Conditions within the Management Area, Including Conditions That Differ Substantially from One Geographic Area to Another

The following is a discussion of the GMA 9 Committee's consideration of this first factor identified in Texas Water Code Section 36.108(d), and how the adopted DFCs for the Ellenburger-San Saba and Hickory aquifers impact this factor.

GMA 9 Ellenburger-San Saba Aquifer Uses and Conditions

TWDB water use surveys for the year 2018 and exempt use estimates for 2020 indicate Ellenburger-San Saba Aquifer pumping only in Blanco County (TWDB 2018 and TWDB 2020). No estimates were reported for any other counties in GMA 9 that overlie the Ellenburger-San Saba Aquifer.

GMA 9 Hickory Aquifer Uses and Conditions

TWDB water use surveys for the year 2018 and exempt use estimates for 2020 indicate pumping from the Hickory Aquifer only in Blanco County (TWDB 2018 and TWDB 2020). No estimates were reported for any other counties in GMA 9 that overlie the Hickory Aquifer.

Impacts of Ellenburger-San Saba Aquifer and Hickory Aquifer DFCs on Aquifer Uses and Conditions

In Kendall County, a DFC of seven-ft drawdown has been adopted for both the Ellenburger-San Saba and Hickory aquifers. However, since no documented pumping occurs from these aquifers in Kendall County, the DFCs will have no impact on aquifer uses and conditions. The CCGCD adopted these DFCs to confirm the importance of these aquifers, and to establish quantitative planning goals, even though the aquifers are not presently being used extensively.

4.2.2.2 The Water Supply Needs and Water Management Strategies Included in the State Water Plan

The following is a discussion of the GMA 9 Committee's consideration of this second factor identified in Texas Water Code Section 36.108(d), and how the adopted Ellenburger-San Saba and Hickory aquifer DFCs impact this factor.

Texas Water Code Section 36.1071(e)(4) also requires that GCDs consider the water supply needs and water management strategies, included in the 2017 SWP, among other considerations, in developing and adopting their GMPs**.** To comply with this requirement, the GCDs in GMA 9 all have adopted GMPs that include consideration of the water supply needs and water management strategies identified in the most recently adopted SWP that was in place at the time their management plans were adopted. Given the various GCD deadlines for adopting GMPs, this factor discussion focuses on the water supply needs and water management strategies contained in the 2017 SWP for those counties located within the GMA 9 GCDs.

2017 State Water Plan Water Supply Needs and GMA 9

For a complete discussion of the GMA 9 Committee's consideration of this second factor – water supply needs and water management strategies included in the SWP – as it relates to water supply needs in the 2017 SWP and GMA 9, please refer to **Section 4.1.3.2** of this ER.

On December 14, 2020, the GMA 9 Committee was provided with, and considered, a detailed listing of all water supply needs contained in the 2017 SWP for the counties covered by the GMA 9 GCDs within Regions J, K, and L. It is important to note that the water supply needs listed in the 2017 SWP include the entire county, and GMA 9 may not contain the entire county within its boundaries. The TWDB provides this and other statutorily required data to the GCDs to prepare their updated GMPs. Some of this data is apportioned by formula to reflect district-specific information as required by the Texas Water Code. The water supply needs data, however, is provided on a county-wide basis because the GCDs are only required to consider the information in these tables (Allen 2017a-i).

Impacts of Ellenburger-San Saba and Hickory Aquifer DFCs on Water Supply Needs and Water Management Strategies Included in the State Water Plan

None of the water supply needs or management strategies in the 2017 SWP are related to either the Ellenburger-San Saba Aquifer or Hickory Aquifer in Kendall County. Therefore, it is highly unlikely these DFCs will impact the 2017 SWP.

4.2.2.3 Hydrological Conditions, Including for Each Aquifer in the Management Area the TERS as Provided by the EA, and the Average Annual Recharge, Inflows, and Discharge

The following is a discussion of the GMA 9 Committee's consideration of this third factor identified in Texas Water Code Section 36.108(d) and how the adopted DFCs for the Ellenburger-San Saba and Hickory aquifers impact this factor.

Total Estimated Recoverable Storage

For discussion of the TERS amounts provided for the Ellenburger-San Saba and Hickory aquifers, please refer to **Chapter 3.0** of this ER.

Average Annual Recharge

The TWDB estimates that the recharge from precipitation on the outcrop to the Ellenburger-San Saba Aquifer in Kerr and Kendall counties is zero ac-ft/year because there is no surface outcrop of the aquifer in those counties. **Table 54** summarizes the flow into and out of the CCGCD, as well the annual volumes of flow between the Ellenburger-San Saba and other aquifers.

Table 54. Summary of Ellenburger-San Saba and Hickory Aquifer Recharge, Inflows, and Discharge to Other Aquifers in the CCGCD

Aquifer	Estimated Annual Recharge from Precipitation (ac-ft/year)	Estimated Annual Volume Discharge to Springs and Surface Water (ac-ft/year)	Estimated Annual Volume Flow into GCD within Aquifer (ac-ft/year)	Estimated Annual Volume Flow Out of GCD within Aquifer (ac-ft/year)	Estimated Net Annual Flow between Aquifers in the GCD (ac-ft/year)
Ellenburger-San Saba Aquifer	0	0	5,059	4,811	1,626 (From Ellenburger-San Saba to Hickory) 3,948 (From Ellenburger-San Saba to brackish units) 4,743 (From Ellenburger-San Saba to overlying units) 2,746 (From Ellenburger-San Saba to underlying confining units) 75 (From Ellenburger-San Saba to underlying Precambrian units)
Hickory Aquifer	0	0	2,696	2,065	1,623 Flow from Hickory into Ellenburger-San Saba 2,753 Flow into Hickory from overlying confining units 200 Flow from Hickory into underlying confining units 1,288 Flow into Hickory from brackish Ellenburger-San Saba 280 Flow from Hickory into brackish Hickory

Source: Jones 2019.

Impacts of Ellenburger-San Saba and Hickory Aquifer DFCs on Hydrological Conditions

In Kendall County, DFCs of seven feet have been adopted for the Ellenburger-San Saba and Hickory aquifers. However, since no documented pumping occurs from these aquifers in Kendall County, the DFCs are not expected to have any significant impact on hydrological conditions. The DFCs were adopted so that the CCGCD would be able to retain its managerial jurisdiction even though the aquifers are not being utilized at present.

4.2.2.4 Other Environmental Impacts, Including Impacts on Spring Flow and Other Interactions between Groundwater and Surface Water

The following provides a discussion of the GMA 9 Committee's considerations of this fourth factor identified in Texas Water Code Section 36.108(d) and discussion of the Ellenburger-San Saba and Hickory aquifer DFCs impacts on this factor. As noted earlier in **Section 4.1.3.4** of this ER, the Texas Water Code also requires that GCDs consider the following: 1) the annual amount of recharge to the aquifers; 2) discharge from the aquifers to springs and any surface water bodies, including lakes, streams, and rivers; and 3) flow into and out of the GCDs within each aquifer and between aquifers in the GCDs, if a GAM is available, in developing their GMPs. To comply with this requirement, the GCDs in GMA 9 all have adopted GMPs for their GCDs that include consideration of these three factors.

Spring Flow and Groundwater/Surface Water Interaction Considerations in GMA 9

In the 2021 DFC joint-planning cycle, the GMA 9 Committee also received and considered results from the *Texas Aquifer Study – Groundwater Quantity, Quality, Flow, and Contributions to Surface Water* for the Ellenburger-San Saba and the Hickory Aquifers (Anaya et al., 2016). Explanation of how baseflow volumes were determined in this study can be found in **Section 4.1.3.4** of this ER. According to this study, precipitation and runoff contribute recharge to the Ellenburger-San Saba Aquifer in upland areas with discharge occurring as stream baseflow at lower elevations.

Impacts of Ellenburger-San Saba and Hickory Aquifer DFCs on Other Environmental Impacts, Including Impacts on Spring Flow and Other Interactions between Groundwater and Surface Water

There are no known springs emanating from either the Ellenburger-San Saba and Hickory aquifers in Kendall County. The potential MAGs amounts resulting from the DFCs for the Ellenburger-San Saba and Hickory aquifers in Kendall County will likely result in very small groundwater availability amounts. Also, since no documented pumping occurs from either of these aquifers in Kendall County, the DFCs will have no impact on this factor.

4.2.2.5 The Impact of Subsidence

The following is a discussion of the GMA 9 Committee's consideration of this fifth factor identified in Texas Water Code Section 36.108(d) and how the adopted DFCs for the Ellenburger-San Saba and Hickory aquifers impact this factor. For a discussion about subsidence, please refer to **Section 4.1.3.5**.

Impacts of Ellenburger-San Saba Aquifer and Hickory Aquifer DFCs on Subsidence

Based on the discussion of subsidence presented in **Section 4.1.3.5**, it is highly improbable that the DFC of seven feet adopted for both the Ellenburger-San Saba and Hickory Aquifers in Kendall County will have any impact on any potential form of subsidence in the county.

4.2.2.6 Socioeconomic Impacts Reasonably Expected to Occur

The following provides a discussion of the GMA 9 Committee's consideration of the sixth factor listed in Texas Water Code Section 36.108(d) to be discussed in the ER, and discussion of how the Ellenburger-San Saba and Hickory aquifer DFCs impact this factor.

For discussion of socioeconomic impacts as they relate to the state, regional, and joint-planning processes, please refer to **Section 4.1.3.6**, earlier in this ER.

Socioeconomic Impacts Reasonably Expected to Occur, and Possible Impacts of Ellenburger-San Saba and Hickory Aquifer DFCs

It is difficult to assess direct socioeconomic impacts likely to occur for the Ellenburger-San Saba Aquifer and Hickory Aquifer DFCs since no documented pumping occurs from these aquifers in Kendall County. Localized implementation of water management strategies at the CCGCD level may be more likely to inform direct economic impacts on the user community once pumping from these aquifers begins to occur. At that level, GCDs may better positioned to anticipate and address these issues through program implementation.

These two DFCs were adopted so the CCGCD would retain managerial jurisdiction even though these aquifers are not currently being used. While the potential MAGs resulting from the application of these two DFCs to the Ellenburger-San Saba and Hickory aquifers, respectively, in Kendall County may result in small groundwater availability amounts, the GMA 9 Committee supports the CCGCD in their efforts to balance this possible groundwater production with efforts to conserve, preserve, and protect these water resources.

4.2.2.7 The Impact on Interests and the Rights in Private Property, Including Ownership and the Rights of Management Area Landowners and Their Lessees and Assigns in Groundwater as Recognized Under Texas Water Code Section 36.002

For discussion of private property rights considerations in GMA 9, refer to **Section 4.1.3.7**, earlier in this ER.

Impacts of Ellenburger-San Saba and Hickory Aquifer DFCs on Interests and Rights in Private Property, Including Ownership and Rights of Management Area Landowners and Their Lessees and Assigns in Groundwater as Recognized Under the Texas Water Code Section 36.002

It is difficult to assess private property rights impacts likely to occur for the Ellenburger-San Saba and Hickory aquifer DFCs since no documented pumping occurs from these aquifers in Kendall County. Localized implementation of water management strategies at the CCGCD level may be more likely to balance private property rights impacts on the user community as pumping from these aquifers begins to occur. At that level, the CCGCD may better positioned to anticipate and address these issues through program implementation.

The DFCs were adopted so that the CCGCD would be able to retain their managerial jurisdiction even though the aquifers are not being utilized at present. While the potential MAGs resulting from the application of these two DFCs to the Ellenburger-San Saba and Hickory aquifers, respectively, in Kendall County may result in small groundwater availability amounts, the GMA 9 Committee supports the CCGCD in their efforts to balance this possible groundwater production with efforts to conserve, preserve, and protect these water resources.

4.2.2.8 The Feasibility of Achieving the DFC

For a discussion regarding the feasibility of achieving DFCs, please refer to **Section 4.1.3.8** in this ER.

Ellenburger-San Saba Aquifer and Hickory Aquifer DFC Achievement Feasibility

The feasibility of these DFCs being achieved in Kendall County cannot be determined until these resources are relied upon more consistently by the local users. From a practical standpoint, the monitoring well network will likely need only one or two wells to monitor these DFCs and verify DFC compliance.

Impact of Ellenburger-San Saba Aquifer and Hickory Aquifer DFCs on DFC Achievement Feasibility

The Hickory Aquifer DFC is the same as the DFC for this aquifer in GMA 7 – both are set at seven feet. The Ellenburger-San Saba Aquifer DFC is set at seven feet in GMA 9, as compared to a DFC of five feet for this aquifer in GMA 7. It is unlikely that these DFCs will be impacted by any pumping in Kendall County in GMA 9, thus achievement of the DFC is feasible. Additionally, monitoring any potential impacts within GMA 9 as a result of pumping in GMA 7 in Gillespie County is reasonable.

4.2.2.9 Any Other Information Relevant to the Specific DFC

As stated in **Section 4.1.3.9**, in the 2021 DFC joint-planning cycle, the GMA 9 Committee members considered other information related to the major aquifers that was also considered in the 2016 joint-planning cycle. None of these other considerations pertained to either the Ellenburger-San Saba or Hickory aquifers.

Impacts of Ellenburger-San Saba and Hickory Aquifer DFCs on Other Factors

As noted above, no other considerations were noted by the GMA 9 GCDs. Therefore, no additional impacts for these DFCs have been identified.

4.2.3 Other DFCs Considered by GMA 9

The Texas Water Code requires that the ER, among other things, list other DFC options that were considered, if any, and the reasons why these other DFCs were not adopted (Texas Water Code Section 36.108(d-3)(4)). As stated in **Section 4.2.1**, the TWDB will model a simulation of a 30-foot drawdown for the Ellenburger-San Saba Aquifer in the next DFC joint-planning cycle. For this DFC joint-planning cycle, however, the GMA 9 Committee did not consider or discuss any other specific DFCs other than the ones they adopted as proposed for the Ellenburger-San Saba and Hickory aquifers on November 15, 2021.

4.2.4 Consideration of Recommendations Made by Others

The Texas Water Code requires that the ER also include a discussion of the reasons why recommendations made by either advisory committees and in relevant public comments received by the GCDs were or were not incorporated into the DFCs (Texas Water Code Section 36.108(d-3)(5). GMA 9 and the GMA 9 GCDs did not receive public comments on the DFCs for the minor aquifers. Refer to **Appendix C.**

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Appendix A

TWDB DFC Submission Packet Checklist

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Texas Water Development Board Desired Future Condition Submission Packet Checklist - Administrative Completeness (part 1)			
Groundwater Management Area: 9			
Reviewing Staff:		**Date Packet Received:** **Date E-mail Acknowledgement Sent:** **Date Review Completed:**	
	Citation of Rule	Present in packet and administratively complete	Notes
1. Is a copy of the explanatory report addressing the information required by Texas Water Code §36.108(d-3) and the criteria in Texas Water Code §36.108(d) included? *(refer to Explanatory Report checklist before responding)*	31 TAC §356.32(1)	Yes	• GMA 9 ER: *Groundwater Management Area 9 Explanatory Report for Desired Future Conditions for Major and Minor Aquifers* (November 2021)
2. Is a copy of the resolution of the groundwater management area adopting the desired future condition(s) as required by Texas Water Code §36.108(d-3) included?	31 TAC §356.32(2)	Yes	• GMA 9 ER: Appendix D
3. Is a copy of the notice that was posted for the joint planning meeting at which the districts collectively adopted the desired future condition(s) as required by Texas Water Code §36.108(e) and §36.108(e-2) included?	31 TAC §356.32(3)	Yes	• GMA 9 ER: Appendix E
4. Is the name of a designated representative of the groundwater management area for TWDB staff to contact as necessary included?	31 TAC §356.32(4)	Yes	• GMA 9 Cover Letter to TWDB Transmitting • GMA 9 Adopted DFCs, ER, and Other • Required Information (includes Chairman Ronald Fieseler's contact information)
5. Are any groundwater availability model files or aquifer assessments acceptable to the executive administrator used in developing the adopted desired future condition(s) with documentation sufficient to replicate the work included? *(refer to the Groundwater Availability Model Administrative Elements checklist before responding)*	31 TAC §356.32(5)	Yes	• GMA 9 ER: • Tables 10 and 11 – Current GMA 9 Modeled Available Groundwater Amounts • Table 18- TWDB GMA 9 GAM Runs, Tasks or Aquifer Assessments
6. Is any other information the executive administrator may require to be able to estimate the modeled available groundwater included?	31 TAC §356.32(6)		• Defer to TWDB staff
Mark elements that are present in the packet with YES			
Mark elements that are not applicable with NA			
Mark elements that are missing from the packet with NO			

Texas Water Development Board Desired Future Condition Submission Packet Checklist - Groundwater Availability Model Administrative Elements (part 2)			
Groundwater Management Area: 9			
Reviewing Staff:		**Date Packet Received:**	
		Date Review Completed:	
	Citation of Rule	Present in packet and administratively complete	Notes
1. Is a descriptive narrative of the methods and references used to determine the desired future condition(s) included with the desired future condition(s) statements?		Yes	• Trinity Aquifer DFC - Chapter 2.0; and Chapter 4.0, Section 4.1 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 2.0; and Chapter 4.0, Section 4.1 • Ellenburger-San Saba Aquifer DFC - Chapter 2.0; and Chapter 4.0, Section 4.2 • Hickory Aquifer DFC - Chapter 2.0; Chapter 4.0, and Section 4.2 • Chapter 5: References
2. Is any other information the executive administrator may require to be able to estimate the modeled available groundwater included?	31 TAC §356.32(6)	Defer to TWDB Staff	• Defer to TWDB staff
3. If item 2 is no, please list additional information required. (For example, model or GIS files necessary for review)		NA	
Mark elements that are present in the packet with YES			
Mark elements that are not applicable with NA			
Mark elements that are missing from the Packet with NO			

Texas Water Development Board			
Desired Future Condition Submission Packet Checklist - Factors and Technical Elements (part 3)			
Groundwater Management Area: 9			
Reviewing Staff:		**Date Packet Received:**	
		Date Review Completed:	
	Citation of Rule	Present in packet and administratively complete	Notes
1. Does the explanatory report identify each desired future condition?	TWC §36.108(d-3)	Yes	GMA 9 ER: Table 2.
2. Does the explanatory report provide the policy and technical justifications for each desired future condition?	TWC §36.108(d-3)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.1 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.2 • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.1 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.1
3. Does the explanatory report include documentation that the factors under Subsection (d) were considered by the districts and a discussion of how the adopted desired future condition(s) impacts each factor?	TWC §36.108(d-3)	Yes	• Trinity Aquifer DFC - Chapter 2.0; Chapter 4.0, Section 4.1.3; and Appendix E • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 2.0; Chapter 4.0, Section 4.1.3; and Appendix E • Ellenburger-San Saba Aquifer DFC - Chapter 2.0; Chapter 4.0, Section 4.2.2; and Appendix E • Hickory Aquifer DFC - Chapter 2.0; Chapter 4.0, Section 4.2.2; and Appendix E
3a. Did the districts consider aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another?	TWC §36.108(d1)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.3.1 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.3.1 • Ellenburger-San Saba Aquifer DFC - Chapter 6.0, Subsection 4.2.2.1 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.2.1
3b. Did the districts consider the water supply needs and water management strategies included in the state water plan?	TWC §36.108(d2)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.3.2 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.3.2 • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.2.2 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.2.2
3c. Did the districts consider hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge?	TWC §36.108(d3)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.3.3 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.3.3 • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.2.3 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.2.3
3d. Did the districts consider other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water?	TWC §36.108(d4)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.3.4 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.3.4 • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.2.4 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.2.4
3e. Did the districts consider the impact on subsidence?	TWC §36.108(d5)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.3.5 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.3.5 • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.2.5 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.2.5
3f. Did the districts consider socioeconomic impacts reasonably expected to occur?	TWC §36.108(d6)	Yes	• Trinity Aquifer DFC - Chapter 6.0, Subsection 4.1.3.6 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.3.6 • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.2.6 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.2.6
3g. Did the districts consider the impact on the interests and rights in private property, including ownership and the rights of management area landowners and their lessees and assigns in groundwater as recognized under Section 36.002?	TWC §36.108(d7)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.3.7 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.3.7 • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.2.7 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.2.7

3h. Did the districts consider the feasibility of achieving the desired future condition(s)?	TWC §36.108(d8)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.3.8 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.3.8 • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.2.8 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.2.8
3i. Did the districts consider any other information relevant to the specific desired future condition(s)?	TWC §36.108(d9)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.3.9 • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.3.9 • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.2.9 • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.2.9
4. Does the explanatory report list other desired future condition options considered, if any, and the reasons why those options were not adopted?	TWC §36.108(d-3)(4)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.4; and Appendix E • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.4; and Appendix E • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.3; and Appendix E • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.3; and Appendix E
5. Does the explanatory report discuss reasons why recommendations made by advisory committees and relevant public comments received by the districts were or were not incorporated into the desired future condition(s)?	TWC §36.108(d-3)(5)	Yes	• Trinity Aquifer DFC - Chapter 4.0, Subsection 4.1.5; and Appendix C • Edwards-Trinity (Plateau) Aquifer DFC - Chapter 4.0, Subsection 4.1.5; and Appendix C • Ellenburger-San Saba Aquifer DFC - Chapter 4.0, Subsection 4.2.4; and Appendix C • Hickory Aquifer DFC - Chapter 4.0, Subsection 4.2.4; and Appendix C
Mark elements that are present in the packet with YES			
Mark elements that are missing from the packet with NO			

Texas Water Development Board Desired Future Condition Submission Packet Checklist - Non-Relevant Aquifer Elements (part 6)		
Groundwater Management Area: 9	**Reviewing Staff:**	
Required Documentation (31 TAC §356.31(b)): 1. Description, location, and/or map of aquifer or portion of the aquifer. 2. Summary of aquifer characteristics, groundwater demands, and current groundwater uses, including the total estimated recoverable storage as provided by the executive administrator, that support the conclusion that desired future conditions in adjacent or hydraulically connected relevant aquifer(s) will not be affected. 3. Why the aquifer or portion of the aquifer is non-relevant for joint planning.		
Aquifers	Present in packet	Notes
1 Edwards Aquifer (Balcones Fault Zone) in Bexar, Comal, Hays, and Travis Counties	Yes	Chapter 3.0, Section 3.1.1
2 Edwards Group of Edwards-Trinity (Plateau) Aquifer in Blanco and Kerr Counties	Yes	Chapter 3.0, Section 3.1.2
3 Ellenburger-San Saba Aquifer in Blanco and Kerr Counties	Yes	Chapter 3.0, Section 3.2.1
4 Hickory Aquifer in Blanco, Hays, Kerr, and Travis Counties	Yes	Chapter 3.0, Section 3.2.2
5 Marble Falls Aquifer in Blanco County	Yes	Chapter 3.0, Section 3.2.3
Mark elements that are present in the packet with YES		
Mark elements that are not applicable with NA		
Mark elements that are missing from the packet with NO		

Appendix B

GMA 9 Boundary Amendment Approval Letter from the TWDB

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Texas Water
Development Board
P.O. Box 13231, 1700 N. Congress Ave.
Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

May 19, 2021

Mr. Ronald G. Fieseler, P.G.
Chairman, Groundwater Management Area 9
Blanco-Pedernales Groundwater Conservation District
P.O. Box 1516
Johnson City, TX 78636

Dear Mr. Fieseler:

We received your two requests, dated March 2, 2021 and April 20, 2021, to amend the boundaries of groundwater management areas 8, 9, and 10 pursuant to 31 Texas Administrative Code (TAC) § 356.22. Based on staff technical and administrative review of the requested boundary changes and supporting documentation, it has been determined that the changes qualify as administrative corrections and have been approved. TWDB staff will make the necessary changes to the data files as described in TAC § 356.22 and will notify you when the change is complete.

By copy of this letter, and in compliance with TAC § 356.22(b), I am also informing the affected districts of this action.

Please feel free to contact Natalie Ballew of our Groundwater staff at 512-463-2779 or natalie.ballew@twdb.texas.gov if you have any questions regarding this action or need any further information.

Sincerely,

Jeff Walker Digitally signed by Jeff Walker Date: 2021.05.19 20:37:17 -05'00'

Jeff Walker
Executive Administrator

c w/o enc: Drew Satterwhite, North Texas Groundwater Conservation District
Michael Redman, Barton Springs Edwards Aquifer Conservation District
John T. Dupnik, P.G., Deputy Executive Administrator of Water Science and Conservation
Larry French, P.G., Groundwater
Natalie Ballew, P.G., Groundwater

Appendix C

GMA 9 Public Comment Summary

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<u>Appendix C</u>

Summarization of Public Comments Received
and
Groundwater Management Area 9 Responses September 22, 2021

Public participation is critical to the planning processes for the management of our groundwater resources. GMA 9 appreciates the many thoughtful comments and participation from its constituents and welcomes continued input throughout the process. These comments are valuable and will be considered by GMA 9 where appropriate and allowed by rule and law.

All Public Comments—both written and oral—received by Groundwater Management Area 9 (GMA 9) and its ten Groundwater Conservation District members (GCDs) have been consolidated into similar comment groupings whenever possible within this document to allow for a more efficient review and reading of the comments and corresponding GMA 9 Responses. Members of the GMA 9 Explanatory Report Liaison Subcommittee met on September 22, 2021 to discuss, review, and respond to the public comments prior to presenting this summary to the full GMA 9 Committee for review and consideration prior to taking action on the Desired Future Conditions (DFC) and the designation of any other aquifers or portions of other aquifers within the GMA 9 as Non-Relevant for regional planning purposes.

A. <u>No Oral Comments</u>

Seven of the ten GCDs received no oral, in-person public comments of any kind during the Public Hearings held at those GCDs. All ten GCDs received one or more written comments (see Mass Mail below).

B. <u>Oral Comments</u>

The Blanco Pedernales GCD, the Comal Trinity GCD, and the Hays Trinity GCD all received oral comments during their public hearings.

C. <u>Mass Mail-outs to GCDs</u>

Mr. Harris Greenwood (Blanco County), the Hill Country Alliance, and the Environmental Defense Fund mailed identical comment letters to multiple GCDs within GMA 9. Each comment letter will only be considered once in this summary and response.

D. <u>Local Governmental Resolutions</u>

The Hays County Commissioners Court, the City of Blanco, and the City of Wimberley submitted identical resolutions (the only differences being the name of the entity, its location and other particulars, and its signatories). These three resolutions will only be considered once in this summary and response.

E. Questions Asked

In almost every oral or written comment, the speaker or author posed question(s). While a Public Hearing is not intended for conversations or Q & A, a few questions were often answered by GCD Directors or District Staff as a courtesy and effort to inform those in attendance. The following were the most common questions:

- Why is there a 50-year timeline for GMA planning? *GMA 9 Response:* *GMAs use a 50-year planning horizon in an effort to better align with the timeline of Regional Water Planning Groups.*
- Why doesn't GMA 9 use a newer, better, and more accurate model? *GMA 9 Response:* *The TWDB dictates what* Groundwater Availability Modeling (GAM) *is utilized in the DFC process and in developing the Modeled Available Groundwater. The Groundwater Modeling group at the Texas Water Development Board [TWDB] is currently working on an update to the Edwards-Trinity (Plateau), Trinity, and Pecos Valley aquifers and then will carve out the Trinity Hill Country from that model and the existing conceptual model. The expected completion date for both models is early 2023" (N. Ballew, personal communication with TGRGCD, July 15, 2021).*
- Does the DFC or GAM restrict pumping of groundwater? *GMA 9 Response:* *Neither the DFC nor the GAM is an actual restriction or limit on pumping, but rather a management tool for tracking, analyzing, and management of a specific drawdown scenario, and is intended to help balance the groundwater demands of many users and interest groups.*
- Can a GCD use the DFC or MAG to stop someone from drilling a new well? *GMA 9 Response*: *The right of a property owner to drill for and use the water beneath their land is heavily protected by the Texas Water Code (TWC). GCDs have specifically listed and restricted regulatory authority, and the ability to deny someone the right to drill a well on their property is extremely limited. The GMA 9 response to the previous question also applies to this question.*
- Why is GMA 9 declaring my aquifer Non-Relevant? *GMA 9 Response: Texas Administrative Code (TAC), §356.31(b) allows a GMA to designate selected aquifers or portions of those aquifers as Non-Relevant for regional planning purposes. This designation may result from the aquifer being physically or geologically isolated from the majority of the GMA 9, it may be a low production or ephemeral aquifer, perhaps the aquifer is only located in one or two GCDs, or it may have other characteristics that render it "Non-Relevant" for other GCDs in the regional planning area. An aquifer declared "Non-Relevant" for regional planning purposes does not mean the aquifer is, in and of itself, "non-relevant". This designation allows local aquifers to be managed on a local basis independent of other GCDs in GMA 9.*

F. General comments opposing the proposed Trinity DFCs

Commentors stated the Proposed DFC for the Trinity Aquifer is excessive. Supporting data or suggested alternatives were not provided. *GMA 9 Response: GMA 9 current usage and water level data, TWDB model runs, and future growth projections indicate that the Proposed DFC is reasonable and appropriate for the aquifer and aquifer users for this planning cycle. GMA 9 welcomes relevant data from any source that will contribute to the discussion of potential changes to the DFCs in the upcoming planning cycle.*

G. Comments proposing a Trinity DFC based on spring flow

Commentors suggested the DFC should be based on spring flow and expressed a desire to protect, maintain, and restore spring flow by limiting pumping from the aquifer and reducing population growth over the aquifer. *GMA 9 Response: These comments were essentially conceptual in nature and did not propose specific DFC language alternatives. GMA 9 received several similar requests to base the DFC on spring flow during the first GMA planning cycle (2005-2010). GMA 9 responded to this earlier public input by asking the TWDB to conduct GAM runs to help the GMA 9 Committee evaluate the feasibility of using spring flow in establishing a DFC. The modeling provided by the TWDB indicated that spring flow could not be maintained during drought years, even with zero pumping, therefore, failing The reasonable and achievable requirements of a DFC. Despite the almost universal interest in a DFC based on spring flow, the GMA 9 Committee has determined that any DFC based on maintaining or restoring spring flow could not be achieved. Additionally, GMA 9 determined that protection of spring flow was best left to local GCDs who have the authority to promulgate rules and management plans to address local spring-related issues.*

H. Comments proposing "Zero Drawdown" or a lowering of the Trinity DFC

Commentors focused on the concept of designating a DFC based on "Zero Drawdown" or, as it is sometimes phrased, "Sustainability". This concept is based on managing an aquifer wherein recharge equals discharge, with an ultimate goal of maintaining a balance in the groundwater system. These comments were quite similar in intent and purpose, and despite differences in phrasing, all comments essentially recommended reducing the current DFC from approximately 30 feet of drawdown “toward zero drawdown”, or “no change in average drawdown" or "no increase in pumping". Several members of the public recommended lowering the DFC from 30 feet to 4 feet or 10 feet or “just somewhere below 30”. GMA 9 Response: *During the first planning cycle, the GMA 9 Committee designated a "Zero Drawdown" DFC for the Edwards Group of the Edwards-Trinity (Plateau) aquifer within the GMA 9. This DFC was appealed by two different public interests filing timely petitions with the TWDB. The appeal process proceeded to a Public Hearing before the TWDB Directors in Austin. Following testimony at that Public Hearing, by both the appellants and GMA 9, the TWDB found the DFC to be "not-*

reasonable" because it did not address projected future use. It was clear from the findings of the TWDB Public Hearing that a "Zero Drawdown" DFC would not be considered achievable or reasonable. Therefore, GMA 9 could not adopt any such recommended DFC during the first planning cycle. This TWDB decision has guided GMA 9 during each subsequent planning cycle. In an attempt to find common ground, GMA 9 considered many DFC scenarios and tested them with numerous model runs. GMA 9 chose the current DFC as the "best fit" to provide a balance between conservation and current demands, reasonable accommodations for projected future demands, and to impact creek and spring flow as little as possible. Based on the model runs and best available data, GMA 9 found that a DFC based on a decreased drawdown of 4 feet or 10 feet are not achievable and are not reasonable as those drawdown levels will not provide sufficient water for current and projected demands over the 50-year planning term.

I. <u>Comments regarding the TWDB model</u>

Several commentors described the Hill Country Trinity Groundwater Availability Model as being inadequate, inaccurate, and/or out-of-date. Some commentors noted that the model was based on regional assumptions and could not be used for local or real-time projections of stream flow, spring flow, and groundwater levels. <u>*GMA 9 Response:*</u> *The Hill Country Trinity Groundwater Availability Model was created and is maintained by the TWDB. Member GCDs of GMA 9 worked with the TWDB during the first planning cycle (2005-2010) in a partial revision of the model when local studies proved that recharge assumptions for the Cibolo Creek watershed were grossly incorrect. No revisions have been made to the model during the present planning cycle; however, "The Groundwater Modeling group at the TWDB is currently working on an update to the Edwards-Trinity (Plateau), Trinity, and Pecos Valley aquifers and then will carve out the Trinity Hill Country from that model and the existing conceptual model. The expected completion date for both models is early 2023" (N. Ballew, personal communication with TGRGCD, July 15, 2021). Further, the Hill Country Trinity Groundwater Availability Model was designed and created as a regional model, and not intended for use as a tool for localized predictive modeling. The TWDB dictates what model is utilized in the DFC process and to determine the Modeled Available Groundwater.*

J. <u>Comments proposing all aquifers be declared as "Relevant"</u>

Commentors suggested all aquifers; and specifically, the Ellenburger Aquifer, should be considered relevant for planning purposes. <u>*GMA 9 Response:*</u> *GMA 9 agrees that all aquifers should be considered relevant for planning purposes. However, GMA 9 has also determined that some aquifers are relevant for regional planning purposes while others are only relevant for local planning and management purposes and therefore need not be addressed on a regional level. GMA 9 reviews GCD-managed aquifers proposed for classification as non-relevant for joint-planning purposes each planning cycle and may make changes when appropriate. GMA 9 must provide the TWDB with the scientific, geological, or hydrogeological justification for each aquifer proposed as Non-Relevant. The final decision of whether or not each proposed Non-*

Relevant declaration is valid is determined by the TWDB. Based on the public comments received and a new GAM available in the next planning cycle, GMA 9 will revisit the Non-Relevant classifications in the next planning cycle.

K. Individual Public Comments

Harris Greenwood (Blanco County)

- Provided extensive comments on the importance of spring flow in the hydrogeological cycle including the following observations:
  - GMA 9 should declare all aquifers as "Relevant". *GMA 9 Response:* *Refer to response in section J above.*
  - GMA 9 is losing springs and other springs are experiencing reduced flow. This is a result of increased pumping. Mr. Greenwood recommends restoring aquifer levels to pre-1970 levels. *GMA 9 Response:* *Restoring aquifer levels to pre-1970 conditions is neither feasible nor reasonable. GMA 9 considered many DFC scenarios and tested them with numerous model runs. GMA 9 chose the current DFC as the "best fit" to provide a balance between conservation and current demands, reasonable accommodations for projected future demands, and to impact creek and spring flow as little as possible. Based on the model runs and best available data, GMA 9 believed that a DFC based on a decreased drawdown may be unachievable and not reasonable because it will likely not provide sufficient water for current and projected demands.*
  - Provided suggestions for alternative water sources for future development and indicates this should be part of the DFC process. *GMA 9 Response:* *GMA 9 is required to plan for desired future conditions of the various aquifers within the GMA 9 area. Alternative water sources are not part of the DFC declarations. However, GMA 9 and its member GCDs encourage use of alternative water supplies where feasible. It is important to note that GCDs do not have the authority to require use of alternative water supplies. The Regional Water Planning process does include alternative water resources for use, 31 TAC §357.35.*

Hill Country Alliance (HCA)

In addition to suggestions previously addressed within this document, HCA recommendations include:

- GMA 9 establishment of separate DFCs for the Upper, Middle, and Lower subdivisions of the Trinity Aquifer. *GMA 9 Response:* *GMA 9 has discussed this issue during each planning cycle. Thus far, GMA 9 has held the position that by setting a DFC for the entire Trinity Aquifer, each GCD can incorporate the local MAG to its best advantage.*

Some GCDs have little or no production from the Upper or Lower Trinity, thus a DFC and MAG for those areas would be of correspondingly little or no use. Due to limited pumping from the Upper and Lower Trinity, there is a general lack of regional data to support the decision to segregate the Trinity. During the second planning cycle, GMA 9 received a recommendation from Kirk Holland, PG, to propose the Upper Trinity as Non-Relevant since it was so rarely used within GMA 9. However, the issue of segregating the Trinity will be reconsidered in the next planning cycle.

- Improving the DFC public participation process by:
  - Establishing a clear start date and inviting public participation early in the process. <u>*GMA 9 Response:*</u> *The GMA 9 joint planning begins directly following the end of the current cycle. In accordance with TWC §36.108(d-3), final adoption of the DFC for the current planning cycle must occur no later than January 5, 2022 and with subsequent DFC adoptions being required at 5-year intervals thereafter. Further, district representatives must meet, at a minimum, annually to conduct joint planning (TWC §36.108(c)). All meetings of the joint planning committee must be posted in accordance with TWC §36.063 with public comment welcomed at each meeting. GMA 9 holds its meetings at different GCD locations to allow easier public attendance for those who prefer to travel shorter distances.*
  - Release of the Explanatory Report prior to the public comment period. <u>*GMA 9 Response:*</u> *The Explanatory Report (ER) is one of the last steps in the DFC process. It follows—and contains the record of—the Committee's process and approval of the DFCs and the classification and justification of GCD-managed aquifers proposed as Non-Relevant for regional planning purposes. That vote and the accompanying ER cannot be completed by the GMA 9 consultants until Public Hearings have been held and those comments received have been reviewed and responded to by the GMA 9 Committee. The ER is still in preparation and in draft form until it is presented to the GMA Committee members just before the vote at the end of the planning cycle. It is important to note that the ER is a record of the GMAs work throughout the five-year DFC process; the ER summarizes the means by which the GMA met all the regional planning requirements of TWC §36.108. It is not a detailed technical report on the scientific, modeling, geological, hydrogeological, or other aquifer characteristics; however, it does summarize and discuss how such characteristics were considered.*
  - Requiring less technical comments from the public. <u>*GMA 9 Response*</u> *The DFC process is based on, and requires, the use of scientific data, groundwater availability models, and various aquifer technical and physical characteristics. Public comments that include such data input are more likely to have an impact on the regional planning process.*

- Reducing the hydrological disconnects between planning and reality by setting DFCs along distinct hydrological boundaries rather than political/county boundaries. DFCs should consider spring flow and surface water interaction with groundwater. More science and data are needed, and data collection should be supported by the state agencies and additional state funding should be provided. *GMA 9 Response:* *DFCs are delineated by the TWDB and are set as closely as possible to the areal extent of the aquifer. In addition to the GMA 9 regional DFC and MAGs modeled by the TWDB, the TWDB modeling provides individual GCDs and Regional Planning Groups with DFCs and MAGs specific to the local GCDs, Counties, and River Basins. The DFCs and MAGs are planning tools and are applied in a variety of ways. GMA 9 considers spring flow and surface water issues in setting the DFC, as required by TWC §36.108. State agencies (primarily the TWDB) have offered various support and assistance in each planning cycle. Additional science and data from outside sources are welcome in GMA 9 (see previous bullet point). To date, GMAs have never received any direct state funding. All GMA expenses are shared by the member GCDs.*

Wimberley Valley Watershed Association (WVWA)

In addition to suggestions previously addressed within this document, WVWA recommendations include:

- Recommending that GMA 9 help design and implement local GCD management tools, strategies, goals, tasks, use of alternative water sources, and development of new models. *GMA 9 Response:* *GMA 9 is mandated to set DFCs and, if appropriate, the non-relevant designation for the aquifers within GMA 9 in accordance with TWC §36.108(d) and Texas Administrative Code (TAC), §356.31(b). It is the responsibility of local GCDs to incorporate various aquifer management tools, strategies, new research, model development, etc., as local needs require.*
- Reducing the DFC from 30 feet to somewhere between 0-4 feet of drawdown. *GMA 9 Response:* *TWDB model runs indicate that the Association's proposed DFC of 0-4 feet of drawdown would be unachievable and unreasonable, and therefore cannot be considered by GMA 9.*
- WVWA noted the 2020 Census will be too late for use in planning. *GMA 9 Response:* *The 2020 Census was delivered too late to be incorporated in the third planning cycle but will be used during the fourth planning cycle.*
- Use of forthcoming Blanco River Aquifer Assessment Tool predictive model for the DFC process. *GMA 9 Response:* *The Blanco River Aquifer Assessment Tool predictive model will be useful but will not supplant the TWDB's updated Groundwater Availability Model due for completion in 2023. It should be pointed out that several current and former*

GMA 9 GCDs (BSEACD, BPGCD, EAA, and HTGCD) have been involved in developing the Blanco River Aquifer Assessment Tool conceptual model and have made funds and staff time available for the upcoming predictive model.

Environmental Defense Fund (EDF)

In addition to suggestions previously addressed within this document, EDF recommendations include:

- Adopting DFCs that are based on local hydrological characteristics rather than regional drawdown. *GMA 9 Response:* *GMA 9 is required by Chapter 36.108 to plan on a regional basis. However, local hydrological characteristics are incorporated in the TWDB Groundwater Availability Model. Once DFCs have been established, the TWDB model uses local hydrological characteristics in the model cells to create local GCD/County/River Basin DFCs and MAGs, which are used in GCD Groundwater Management Plans, Regional Water Plans, and the State Water Plan.*
- Development of a standard method for member GCDs to utilize in determining compliance with DFCs. *GMA 9 Response:* *In accordance with TWC §36.1085, "Each district in the management area shall ensure that its management plan contains goals and objectives consistent with achieving the desired future conditions of the relevant aquifers as adopted during the joint planning process". Standardization may not be mandated by GMA 9, though the GCD members may agree upon a standard. Since 2019, GMA 9 has considered two comparable methods for tracking DFC compliance. Selection and utilization of these methods is based upon individual GCD choice.*
- Development of local DFCs by individual GCDs. One assertion put forth in support of this is the intersectional relationship between the DFC planning process and the development of the state water plan by regional water planning groups and a concern that the resultant water management strategies are "premised on managed depletion". *GMA 9 Response:* *In accordance with TWC §36.108(d-2), the GMAs must take into consideration the water supply needs and management strategies in the appropriate Regional Water Plan(s). Further, the Regional Water Planning Groups are required to incorporate the DFCs and MAGs set by the GMAs into the Regional Water Plans, 31 TAC §357.32(d). In reviewing DFC compliance annually and participating in an iterative five-year planning cycle, GMA 9 will be able to observe the long-term groundwater fluctuation averages and will be able to reassess the DFC if the data shows it to be necessary. During the current round of joint planning, the GMA -9 chose to set DFCs on an aquifer-wide scale. DFCs are not set by individual GCDs but the GMA as a whole and the GMA may best determine how the DFCs are represented. During the upcoming 4th joint planning cycle, GMA 9 may consider developing DFCs based on individual GCDs, individual counties, etc. as other GMAs throughout the state have successfully done. An*

updated GAM—anticipated to be available in the 4th cycle—will provide improved accuracy and assist the GMA 9 in determining how to best adopt DFCs within the GMA 9 according to the best available science. With regards to EDF's concerns about "managed depletion", GMA 9 notes that the GMA 9 Trinity DFC is 30 feet of average drawdown, not depletion. GMA 9 chose this DFC metric to reflect the fact that aquifer levels in the Hill Country Trinity Aquifer fluctuate constantly based local weather, seasonal use, and type of local use. As years of records accumulate, the water levels in monitor wells will average out annual fluctuations. By reviewing DFC compliance annually and going through an iterative five-year planning cycle, GMA 9 will be able to observe the long-term averages and have an opportunity to reassess the DFCs,

- Suggesting a DFC based on spring flow is more appropriate for those areas within GMA 9 where "indicator" springs are present with significant surface/groundwater interaction. For areas where recharge is not influenced by spring flow, EDF recognizes a DFC based on "managed depletion may be appropriate". They state that varying hydrological conditions are not addressed by a single "managed depletion" DFC. They describe the conditions in parts of Blanco and Hays Counties and state that there are areas where aquifer mining is occurring. In several of their comments, they discuss "managed depletion" <u>*GMA 9 Response:*</u> *For responses to the comment about a DFC based on spring flow, please refer to DFCs based on spring flow in section G above. With regards to the "aquifer mining" and/or "managed depletion" concerns , Blanco County Trinity Aquifer Monitor Well records show an average aquifer level in 2020 that was 9 feet higher than the GMA 9 baseline year of 2008, therefore, aquifer mining or "managed depletion" may not appropriately describe the current situation Blanco County. Recent studies along the Hays/Travis County line indicate that some level of aquifer mining may be occurring in that area. The concept of mining any physical resource, including water, describes the removal of that resource without any expectation of recovery or replacement. Hill Country aquifer water levels fluctuate as groundwater is pumped out or leaked out, but from time to time, water is replaced in the aquifers through recharge, and thus does not fall within the definition of mining. Additionally, GMA 9 does not use the term or the concept of "managed depletion". A more appropriate view of the GMA 9 Trinity DFC would be looking at it as "how much fluctuation in average Trinity Aquifer levels are we willing to accept over the next fifty years?*

GMA 9 appreciates all public comments and participation at the GMA 9 meetings and local GCD Public Hearings. GMA 9 will retain all public comments and will consider relevant comments during the next planning cycle.

None of the Boards of Directors of GCD located within GMA-9 proposed any changes to the GMA-9 Proposed DFCs as a result of the public comments received at their Public Hearings, or through the public comment period.

Considered and adopted by GMA-9 on November 15, 2021.

Ronald G. Fieseler, P.G.
Chairman, GMA-9

George Wissmann
Vice Chairman, GMA-9

Appendix D

GMA 9 DFC Adoption Resolution

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STATE OF TEXAS §
§ **RESOLUTION # 111521-01**
GROUNDWATER §
MANAGEMENT AREA 9 §

Adopting the Groundwater Management Area 9 Joint Planning Committee's Proposed Classification of Locally Managed Aquifers as Non-Relevant for Joint Planning Purposes and the Desired Future Conditions for Relevant Major and Minor Aquifers in GMA 9, and authorizing the GMA 9 Chairman to formally submit them and all other required information to the TWDB.

WHEREAS, the Groundwater Conservation Districts (GCDs) located within or partially within Groundwater Management Area 9 (GMA 9) are required under Chapter 36.l08, Texas Water Code to conduct joint planning and designate the Desired Future Conditions (DFCs) for aquifers within GMA 9; and

WHEREAS, the Board Presidents or their Designated Representatives of the GCD Members of the Groundwater Management Area 9 Joint Planning Committee (GMA 9) have met as a Committee in various meetings and conducted joint planning in accordance with Section 36.l08, Texas Water Code since September 2005; and

WHEREAS, GMA 9, having given proper and timely notice, held an open meeting of the GMA 9 Committee on March 22, 2021 in a ZOOM Virtual Meeting format allowed under a variance to the Open Meetings Act issued by the Governor of Texas due to the Covid pandemic; and

WHEREAS, following GMA 9's March 22, 2021 adoption of GMA 9 Proposed DFCs and the Proposed Classification of Non-Relevant Aquifers, and in accordance with Section 36.108, GMA 9 has solicited and considered public comment during a Public Hearing at each GCD located within or partially within GMA 9, through written public comments, and through public comment in person at various GMA 9 Committee meetings; and

WHEREAS, the GMA 9 Committee received and considered technical advice regarding the requirements contained in Chapter 36.108(subsections c-d3), including but not limited to local aquifers, hydrology, geology, recharge characteristics, local groundwater demands and usage, population projections, ground and surface water inter-relationships, and other considerations that affect groundwater conditions from the Texas Water Development Board (TWDB), Regional Water Planning Groups J, K, and L, consultants, hydrologists, geologists, and other groundwater professionals; and

WHEREAS, following public discussion and due consideration of the current and future needs and conditions of the aquifers in question, the current and projected groundwater demand estimates from local GCDs, the TWDB, and Regional Water Planning Groups J, K, and L, the potential effects on springs, surface water, habitat, and water-dependent species for DFCs set through the year 2060 for the Trinity Aquifer or 2080 for the Edwards Group of the Edwards-Trinity (Plateau), the Ellenburger-San Saba, and Hickory aquifers, the following motions were made and acted upon:

Motion #1:

Moved by George Wissmann and seconded by Micah Voulgaris to adopt the following Desired Future Condition through the year 2060 for the Trinity Aquifer located in GMA 9:

- Allow for An Increase in Average Drawdown of Approximately 30 Feet Through 2060 (Throughout GMA 9) Consistent With "Scenario 6" in TWDB GAM Task 10-005.

  The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #2

Moved by Micah Voulgaris and seconded by Dave Mauk to adopt the following Desired Future Condition through the year 2080 for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer for those portions located in Kendall and Bandera counties:

- Allow For No Net Increase in Average Drawdown in Kendall and Bandera Counties Through 2080.

  The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #3

Moved by Micah Voulgaris and seconded by Dave Mauk to adopt the following Desired Future Condition through the year 2080 for the portions of the Ellenburger-San Saba Aquifer located in Kendall County:

- Allow for An Increase in Average Drawdown of No More Than 7 Feet in Kendall County Through 2080.

  The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #4

Moved by Micah Voulgaris and seconded by Dave Mauk to adopt the following Desired Future Condition through the year 2080 for the portions of the Hickory Aquifer located in Kendall County:

- Allow for An Increase in Average Drawdown of No More Than 7 Feet in Kendall County Through 2080.

  The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #5

Moved by Jimmy Klepac and seconded by Gene Williams to propose the classification of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer located in Blanco County and Kerr County as non-relevant for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed

Motion #6

Moved by Jimmy Klepac and seconded by George Wissmann to propose the classification of the Ellenburger-San Saba Aquifer located in Blanco County and Kerr County as non-relevant for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #7

Moved by Charlie Flatten and seconded by Jimmy Klepac to propose the classification of the Hickory Aquifer located in Blanco, Hays, Kerr, and Travis counties as non-relevant for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #8

Moved by Jimmy Klepac and seconded by George Wissmann to propose the classification of the Marble Falls Aquifer located in Blanco County as non-relevant aquifer for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #9

Moved by David Caldwell and seconded by Lane Cockrell to propose the classification of the Edwards Aquifer (Balcones Fault Zone) located in Bexar, Comal, Hays, and Travis counties as non-relevant for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Whereas, the above Motions and Votes of each Committee Member have been recorded in the Minutes of the November 15, 2021 GMA 9 Committee Meeting,

NOW THEREFORE BE IT RESOLVED, Groundwater Management Area 9 Joint Planning Committee Members present and voting on November 15, 2021 do hereby document, record, and confirm the above-described Motions and Votes.

Approved by consensus and signed on November 15, 2021 by the following Voting Groundwater Management Area 9 Joint Planning Committee Members:

Jimmy Klepac – Board President of the Blanco-Pedernales GCD

Dave Mauk – General Manager and Designated Representative for the Bandera County River Authority and Groundwater Conservation District

David Caldwell - General Manager and Designated Representative for the Medina County GCD

Charlie Flatten - General Manager and Designated Representative for the Hays Trinity GCD

Micah Voulgaris – General Manager and Designated Representative for the Cow Creek GCD

George Wissmann – General Manager and Designated Representative for the Trinity Glen Rose GCD

Gene Williams - General Manager and Designated Representative for the Headwaters GCD

H.L. Saur - General Manager and Designated Representative of the Comal Trinity GCD

Lane Cockrell - General Manager and Designated Representative for the Southwestern Travis County GCD

Appendix E

GMA 9 Joint-Planning Meeting Documents and Presentations

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Groundwater Management Area 9 Joint Planning Committee Meeting

NOTICE OF OPEN MEETING

As required by Section 36.108(e), Texas Water Code, a meeting of the **Groundwater Management Area 9 Joint Planning Committee**, comprised of district representatives from the following groundwater conservation districts located wholly or partially within Groundwater Management Area 9: Bandera County River Authority and Groundwater District, Barton Springs/Edwards Aquifer Conservation District, Blanco-Pedernales Groundwater Conservation District, Comal Trinity Groundwater Conservation District , Cow Creek Groundwater Conservation District, Headwaters Groundwater Conservation District, Hays-Trinity Groundwater Conservation District, Medina County Groundwater Conservation District, Trinity-Glen Rose Groundwater Conservation District, and Southwest Travis County Groundwater Conservation District, will be held on **Monday, November 5, 2018, at 10:00 am at the Dripping Springs City Hall, 511 Mercer Street, Dripping Springs, Texas.**

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Approval of January 29, 2018 GMA 9 Meeting Minutes.
5. Texas Water Development Board updates, comments, or communications.
6. Consider GMA 9 Resolution 2018-01 regarding those portions of northern Medina County currently located in GMA 9 being reassigned to GMA 10.
7. Report on progress of "common rules" analysis by GMA 9 ad hoc subcommittee.
8. Discussion on existing GMA 9 DFCs and the possible need for revisions in this planning cycle.
9. Annual Review of individual GCD Management Plans and the accomplishments of GMA 9 in accordance with Chapter 36.108(c). NOTE: GMA0 9 GCDs are required to meet Chapter 36.108(c) requirements and should be prepared to present a short summary of its Management Plan and how it complies with Chapter 36.108(c). Committee members and members of the public are encouraged to conduct individual reviews of each GCD Management Plans prior to the meeting. GMA 9 GCD Management Plans can be found at this website:

   http://www.twdb.texas.gov/groundwater/conservation_districts/index.asp

   Use the index to locate each GCD. Open the desired GCD site and click on the link to the most recent Management Plan to access a PDF copy of their current Plan. The following are the GCDs located within GMA 9
   - Bandera County River Authority and Ground Water District
   - Barton Springs/Edwards Aquifer Conservation District
   - Blanco-Pedernales Groundwater Conservation District
   - Comal Trinity Groundwater Conservation District
   - Cow Creek Groundwater Conservation District
   - Hays Trinity Groundwater Conservation District
   - Headwaters Groundwater Conservation District
   - Medina County Groundwater Conservation District
   - Trinity-Glen Rose Groundwater Conservation District
   - Southwest Travis County Groundwater Conservation District (newly created...no Management Plan at this time)
10. Public Comment.
11. Next meeting date, location, and future agenda items.
12. Announcements.
13. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:

Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 office, (830) 708-5020 cell, email to: manager@blancogw.org

Groundwater Management Area 9 Joint Planning Committee Meeting

NOTICE OF OPEN MEETING

As required by Section 36.108(e), Texas Water Code, a meeting of the **Groundwater Management Area 9 Joint Planning Committee**, comprised of district representatives from the following groundwater conservation districts located wholly or partially within Groundwater Management Area 9: Bandera County River Authority and Groundwater District, Barton Springs/Edwards Aquifer Conservation District, Blanco-Pedernales Groundwater Conservation District, Comal Trinity Groundwater Conservation District , Cow Creek Groundwater Conservation District, Headwaters Groundwater Conservation District, Hays Trinity Groundwater Conservation District, Medina County Groundwater Conservation District, Trinity-Glen Rose Groundwater Conservation District, and Southwest Travis County Groundwater Conservation District, will be held on **Monday, February 4, 2019, at 10:00 am at the Upper Guadalupe River Authority Classroom, located at 125 Lehmann Dr., Kerrville, Texas.**

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Approval of November 5, 2018 GMA 9 Meeting Minutes.
5. Texas Water Development Board updates, comments, or communications.
6. Individual District updates, comments, or communications if necessary.
7. Discussion on existing GMA 9 DFCs and the possible need for revisions in this planning cycle.
8. Discussion on standardization of Monitor Well analysis and reporting.
9. Consider having the GMA 9 Chairman and Vice Chairman meet with consultants Velma Danielson and James Beach to discuss consultant tasks and work products needed by GMA 9 during this planning cycle compared with previous cycle.
10. Public Comment.
11. Next meeting date, location, and future agenda items.
12. Announcements.
13. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:

Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 office, (830) 708-5020 cell, email to: manager@blancogw.org

Groundwater Management Area 9 Joint Planning Committee Meeting

NOTICE OF OPEN MEETING

As required by Section 36.108(e), Texas Water Code, a meeting of the **Groundwater Management Area 9 Joint Planning Committee**, comprised of district representatives from the following groundwater conservation districts located wholly or partially within Groundwater Management Area 9: Bandera County River Authority and Groundwater District, Barton Springs/Edwards Aquifer Conservation District, Blanco-Pedernales Groundwater Conservation District, Comal Trinity Groundwater Conservation District , Cow Creek Groundwater Conservation District, Headwaters Groundwater Conservation District, Hays Trinity Groundwater Conservation District, Medina County Groundwater Conservation District, Trinity-Glen Rose Groundwater Conservation District, and Southwestern Travis County Groundwater Conservation District, will be held on **Monday, April 22, 2019, at 10:00 am at the Bee Cave City Hall, 4000 Galleria Parkway, Bee Cave, Texas 78738.**

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Approval of February 4, 2019 GMA 9 Meeting Minutes.
5. Texas Water Development Board updates, comments, or communications.
6. TWDB presentation on Brackish Groundwater in the Hill Country Trinity Aquifer.
7. Individual District updates, comments, or communications if necessary.
8. Report and recommendations of Technical Committee on standardization of Monitor Well analysis and reporting.
9. Report and recommendations from the GMA 9 Chairman and Vice Chairman on their meeting with consultants Velma Danielson and James Beach to discuss consultant tasks and work products needed by GMA 9 during this planning cycle compared with previous cycle.
10. Discussion on existing GMA 9 DFCs and the possible need for revisions either GMA-wide or GCD specific during this planning cycle.
11. Discussion of consultant work products, including scope of work, timelines, costs, etc. to address the needs of GMA 9 during the current GMA planning cycle.
12. Designation of a GCD to serve as the contracting entity with the consulting team.
13. Public Comment.
14. Next meeting date, location, and future agenda items.
15. Announcements.
16. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:

Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 office, (830) 708-5020 cell, email to: manager@blancogw.org

Directions:

The Hill Country Galleria at Bee Cave is located on Highway 71, west of Austin and south of Lake Travis between RR 2244 and RR 620. Turn north on Cross Town Pkwy to enter the Galleria. You will arrive at a large "roundabout" Circle. There is parking to the left and to the right. The City Hall is the building immediately north of the Circle. We anticipate that we will be meeting in a conference room on the second floor.

Groundwater Management Area 9 Joint Planning Committee Meeting

NOTICE OF OPEN MEETING

As required by Section 36.108(e), Texas Water Code, a meeting of the **Groundwater Management Area 9 Joint Planning Committee**, comprised of district representatives from the following groundwater conservation districts located wholly or partially within Groundwater Management Area 9: Bandera County River Authority and Groundwater District, Barton Springs/Edwards Aquifer Conservation District, Blanco-Pedernales Groundwater Conservation District, Comal Trinity Groundwater Conservation District , Cow Creek Groundwater Conservation District, Headwaters Groundwater Conservation District, Hays Trinity Groundwater Conservation District, Medina County Groundwater Conservation District, Trinity-Glen Rose Groundwater Conservation District, and Southwestern Travis County Groundwater Conservation District, will be held on **Monday, June 17, 2019, at 10:00 am at the Cow Creek Groundwater Conservation District Office, 9 Toepperwein Rd, Boerne, TX 78006.**

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Approval of April 22, 2019 GMA 9 Meeting Minutes.
5. Texas Water Development Board updates, comments, or communications.
6. Individual District updates, comments, or communications if necessary.
    a. Medina County GCD status report.
    b. Southwestern Travis County GCD status report.
7. Discussion regarding GMA 9 continuing its working relationship with the existing consulting team for the current planning cycle.
8. Discussion on existing GMA 9 DFCs and any GCD-requested need for revisions during this planning cycle, either GMA-wide or GCD specific.
9. Discussion of consulting team work products, including a proposed scope of work, timelines, costs, etc. to address GMA 9 needs during the current GMA planning cycle.
10. Public Comment.
11. Next meeting date, location, and future agenda items.
12. Announcements.
13. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:

Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 office, (830) 708-5020 cell, email to: manager@blancogw.org

Groundwater Management Area 9 Joint Planning Committee Meeting

NOTICE OF OPEN MEETING

As required by Section 36.108(e), Texas Water Code, a meeting of the **Groundwater Management Area 9 Joint Planning Committee**, comprised of district representatives from the following groundwater conservation districts located wholly or partially within Groundwater Management Area 9: Bandera County River Authority and Groundwater District, Barton Springs/Edwards Aquifer Conservation District, Blanco-Pedernales Groundwater Conservation District, Comal Trinity Groundwater Conservation District , Cow Creek Groundwater Conservation District, Headwaters Groundwater Conservation District, Hays Trinity Groundwater Conservation District, Medina County Groundwater Conservation District, Trinity-Glen Rose Groundwater Conservation District, and Southwestern Travis County Groundwater Conservation District, will be held on **Monday, November 18, 2019, at 10:00 am at the Mammen Family Public Library 131 Bulverde Crossing, Bulverde, TX 78163.**

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Approval of June 17, 2019 GMA 9 Meeting Minutes.
5. Texas Water Development Board updates, comments, or communications.
6. Individual District updates, comments, or communications if necessary.
   a. Medina County GCD status report.
   b. Southwestern Travis County GCD status report.
7. Annual Review of individual GCD Management Plans and the accomplishments of GMA 9 in accordance with Chapter 36.108(c). NOTE: GMA 9 GCDs are required to meet Chapter 36.108(c) requirements and should be prepared to present a short summary of its Management Plan and how it complies with Chapter 36.108(c). Committee members and members of the public are encouraged to conduct individual reviews of each GCD Management Plans prior to the meeting. GMA 9 GCD Management Plans can be found at this website:

   http://www.twdb.texas.gov/groundwater/conservation_districts/index.asp

   Use the index to locate each GCD. Open the desired GCD site and click on the link to the most recent Management Plan to access a PDF copy of their current Plan. The following are the GCDs located within GMA 9:
   - Bandera County River Authority and Ground Water District
   - Barton Springs/Edwards Aquifer Conservation District
   - Blanco-Pedernales Groundwater Conservation District
   - Comal Trinity Groundwater Conservation District
   - Cow Creek Groundwater Conservation District
   - Hays Trinity Groundwater Conservation District
   - Headwaters Groundwater Conservation District
   - Medina County Groundwater Conservation District

- Trinity-Glen Rose Groundwater Conservation District
- Southwestern Travis County Groundwater Conservation District (newly created and pending confirmation election...no Management Plan at this time)

8. Hydrogeological Studies in Southwestern Travis County, a presentation by Brian Hunt.
9. Proposed use of a common spreadsheet evaluation of monitor well water levels for GMA 9 GCDs. (Fieseler/Hunt)
10. Discussion: would GCDs prefer a 10 year planning cycle vs the current 5 year cycle?
11. Review Desired Future Condition (DFC) Joint Planning Requirements in Texas Water Code Section 36.108. (consulting team)
12. Review approach and schedule for GMA 9 third round of DFC joint planning. (consulting team)
13. Review previous groundwater availability model runs, DFCs and non-relevant aquifer classifications from GMA 9 second round of DFC joint planning. (consulting team)
14. Public Comment.
15. Next meeting date, location, and future agenda items.
16. Announcements.
17. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:

Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 office, (830) 708-5020 cell, email to: manager@blancogw.org

Notice of an Open Meeting of the
Groundwater Management Area 9 Joint Planning Committee
Monday, December 14, 2020 at 9:00 AM

Please use the following link to register for the meeting:

https://blantonassociatesinc.webex.com/blantonassociatesinc/onstage/g.php?MTID=eeefeb5675bc2b6fb3e7ef4f285d519d5

or

Join by phone at +1-408-418-9388 with access code: 132 644 0246

Notice is hereby given that the groundwater conservation districts located wholly or partially within Groundwater Management Area (GMA) 9, as designated by the Texas Water Development Board (TWDB), consisting of Bandera County River Authority and Ground Water District, Barton Springs/Edwards Aquifer Conservation District, Blanco-Pedernales Groundwater Conservation District, Cow Creek Groundwater Conservation District, Hays Trinity Groundwater Conservation District, Headwaters Groundwater Conservation District, Medina County Groundwater Conservation District, Southwestern Travis County Groundwater Conservation District, and the Trinity-Glen Rose Groundwater Conservation District will hold a Joint Planning meeting at **9:00 AM on Monday, December 14, 2020.**

Notice is hereby given that, in accordance with Governor Abbott's March 16, 2020, action to temporarily suspend certain provisions of the Texas Open Meetings Act, a GMA 9 Joint Planning Meeting will be held via telephone and video conference call beginning at **9:00 AM on Monday, December 14, 2020**. Any member of the public who wishes to participate remotely may do so through the remote access options provided above. If you have any difficulties in registering for this meeting, please contact Robert Ryan at rryan@blantonassociates.com or at (512) 694-7823.

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Approval of November 18, 2019 GMA 9 Meeting Minutes.
5. Texas Water Development Board updates, comments, or communications.
6. Individual District updates, comments, or communications if necessary.
7. Annual Review of individual GCD Management Plans and the accomplishments of GMA 9 in accordance with Chapter 36.108(c). NOTE: GMA 9 GCDs are required to meet Chapter 36.108(c) requirements and should be prepared to present a short summary of its Management Plan and how it complies with Chapter 36.108(c). Committee members and members of the public are encouraged to conduct individual reviews of each GCD Management Plans prior to the meeting. GMA 9 GCD Management Plans can be found at this website:
   http://www.twdb.texas.gov/groundwater/conservation_districts/index.asp.
   Use the index to locate each GCD. Open the desired GCD site and click on the link to the most recent Management Plan to access a PDF copy of their current Plan.

The following are the GCDs located within GMA 9:

- Bandera County River Authority and Ground Water District
- Barton Springs/Edwards Aquifer Conservation District
- Blanco-Pedernales Groundwater Conservation District
- Comal Trinity Groundwater Conservation District
- Cow Creek Groundwater Conservation District
- Hays Trinity Groundwater Conservation District
- Headwaters Groundwater Conservation District
- Medina County Groundwater Conservation District
- Trinity-Glen Rose Groundwater Conservation District
- Southwestern Travis County Groundwater Conservation

8. Receive report on status of 2022 DFC Joint Planning Cycle, including revised schedule. (consulting team)

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

10. Review and discuss DFC statements adopted by GMA 9 in last round of DFC Joint Planning and discuss possible revisions. (consulting team)

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

12. Consider SWTCGCD request for special consideration regarding funding contributions for GMA 9 2022 DFC Joint Planning Cycle Explanatory Report expenses.

13. Consider resolution to amend the boundary between GMA 8 and GMA 9 in Travis County.

14. Consider resolution to amend the boundary between GMA 9 and GMA 10 in Hays and Travis counties.

15. Public Comment.

16. Next meeting date, location, and future agenda items.

17. Announcements.

18. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:
Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 (office no.), (830) 708-5020 (cell no.), or email to: manager@blancogw.org

Notice of an Open Meeting of the
Groundwater Management Area 9 Joint Planning Committee
Monday, January 25, 2021 at 9:00 AM

Please use the following link to register for the meeting:

GMA 9 is inviting you to a scheduled Virtual Telephone and Video Zoom meeting.

Topic: GMA-9
Time: Jan 25, 2021 09:00 AM Central Time (US and Canada)

Join Zoom Meeting
http://zoom.us

Meeting ID: 879 1615 4376
Passcode: 841774

Join by phone at

Dial by your location
+1 346 248 7799 US (Houston)
+1 253 215 8782 US (Tacoma)
+1 669 900 6833 US (San Jose)
+1 301 715 8592 US (Washington D.C)
+1 312 626 6799 US (Chicago)
+1 929 205 6099 US (New York)
Meeting ID: 879 1615 4376
Passcode: 841774

Notice is hereby given that the groundwater conservation districts located wholly or partially within Groundwater Management Area (GMA) 9, as designated by the Texas Water Development Board (TWDB), consisting of Bandera County River Authority and Ground Water District, Barton Springs/Edwards Aquifer Conservation District, Blanco-Pedernales Groundwater Conservation District, Comal Trinity Groundwater Conservation District, Cow Creek Groundwater Conservation District, Hays Trinity Groundwater Conservation District, Headwaters Groundwater Conservation District, Medina County Groundwater Conservation District, Southwestern Travis County Groundwater Conservation District, and the Trinity Glen Rose Groundwater Conservation District will hold a Joint Planning meeting at **9:00 AM on Monday, January 25, 2021.**

Notice is hereby given that, in accordance with Governor Abbott's March 16, 2020, action to temporarily suspend certain provisions of the Texas Open Meetings Act, a GMA 9 Joint Planning Meeting will be held via telephone and video conference call beginning at **9:00 AM on Monday, January 25, 2021**. Any member of the public who wishes to participate remotely may do so through the remote access options provided above. If you have any difficulties in registering for this meeting, please contact:

Hayli Phillips
Intergovernmental Affairs Manager
Bandera County River Authority and Groundwater District
(830)796-6201
www.bcragd.org

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Approval of June 17, 2019, November 18, 2019, and December 14, 2020 GMA 9 Meeting Minutes.
5. Texas Water Development Board updates, comments, or communications.
6. Individual District updates, comments, or communications if necessary.
7. Receive report on recommendations from work group and take possible action regarding SWTCGCD contribution to fund GMA 9 2022 DFC Joint Planning Cycle.
8. Receive report on recommendations from work group and take possible action regarding resolution to amend the boundary between GMA 8 and GMA 9 in Travis County.
9. Receive report from TWDB and discuss possible resolution to amend the boundary between GMA 9 and GMA 10 in Hays and Travis counties.
10. Receive report on status of 2022 DFC Joint Planning Cycle, including schedule. (consulting team)
11. 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. (consulting team)
12. Public Comment.
13. Next meeting date, location, and future agenda items.
14. Announcements.
15. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:
Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 (office no.), (830) 708-5020 (cell no.), or email to: manager@blancogw.org

Notice of an Open Meeting of the
Groundwater Management Area 9 Joint Planning Committee
Monday, March 22, 2021 at 10:00 AM

Please use the following link to register for the meeting:

GMA 9 is inviting you to a scheduled Virtual Telephone and Video Zoom meeting.
Topic: GMA-9
Time: Mar 22, 2021 10:00 AM Central Time (US and Canada)

Join Zoom Meeting
https://us02web.zoom.us/j/83916176389?pwd=Qm1QQ29KYmgxMmpGcXd1S2R5UEVCQT09

Meeting ID: 839 1617 6389
Passcode: 687260
One tap mobile
+13462487799,,83916176389#,,,,*687260# US (Houston)
+16699006833,,83916176389#,,,,*687260# US (San Jose)

Dial by your location
+1 346 248 7799 US (Houston)
+1 669 900 6833 US (San Jose)
+1 253 215 8782 US (Tacoma)
+1 929 205 6099 US (New York)
+1 301 715 8592 US (Washington DC)
+1 312 626 6799 US (Chicago)
Meeting ID: 839 1617 6389
Passcode: 687260
Find your local number: https://us02web.zoom.us/u/kbun3dFrKB

Notice is hereby given that the groundwater conservation districts located wholly or partially within Groundwater Management Area (GMA) 9, as designated by the Texas Water Development Board (TWDB), consisting of Bandera County River Authority and Ground Water District, Barton Springs/Edwards Aquifer Conservation District, Blanco-Pedernales Groundwater Conservation District, Comal Trinity Groundwater Conservation District, Cow Creek Groundwater Conservation District, Hays Trinity Groundwater Conservation District, Headwaters Groundwater Conservation District, Medina County Groundwater Conservation District, Southwestern Travis County Groundwater Conservation District, and the Trinity Glen Rose Groundwater Conservation District will hold a Joint Planning meeting at **10:00 AM on Monday, March 22, 2021.**

Notice is hereby given that, in accordance with Governor Abbott's March 16, 2020, action to temporarily suspend certain provisions of the Texas Open Meetings Act, a GMA 9 Joint Planning Meeting will be held via telephone and video conference call beginning at **10:00 AM on Monday, March 22, 2021**. Any member of the public who wishes to participate remotely may do so through the remote access options provided above. If you have any difficulties in registering for this meeting, please contact:

Hayli Phillips
Intergovernmental Affairs Manager
Bandera County River Authority and Groundwater District
(830)796-6201
www.bcragd.org

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Approval of January 25, 2021 Meeting Minutes.
5. Texas Water Development Board updates, comments, or communications.
6. Update on the TWDB's Edwards-Trinity Plateau brackish groundwater study (Evan Strickland).
7. Individual District updates, comments, or communications if necessary.
8. Consider SWTCGCD's request for a waiver on paying an equal share of costs for the Explanatory Report required for the GMA 9 2022 DFC Joint Planning Cycle.
9. Discuss and consider adopting proposed non-relevant aquifer classifications pursuant to Title 31, Texas Administrative Code § 356.31(b) and proposed desired future conditions pursuant to Texas Water Code § 36.108(d). (consulting team)
10. Discuss and consider public comment process for desired future condition public hearings. (consulting team)
11. Public Comment.
12. Next meeting date, location, and future agenda items.
13. Announcements.
14. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:
Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 (office no.), (830) 708-5020 (cell no.), or email to: manager@blancogw.org

Groundwater Management Area 9 Joint Planning Committee Meeting

NOTICE OF OPEN MEETING

As required by Section 36.108(e), Texas Water Code, a meeting of the **Groundwater Management Area 9 Joint Planning Committee**, comprised of district representatives from the following groundwater conservation districts located wholly or partially within Groundwater Management Area 9: Bandera County River Authority and Groundwater District, Cow Creek Groundwater Conservation District, Headwaters Groundwater Conservation District, Hays Trinity Groundwater Conservation District, Medina County Groundwater Conservation District, Trinity-Glen Rose Groundwater Conservation District, and Southwestern Travis County Groundwater Conservation District, will be held on **Monday, September 27, 2021, at 10:00 am at the Bandera Electric Cooperative Community Room, 3172 State Hwy 16 North, Bandera, Texas 78003.**

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Public Comment.
5. Approval of January 25, 2021 and March 22, 2021 GMA 9 Meeting Minutes.
6. Texas Water Development Board updates, comments, or communications.
7. Individual District updates, comments, or communications if necessary.
8. Annual individual GCD reports on DFC Compliance.
9. Consider public comments submitted and received by GMA 9 and its member GCDs as part of the Public Comment Period on the Proposed Desired Future Conditions, and the GMA 9 draft document "Summarization of Public Comments Received and GMA 9 Responses."
10. Discuss process and schedule to finalize and approve the 2021 GMA 9 Explanatory Report for Desired Future Conditions for Major and Minor Aquifers.
11. Announcements.
12. Next meeting date, location, and future agenda items.
13. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:
Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 office, (830) 708-5020 cell, email to: manager@blancogw.org

Groundwater Management Area 9 Joint Planning Committee Meeting

NOTICE OF OPEN MEETING

As required by Section 36.108(e), Texas Water Code, a meeting of the **Groundwater Management Area 9 Joint Planning Committee**, comprised of district representatives from the following groundwater conservation districts located wholly or partially within Groundwater Management Area 9: Bandera County River Authority and Groundwater District, Cow Creek Groundwater Conservation District, Headwaters Groundwater Conservation District, Hays Trinity Groundwater Conservation District, Medina County Groundwater Conservation District, Trinity-Glen Rose Groundwater Conservation District, and Southwestern Travis County Groundwater Conservation District, will be held on **Monday, November 15, 2021, at 10:00 am at the Cow Creek Groundwater Conservation District, 9 Toepperwein Rd, Boerne, TX 78006.**

Discussion and/or possible action may occur on the following business matters:

1. Call to Order.
2. Receipt of Posted Meeting Notices.
3. Introductions.
4. Public Comment.
5. Approval of September 27, 2021 GMA 9 Meeting Minutes.
6. Texas Water Development Board updates, comments, or communications.
7. Individual District updates, comments, or communications if necessary.
8. Annual individual GCD reports on DFC Compliance if necessary.
9. Consider approval of GMA 9 draft document *"Summarization of Public Comments Received and GMA 9 Responses,"* which will be attached to the Explanatory Report as Appendix C and reconfirm GMA 9 Committee's consensus decision to not make changes to the DFC statements because of the public hearing comments.
10. Review Draft *"Groundwater Management Area 9 2021 Explanatory Report for Desired Future Conditions for Major and Minor Aquifers."*
11. Consider approval of GMA 9 Resolution # 111521-1 *"Adopting the Groundwater Management Area 9 Joint Planning Committee's Proposed Classification of Locally Managed Aquifers as Non-Relevant for Joint Planning Purposes and the Desired Future Conditions for Relevant Major and Minor Aquifers in GMA 9, and authorizing the GMA 9 Chairman to formally submit them and all other required information to the TWDB."*
12. Consider approval of *"Groundwater Management Area 9 2021 Explanatory Report for Desired Future Conditions for Major and Minor Aquifers."*
13. Announcements. In answer to many inquiries , the Fourth GMA 9 Joint Planning cycle will begin at the first GMA 9 Meeting held during 2023. It is likely to be a very active cycle due to new census data and demographic changes, a revised Trinity Aquifer model, and detailed reviews of DFC and Non-Relevant designations.
14. Next meeting date, location, and future agenda items.
15. Adjournment.

Further information, questions, or comments concerning any aspect of this meeting should be directed to:

Mr. Ron Fieseler, GMA 9 Planning Committee Chairman
c/o Blanco-Pedernales Groundwater Conservation District
601 West Main, P.O. Box 1516, Johnson City, TX 78636
(830) 868-9196 office, (830) 708-5020 cell, email to: manager@blancogw.org

GMA 9 DFC Joint Planning Overview

Third (Year 2022) Round

November 18, 2019

Blanton & Associates, Inc.

Environmental Consulting • Planning • Project Management

wsp

GMA 9 DFC Joint Planning Overview

Today's Meeting:

1. Review DFC Joint Planning Requirements in TWC Section 36.108 *(Agenda Item 11)*

2. Review Approach and Schedule for GMA 9 Third Round – DFC Joint Planning *(Agenda Item 12)*

3. Review DFCs and Non-Relevant Aquifer Classifications from GMA 9 Second Round – DFC Joint Planning, and Previous GAM Runs *(Agenda Item 13)*

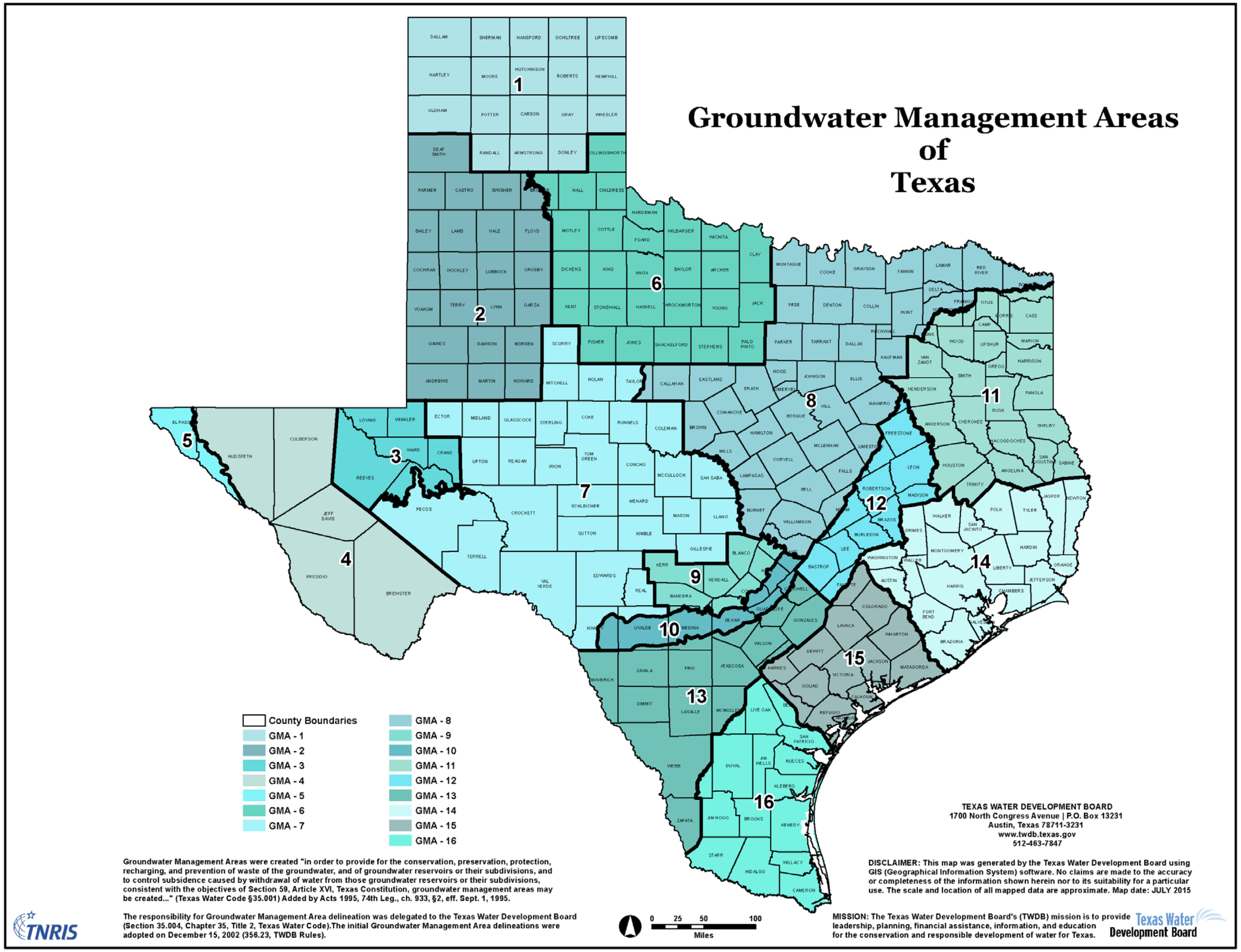
4. Next Steps

TWC 36.108 GMA Joint Planning Overview

Agenda Item 11:

Review DFC Joint Planning Requirements in TWC Section 36.108

TWC 36.108 GMA Joint Planning Overview



Source: TWDB, October 2019

TWC 36.108 GMA Joint Planning Overview

GMA Joint Planning – TWC Sec. 36.108 & 31 TAC Ch. 356

Texas Water Code Section 36.108 – Joint Planning in Management Area

- 36.108 (a) – Definitions
- 36.108 (b) – District Management Plans Share and Compare
- 36.108 (c) – Annual Management Area Joint Planning
- 36.108 (d), (d-1 – d-4) – Desired Future Conditions Process
- 36.108 (e), (e-1 – e-3) – Meeting Notice Requirements
- 36.1081 – Technical Staff and Subcommittees for Joint Planning
- 36.1083, 36.10835 – DFC Appeals
- 36.1084 – Modeled Available Groundwater
- 36.1085 – Management Plan Goals and Objectives
- 36.1086 – District Joint Efforts in Management Area
- 36.3011(b) – TCEQ Inquiry Petition Process

31 Texas Administrative Code, Chapter 356 – Groundwater Management

TWC 36.108 GMA Joint Planning Overview

For DFC Joint Planning, GCDs:

- Consider GAM Runs/Data/Information and 9 Factors and Propose DFCs for Adoption for Relevant Aquifers
- May Establish Different DFCs for Relevant Aquifer/Subdivisions in GMA
- May Propose Portion(s) of Aquifers as Non-Relevant for Joint Planning Purposes
- Meet "Balance Test" for DFCs
- Adopt Proposed DFCs/Non-Relevant Classifications – May 1, 2021
- Adopt Final DFCs/Non-Relevant Classifications – January 5, 2022
- Submit DFCs and Explanatory Report to TWDB (Due 60 Days After GMA Approval)

"Balance Test" for Desired Future Conditions

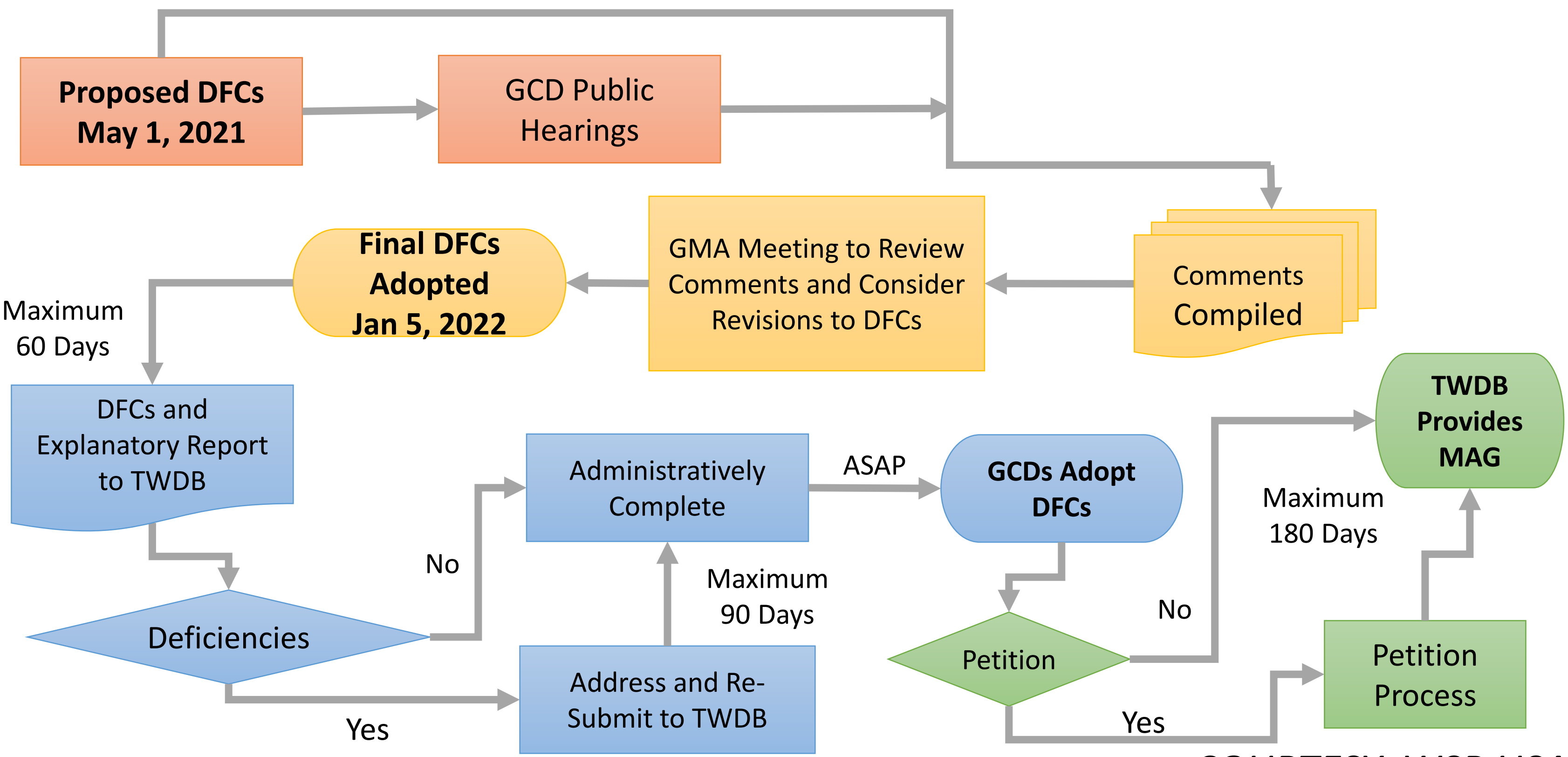
Highest Practicable Level of Groundwater Production

Conservation, Preservation, Protection, Recharging, and Prevention of Waste of Groundwater, and Control of Subsidence

DFC Factor Considerations

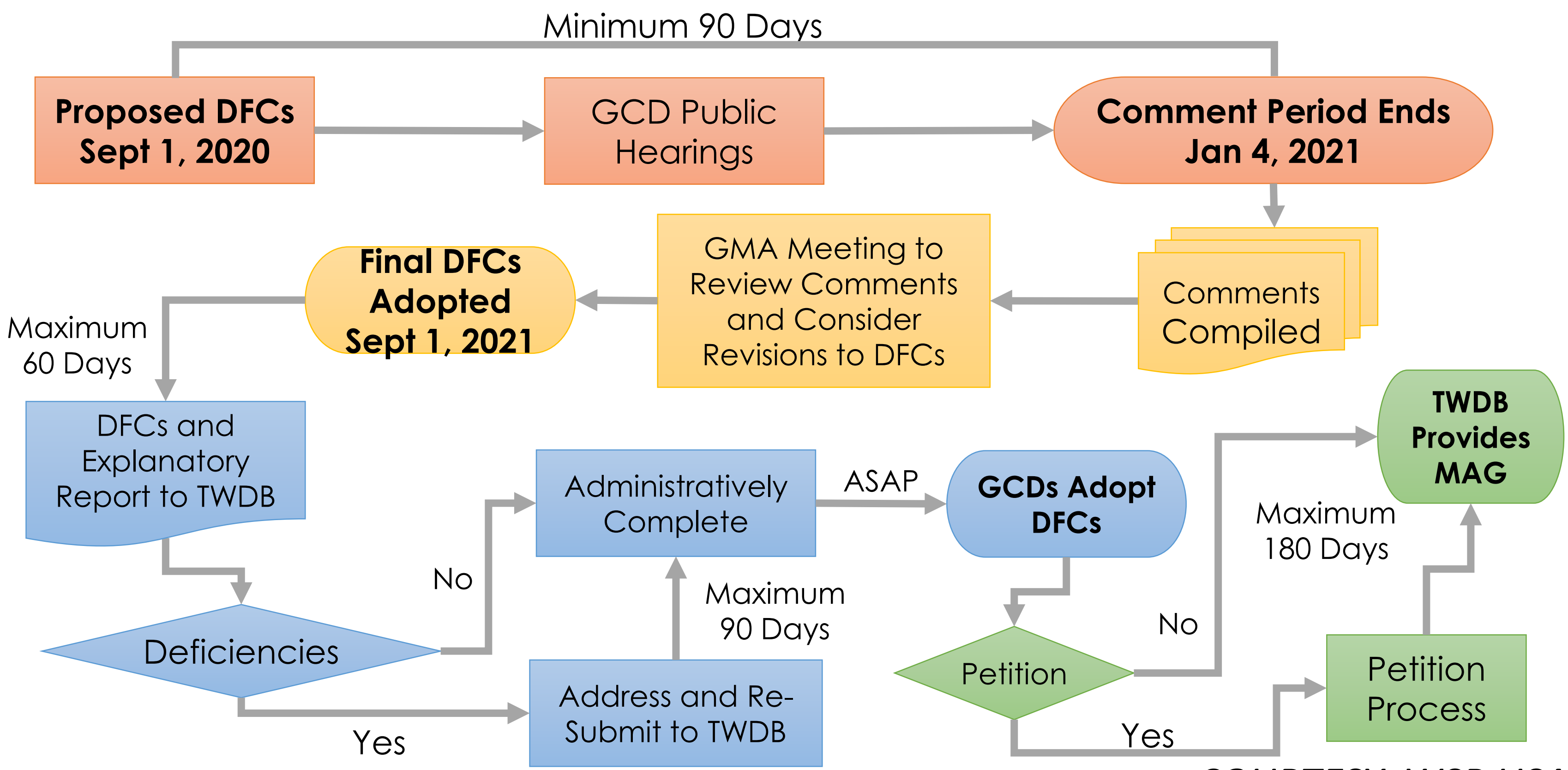
Aquifer Uses or Conditions	Supply Needs and Management Strategies	Hydrological Conditions
Environmental Impacts	Subsidence Impacts	Socioeconomic Impacts
Private Property Rights	DFC Feasibility	Other Relevant Information

DFC Process
(TWC Sec. 36.108 & 31 TAC Ch. 356)



COURTESY: WSP USA, INC.

TWC 36.108 GMA Joint Planning Overview



COURTESY: WSP USA, INC.

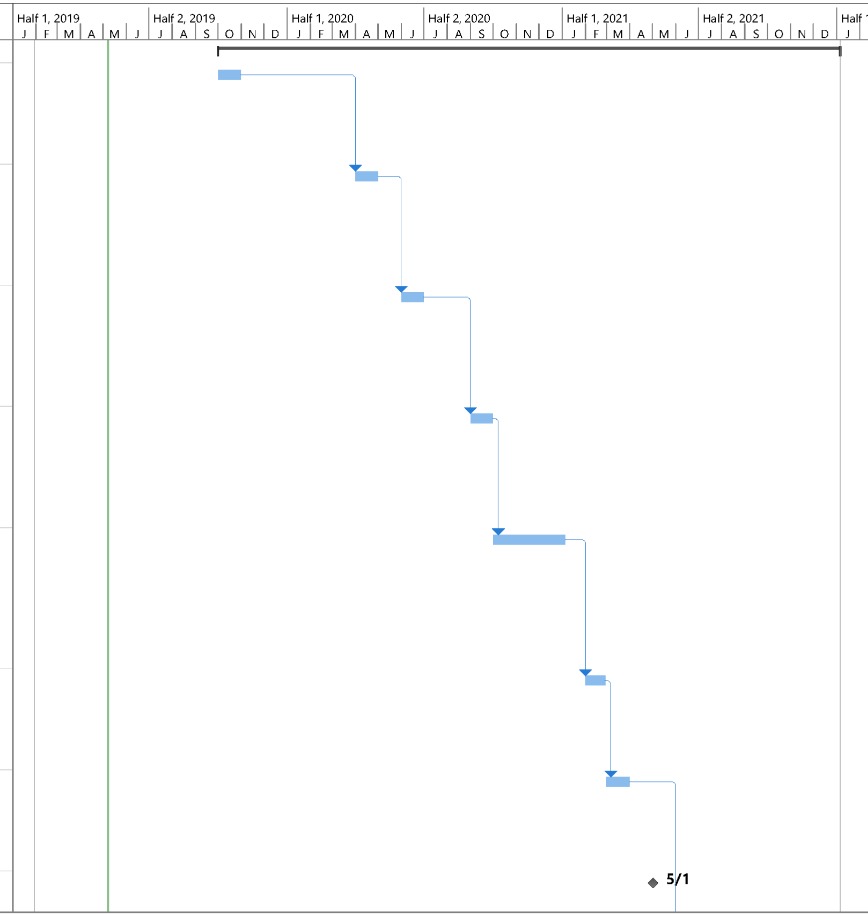
TWC 36.108 GMA Joint Planning Overview

Agenda Item 12:

Review Approach and Schedule for GMA 9 Third Round – DFC Joint Planning

GMA 9 DFC Joint Planning – Third (Year 2022) Round

ID	Task Name	Duration	Start	Finish	Predecessors
1	**GMA 9 Joint Planning Process**	**592 days**	**Tue 10/1/19**	**Wed 1/5/22**	
2	GMA 9 meeting – Review project approach and timeline; present report on requirements of Texas Water Code Section 36.108; and review previous GAM runs and DFCs, and proposed non-relevant aquifer classifications.	4.5 wks	Tue 10/1/19	Thu 10/31/19	
3	GMA 9 meeting – Provide project update; discuss GAM run results and possible DFCs; discuss possible non-relevant aquifer classifications; present report regarding Texas Water Code Subsections 36.108(d)(1-9); and discuss nine factors.	4.4 wks	Wed 4/1/20	Thu 4/30/20	2
4	GMA 9 meeting – Provide project update; present report regarding possible proposed non-relevant aquifer classifications; discuss and identify DFCs to be proposed by GMA 9; and continue discussions of nine factors as needed.	4.3 wks	Mon 6/1/20	Tue 6/30/20	3
5	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 approved proposed DFCs must be approved by 2/3 vote of GMA 9.	4.3 wks	Tue 9/1/20	Wed 9/30/20	4
6	90-day public comment period on proposed non-relevant aquifers and DFCs – As applicable, hold public hearings and make available information used to develop these proposals, including how the nine factors were considered in developing the proposed DFCs.	68 days	Thu 10/1/20	Mon 1/4/21	5
7	GCDs compile public comments received during the public comment period; and prepare GCD summary reports and discussion of proposed revisions to DFCs, if applicable.	4 wks	Mon 2/1/21	Fri 2/26/21	6
8	GMA 9 meeting – Review GCD public comment summaries and proposed revisions to DFCs, if applicable; and consider GCD suggestions to modify proposed DFCs based on public comments.	4.5 wks	Mon 3/1/21	Wed 3/31/21	7
9	Texas Water Code Section 36.108 (d) deadline to adopt proposed DFCs.	0 days	Sat 5/1/21	Sat 5/1/21	



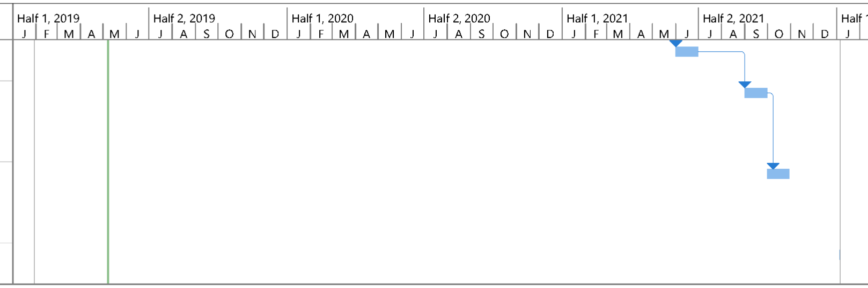
Project: Schedule_GMA9meetin
Date: Wed 5/8/19

Task		Project Summary		Manual Task		Start-only		Deadline	
Split		Inactive Task		Duration-only		Finish-only		Progress	
Milestone	◆	Inactive Milestone	◇	Manual Summary Rollup		External Tasks		Manual Progress	
Summary		Inactive Summary		Manual Summary		External Milestone	◇		

Page 1

GMA 9 DFC Joint Planning – Third (Year 2022) Round

ID	Task Name	Duration	Start	Finish	Predecessors
10	GMA 9 Meeting - Review and discuss complete draft explanatory report	4.4 wks	Tue 6/1/21	Wed 6/30/21	8
11	GMA 9 meeting – Consider action to adopt final DFCs, non-relevant aquifer classification proposals, and the explanatory report for GMA 9.	4.4 wks	Wed 9/1/21	Thu 9/30/21	10
12	Prepare and submit DFCs and explanatory report to TWDB and to each GCD. Submission packet due to the TWDB within 60 days of action to adopt the DFCs.	4.2 wks	Fri 10/1/21	Fri 10/29/21	11
13	Texas Water Code Section 36.108 (d-3) deadline to adopt final DFCs.	1 day	Wed 1/5/22	Wed 1/5/22	



Project: Schedule_GMA9meetin
Date: Wed 5/8/19

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

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GMA 9 DFC Joint Planning – Third (Year 2022) Round

B&A Team Approach to Presenting Information on Nine Factors (Texas Water Code Subsections 36.108(d)(1-9)):

Factor presentations – April 2020 GMA 9 Meeting

Focused discussion on factors during the meeting

B&A Team presentations to guide discussions – GCDs make presentations available during 90-day public comment period

Factor presentation content to be reflective of explanatory report content

GMA 9 DFC Joint Planning – Third (Year 2022) Round

B&A Team Approach to Preparing the Explanatory Report (Texas Water Code Section 36.108(d-3))

Use GMA 9 second round of DFC joint planning ER as starting point

Update ER discussion and appendices as needed

B&A Team presents and reviews 1st ER draft – June 2021

GMA 9 considers ER approval – September 2021

TWC 36.108 GMA Joint Planning Overview

Agenda Item 13:

Review DFCs and Non-Relevant Aquifer Classifications from GMA 9 Second Round – DFC Joint Planning, and Previous GAM Runs

GMA-9 ADOPTED
PROPOSED NON-RELEVANT AQUIFER CLASSIFICATIONS
(MAJOR AND MINOR AQUIFERS)

PROPOSED 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 GROUP OF 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 DFC Joint Planning – Second Round Results and Technical Considerations

Aquifer	Desired Future Condition (DFC)	Date DFC Adopted
Trinity	Increase in average drawdown of approximately 30 feet through 2060	4/18/2016
Edwards Group of the 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

* Groundwater Management Area 9 originally adopted the desired future condition for the Ellenburger-San Saba Aquifer on 4/18/2016. The revised desired future condition shown in this table was adopted on 10/17/2016.

GMA 9 DFC Joint Planning – Second Round Results and Technical Considerations

Aquifer	County	Regional Water Planning Area	River Basin	Modeled Available Groundwater						TWDB Report
				2020	2030	2040	2050	2060	2070	
Edwards Group of the Edwards-Trinity (Plateau)	Bandera	J	Guadalupe	81	81	81	81	81	81	GR16-023_MAG
Edwards Group of the Edwards-Trinity (Plateau)	Bandera	J	San Antonio	1,890	1,890	1,890	1,890	1,890	1,890	GR16-023_MAG
Edwards Group of the Edwards-Trinity (Plateau)	Bandera	J	Nueces	38	38	38	38	38	38	GR16-023_MAG
Edwards Group of the Edwards-Trinity (Plateau)	Kendall	L	Colorado	69	69	69	69	69	69	GR16-023_MAG
Edwards Group of the Edwards-Trinity (Plateau)	Kendall	L	Guadalupe	130	130	130	130	130	130	GR16-023_MAG
Ellenburger-San Saba	Kendall	L	Colorado	10	10	10	10	10	10	GR16-023_MAG
Ellenburger-San Saba	Kendall	L	Guadalupe	64	64	64	64	64	64	GR16-023_MAG
Hickory	Kendall	L	Colorado	12	12	12	12	12	12	GR16-023_MAG
Hickory	Kendall	L	Guadalupe	128	128	128	128	128	128	GR16-023_MAG
Trinity	Bandera	J	San Antonio	6,305	6,305	6,305	6,305	6,305		GR16-023_MAG
Trinity	Bandera	J	Nueces	903	903	903	903	903		GR16-023_MAG
Trinity	Bandera	J	Guadalupe	76	76	76	76	76		GR16-023_MAG
Trinity	Bexar	L	San Antonio	24,856	24,856	24,856	24,856	24,856		GR16-023_MAG
Trinity	Blanco	K	Colorado	1,322	1,322	1,322	1,322	1,322		GR16-023_MAG
Trinity	Blanco	K	Guadalupe	1,251	1,251	1,251	1,251	1,251		GR16-023_MAG
Trinity	Comal	L	Guadalupe	6,906	6,906	6,906	6,906	6,906		GR16-023_MAG
Trinity	Comal	L	San Antonio	3,308	3,308	3,308	3,308	3,308		GR16-023_MAG
Trinity	Hays	K	Colorado	4,710	4,707	4,706	4,706	4,706		GR16-023_MAG
Trinity	Hays	L	Guadalupe	4,410	4,410	4,410	4,410	4,410		GR16-023_MAG
Trinity	Kendall	L	Colorado	135	135	135	135	135		GR16-023_MAG
Trinity	Kendall	L	Guadalupe	6,028	6,028	6,028	6,028	6,028		GR16-023_MAG

GMA 9 DFC Joint Planning – Second Round Results and Technical Considerations

Aquifer	County	Regional Water Planning Area	River Basin	Modeled Available Groundwater						TWDB Report
				2020	2030	2040	2050	2060	2070	
Trinity	Kendall	L	San Antonio	4,976	4,976	4,976	4,976	4,976		GR16-023_MAG
Trinity	Kerr	J	Guadalupe	14,129	14,056	13,767	13,450	13,434		GR16-023_MAG
Trinity	Kerr	J	San Antonio	471	471	471	471	471		GR16-023_MAG
Trinity	Kerr	J	Colorado	318	318	318	318	318		GR16-023_MAG
Trinity	Kerr	J	Nueces	0	0	0	0	0		GR16-023_MAG
Trinity	Medina	L	San Antonio	925	925	925	925	925		GR16-023_MAG
Trinity	Medina	L	Nueces	1,575	1,575	1,575	1,575	1,575		GR16-023_MAG
Trinity	Travis	K	Colorado	8,672	8,655	8,643	8,627	8,598		GR16-023_MAG
GMA 9 Total				**93,698**	**93,605**	**93,303**	**92,970**	**92,925**	**2,422**	**GR16-023_MAG**

GMA 9 DFC Joint Planning – Technical Considerations

- Conceptual Model updated in Report (May 2018)
- Another Conceptual Model update underway (to be completed in 2019)
- Anticipated date of updated Hill Country GAM (????) – but not available for round of planning.
- Current scope, budget, and schedule to not include new GAM runs

GMA 9 DFC Joint Planning – Technical Considerations

GMA 9 DFC Joint Planning – TWDB Guidance

1. Edwards Group of the Edwards-Trinity (Plateau) Aquifer in Kerr and Blanco counties;
2. Ellenberger-San Saba Aquifer in Blanco and Kerr counties;
3. Hickory Aquifer in Blanco, Hays, Kerr, and Travis counties;
4. Marble Falls Aquifer in Blanco County; and
5. Edwards (Balcones Fault Zone) Aquifer in Bexar, Comal, Hays, and Travis counties.

Next Steps

Questions?

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

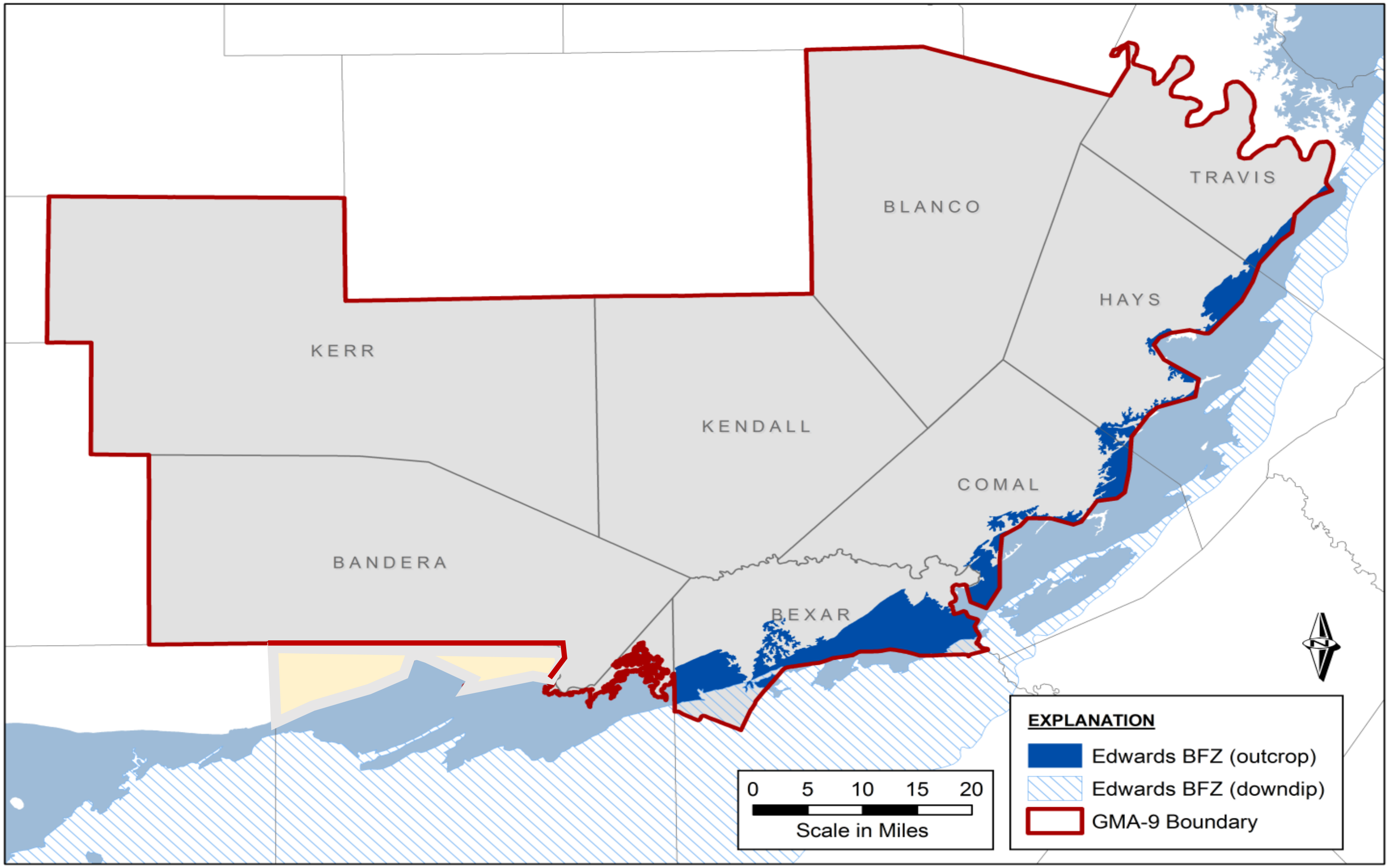
GMA 9 Joint Planning Process Schedule – Revised 12/14/20

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**

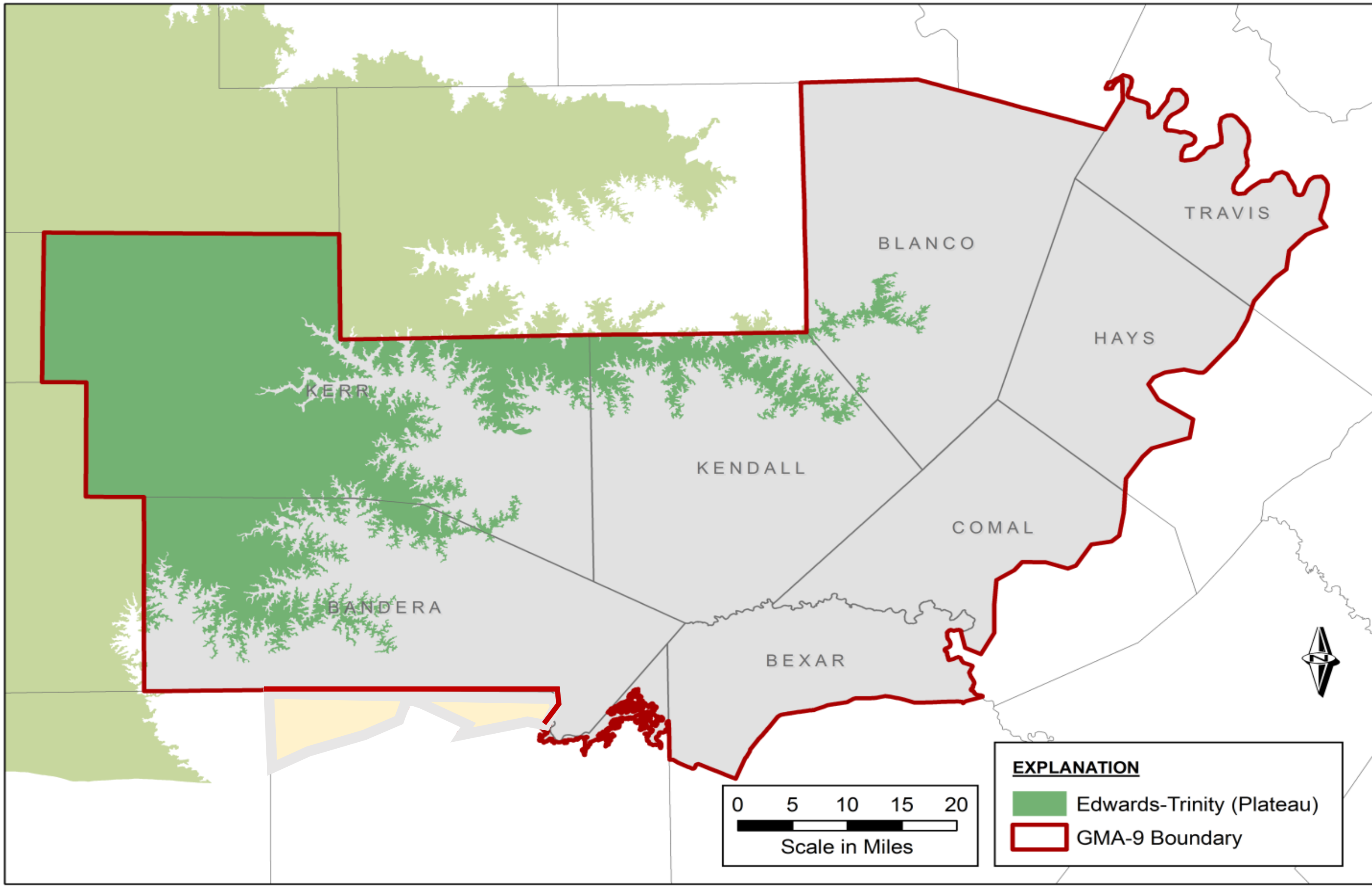
GMA-9 Non-Relevant Aquifer Classifications

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

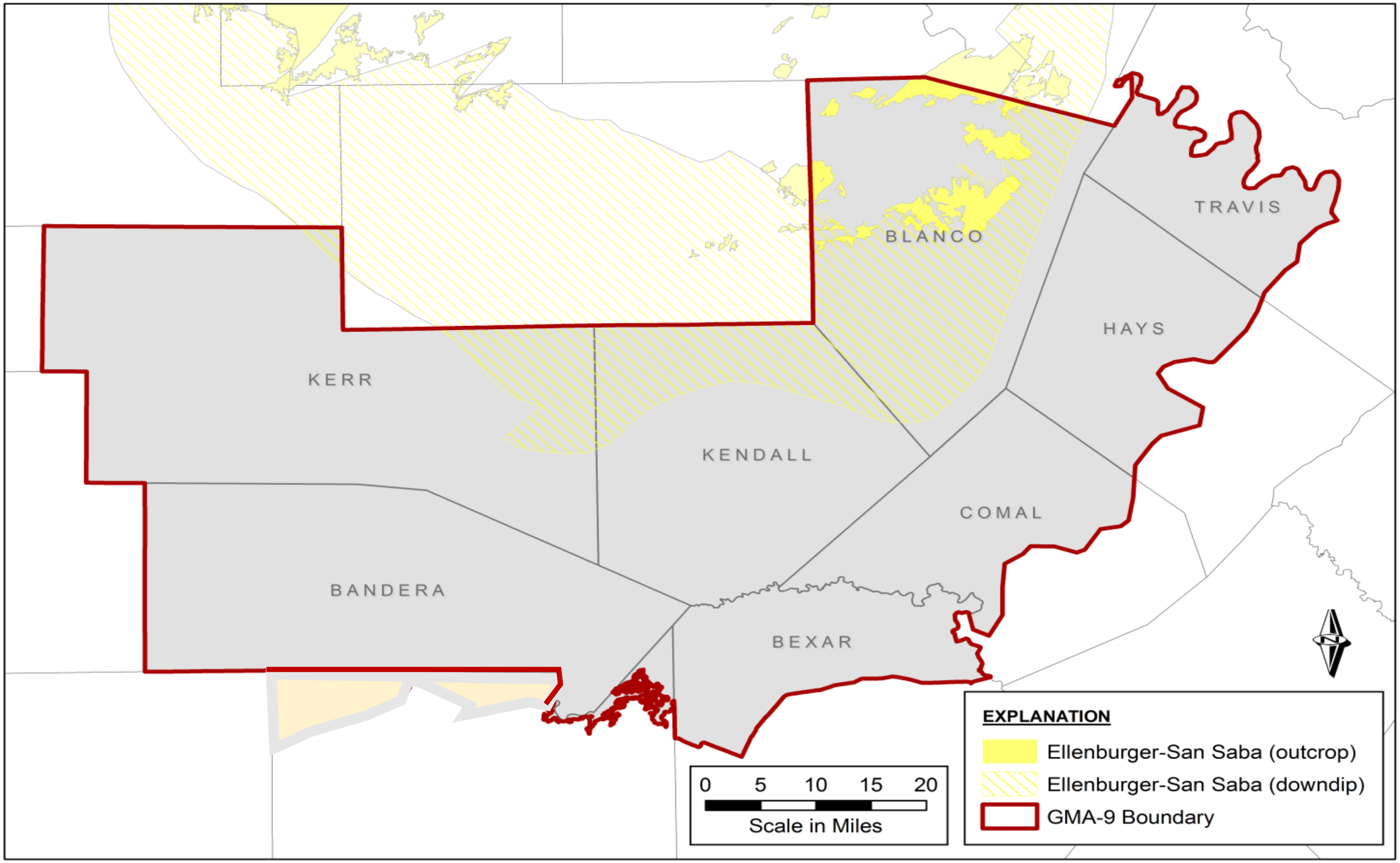
GMA-9 Non-Relevant Aquifer: Edwards BFZ



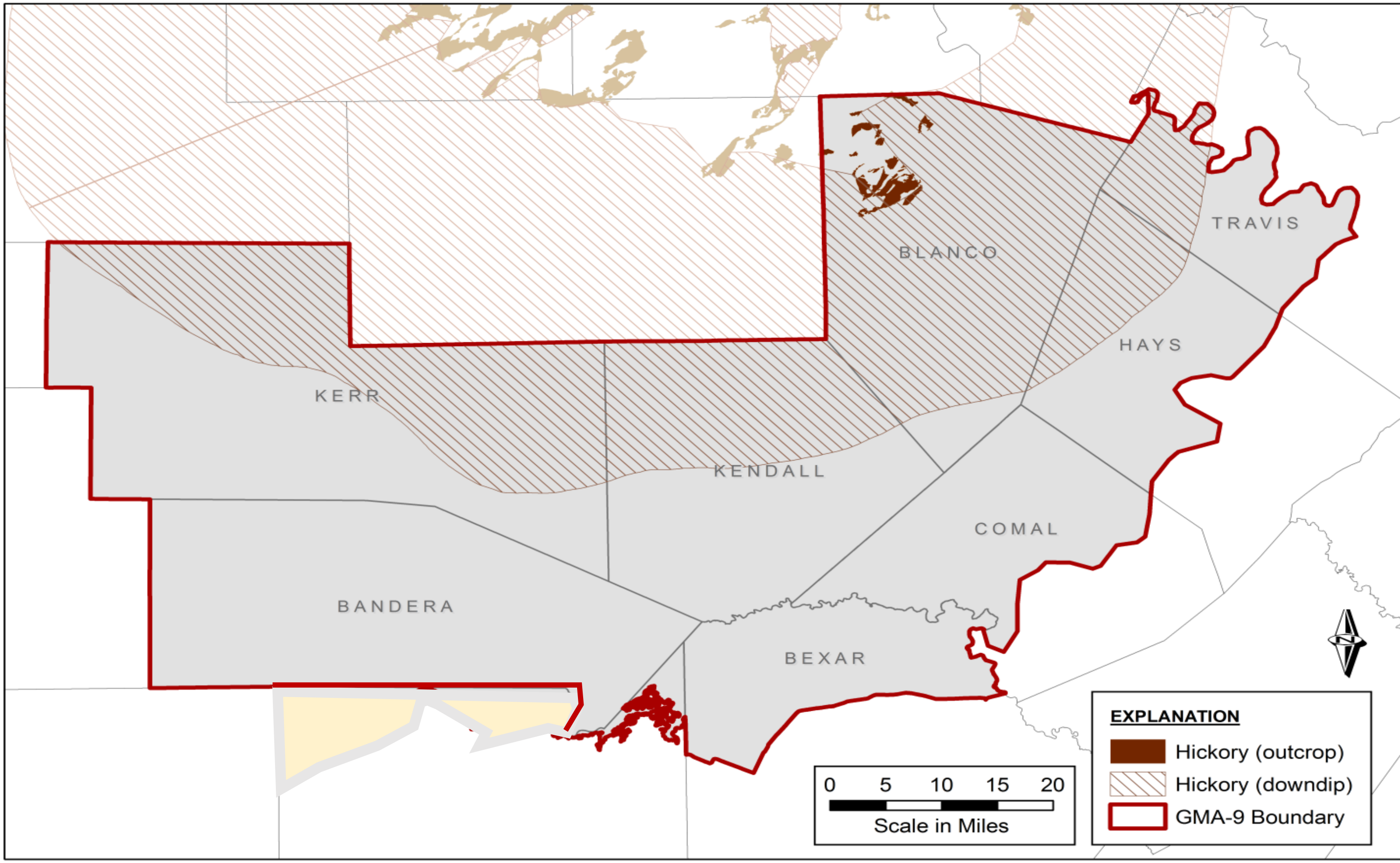
GMA-9 Non-Relevant Aquifer: Edwards-Trinity (Plateau)



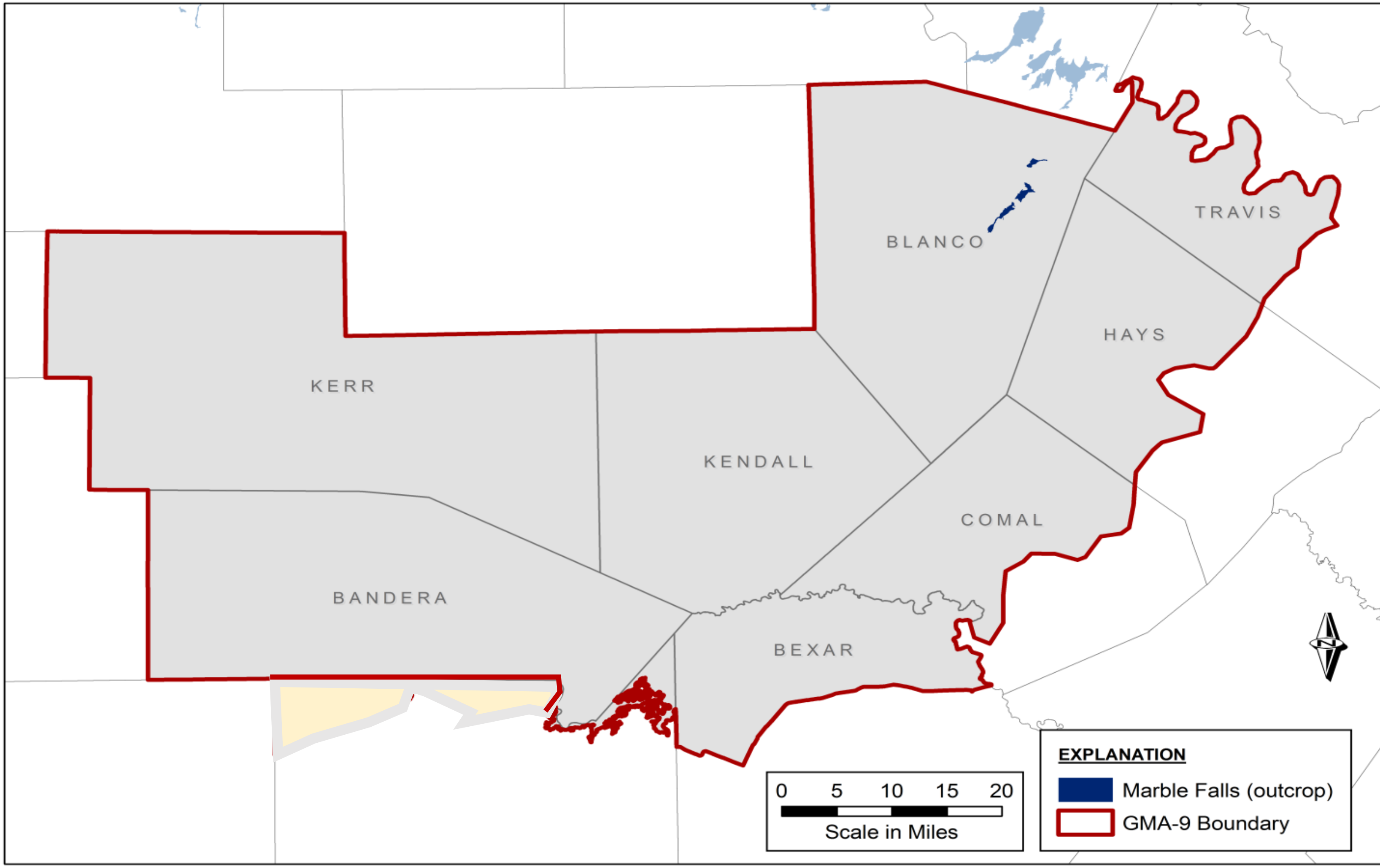
GMA-9 Non-Relevant Aquifer: Ellenburger-San Saba



GMA-9 Non-Relevant Aquifer: Hickory



GMA-9 Non-Relevant Aquifer: Marble Falls



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

- Example: 5 percent or up to one foot when comparing DFCs to average drawdown calculations from model files

- Results not until fall 2021 – but before GMA 9 final DFC adoption

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

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

Review and Discuss DFC Statements – Policy and Technical Justifications

Review and Discuss DFC Statements – Policy and Technical Justifications

Review and Discuss DFC Statements – Policy and Technical 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

- 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

- 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

- 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

- Assess DFC over time, re-evaluate during next planning round, and consider new model runs

- 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

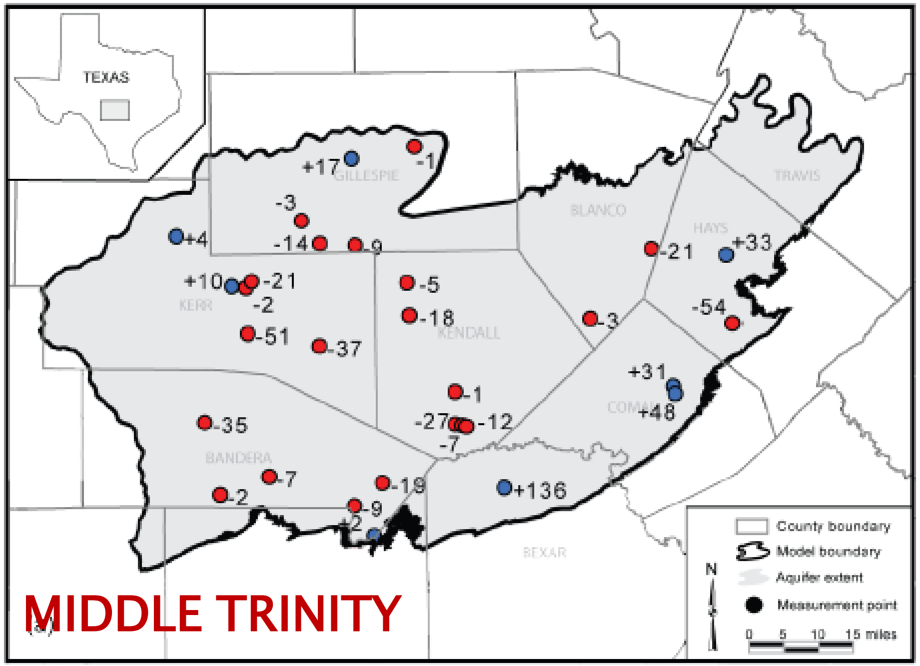
Aquifer Uses or Conditions	Supply Needs and Management Strategies	Hydrological Conditions
Environmental Impacts	Subsidence Impacts	Socioeconomic Impacts
Private Property Rights	DFC Feasibility	Other Relevant Information

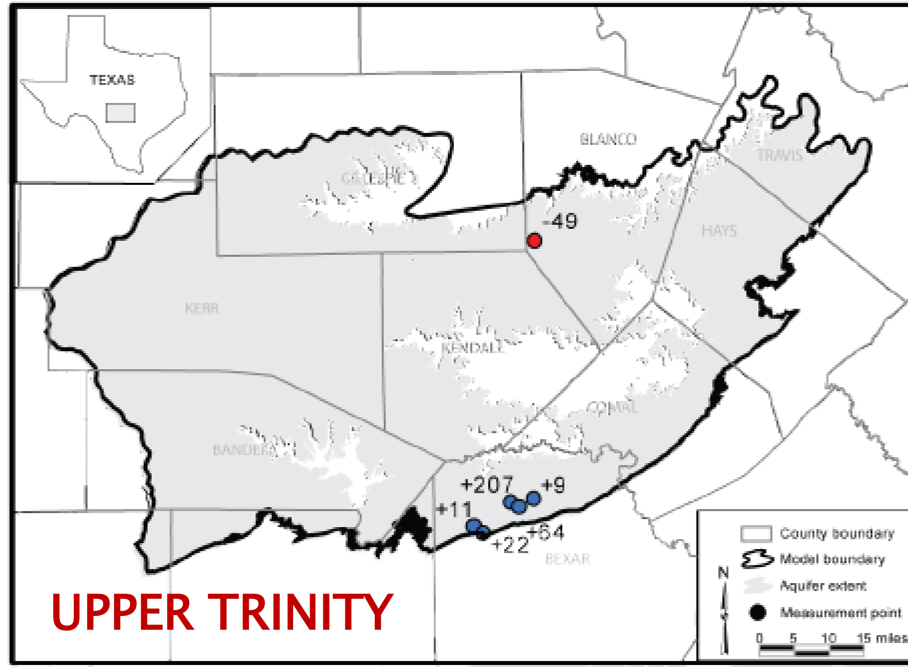
Aquifer Uses and Conditions

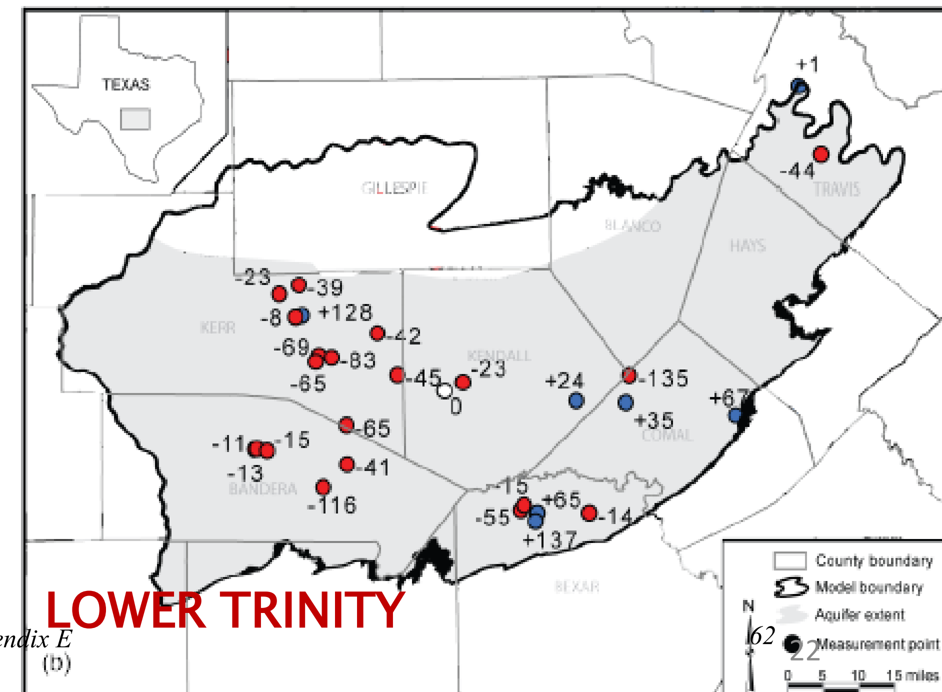
- Pumping from Trinity Aquifer estimated by Groundwater Conservation District for 2008 (Acre-feet per year)

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**

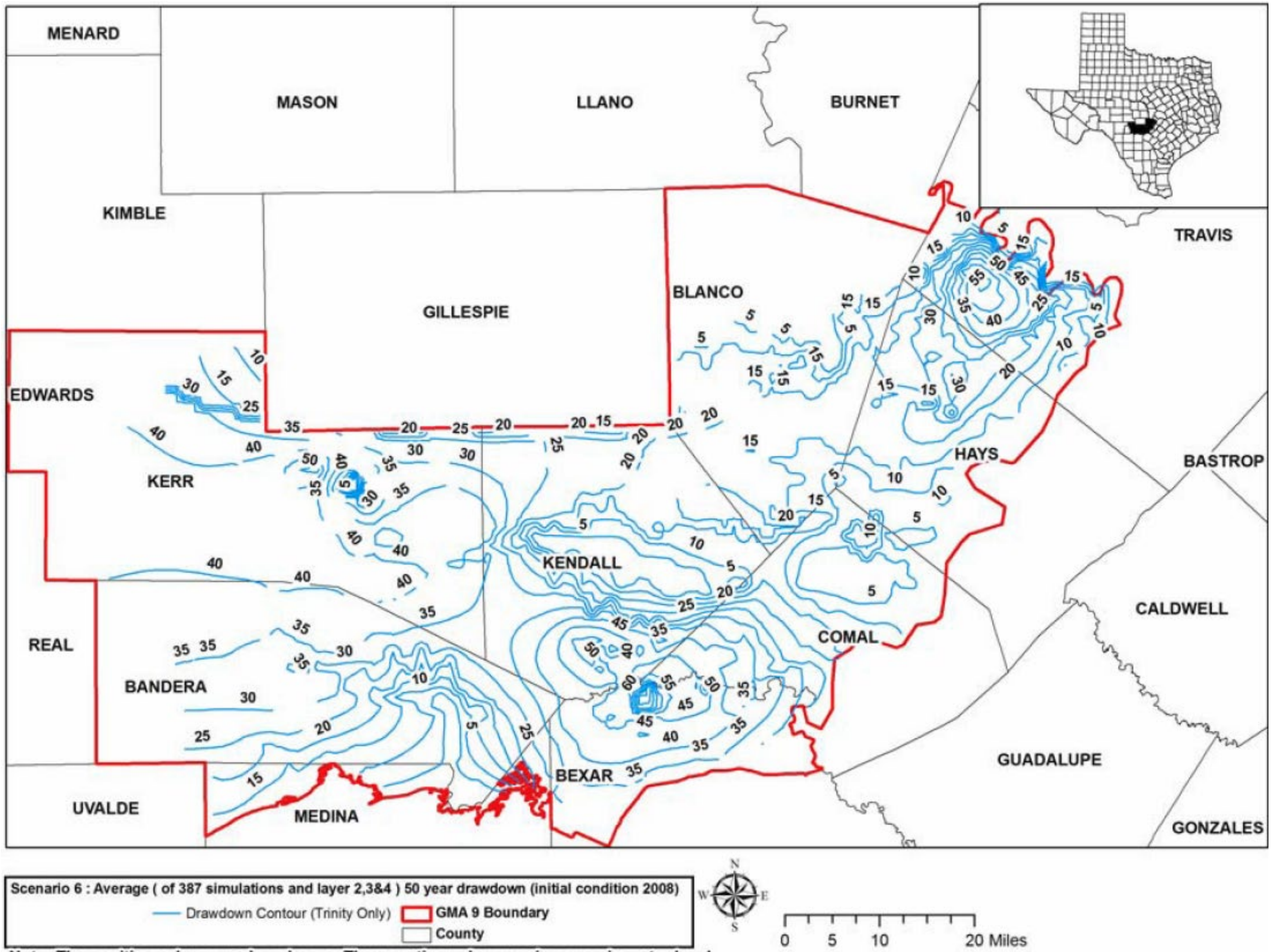
Net Water Level Change:
1980 – 1997





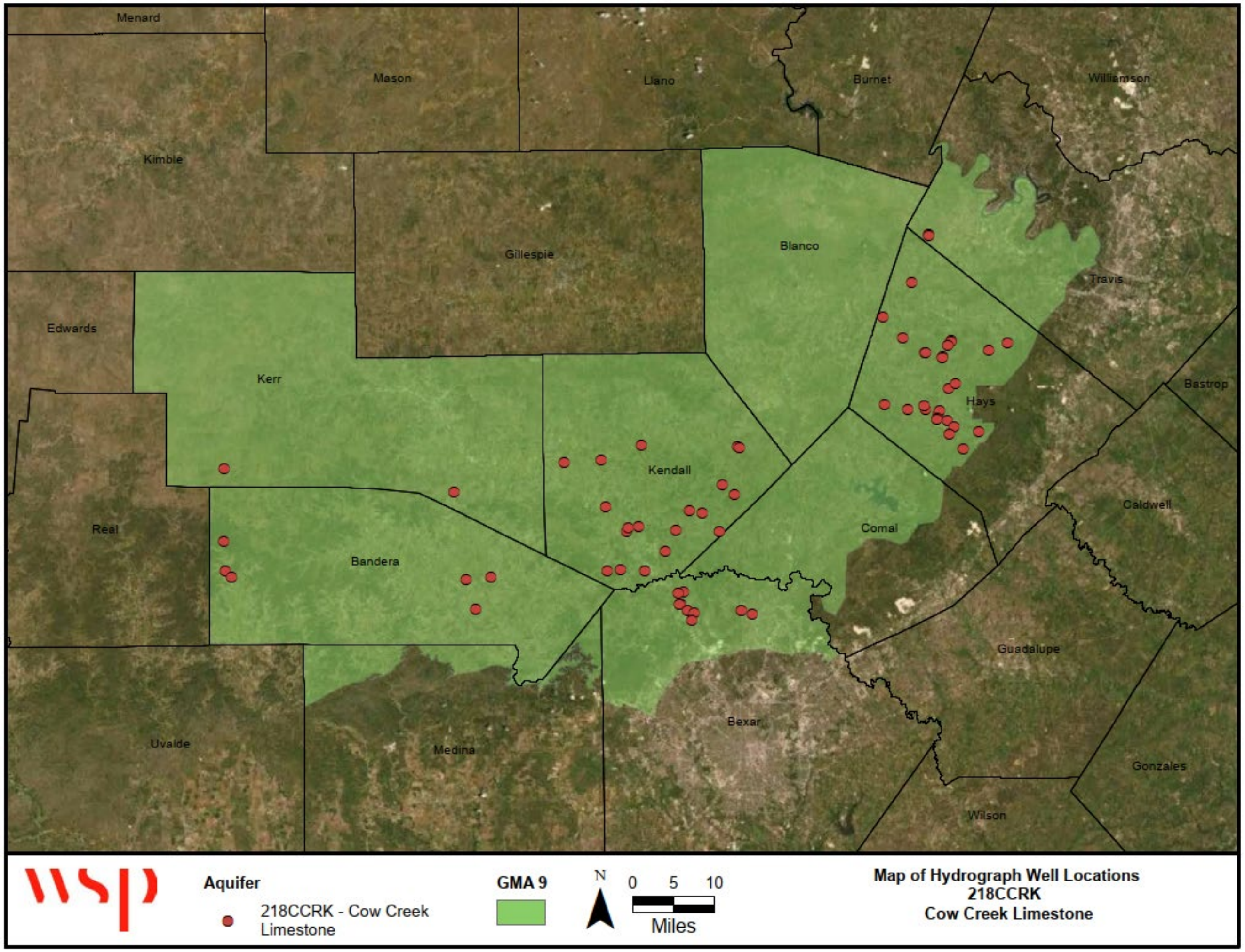


Resulting Average Water Level Decline in All Layers of Trinity after 50 years (from 387 simulations)

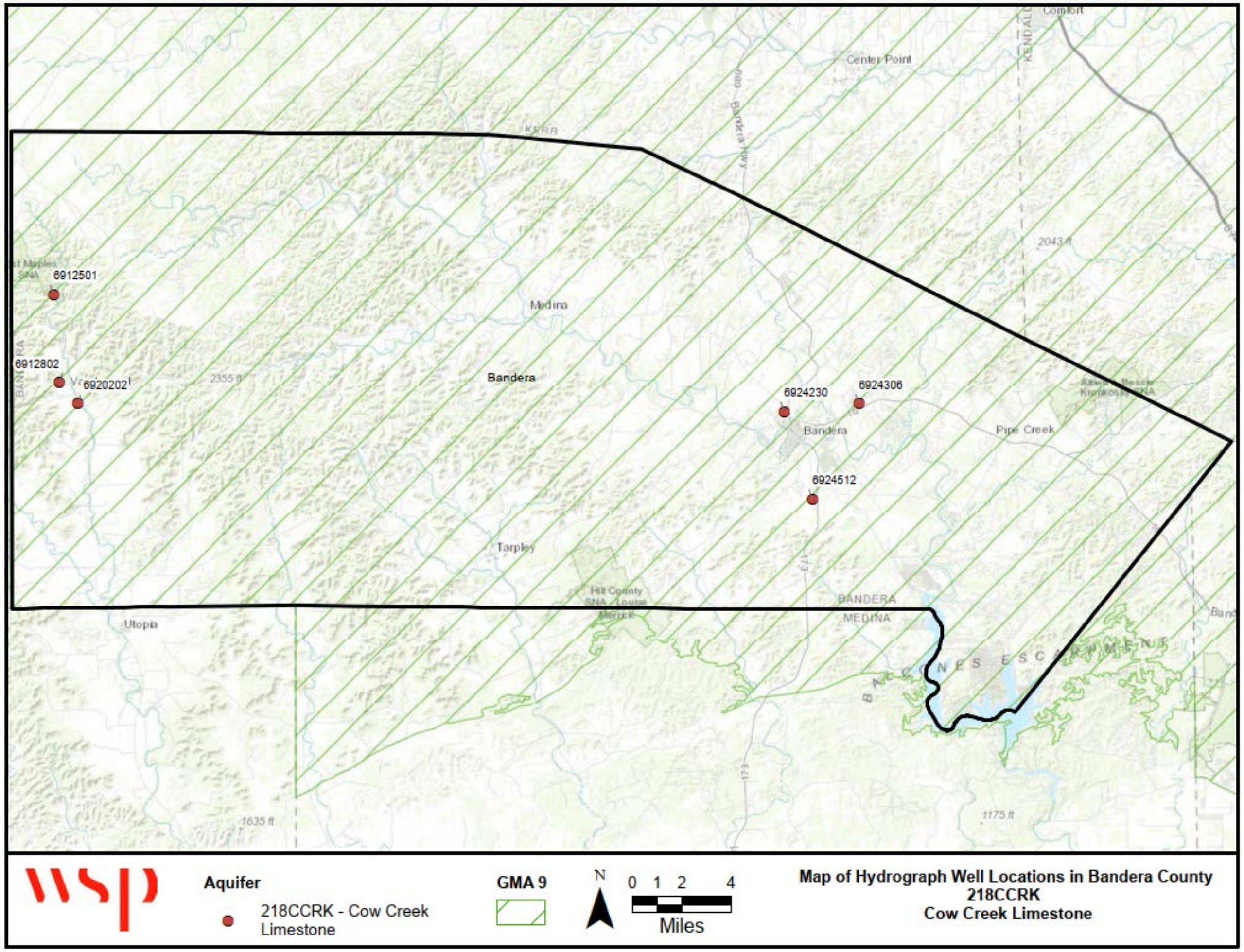


Note: The positive values are drawdowns. The negative values are increase in water level.

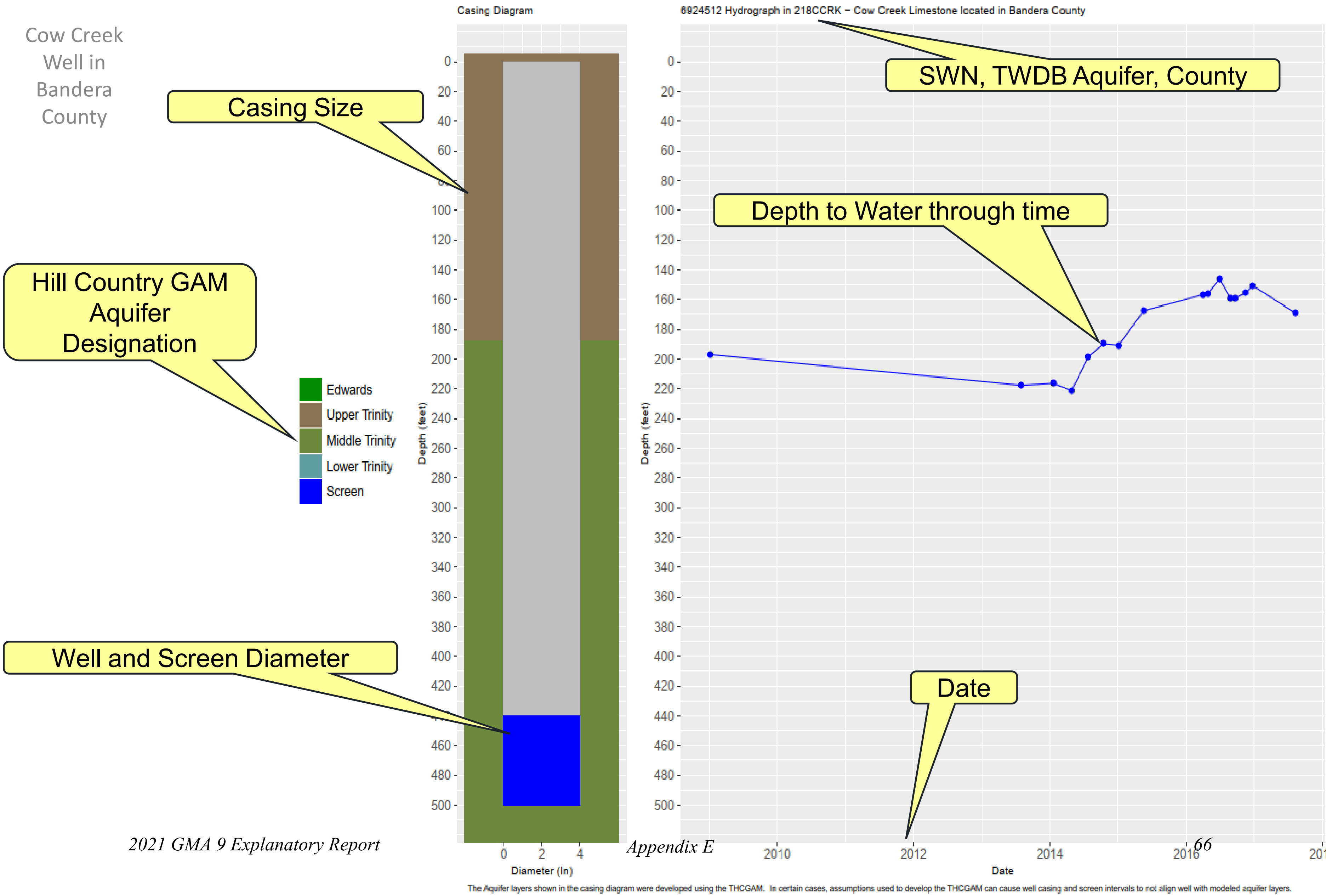
GMA 9 2022 DFC Joint Planning Cycle

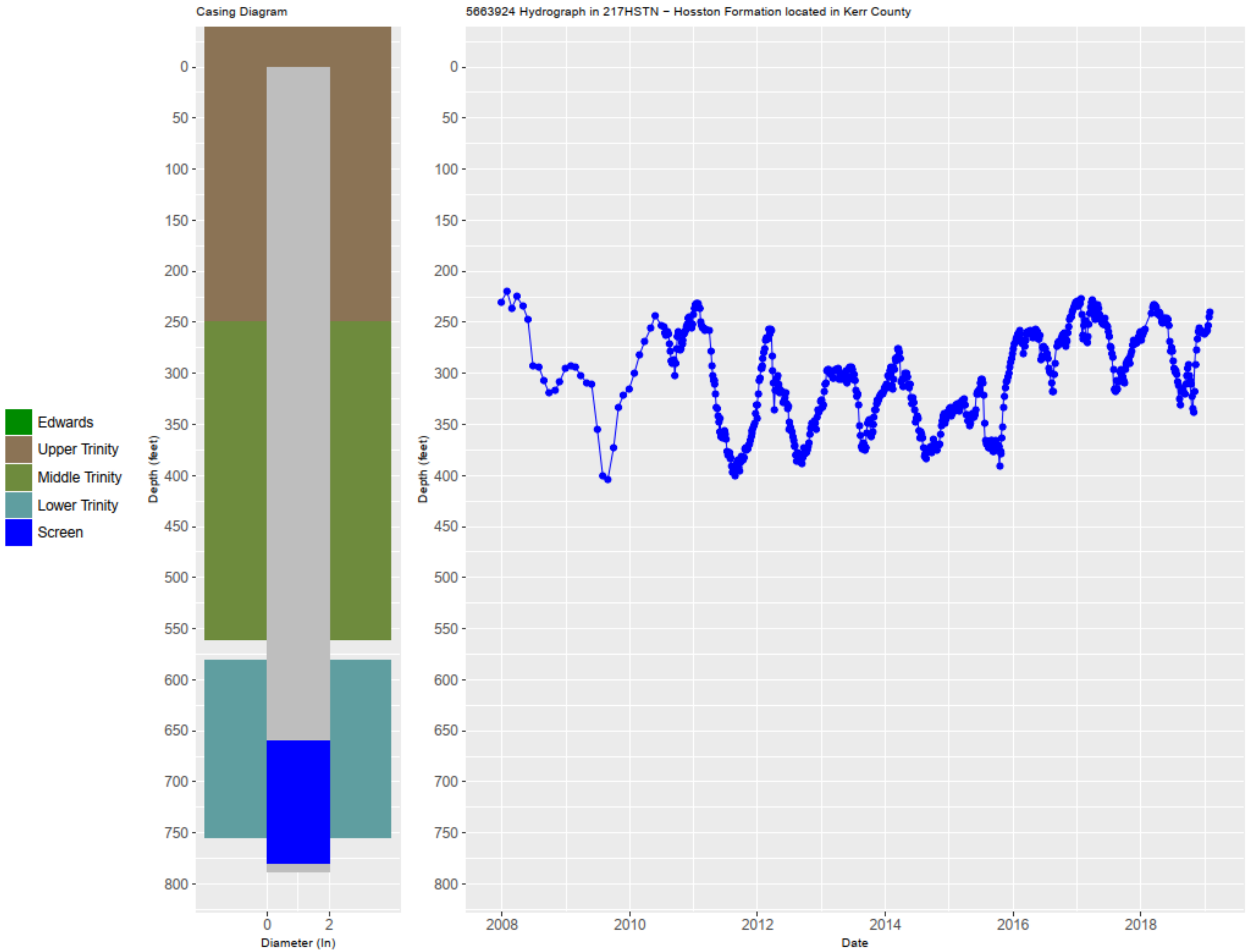


GMA 9 2022 DFC Joint Planning Cycle



Cow Creek Well in Bandera County





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Water level changes since 2008

Trinity Aquifer DFC Compliance Analysis for Blanco County

Monitor Well Name	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.	Average Well Drawdown Change in feet From 2008
	Calendar Year Average Water Level Below Land Surface												
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

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

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

- 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%

- 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.

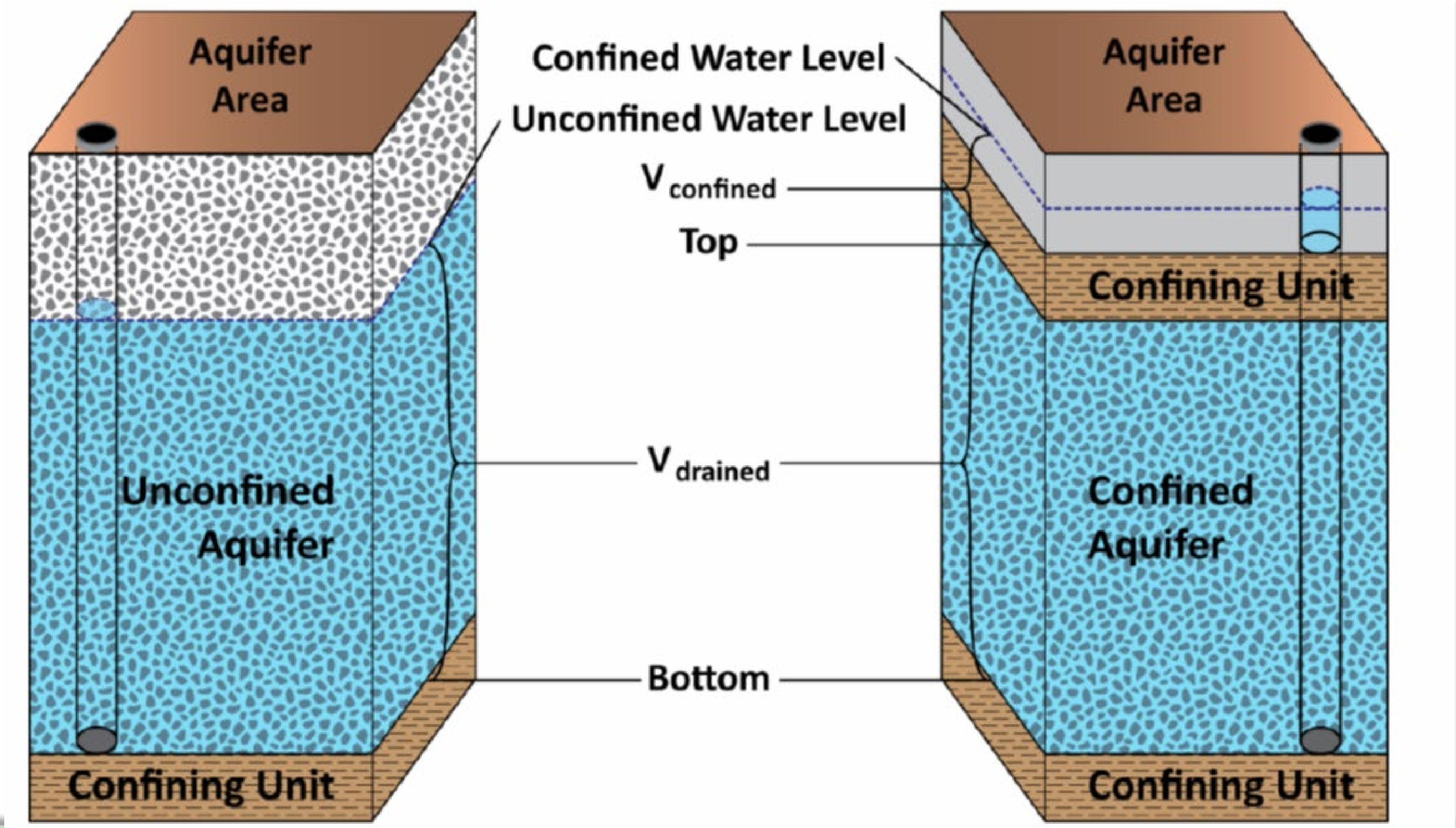
TWC § 36.108(d) Nine Factor Consideration

SWP Water Supply Needs/Water Management Strategies

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

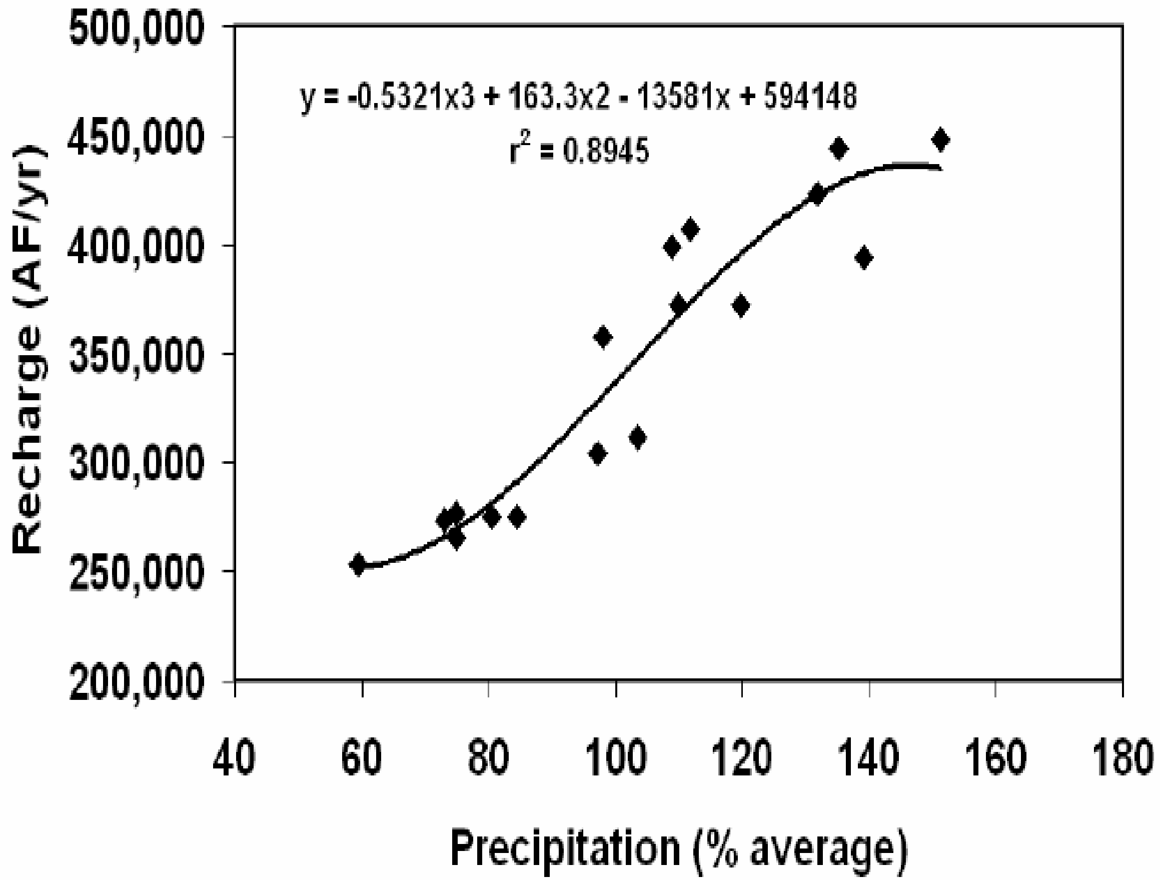
Edwards-Trinity Plateau Aquifer Kendall County

- 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

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

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."

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

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	-

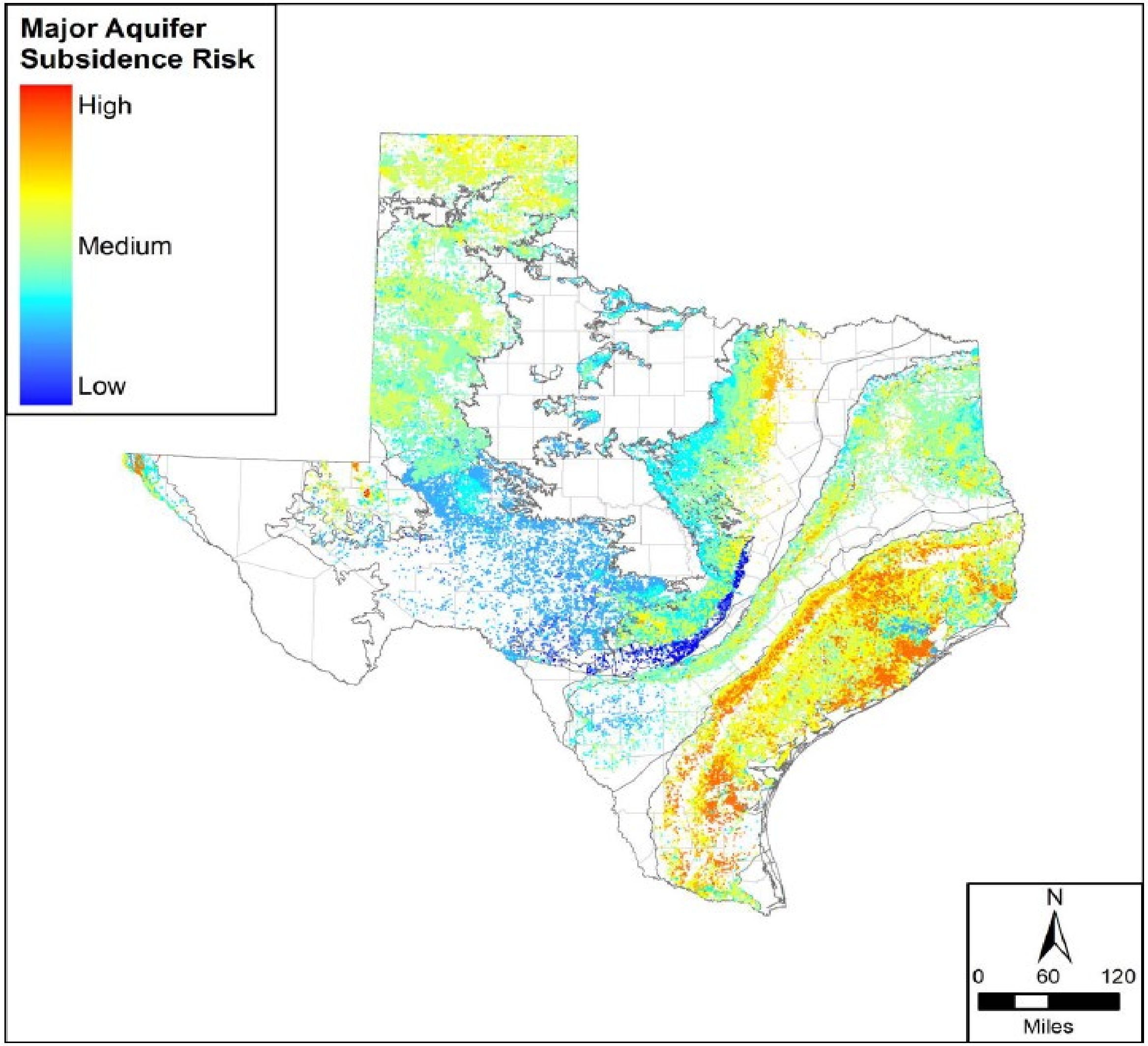
- There was no estimated annual discharge from the Ellenburger-San Saba or Hickory Aquifers to springs or any surface waterbodies.

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

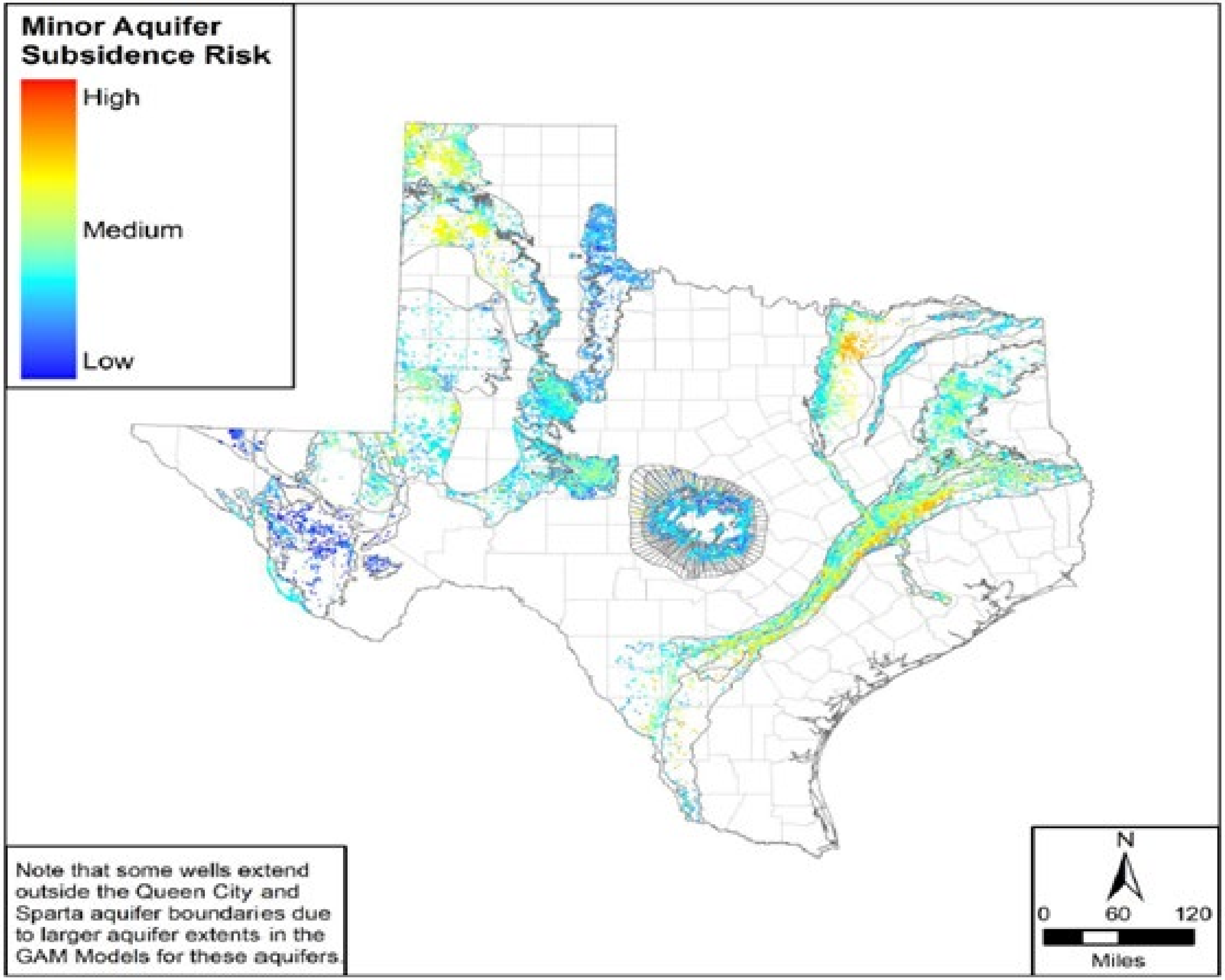
Highlighted GMA 9 GCD Management Plan Environmental-Related Objectives

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

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

Groundwater Management Area 9

2022 DFC Joint Planning Cycle

January 25, 2021

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 schedule. *(Agenda Item #)*

2. 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. *(Agenda Item #)*

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 25, 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**

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

TWC § 36.108(d) Nine Factor Consideration
Socioeconomic Impacts Reasonably Expected to Occur

Socioeconomic Impacts Reasonably Expected to Occur

Other Considerations

- GCDs to use their best judgment in developing their response to this factor.
- Refer to the socioeconomic impacts of unmet water needs in the state and regional water plans.
  - 2017 State Water Plan
  - 2021 Regional Water Plans – Regions J, K, and L
- DFC joint planning has an indirect relationship to the state and regional water planning processes.
  - MAG amounts are given to the GCDs and Regional Water Planning Groups

TWC § 36.108(d) Nine Factor Consideration
Socioeconomic Impacts Reasonably Expected to Occur

- Estimates are based on the needs not met in a single year during a drought of record condition in each planning decade.
- Economic impacts include income and job losses and social impacts include population and school enrollment losses.
- Impacts are estimated for the irrigation, livestock, manufacturing, mining, municipal, and steam-electric power water user groups.

2017 State Water Plan

- Statewide Income losses $73 Billion in 2020 and more than $151 Billion in 2070.
- Job losses due to drought of record could be 424,000 in 2020 and 1.3 Million in 2070.
- The vast majority of unmet needs are within the irrigation water use category - this is the case for Regions J, K, and L.

TWC § 36.108(d) Nine Factor Consideration
Socioeconomic Impacts Reasonably Expected to Occur

2021 Regions J, K, and L Socioeconomic Analysis

	Income Losses		Job Losses		Population Losses	
	2020	2070	2020	2070	2020	2070
Region J	$233 Million	$257 Million	2,300	3,000	417	539
Region K	$1.282 Billion	$2.609 Billion	5,018	27,413	921	5,033
Region L	$16.57 Billion	$9.38 Billion	100,514	94,978	18,454	17,438

Source: Ellis, John R., Socioeconomic Impacts of Projected Water Shortages for (Region J, Region K, and Region L) Regional Water Planning Area, Prepared in Support of the 2021 (Region J, Region K, and Region L) Regional Water Plans, 2019.

“Both the regional water plans and the state water plan do not address the potential costs or social impacts associated with establishing DFCs at the GMA level. DFCs are intended to function as a water planning goal for regional water planning and management and are used to develop MAG values.”
(GMA 9 Explanatory Report, April 18, 2016, p. 104.)

TWC § 36.108(d) Nine Factor Consideration
Socioeconomic Impacts Reasonably Expected to Occur

- In response to petitions challenging the DFCs due to socioeconomic impacts, GMA 9 responded:
  - DFC defines a management philosophy or approach to reach a desirable, achievable and acceptable level of use.
  - DFC was not a guarantee of social or economic stability
  - Short-term fluctuations in water levels in private wells were not a direct result of the DFC itself, but more the result of localized pumping demands, weather patterns and hydrogeological characteristics.

- Regional DFCs establish a framework for setting long-term water management programs and practices.
- Regional DFCs are not the singular factor in evaluating potential economic or social impacts of water planning on the user community.
- Localized implementation of water management initiatives at the GCD level may be more likely to result in direct economic impacts on the user community.

Discussion

Impact on Interests and Rights in Private Property

Texas Water Code, Section 36.002: Ownership of Groundwater

- The legislature recognizes that a landowner owns the groundwater below the surface of the landowner's land as real property.
- The groundwater ownership and rights described by this section entitle the landowner, including the landowner's lessees, heirs, or assigns, to drill for and produce the groundwater below the surface of real property, subject to Subsection (d), without causing waste or malicious drainage of other property or negligently causing subsidence and, have any other right recognized under common law.
- The groundwater ownership and rights described by this section do not: entitle a landowner, including a landowner's lessees, heirs, or assigns to the right to capture a specific amount of groundwater below the surface of that landowner's land; or affect the existence of common law defenses or other defenses to liability under the rule of capture.
- Nothing in this code shall be construed as granting the authority to deprive or divest a landowner, including a landowner's lessees, heirs, or assigns of the groundwater ownership and rights described by this section.

TWC § 36.108(d) Nine Factor Consideration
Impact on Interests and Rights in Private Property

Texas Water Code, Section 36.002: Ownership of Groundwater (continued)

Other Considerations

- GCDs continue to improve science and data to develop and implement various management strategies that reduce aquifer demand and to help achieve the DFC.

- GCDs have flexibility regulating groundwater by considering all available options provided in Chapter 36 before taking an action that my impact private property rights.

TWC § 36.108(d) Nine Factor Consideration

Impact on Interests and Rights in Private Property

Previous GMA 9 Considerations and Conclusions Regarding the Impact on Interests and Rights in Private Property Factor

TWC § 36.108(d) Nine Factor Consideration
Impact on Interests and Rights in Private Property

Proposed Legislation (SB 152 - Amendment to TWC 36.1025: Petition to Change Rules)

- A person with groundwater ownership and rights may petition the district where the property that gives rise to the ownership and rights is located to adopt a rule or modify a rule adopted under this chapter.
- A petition submitted under this section must include an explanation of why the adoption or modification of the rule requested is necessary to be consistent with ownership and rights under Section 36.002 or conservation or beneficial use of the groundwater resources located in the district in regard to either the entire district or an aquifer, subdivision of an aquifer, or geologic strata

Feasibility of Achieving the Desired Future Condition

Insert James's slides

TWC § 36.108(d) Nine Factor Consideration
Other Relevant Information

Other relevant information factors as they relate to DFC consideration and adoption

Considerations from 2nd - Round Planning Cycle

GMA 9 did not identify any GCD-specific and or local issues that may be impacted for the Edwards Group of the Edwards -Trinity Plateau Aquifer DFC and the Ellenburger-San Saba Aquifer and Hickory Aquifer DFCs.

TWC § 36.108(d) Nine Factor Consideration
Other Relevant Information

- Potential Large-Scale Pumping East of GMA 9 with the Trinity Aquifer
  - GMA 10 would conduct an analysis of the impacts from the potential pumping
  - GMA 9 would consider the results during third-round planning cycle.
- Drawdown from Contiguous, Unregulated Areas
  - Middle Trinity Aquifer is dewatered because of major development in western Travis County - which was unregulated at the time.
- Differences in Trinity Aquifer Hydrogeology
  - Aquifer does not function uniformly across the extent of GMA 9.
  - Update to Hill Country Trinity GAM needs to include these differences to develop multiple, achievable DFCs for the aquifer.
  - GMA 9 would consider this issue during third-round planning cycle.

TWC § 36.108(d) Nine Factor Consideration
Other Relevant Information

- Effects of City of Kerrville ASR Project on Trinity Aquifer
  - Middle Trinity Aquifer is dewatered because of major development in western Travis County - which was unregulated at the time.

(possibly insert updated graph of HGCD monitor well 11)

- Targeted and Specific Exemptions that May Affect the Trinity MAG
  - TGRGCD exempts public water supply wells – normally non-exempt under Chapter 36
  - HTGCD exempts agricultural use wells – normally non-exempt under Chapter 36
  - GMA 9 will monitor these issues and consider during the third-round planning cycle

GMA 9 2022 DFC Joint Planning Cycle – Next Steps

March 2021 GMA 9 Meeting –

- Presentation on summary of how proposed DFC impacts each factor when proposed DFCs considered for adoption.
- Consider action to approve proposed non-relevant aquifer classifications and proposed DFCs, and to distribute both to the GCDs in GMA 9.

April 2021 – July 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.

May 1, 2021 –

- Deadline to adopt proposed DFCs.

Questions and Discussion

Discuss Possible DFC Policy and Technical Justifications, and Balance Test

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

Discuss Possible DFC Policy and Technical Justifications, and Balance Test

Discuss Possible DFC Policy and Technical Justifications, and Balance Test

Discuss Possible DFC Policy and Technical Justifications, and Balance Test

- 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

- 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

Discuss Possible DFC Policy and Technical Justifications, and Balance Test

- 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

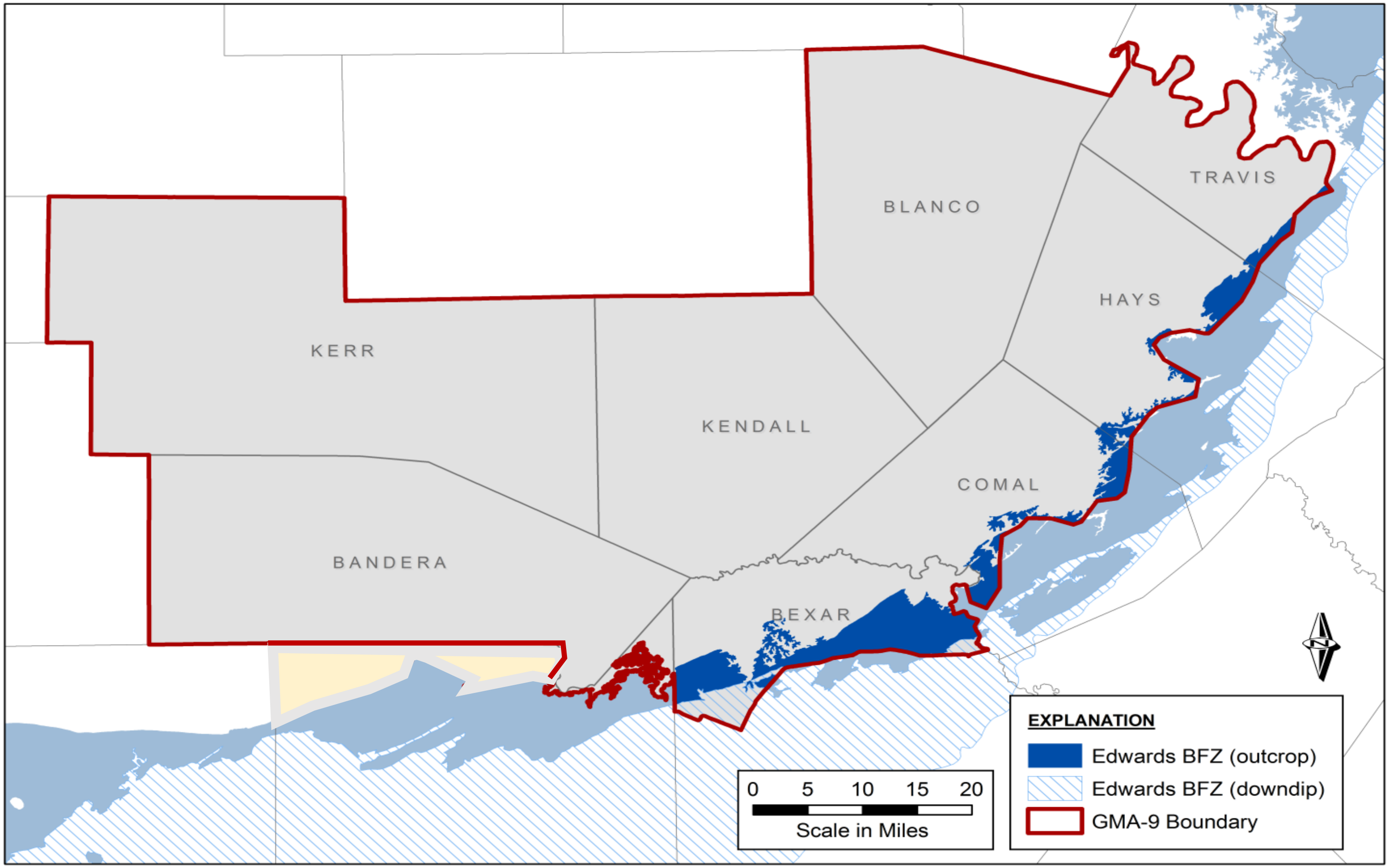
Discuss Possible DFC Policy and Technical Justifications, and Balance Test

- 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
- Assess DFC over time, re-evaluate during next planning round, and consider new model runs
- 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)

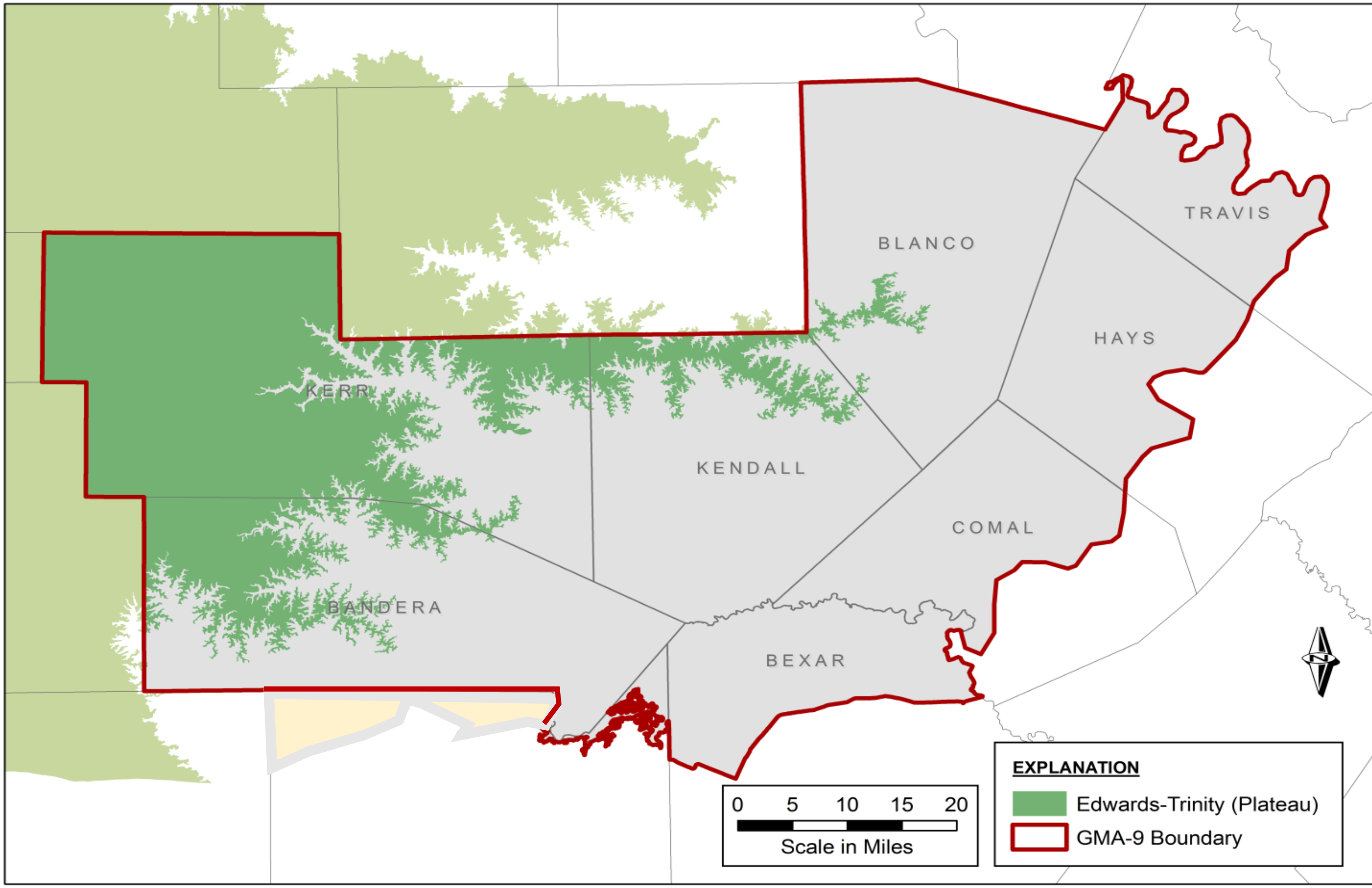
Revised Draft Non-Relevant Aquifer Information

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

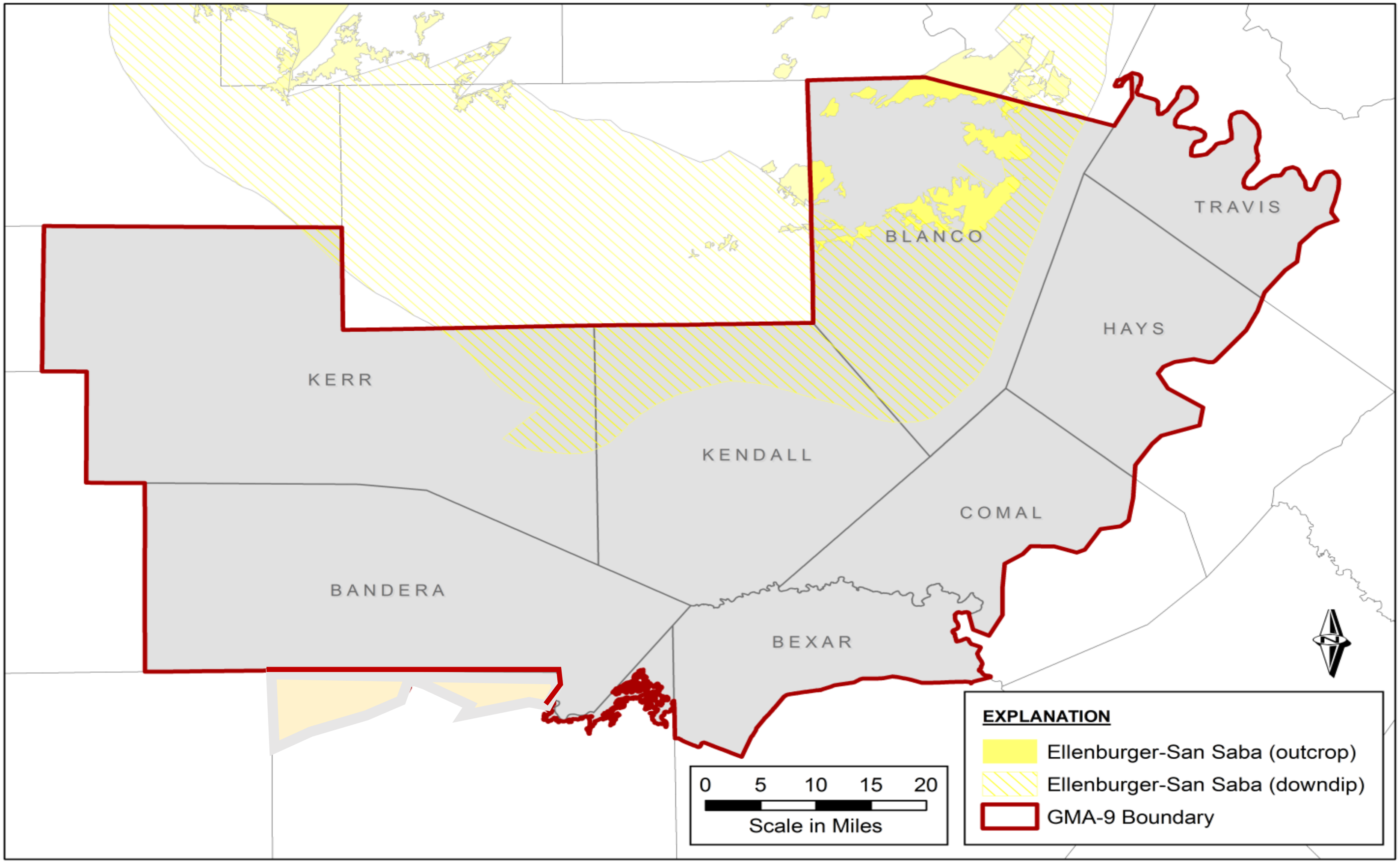
GMA-9 Non-Relevant Aquifer: Edwards BFZ



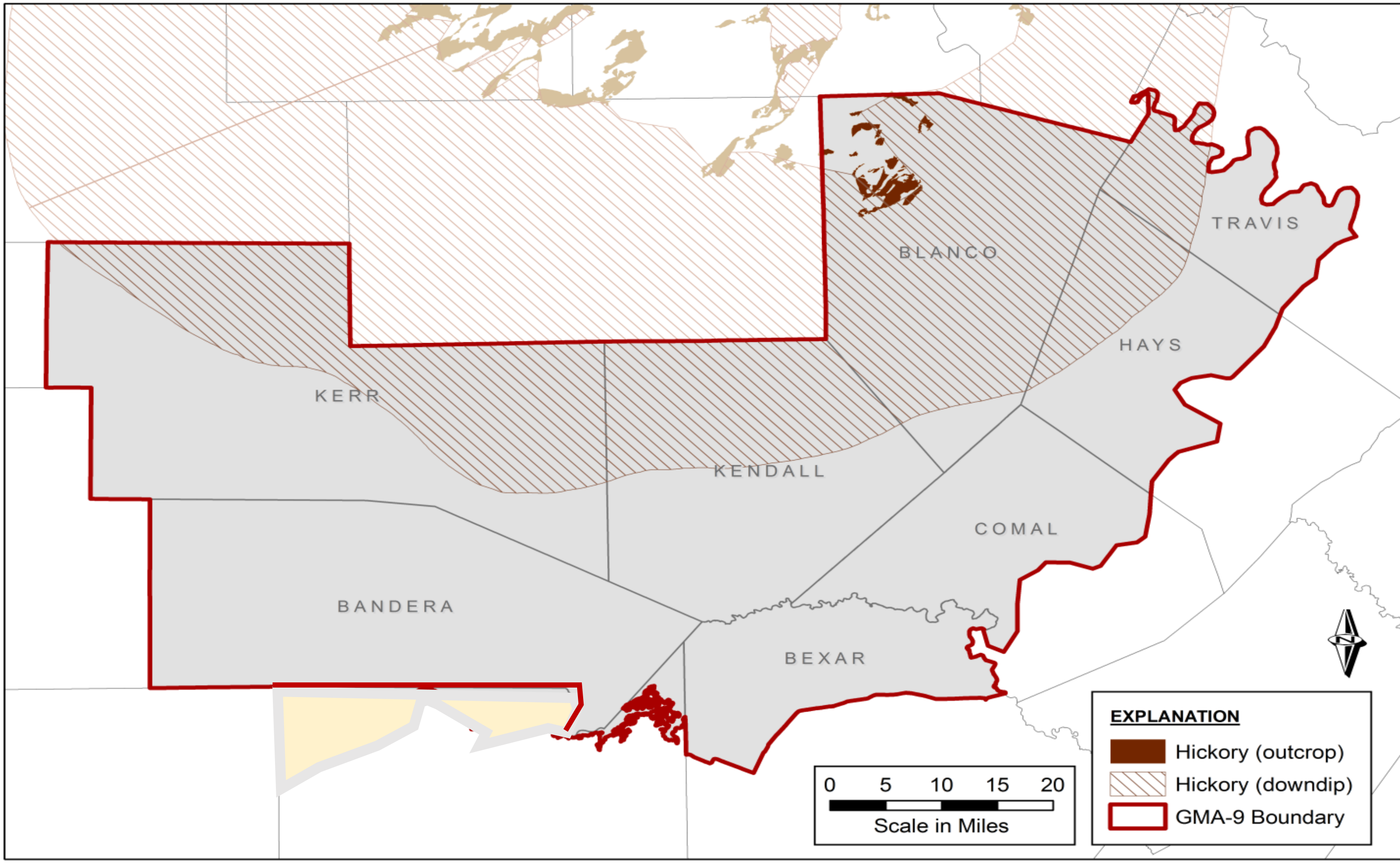
GMA-9 Non-Relevant Aquifer: Edwards-Trinity (Plateau)



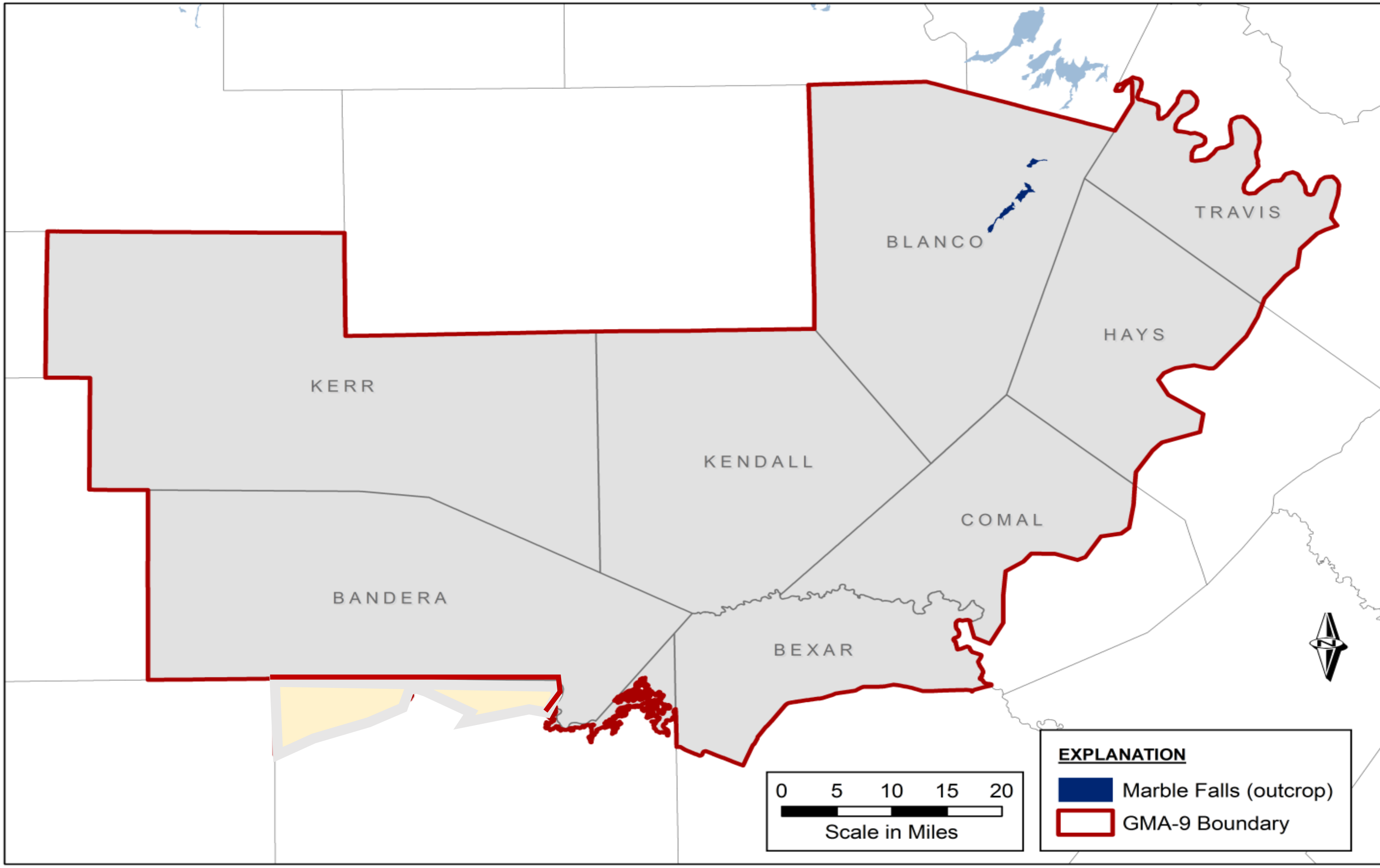
GMA-9 Non-Relevant Aquifer: Ellenburger-San Saba



GMA-9 Non-Relevant Aquifer: Hickory



GMA-9 Non-Relevant Aquifer: Marble Falls



Review and Discuss DFC Statements – TWDB Discussions

- Example: 5 percent or up to one foot when comparing DFCs to average drawdown calculations from model files

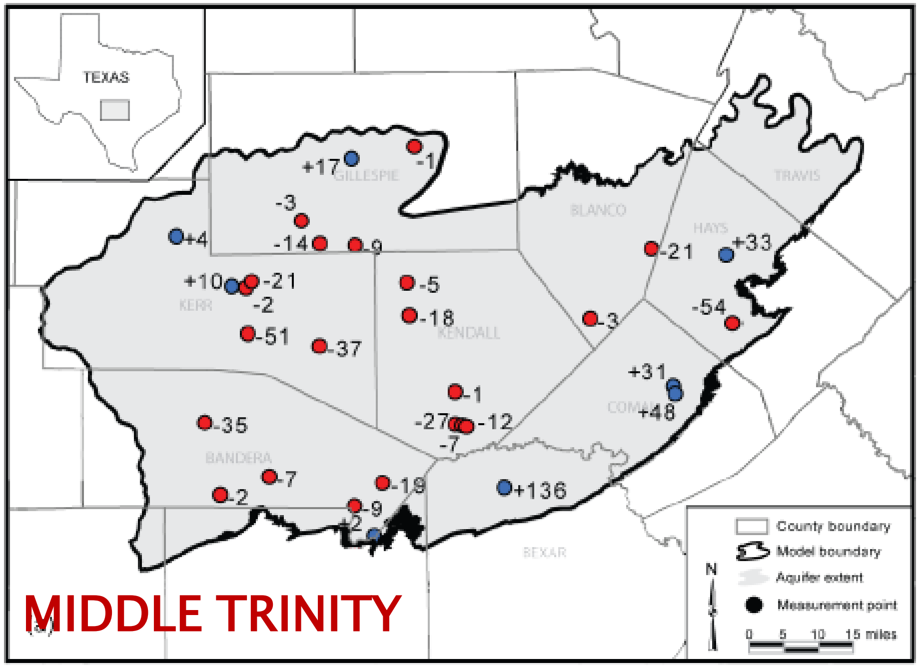
- Results not until fall 2021 – but before GMA 9 final DFC adoption

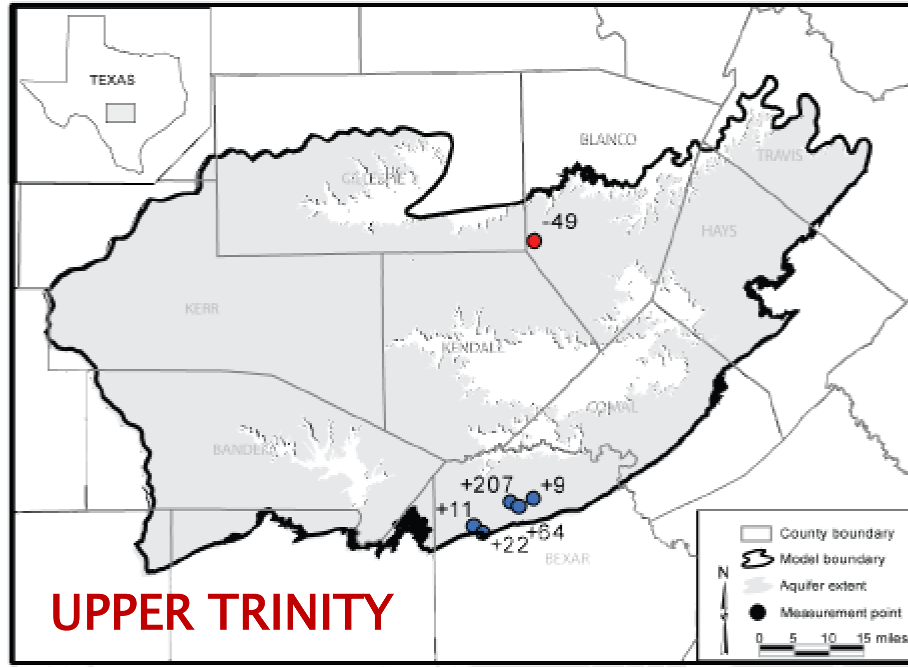
Aquifer Uses and Conditions

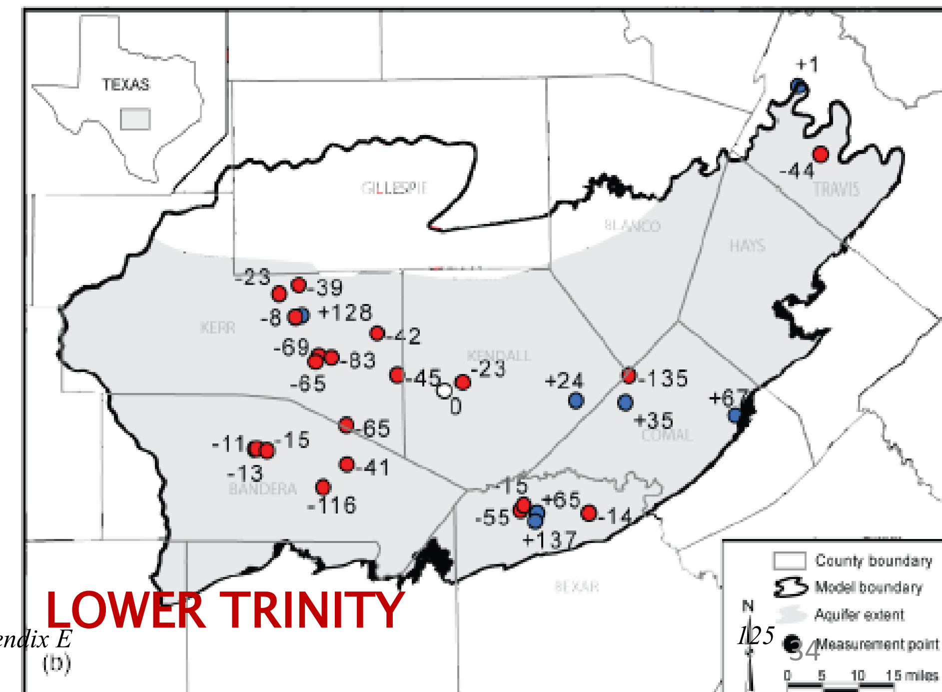
- Pumping from Trinity Aquifer estimated by Groundwater Conservation District for 2008 (Acre-feet per year)

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**

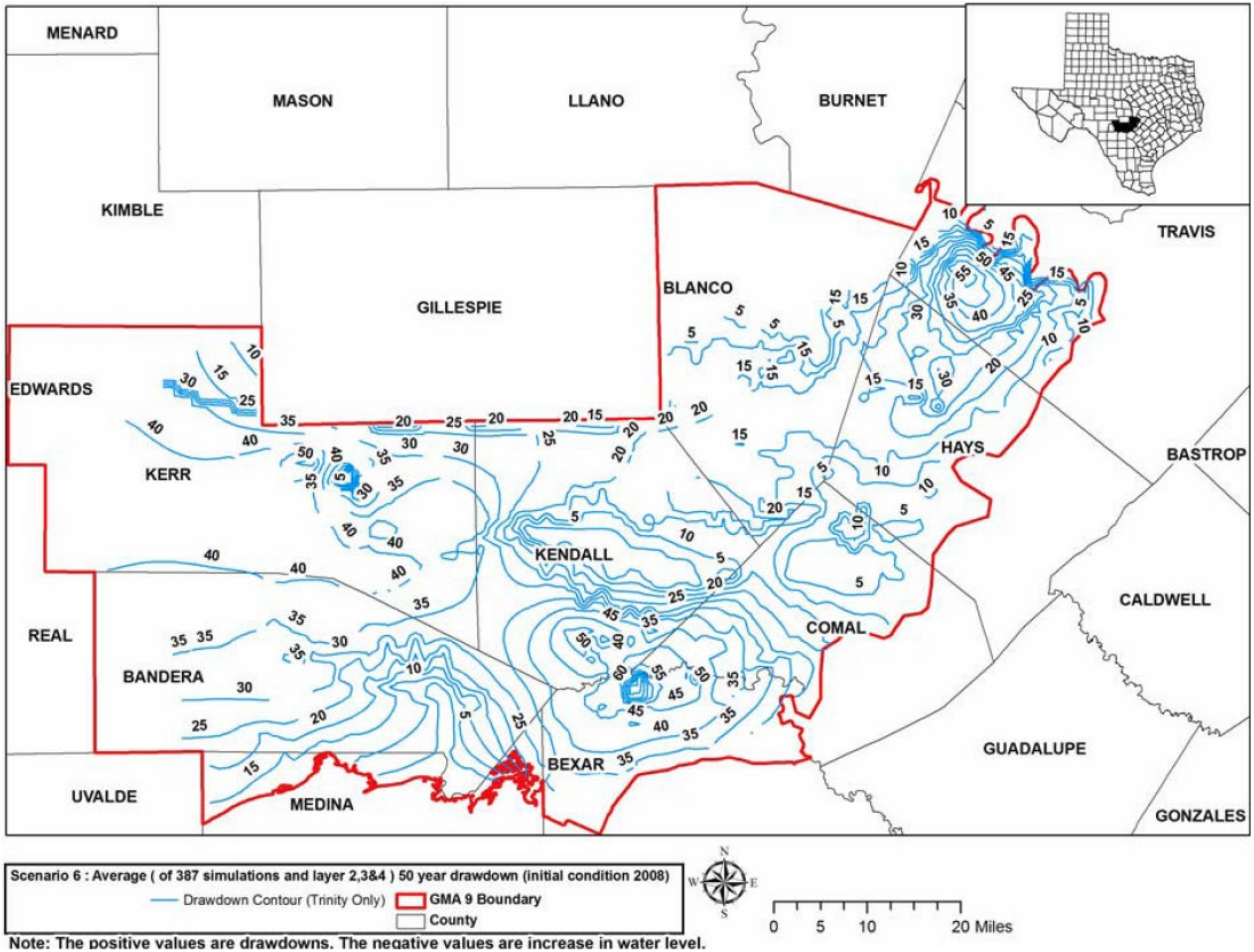
Net Water Level Change: 1980 – 1997



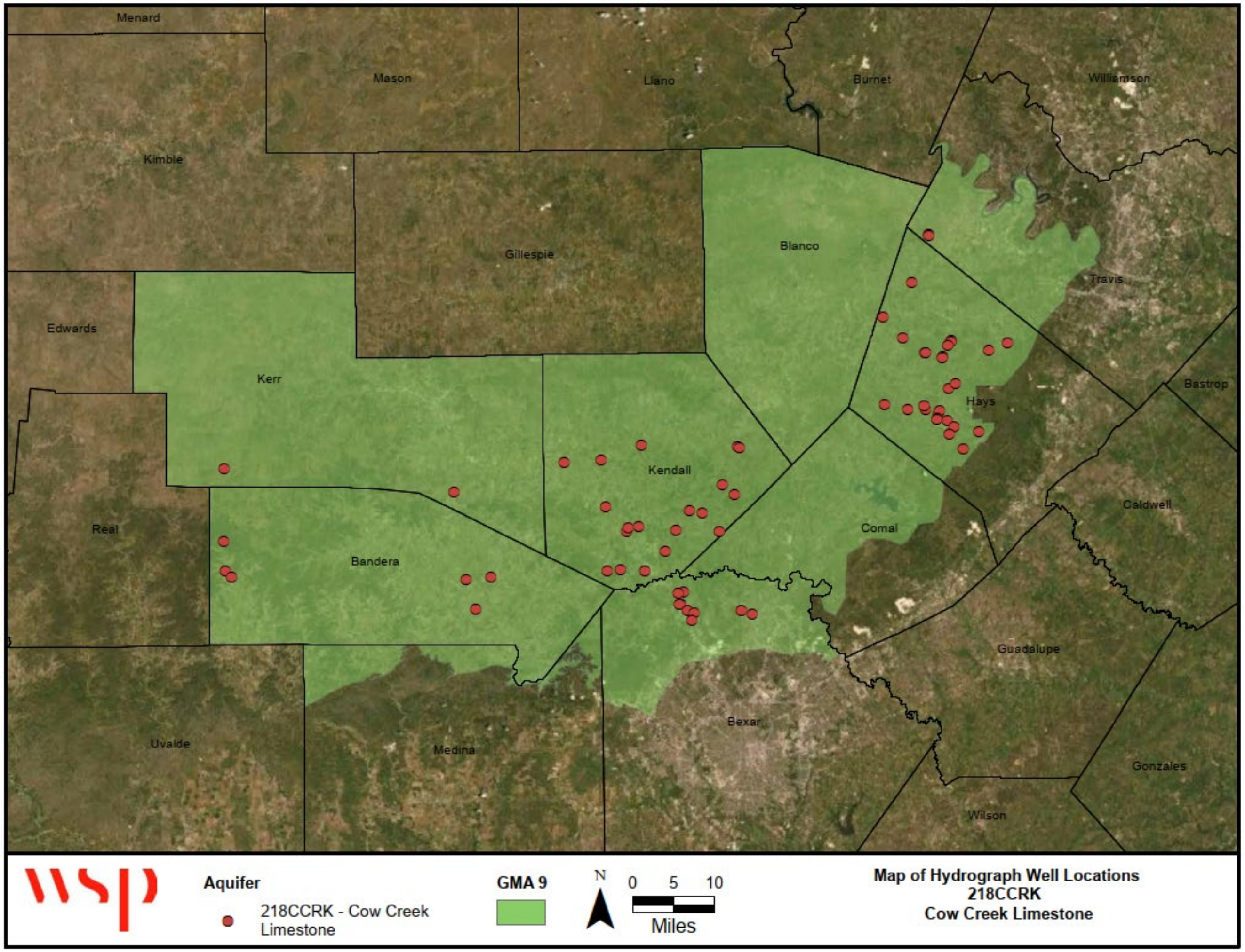




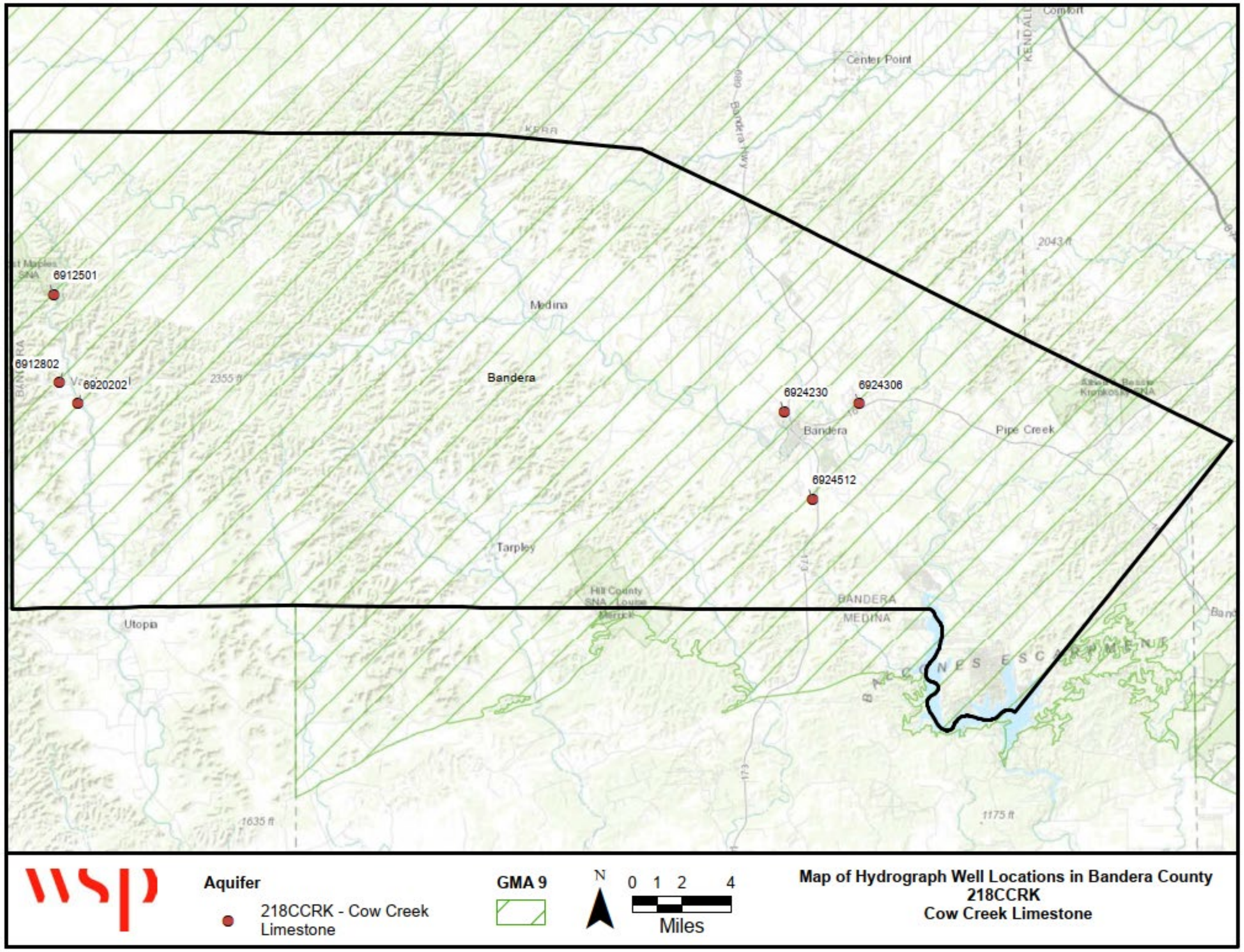
Resulting Average Water Level Decline in All Layers of Trinity after 50 years (from 387 simulations)



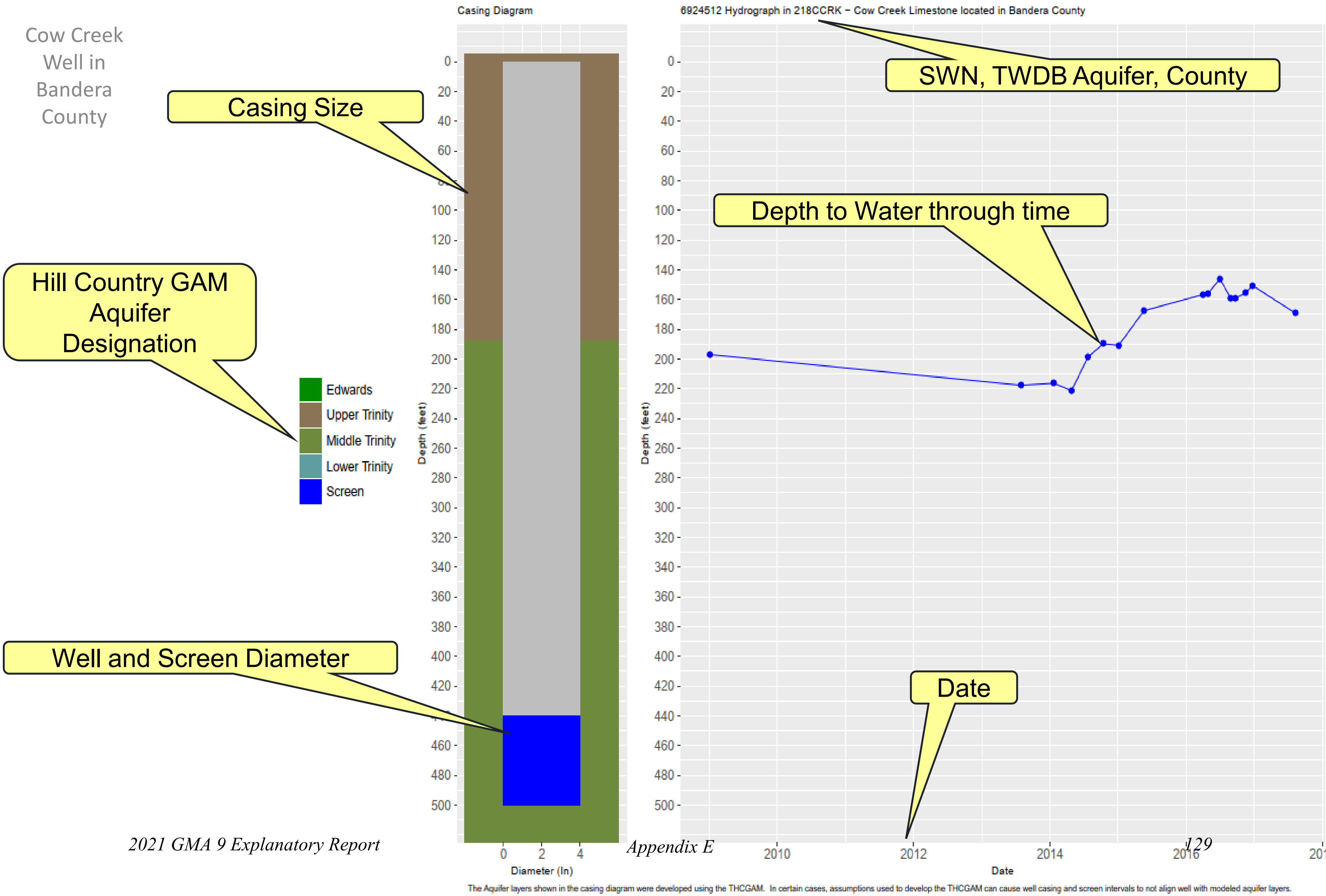
GMA 9 2022 DFC Joint Planning Cycle

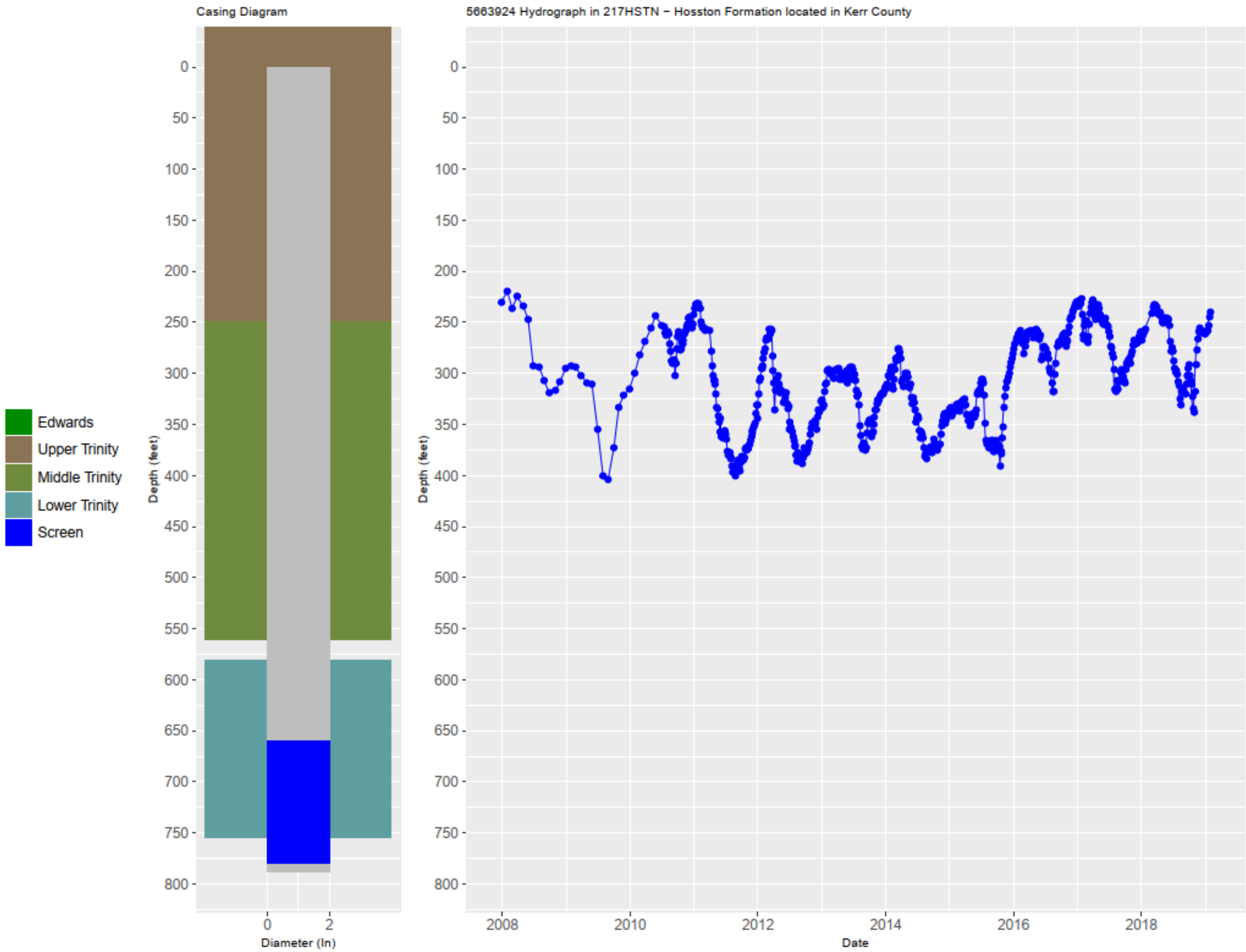


GMA 9 2022 DFC Joint Planning Cycle



Cow Creek Well in Bandera County





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Water level changes since 2008

Trinity Aquifer DFC Compliance Analysis for Blanco County

Monitor Well Name	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.	Average Well Drawdown Change in feet From 2008
	Calendar Year Average Water Level Below Land Surface												
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

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

- 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%

- 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.

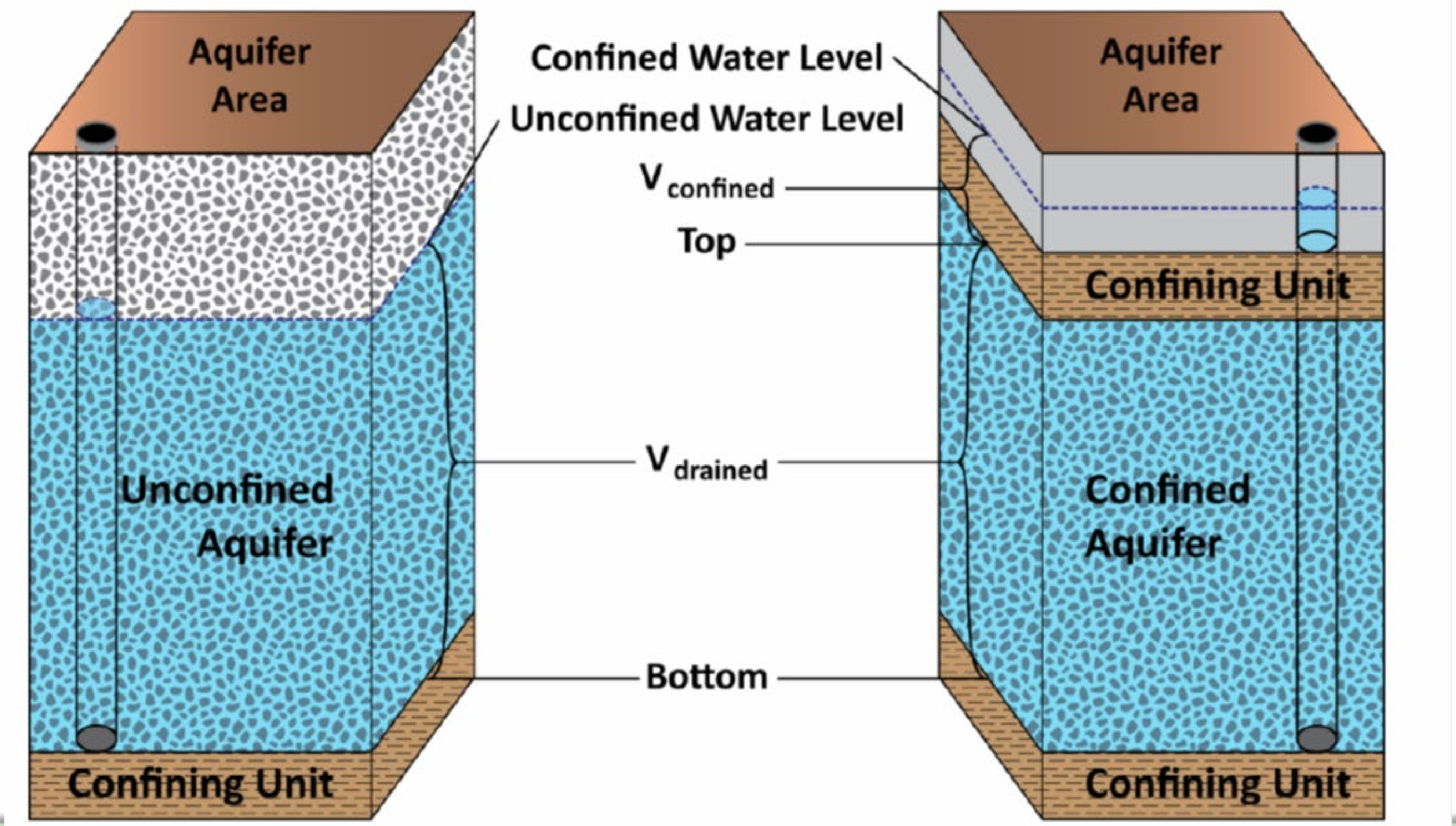
TWC § 36.108(d) Nine Factor Consideration

SWP Water Supply Needs/Water Management Strategies

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

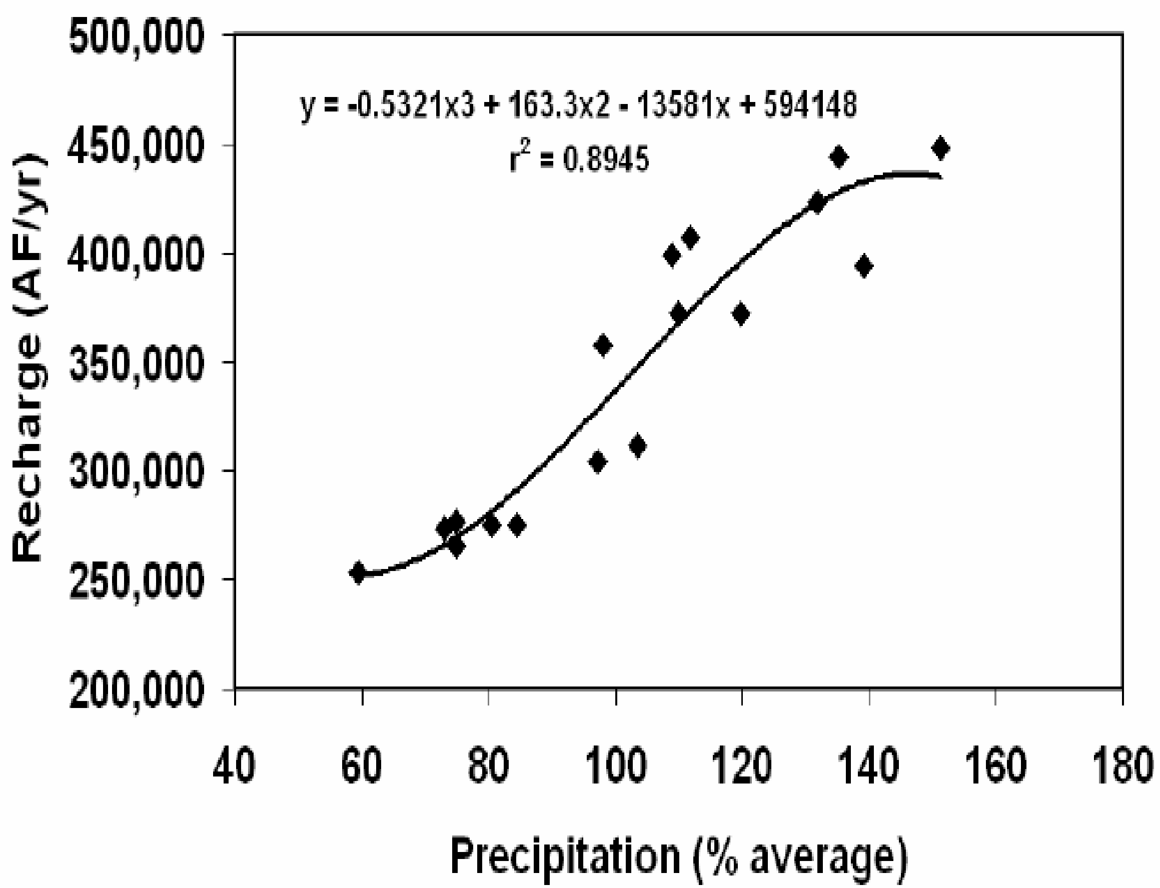
Edwards-Trinity Plateau Aquifer
Kendall County

- 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

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

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."

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

New Information: GCD Management Plan GAM Results

Estimated Annual Discharge from Aquifer to Springs and any Surface Waterbody

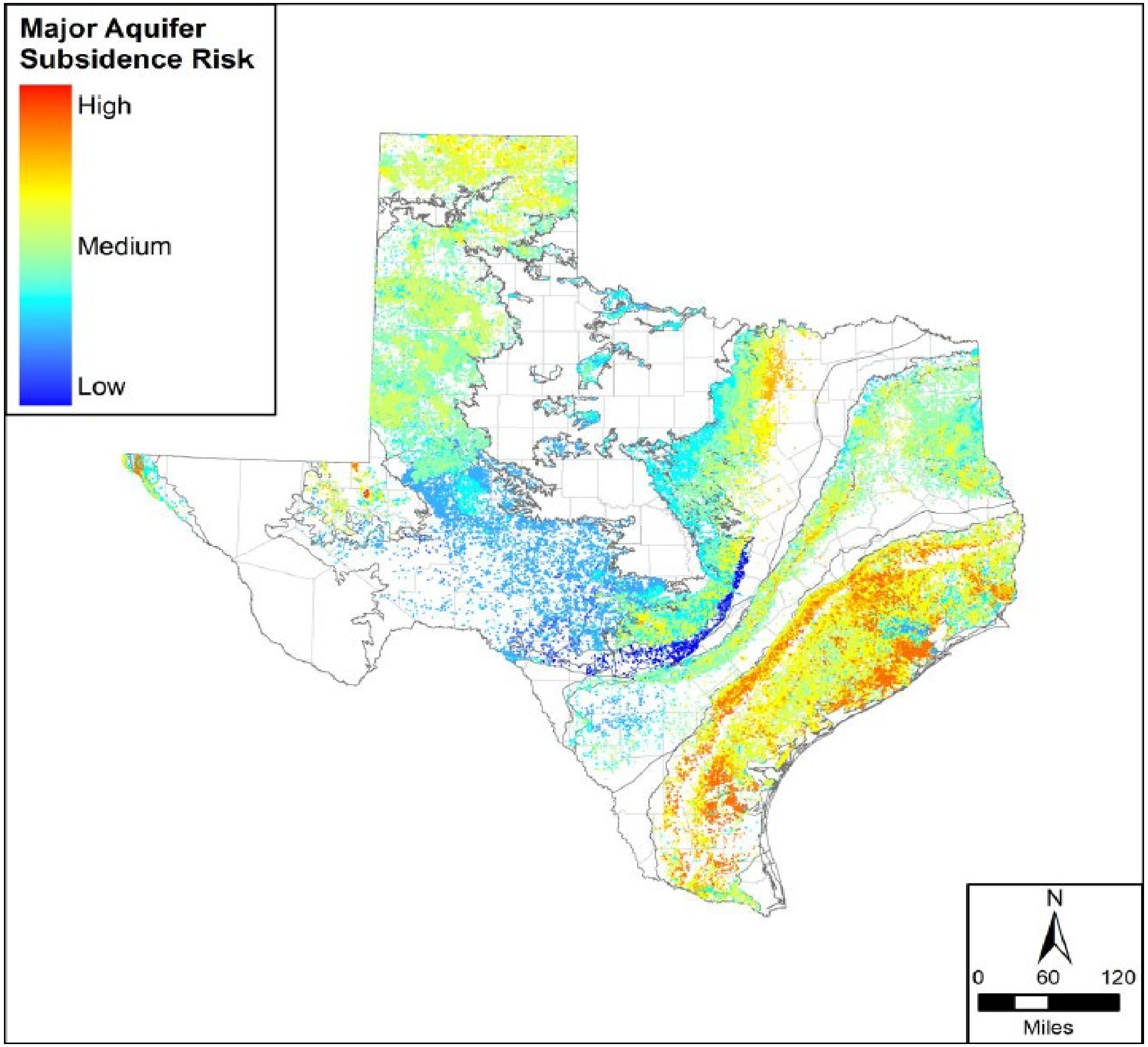
Groundwater Conservation District	Trinity Aquifer (acre-feet/year)	Edwards-Trinity (Plateau) Aquifer (acre-feet/year)
Bandera County River Authority and Groundwater District	32,750	4,141
Blanco-Pedernales GCD	25,448	0
Cow Creek GCD	31,131	3,061
Comal Trinity GCD	15,601	-
Headwaters GCD	18,473	17,697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

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

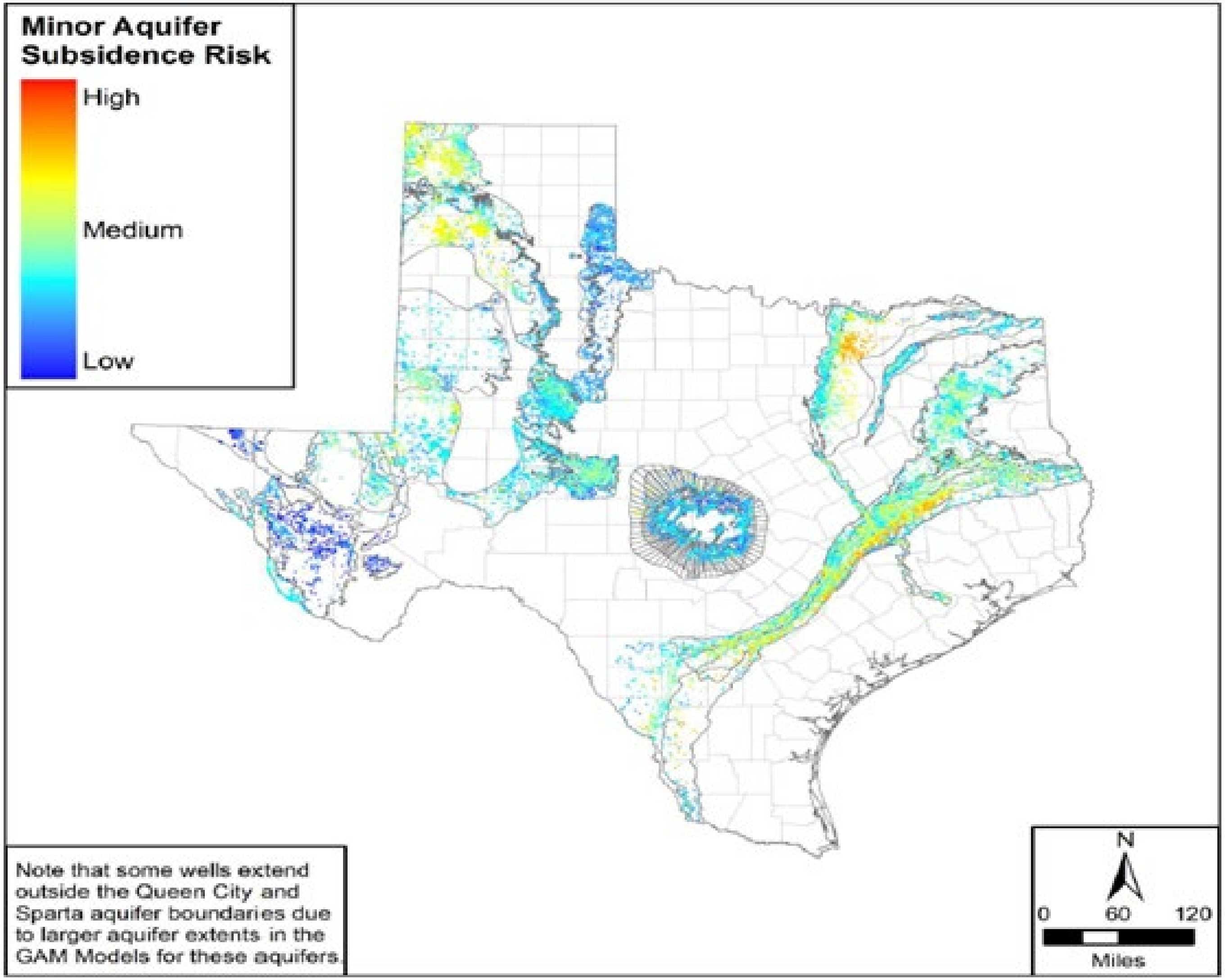
Highlighted GMA 9 GCD Management Plan Environmental-Related Objectives

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

Visualizing the Subsidence Risk



Visualizing the Subsidence Risk



Groundwater Management Area 9

2022 DFC Joint Planning Cycle

March 22, 2021

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

AGS
Advanced Groundwater Solutions, LLC

GMA 9 2022 DFC Joint Planning Cycle

For Today's Meeting:

- Discuss and consider adopting proposed non-relevant aquifer classifications pursuant to Title 31, Texas Administrative Code § 356.31(b) and proposed desired future conditions pursuant to Texas Water Code § 36.108(d). *(Agenda Item 9)*

- Discuss and consider public comment process for desired future condition public hearings. *(Agenda Item 10)*

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

GMA 9 Joint Planning Process Schedule – Revised 3/22/21

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 25, 2021
GMA 9 meeting – Consider action to approve proposed non-relevant aquifer classifications and adopt proposed DFCs[1], 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 22, 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 are considered in developing proposed DFCs.	April 1 – June 30, 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 [2], 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

[1] **Texas Water Code § 36.108(d) deadline for GMA to adopt proposed DFCs is May 1, 2021**

[2] **Texas Water Code § 36.108 (d-3) deadline for GMA to adopt final DFCs is January 5, 2022**

DFC Feasibility Factor

Before adoption of DFCs, GCDs shall consider groundwater availability models and other data or information for the management area and consider nine factors including the feasibility of achieving the desired future conditions(TWC § 36.108(d)(8)).

Considerations

- TWC and TAC do not provide guidance on how GMAs and GCDs are to consider this factor.

TWC § 36.108(d) Nine Factor Consideration
Feasibility of Achieving the DFC

Is it feasible to achieve the DFC in the aquifer?

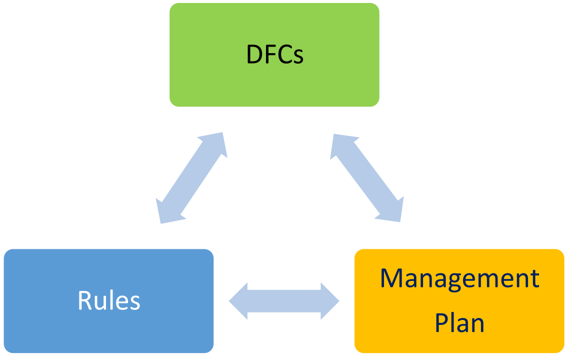
Groundwater Availability Models help ensure that DFCs are generally physically achievable in the aquifer and represent the best available science according to TWDB declaration.

DFCs compliance is determined by assessing actual aquifer conditions.

Is it feasible to achieve the DFC from a regulatory standpoint ?

Adopted Rules and Management Plans in each district help ensure that DFCs can achieved.

DFCs are less likely to be achieved in areas without GCDs.



TWC § 36.108(d) Nine Factor Consideration
Feasibility of Achieving the DFC

DFC Feasibility Factor

- ✓ Chapter 36 gives GCDs authority to manage aquifers locally and jointly.
- ✓ GCDs continue to collect data and improve science and understanding of the aquifer.
- ✓ GCDs have monitoring plans to track status of aquifers compared to DFCs.
- ✓ GCDs set goals and objectives in TWDB-approved management plans.
- ✓ Based on the best available science (the approved Groundwater Availability Model or other quantitative tools), the DFCs are physically possible.
- ✓ Modeled Available Groundwater (MAGs) are estimated based on DFCs.
- ✓ MAGs are used as maximum groundwater supply for RWPG recommended strategies.
- ✓ GCDs have rule-making authority to meet DFCs.
- ✓ GCDs have authority to limit production and implement well spacing.
- ✓ GCDs have enforcement capabilities.
- ✓ GCDs are voting members on RWPGs.

Other information relevant to DFCs consideration and adoption

Before adoption of DFCs, GCDs consider groundwater availability models and other data or information for the management area and consider nine factors including other information relevant to the specific desired future conditions (Texas Water Code § 36.108(d)(9)).

Other considerations

- GMA 9 does not identify any GCD-specific and/or local issues that may impact the Edwards Group of the Edwards-Trinity Plateau Aquifer DFC, the Ellenburger-San Saba Aquifer, and the Hickory Aquifer DFCs.
- Potential large-scale pumping in GMA 9 in the Trinity Aquifer.
- Drawdown in the Middle Trinity Aquifer in southwestern Travis County.

Other Considerations (continued)

- Differences in Trinity Aquifer hydrogeology
  - Aquifer does not function uniformly across extent of GMA 9.
  - Update to Hill Country Trinity GAM needs to include these differences to develop multiple, achievable DFCs.

- Targeted and specific exemptions that may affect Trinity MAG
  - TGRGCD enabling statute exempts some existing public water supply wells – normally non-exempt under Chapter 36.
  - HTGCD enabling statute exempts agricultural use wells – normally non-exempt under Chapter 36.

- Excessive growth in Travis, Hays, and Comal County causing an increased demand on groundwater in those high growth areas. Increased demand leads to lowering of local water levels in those counties, which causes a subsequent "cone of depression" and increase of groundwater flow from upgradient Blanco County, which then results in (1) a decline in Blanco County groundwater resources, and (2) a corresponding negative impact on groundwater and property rights of Blanco County well and property owners.

Proposed Non-Relevant Aquifers

Texas Administrative Code Chapter 356.31

- According to the TAC, a GMA may propose to classify an aquifer/portion of an aquifer as non-relevant.
- GCDs must submit the following:
  - A description, location, and or map of the aquifer;
  - A summary of aquifer characteristics, demands, current use including TERS that support conclusions that DFCs in adjacent or hydraulically connected hydraulically relevant aquifer(s) will not be affected;
  - An explanation of why the aquifer or portion of the aquifer is non-relevant for joint planning purposes.

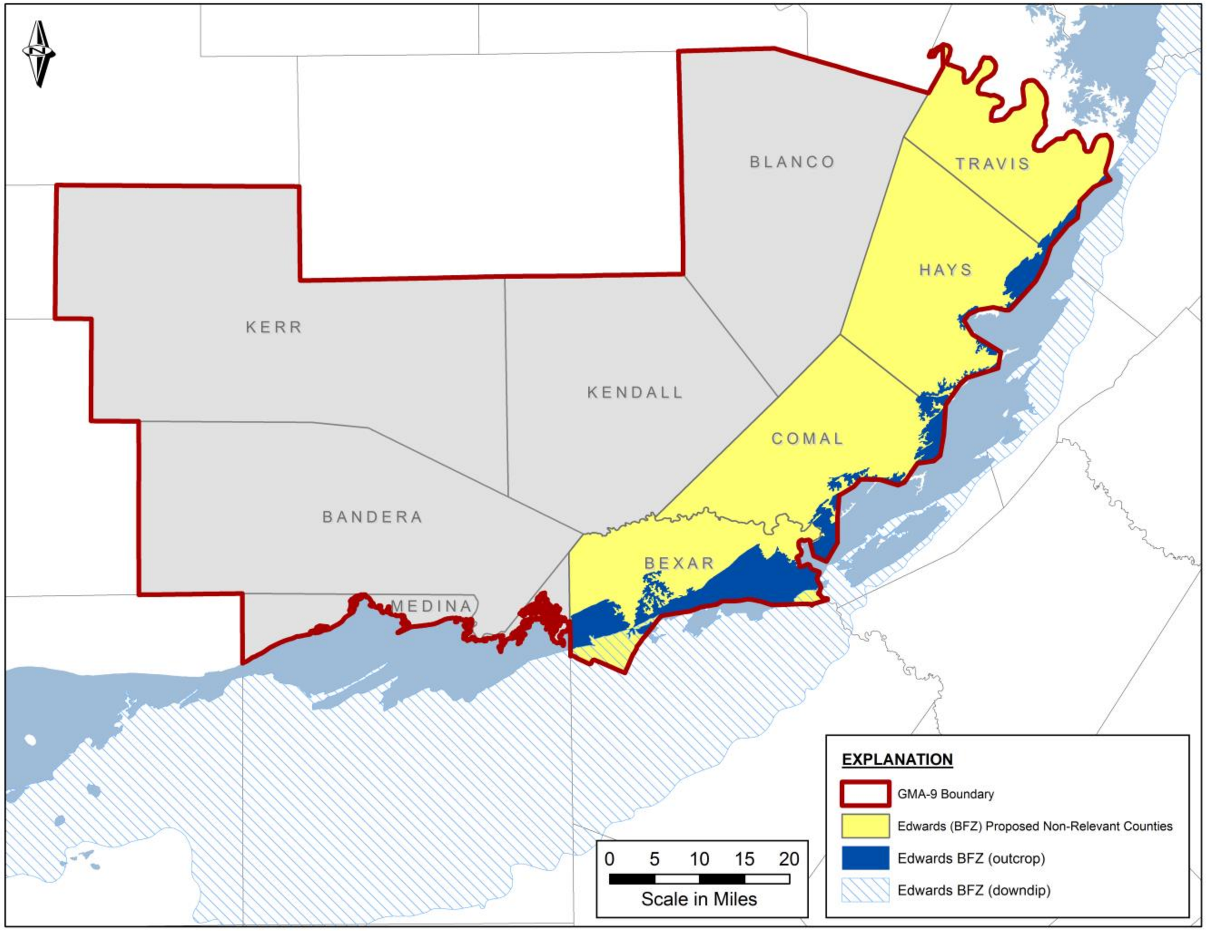
Proposed Non-Relevant Aquifers

GMA 9 Proposed Non-Relevant Aquifer Classifications (Major and Minor Aquifers)	
PROPOSED NON-RELEVANT AQUIFER CLASSIFICATION	Applicable Areas Within GMA 9 (All or portions of the following counties)
Edwards Aquifer (Balcones Fault Zone)	Bexar, Comal, Hays, and Travis counties
Edwards Group of 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

Proposed Non-Relevant Aquifers –
Edwards Aquifer (BFZ): Bexar, Comal, Hays, and Travis Counties

Aquifer Characteristics:

- Limestone karst aquifer
- 200-600 feet thick
- Presence of sinkholes, sinking streams, caves, large springs, and highly productive water wells
- Responds quickly to rainfall, drought, and pumping



Proposed Non-Relevant Aquifers – Edwards Aquifer (BFZ): Bexar, Comal, Hays, and Travis Counties

Demands

- The City of San Antonio obtains the majority of its water supply from the aquifer.

Current Uses

- Non-exempt wells are used for municipal, industrial, or irrigation purposes.
- Exempt wells are used for livestock and domestic purposes.

Total Estimated Recoverable Storage Amounts within GMA 9

- The TERS volume estimates calculated by the TWDB (Jones and Bradley 2013) for the Edwards Aquifer (BFZ) have not been updated.

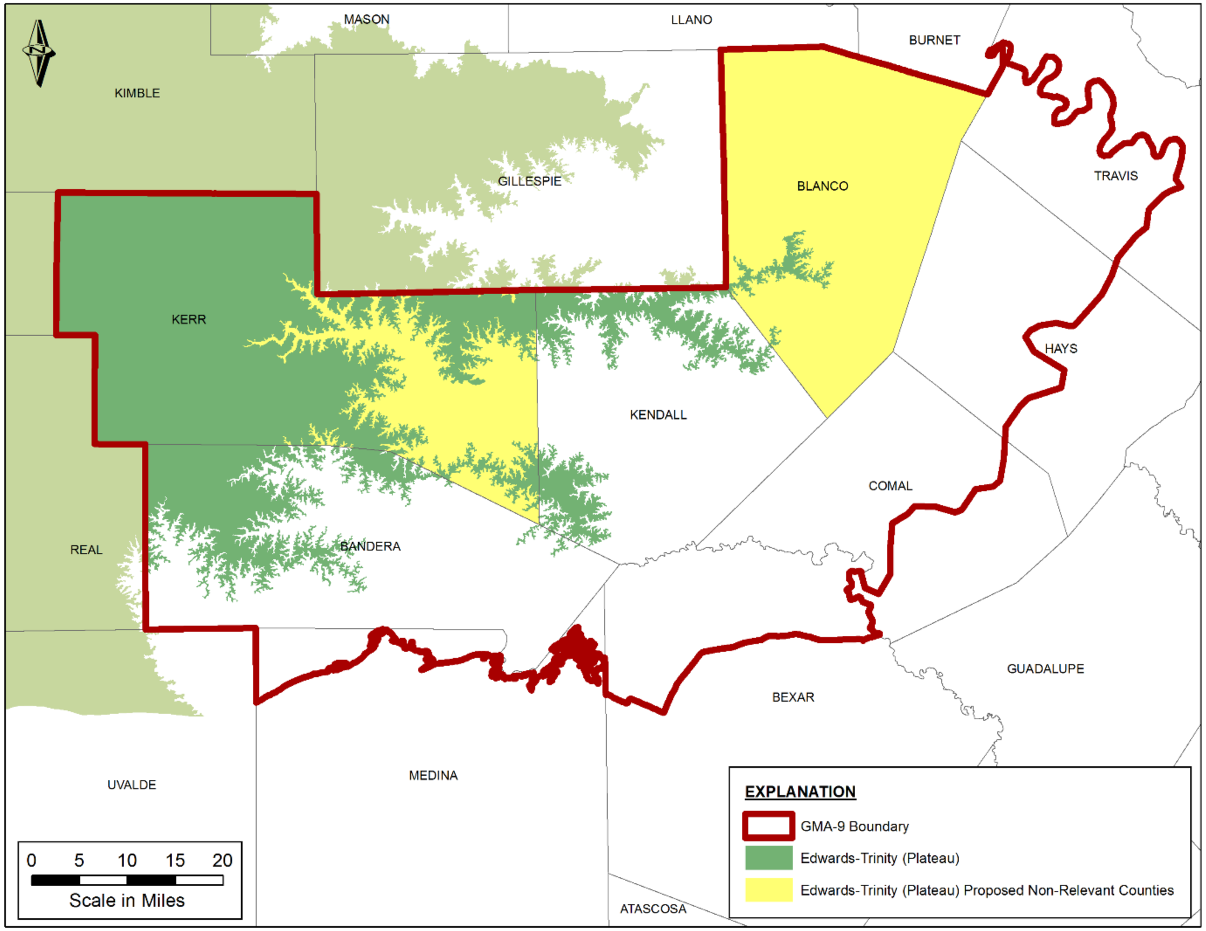
An explanation as to why the Edwards Aquifer (BFZ) is non-relevant

- The Edwards Aquifer is under the regulatory and management jurisdiction of the EAA and the BSEACD.
- Protective aquifer conditions and potential pumping amounts were set for the entirety of the Edwards Aquifer (BFZ) (San Antonio segment and EAA-regulated) and can only be amended through legislative actions.
- The EAA Act serves as the current DFCs and the de facto MAG amount.
- The portion of the Edwards Aquifer located in the BSEACD contains a very small amount of water. The BSEACD rules only allow exempt wells to be drilled in this portion of the Edwards Aquifer.

Proposed Non-Relevant Aquifers – Edwards Group of the Edwards-Trinity (Plateau) Aquifer: Blanco and Kerr Counties

Aquifer Characteristics:

- Thin layers of limestone and dolomite
- More porous than the Trinity Aquifer
- Yields are low



Proposed Non-Relevant Aquifers – Edwards Group of the Edwards-Trinity (Plateau) Aquifer: Blanco and Kerr Counties

Current Uses

Edwards Group of Edwards-Trinity (Plateau) Aquifer Estimated 2018 Groundwater Use (by GMA 9 County)

GMA 9 County	Type of Use and Estimated Use Amount for 2018 (in ac-ft)						
	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Totals
Bandera	49	0	0	0	0	66	115
Blanco	0	0	0	0	0	2	2
Hays	0	0	0	0	0	3	3
Kendall	44	0	0	0	0	19	63
Kerr	767	0	0	0	64	138	969
Totals	860	0	0	0	64	228	1,152

Source: TWDB Water Use Survey Team, Historical Groundwater Pumping Estimates

Proposed Non-Relevant Aquifers – Edwards Group of the Edwards-Trinity (Plateau) Aquifer: Blanco and Kerr Counties

Demands

- The small amount of water that is produced from this aquifer is generally used for domestic and livestock purposes.
- As of 2008, the BPGCD did not identify any non-exempt wells.

Total Estimated Recoverable Storage Amounts within GMA 9

- The TERS volume estimates calculated by the TWDB (Jones and Bradley 2013) for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer have not been updated.

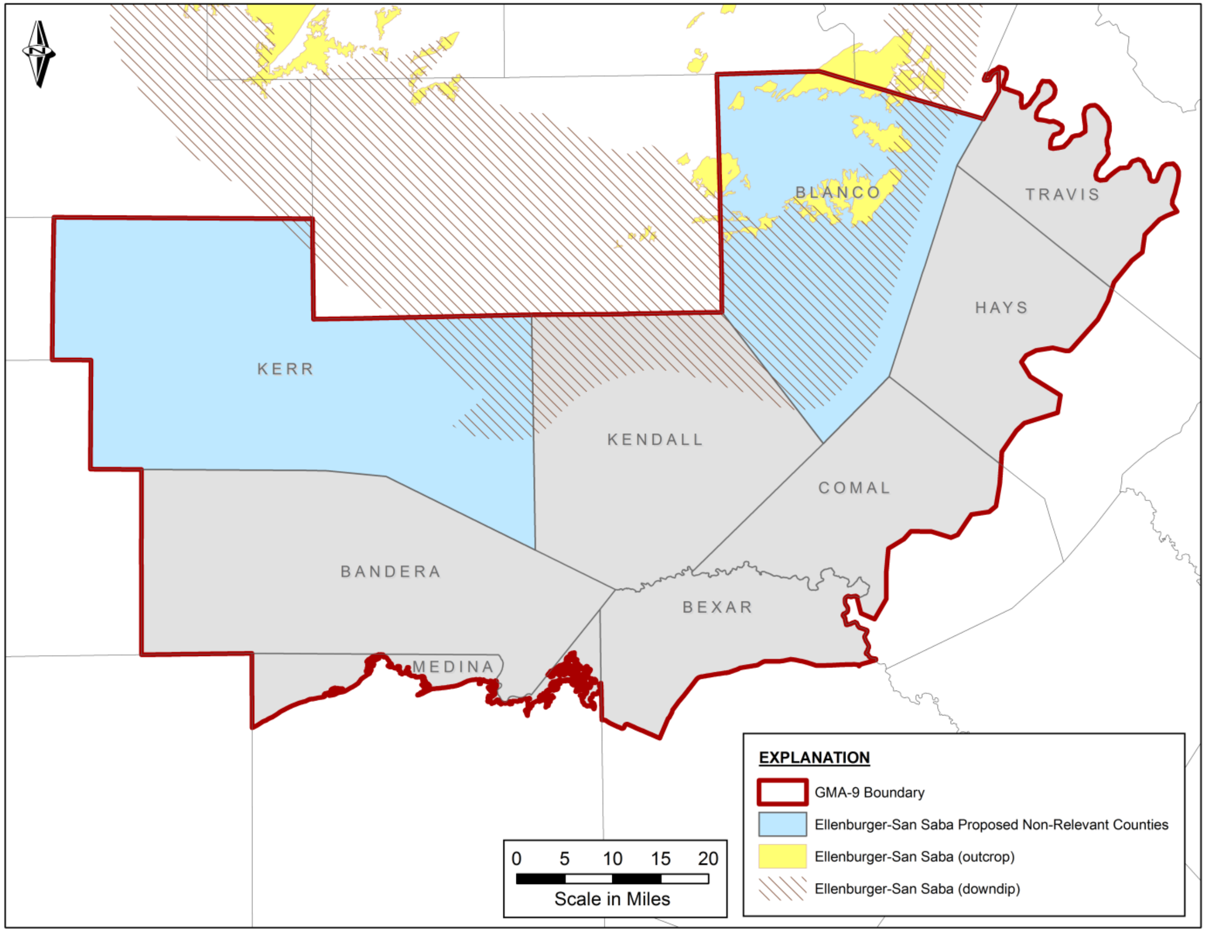
An explanation as to why the Edwards Group of the Edwards-Trinity (Plateau) is non-relevant

- Not a significant source of groundwater in Blanco and Kerr counties; pumping that occurs is likely for exempt uses in rural areas.
- Will not affect other users, proximal GCDs, or others jointly planning for the Edwards Group within GMA 9 or in other GMAs.
- For HGCD (Kerr County) , 1) the Edwards Group is considered <10% county groundwater use; 2) HGCD rules prohibit non-exempt well drilling in Edwards Group; 3) any pumping is exempt and primarily for domestic and livestock use.

Proposed Non-Relevant Aquifers – Ellenburger-San Saba Aquifer: Blanco and Kerr Countes

Aquifer Characteristics:

- Limestone and dolomite aquifer
- 0 to 1,000 feet range in thickness
- Average yield from all types of wells is about 65 gpm



Proposed Non-Relevant Aquifers – Ellenburger-San Saba Aquifer: Blanco and Kerr Counties

Ellenburger-San Saba Aquifer 2018 Groundwater Use (by GMA 9 County)							
GMA 9 County	Type of Use and Estimated Use Amounts for 2018 (in ac-ft)						
	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Totals
Blanco	175	0	0	0	1,367	87	1,629
Totals	175	0	0	0	1,367	87	1,629

Source: TWDB Water Use Survey Team, Historical Groundwater Pumping Estimates

Total Estimated Recoverable Storage Amounts within GMA 9

- The TERS volume estimates calculated by the TWDB (Jones and Bradley 2013) for the Ellenburger-San Saba Aquifer have not been updated.

Proposed Non-Relevant Aquifers – Ellenburger-San Saba Aquifer: Blanco and Kerr Counties

Demands

- Municipal demands make up the largest proportion of groundwater use from the Ellenburger-San Saba, followed by irrigation and livestock.
- Johnson City uses water from the aquifer, and the City of San Saba uses water from San Saba Springs, which is believed to be derived from the Ellenburger-San Saba Aquifer.

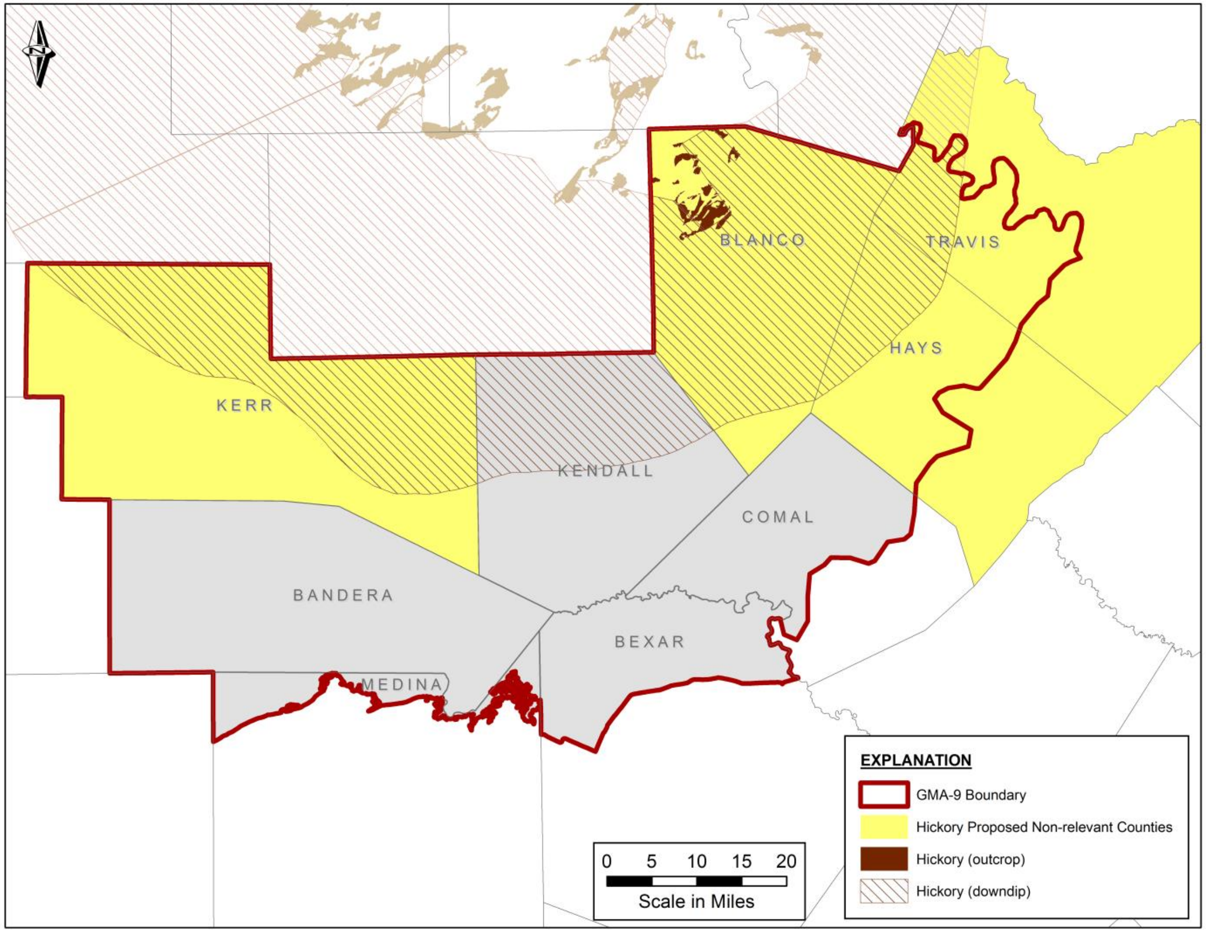
An explanation as to why the Ellenburger-San Saba is non-relevant

- There is limited production from the Ellenburger-San Saba in Kerr County.
- Largest permitted well system in Blanco County is owned by Johnson City and is already TCEQ and BPGCD regulated.
- Other than a few small-volume permitted wells in Blanco County, production is from exempt domestic and/or livestock watering wells.
- Geological and hydrogeological characteristics ensure that production from the Ellenburger-San Saba Aquifer does not affect other GCDs within GMA 9.
- Classifying the Ellenburger-San Saba Aquifer as non-relevant in Blanco and Kerr counties will have no significant impact on surrounding entities or the joint planning process.

Proposed Non-Relevant Aquifers – Hickory Aquifer: Blanco, Hays, Kerr, and Travis Counties

Aquifer Characteristics:

- Sandstone aquifer
- Production occurs in the outcrop area
- Highest yields typically found in the Llano uplift



Proposed Non-Relevant Aquifers – Hickory Aquifer: Blanco, Hays, Kerr, and Travis Counties

Current Uses

Hickory Aquifer 2018 Groundwater Use (by GMA 9 County)							
GMA 9 County	Type of Use and Estimated Use Amounts for 2018 (in ac-ft)						
	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Totals
Blanco	53	0	0	0	273	33	359
Totals	53	0	0	0	273	33	359

Source: TWDB Water Use Survey Team, Historical Groundwater Pumping Estimates

Total Estimated Recoverable Storage Amounts within GMA 9

- The TERS volume estimates calculated by the TWDB (Jones and Bradley 2013) for the Hickory Aquifer have not been updated.

Proposed Non-Relevant Aquifers –
Hickory Aquifer: Blanco, Hays, Kerr, and Travis Counties

Demands

- Irrigation makes up the largest proportion of groundwater use from the Hickory.
- The cities of Brady, Mason, and Fredericksburg (outside of GMA 9) use groundwater for municipal purposes.
- In western Hays county, groundwater is primarily for residential use and livestock use; there is little agriculture or commercial use. Rural demand is met by wells producing from the Lower Glen Rose and the Cow Creek formations.

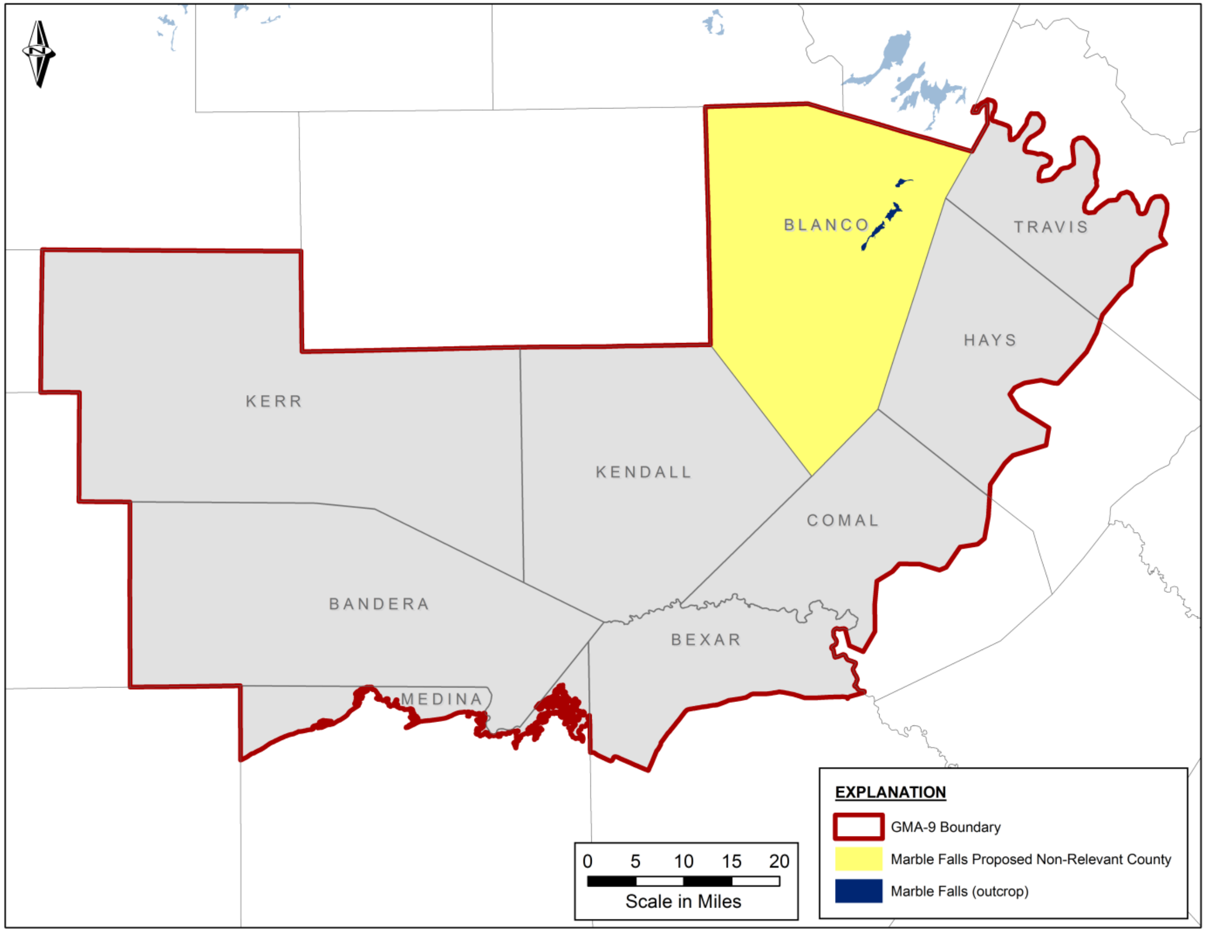
An explanation as to why the Hickory is non-relevant

- There is very limited use in Hays and Kerr counties, generally considered less economically viable or likely to be developed in these counties due to its significant depth.
- Only northwestern Blanco County has manageable quantities of Hickory groundwater production.
- Almost all Blanco County Hickory Aquifer wells are for exempt use.
- Hays County has no known Paleozoic rock water production and HTGCD did not include the Hickory Aquifer in planning.
- Given water quality uncertainty in portions of Blanco, Hays, Kerr, and Travis counties, non-relevant classification is not expected to impact this or other aquifers in this round of planning.

Proposed Non-Relevant Aquifers – Marble Falls Aquifer: Blanco County

Aquifer Characteristics:

- Finely-grained, thinly to thickly bedded limestone with imbedded shale
- Capable of producing small to moderate quantities of water
- Yield typically is less than 100 gpm



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Proposed Non-Relevant Aquifers – Marble Falls Aquifer: Blanco County

Current Uses

Marble Falls Aquifer 2018 Groundwater Use (by GMA 9 County)							
GMA 9 County	Type of Use and Estimated Use Amounts for 2018 (in ac-ft)						
	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Totals
Blanco	6	0	0	0	0	2	8
Totals	6	0	0	0	0	2	8

Source: TWDB Water Use Survey Team, Historical Groundwater Pumping Estimates

Total Estimated Recoverable Storage Amounts within GMA 9

- The TERS volume estimates calculated by the TWDB (Jones and Bradley 2013) for the Marble Falls Aquifer have not been updated.

Proposed Non-Relevant Aquifers – Marble Falls Aquifer: Blanco County

Demands

- Municipal, agricultural, and industrial use account for groundwater use from the Marble Falls Aquifer.
- The TWDB has seen no significant water level declines in wells.

An explanation as to why the Marble Falls is non-relevant

- Fewer than a dozen Marble Fall Aquifer well in Blanco County, and all are exempt.
- Small volume of Marble Falls production does not affect other GMA 9 GCDs.
- Classifying the Marble Falls as non-relevant in Blanco County, and all other counties in GMA 9, will have no significant impact on current water users, other GCDs, or the joint planning process.
- BPGCD has jurisdiction over the Marble Falls and will continue to manage the aquifer.

Proposed Desired Future Conditions

GMA 9 Proposed Desired Future Conditions (Major and Minor Aquifers)	
MAJOR OR MINOR AQUIFER	**PROPOSED DESIRED FUTURE CONDITION***
Trinity	Allow for an increase in average drawdown of approximately 30 feet through 2060 (throughout GMA 9) consistent with “Scenario 6” in TWDB GAM Task 10-005
Edwards Group of the Edwards-Trinity (Plateau)	Allow for no net increase in average drawdown in Bandera and Kendall counties through 2080
Ellenburger-San Saba	Allow for an increase in average drawdown of no more than 7 feet in Kendall County through 2080
Hickory	Allow for an increase in average drawdown of no more than 7 feet in Kendall County through 2080

* Allow for DFC variance of up to five percent when comparing DFCs to average drawdown calculations from model files.

Proposed Desired Future Conditions

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

- For detailed discussion refer to GMA 9 2016 Explanatory Report.
- DFCs long-term targets (50-year time period).
- Severe drought, extreme wet conditions and average weather conditions have occurred since DFCs initially adopted. This data and information, along with the updated Hill Country Trinity GAM will be critical in assessing the DFCs in the next round of joint planning.
- Groundwater Availability Model Justifications
  - 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”
    - 2010 – 2060: Trinity Aquifer: 93,052 – 90,503 acre-feet/year
  - MAG estimates extracted from previous GAM run 08-90 meets DFC for Edwards-Trinity Plateau Aquifer and allows for no net increase in average drawdown in Kendall and Bandera counties.
    - Committee selected DFC to balance MAG quantity to allow for some additional demand and reasonably protect spring flow and base flows to creeks and rivers.
    - 2010 – 2070: Edwards Group of Edwards-Trinity Plateau Aquifer: 2,208 acre-feet/year.

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Proposed Desired Future Conditions

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

- 2016 – 2020: GCDs assessed water level changes and information on DFCs.
  - Data Assessment – *"Groundwater Management Area 9: Proposed DFC Monitoring Methodology."* Fieseler and Hunt. November 2019 – Trinity Aquifer only
  - Hill Country Trinity GAM Update – by 2027
- Practical and cost-efficient methodology to review/refine new DFCs with sufficient/relevant data.
- GCDs Management Plans, as required, address these DFCs.

Proposed Desired Future Conditions

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

- For detailed discussion refer to GMA 9 2016 Explanatory Report.
- DFCs long-term targets (50-year time period).
- 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.
- Groundwater Availability Model Justifications.
  - Assess DFC over time, re-evaluate during next planning round, and consider new model runs.
  - DFCs set to manage potential groundwater production with conservation and preservation of these aquifers in Kendall County.
  - 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).

Proposed Desired Future Conditions

Aquifer Uses or Conditions **December 14, 2020**	Supply Needs and Management Strategies **December 14, 2020**	Hydrological Conditions **December 14, 2020**
Environmental Impacts **December 14, 2020**	Subsidence Impacts **December 14, 2020**	Socioeconomic Impacts **January 25, 2021**
Private Property Rights **January 25, 2021**	DFC Feasibility **March 22, 2021**	Other Relevant Information **January 25 and March 22, 2021**

Proposed Non-Relevant Aquifers

GMA 9 Proposed Non-Relevant Aquifer Classifications (Major and Minor Aquifers)	
PROPOSED NON-RELEVANT AQUIFER CLASSIFICATION	Applicable Areas Within GMA 9 (All or portions of the following counties)
Edwards Aquifer (Balcones Fault Zone)	Bexar, Comal, Hays, and Travis counties
Edwards Group of 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

Proposed Desired Future Conditions

GMA 9 Proposed Desired Future Conditions (Major and Minor Aquifers)	
MAJOR OR MINOR AQUIFER	**PROPOSED DESIRED FUTURE CONDITION***
Trinity	Allow for an increase in average drawdown of approximately 30 feet through 2060 (throughout GMA 9) consistent with "Scenario 6" in TWDB GAM Task 10-005
Edwards Group of the Edwards-Trinity (Plateau)	Allow for no net increase in average drawdown in Bandera and Kendall counties through 2080
Ellenburger-San Saba	Allow for an increase in average drawdown of no more than 7 Feet in Kendall County through 2080
Hickory	Allow for an increase in average drawdown of no more than 7 feet in Kendall County through 2080

* Allow for DFC variance of up to five percent when comparing DFCs to average drawdown calculations from model files.

GMA Action to Adopt Proposed DFCs (and Non-Relevant Aquifers)

Texas Water Code §§ 36.108 (d) and (d-2):

- DFCs proposed for adoption relevant aquifers within GMA after considering technical and other data, and the nine factors.
- DFCs must provide balance between highest practicable level of groundwater production, and conservation, preservation, protection, recharging, and prevention of waste of groundwater and control of subsidence in GMA.
- DCFs proposed under TWC §36.108 (d) must be approved by two-thirds vote of all GCD representatives for distribution to GCDs in GMA.

GMA 9 2022 DFC Joint Planning Cycle – Next Steps

GMA 9 Proposed Desired Future Conditions and Non-Relevant Aquifer Classifications
90-Day Public Comment/Public Hearing Process and Timeline
March 22, 2021

Date	Description
April 1, 2021	Notices of Adopted Proposed Desired Future Conditions and Non-Relevant Aquifer Classifications Mailed to Ten GCDs.
April 1, 2021	90-Day Public Comment Period Begins.
April 1, 2021 – June 30, 2021	GCDs Hold Public Hearings Per Notice Requirements in Texas Water Code §§ 36.108 (d-2), 36.063, and 36.101 (d).
June 30, 2021	90-Day Public Comment Period Ends.
August 2021	GCDs Prepare Public Comment Summary Reports.
September 2021	GMA 9 Meets to Consider GCD Public Comment Summary Reports.
October 2021	Consultant Incorporates Public Comment Summary Reports into ER and Finalizes Draft Report.

GMA 9 2022 DFC Joint Planning Cycle – Next Steps

For 90-Day Public Comment Period:

- Letter to GCDs with formal notification of March 22, 2021 action to adopt proposed DFCs and non-relevant aquifer classifications.
- Public comment form.
- Sample GCD public hearing information for agenda meeting notice.
- Consultant to provide Sharefile link to documents for 90-day public comment period.

Appendix F
GMA 9 Hydrographs

Contained in this appendix are hydrographs for wells in the Edwards and the Trinity Aquifers. Each hydrograph displays the depth to water through time for one well. The period of record varies between wells, but most hydrographs detail the depth to water over the course of the last 30 years.

The hydrographs are organized by geologic unit in the following order:

- Hosston Formation;
- Antlers Sand;
- Cow Creek Limestone;
- Edwards and Associated Limestones (BFZA);
- Edwards Limestone;
- Edwards and Associated Limestones (EDRDA);
- Fredericksburg Group;
- Glen Rose Limestone;
- Glen Rose Limestone, Lower Member;
- Glen Rose Limestone, Upper Member;
- Hensell Sand Member of Travis Peak Formation;
- Trinity (Hensell Sand) and Ellenburger Group.

Within each geologic grouping, the hydrographs are also organized by county alphabetically. In addition to the hydrographs, there are casing diagrams for each well, a legend depicting the Hill Country GAM Aquifer Designation (Edwards, Upper Trinity, Middle Trinity, and Lower Trinity) for each well, and a map indicating the location of the well within GMA 9.

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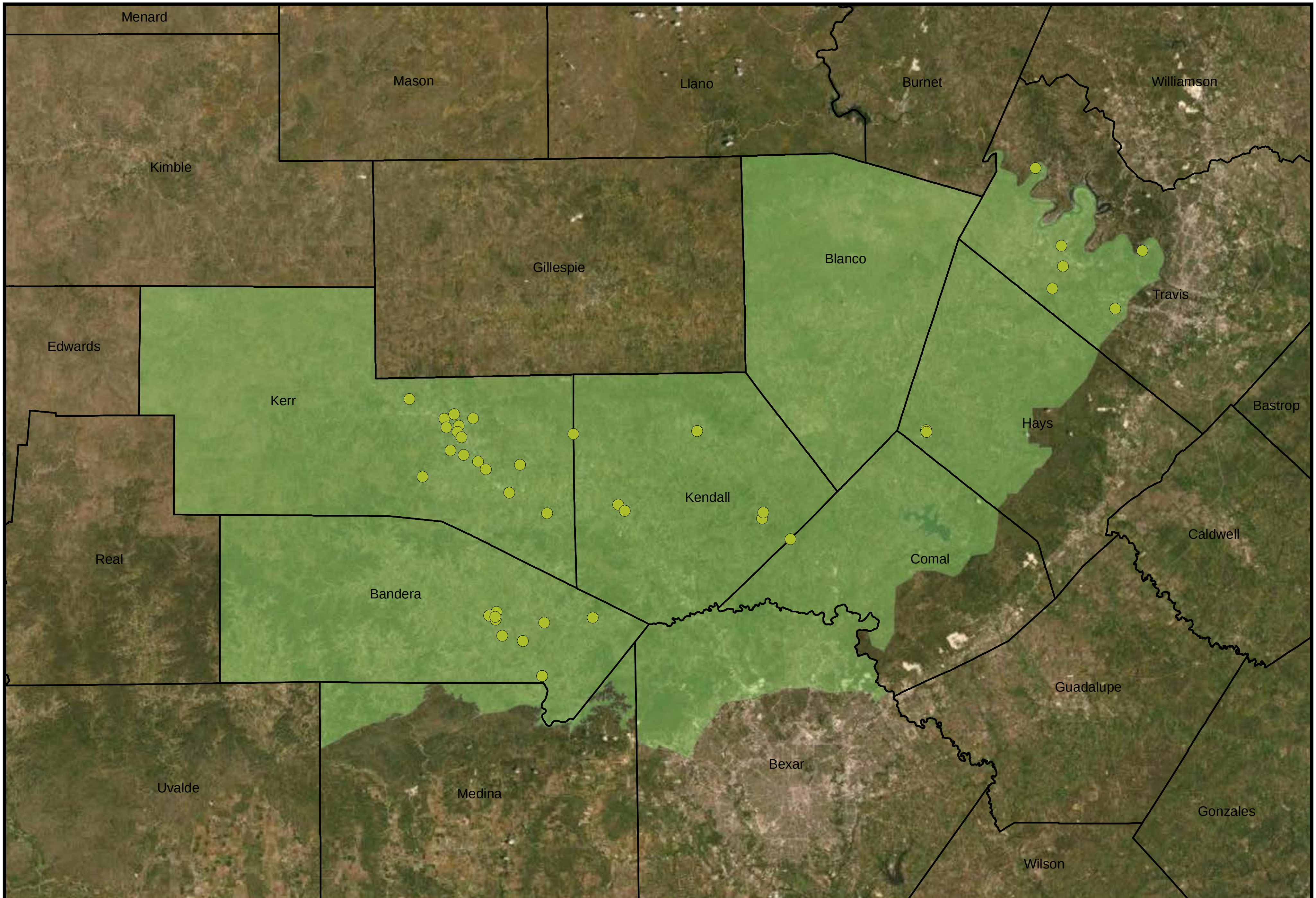


Aquifer

217HSTN - Hosston Formation

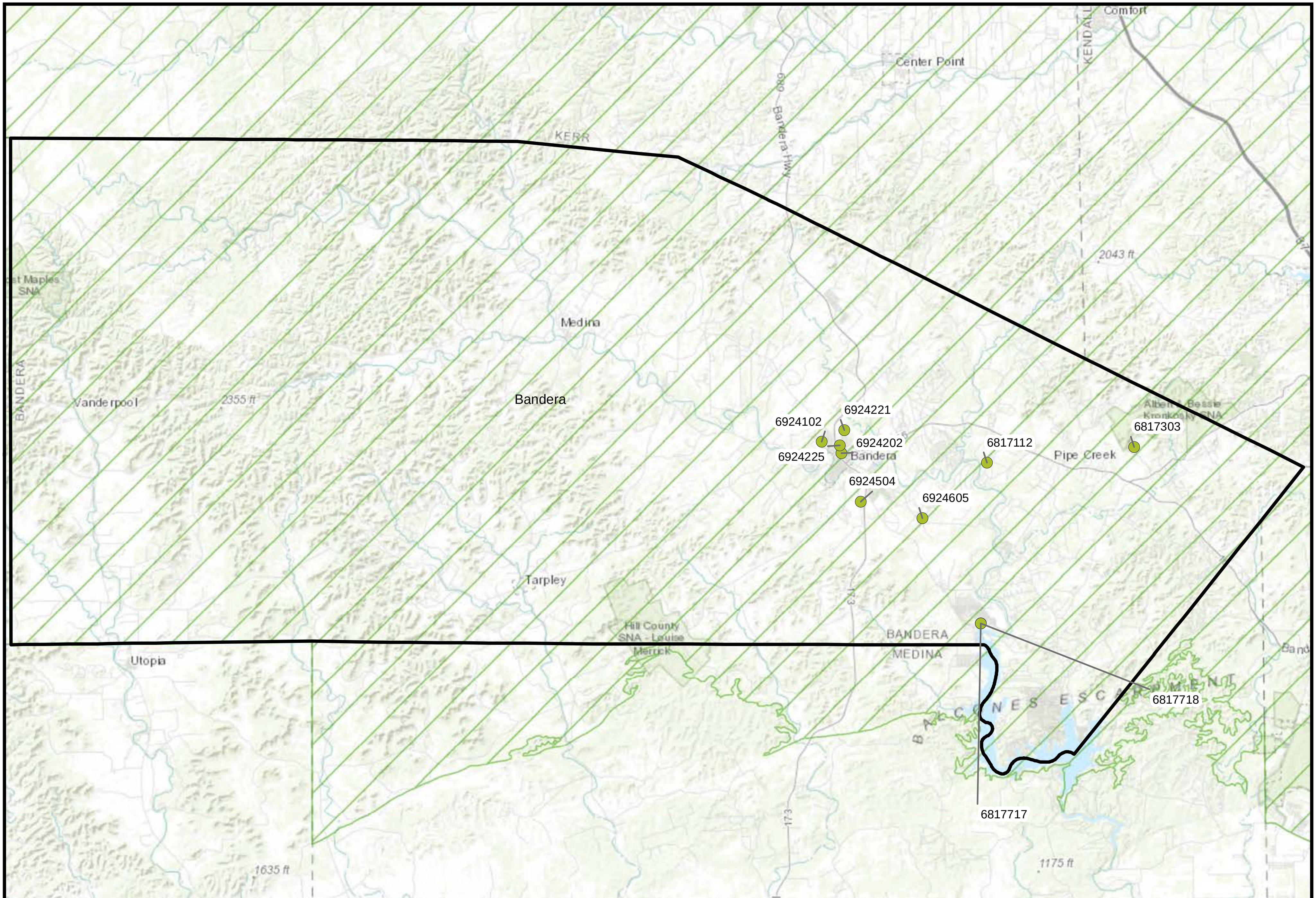
GMA 9

N

0 5 10

Miles

Map of Hydrograph Well Locations
217HSTN
Hosston Formation



Aquifer

217HSTN - Hosston Formation

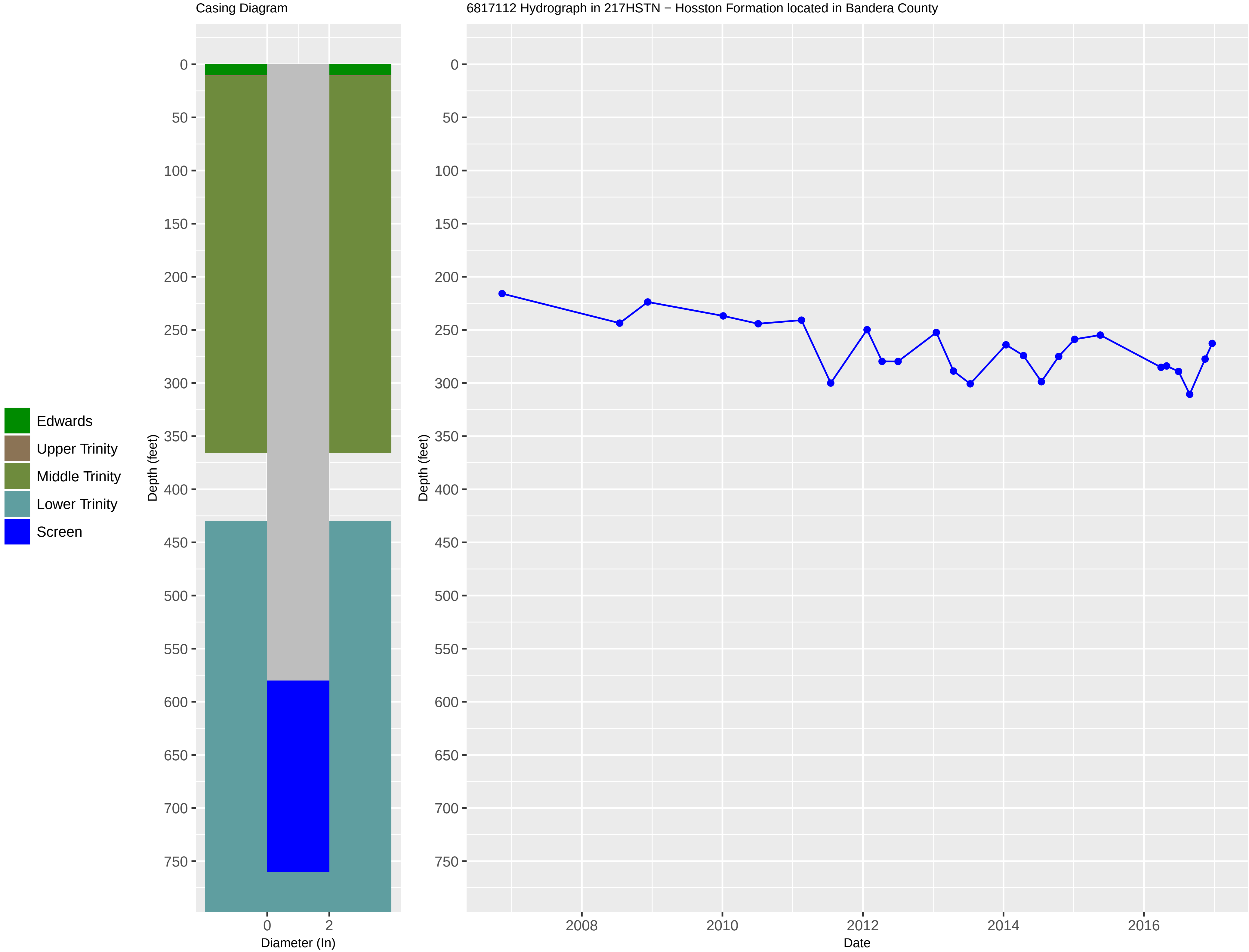
GMA 9

N

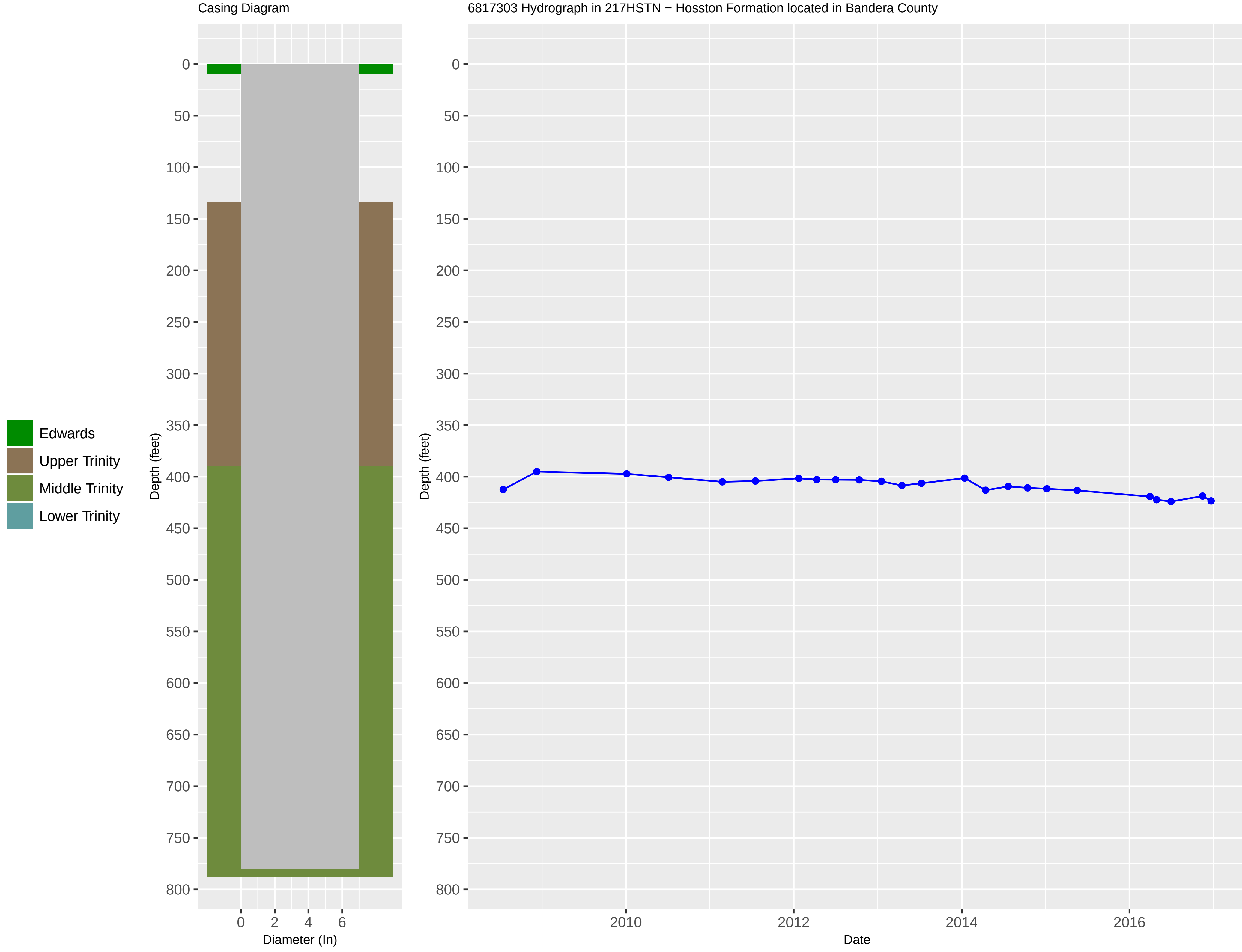
0 1 2 4

Miles

Map of Hydrograph Well Locations in Bandera County
217HSTN
Hosston Formation

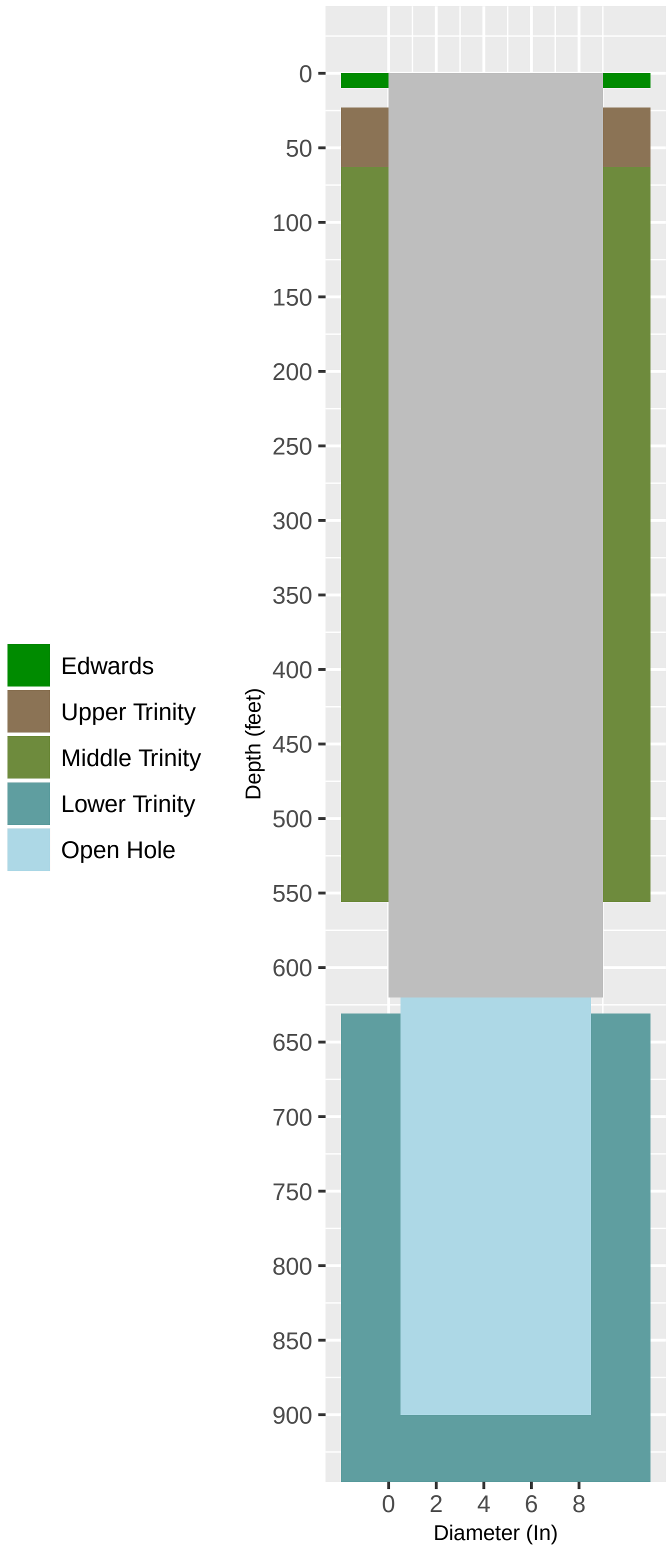


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

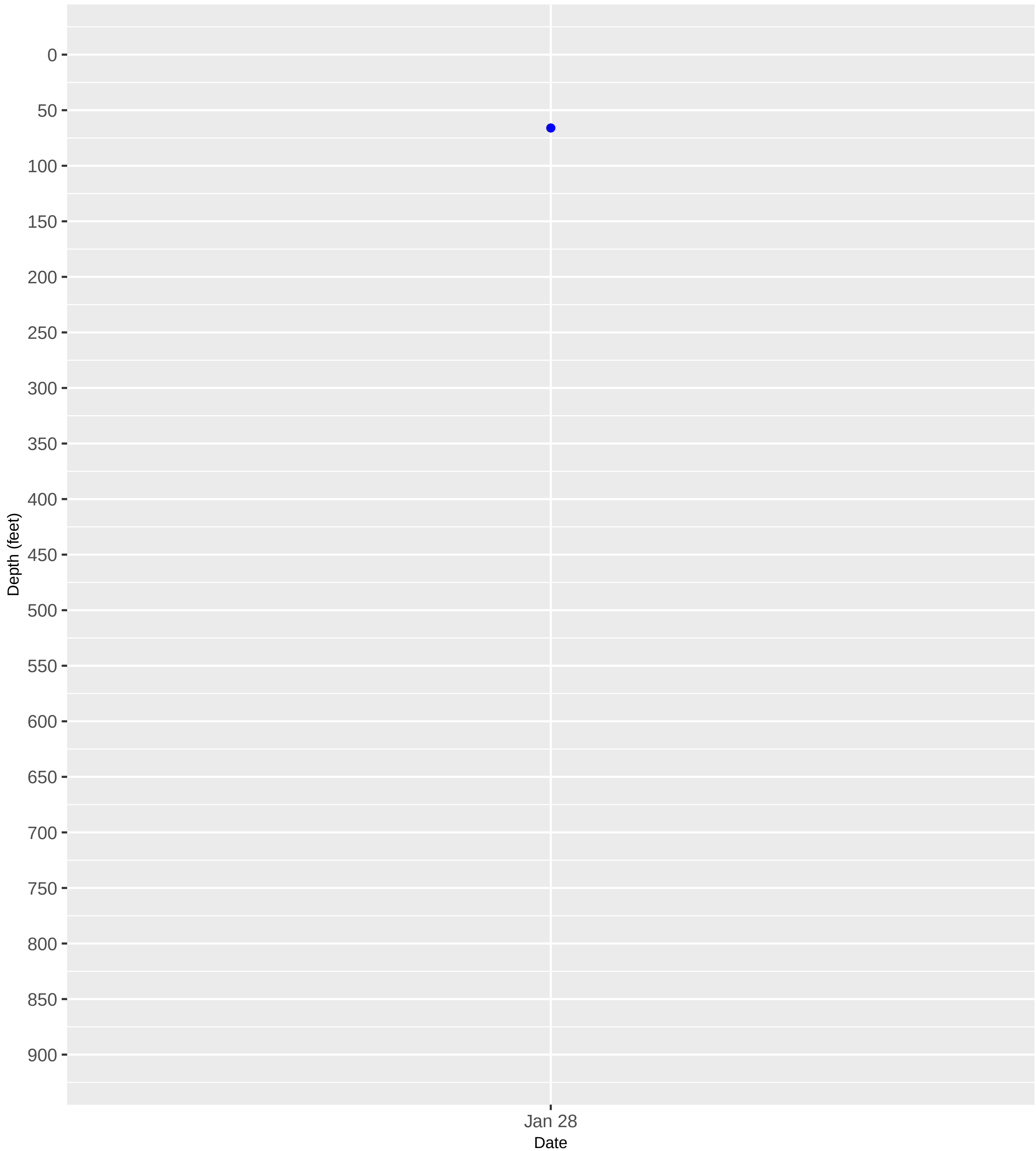


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram



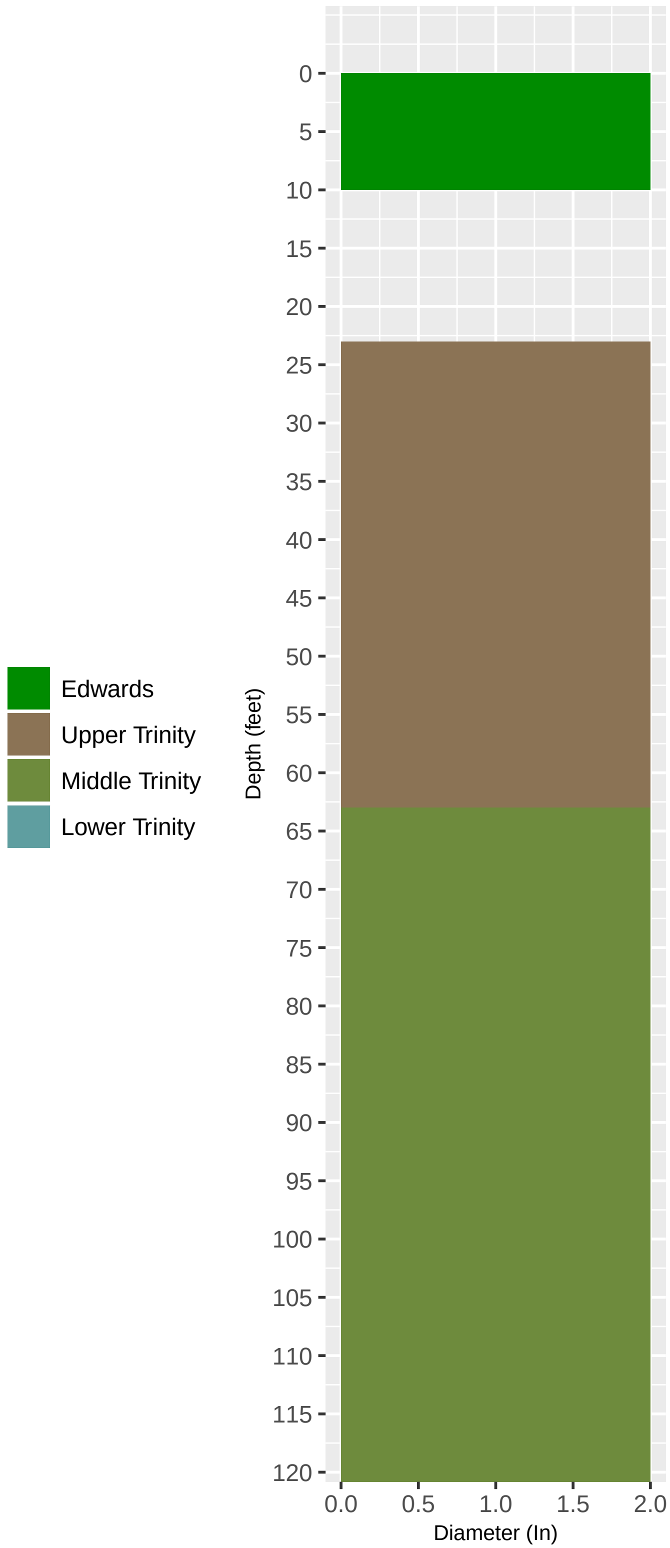
6817717 Hydrograph in 217HSTN − Hosston Formation located in Bandera County

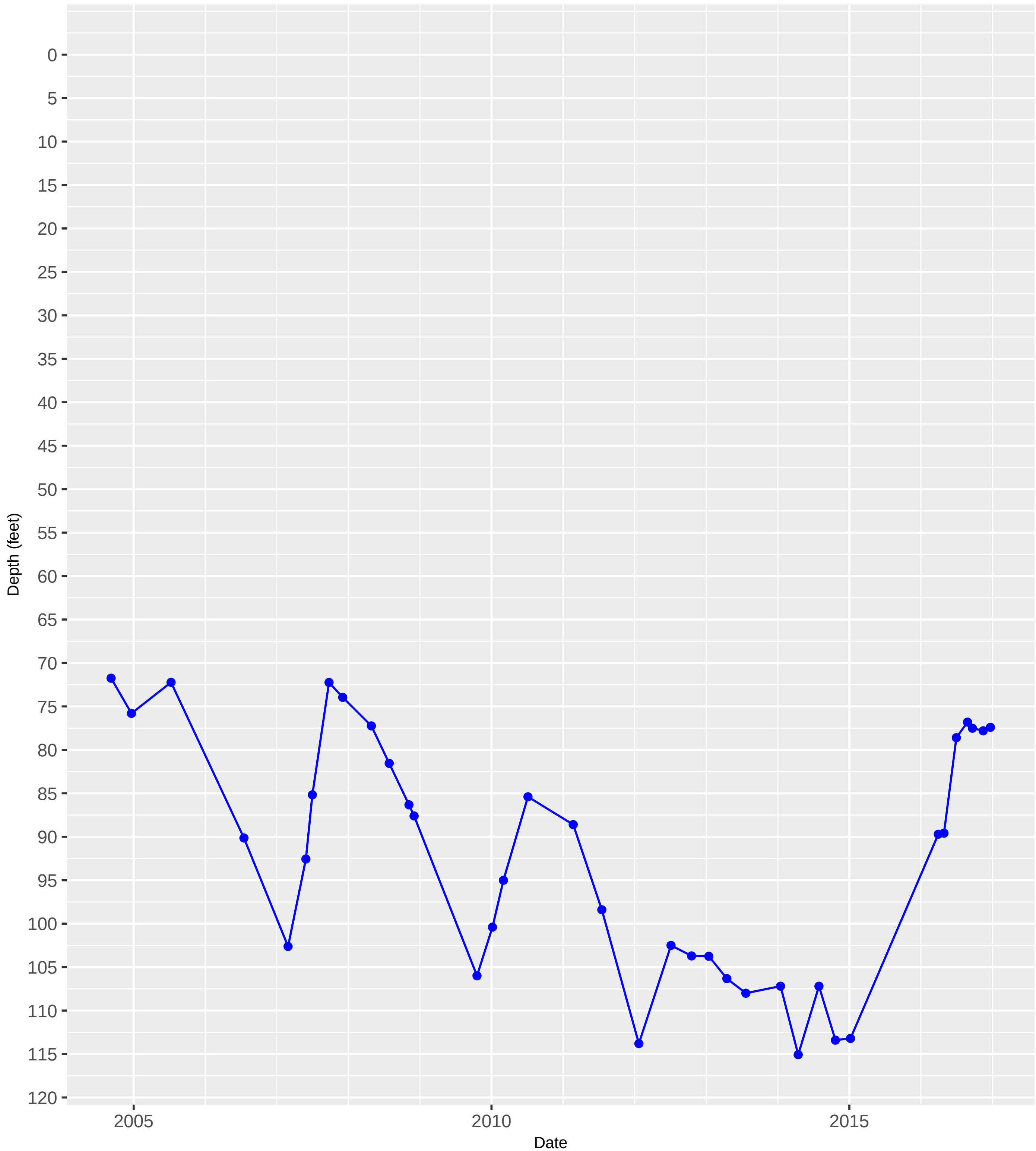


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

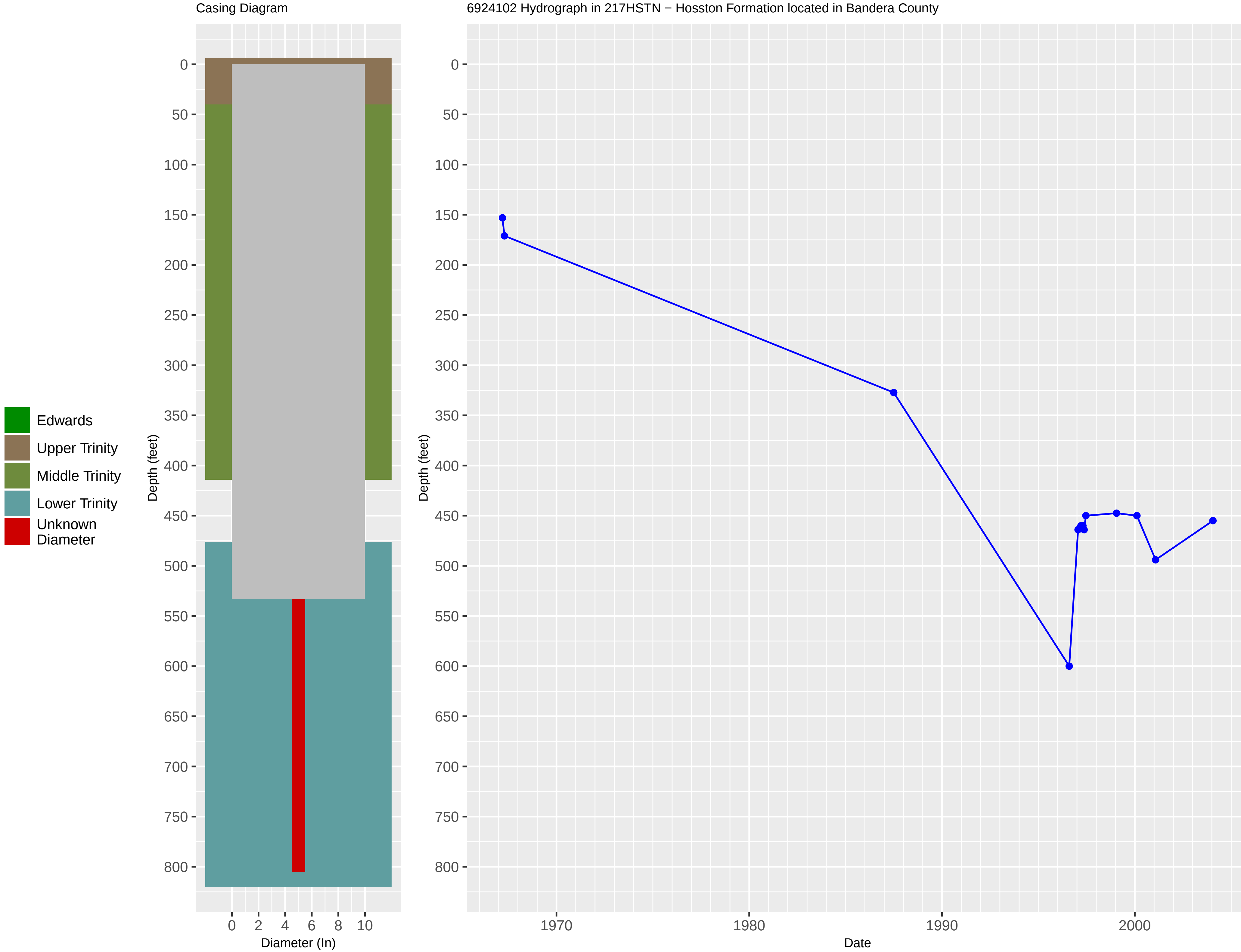
Casing Diagram

6817718 Hydrograph in 217HSTN − Hosston Formation located in Bandera County





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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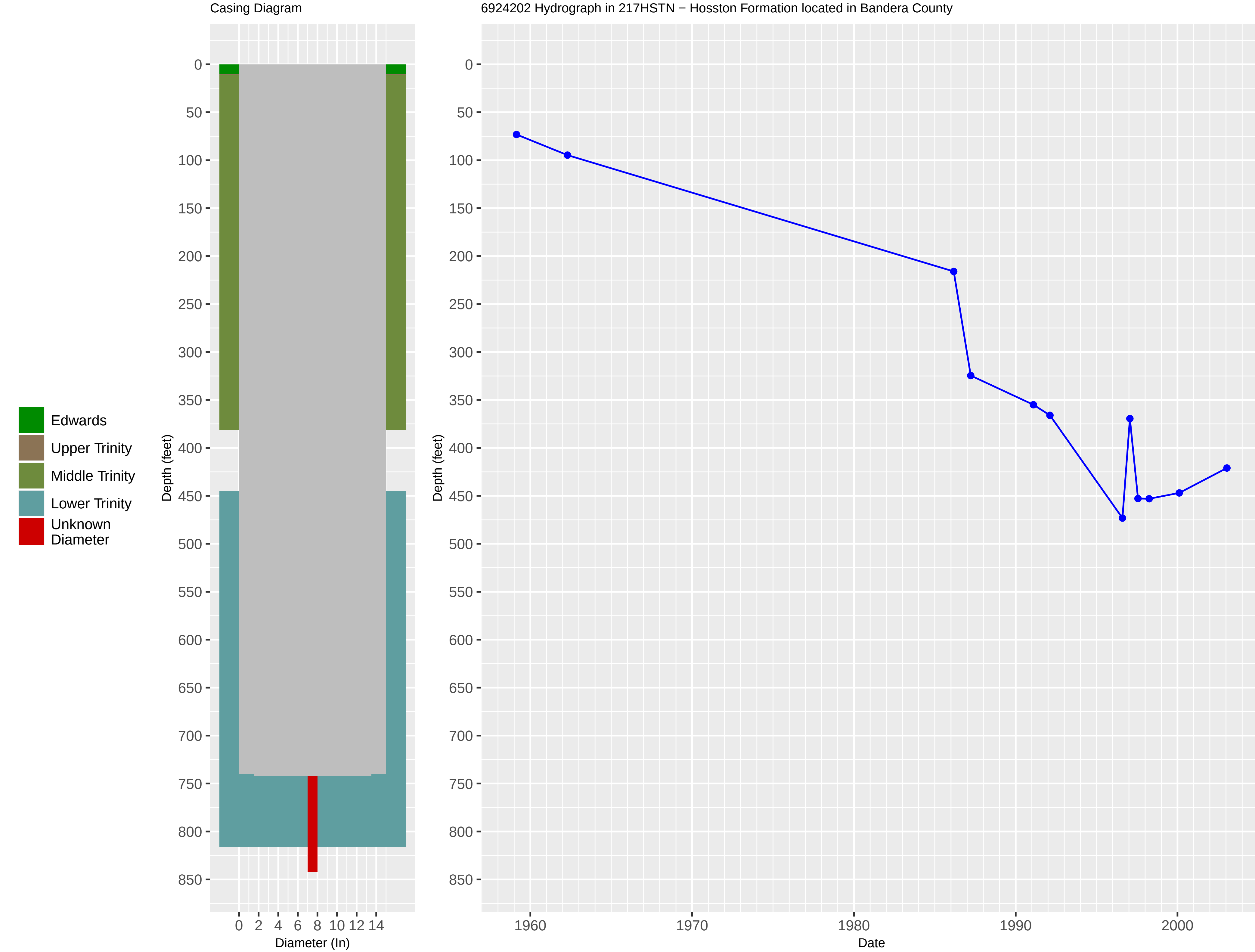

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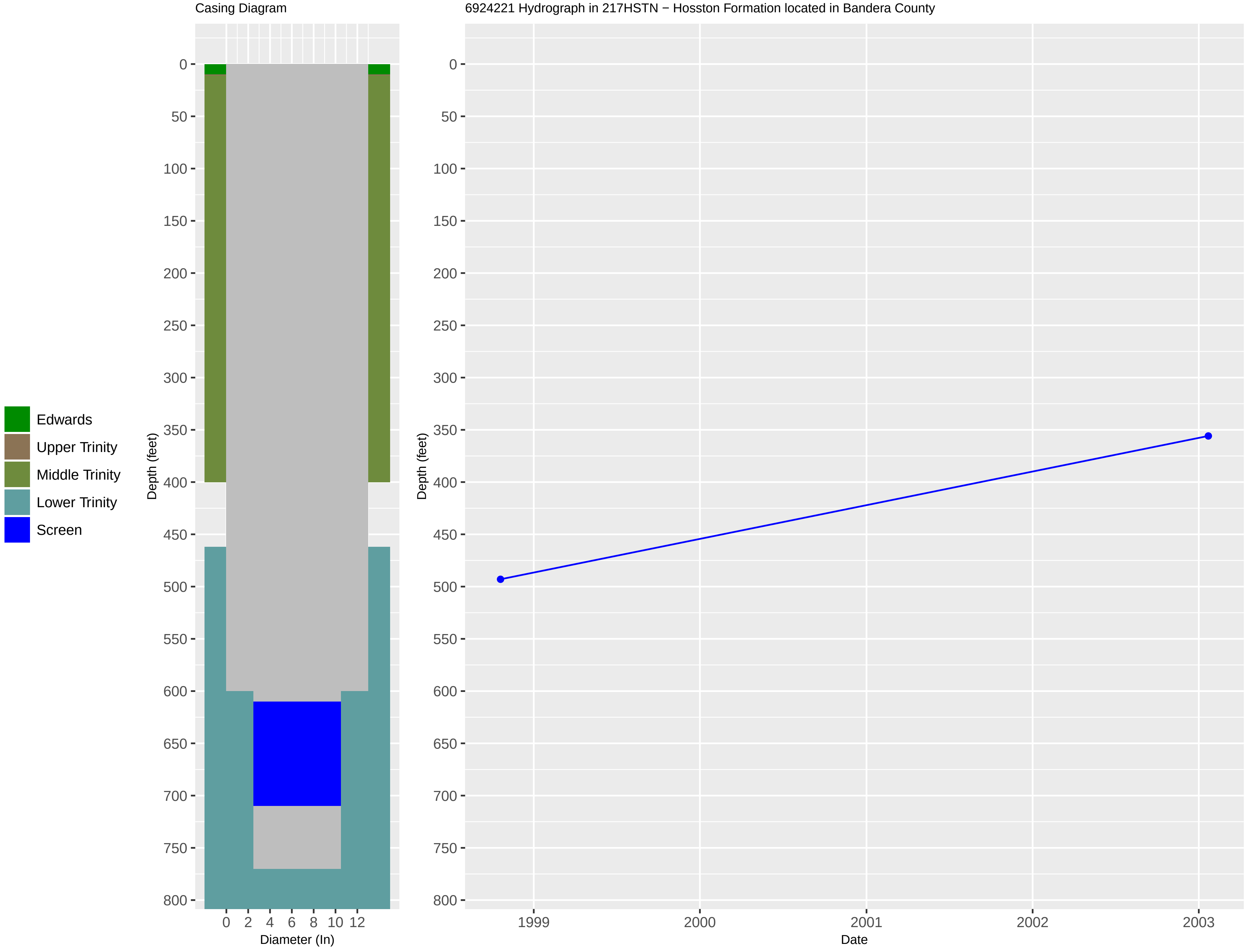

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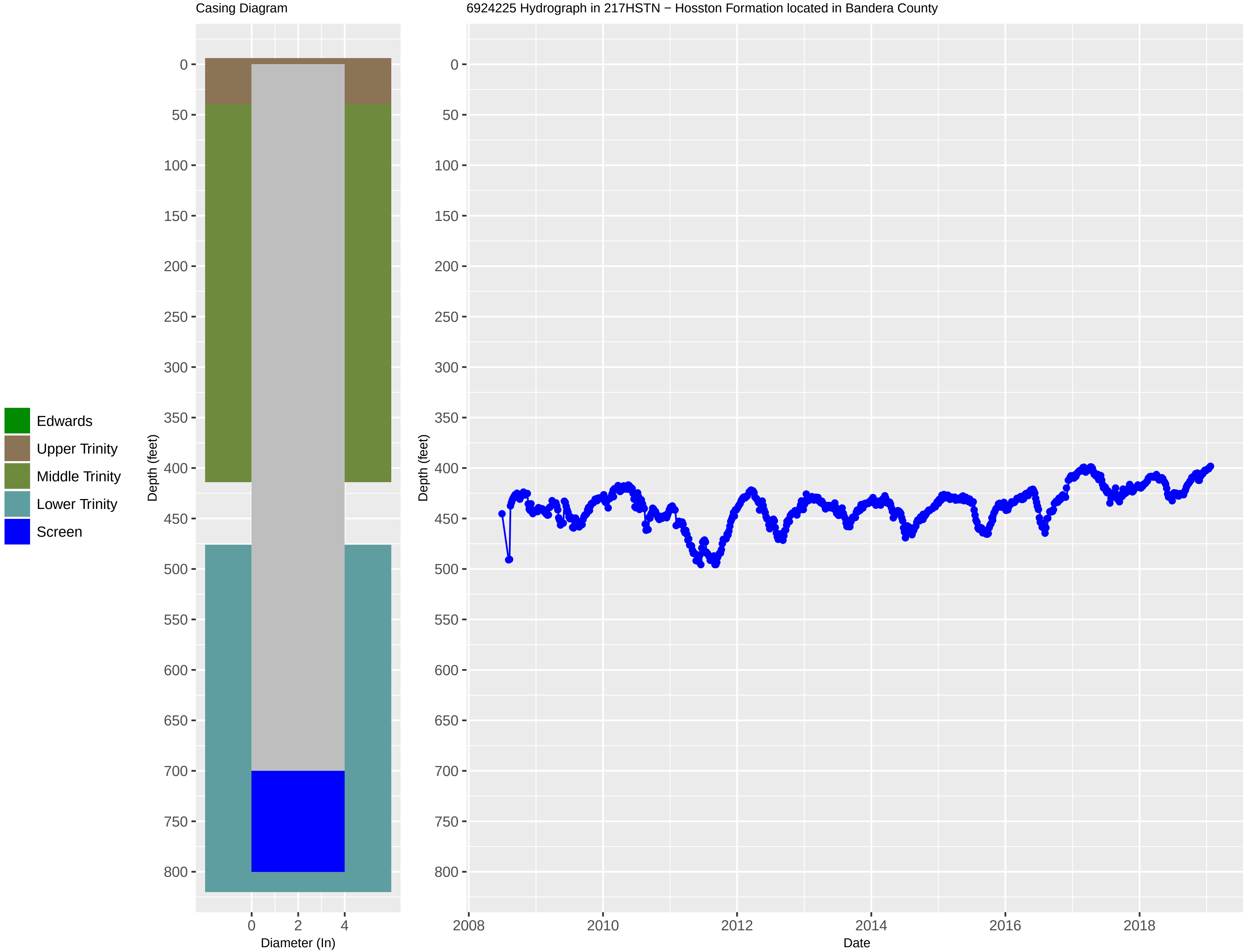

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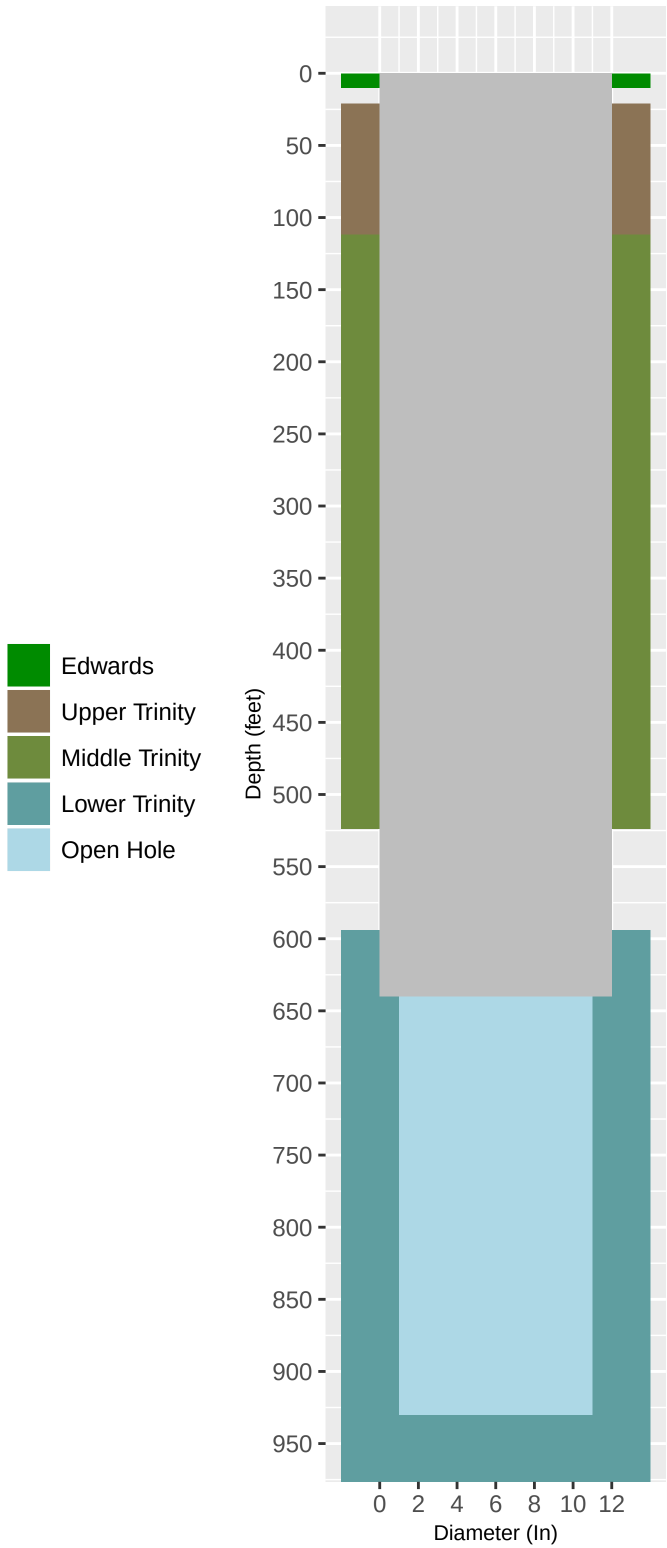
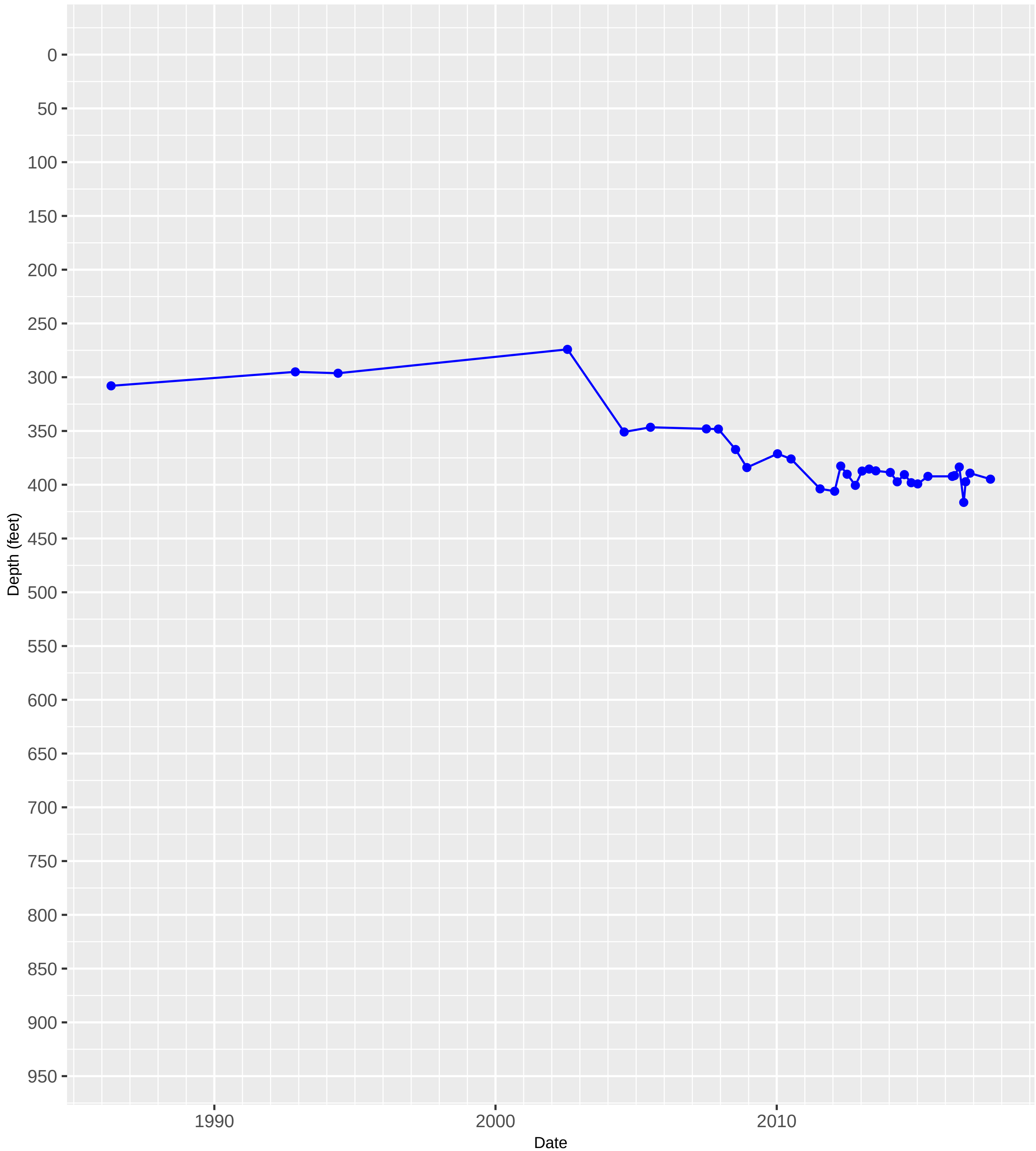
Casing Diagram



6924504 Hydrograph in 217HSTN − Hosston Formation located in Bandera County



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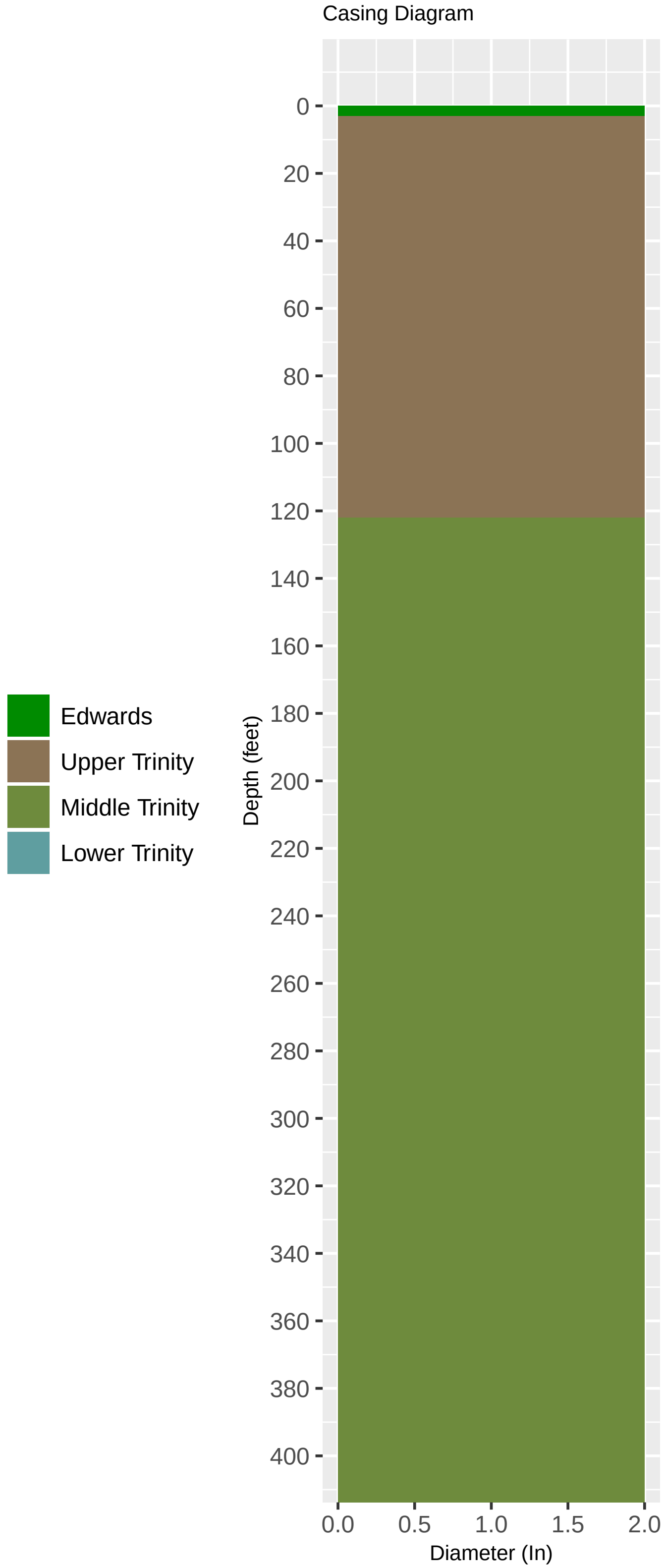

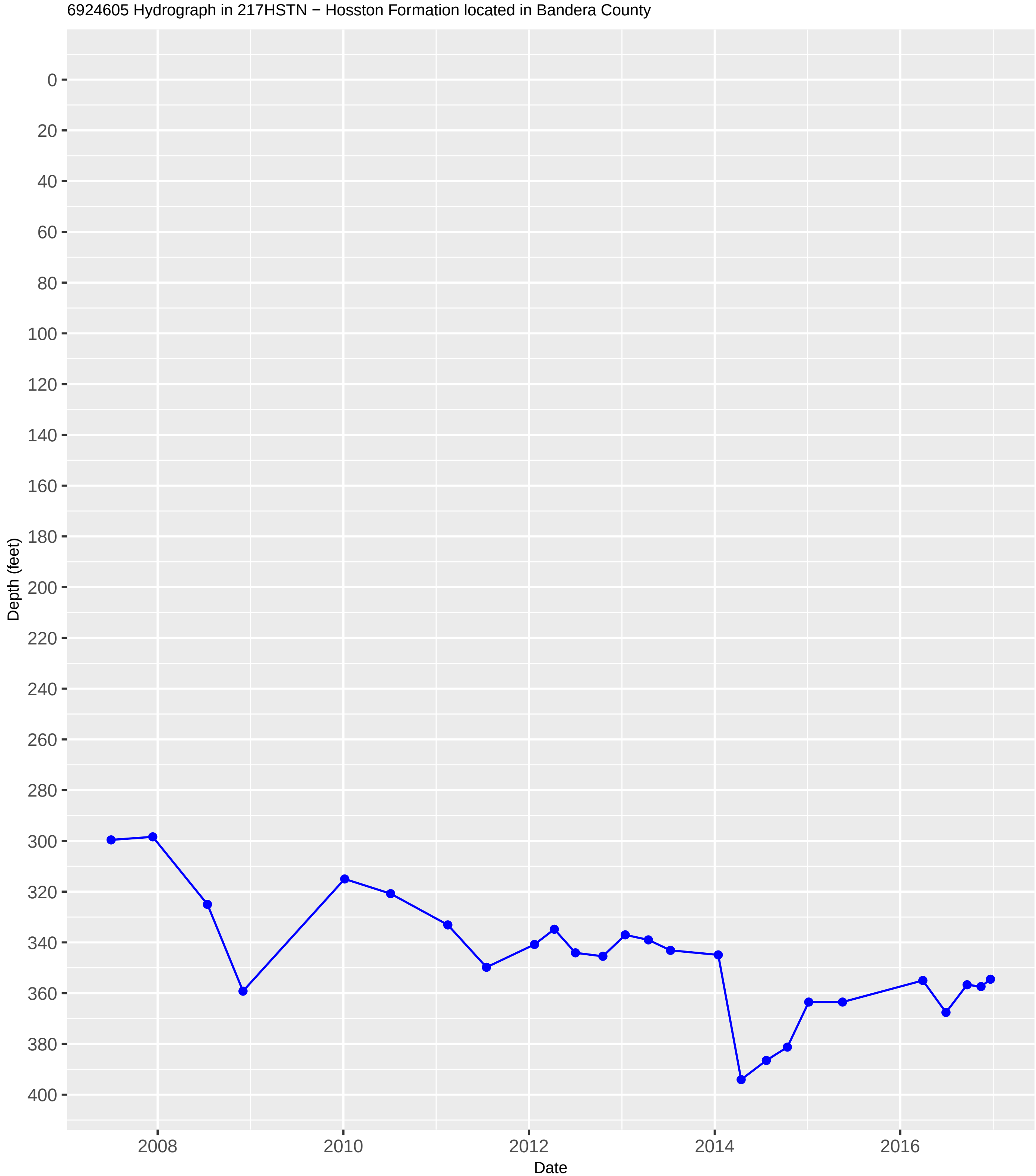

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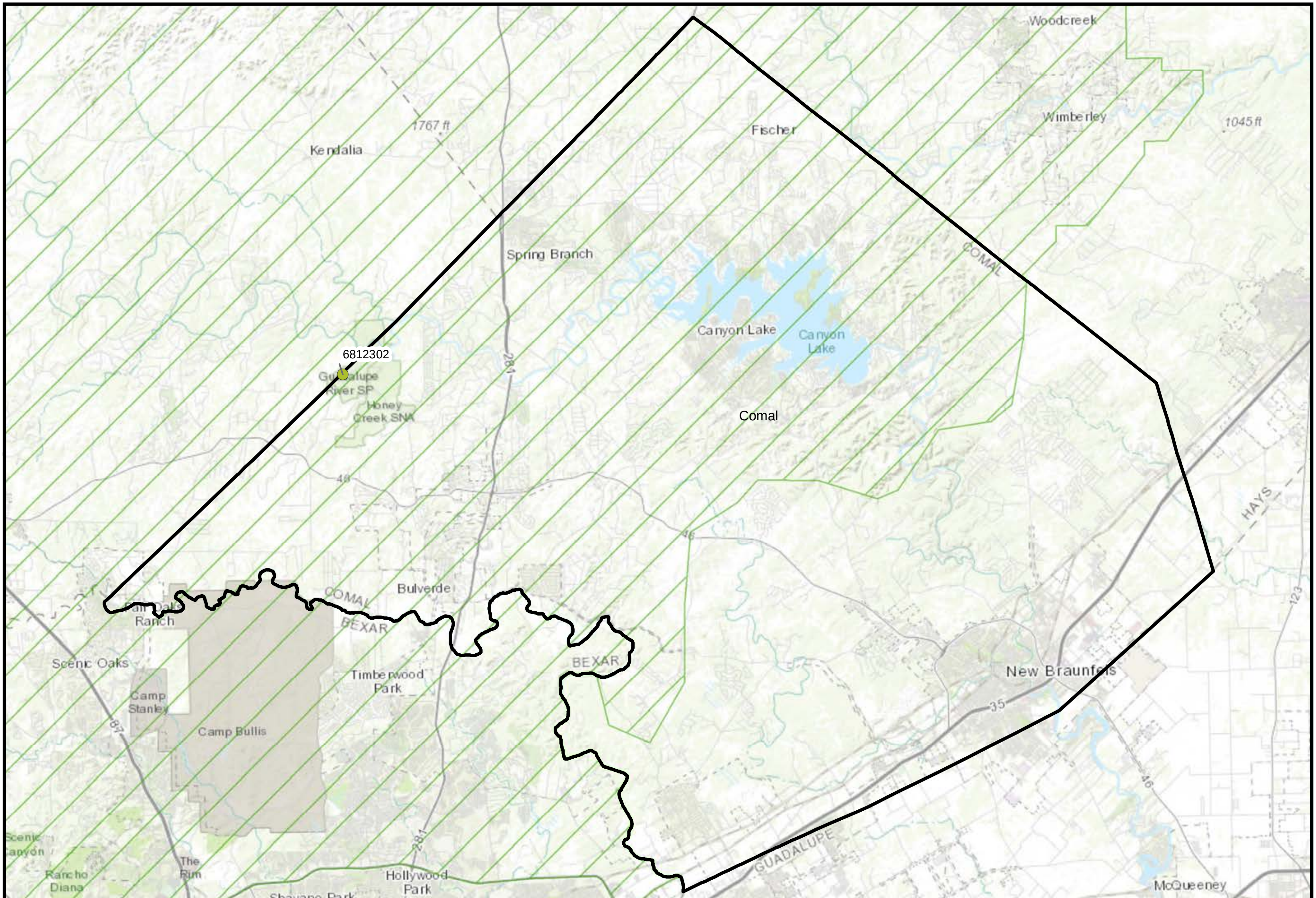


Aquifer

217HSTN - Hosston Formation

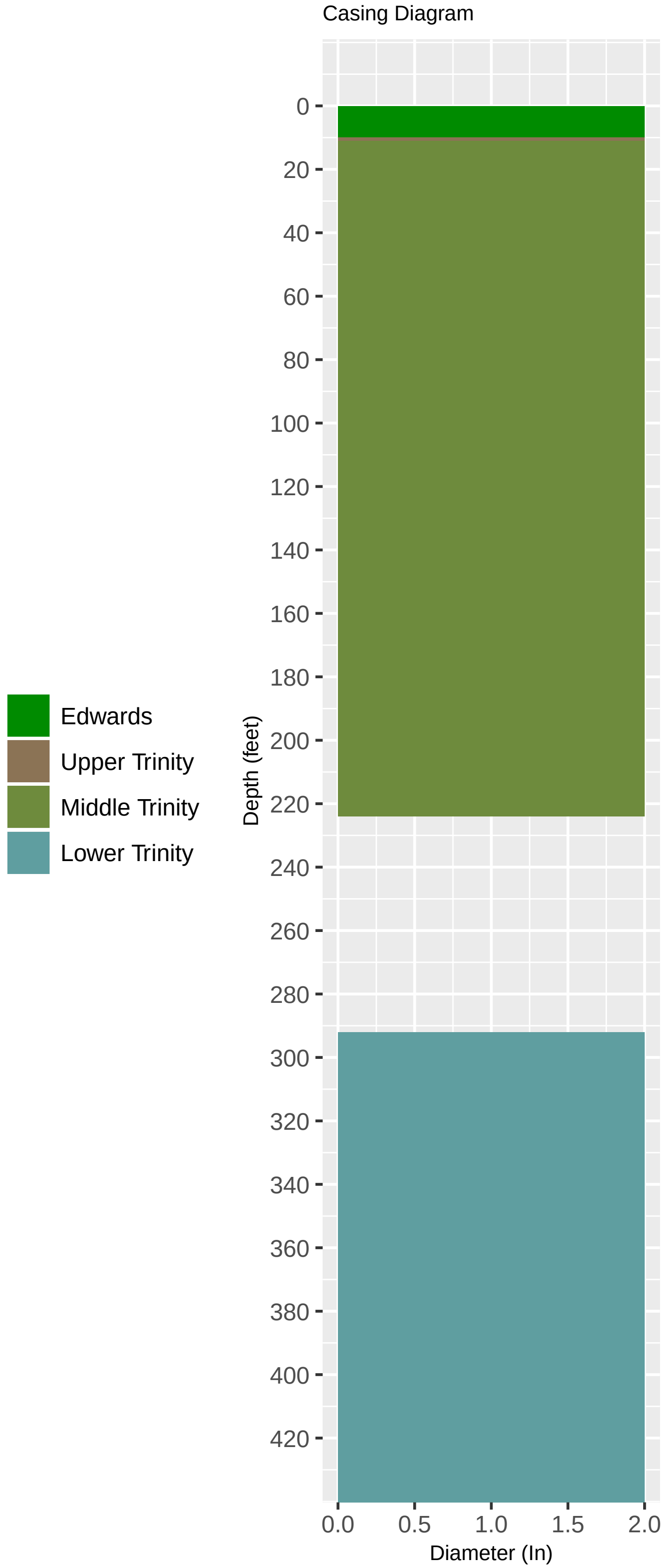
GMA 9

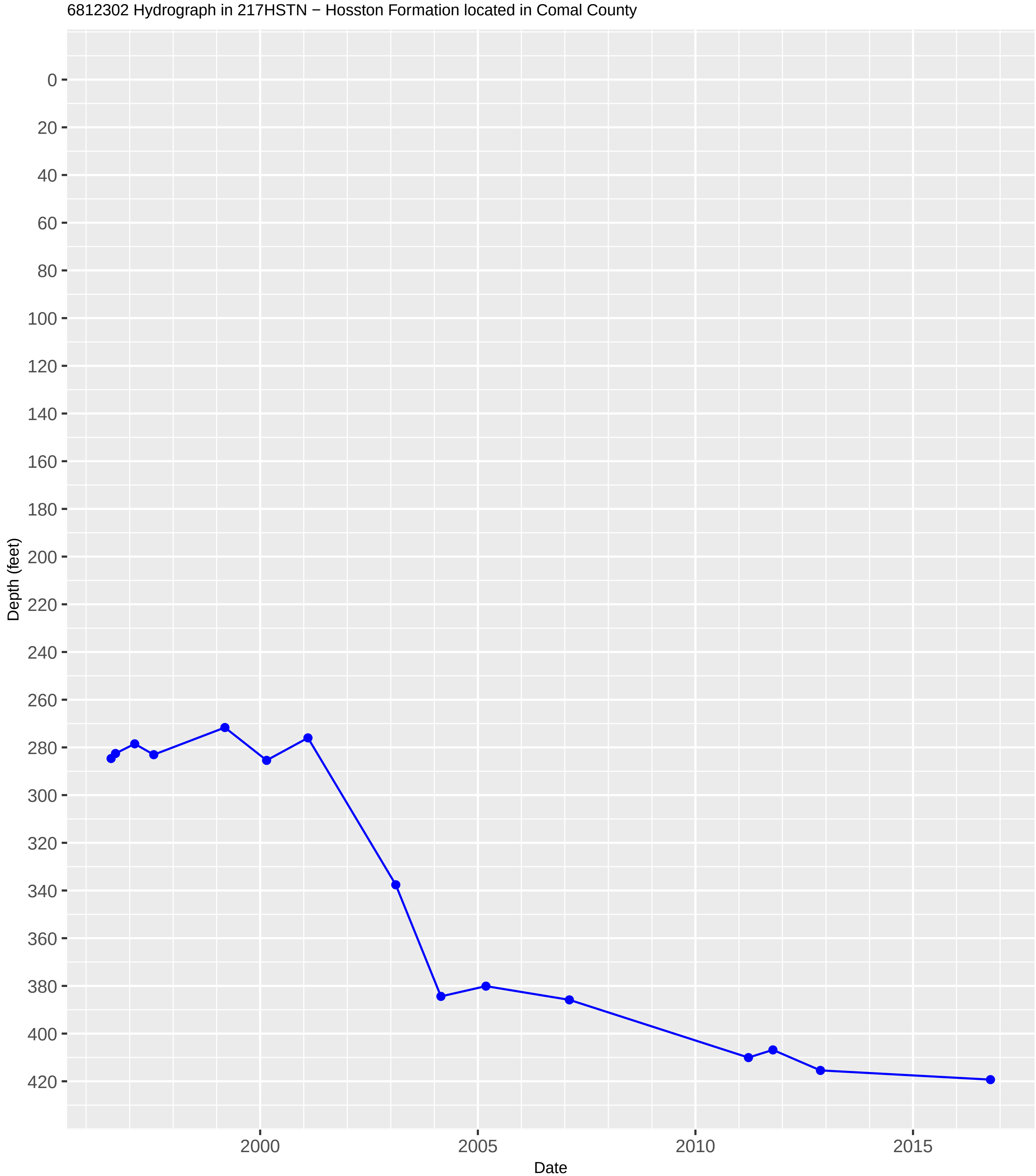
N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Comal County
217HSTN
Hosston Formation





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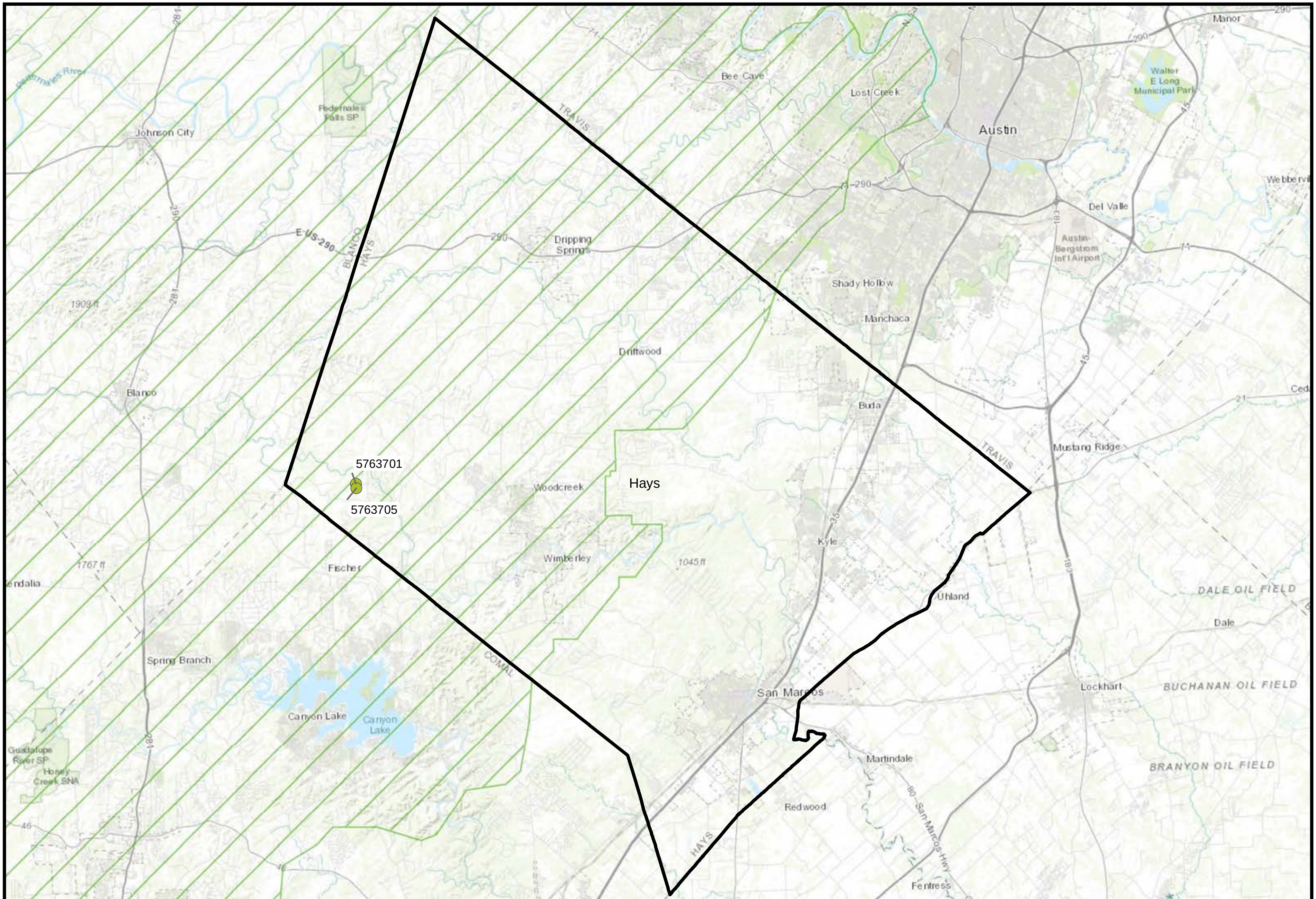


Aquifer

217HSTN - Hosston Formation

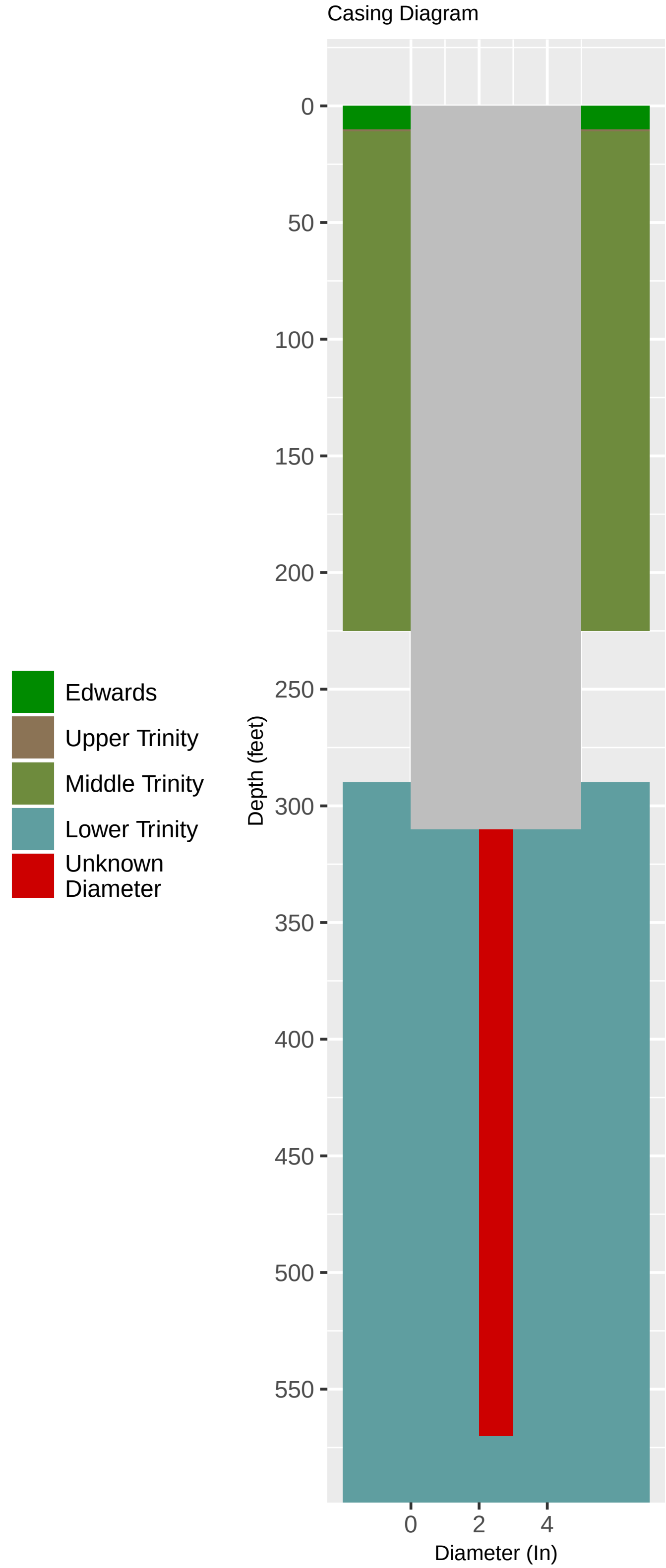
GMA 9

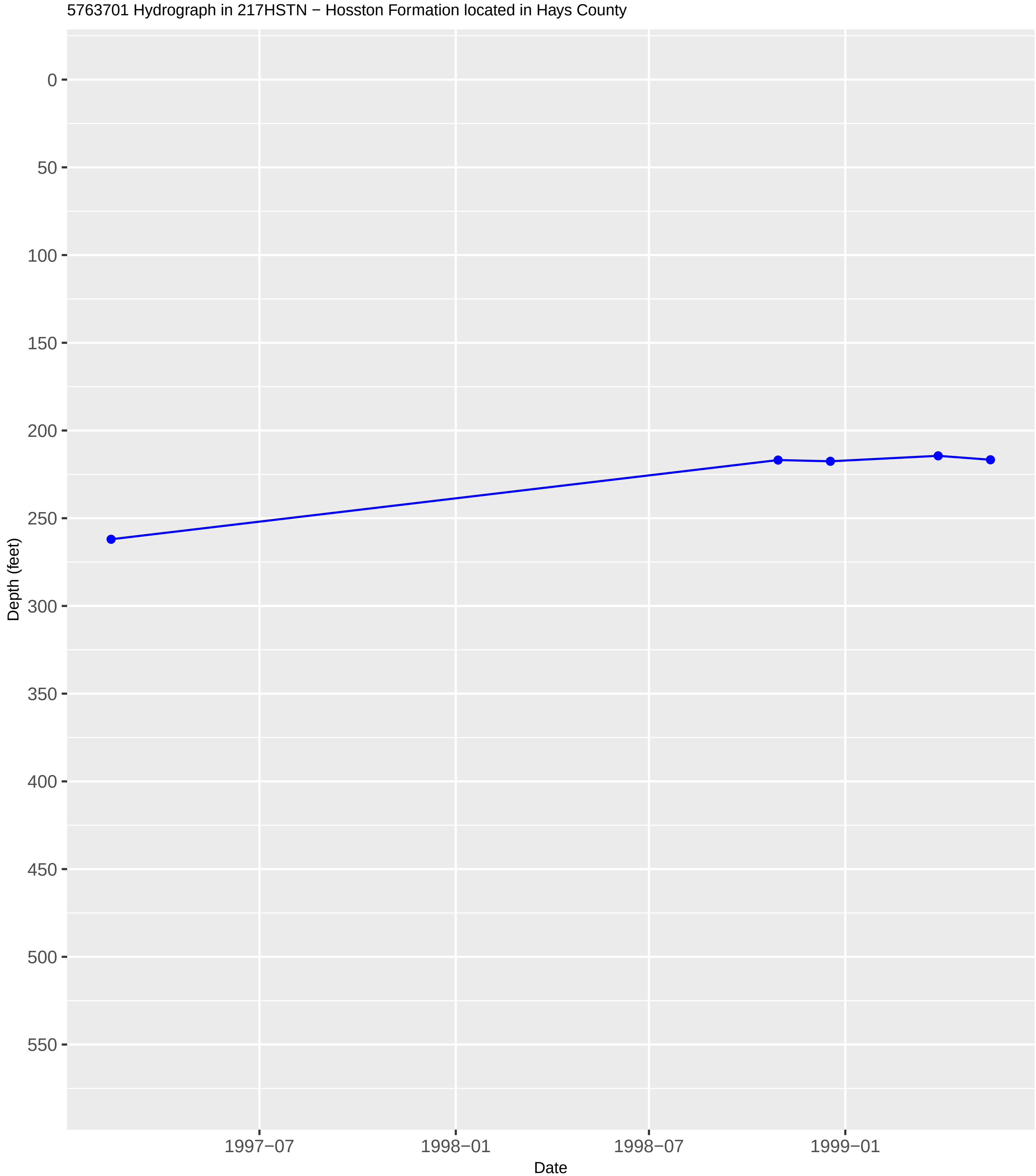
N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Hays County
217HSTN
Hosston Formation





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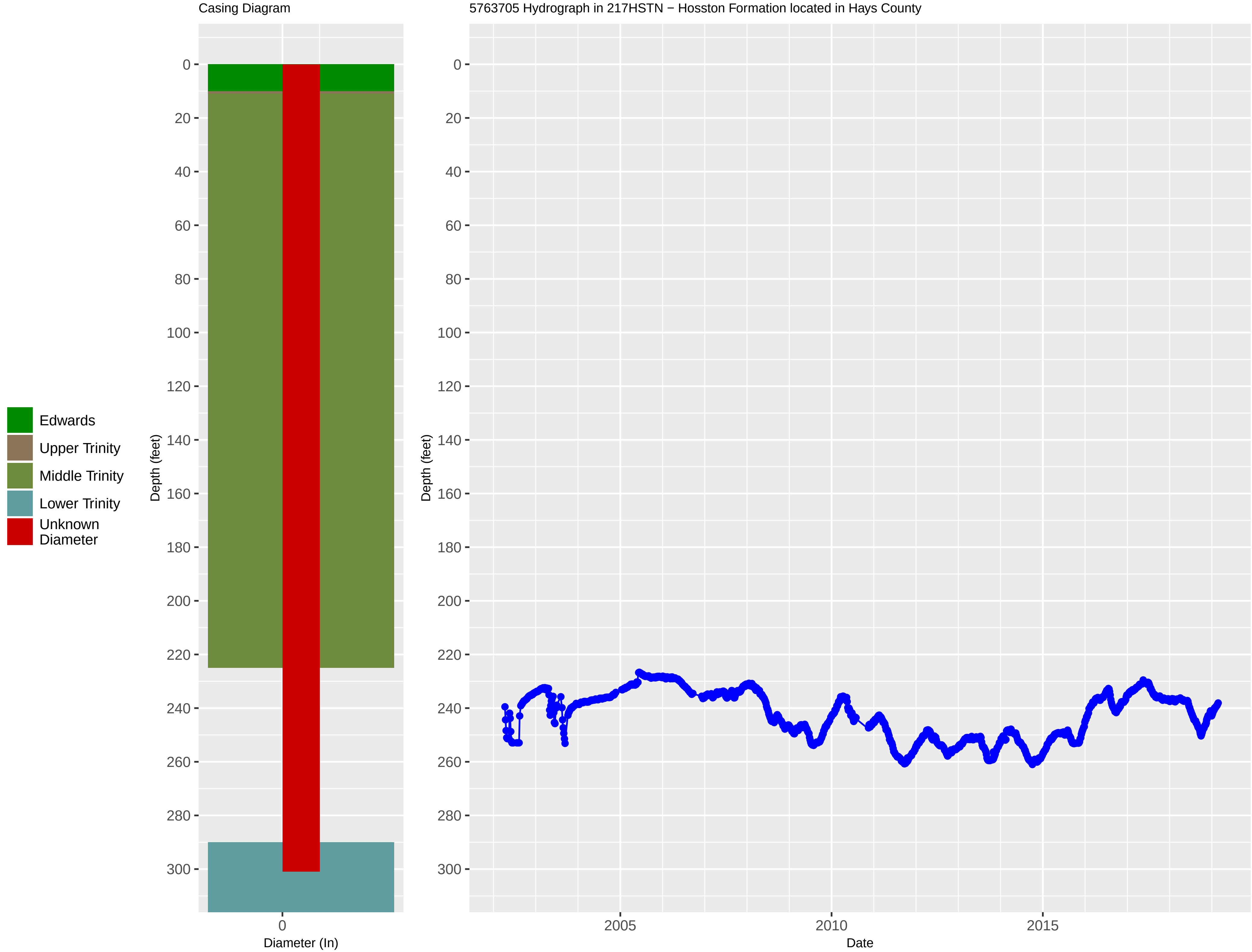

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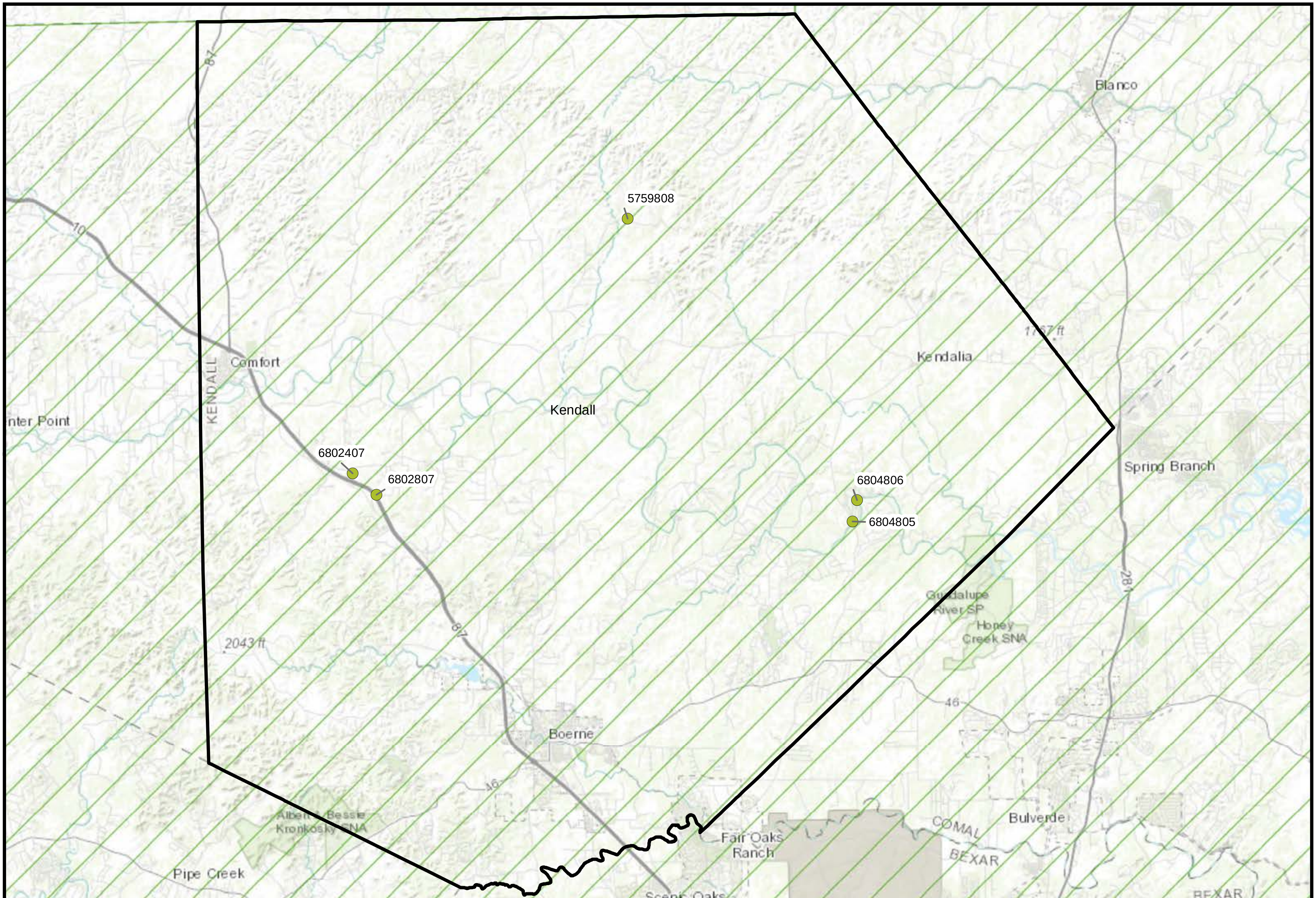


Aquifer

217HSTN - Hosston Formation

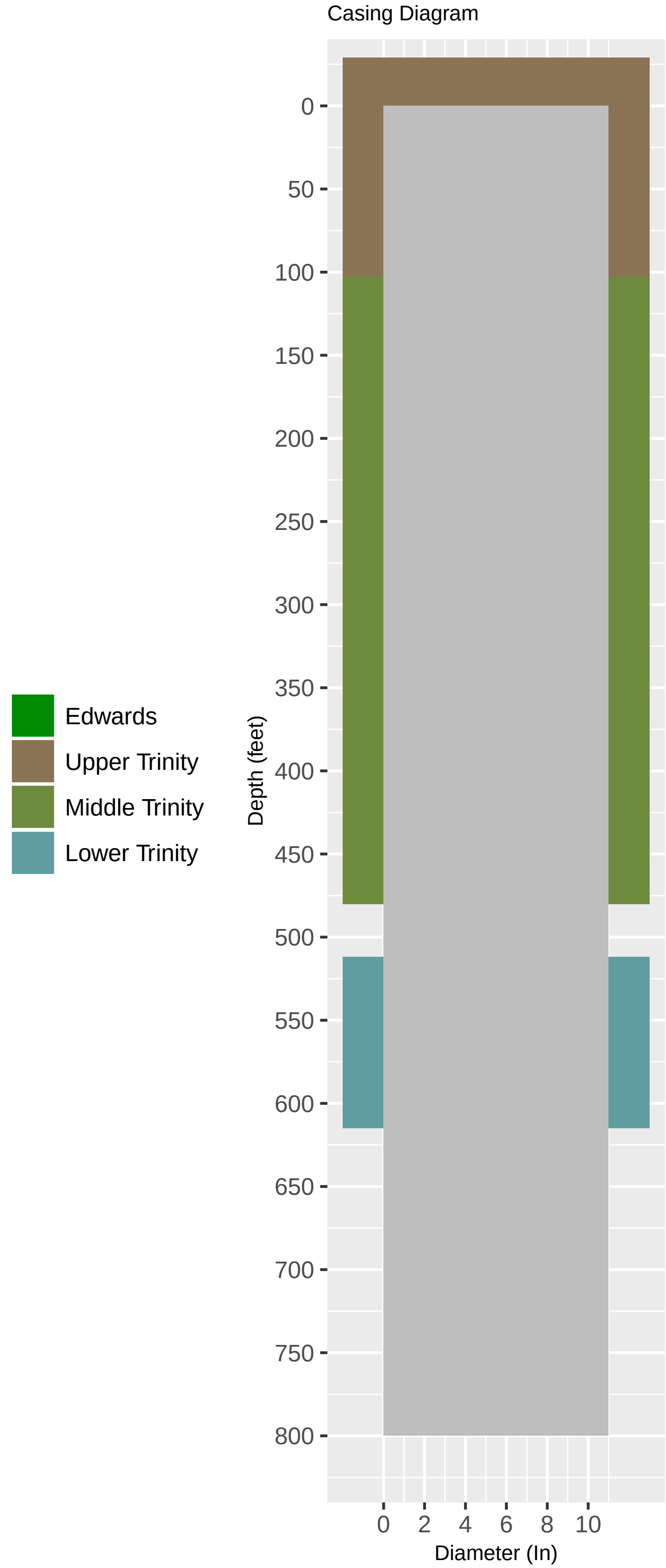
GMA 9

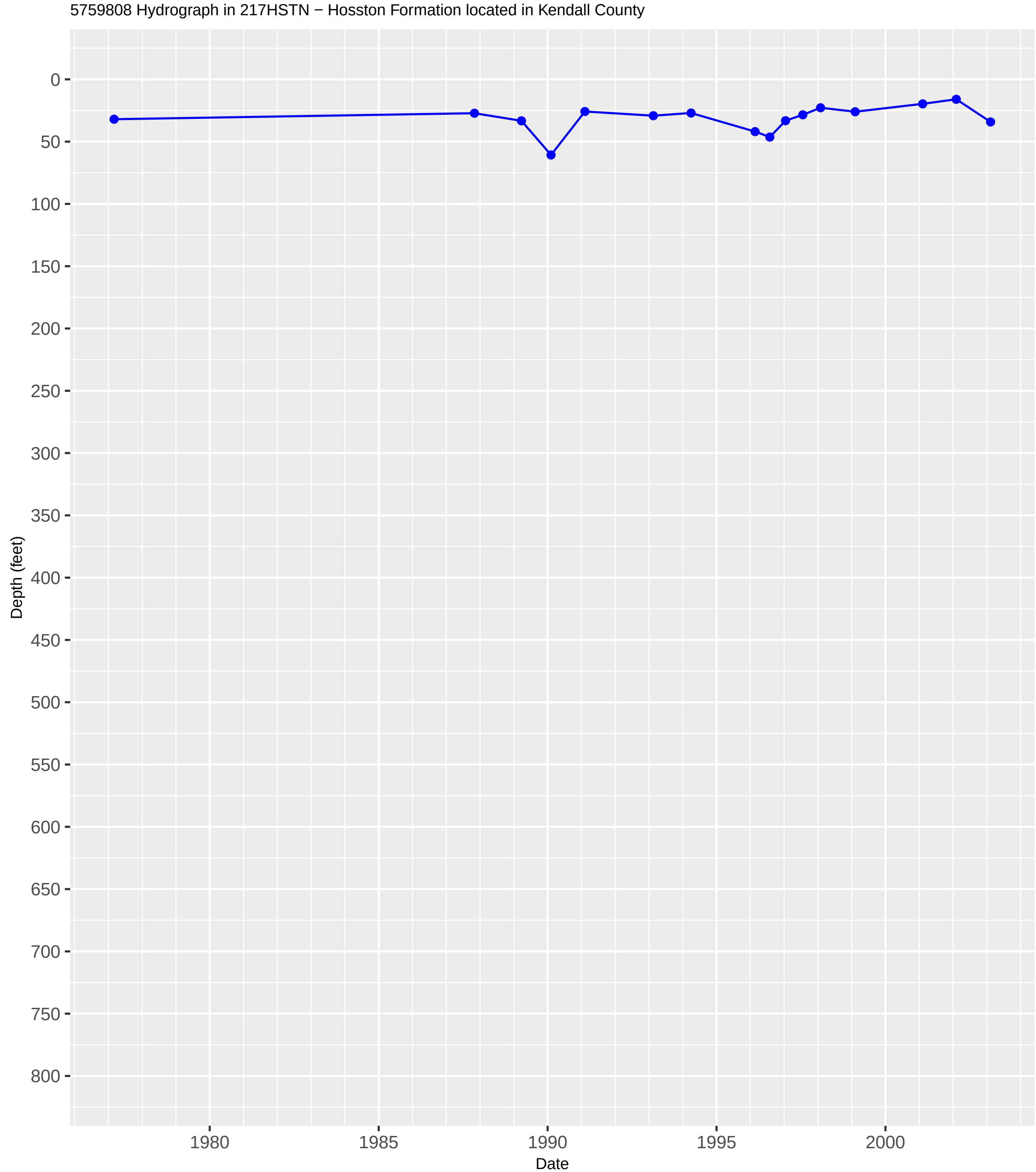
N

0 1 2 4

Miles

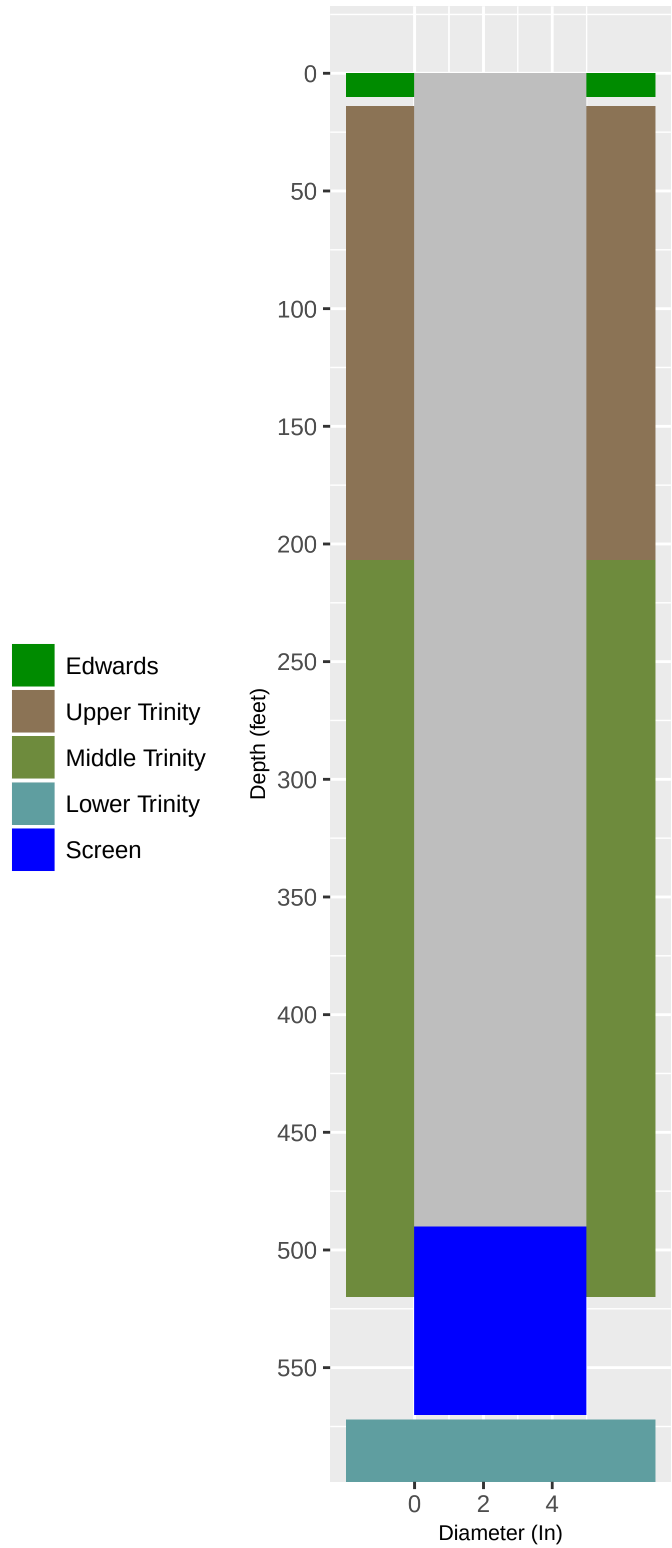
Map of Hydrograph Well Locations in Kendall County
217HSTN
Hosston Formation



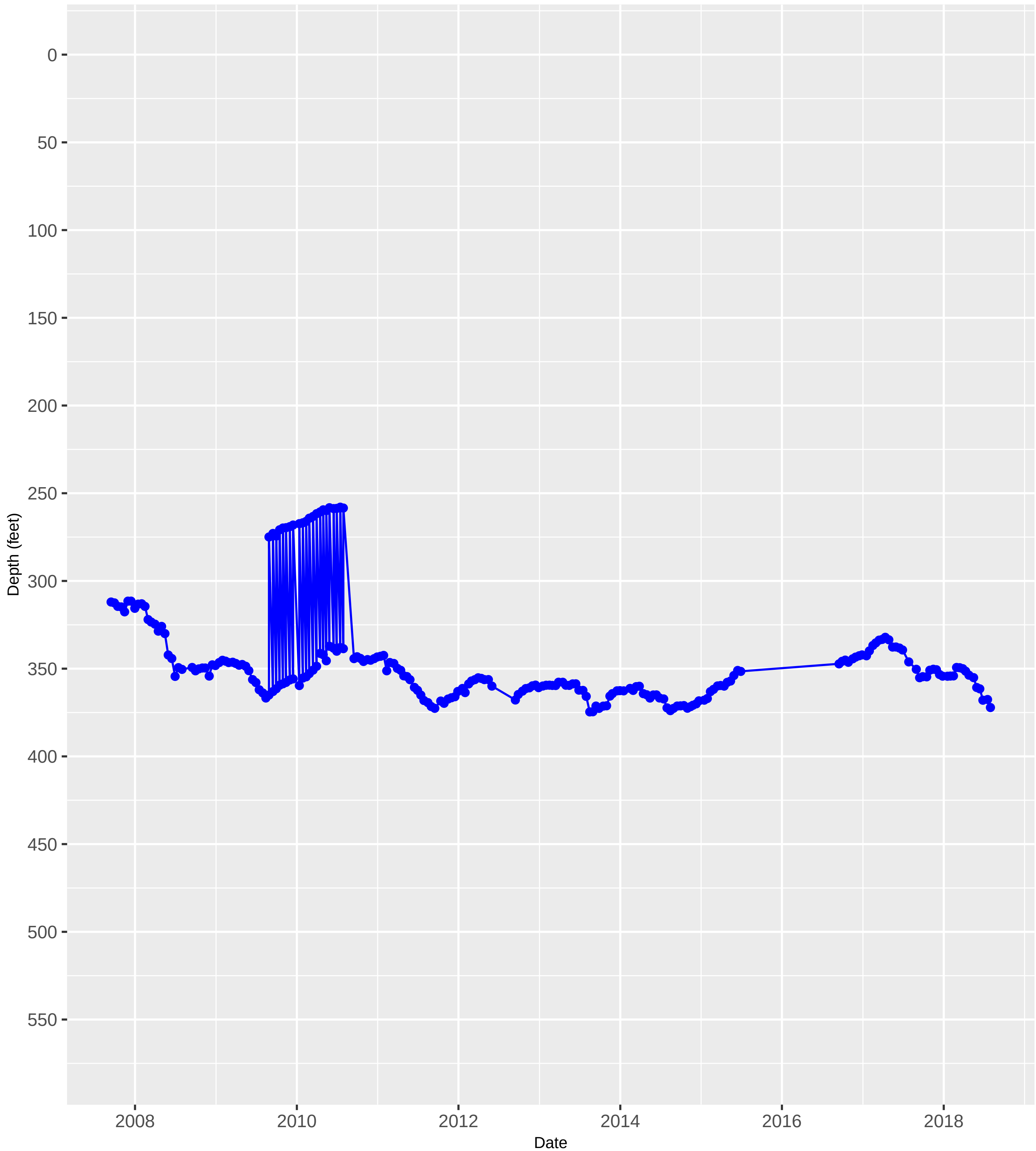


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

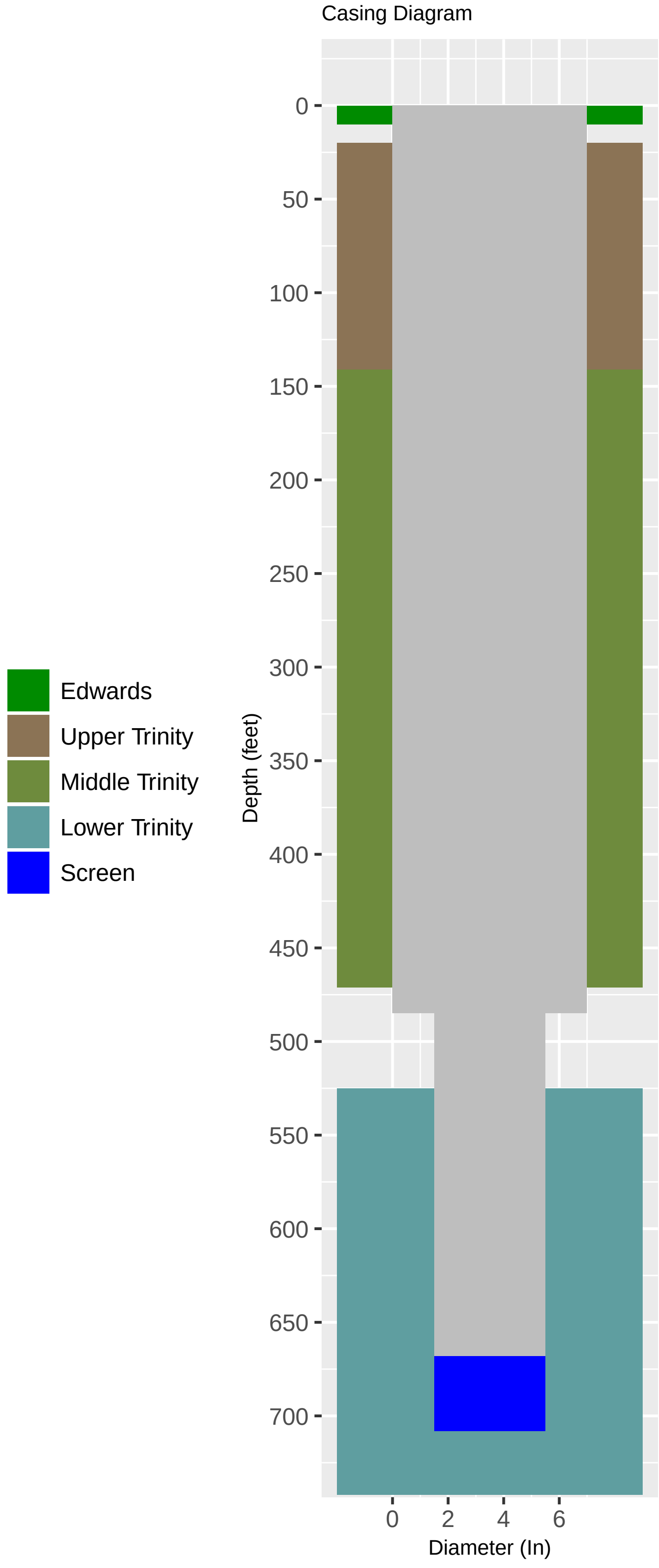
Casing Diagram

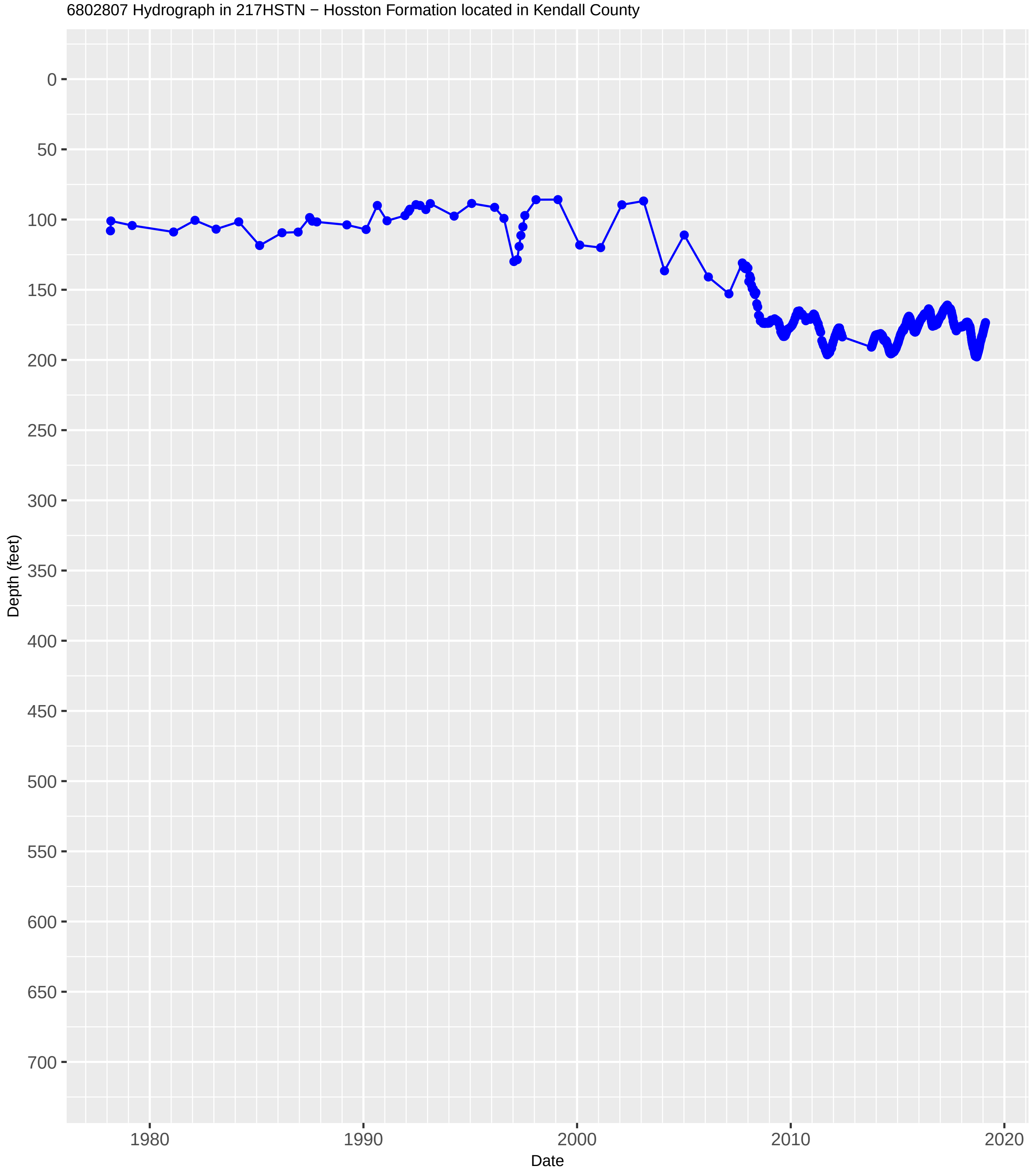


6802407 Hydrograph in 217HSTN − Hosston Formation located in Kendall County



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.





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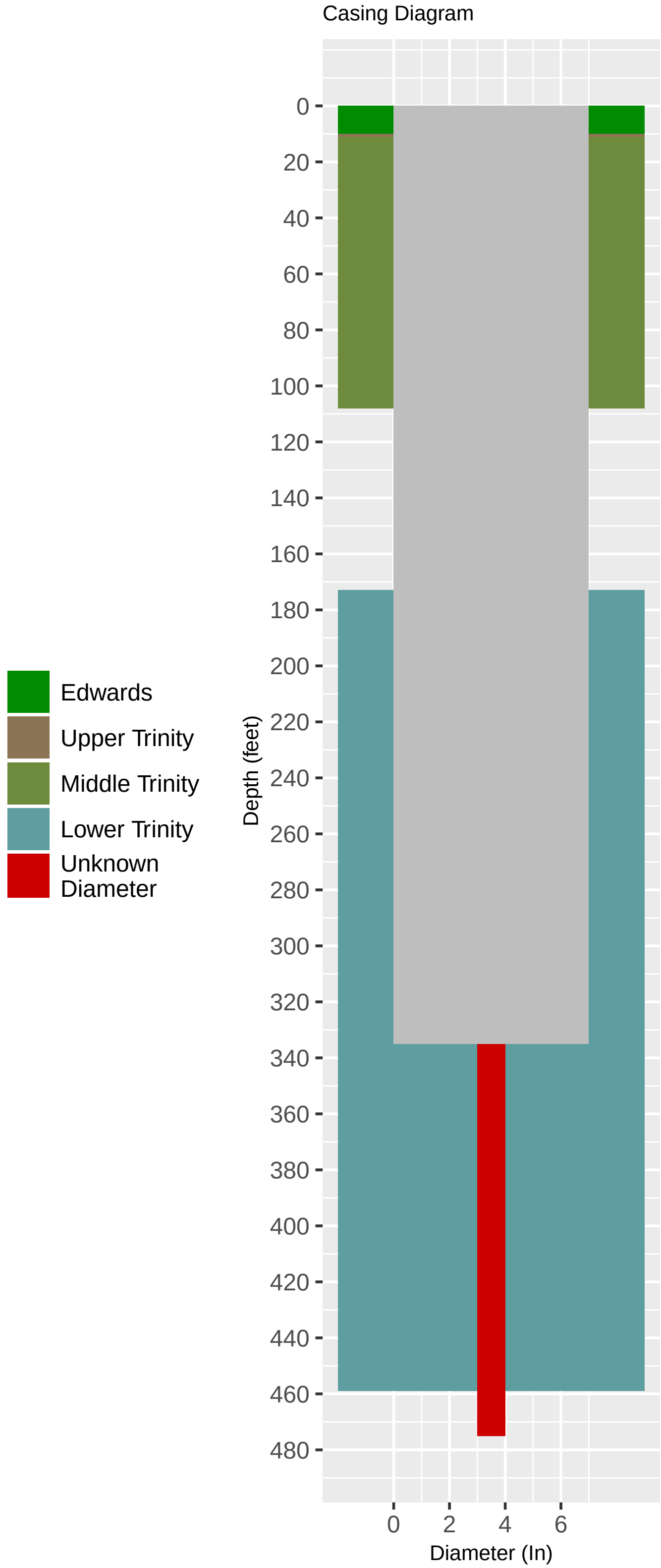

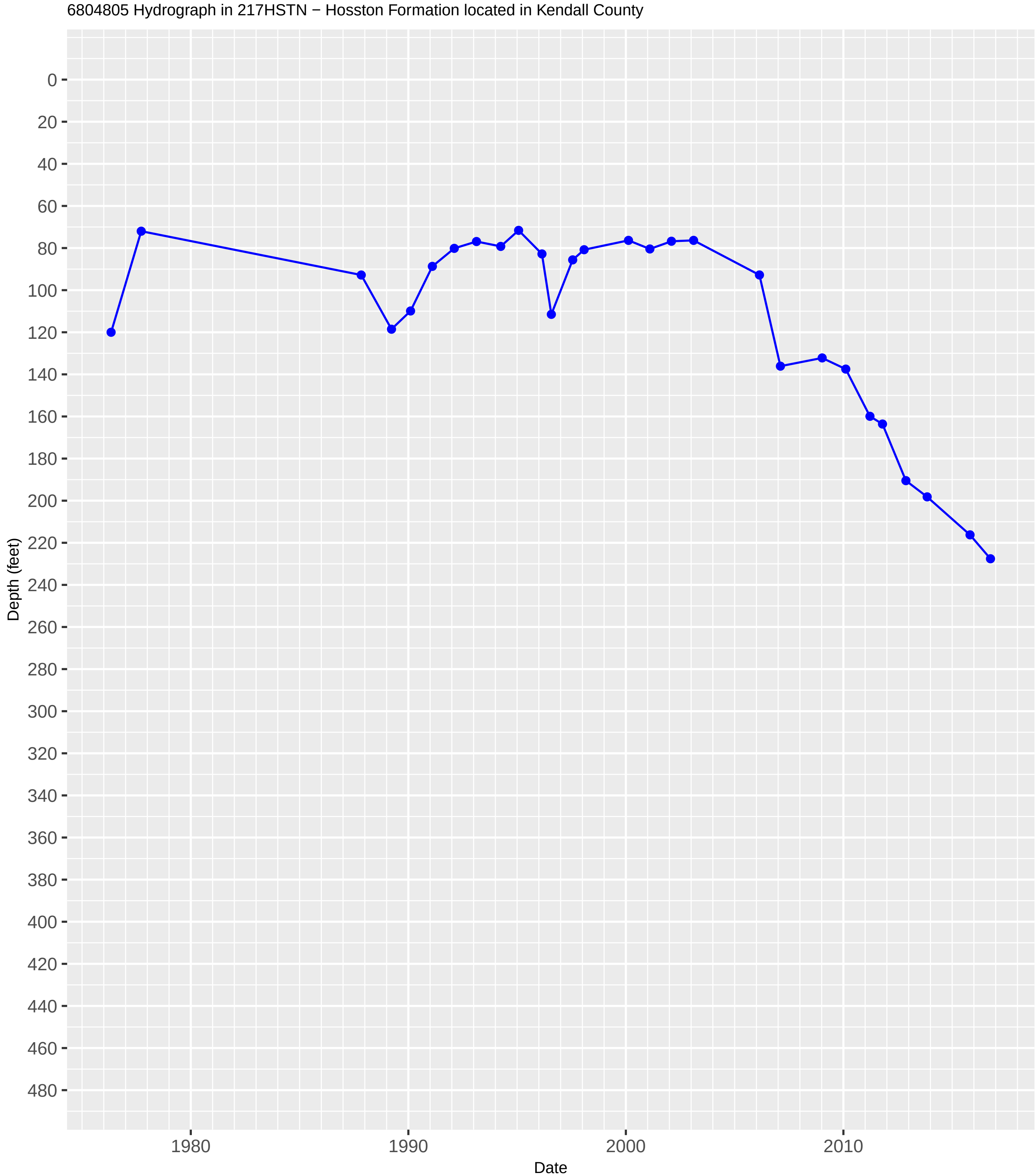

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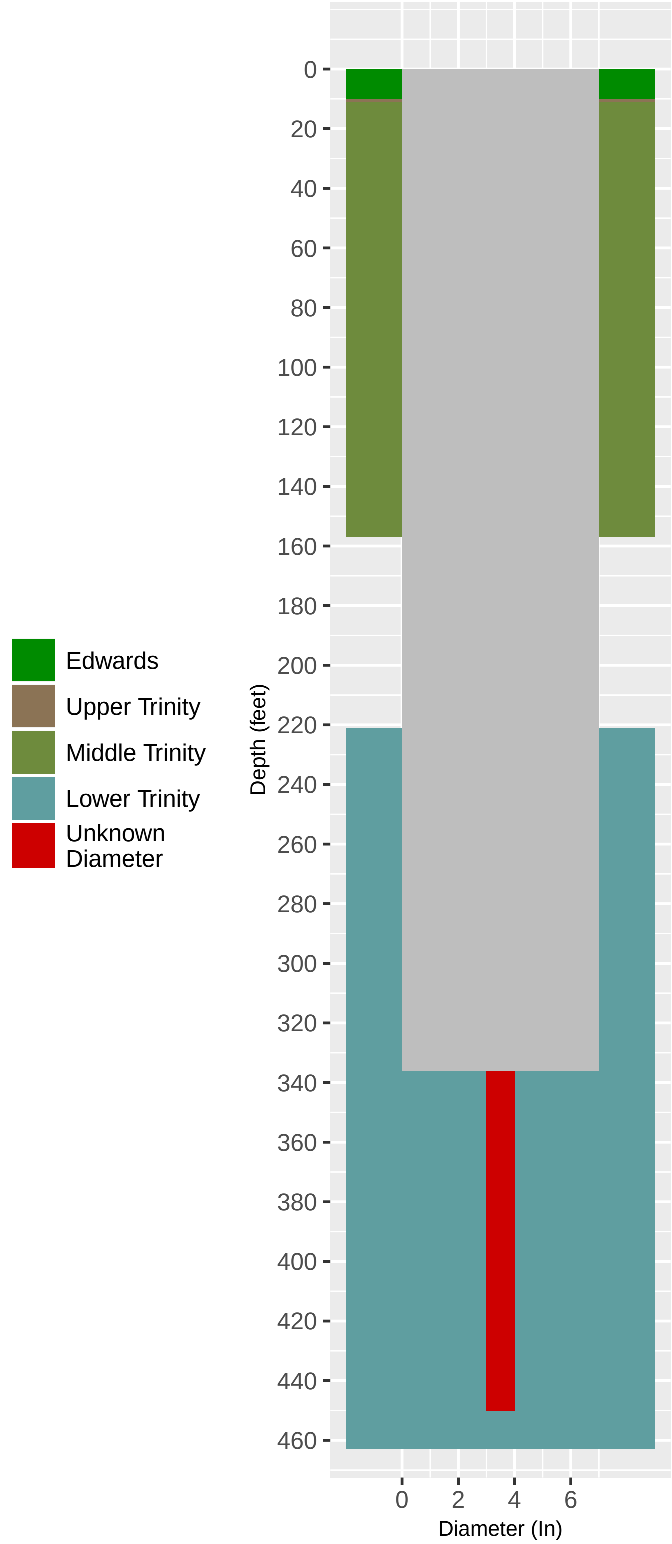
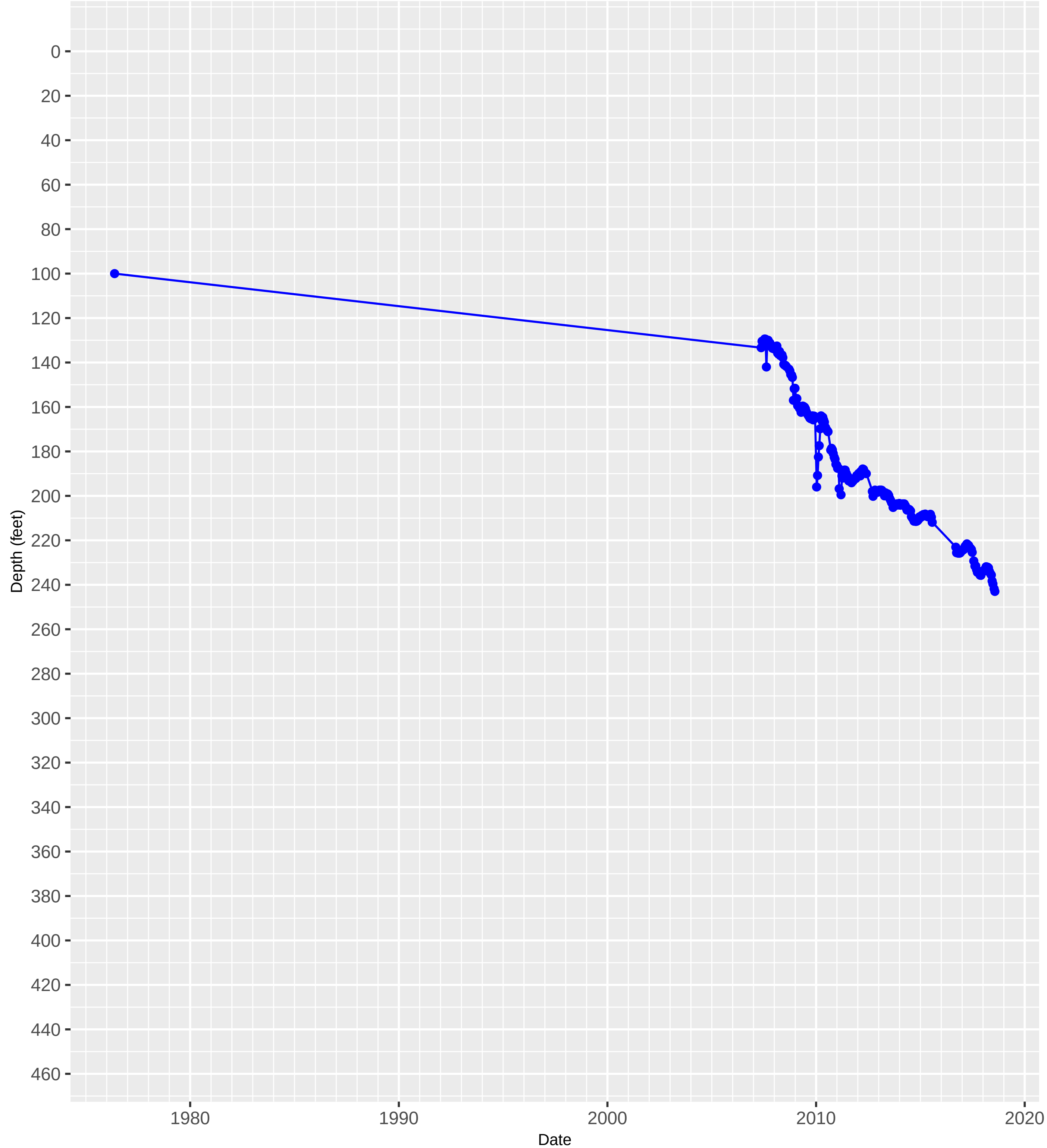
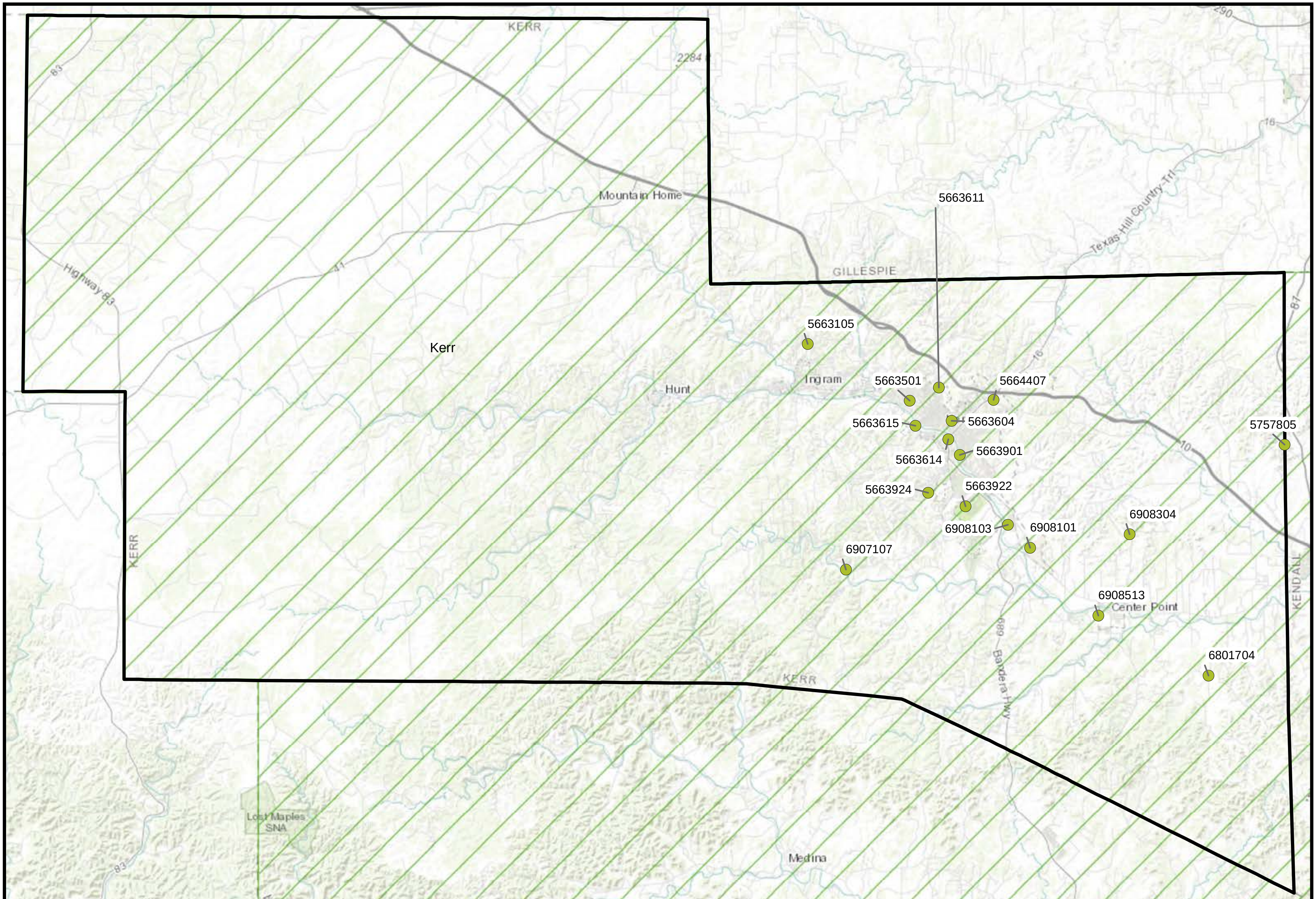
Casing Diagram



6804806 Hydrograph in 217HSTN − Hosston Formation located in Kendall County



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



Aquifer

217HSTN - Hosston Formation

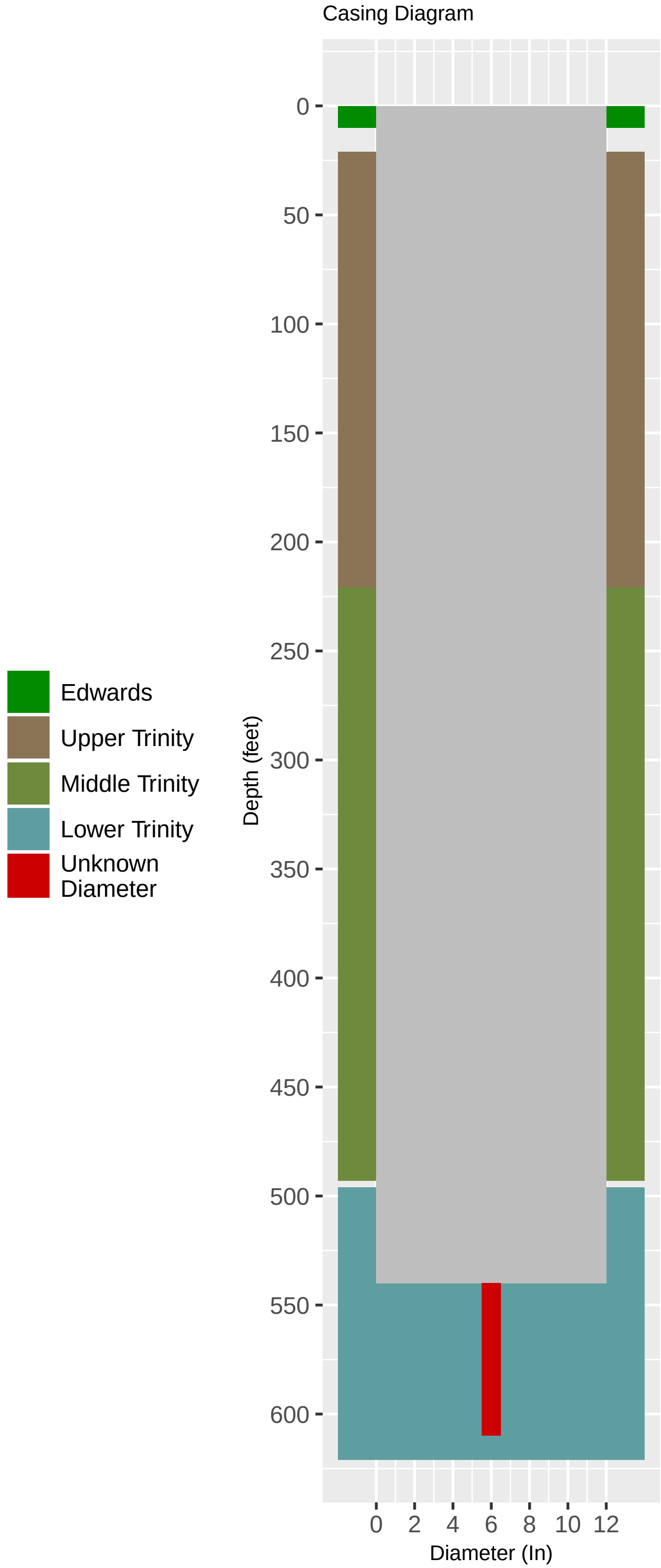
GMA 9

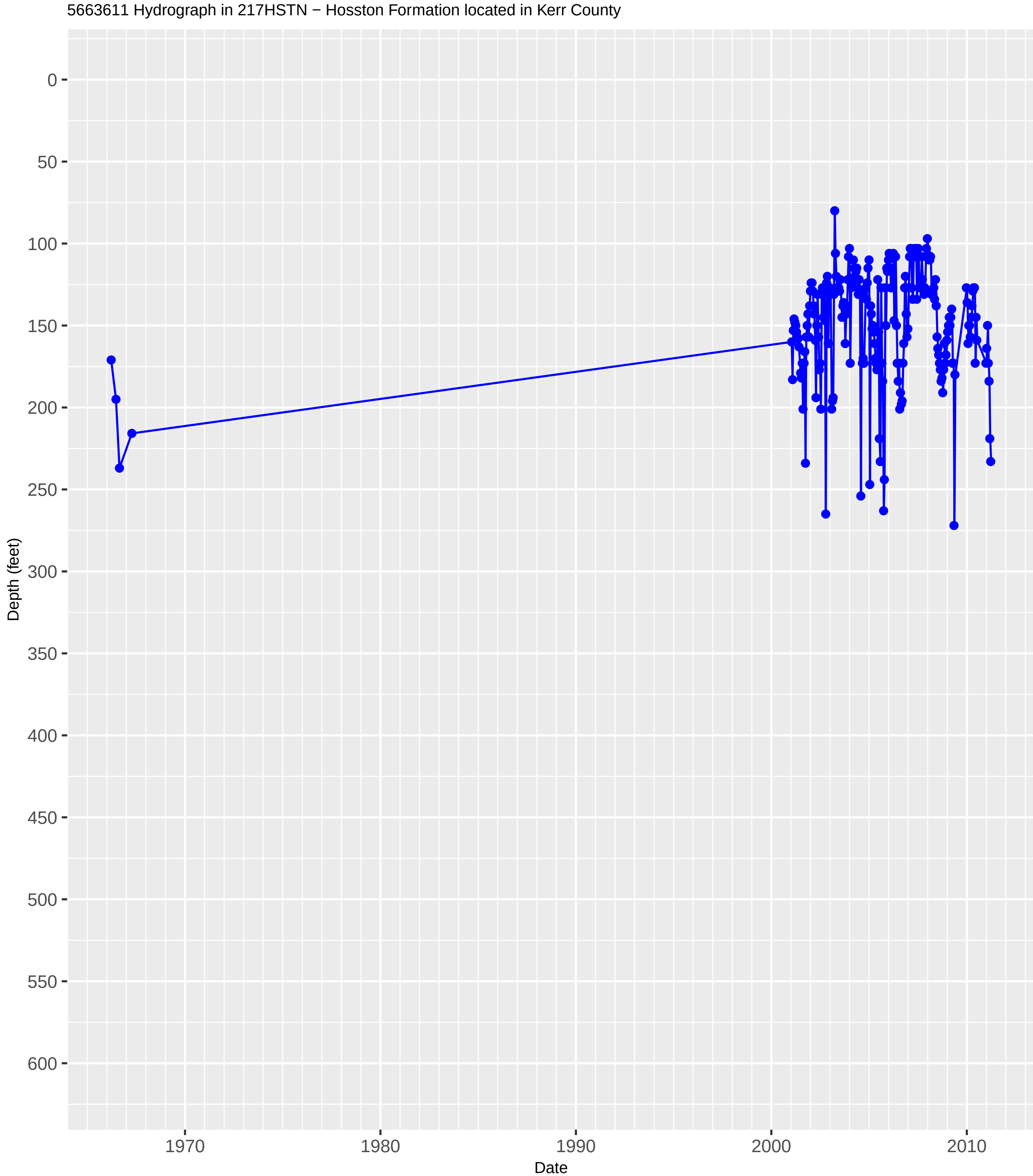
N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Kerr County
217HSTN
Hosston Formation





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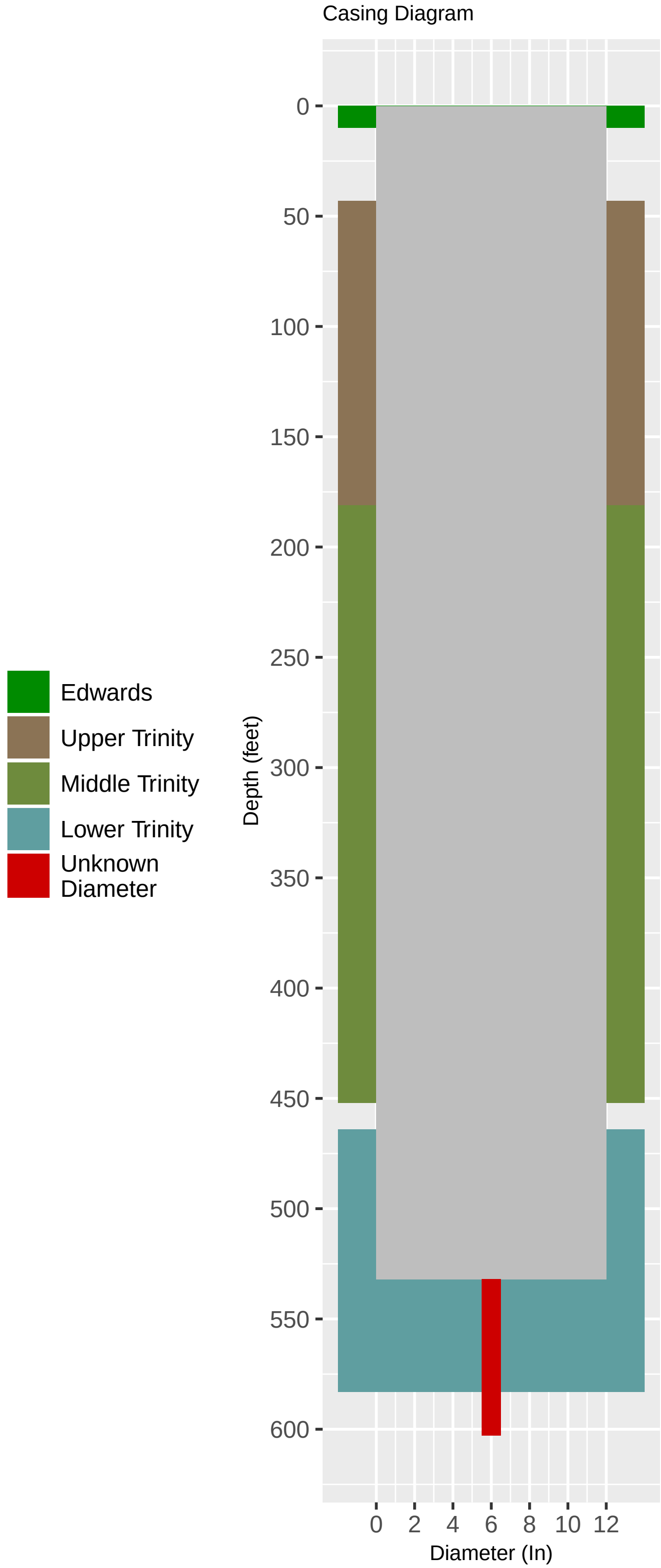

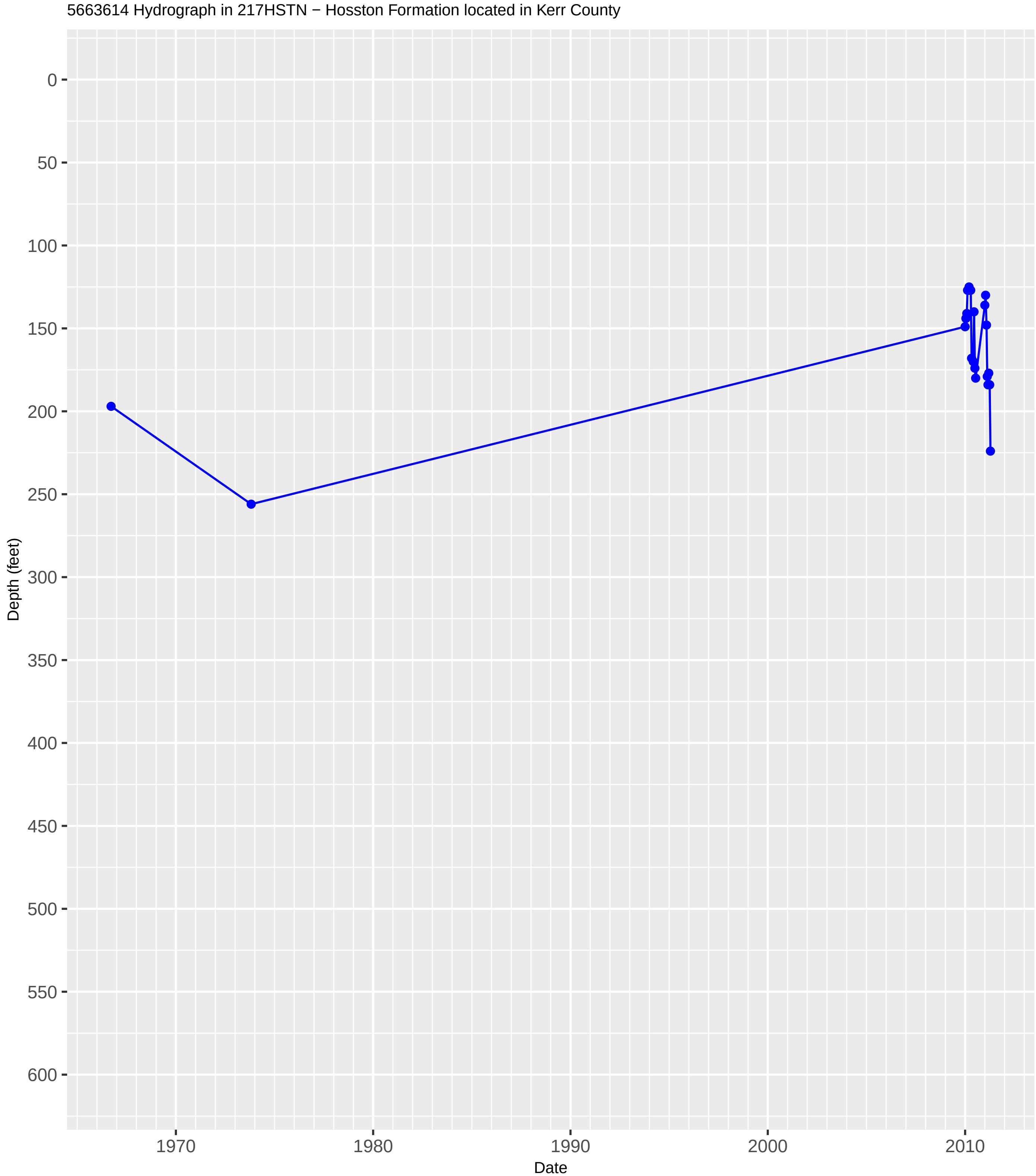

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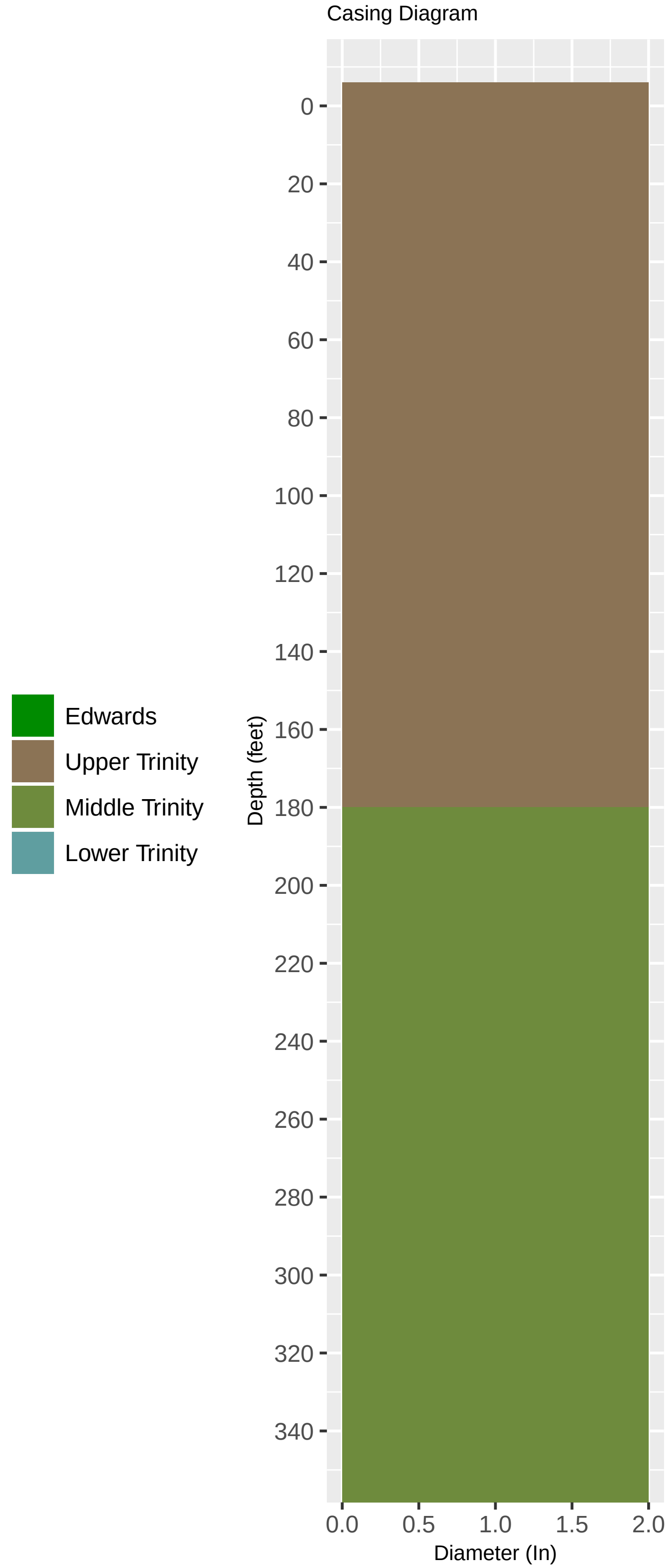

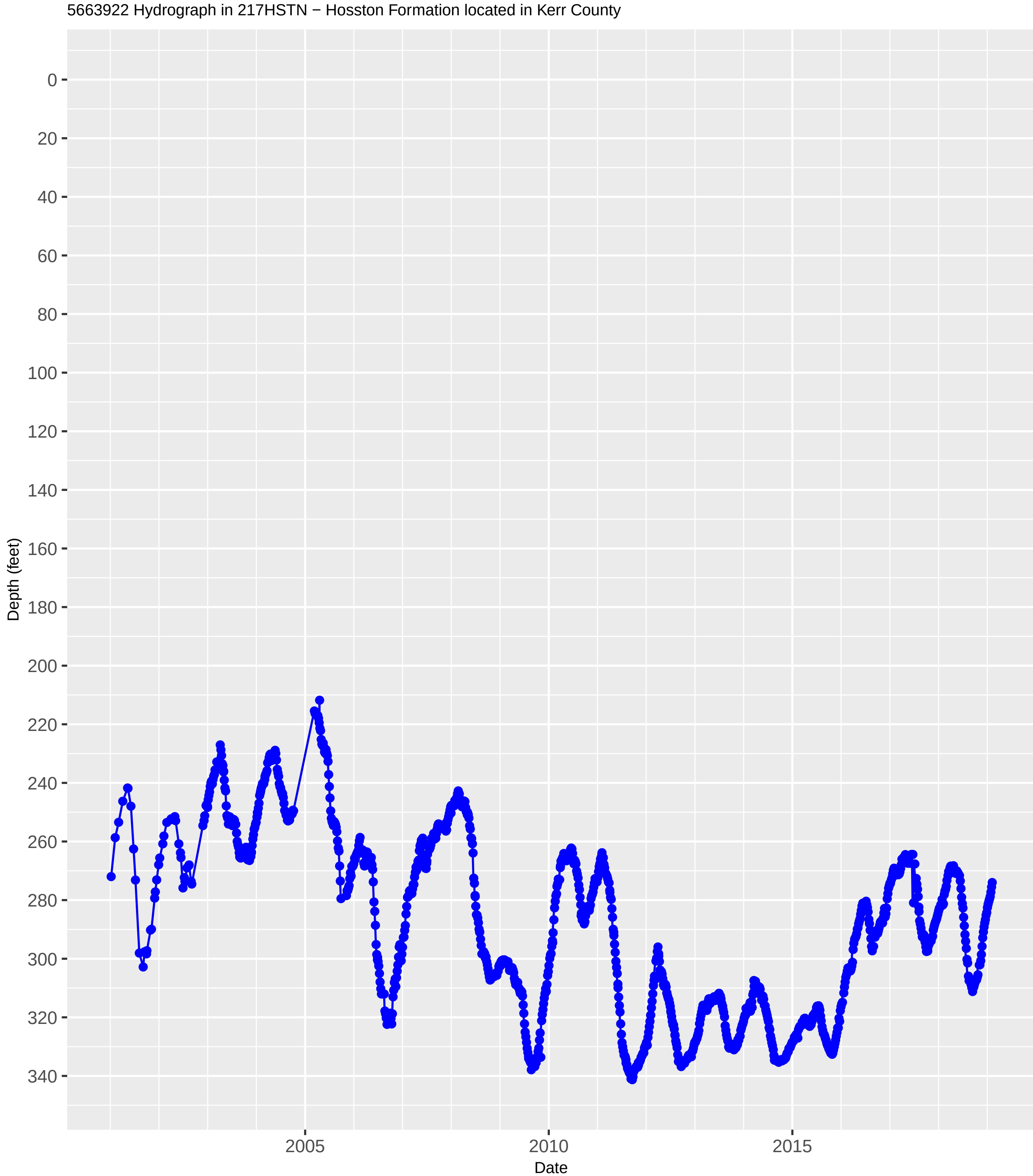

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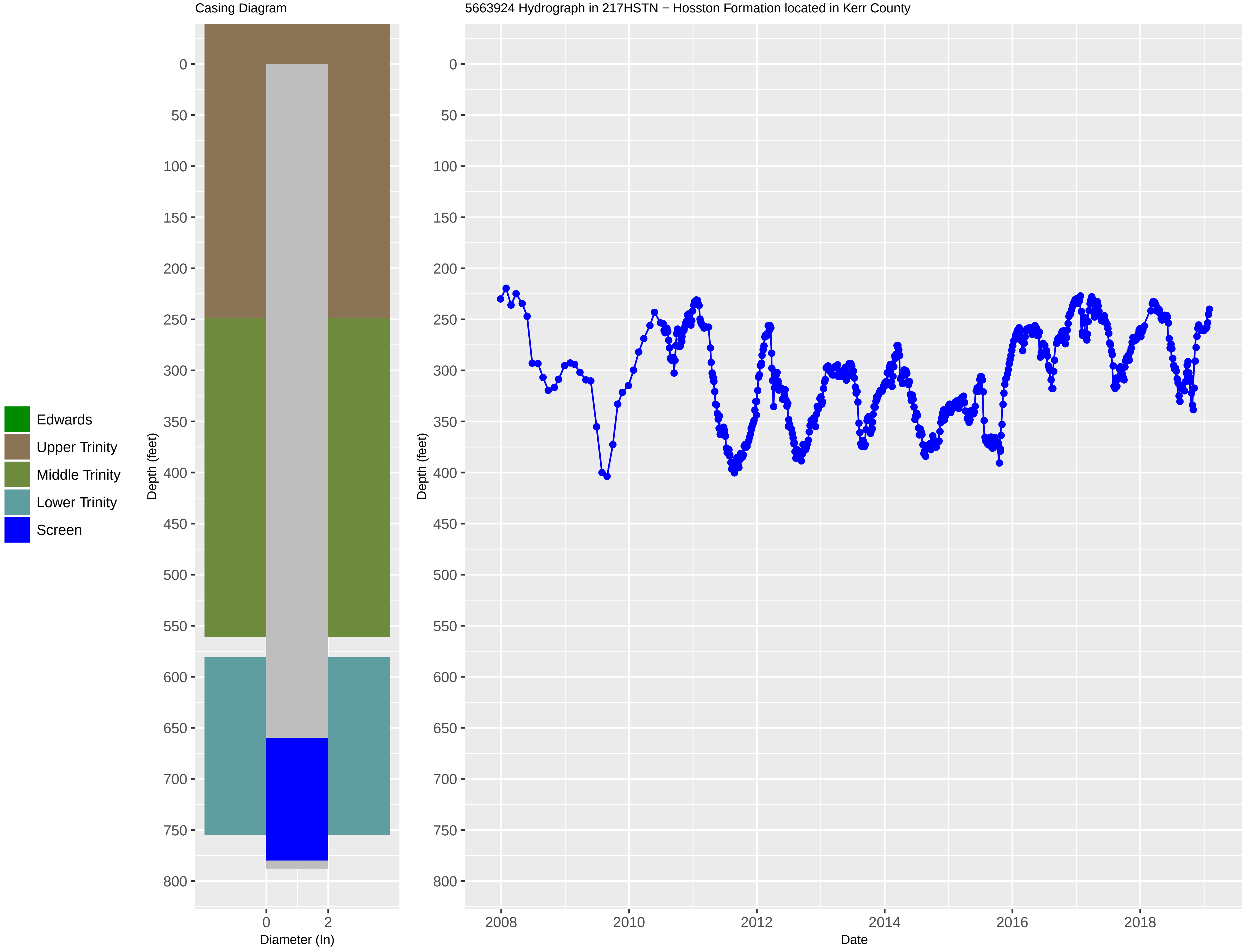

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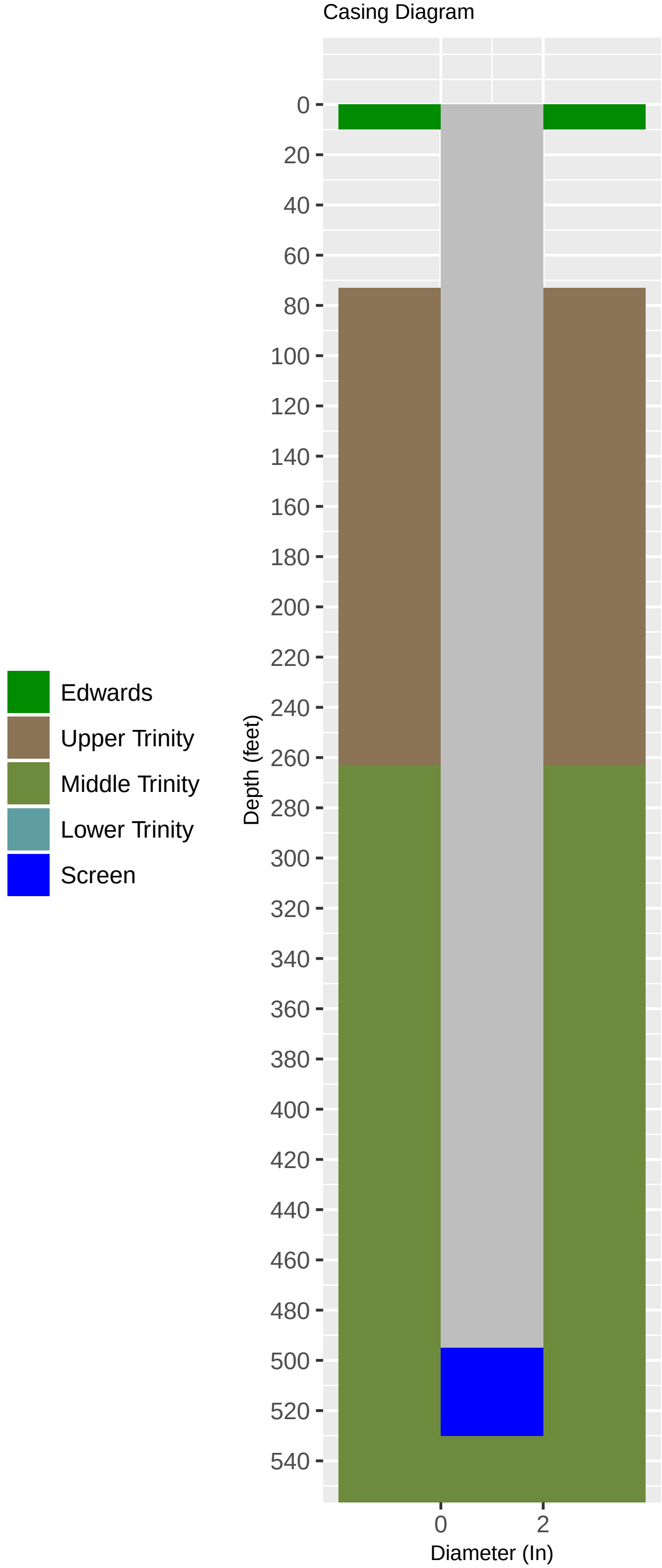

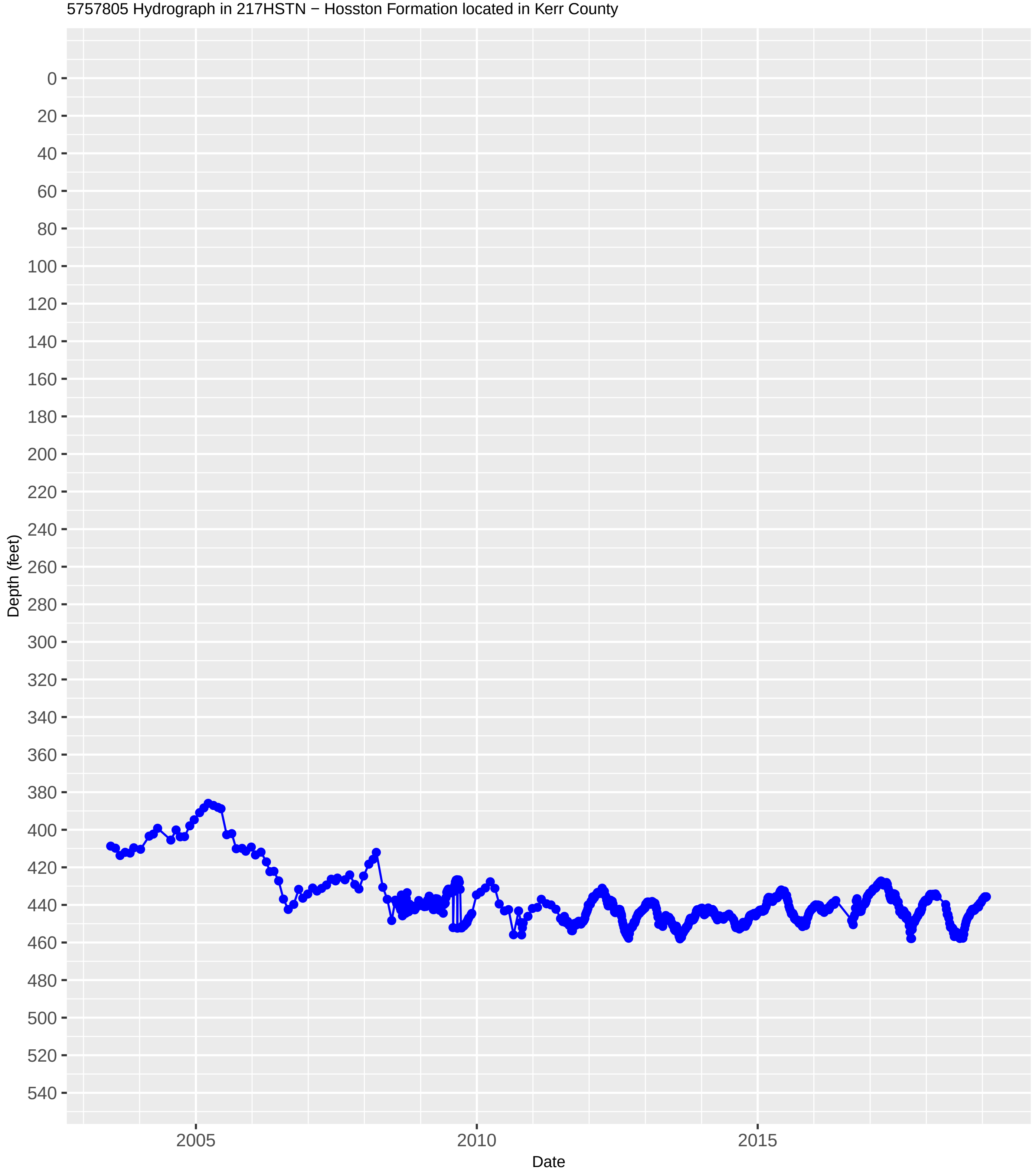

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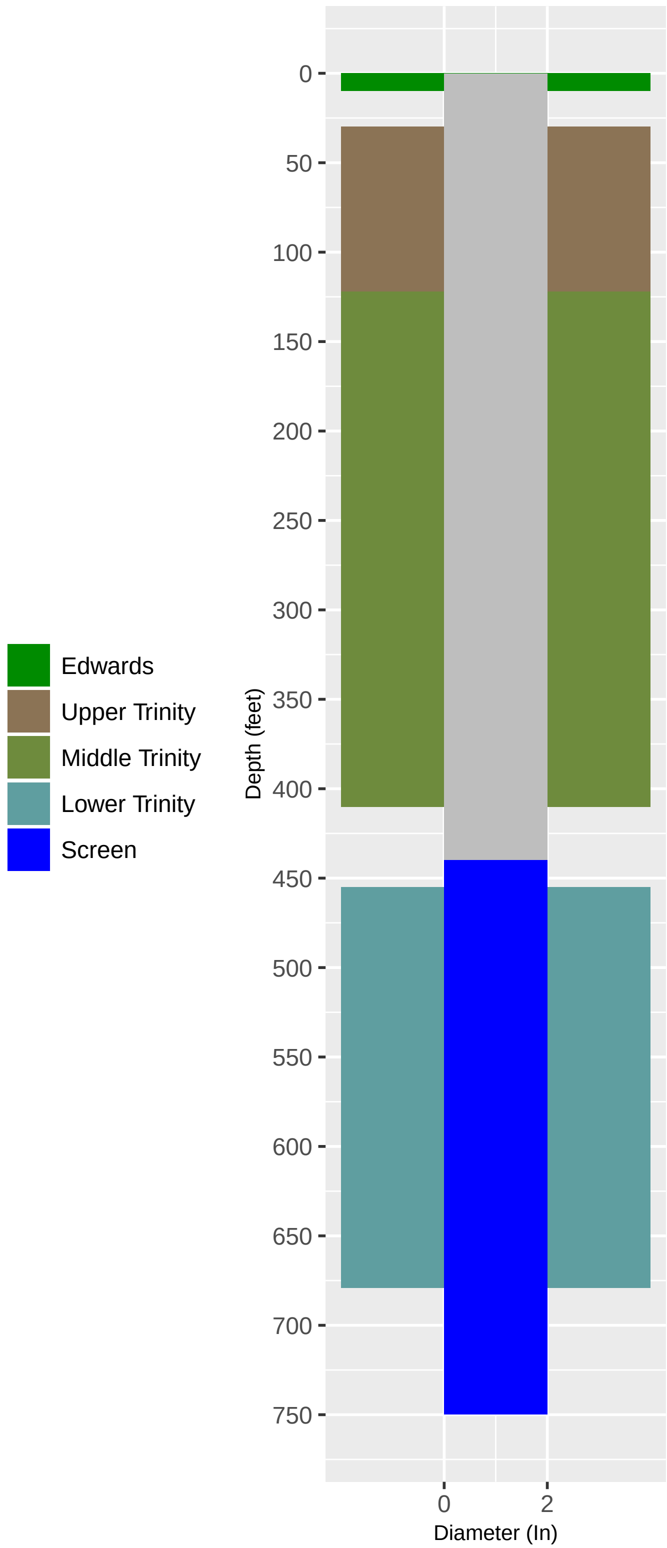
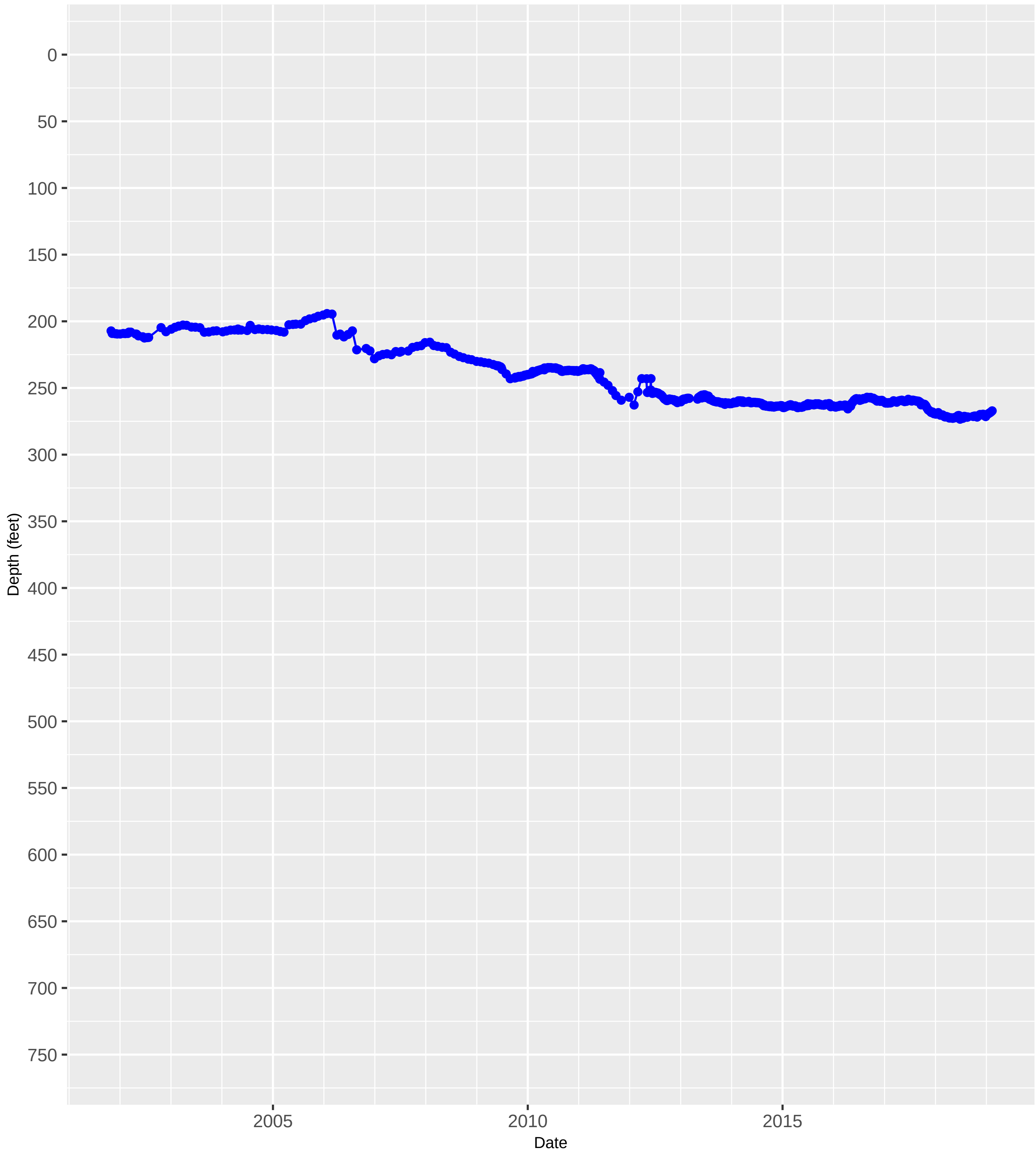
Casing Diagram



6801704 Hydrograph in 217HSTN − Hosston Formation located in Kerr County



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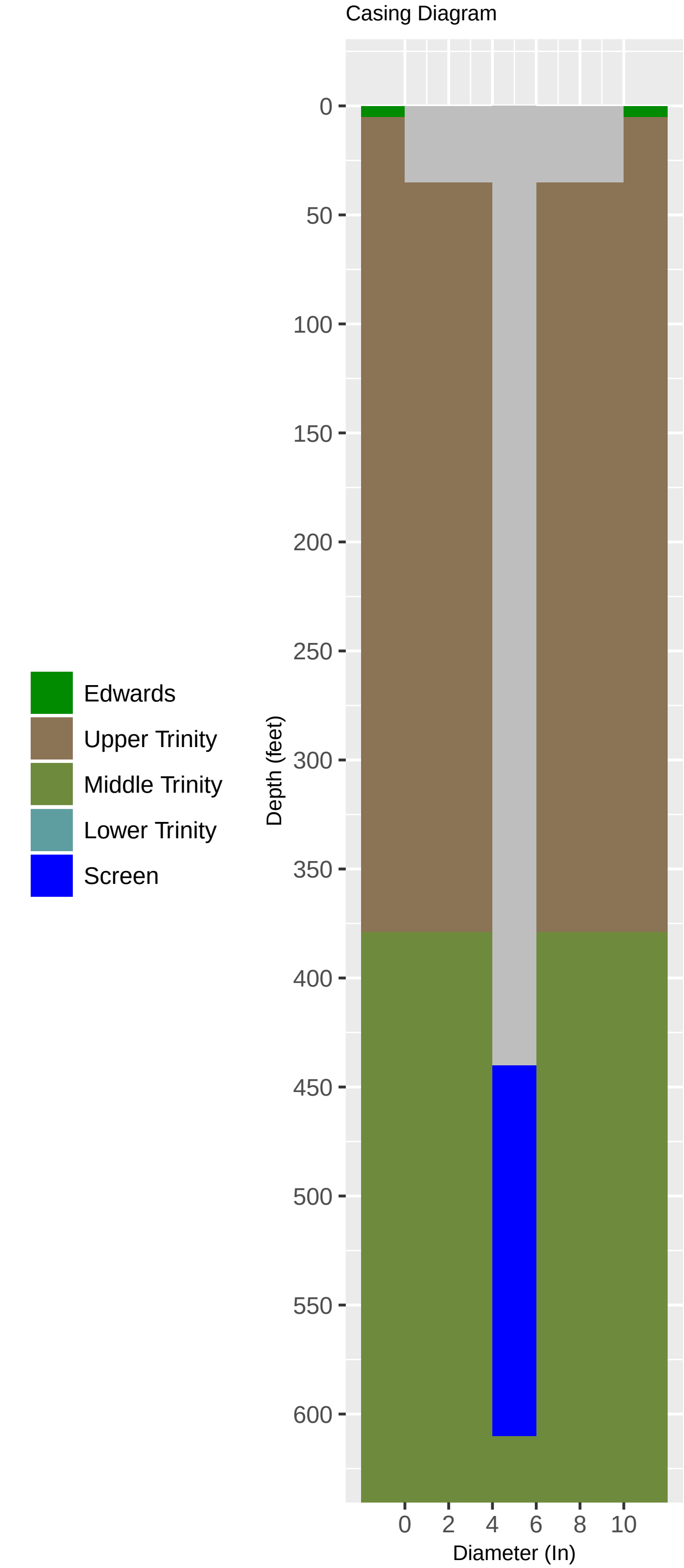

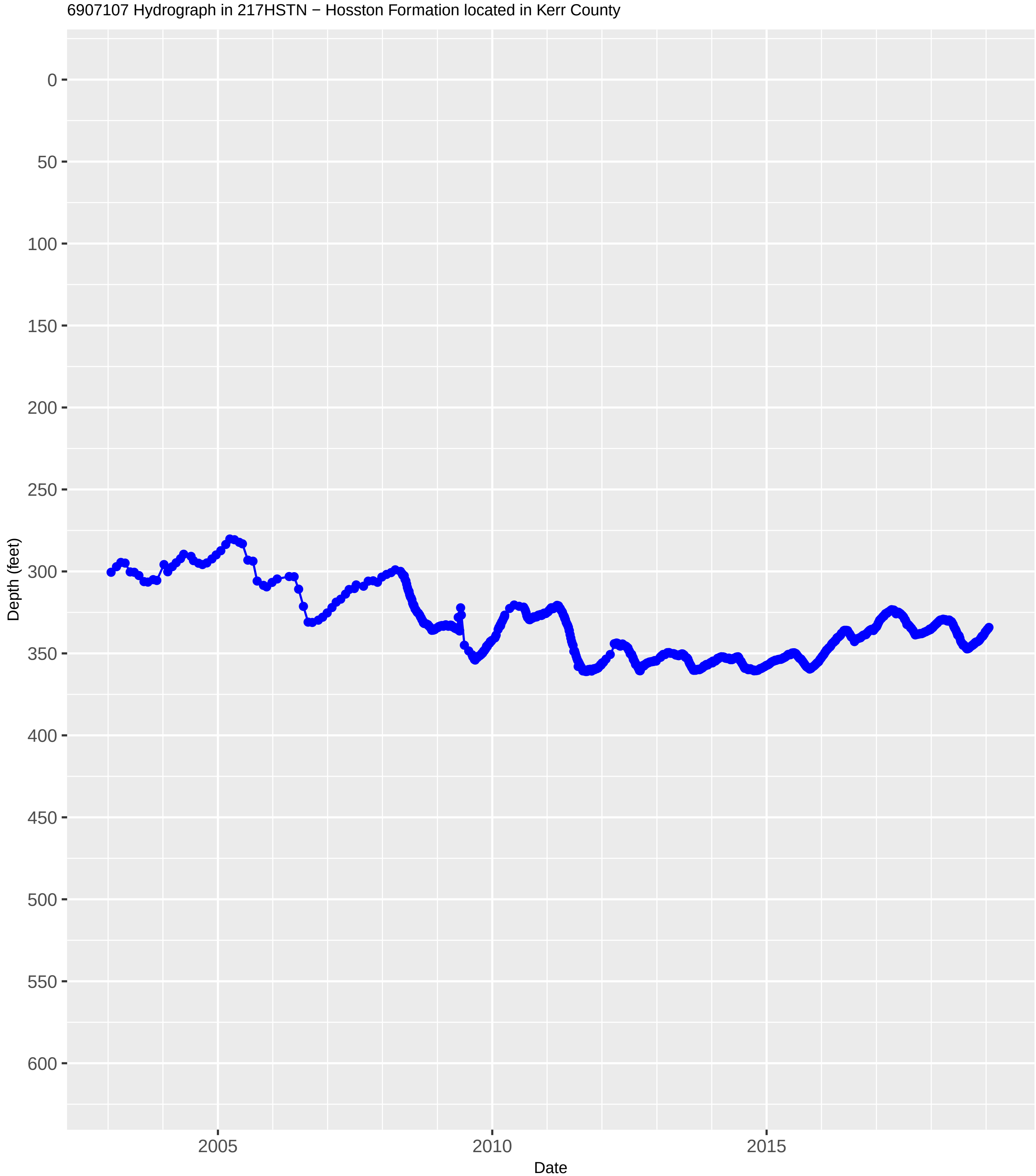

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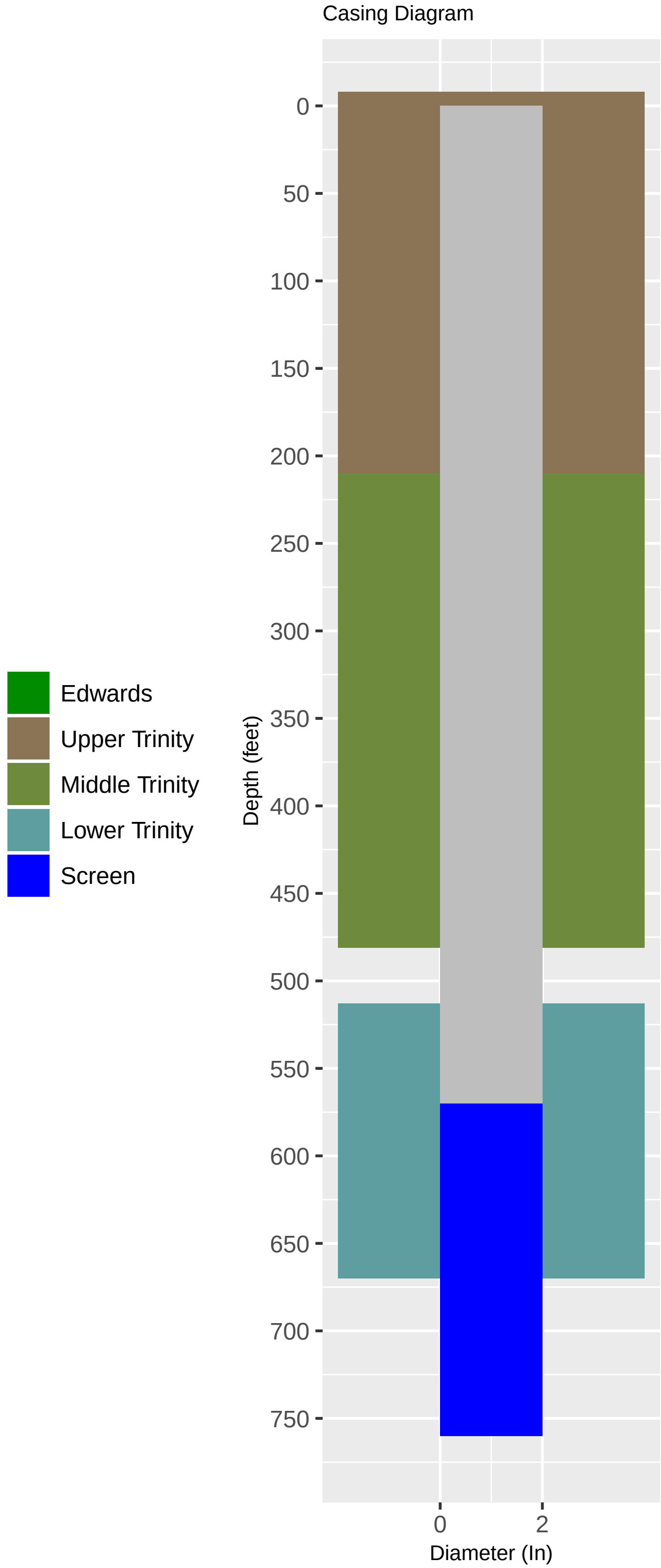

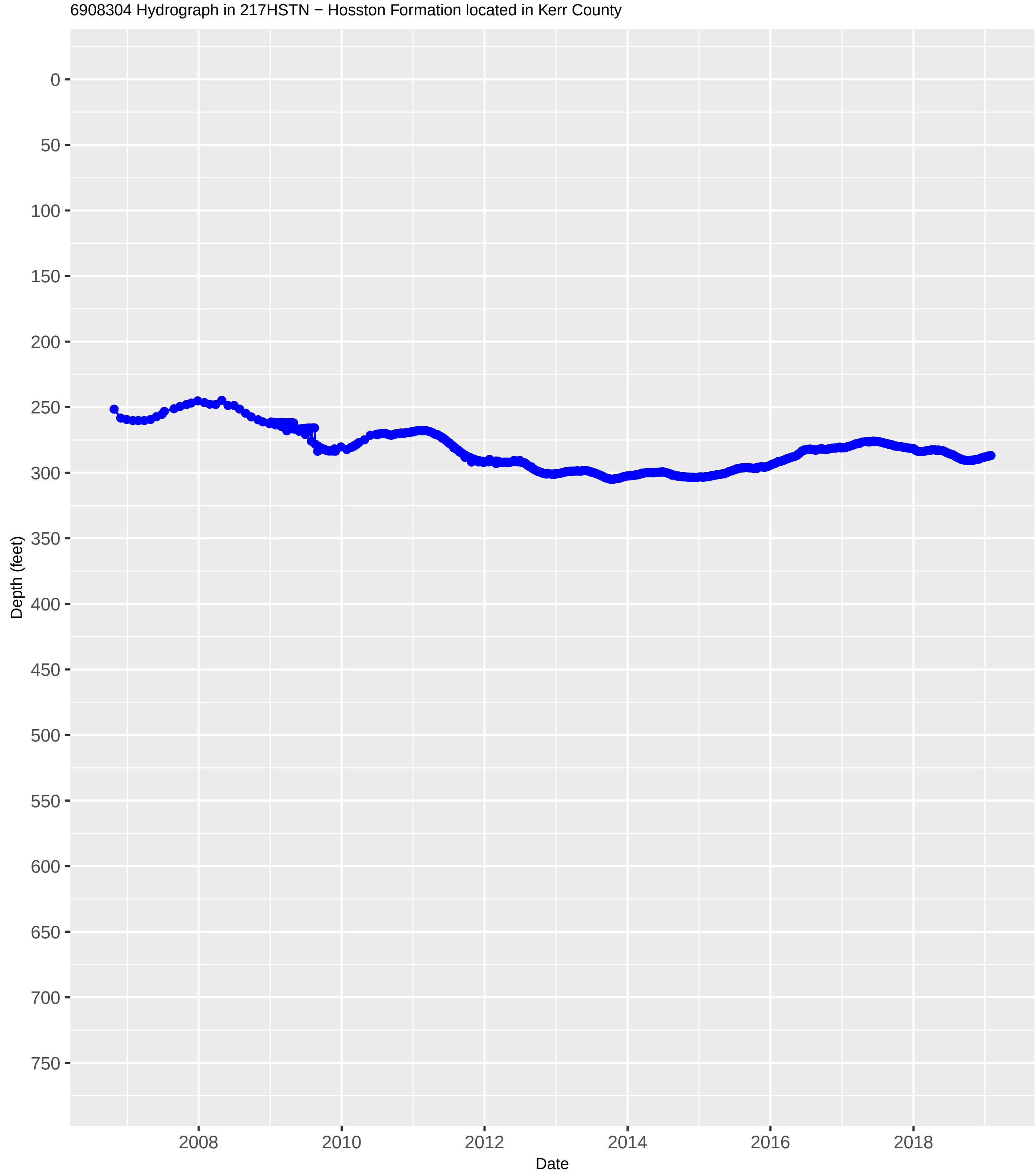

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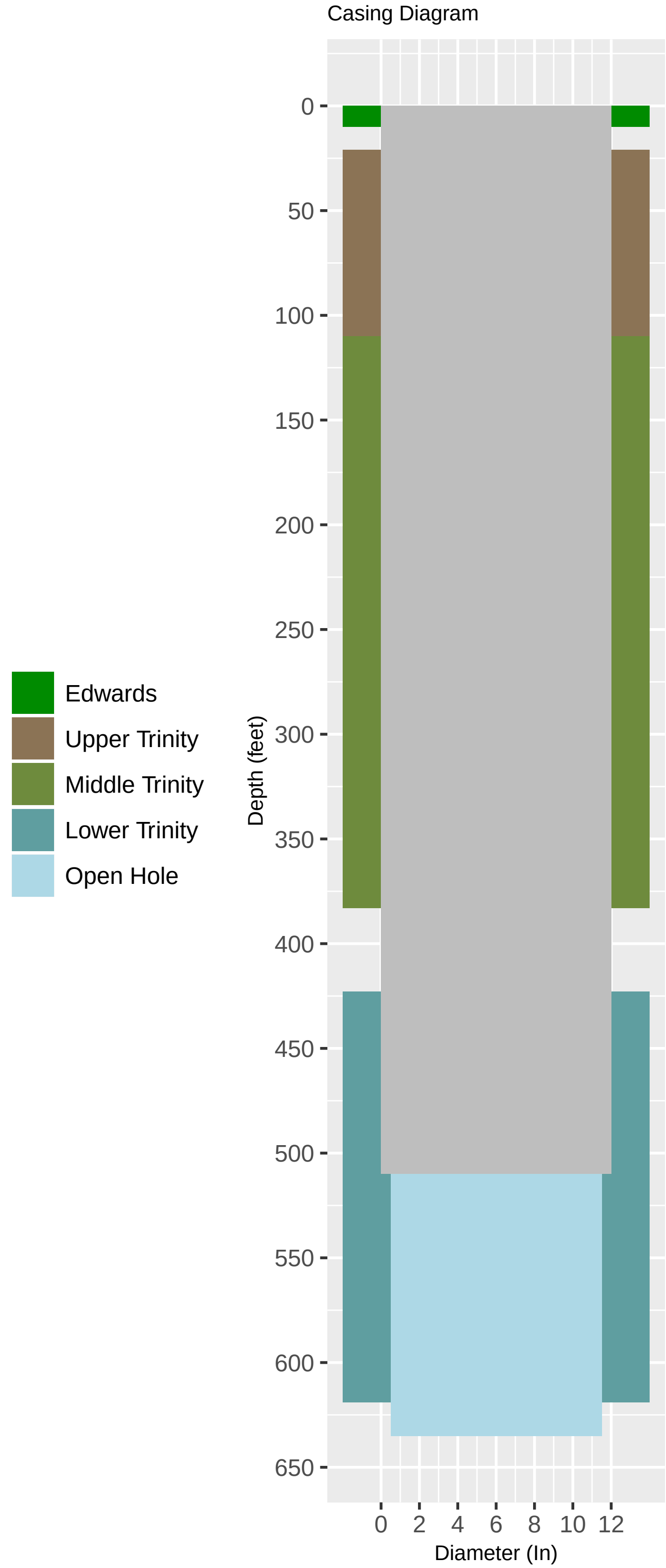

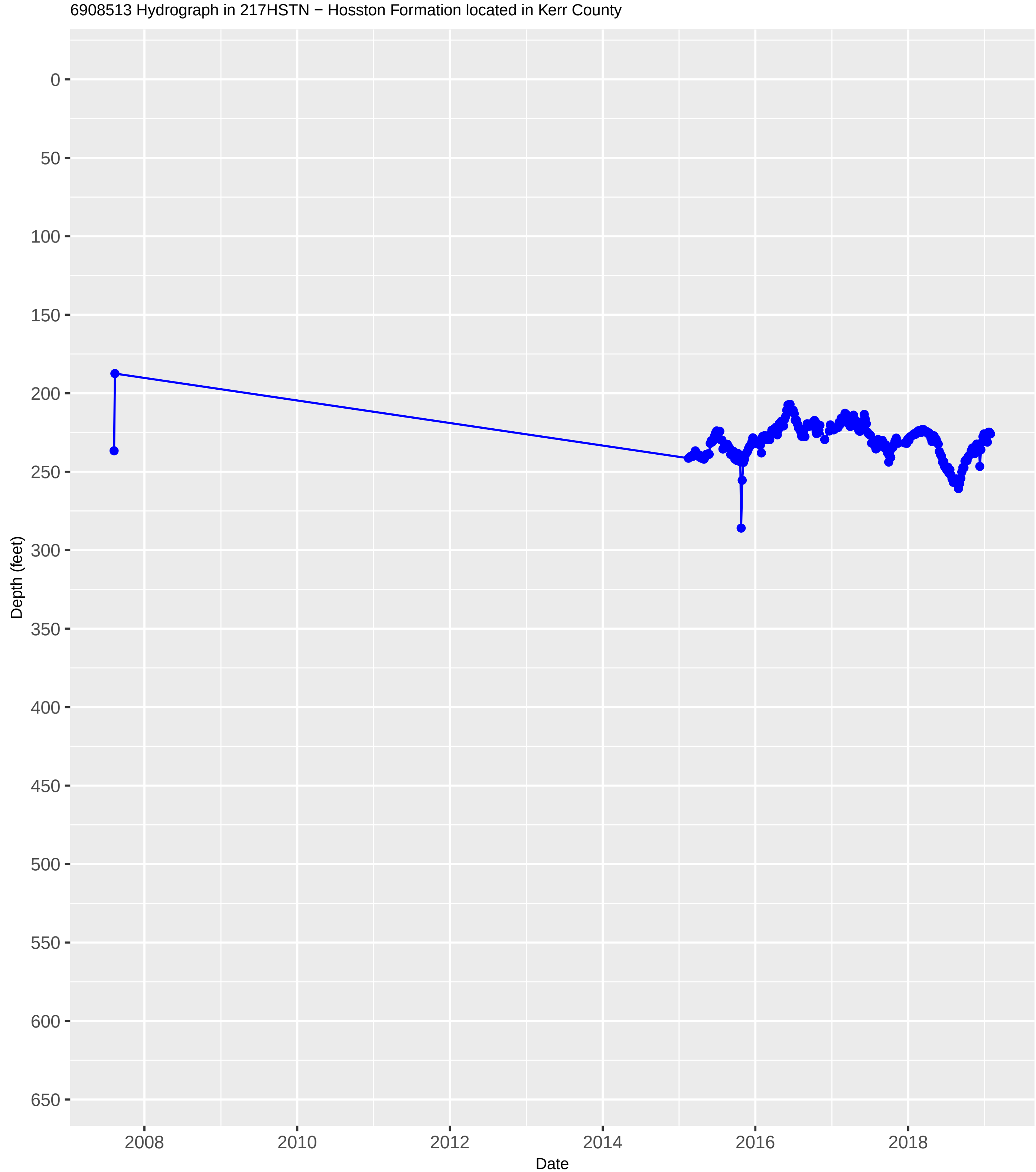

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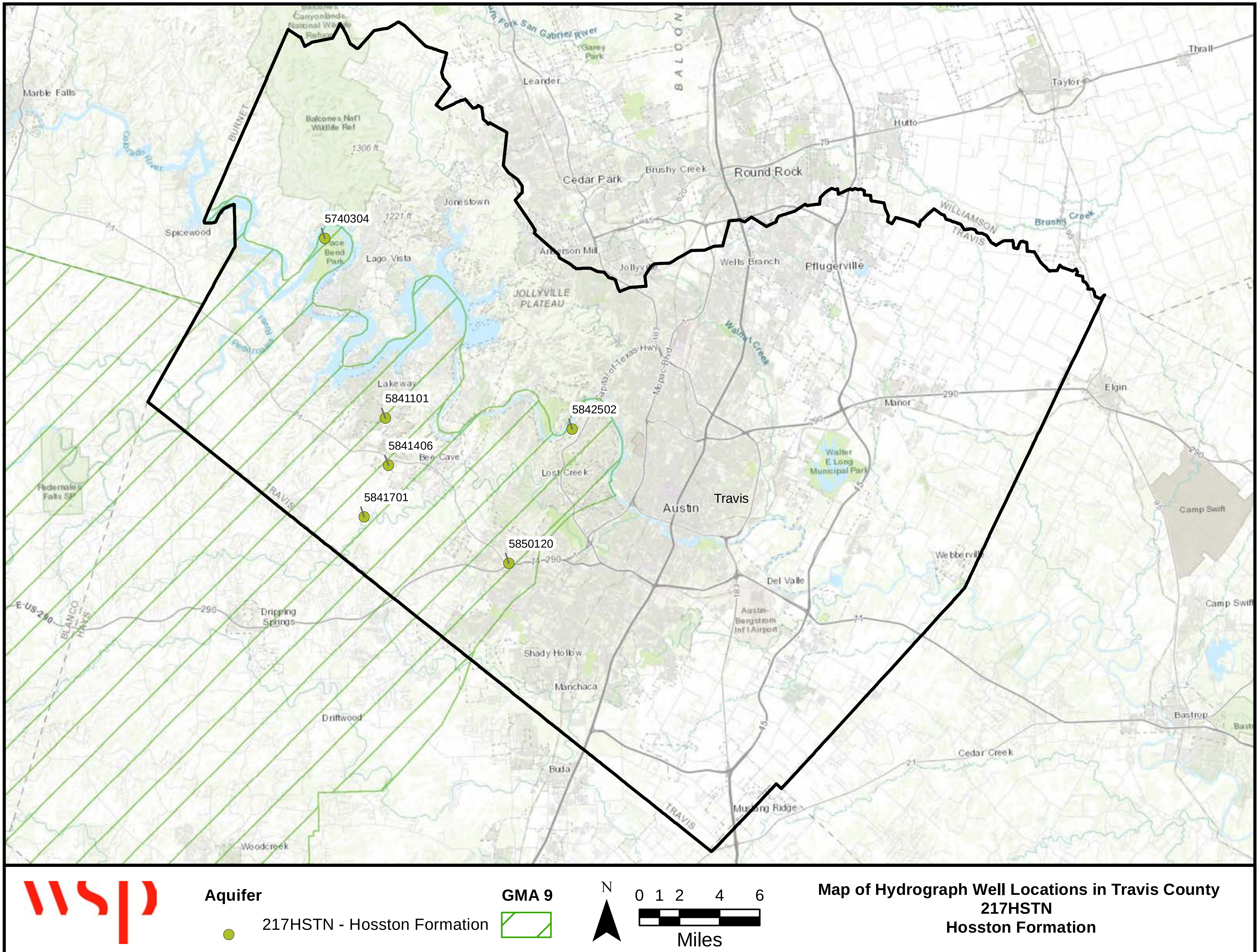
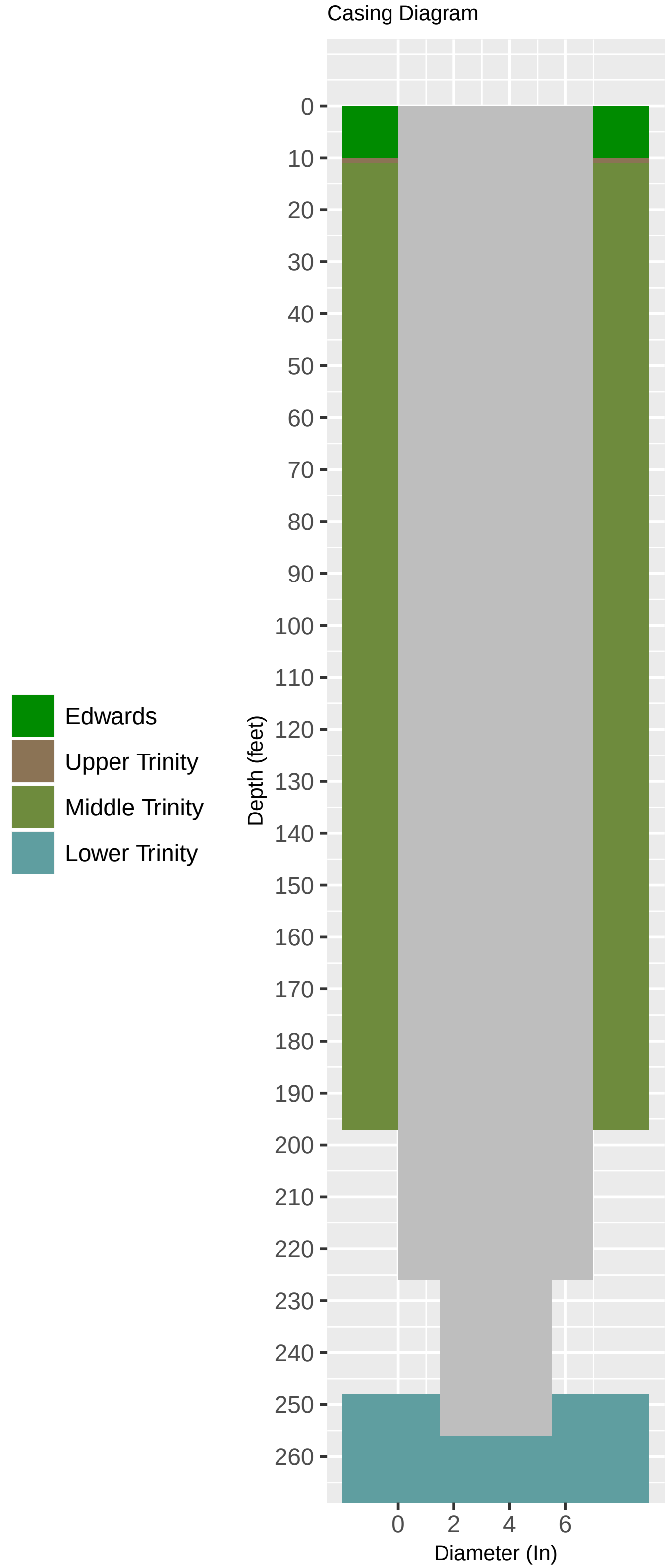
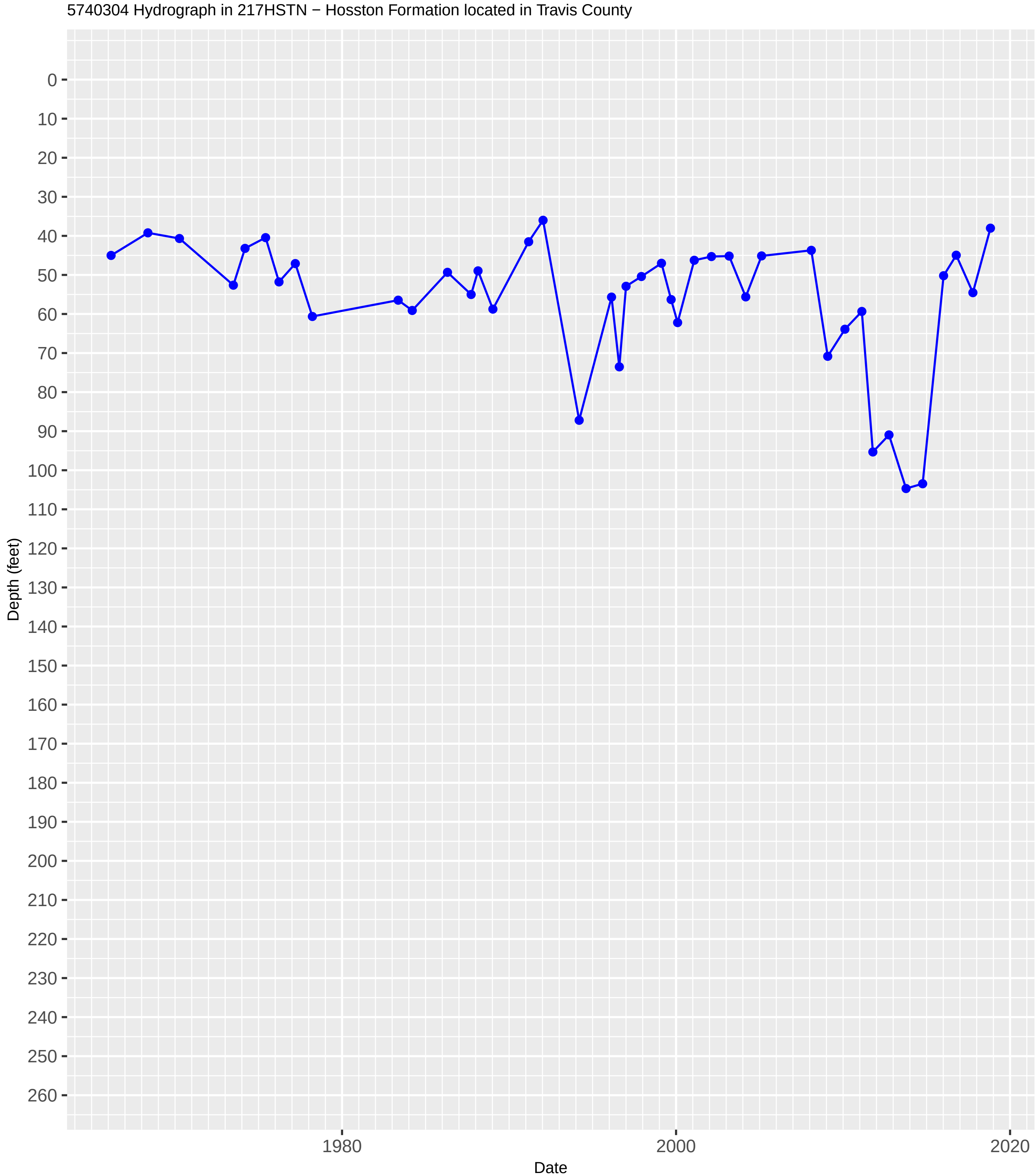


Map of Hydrograph Well Locations in Travis County
217HSTN
Hosston Formation





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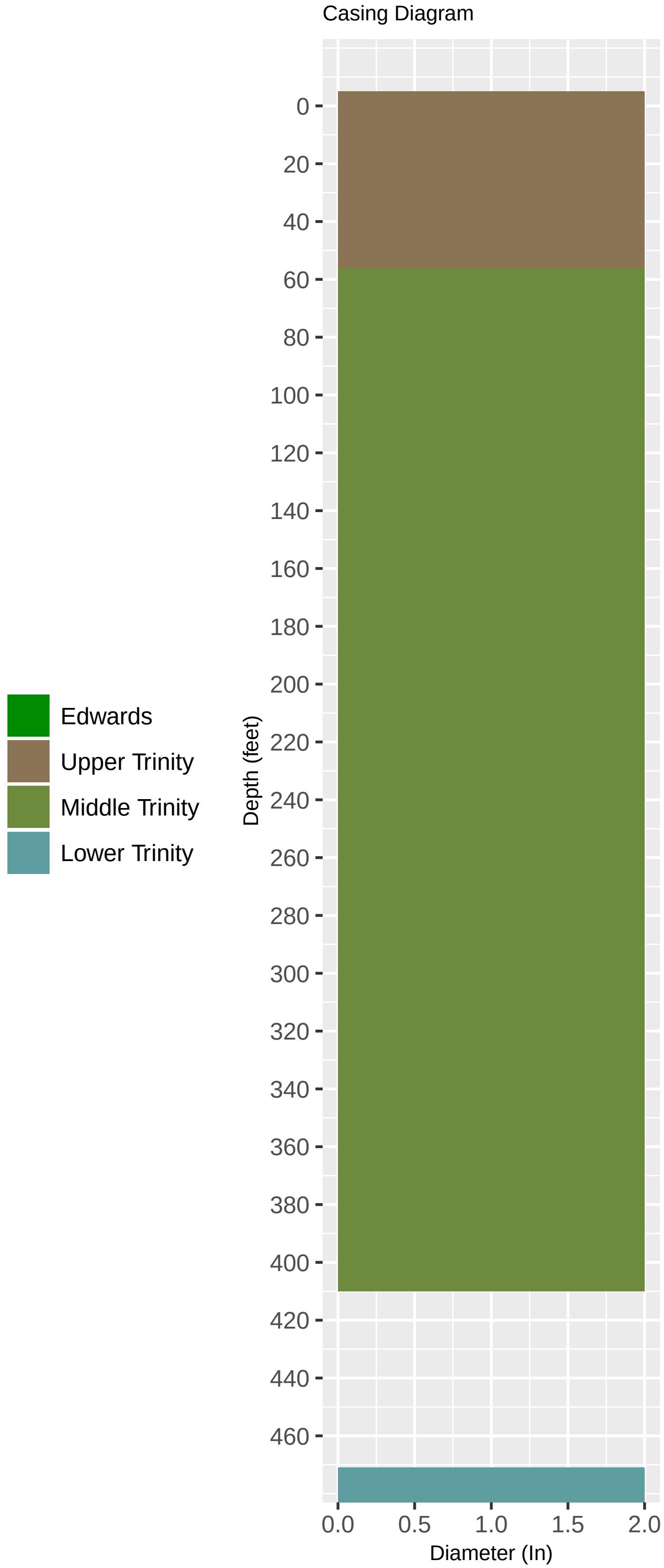

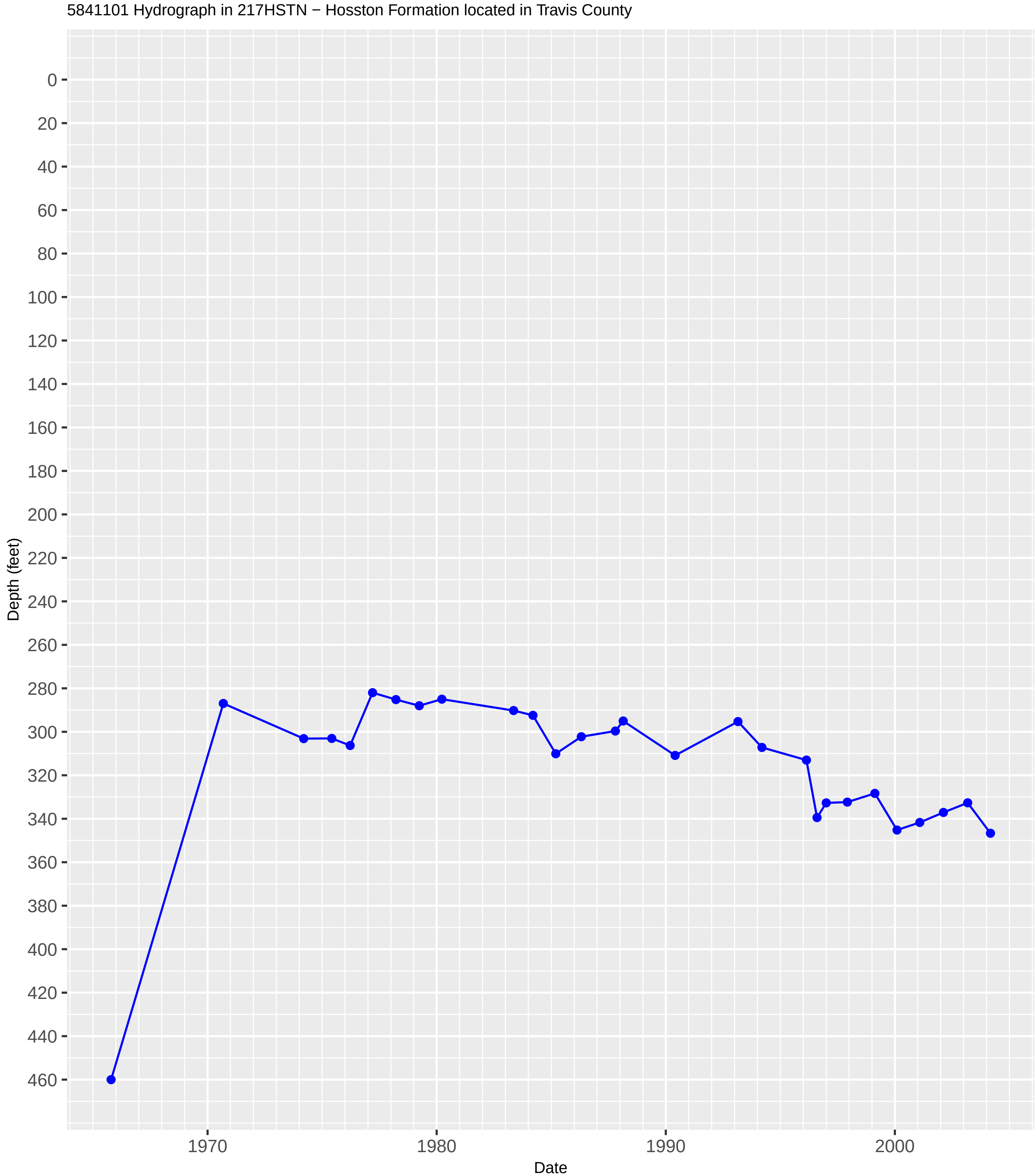

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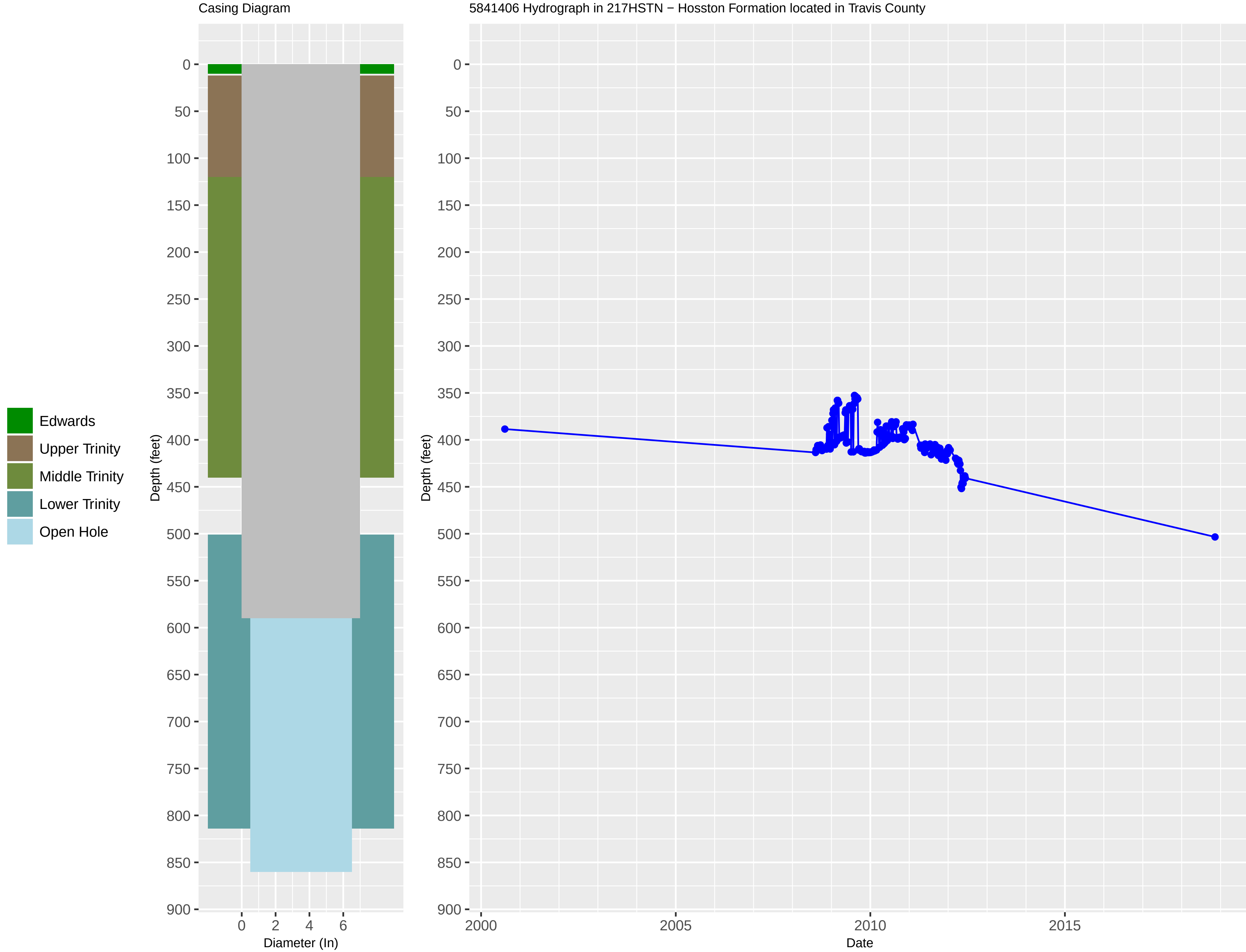

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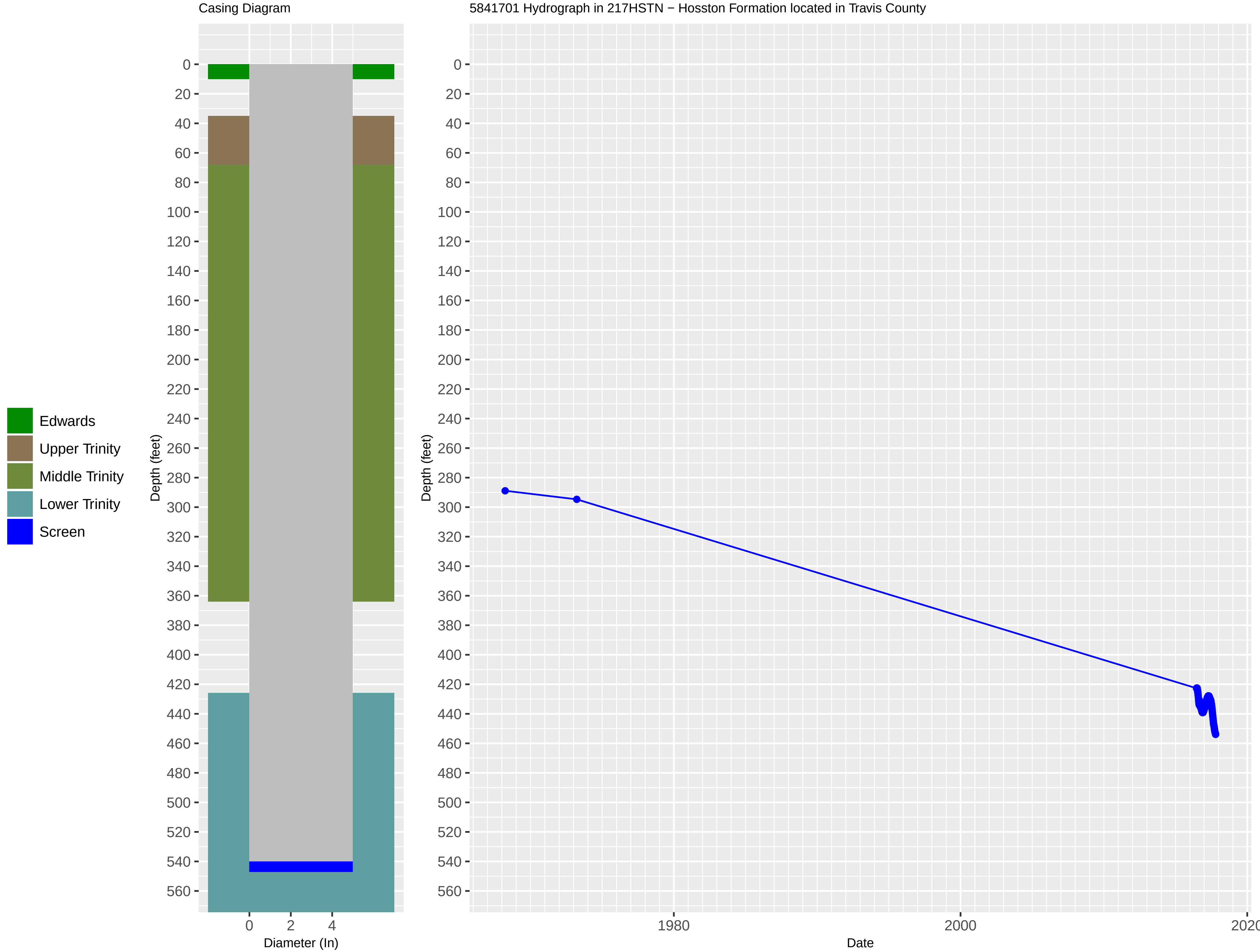
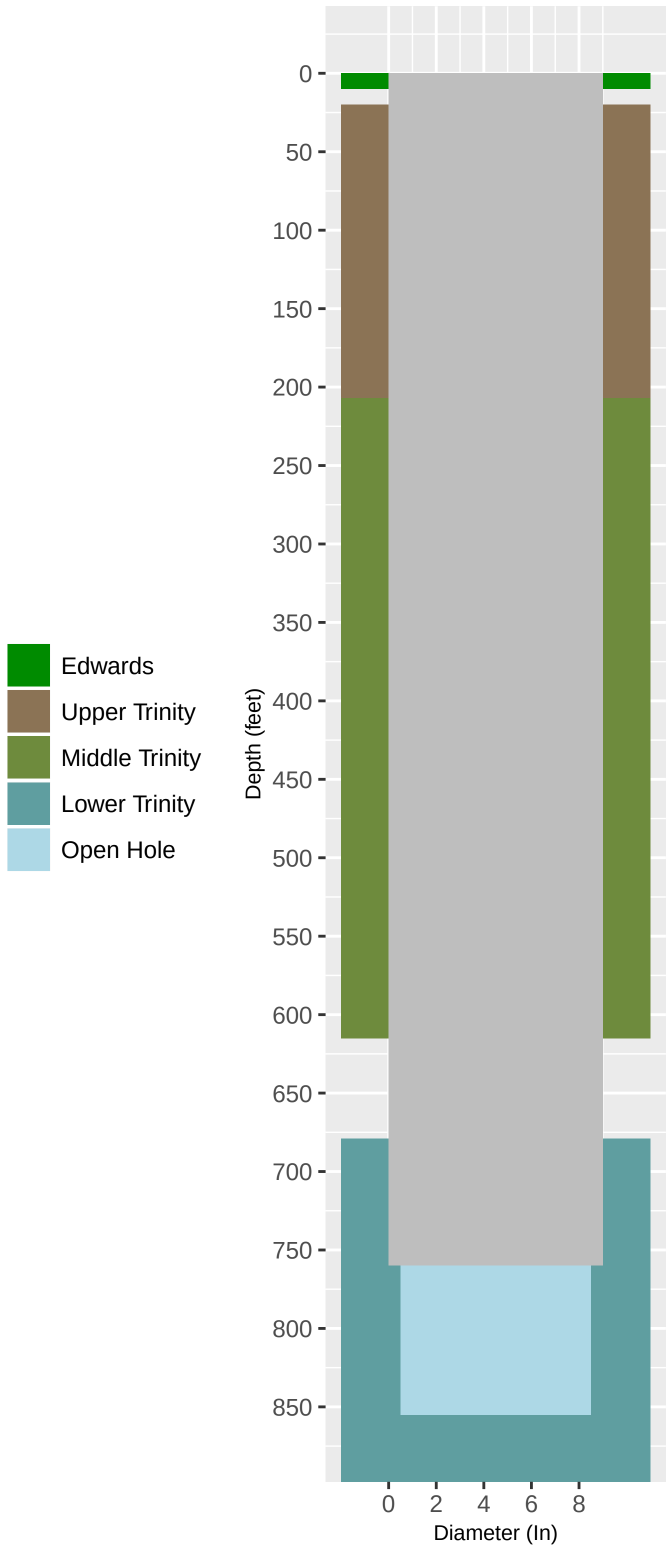
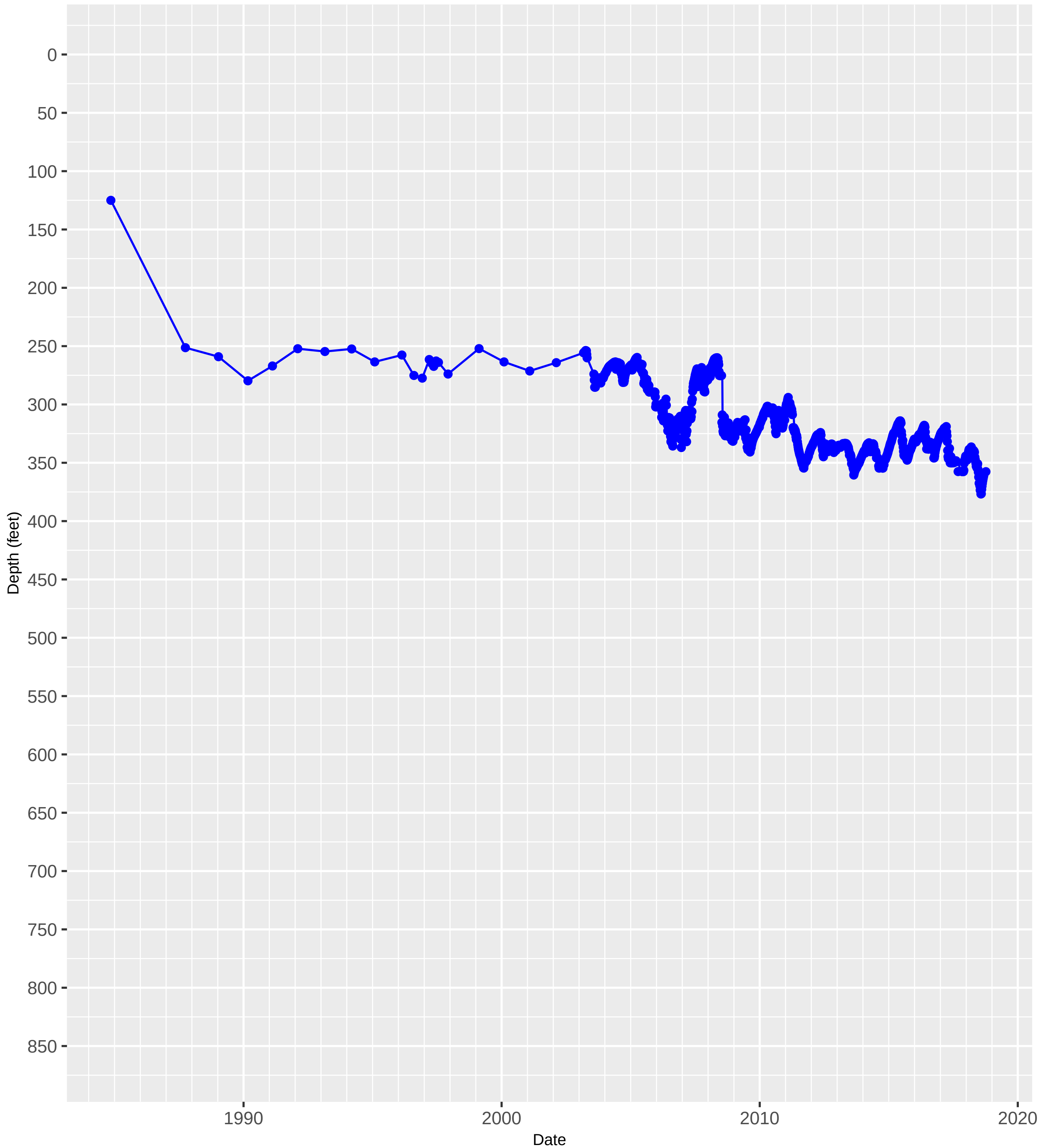


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

5850120 Hydrograph in 217HSTN − Hosston Formation located in Travis County





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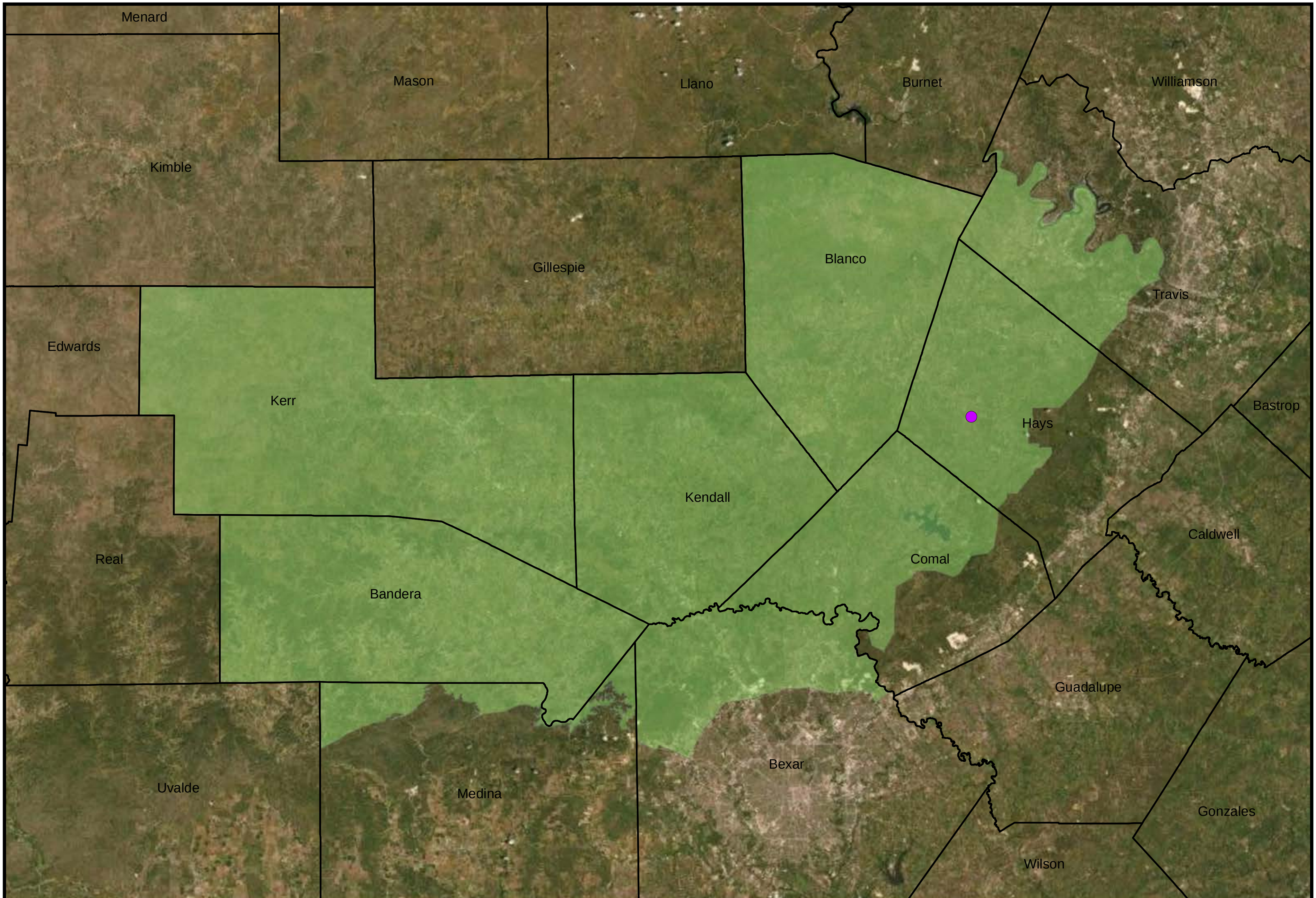


Aquifer

218ALRS - Antlers Sand

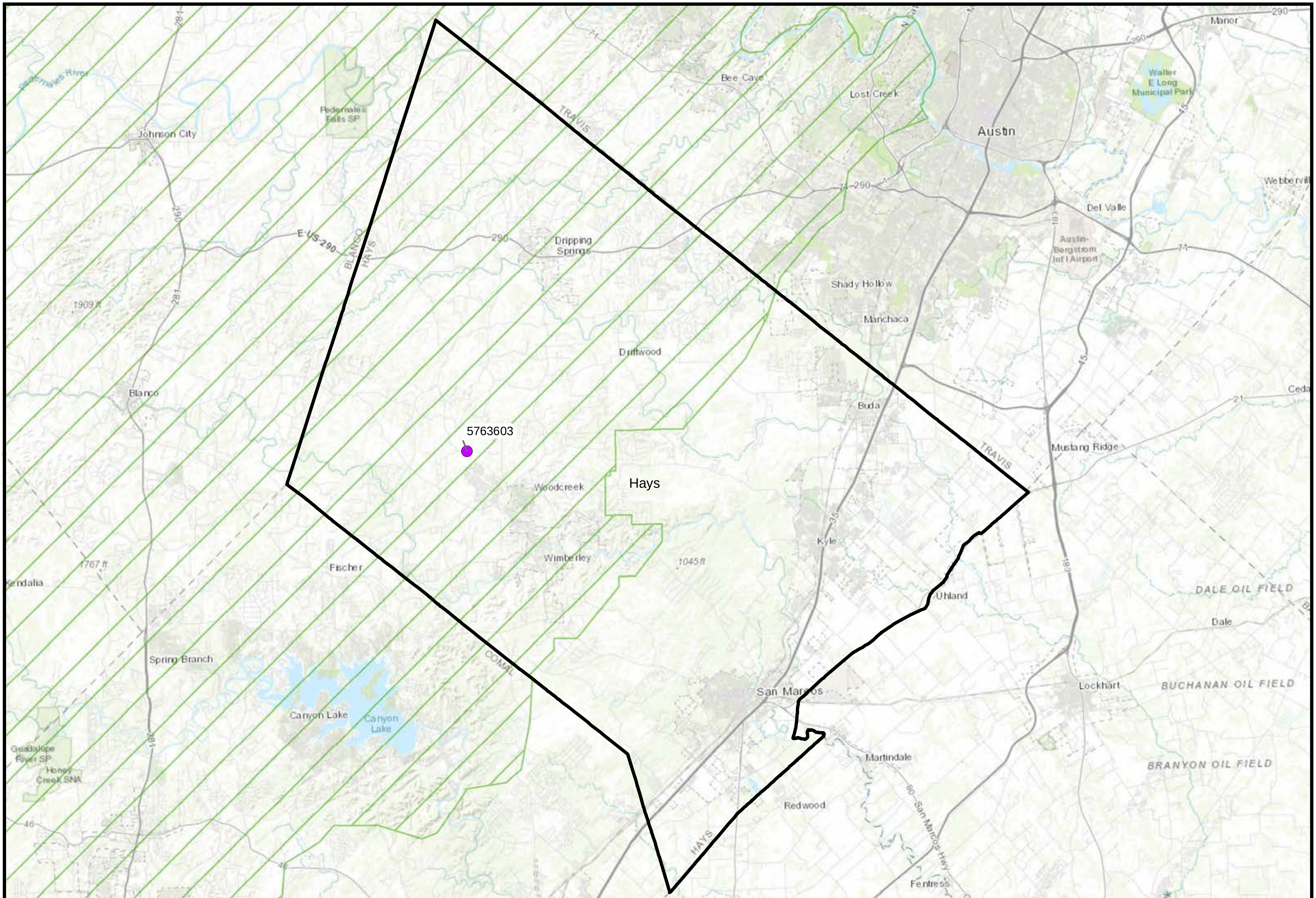
GMA 9

N

0 5 10

Miles

Map of Hydrograph Well Locations
218ALRS
Antlers Sand



Aquifer

218ALRS - Antlers Sand

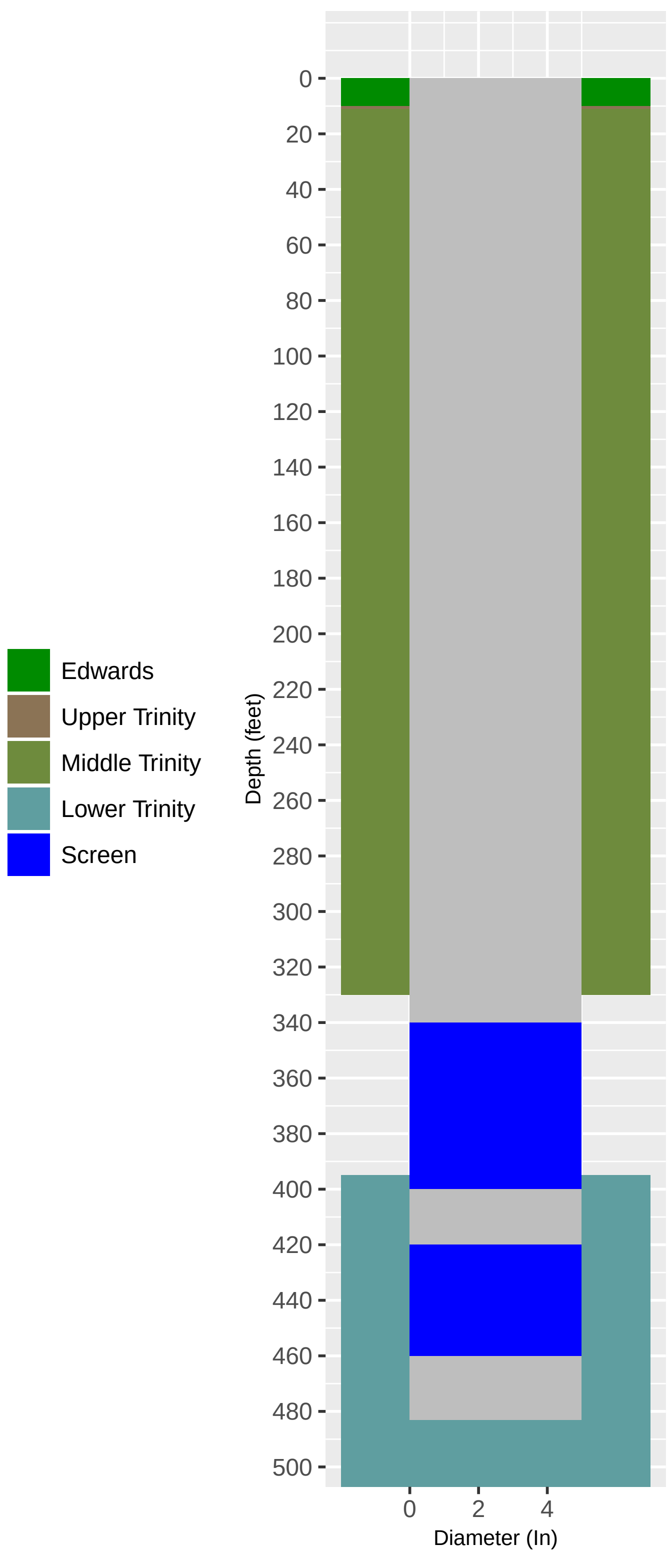
GMA 9

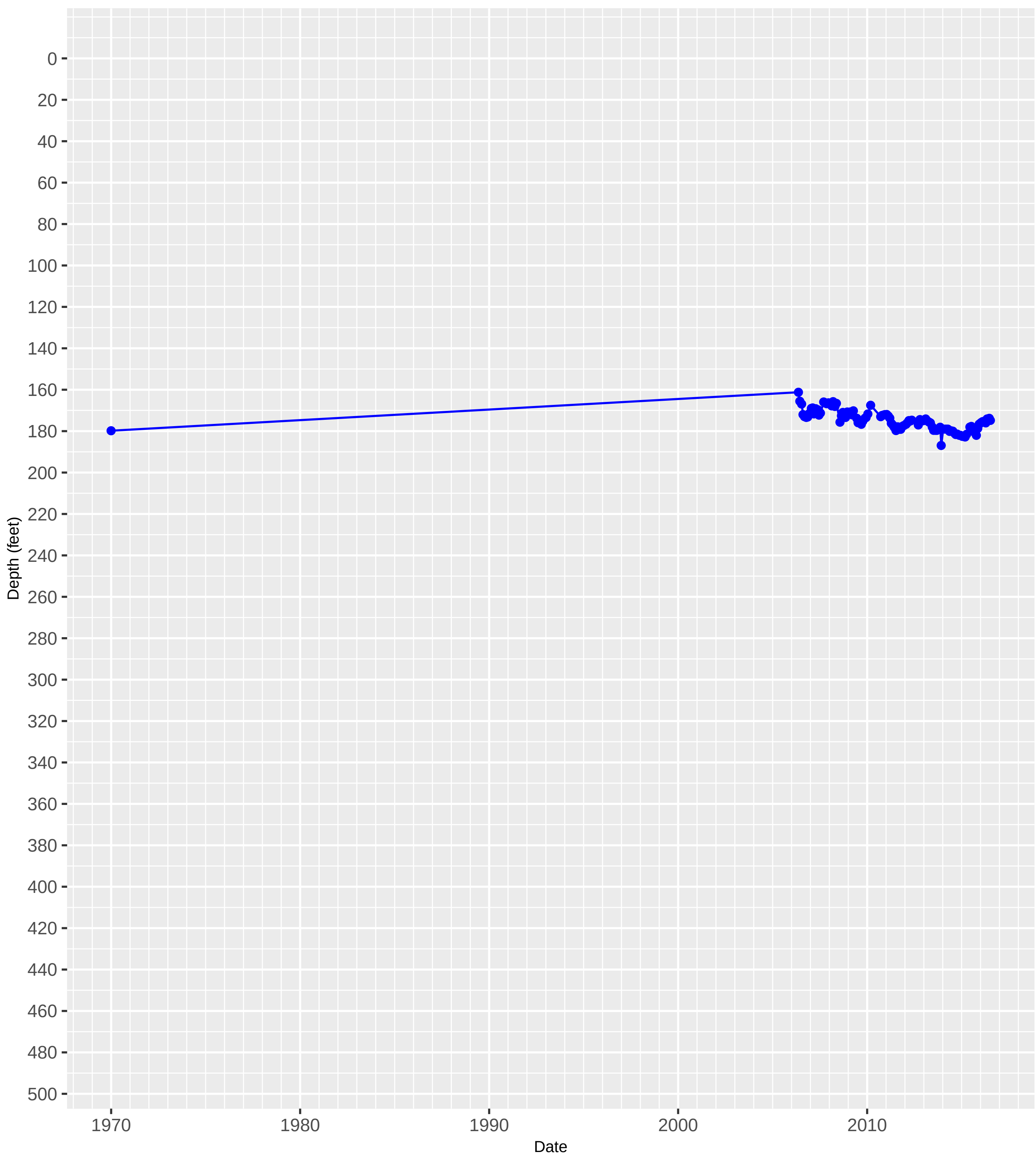
N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Hays County
218ALRS
Antlers Sand





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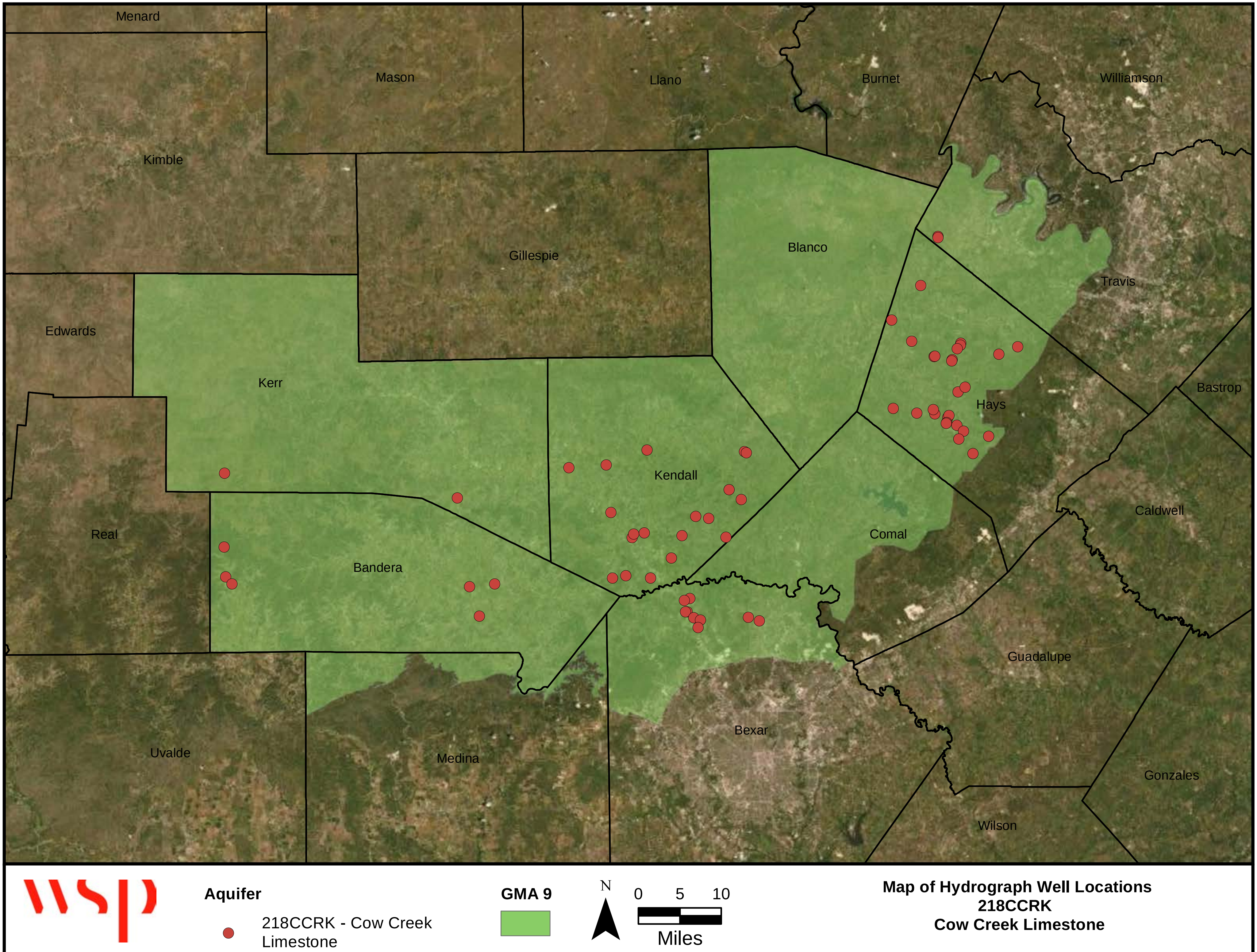
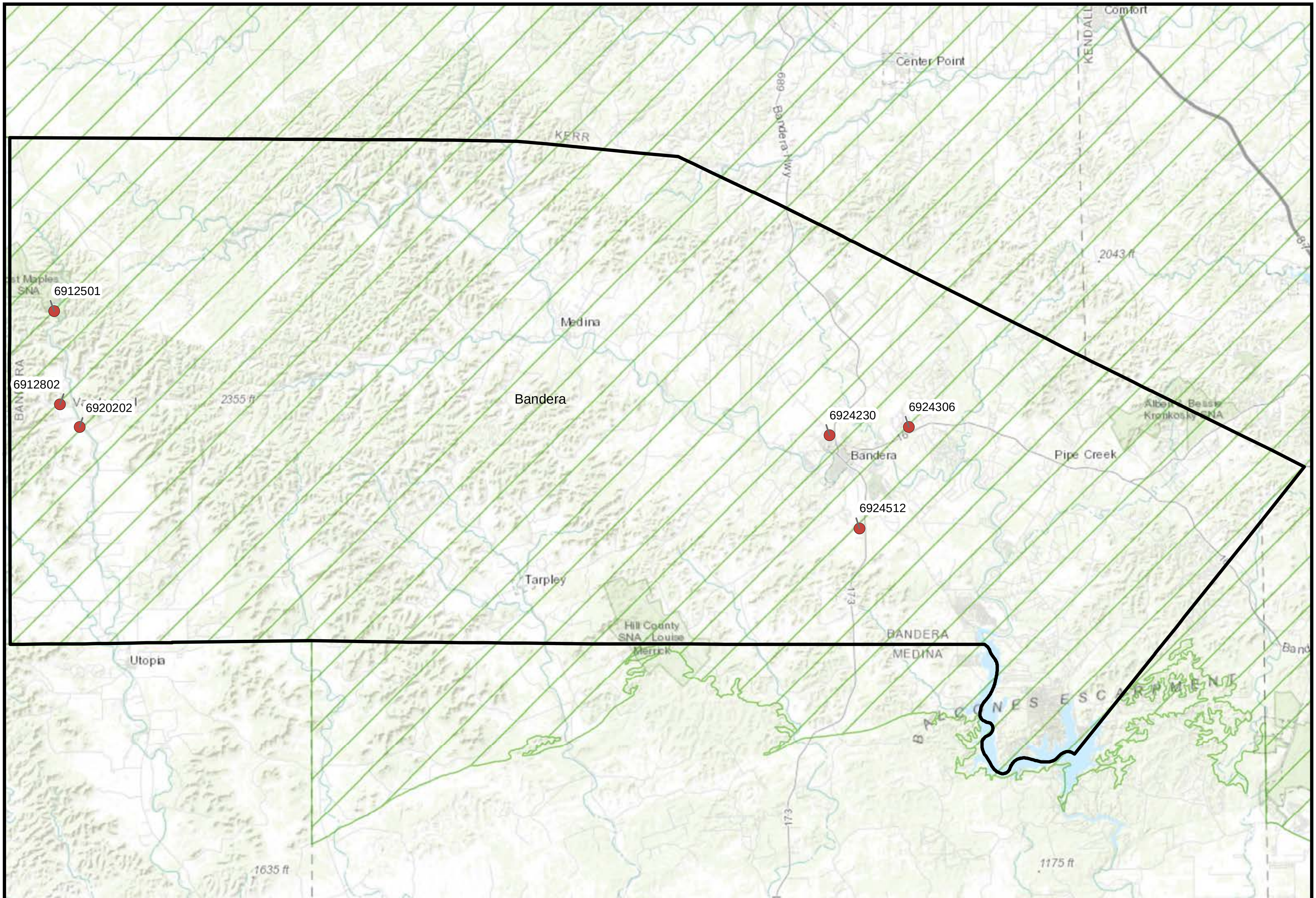
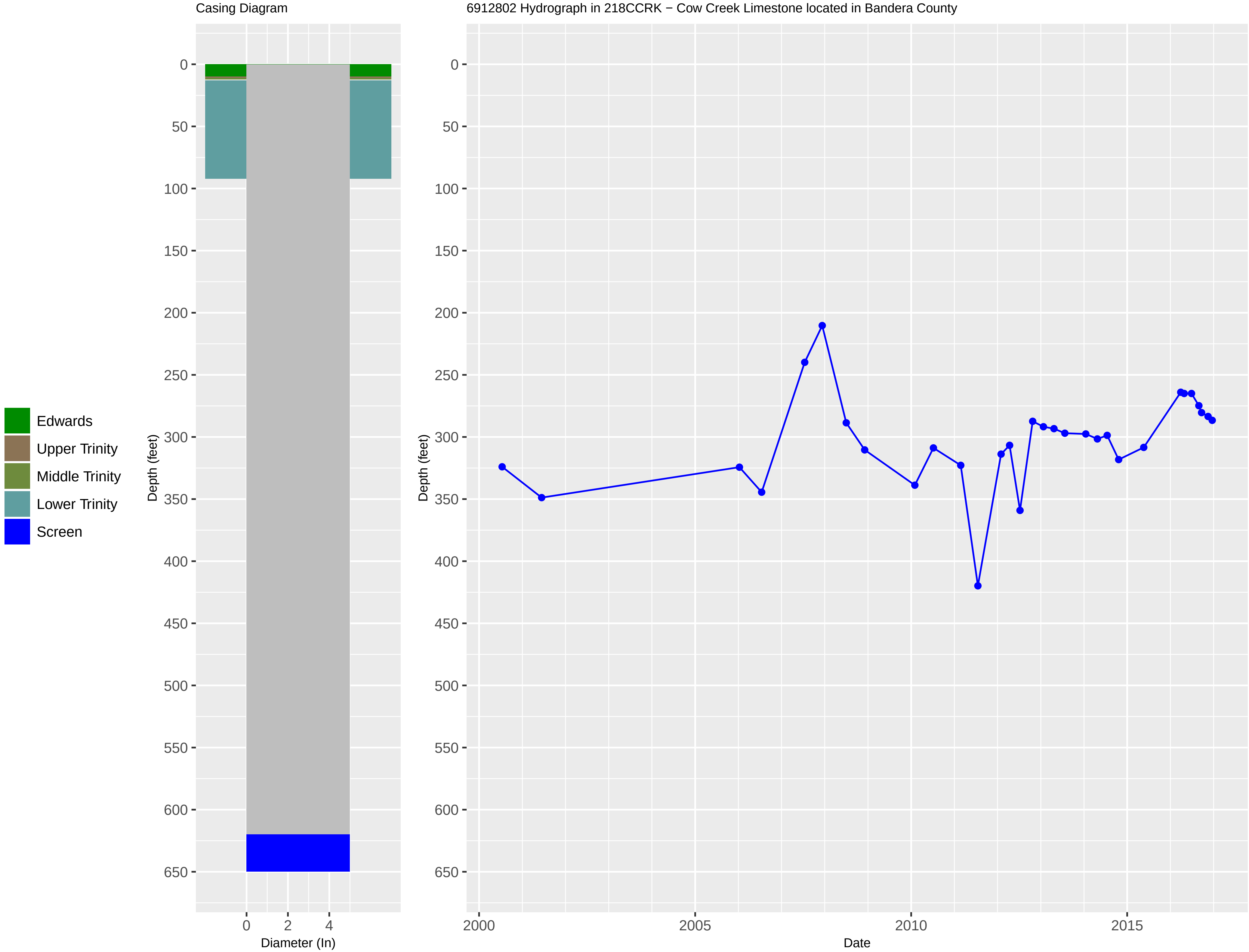


Map of Hydrograph Well Locations
218CCRK
Cow Creek Limestone



Map of Hydrograph Well Locations in Bandera County
218CCRK
Cow Creek Limestone

The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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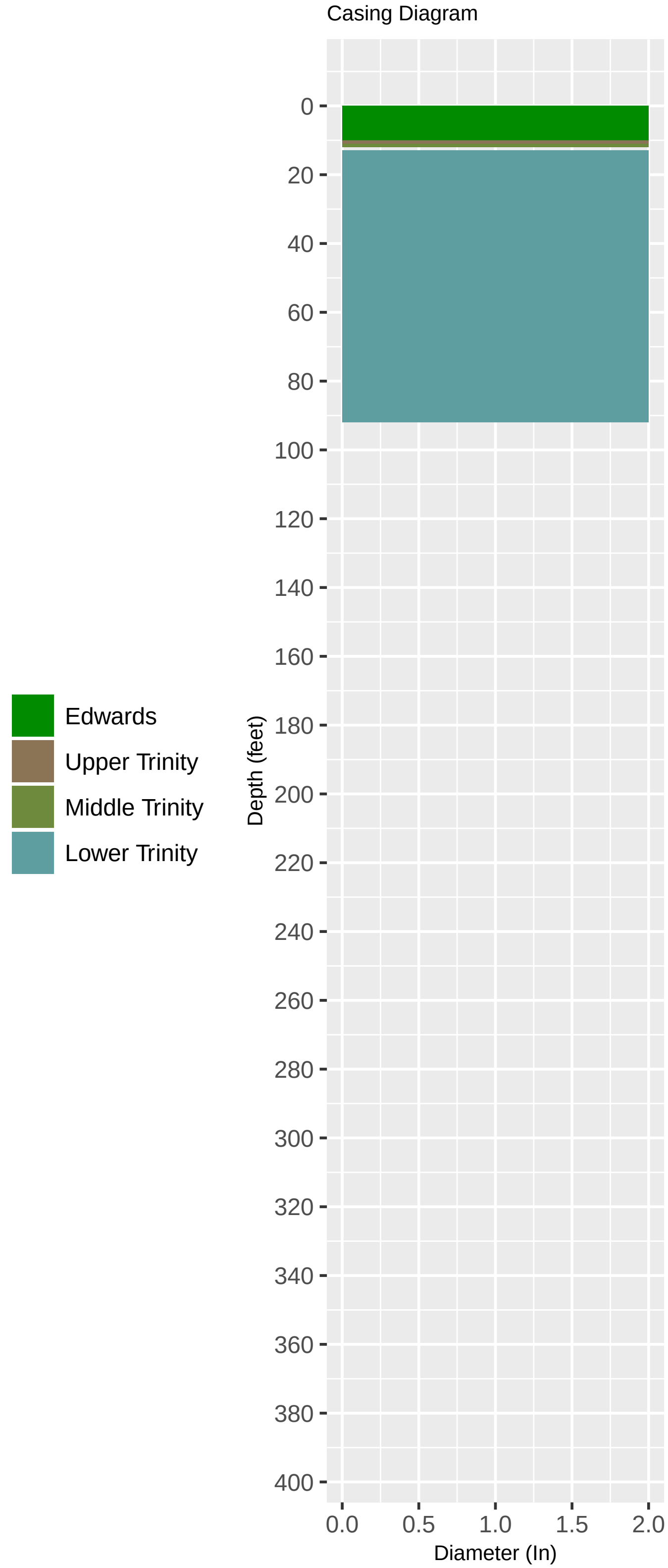

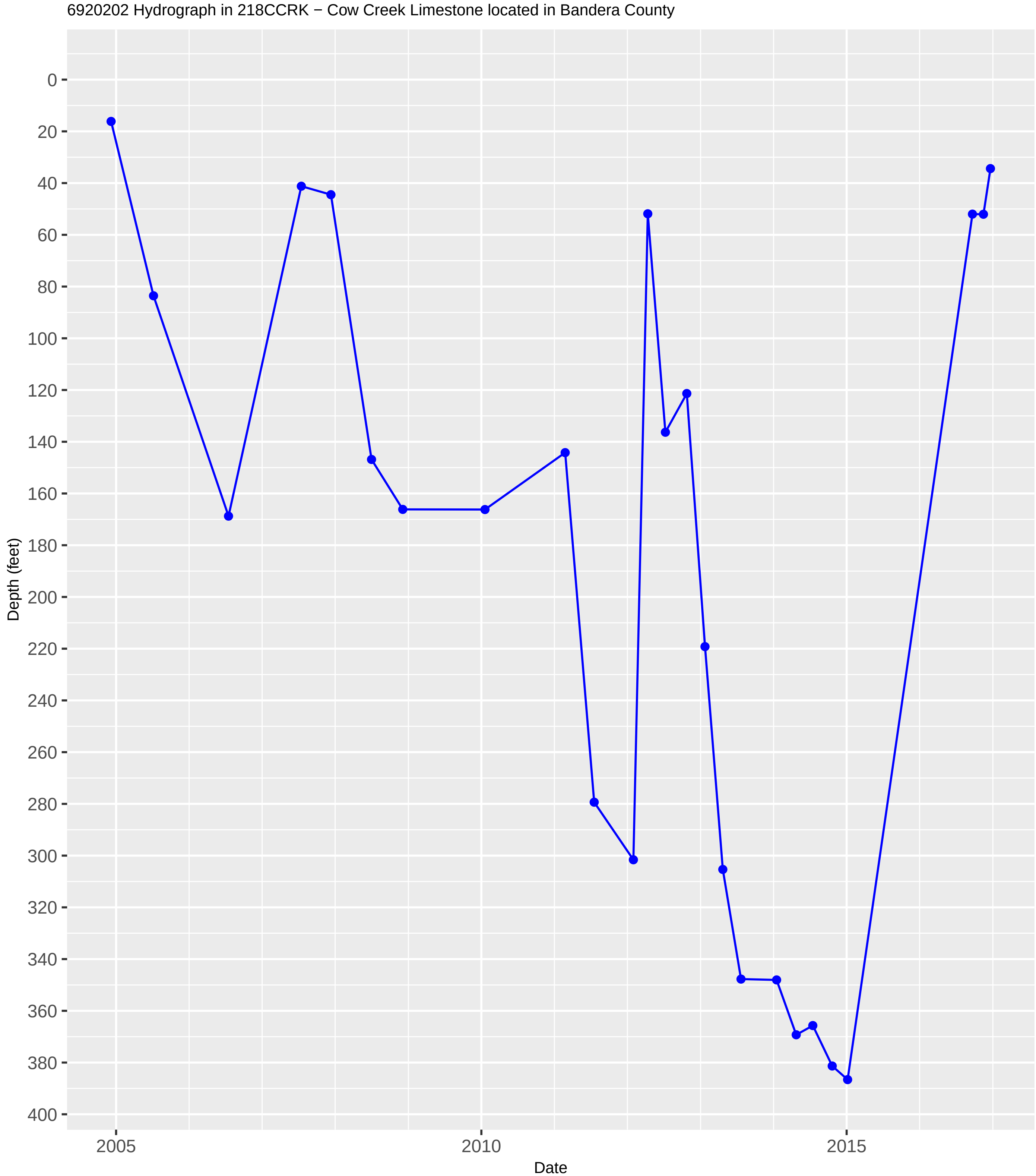

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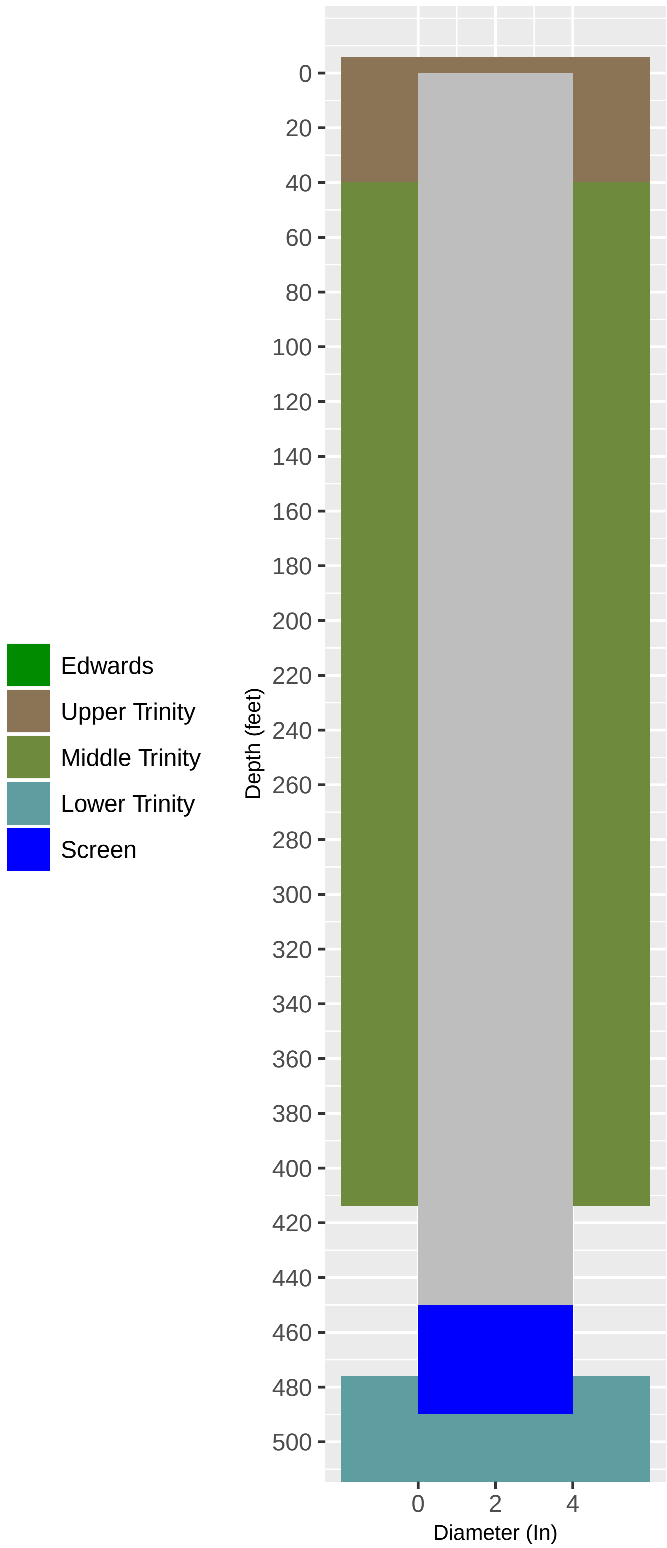
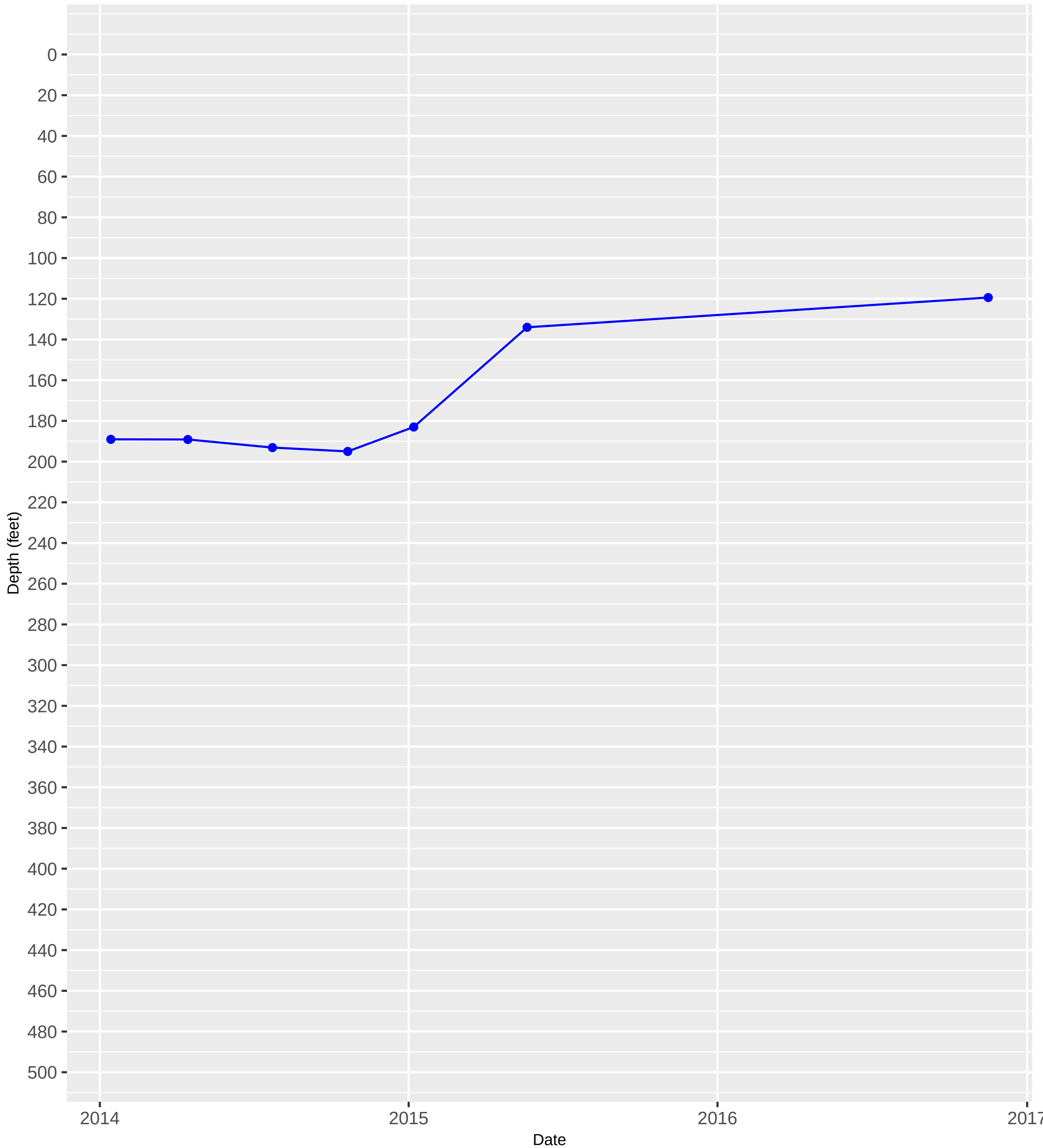
Casing Diagram



6924230 Hydrograph in 218CCRK − Cow Creek Limestone located in Bandera County



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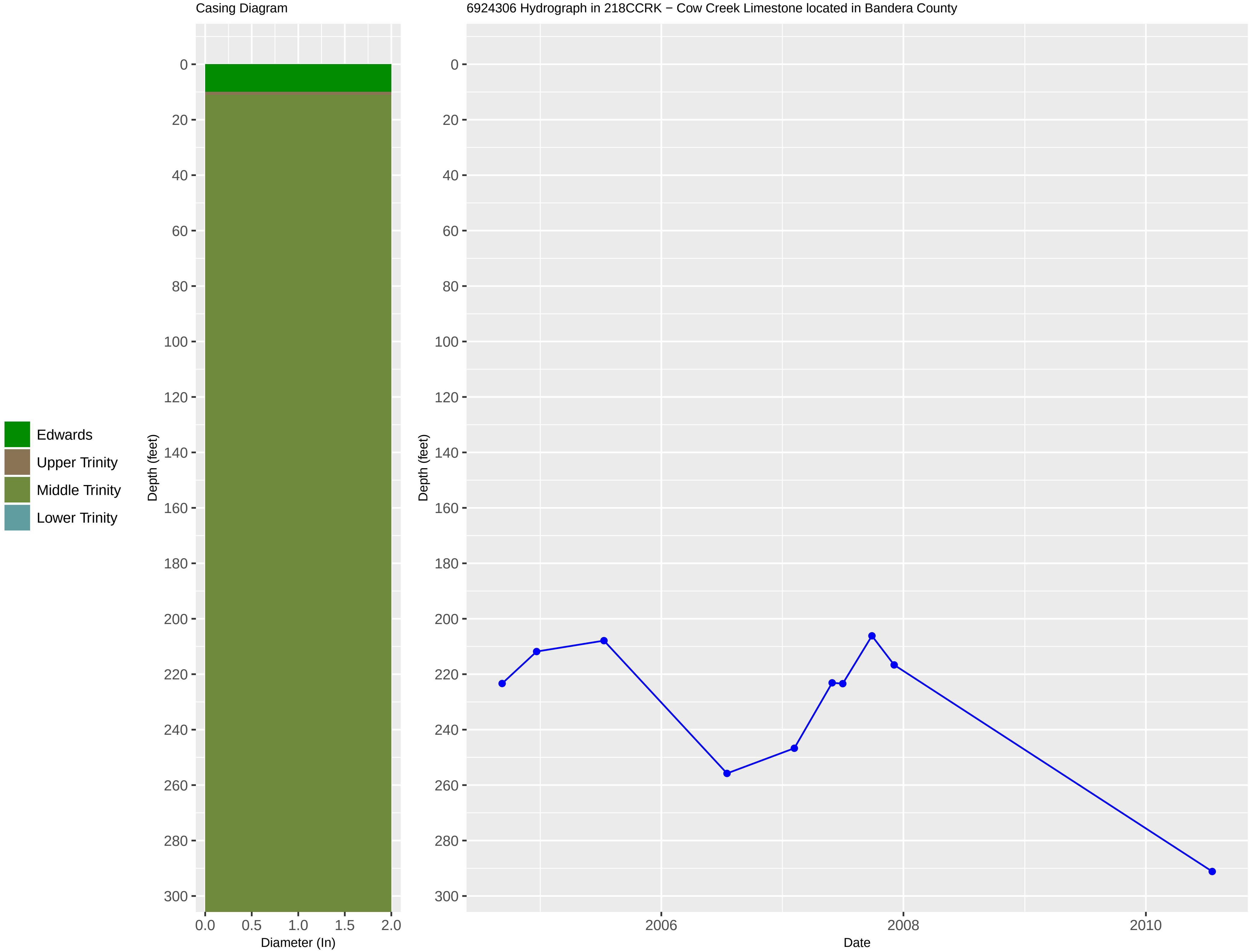

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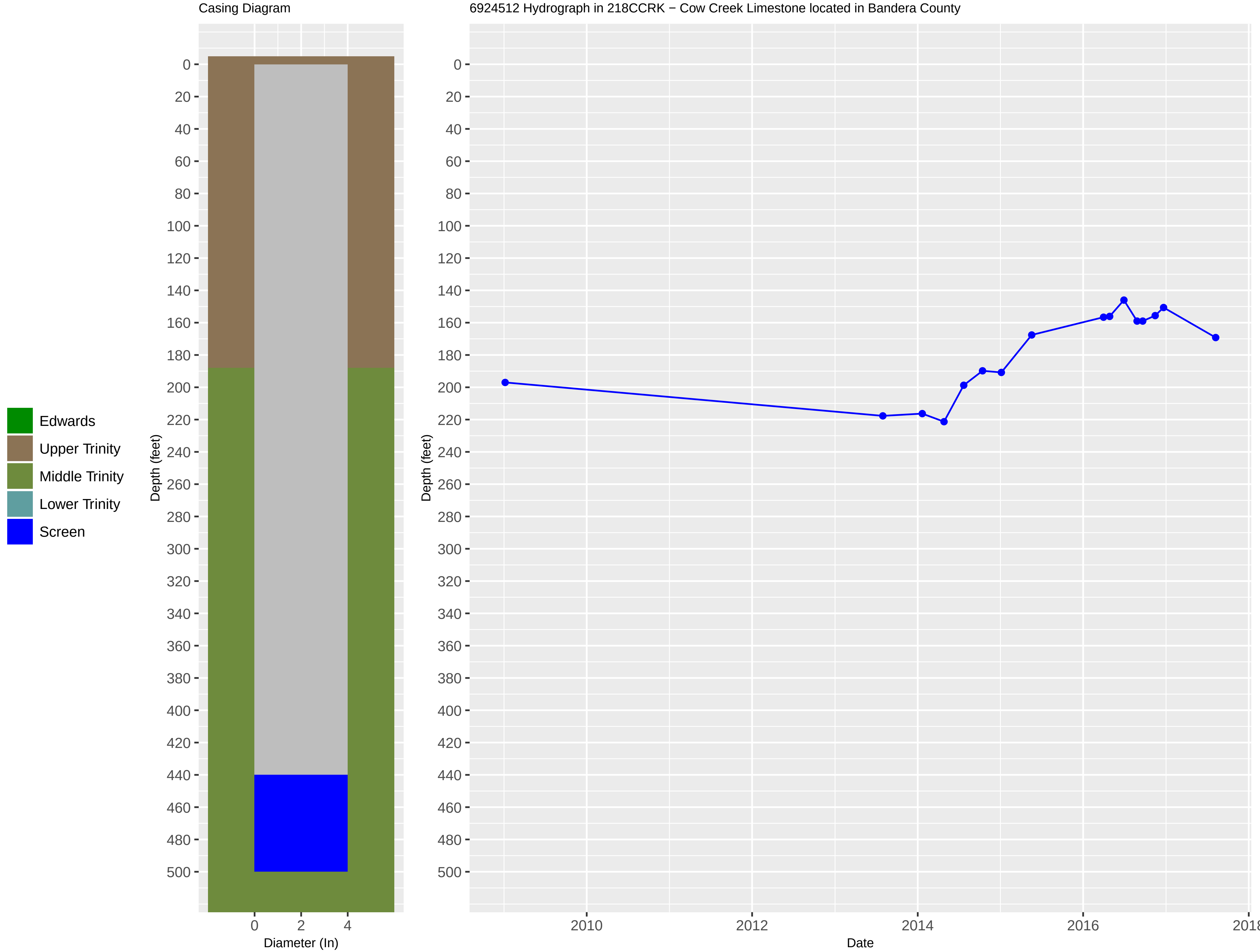
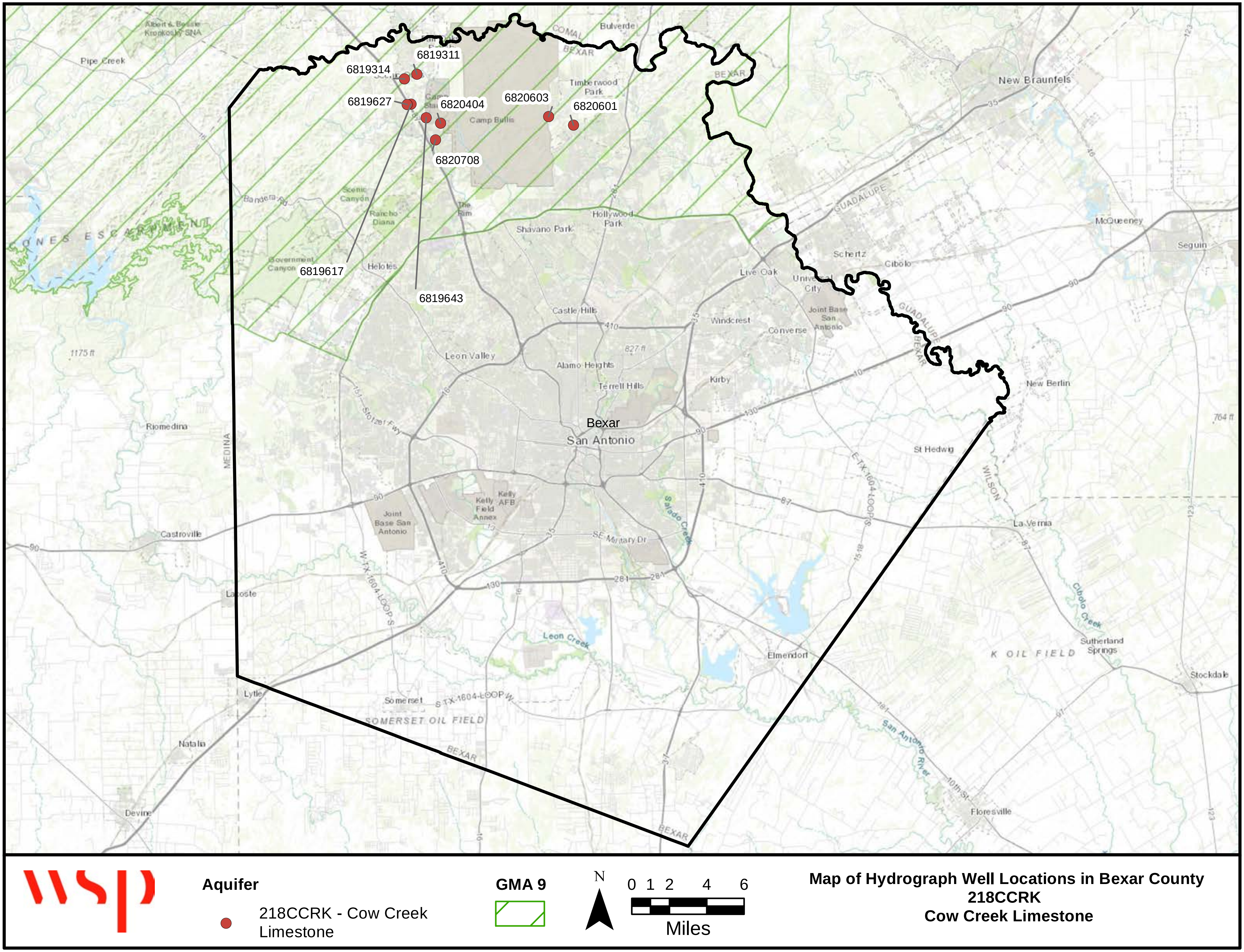
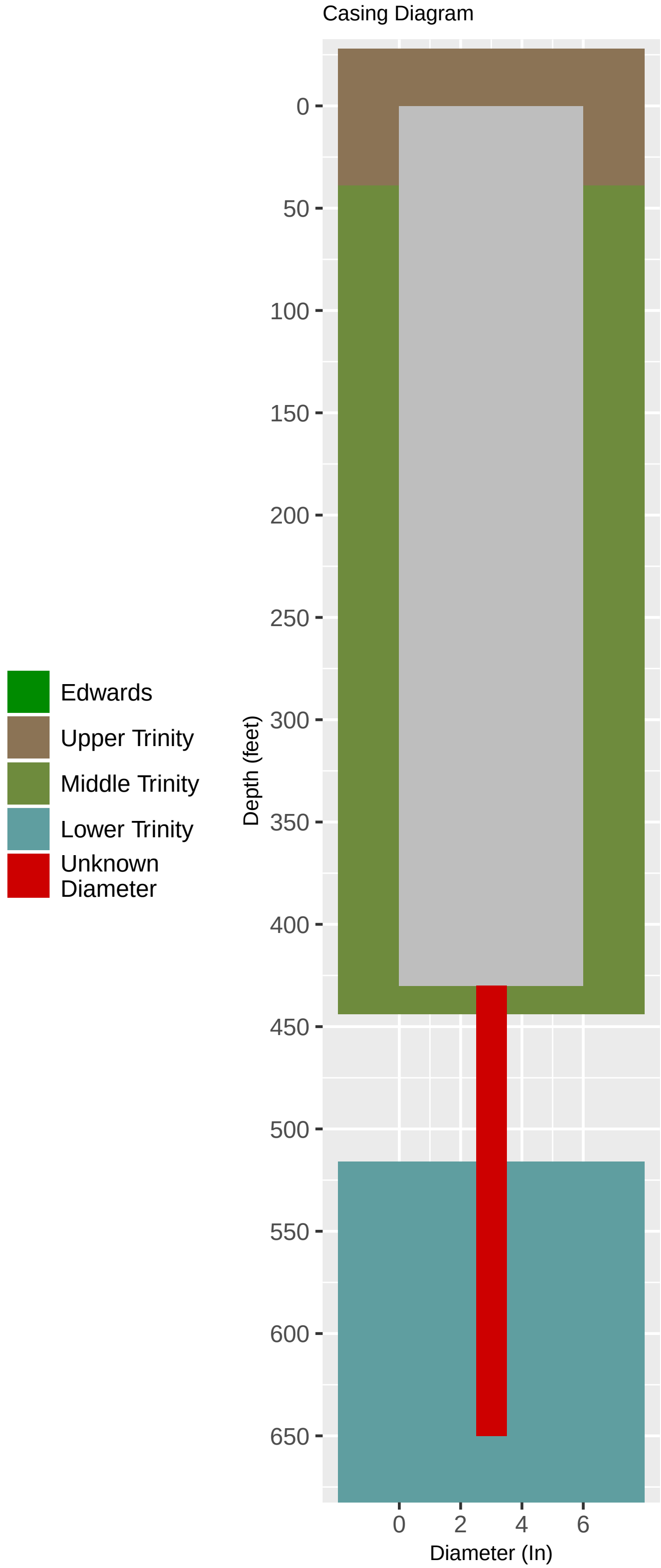
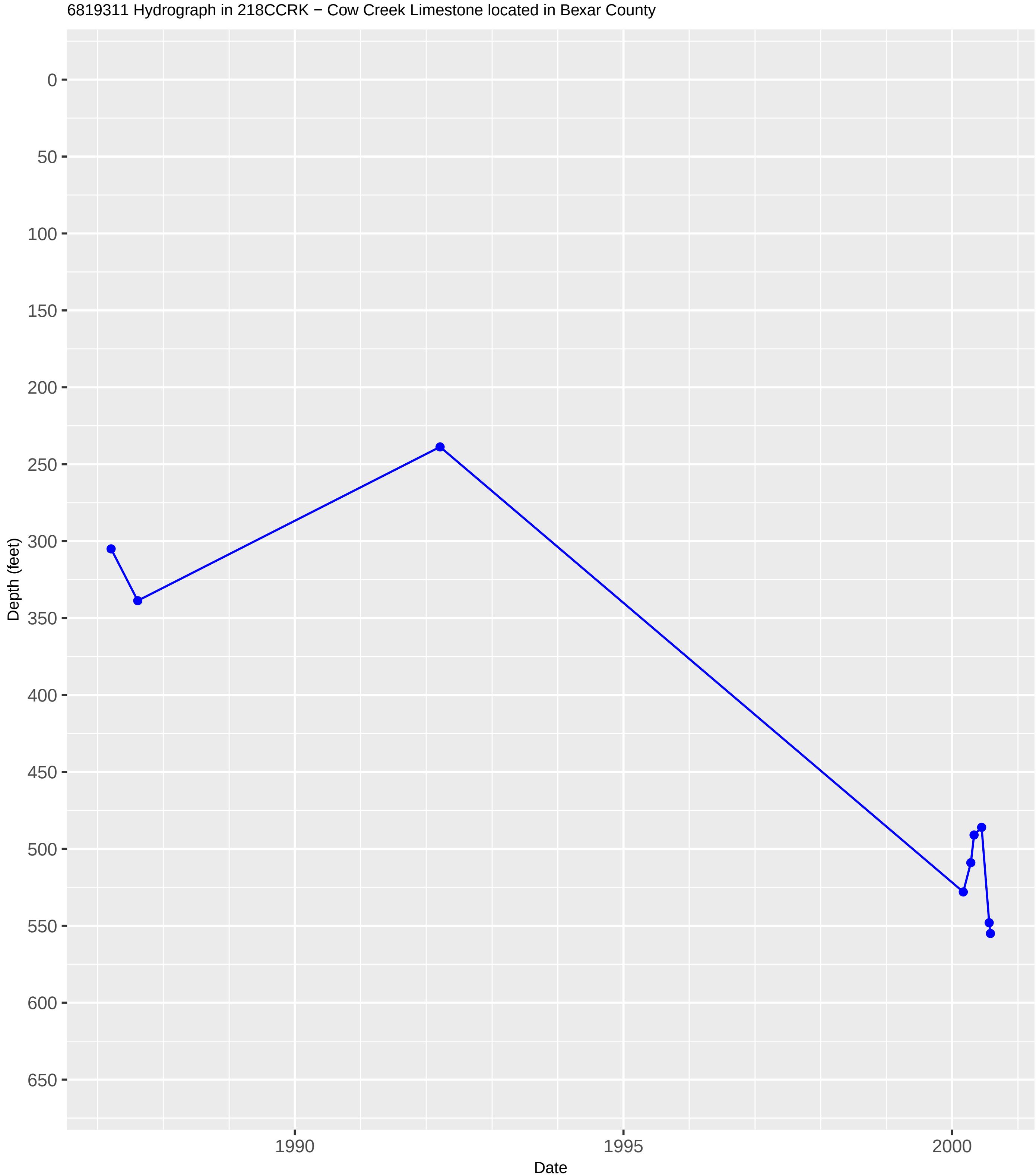


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



Map of Hydrograph Well Locations in Bexar County
218CCRK
Cow Creek Limestone





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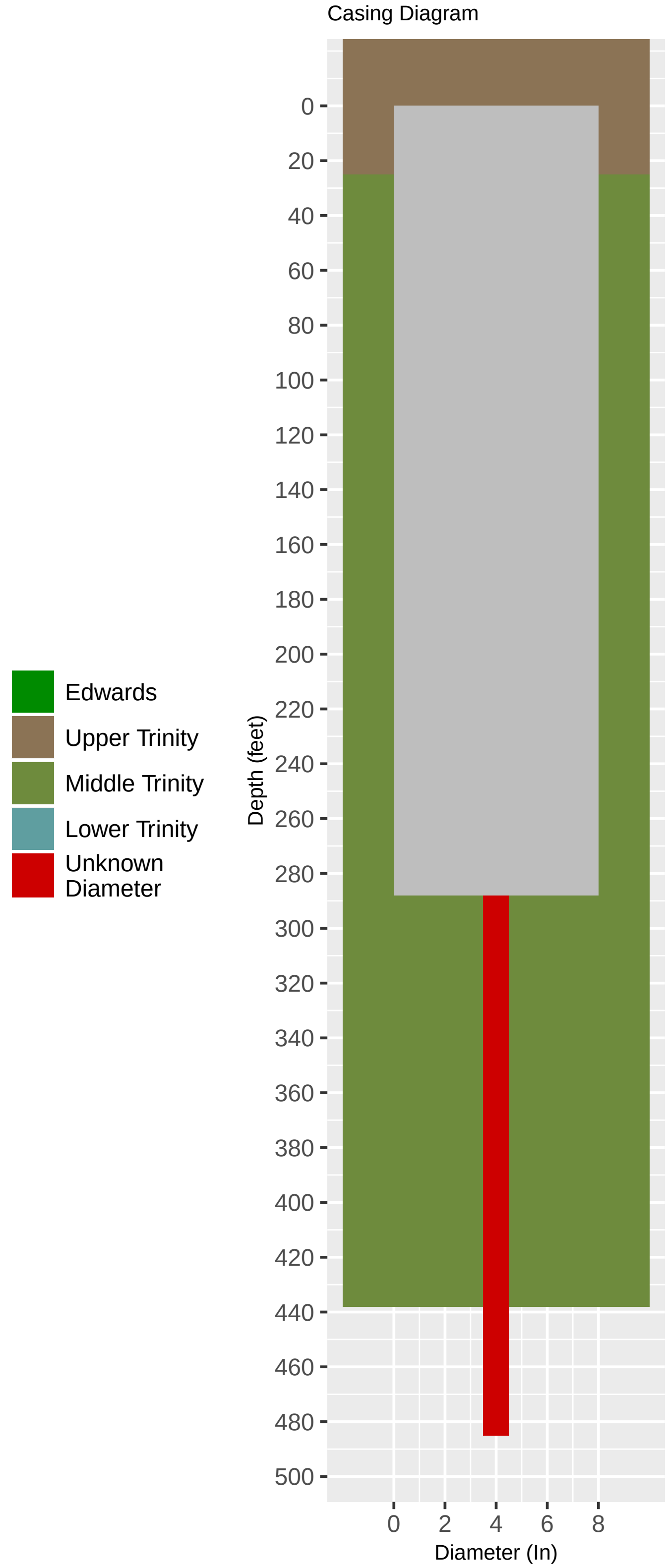

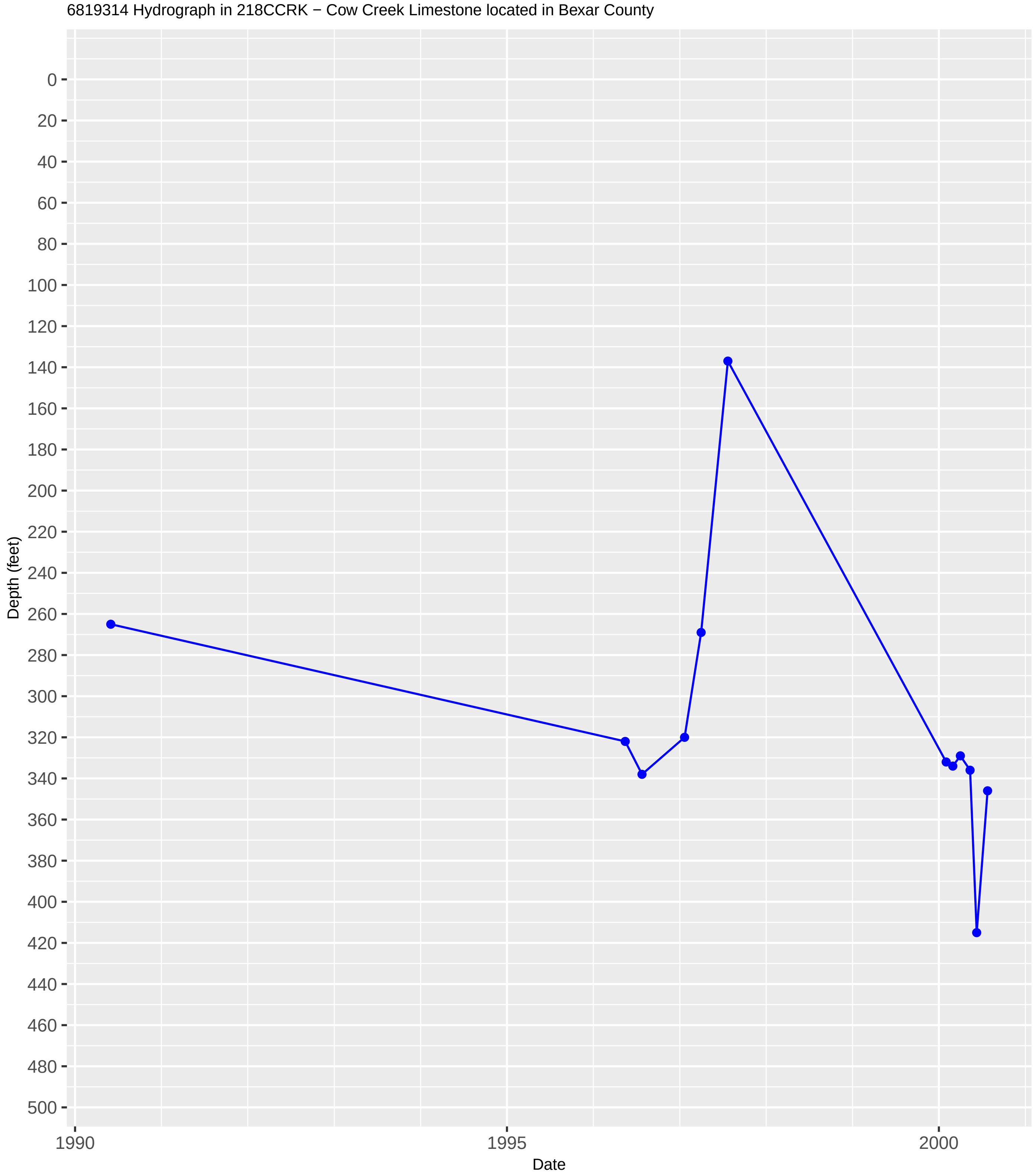

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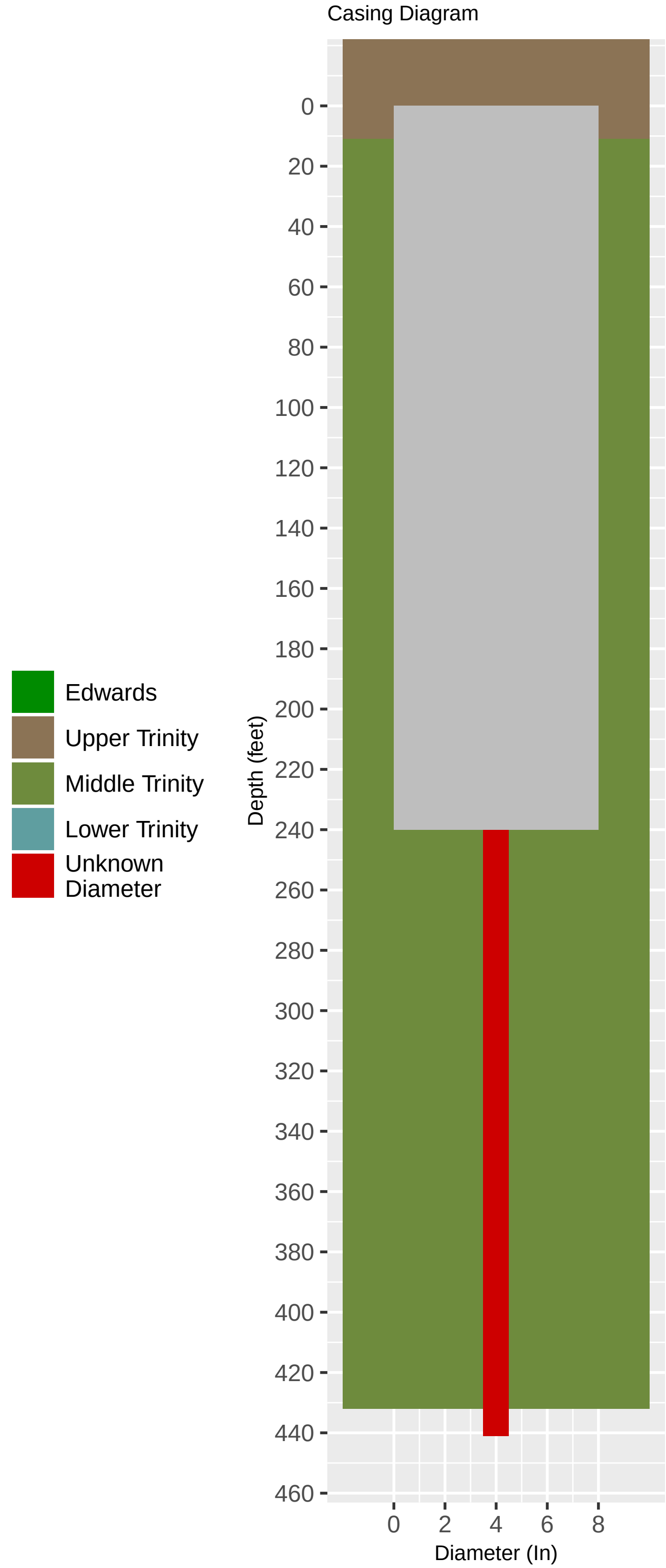
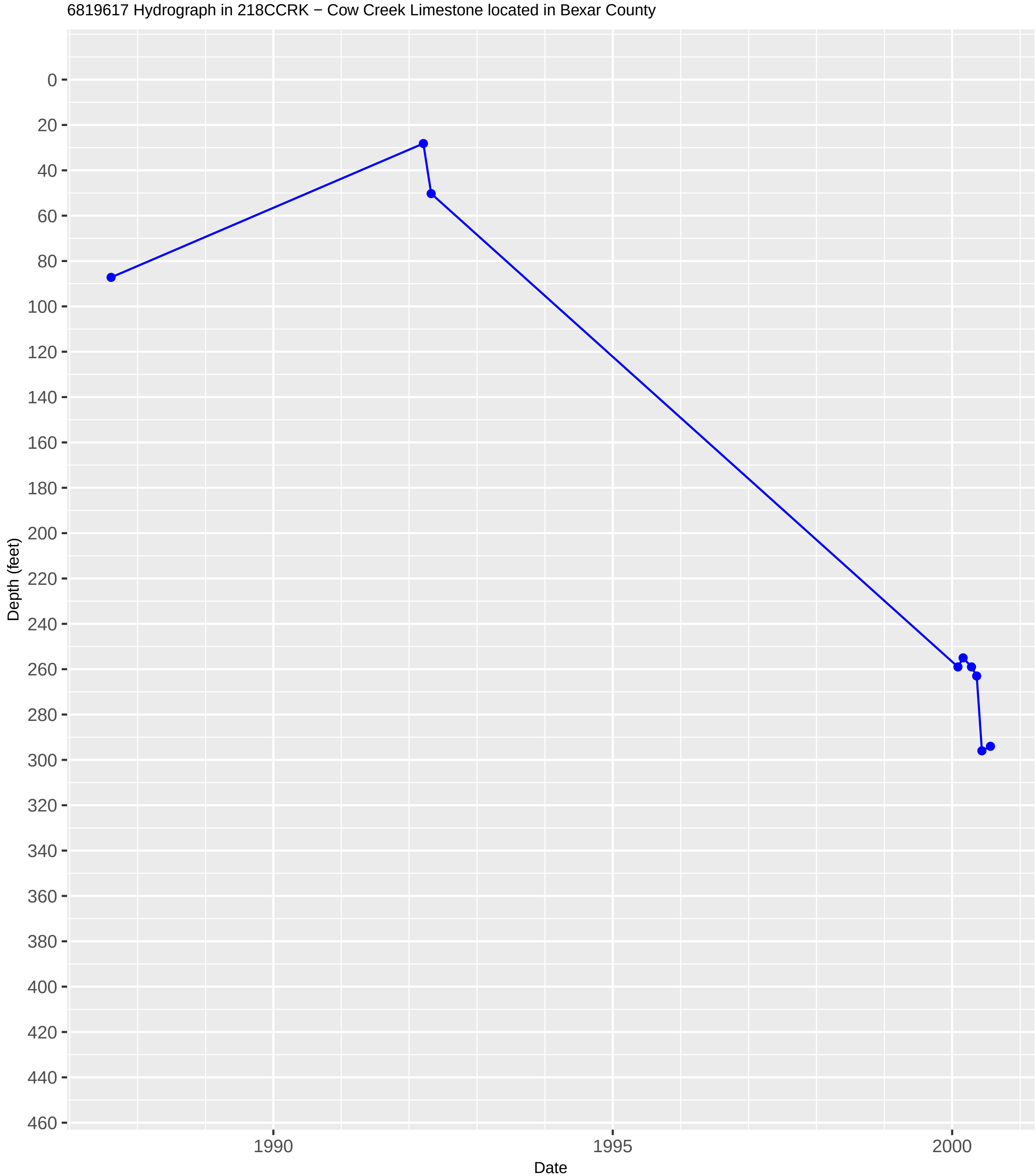
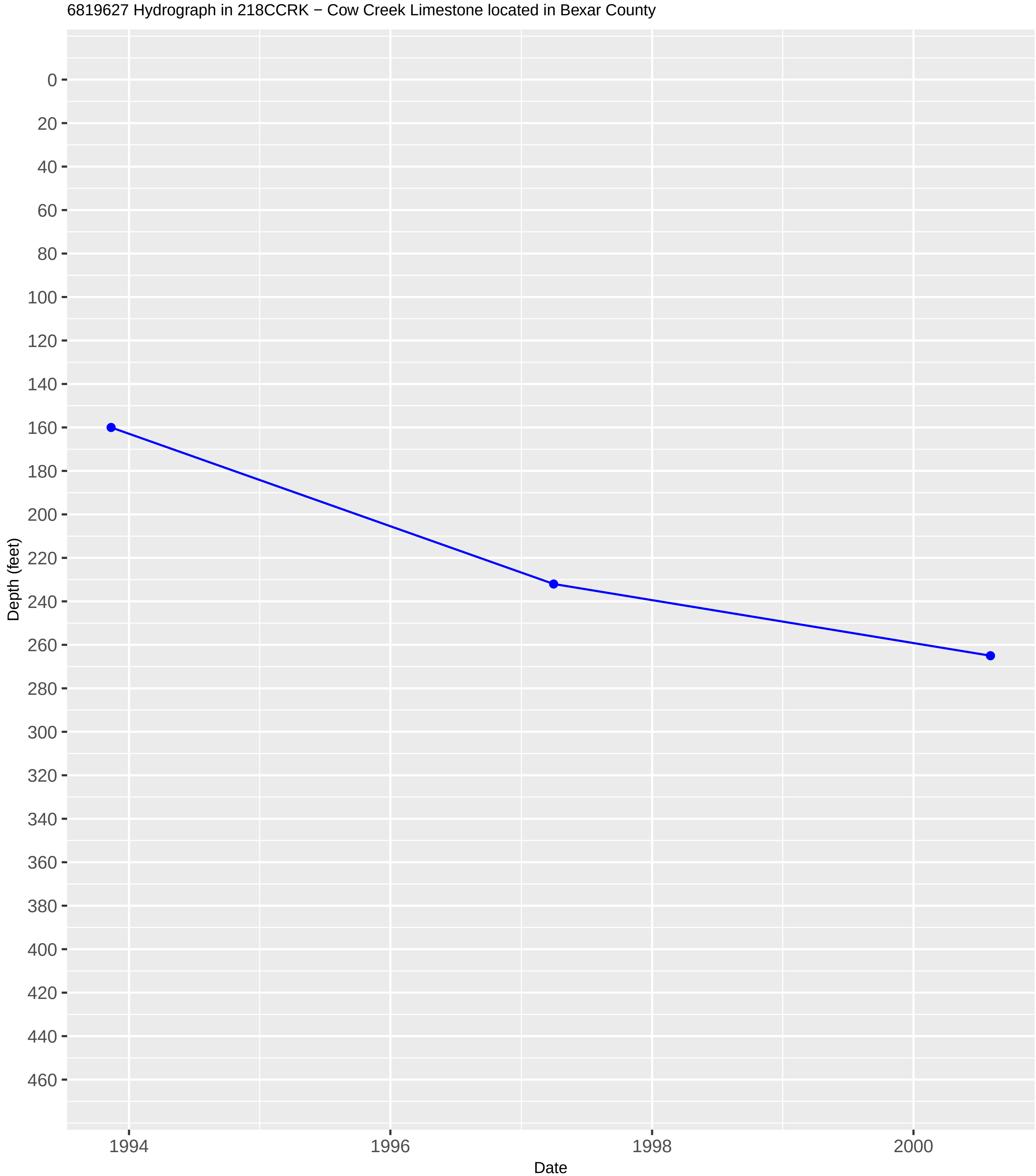




The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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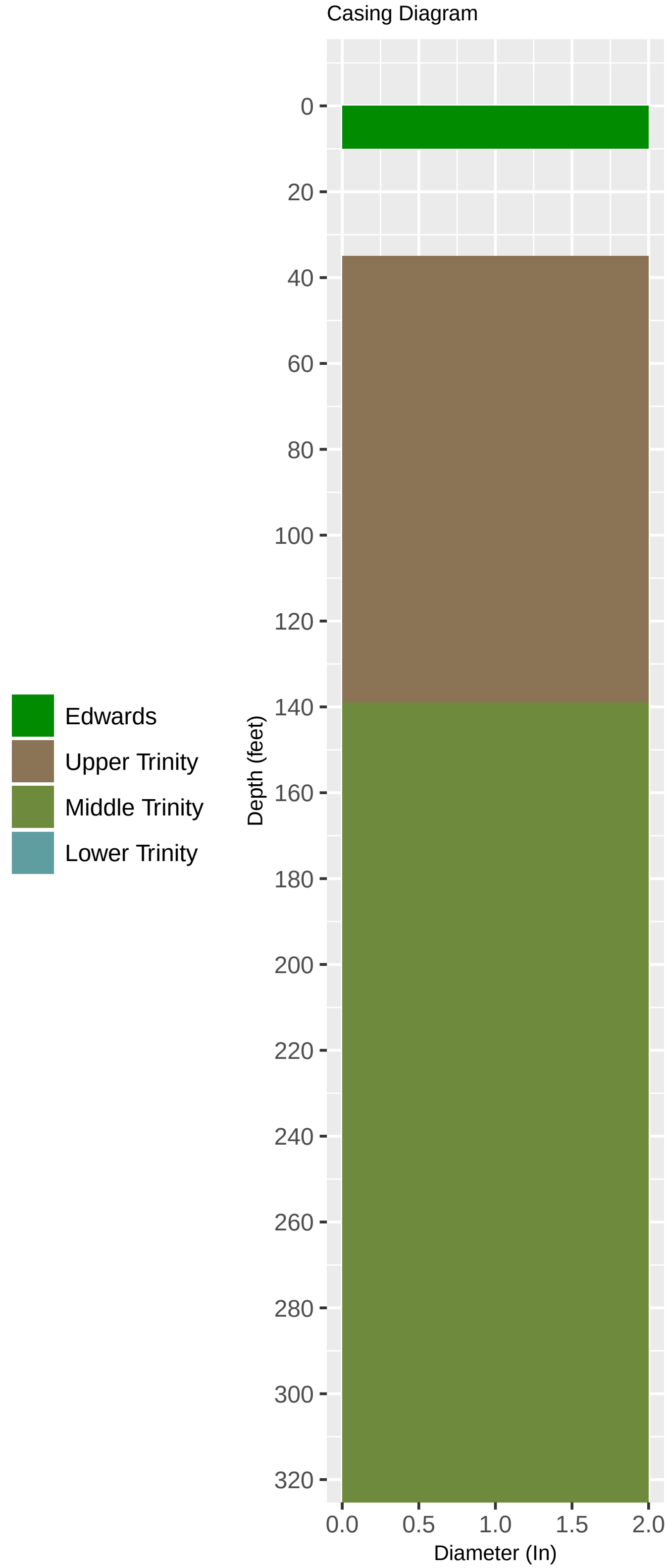
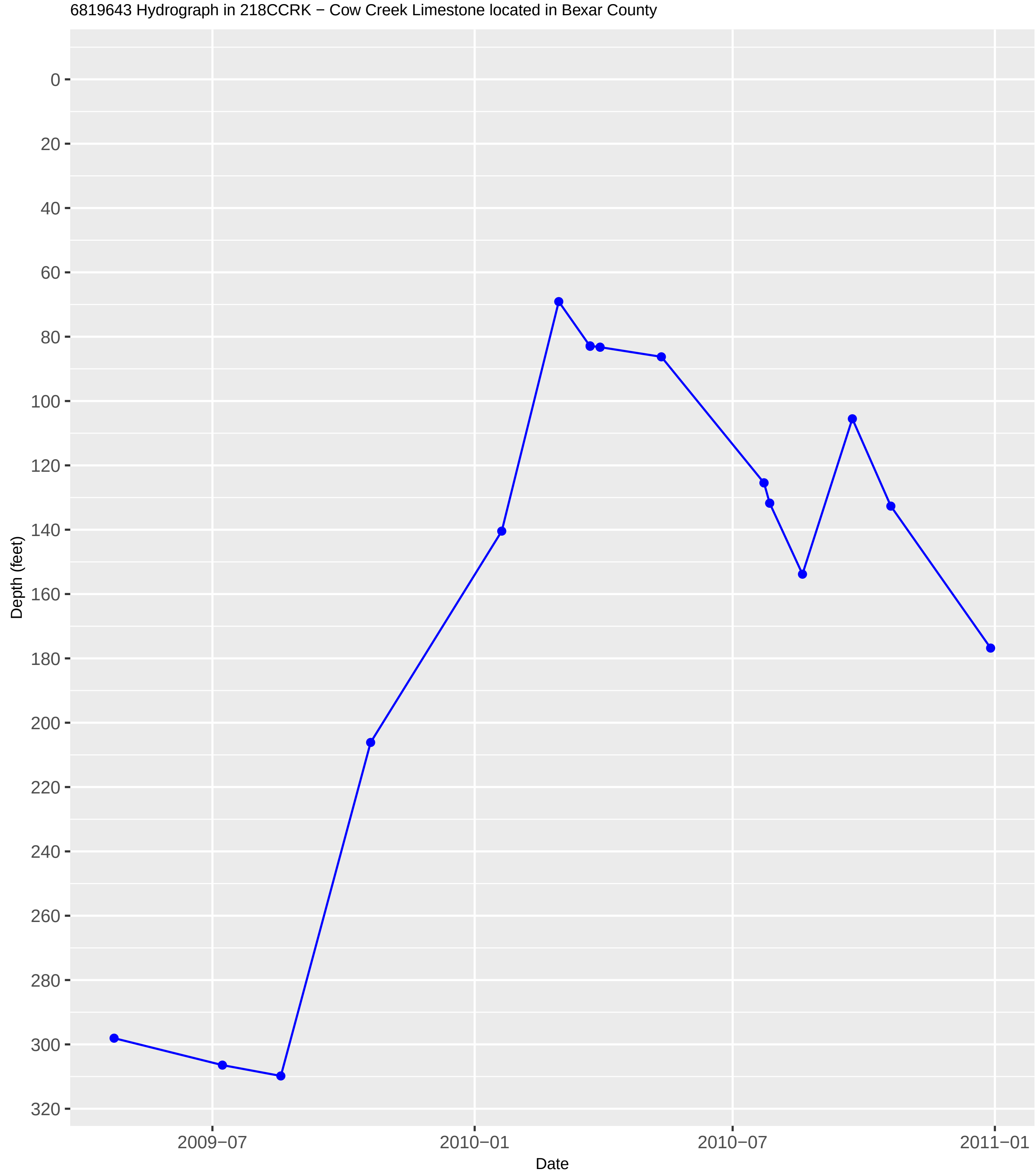
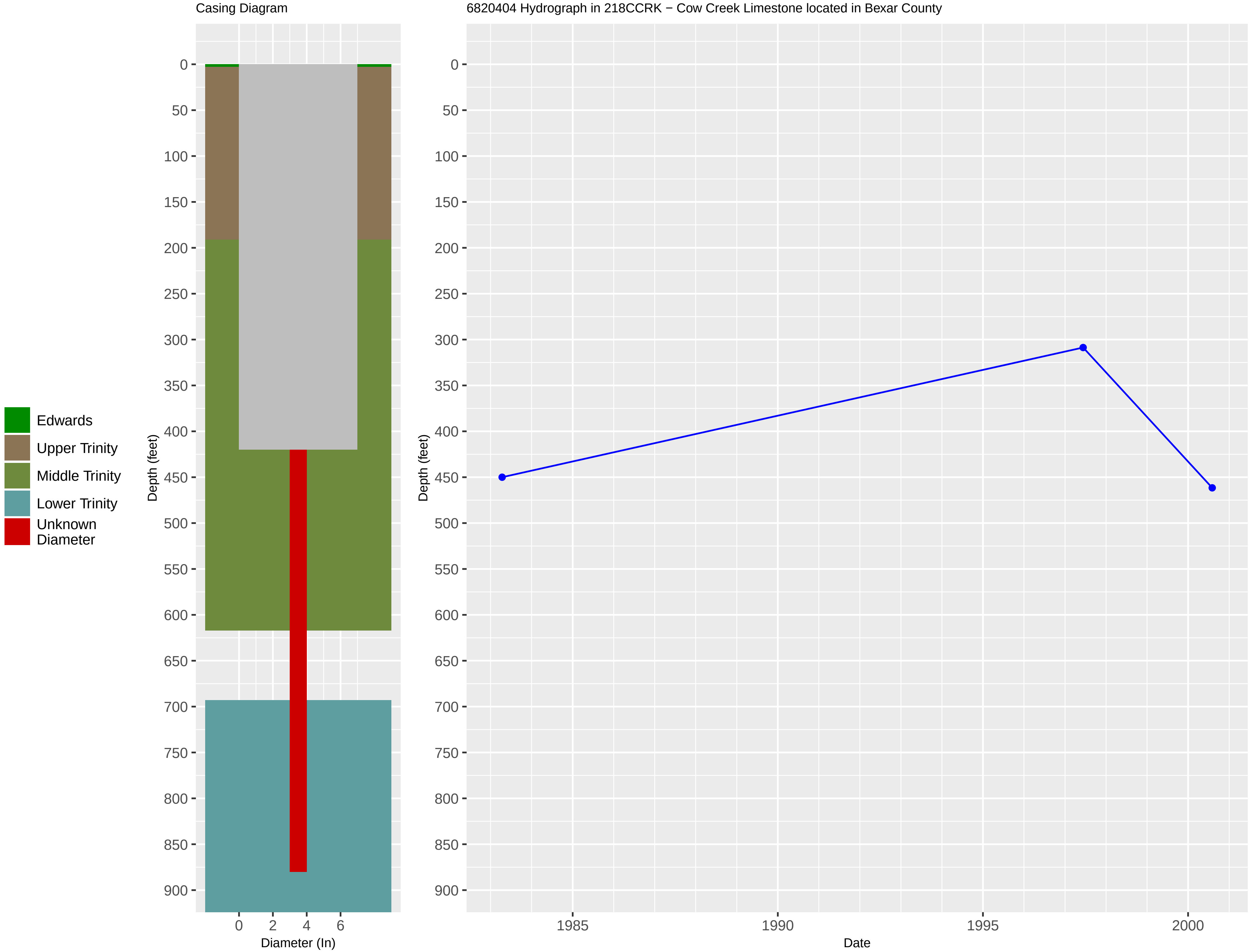




The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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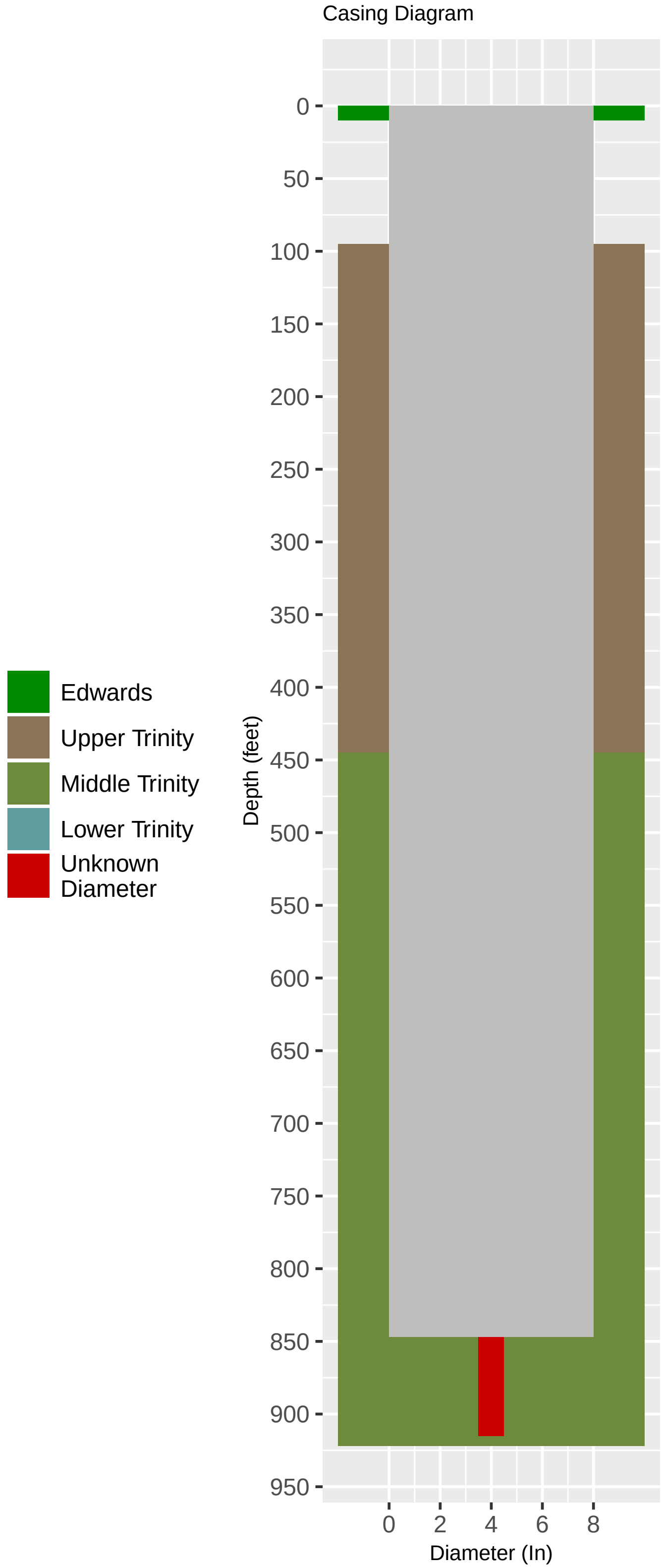

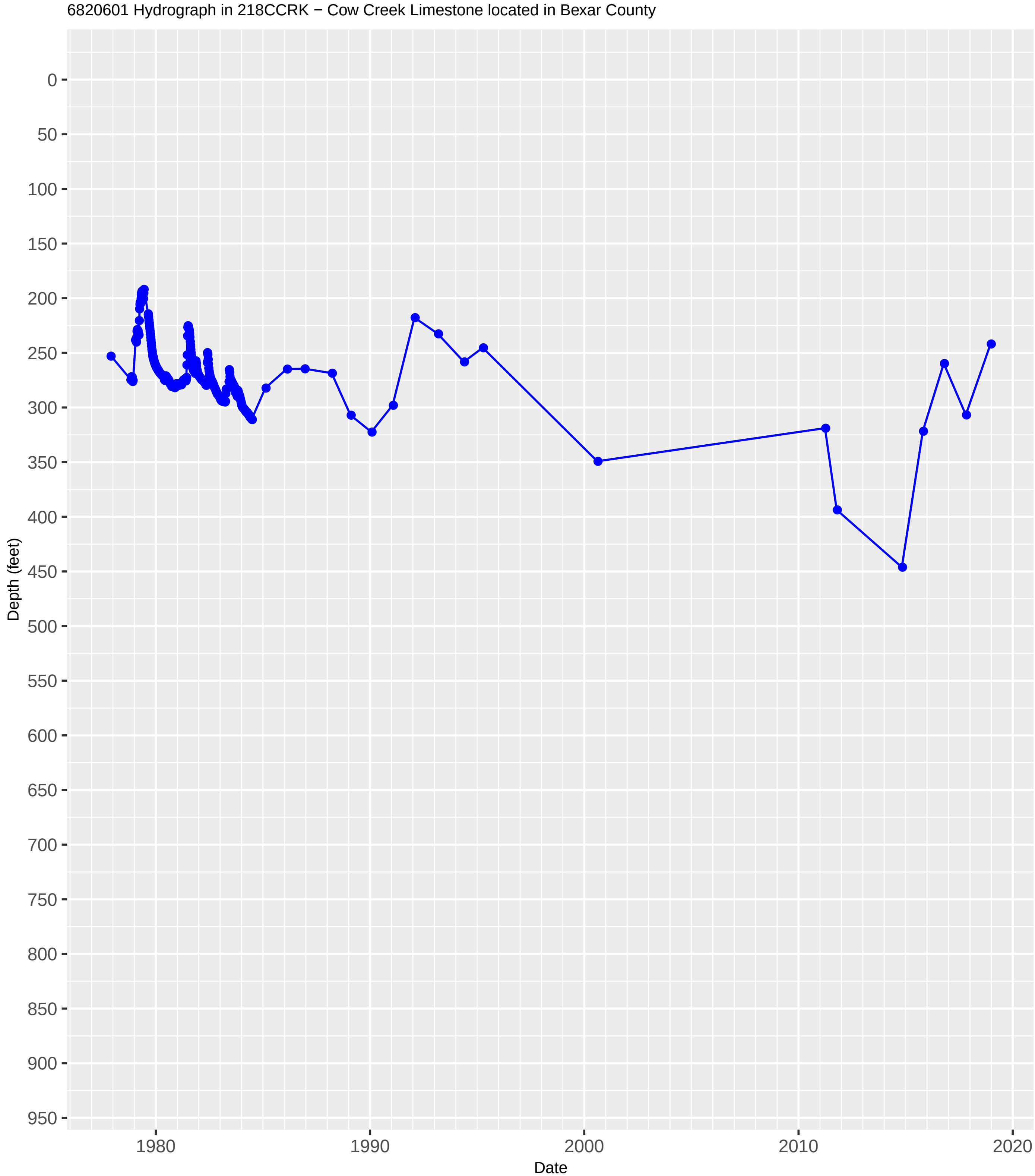

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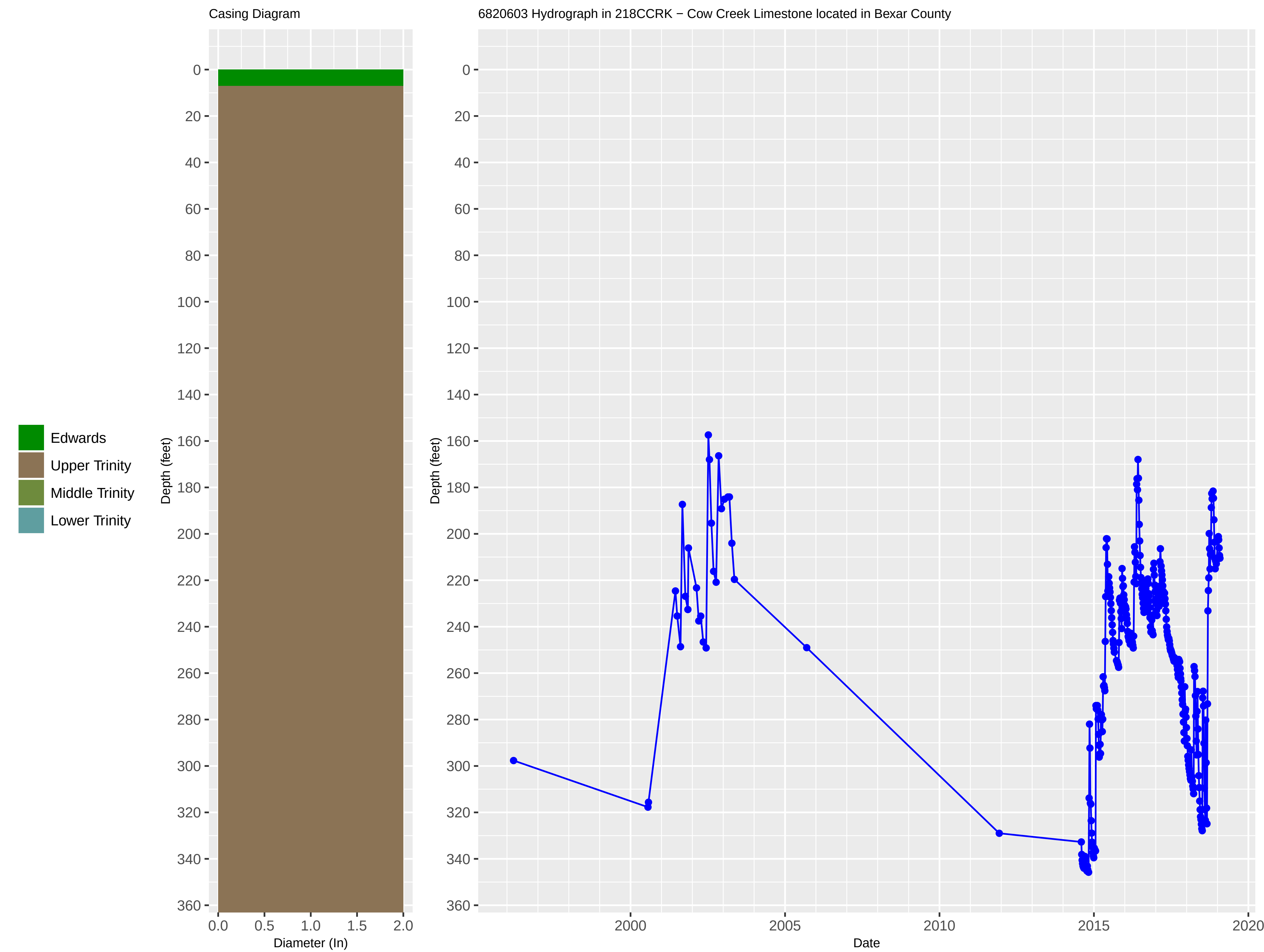

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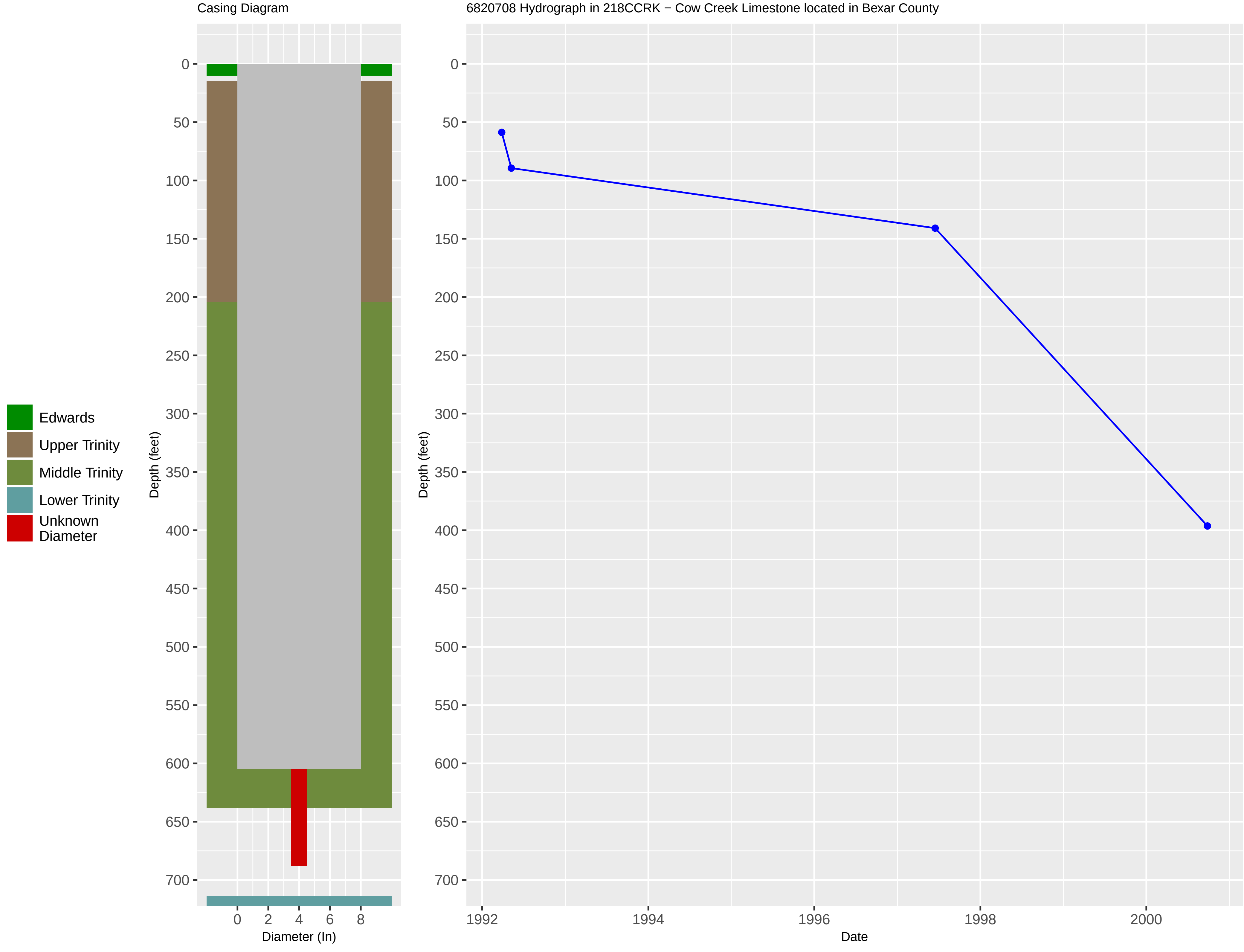

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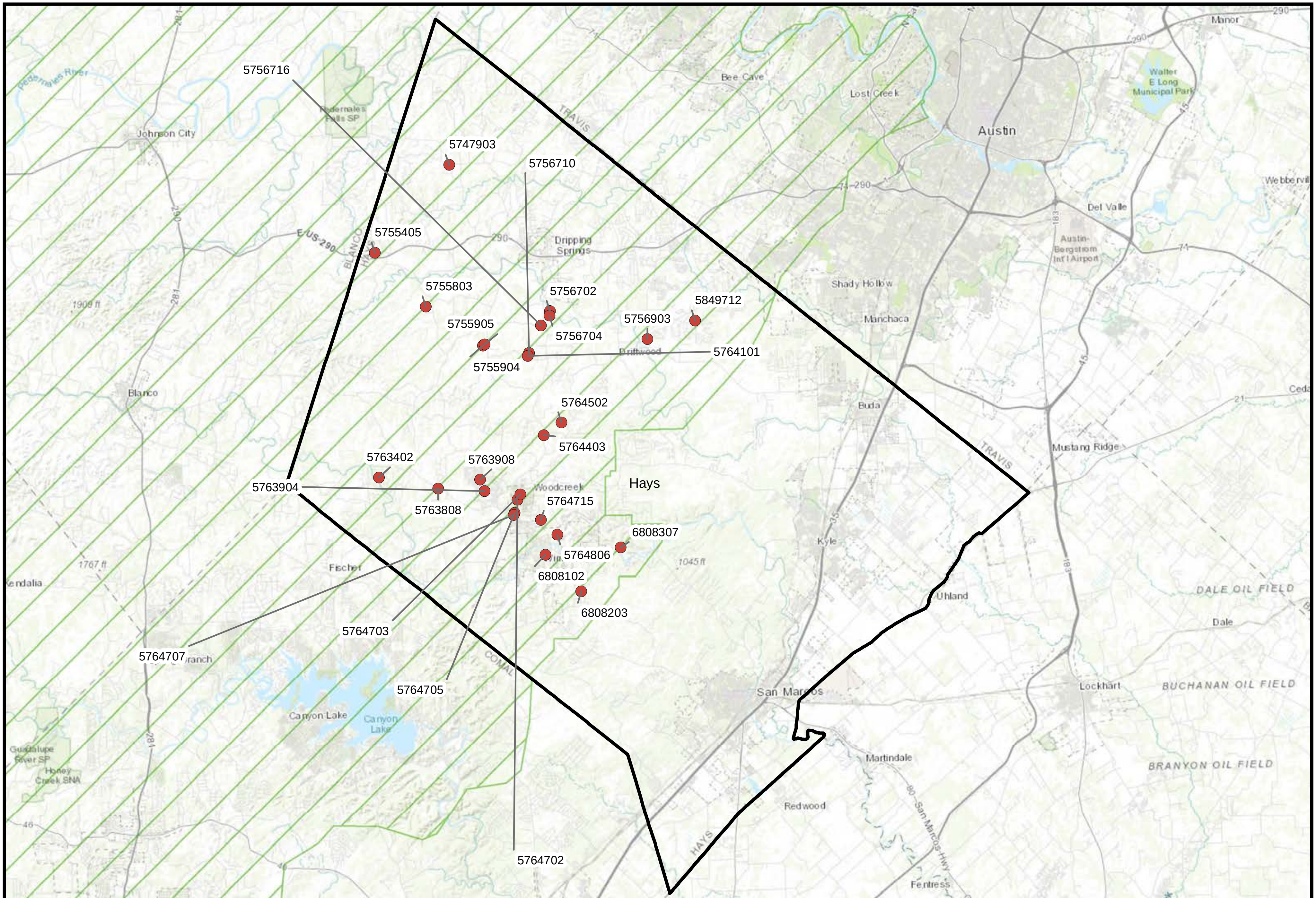

Aquifer

218CCRK - Cow Creek Limestone

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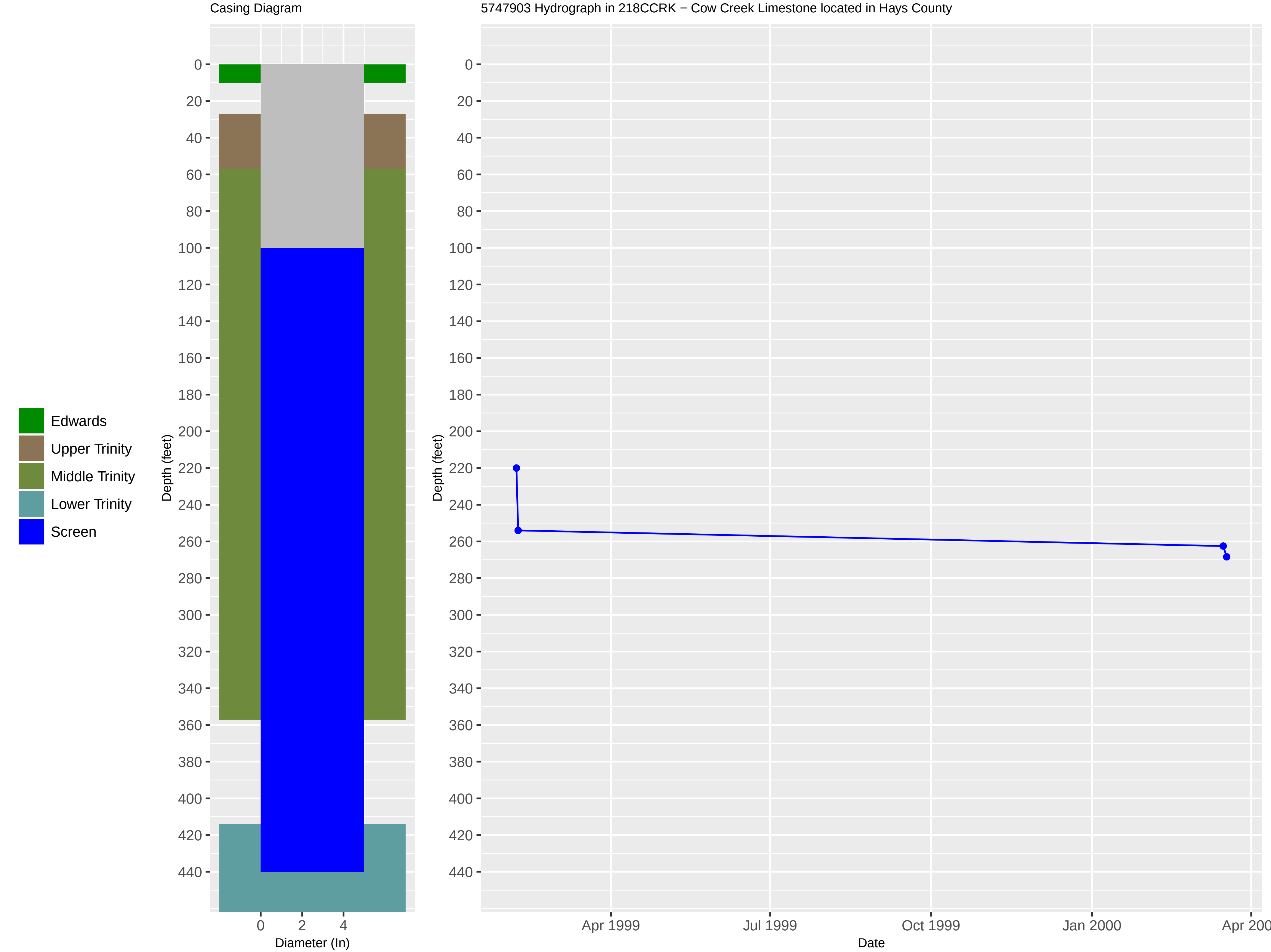
Map of Hydrograph Well Locations in Hays County
218CCRK
Cow Creek Limestone



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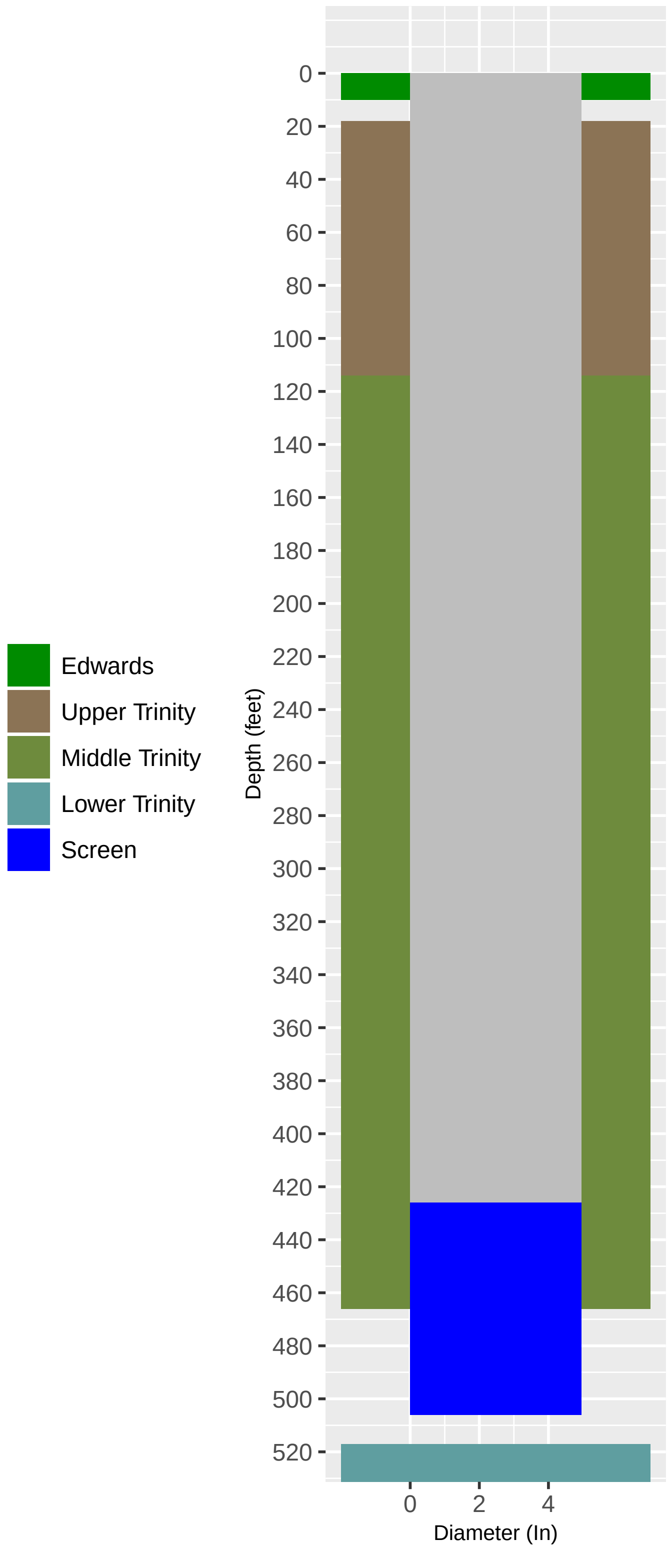
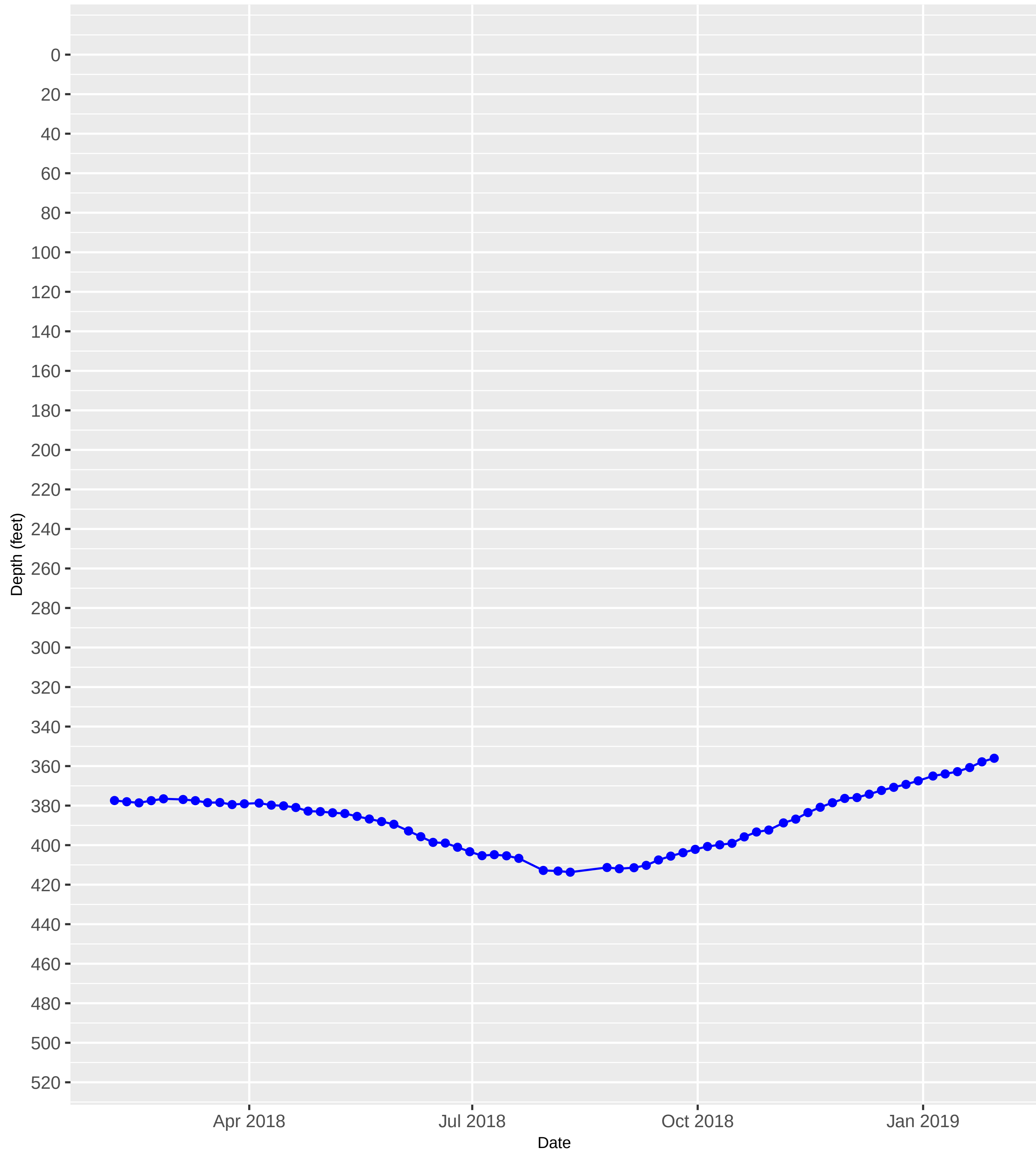
Casing Diagram



5755405 Hydrograph in 218CCRK − Cow Creek Limestone located in Hays County



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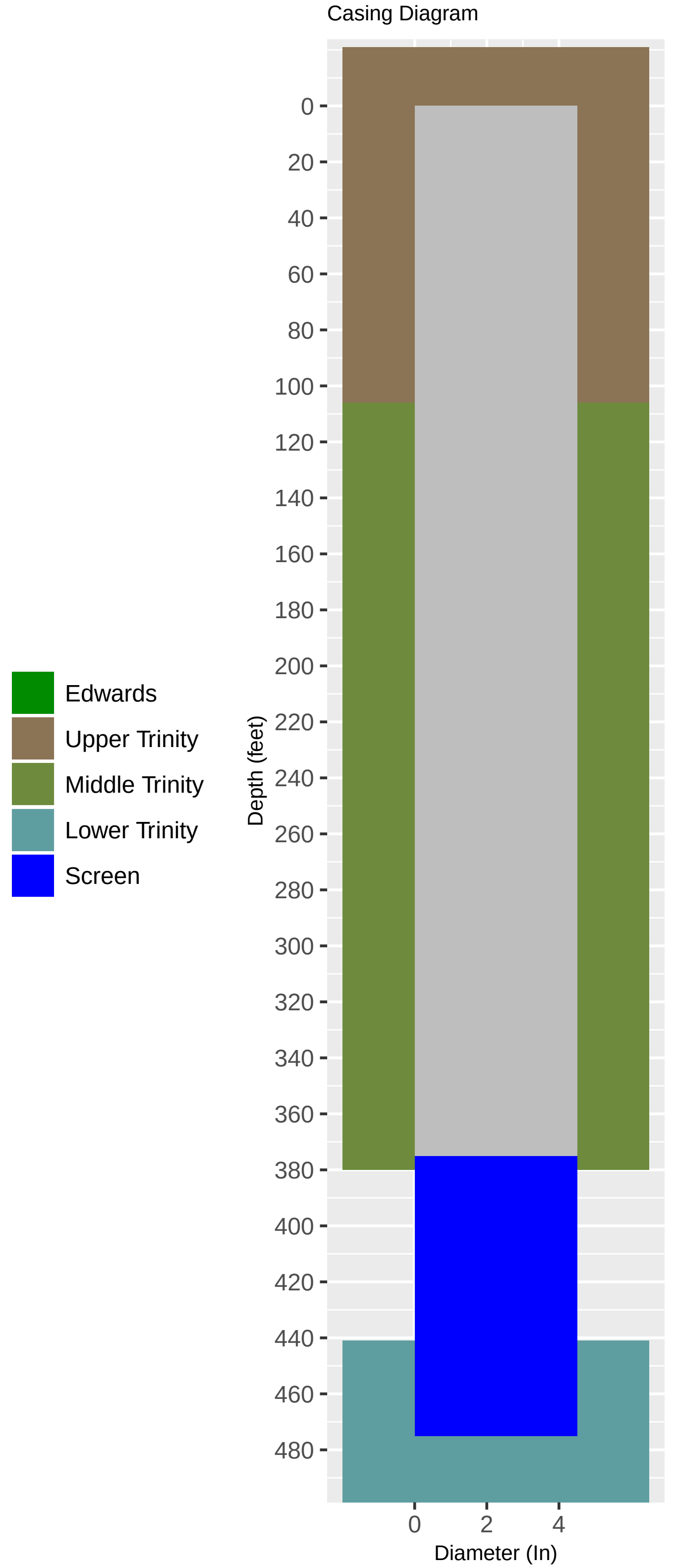
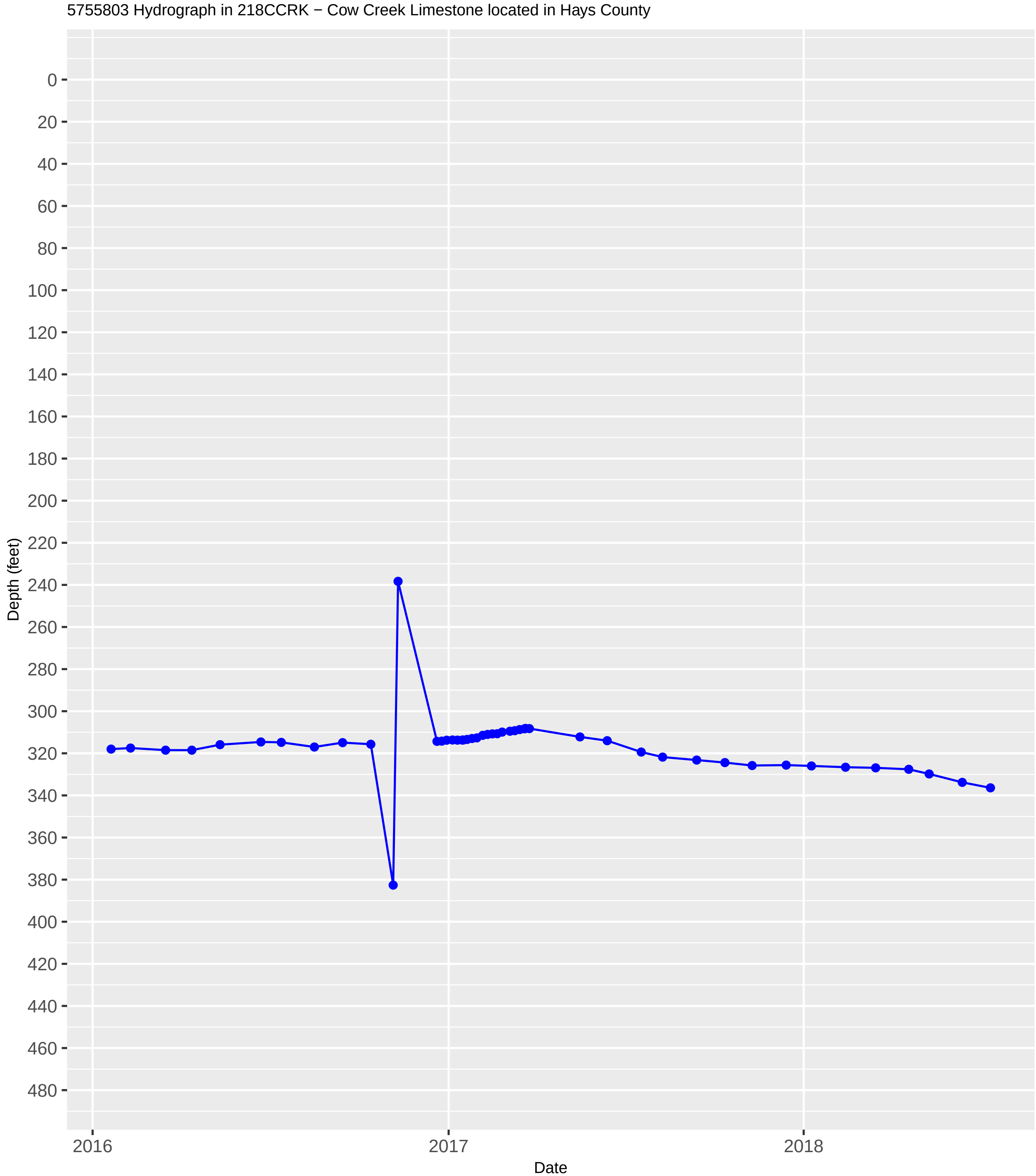
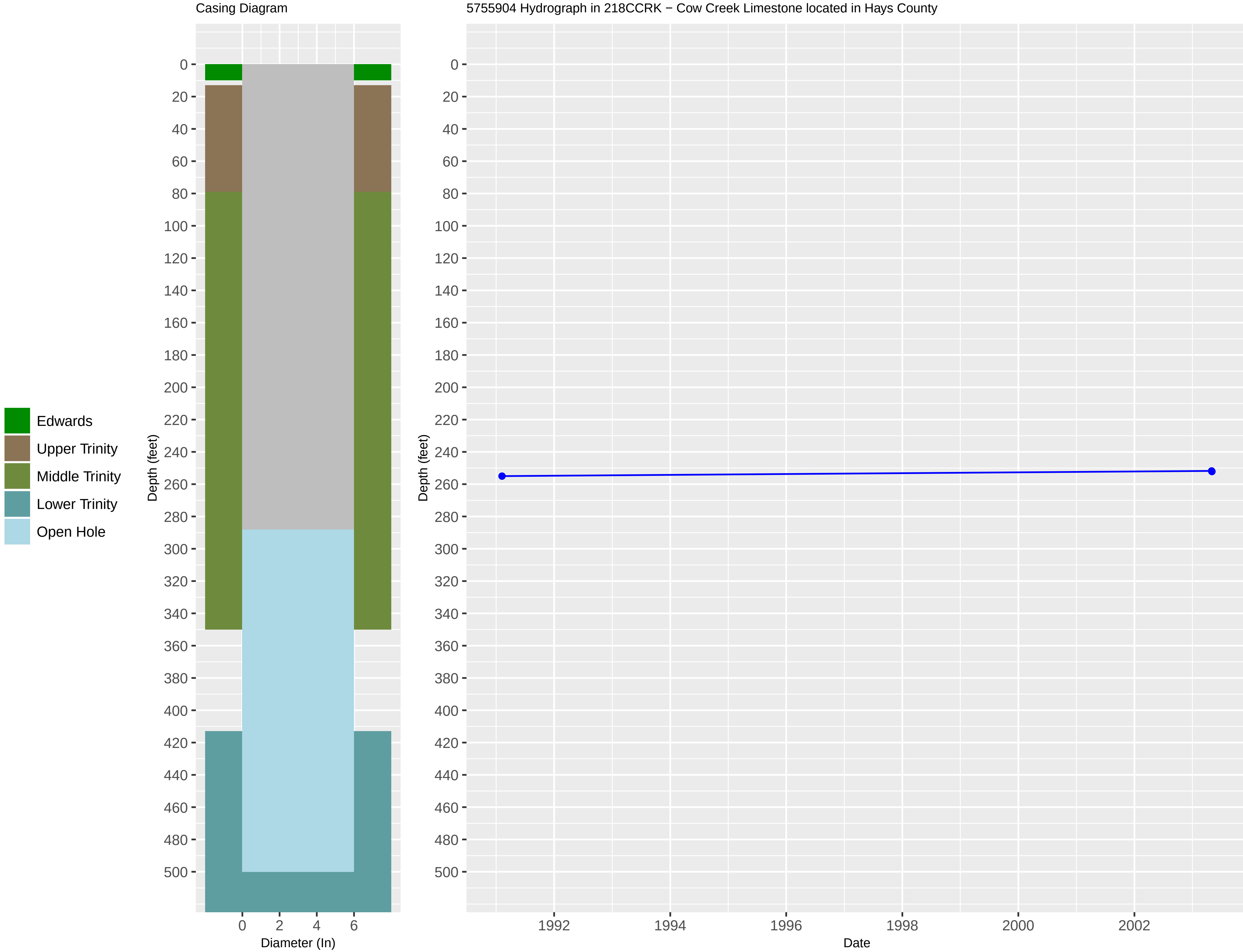




The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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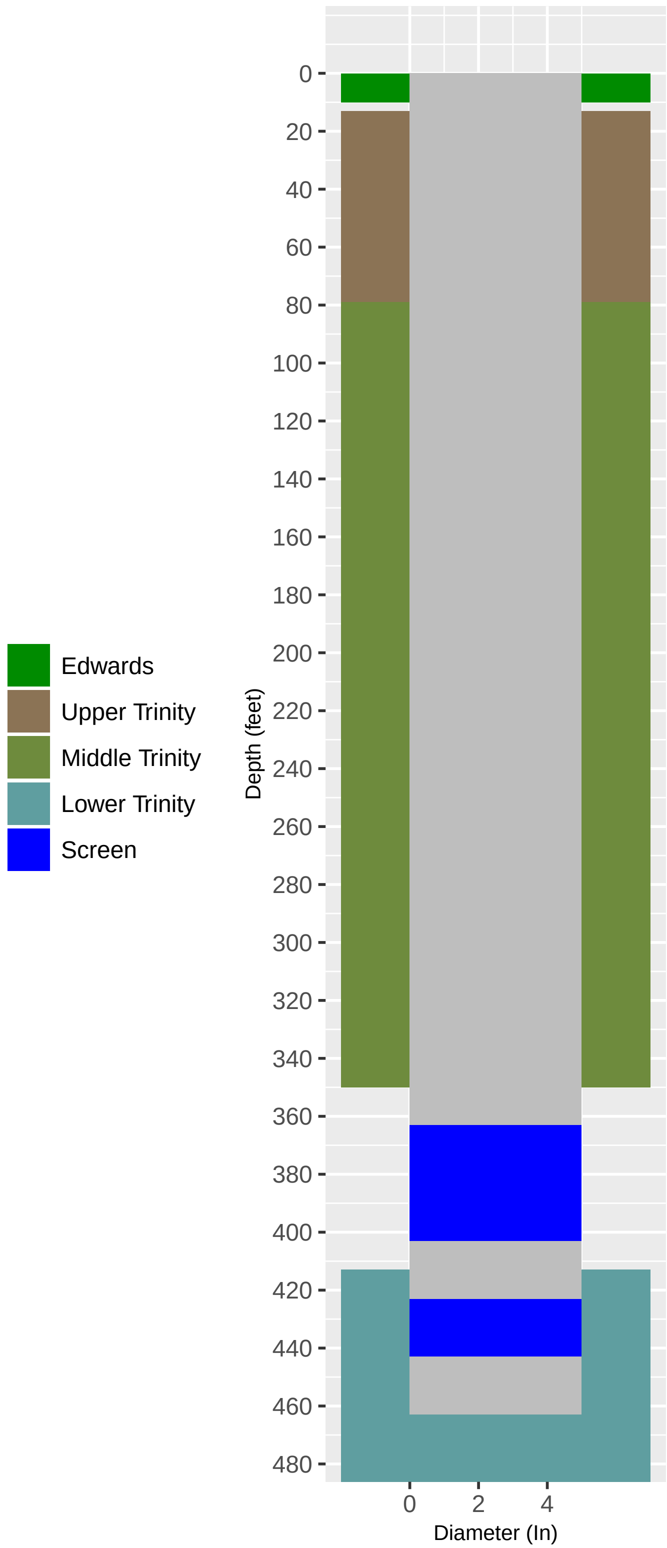
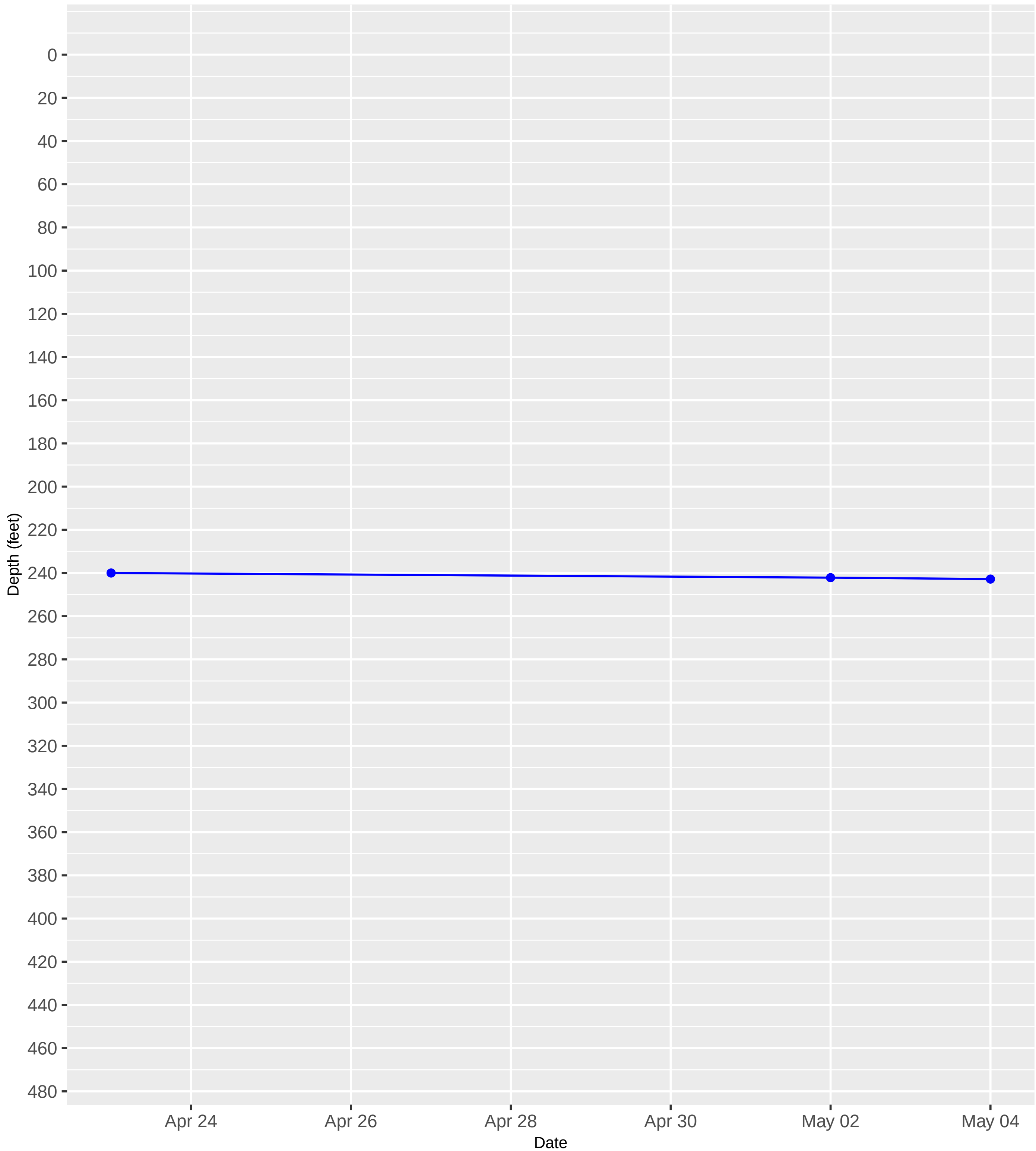
Casing Diagram



5755905 Hydrograph in 218CCRK − Cow Creek Limestone located in Hays County



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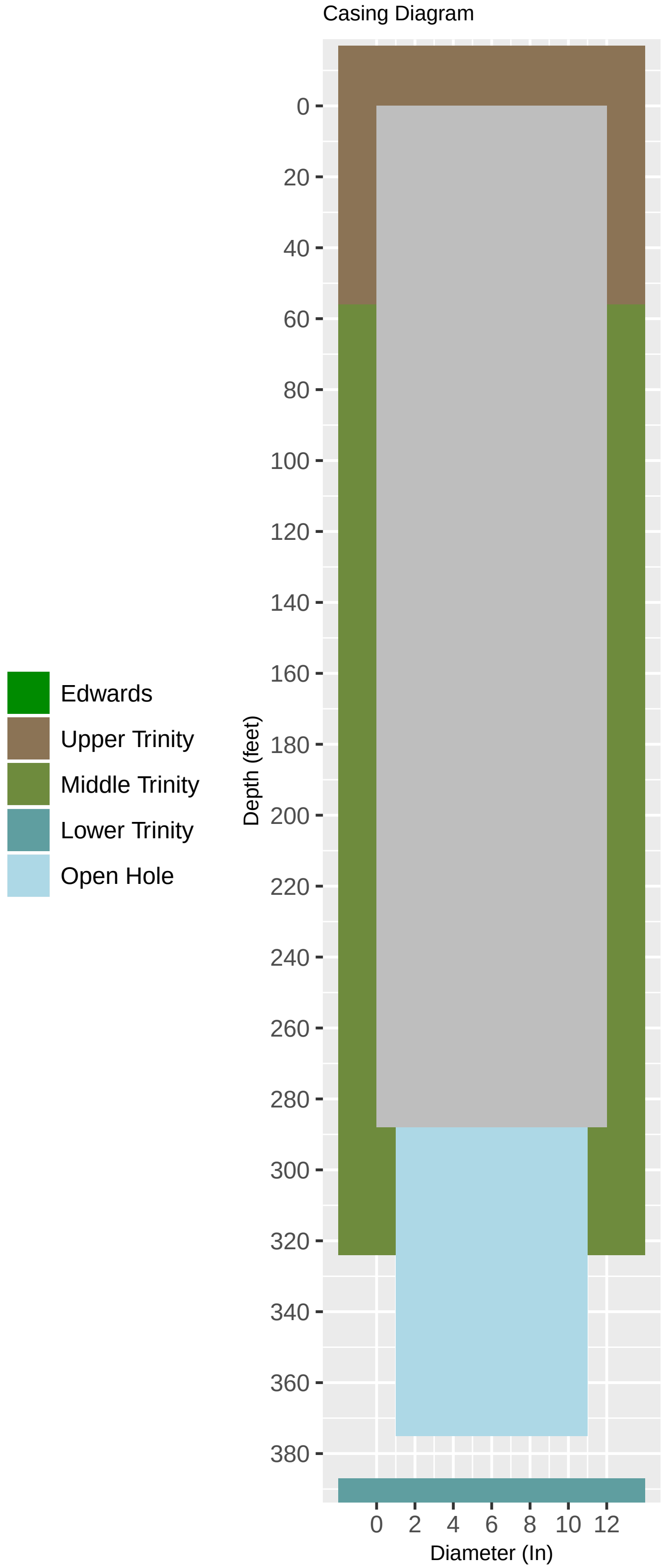

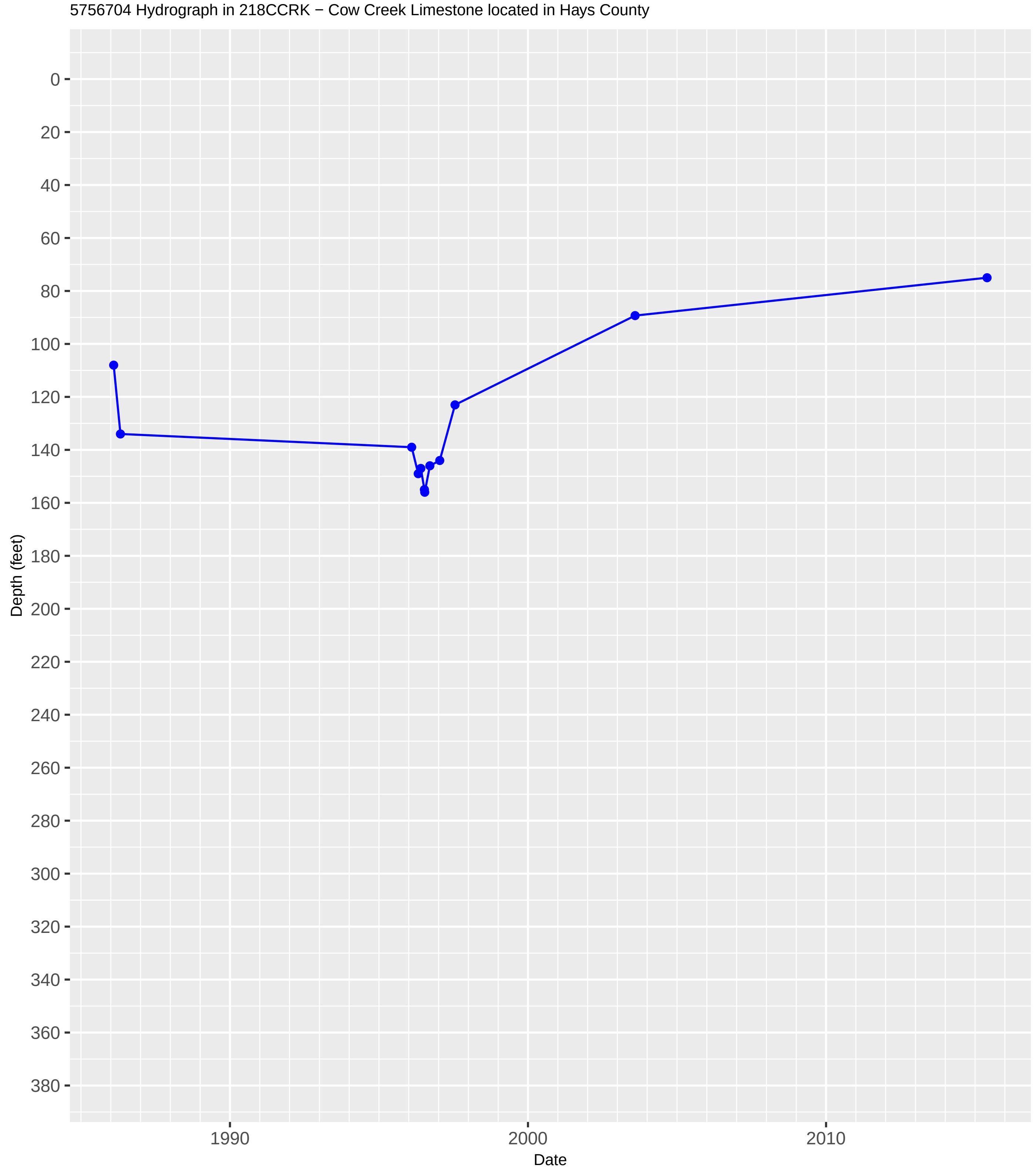

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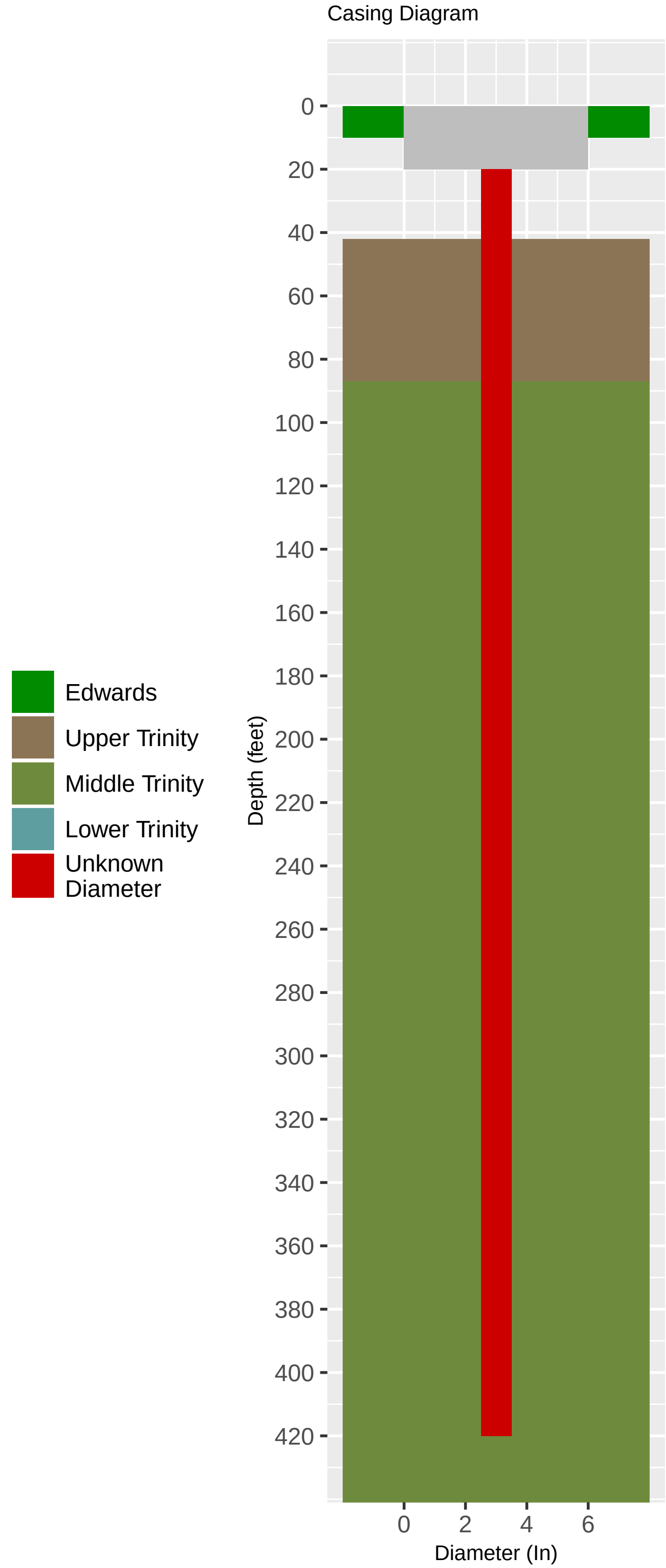

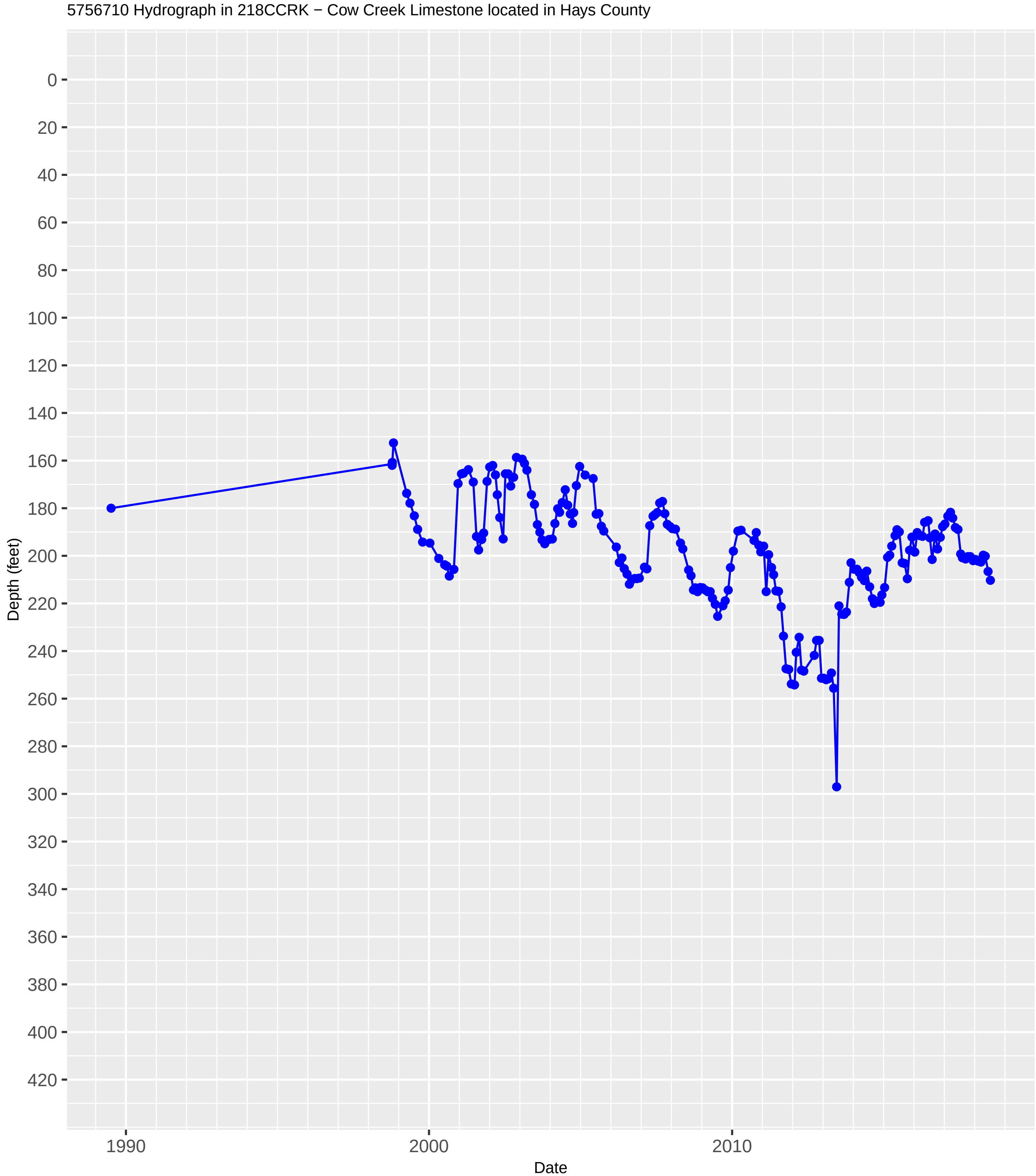

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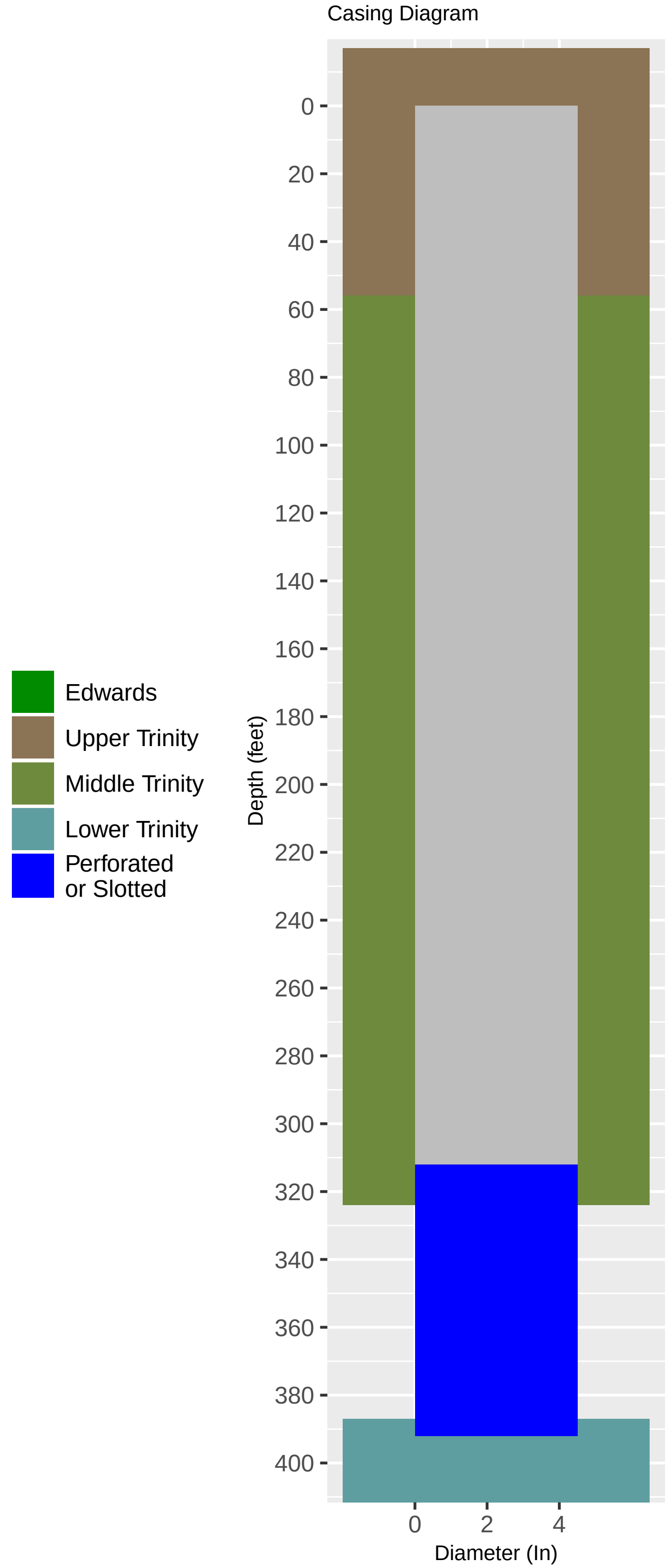
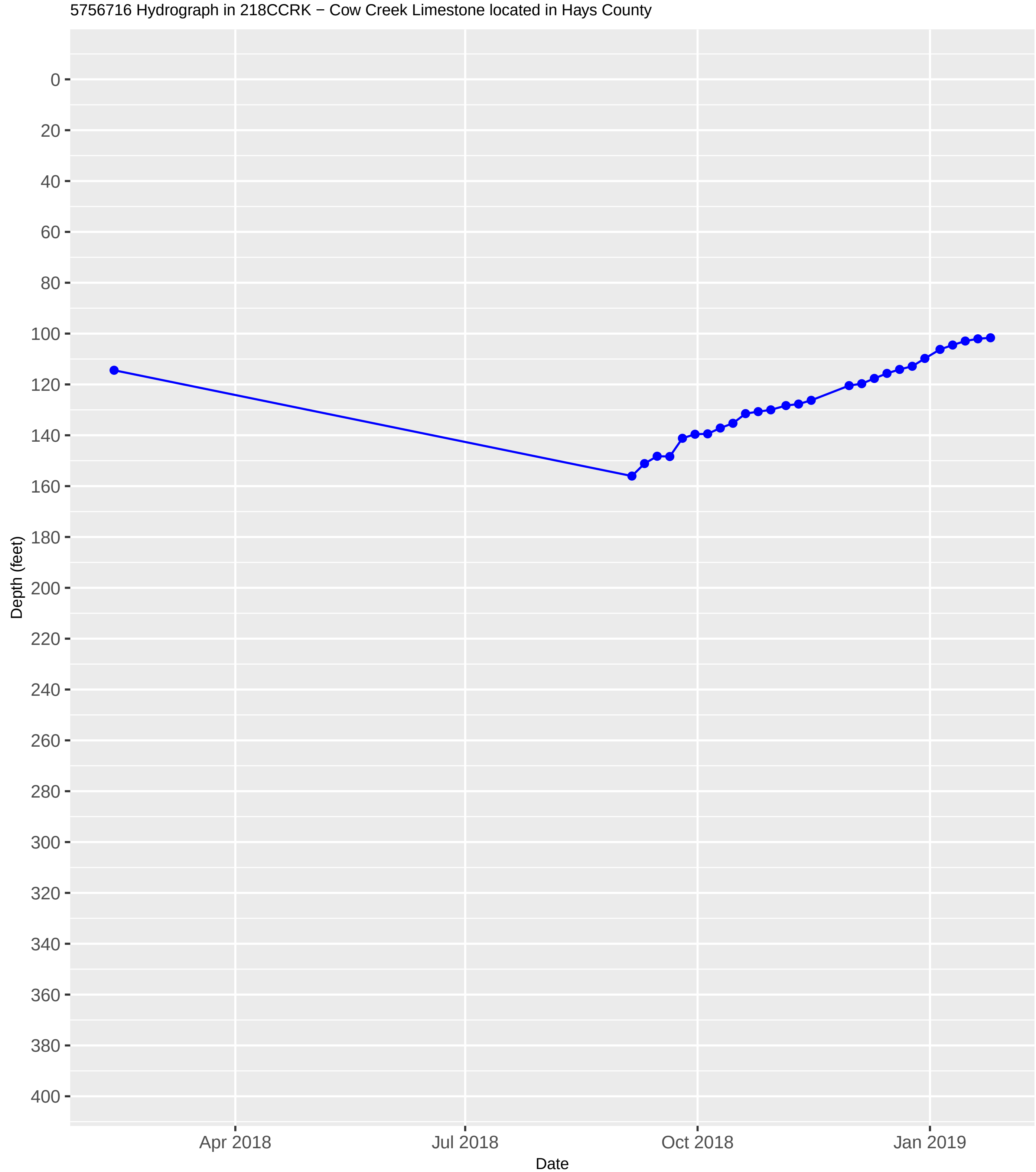
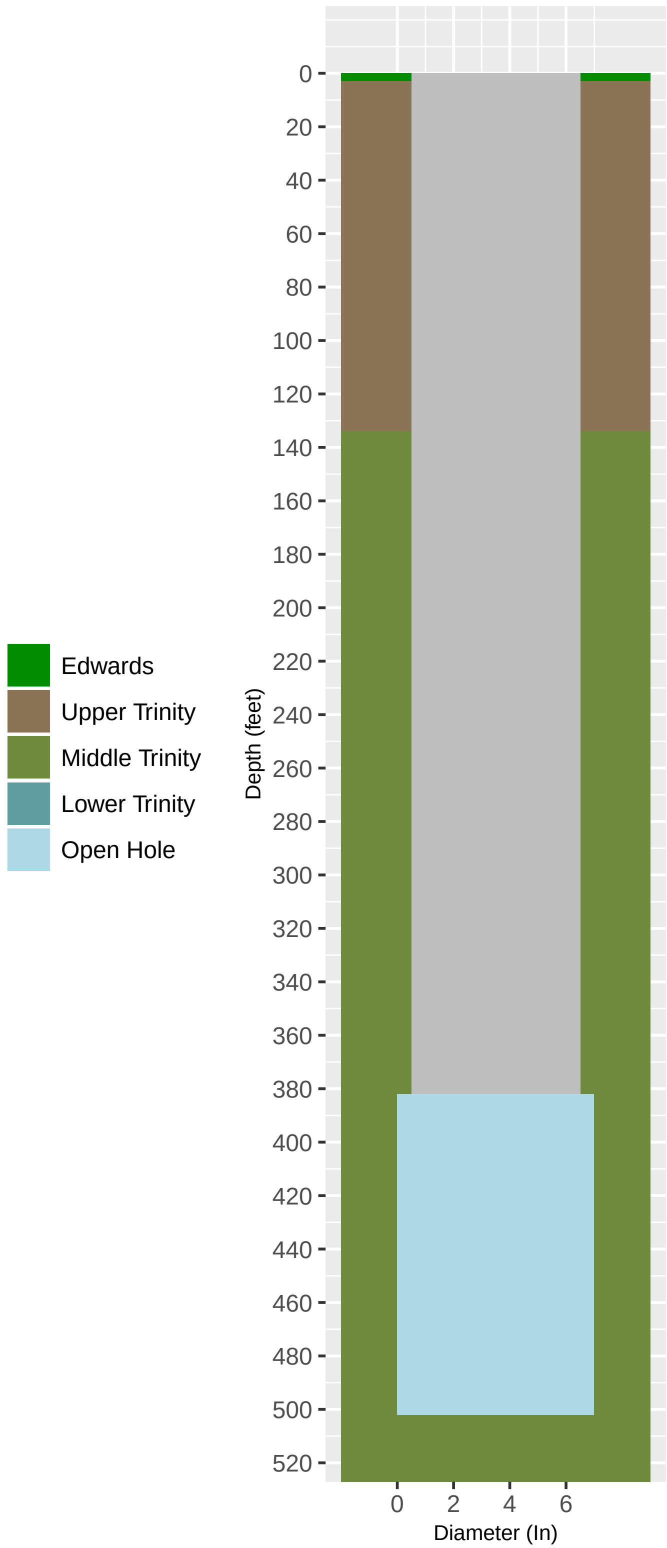


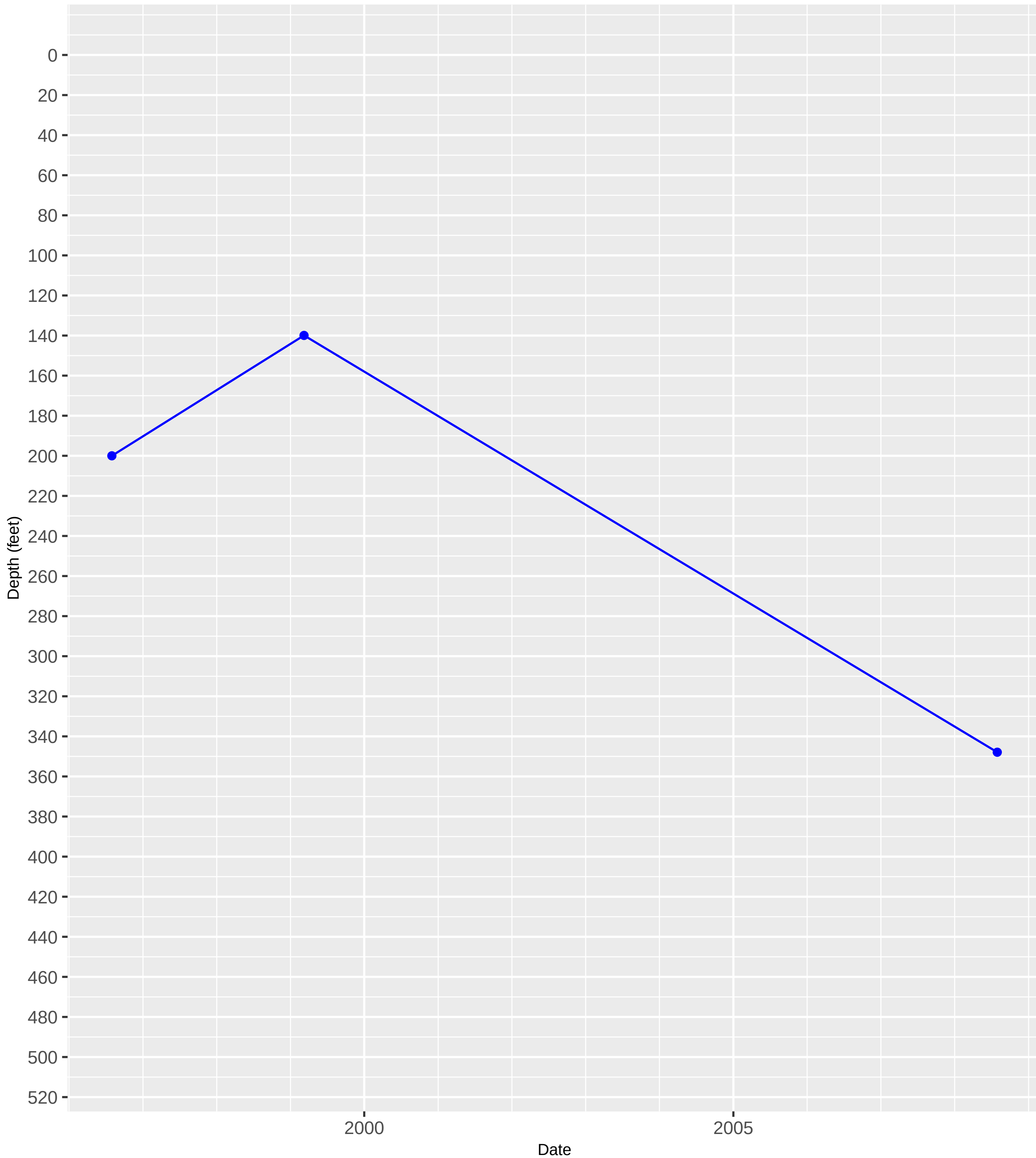


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

5756903 Hydrograph in 218CCRK − Cow Creek Limestone located in Hays County

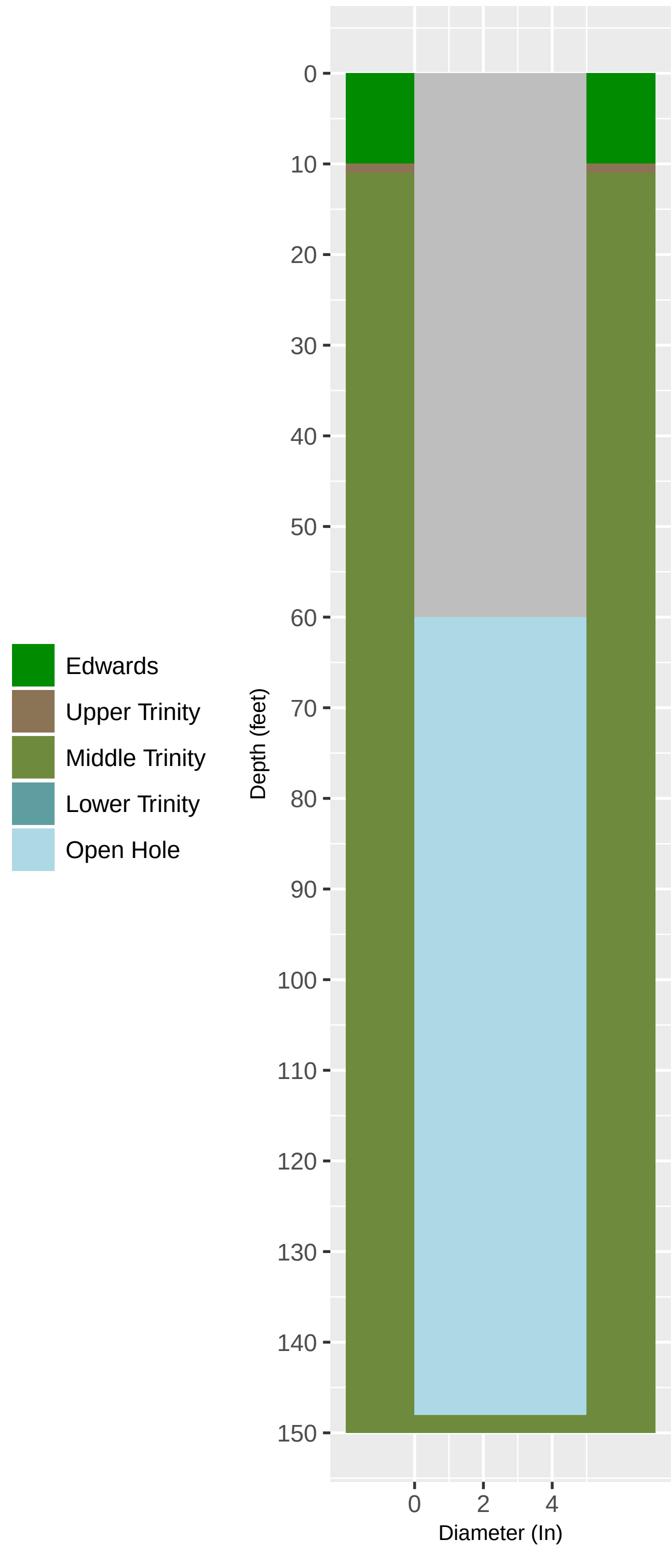


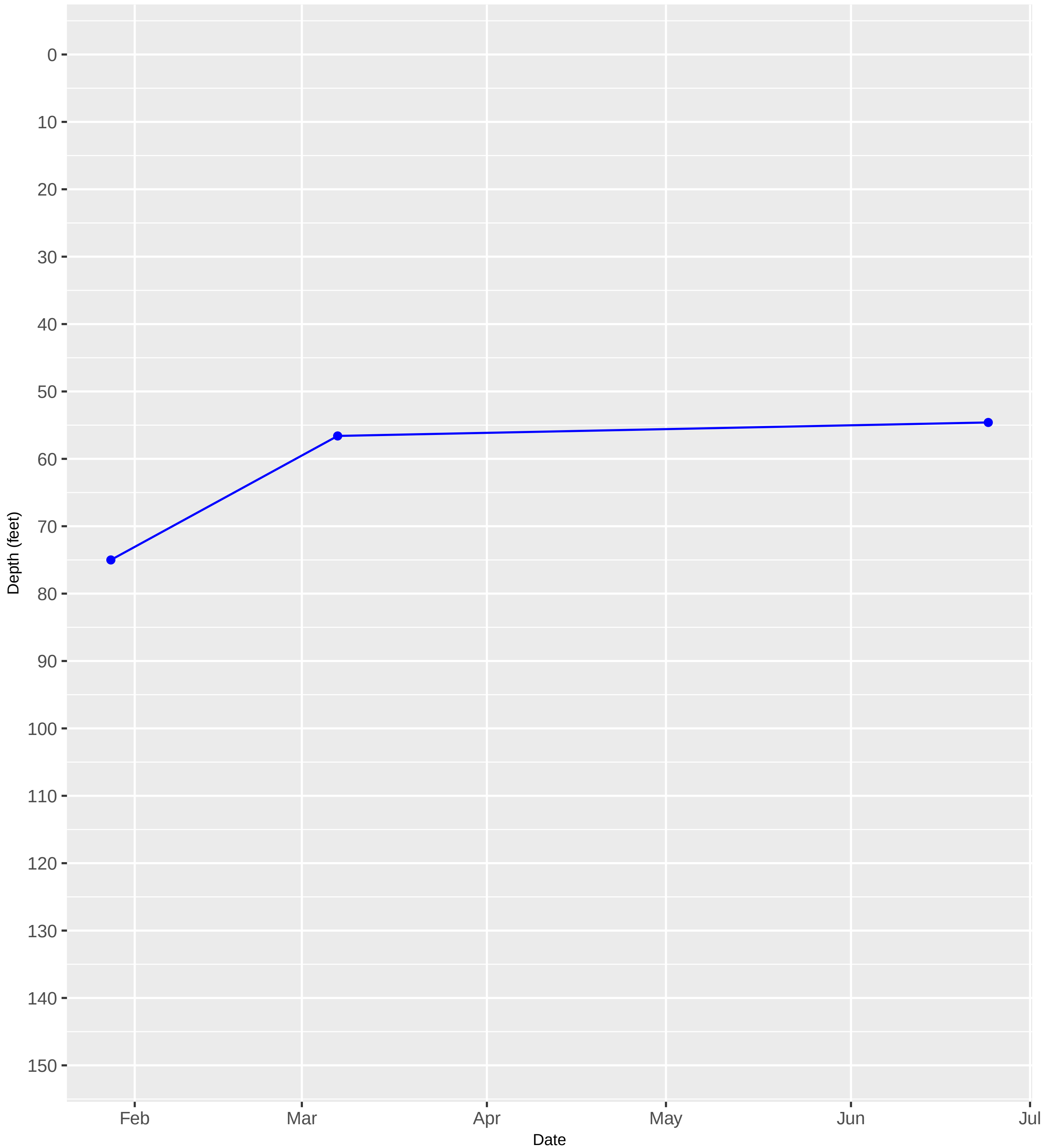


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

5763402 Hydrograph in 218CCRK − Cow Creek Limestone located in Hays County





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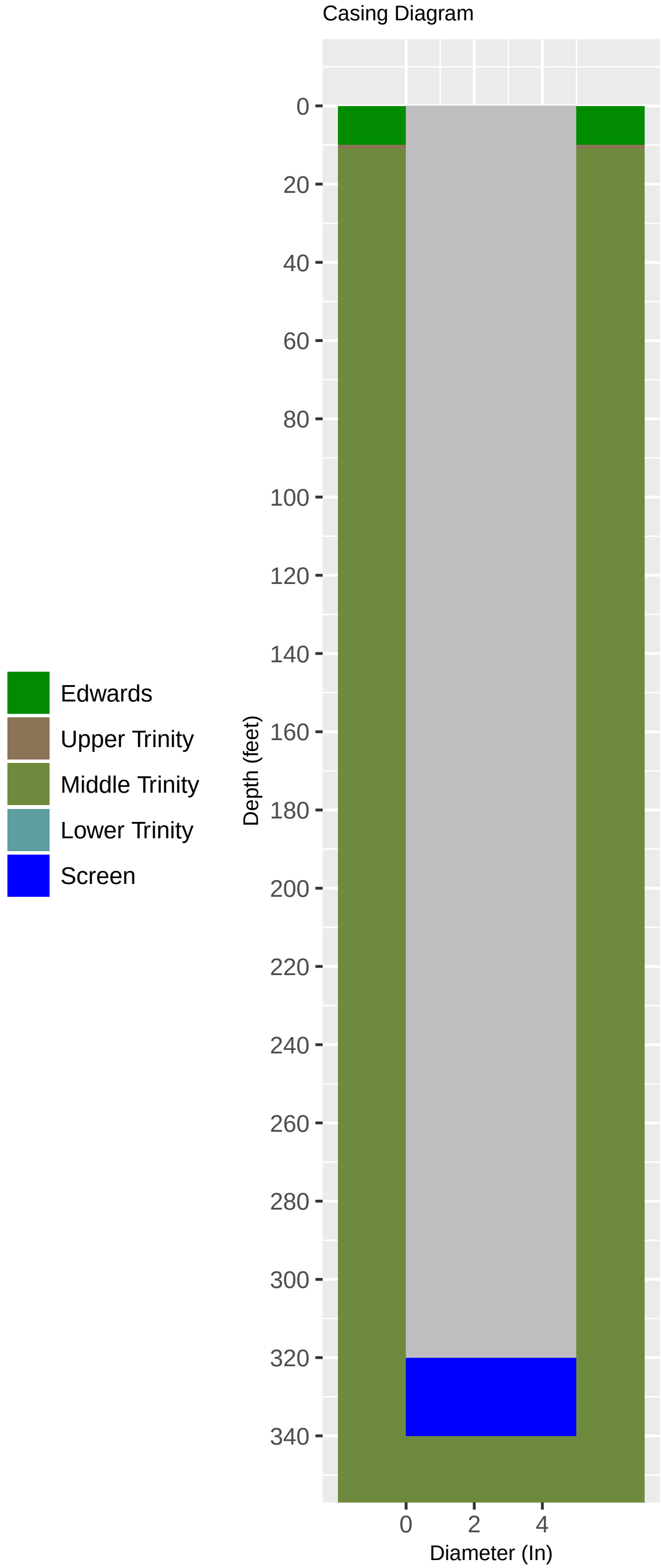

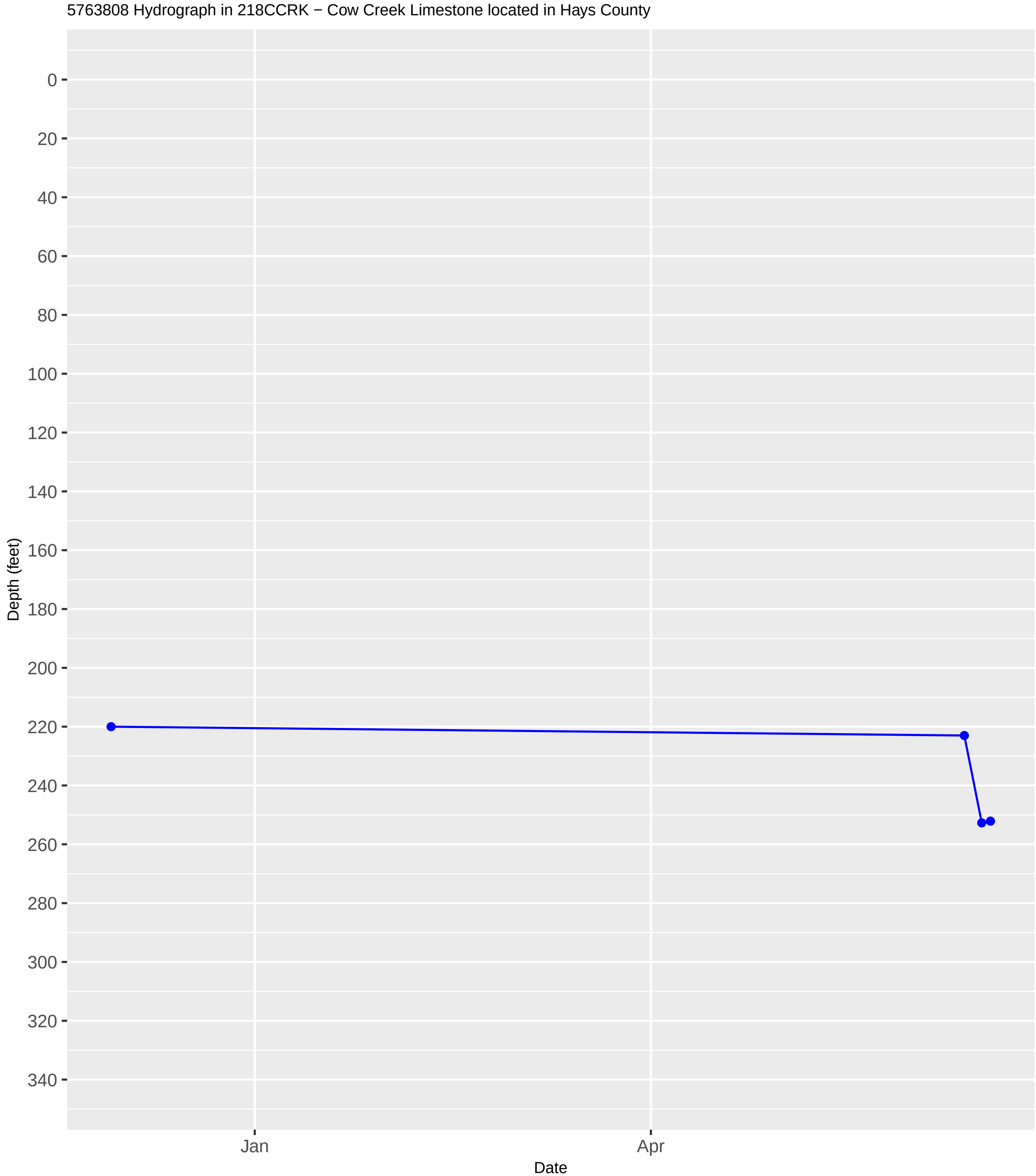

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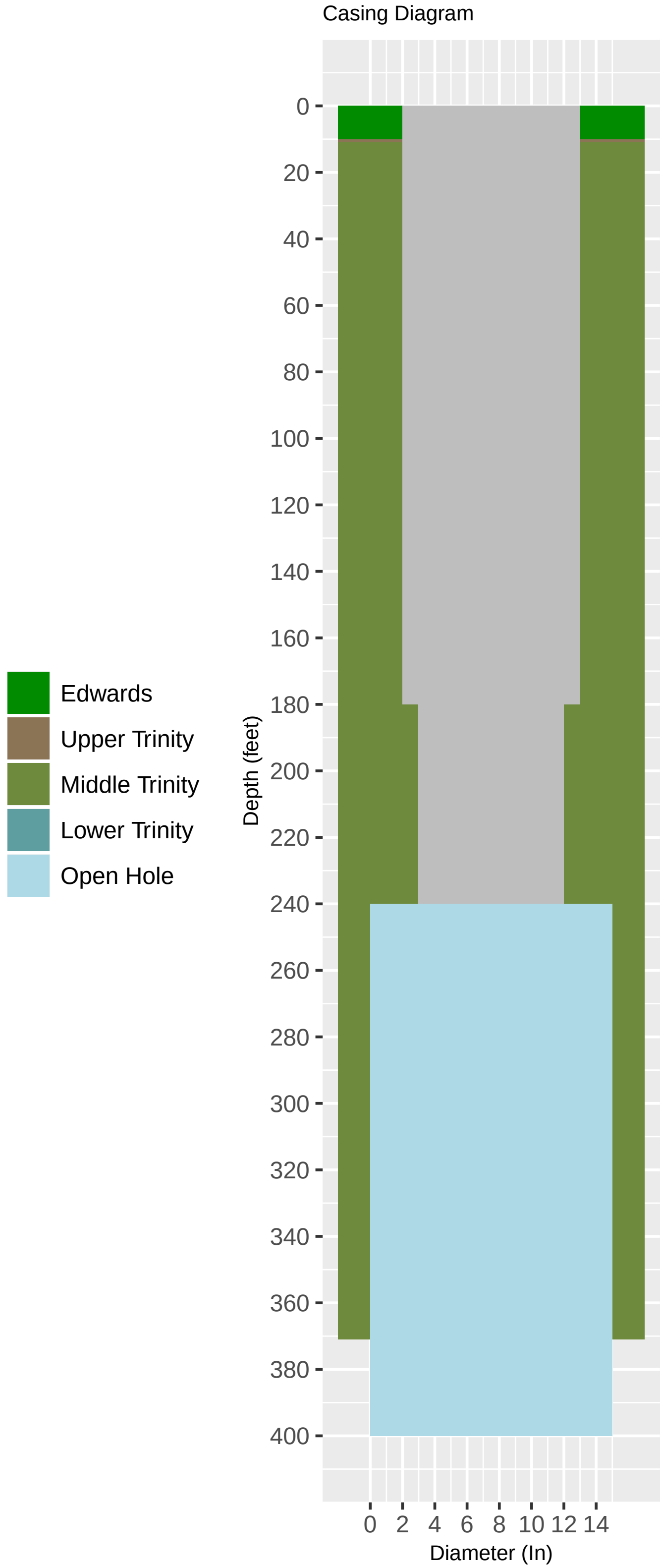

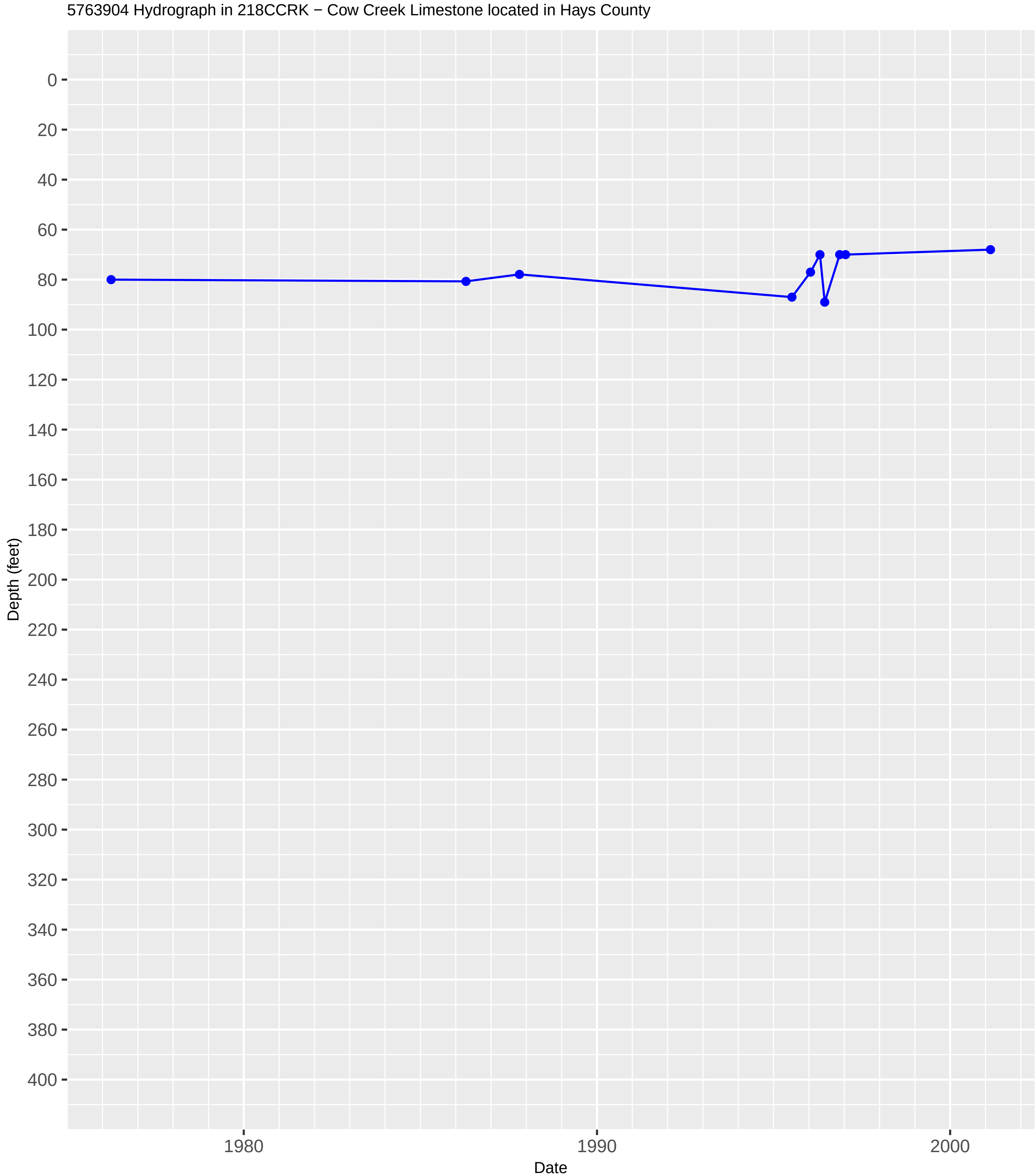

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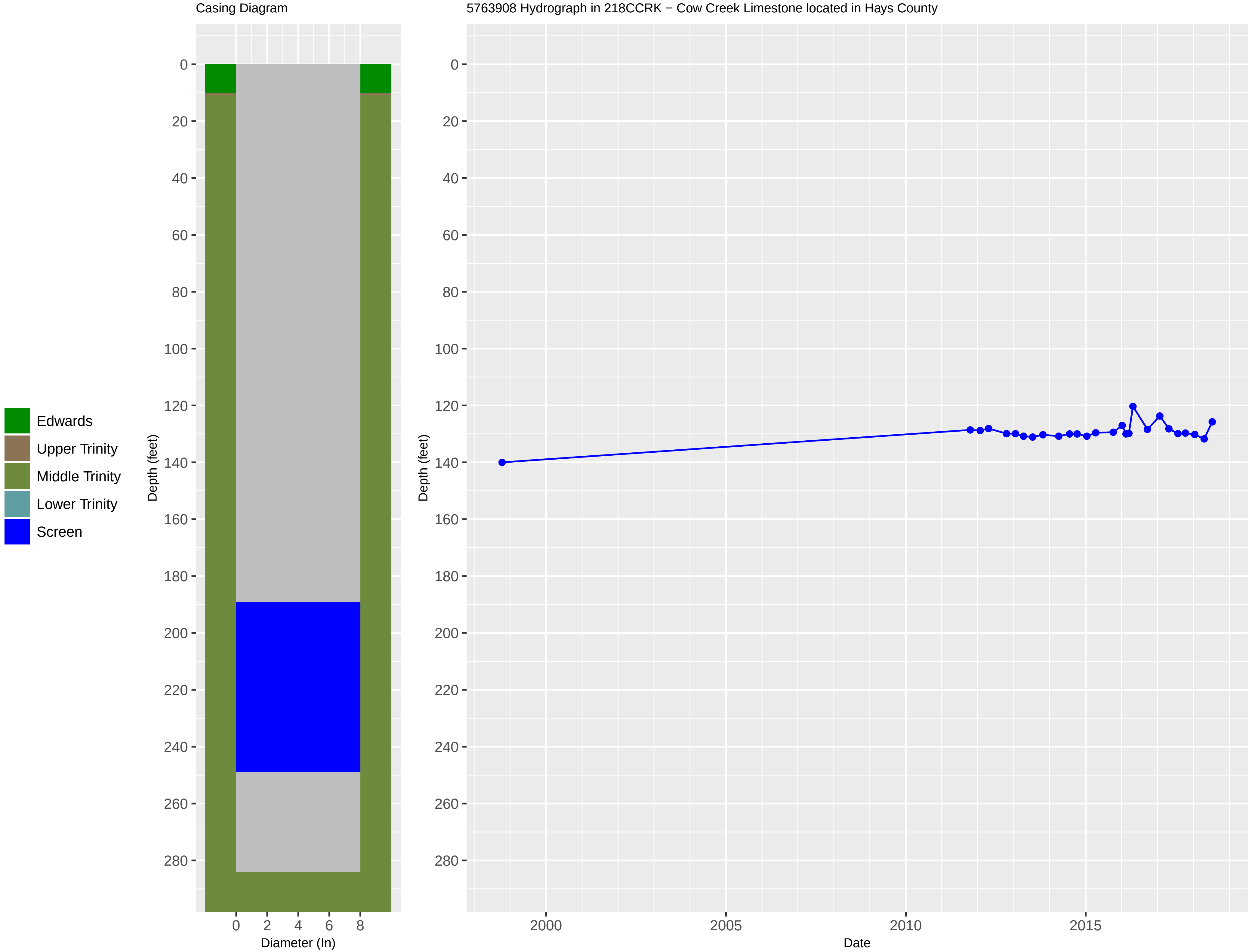

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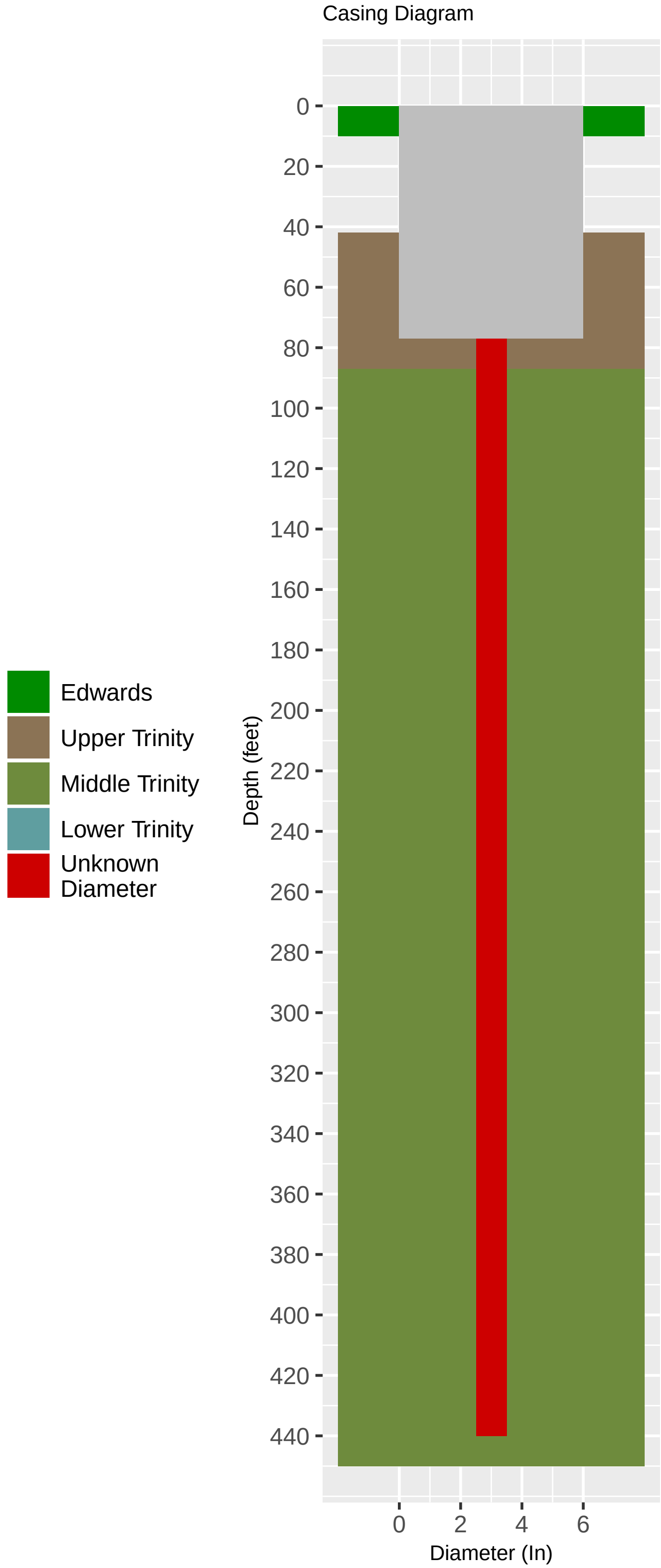

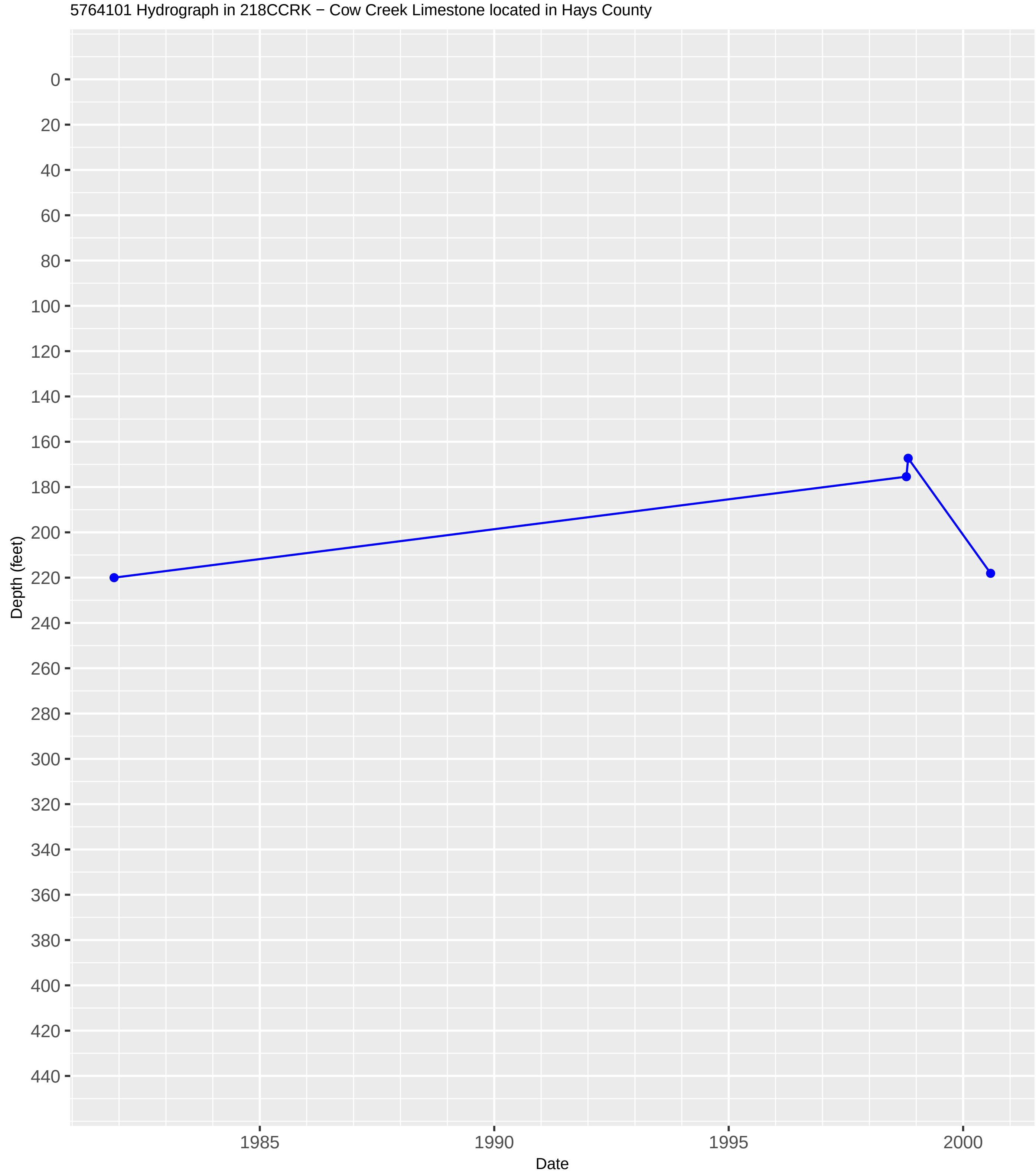

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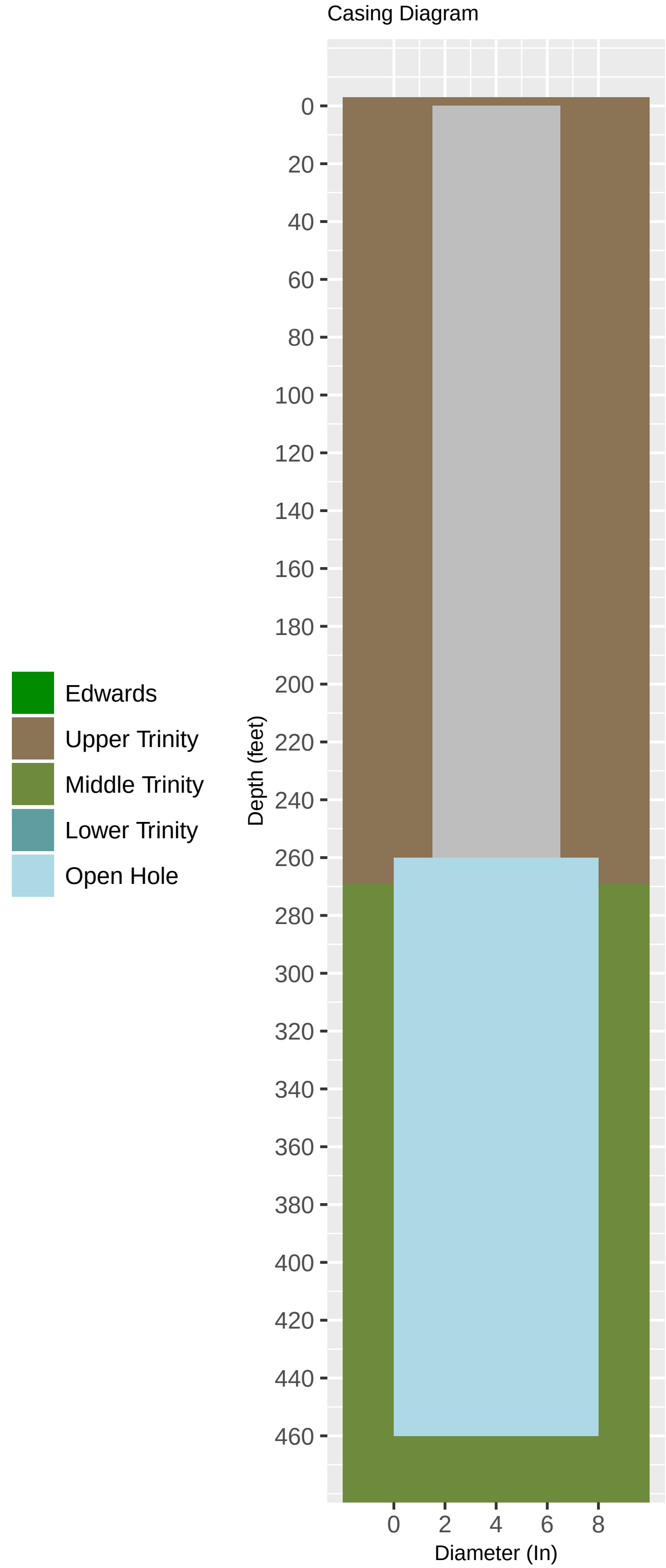

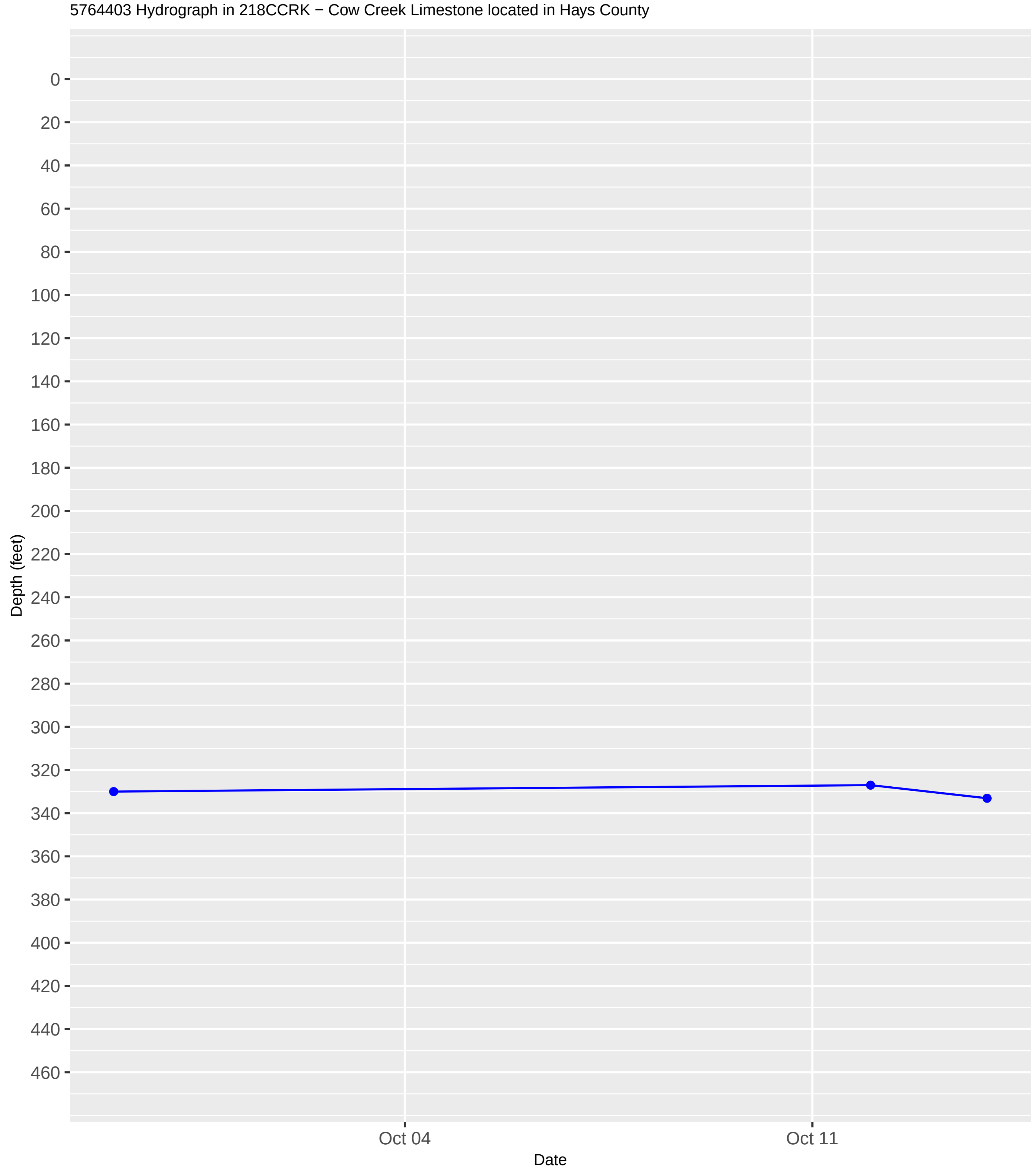

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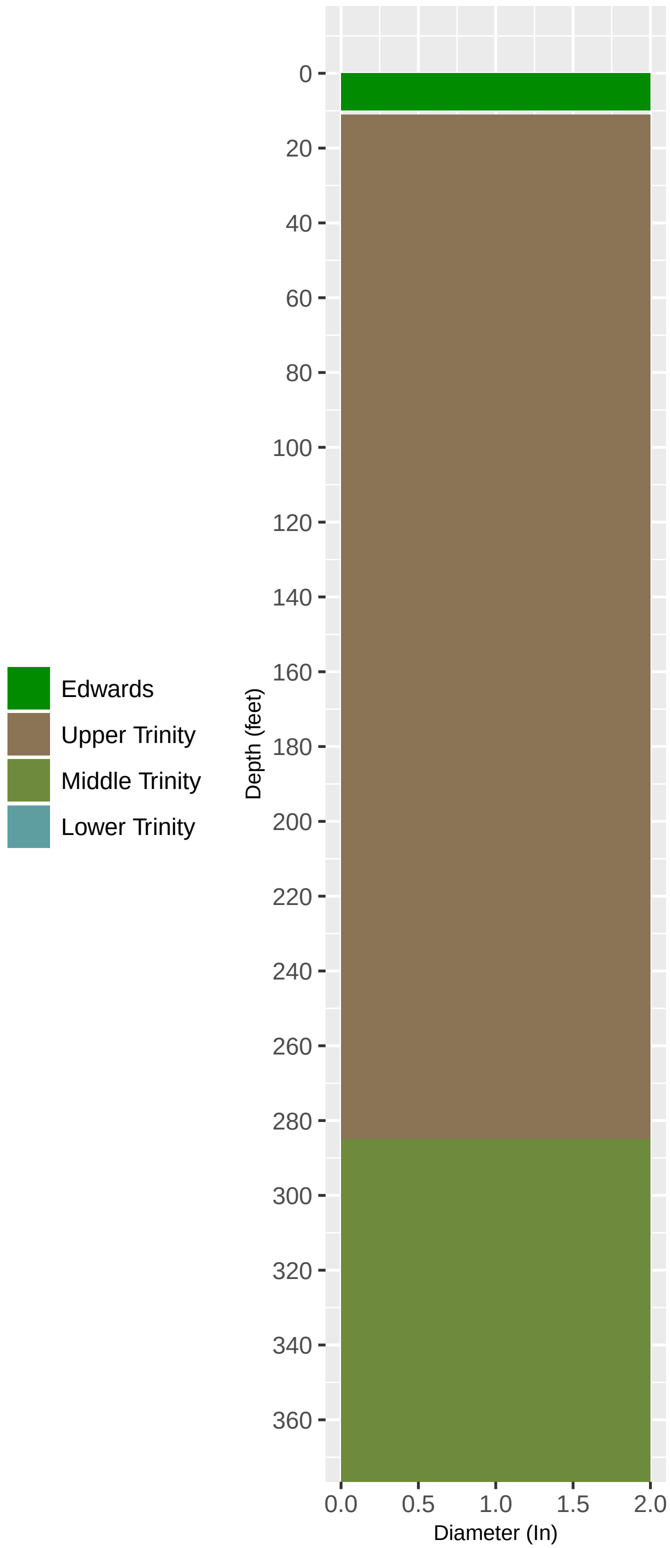
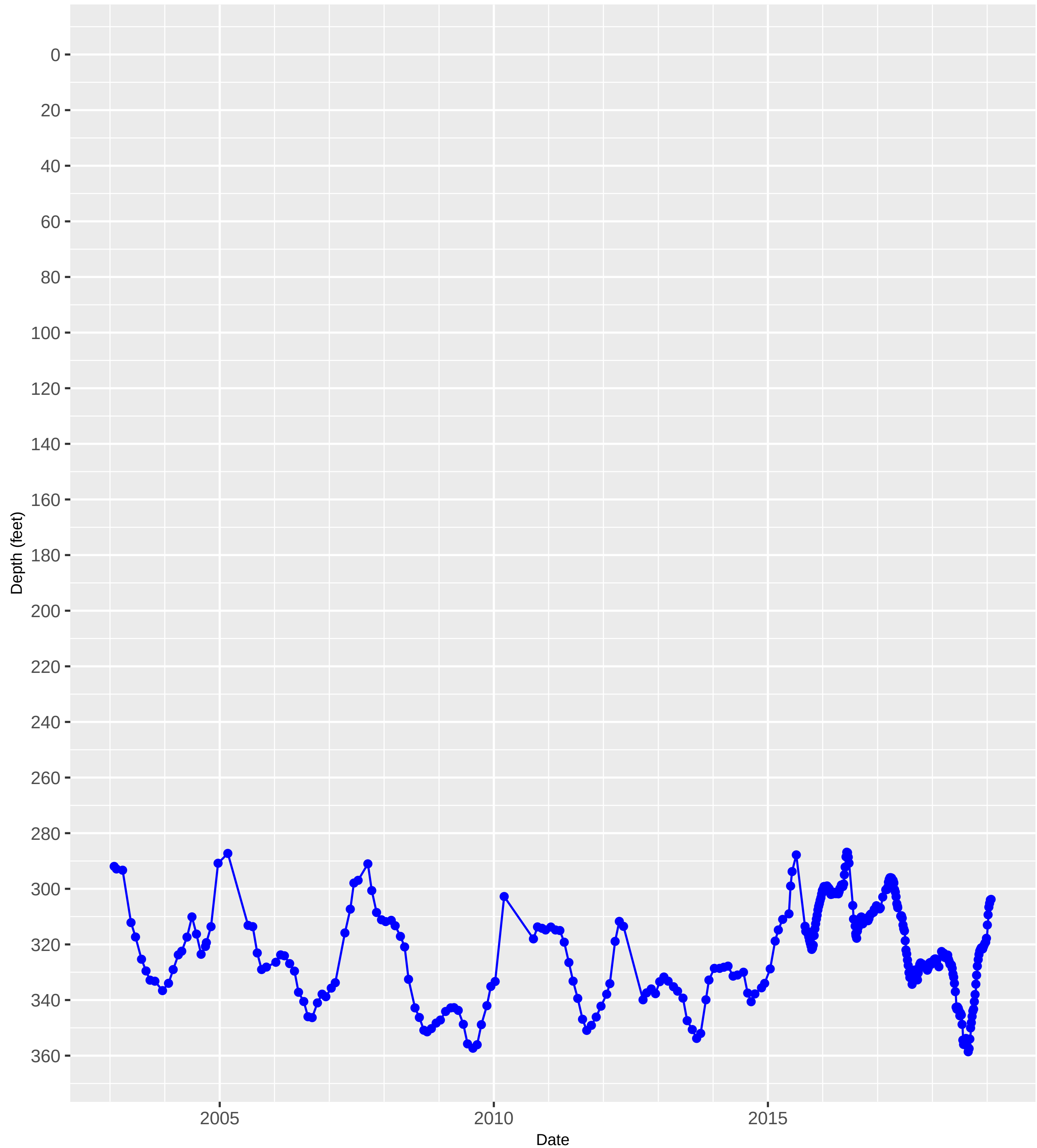
Casing Diagram



5764502 Hydrograph in 218CCRK − Cow Creek Limestone located in Hays County



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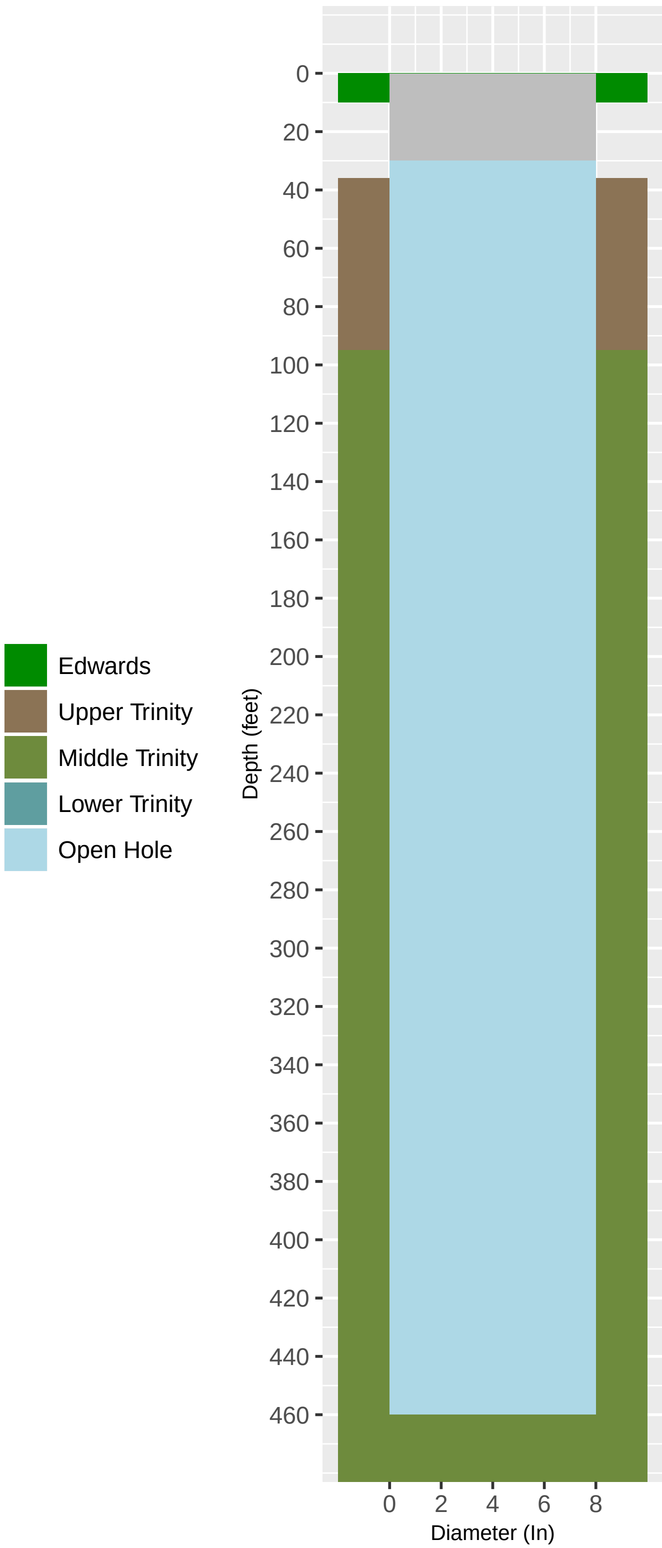
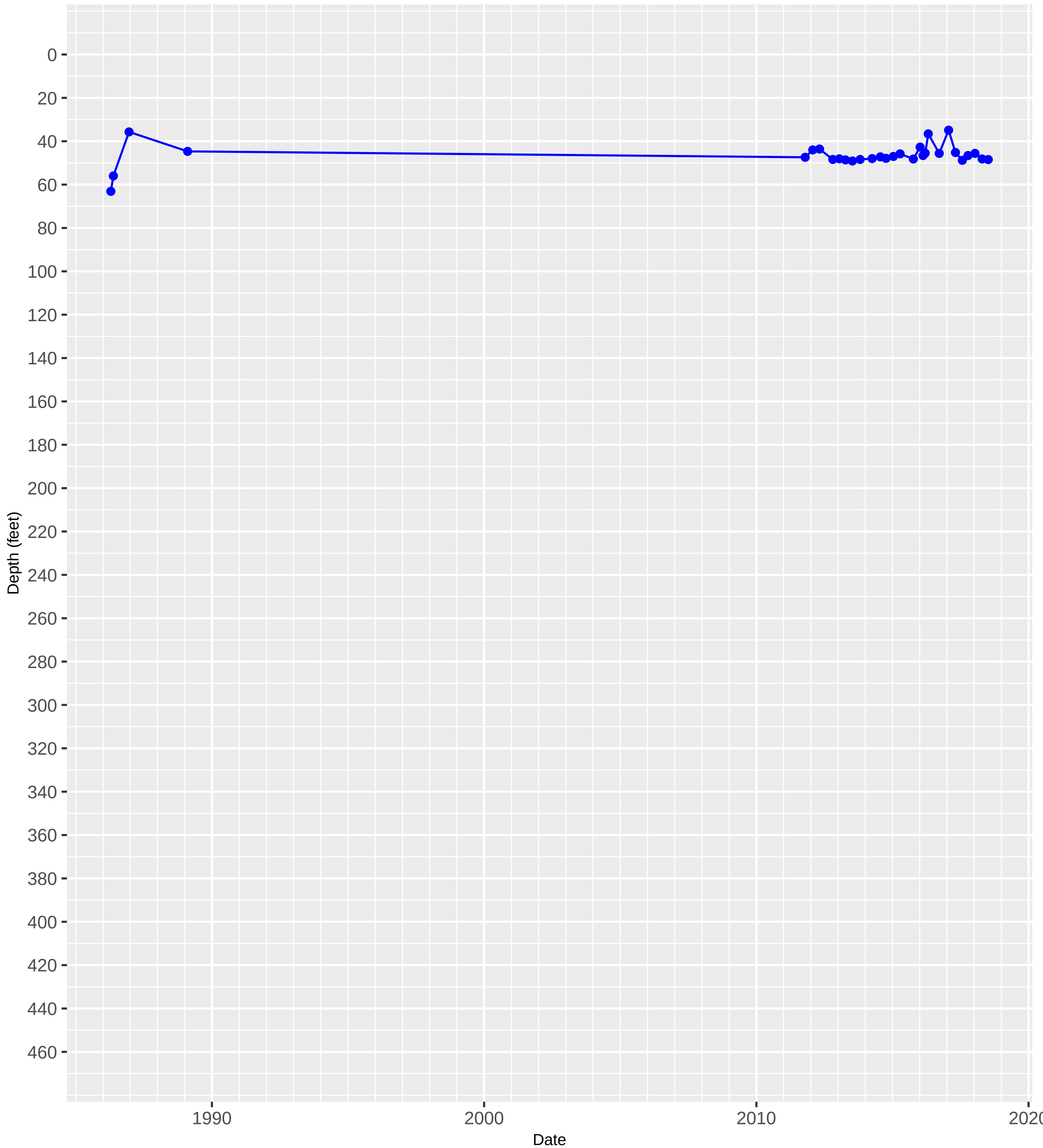
Casing Diagram



5764703 Hydrograph in 218CCRK − Cow Creek Limestone located in Hays County



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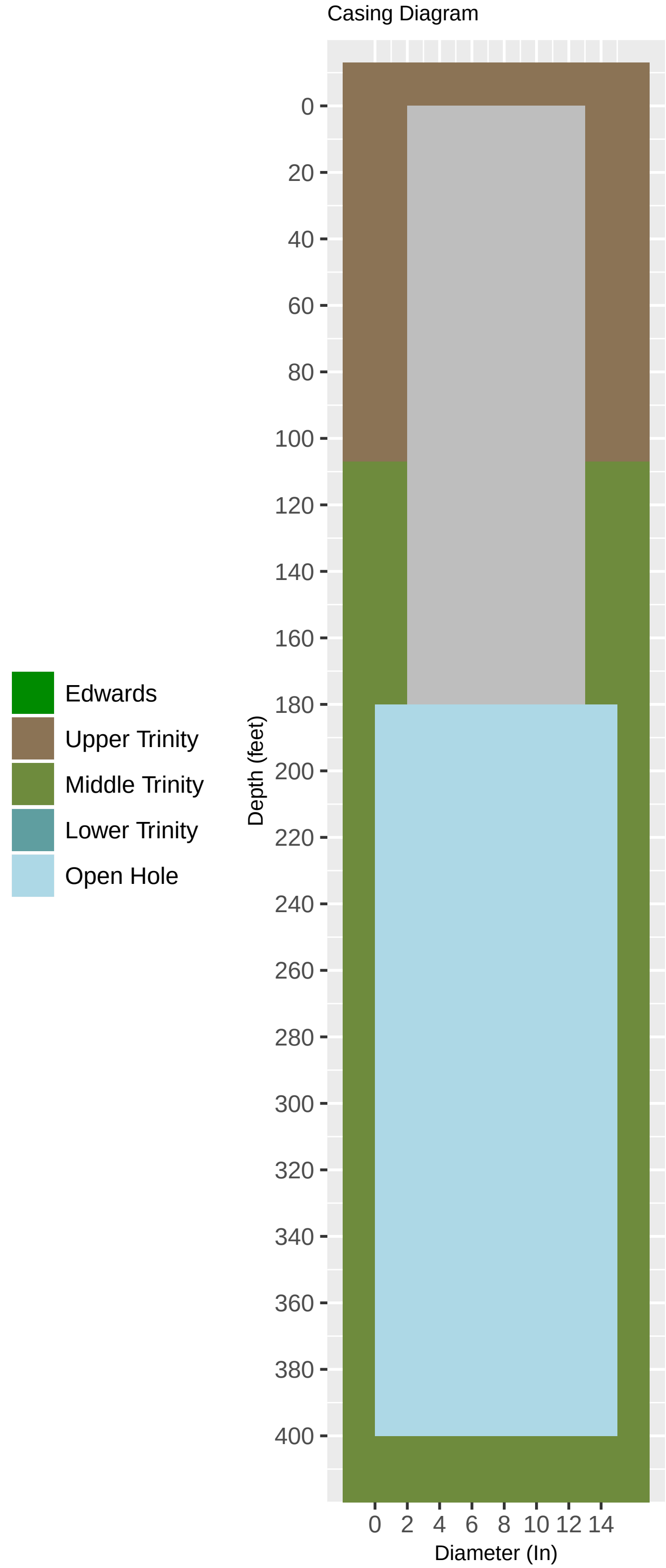
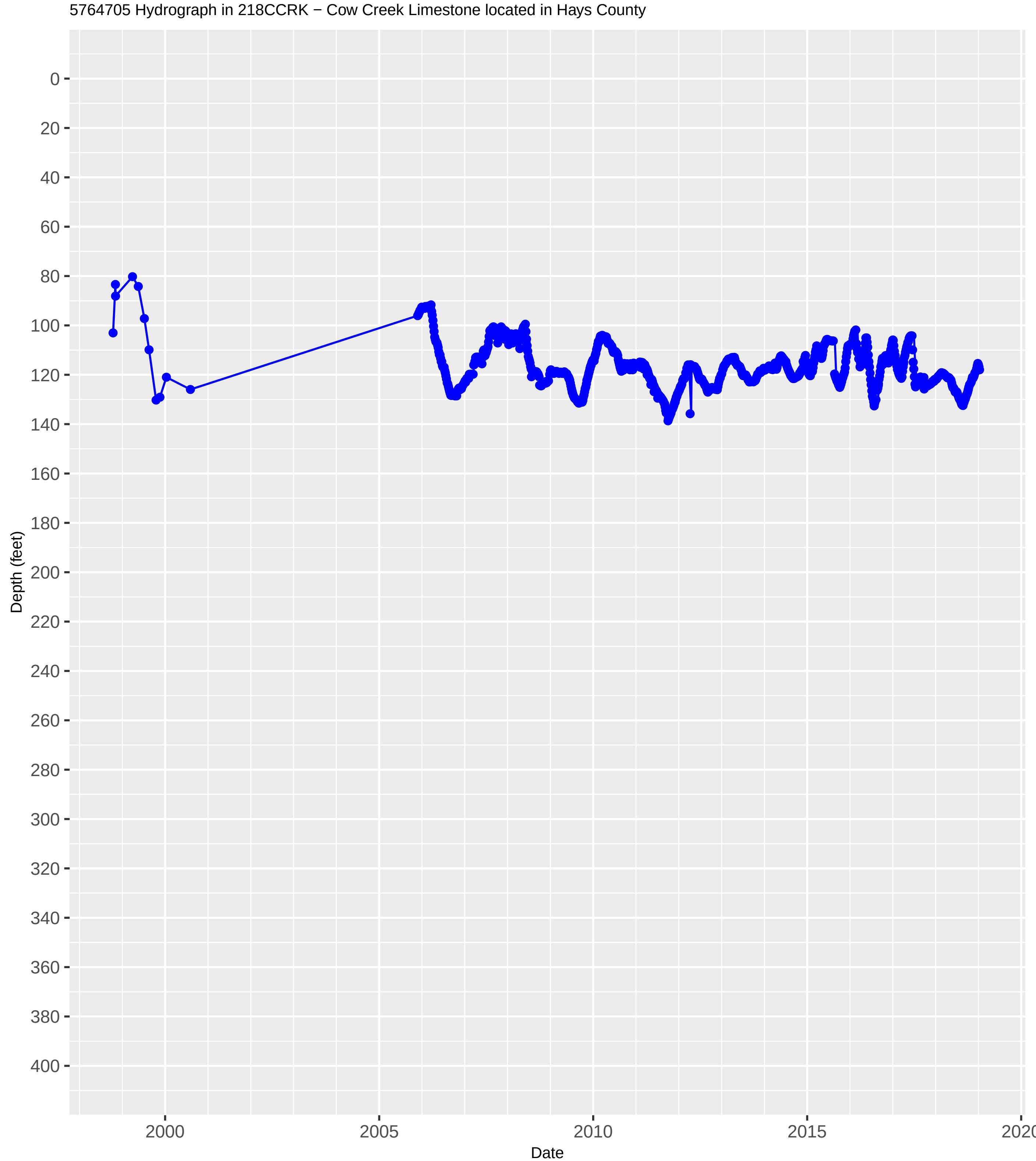
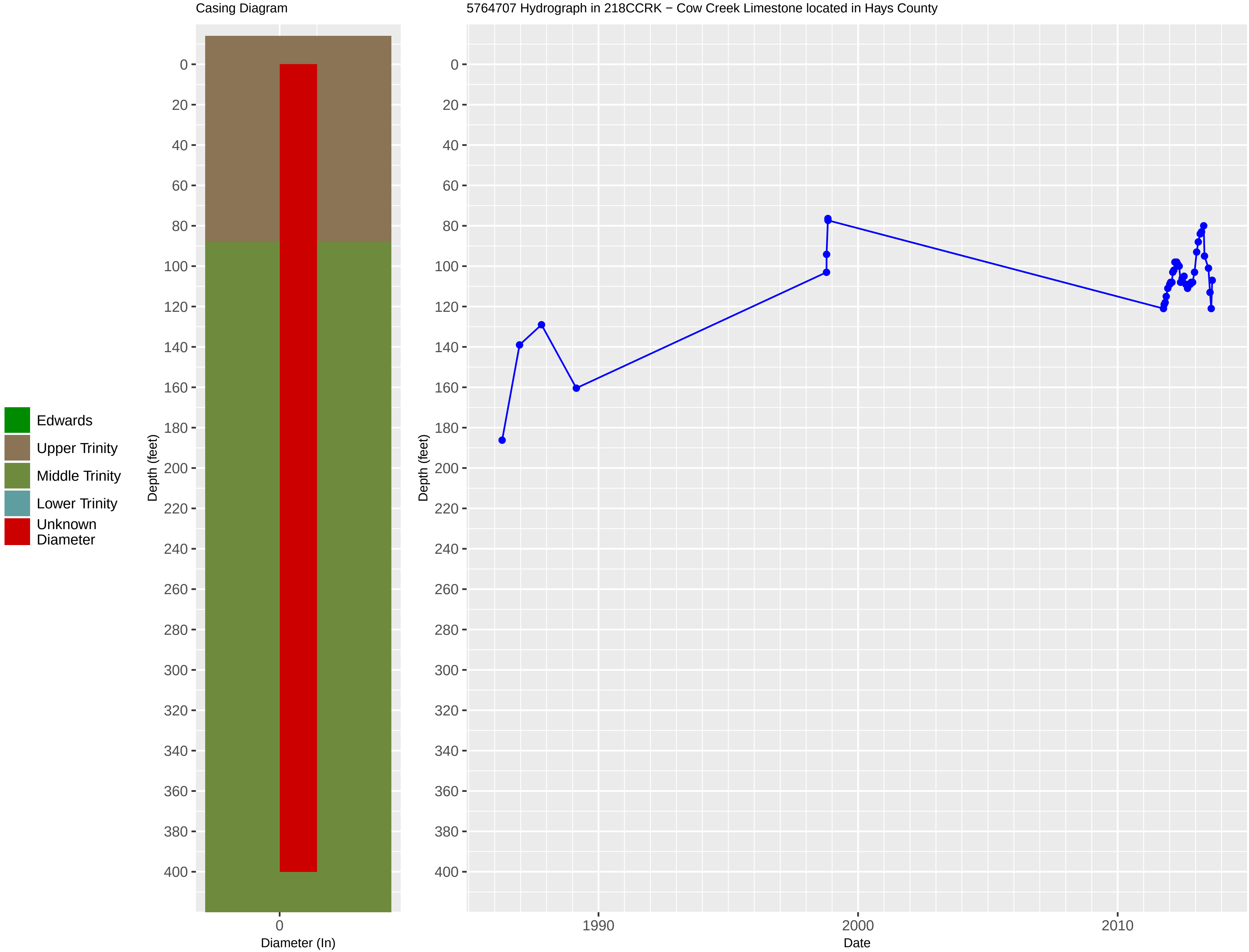




The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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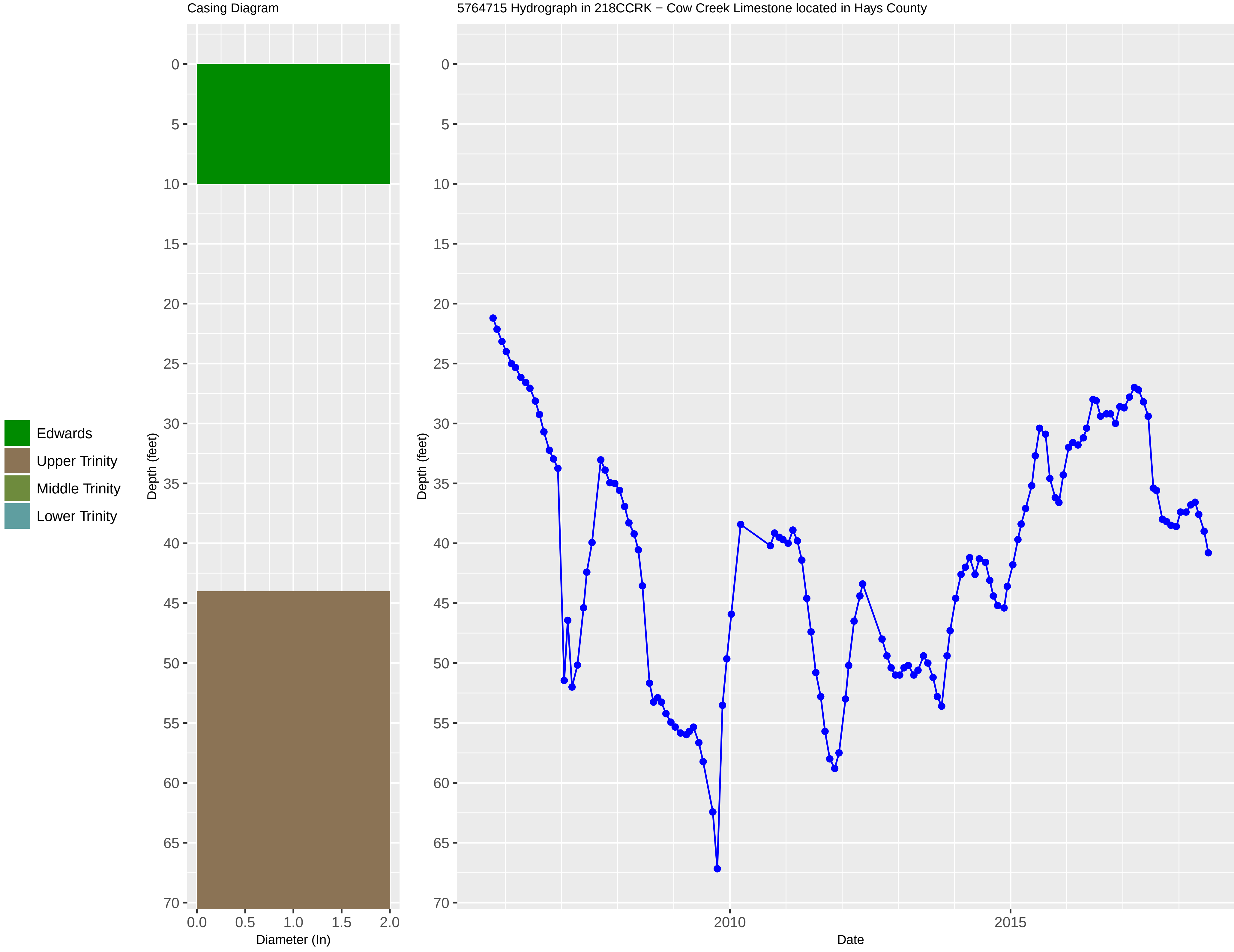
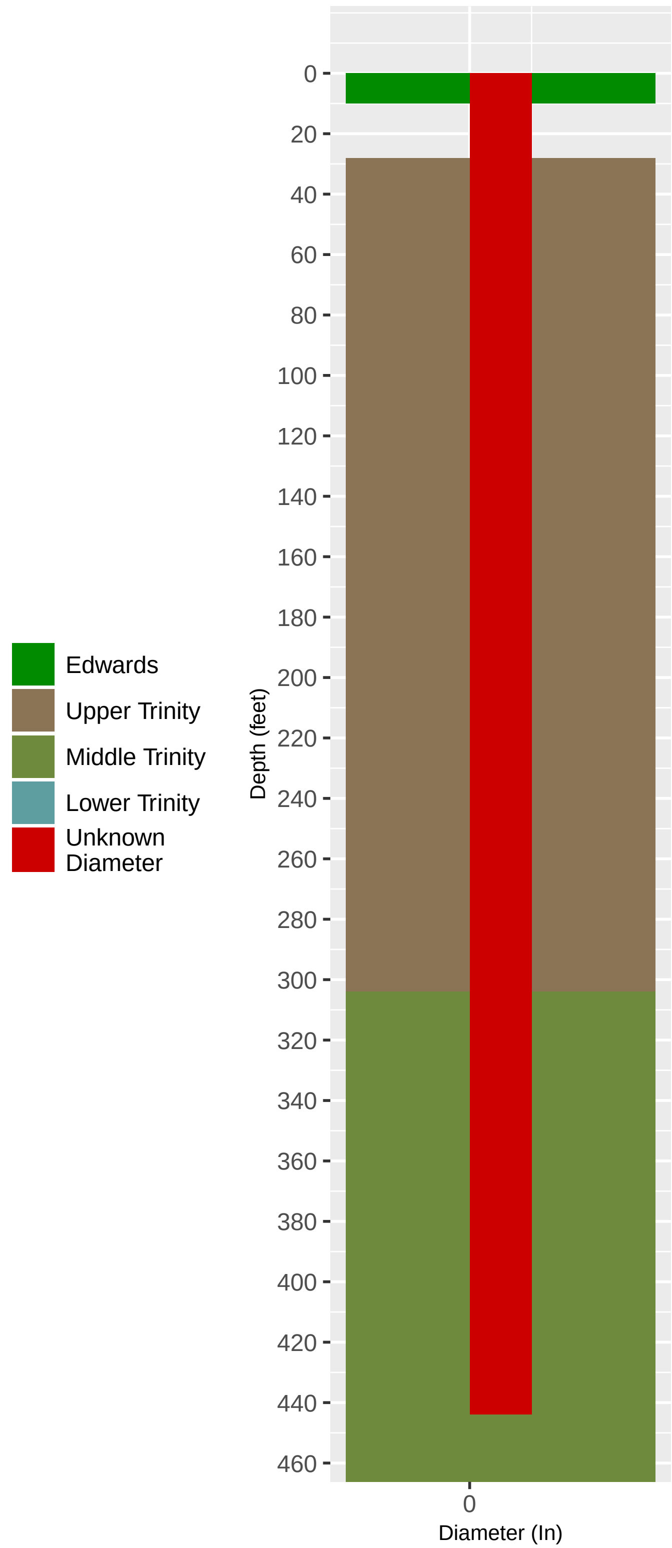
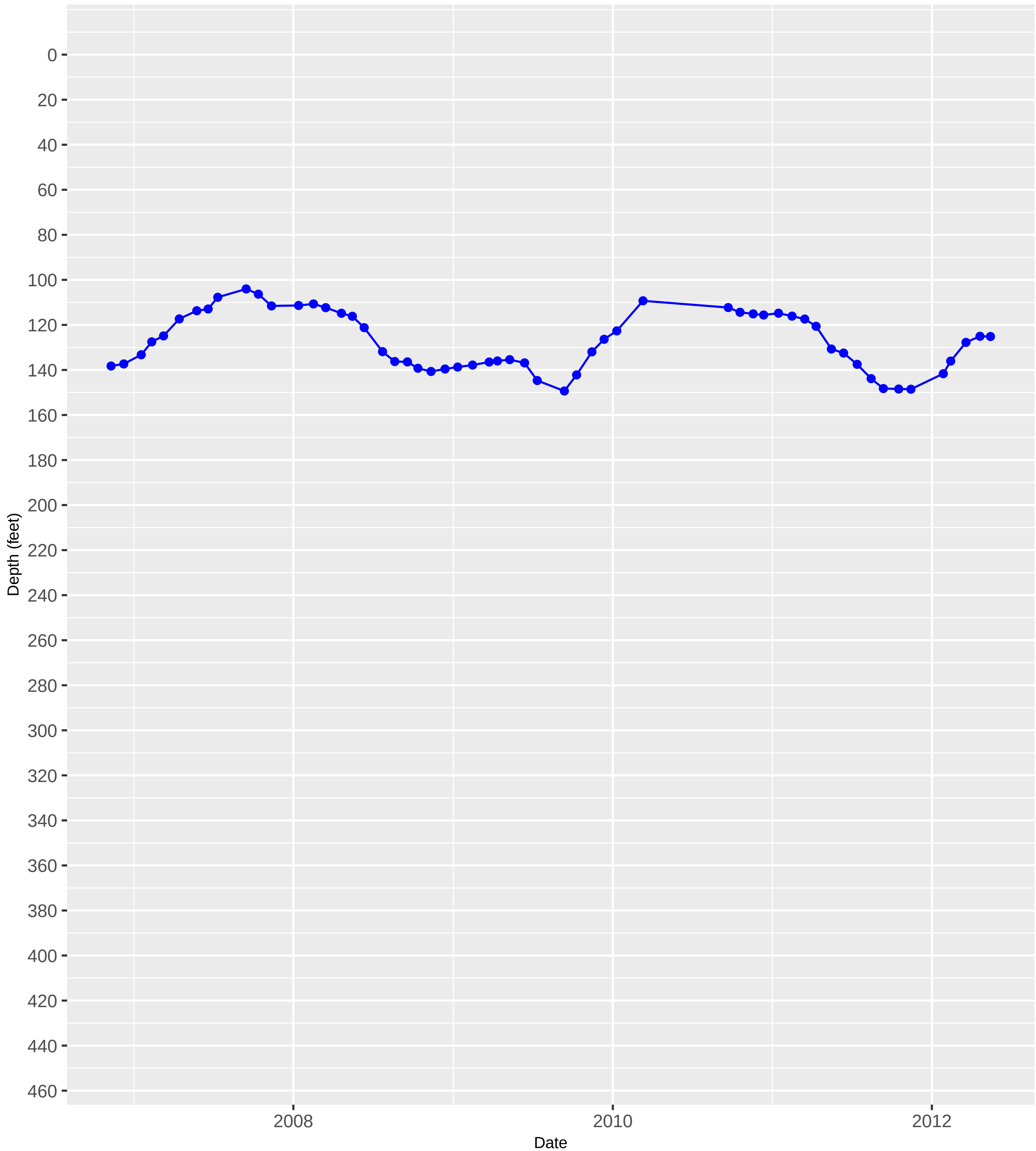


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram



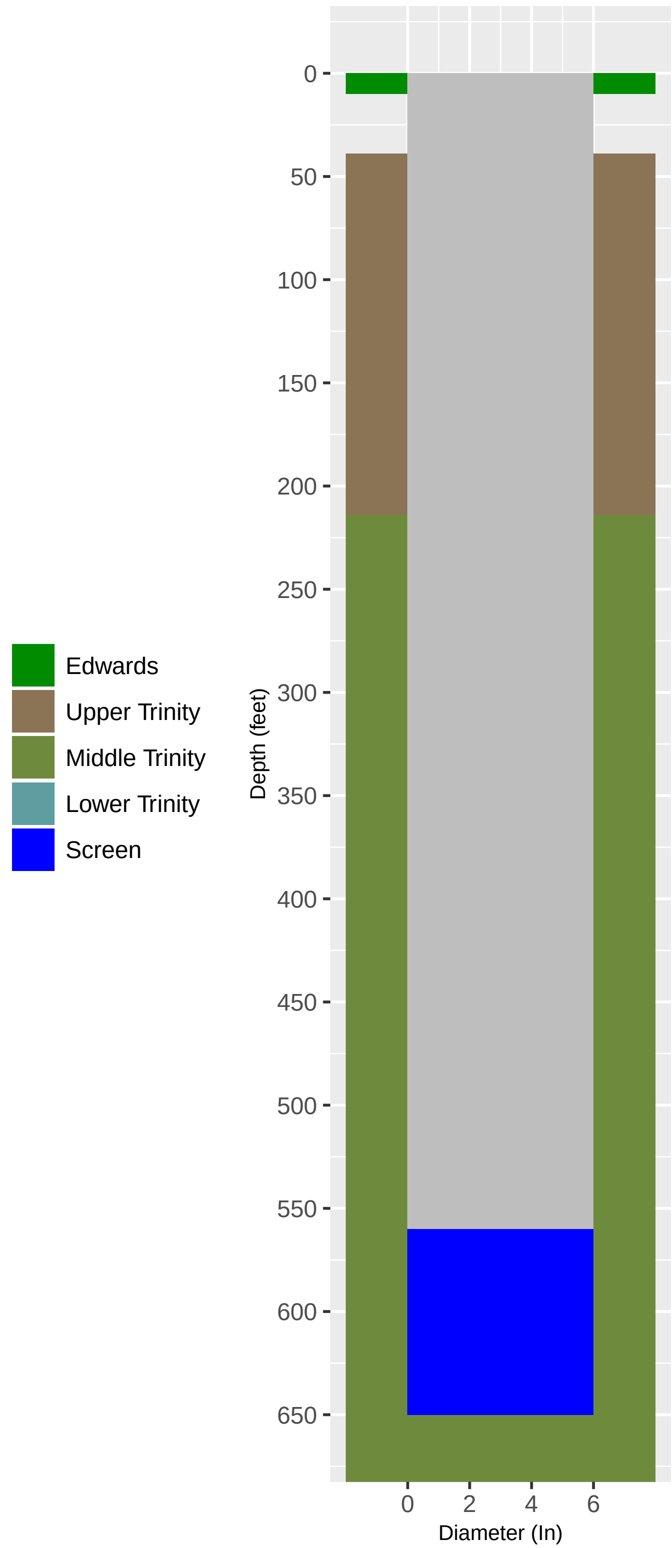
5764806 Hydrograph in 218CCRK − Cow Creek Limestone located in Hays County

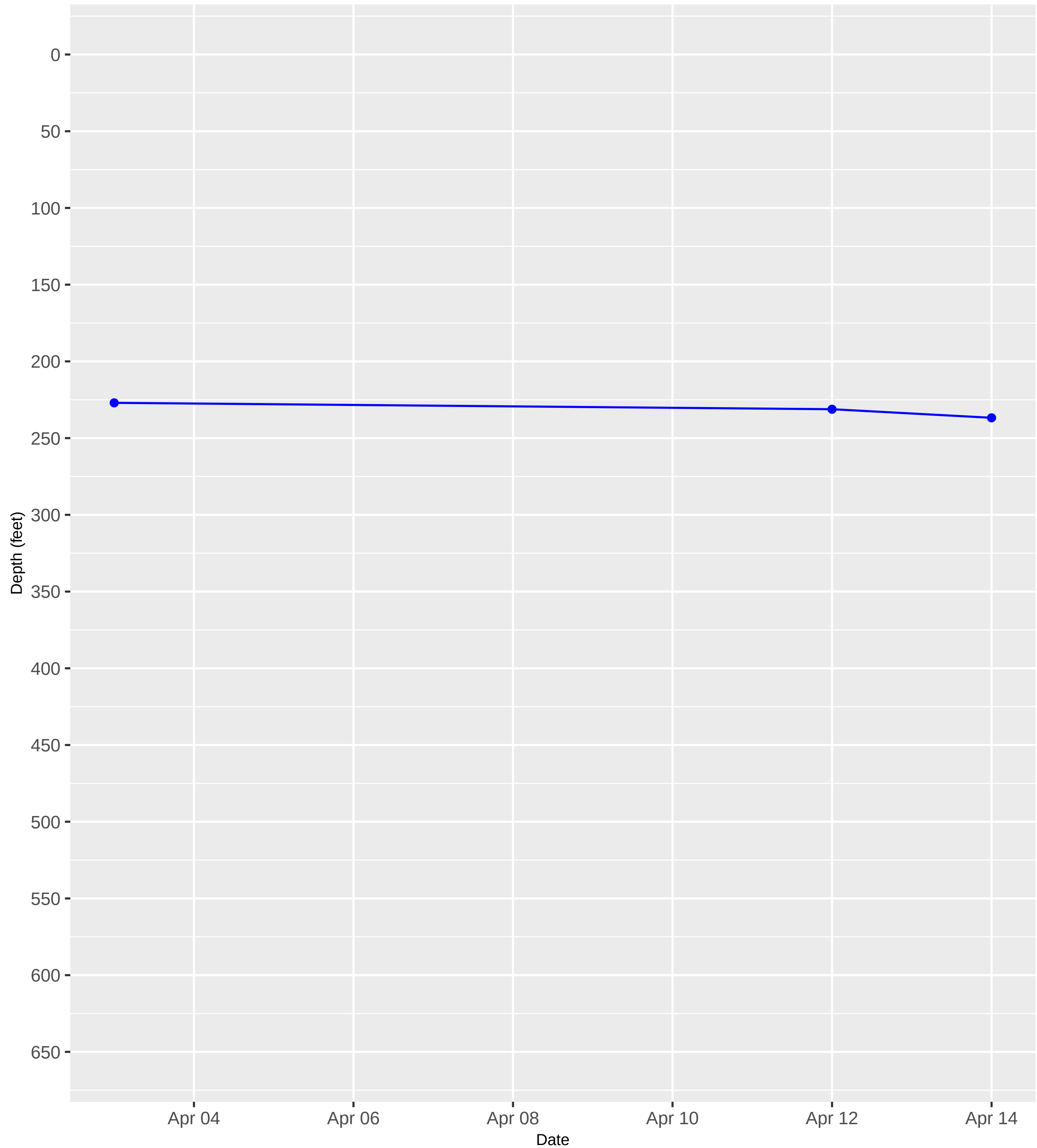


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

5849712 Hydrograph in 218CCRK − Cow Creek Limestone located in Hays County

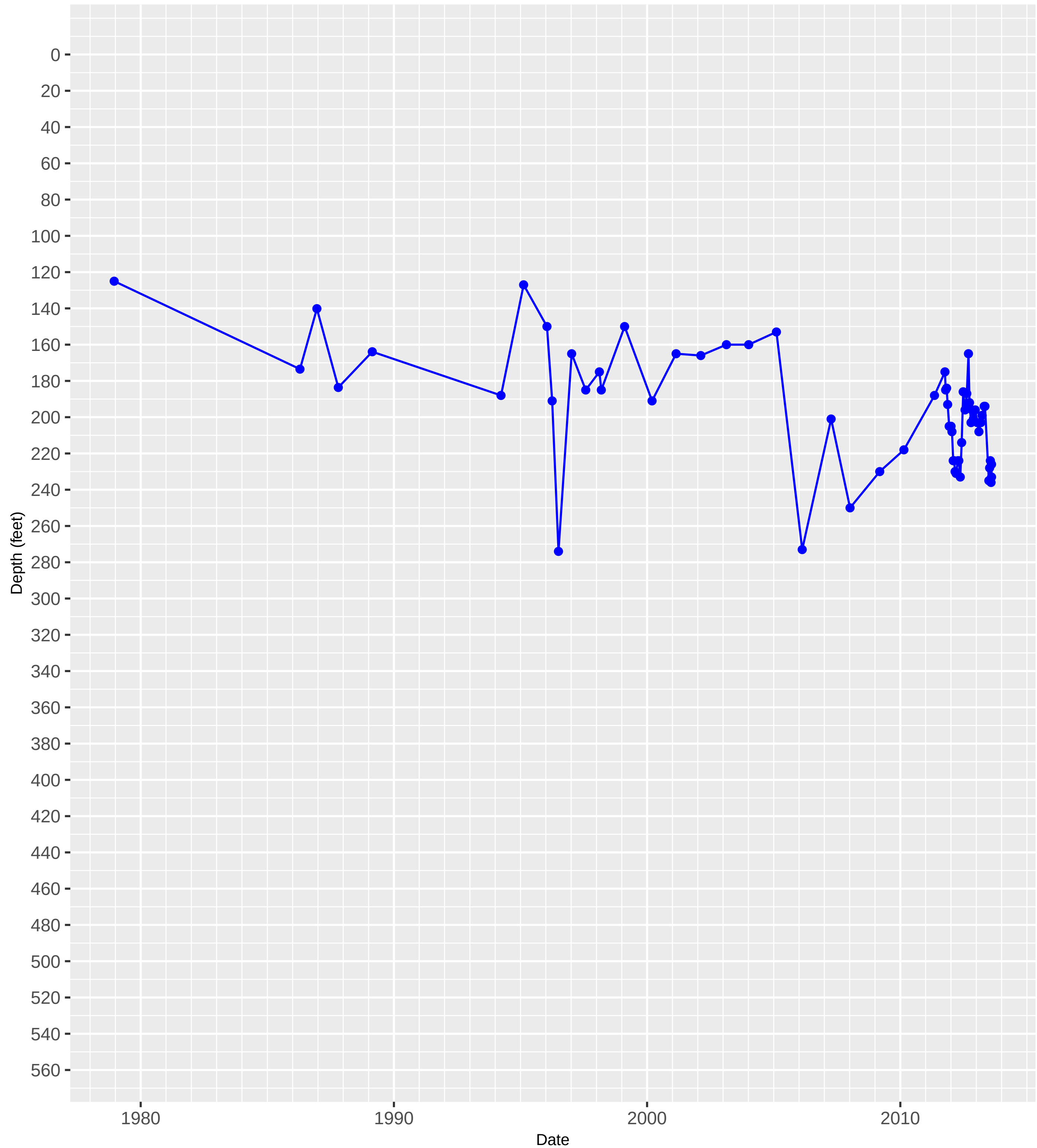




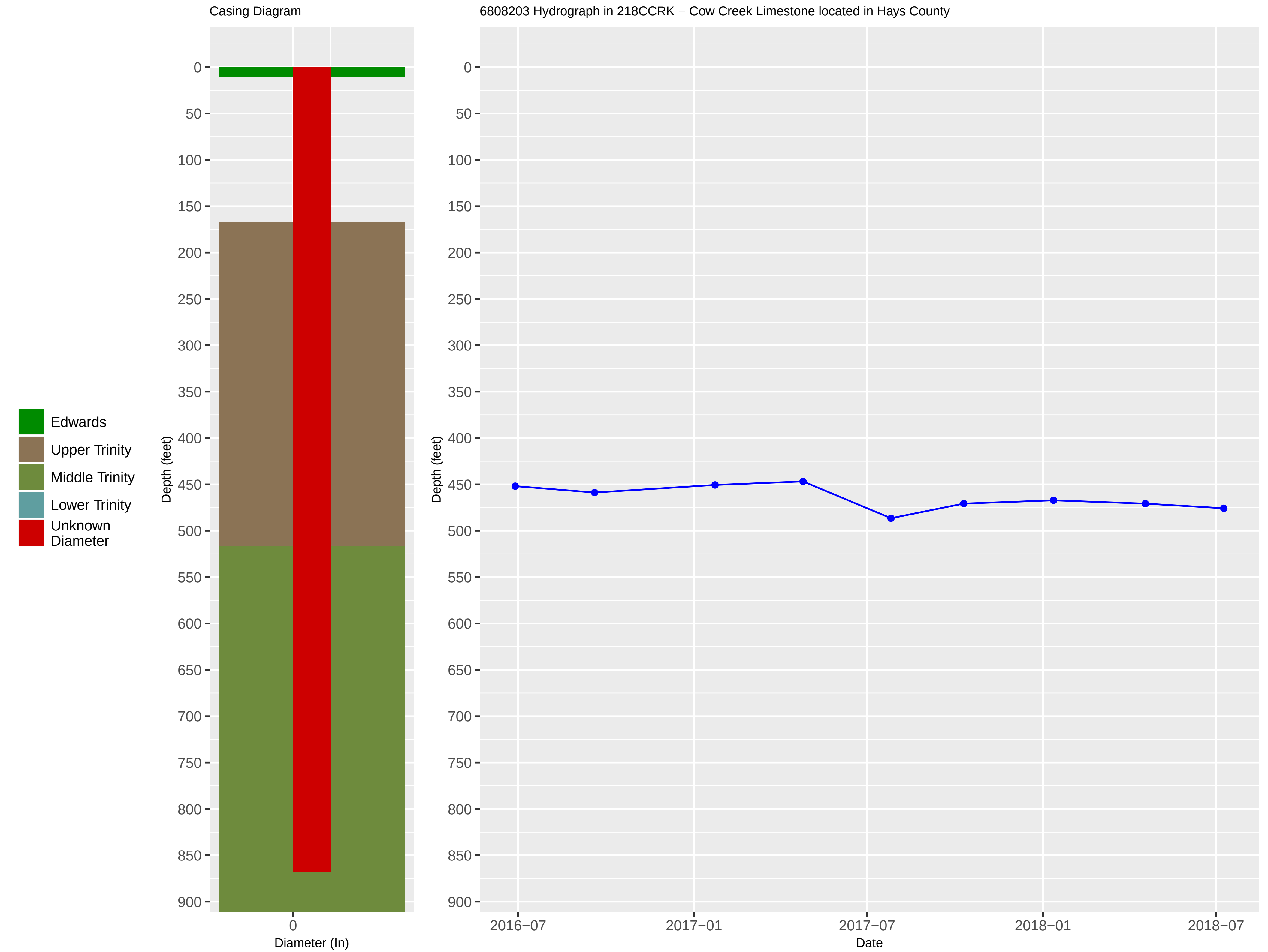
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

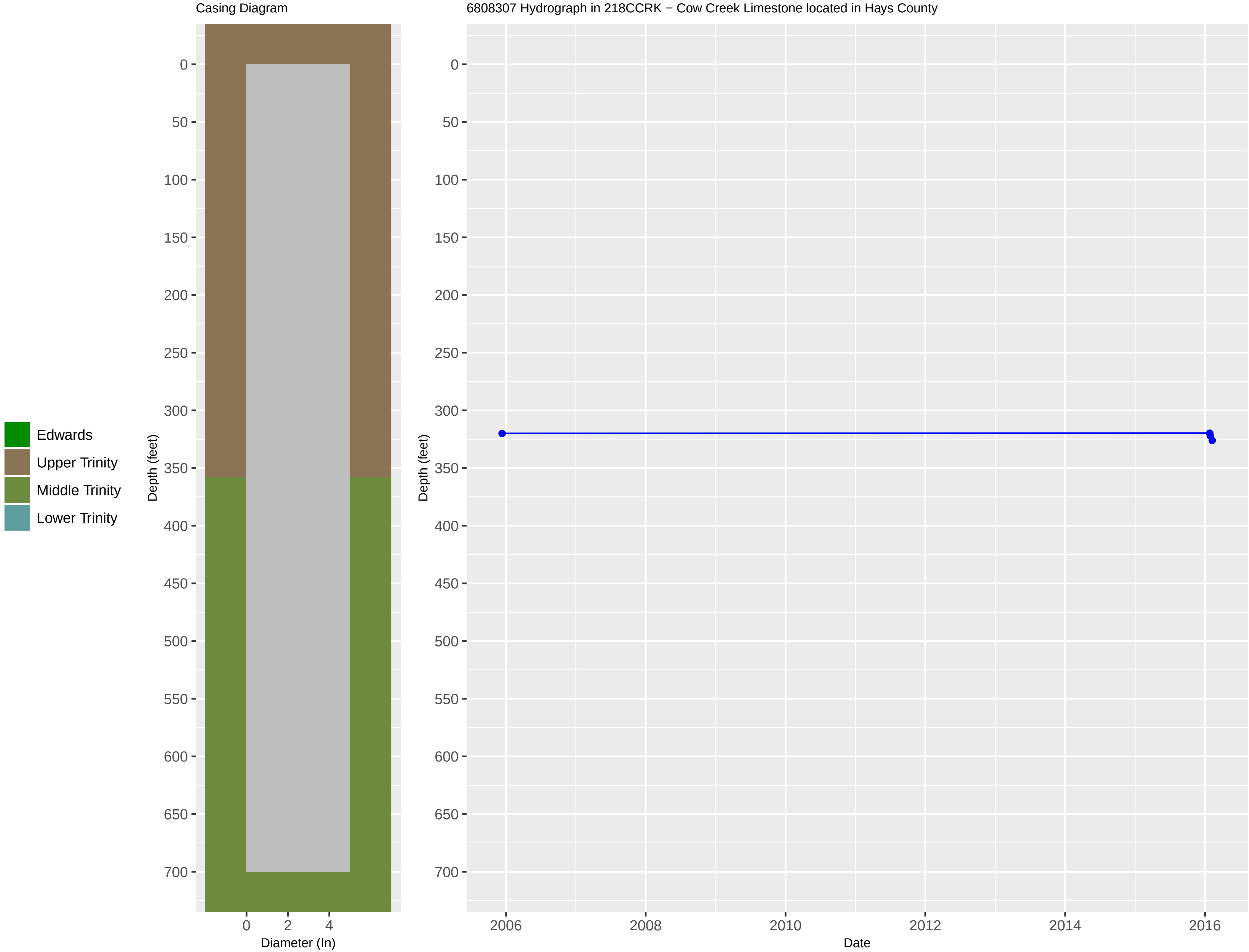
6808102 Hydrograph in 218CCRK − Cow Creek Limestone located in Hays County



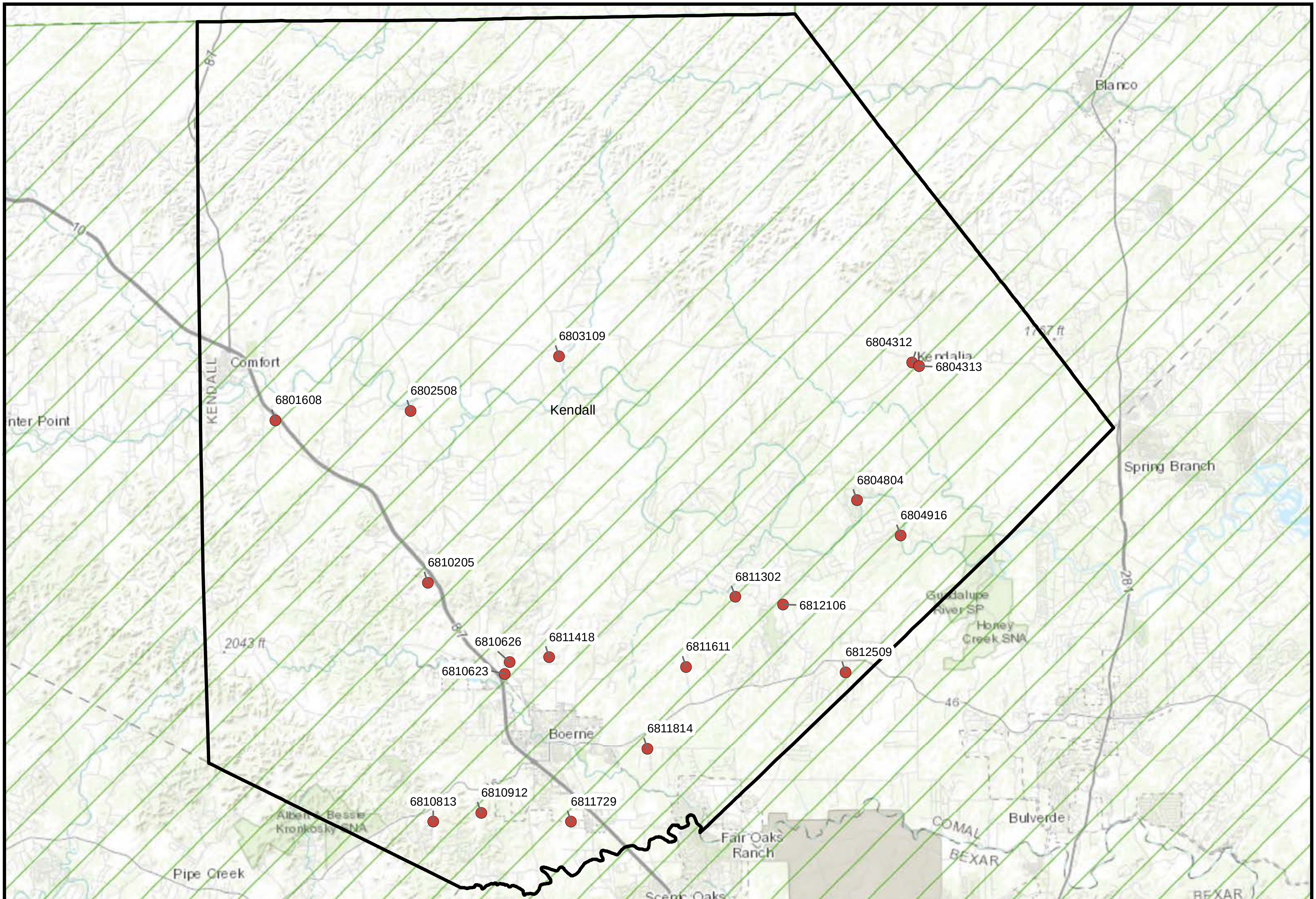
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



Aquifer

218CCRK - Cow Creek Limestone

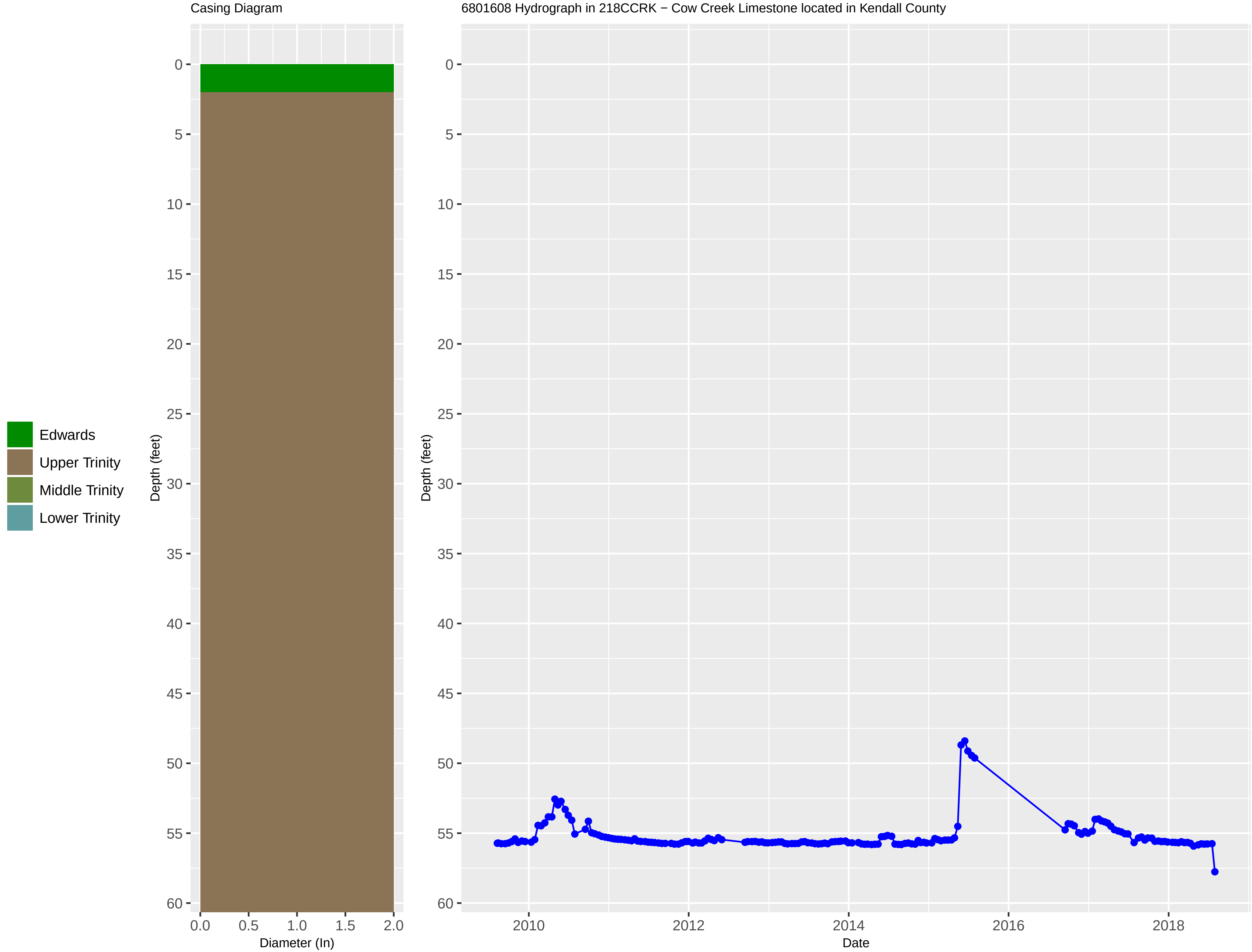
GMA 9

N

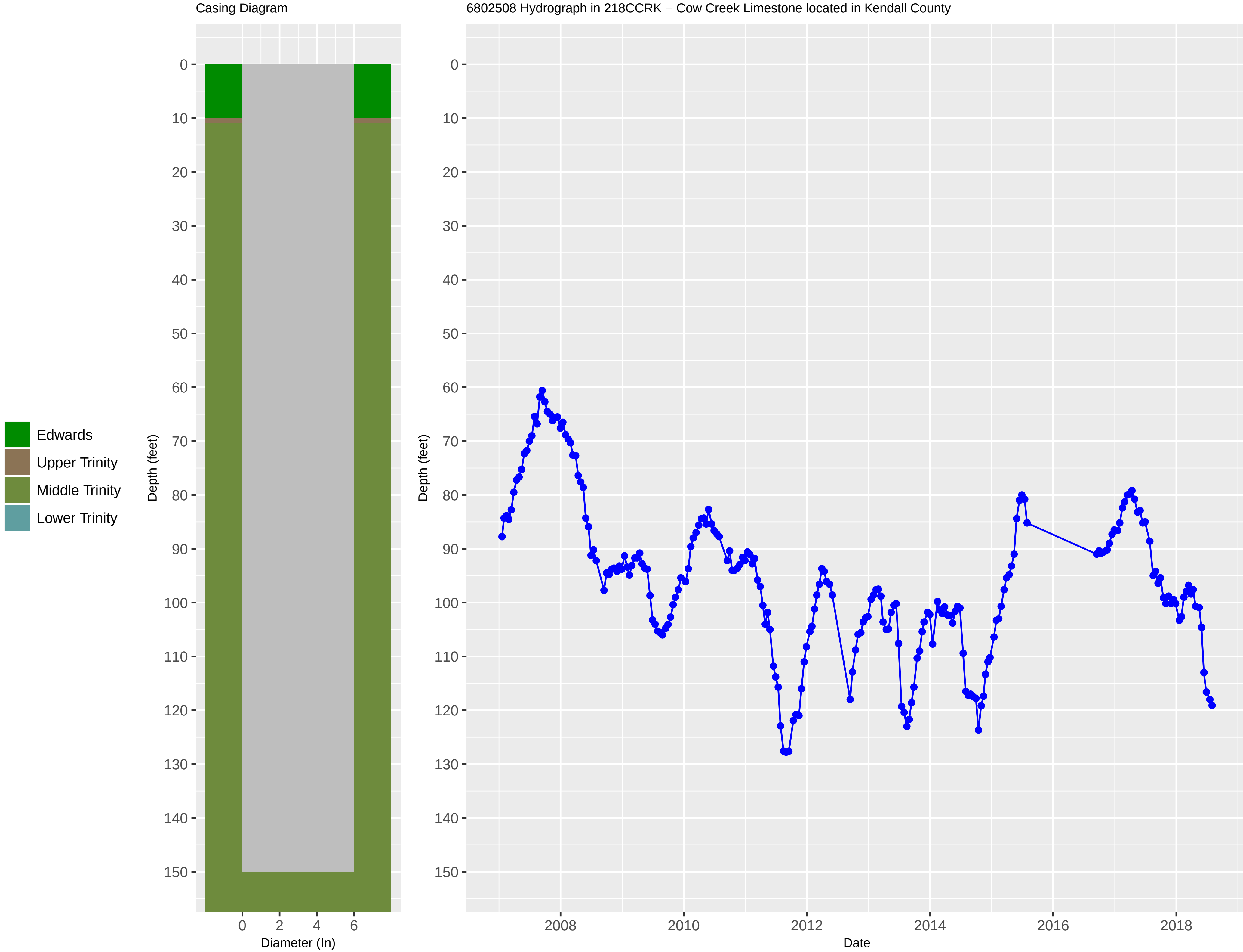
0 1 2 4

Miles

Map of Hydrograph Well Locations in Kendall County
218CCRK
Cow Creek Limestone

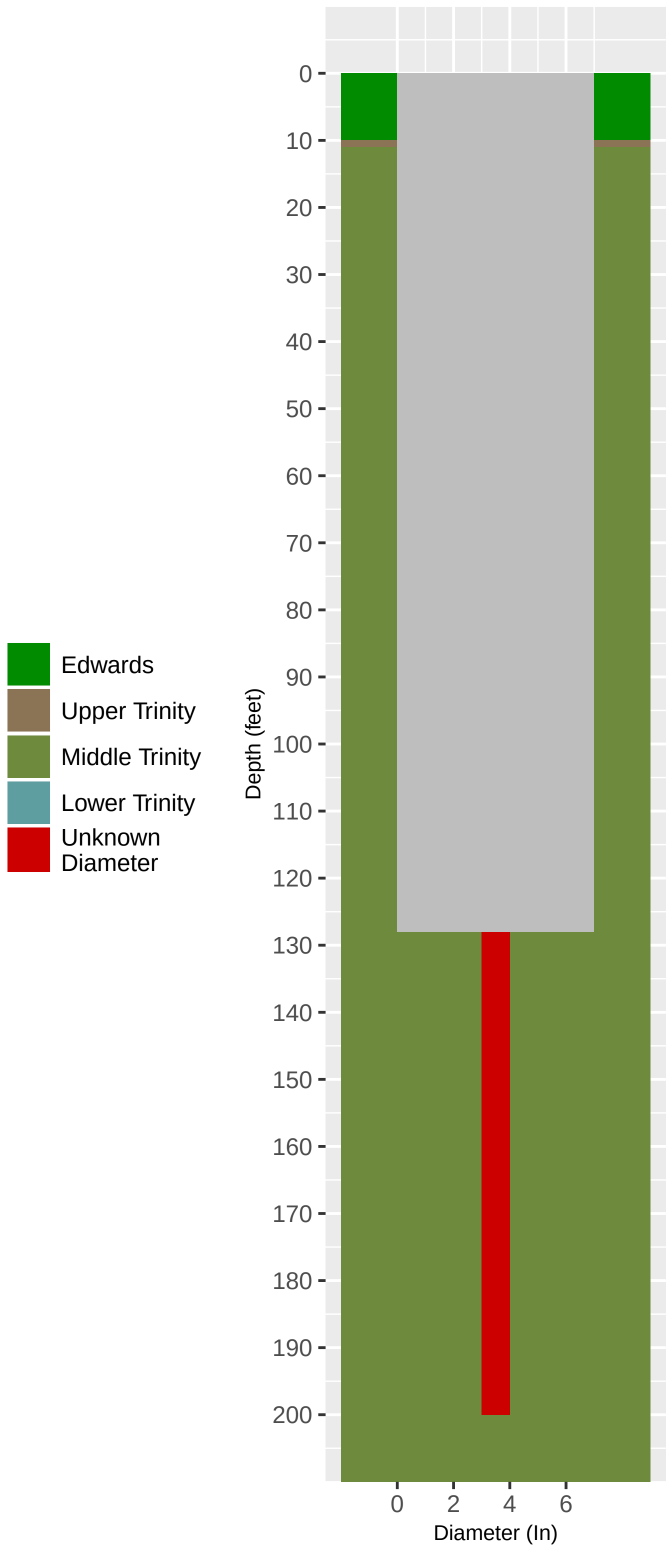


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

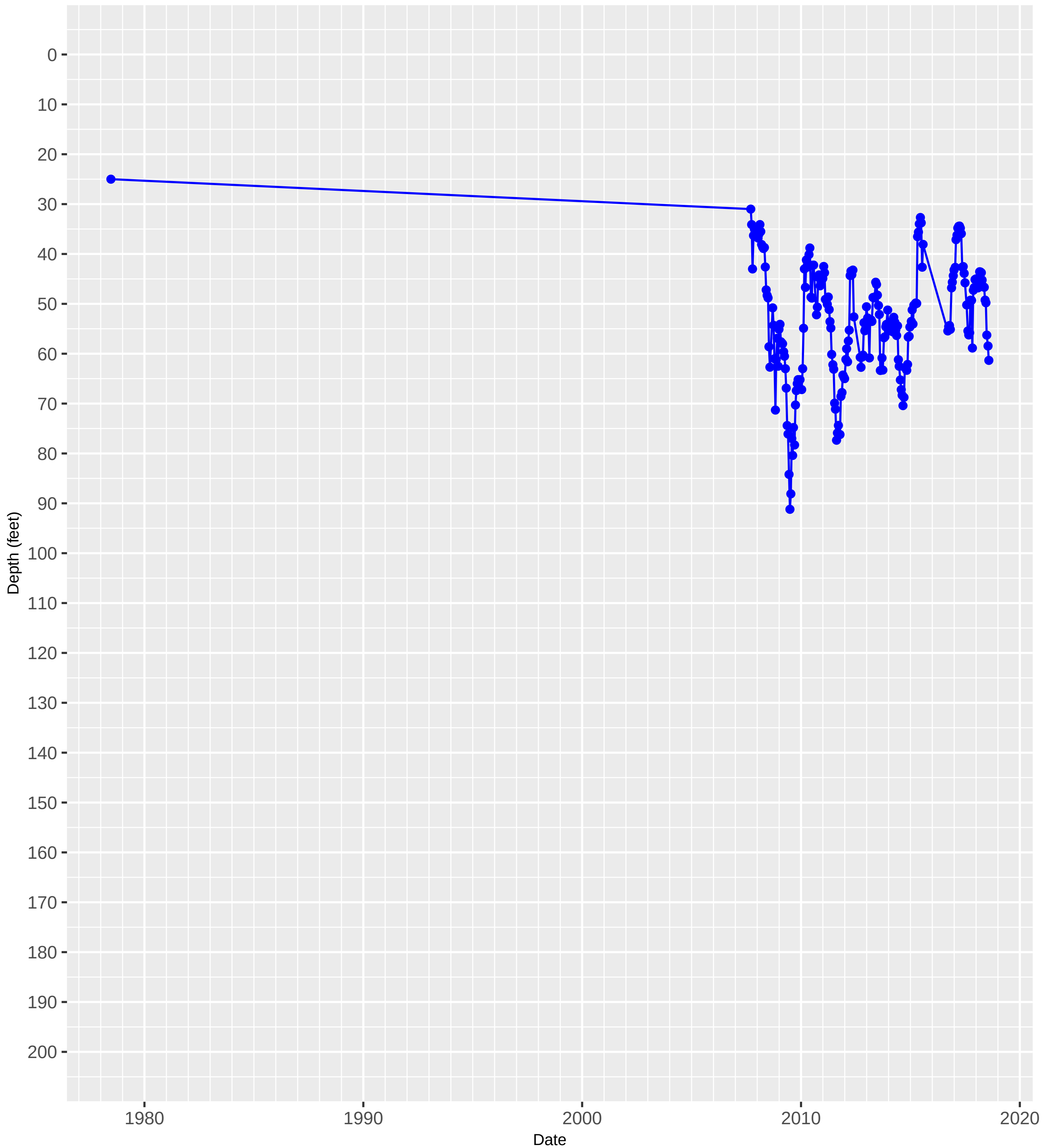


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram



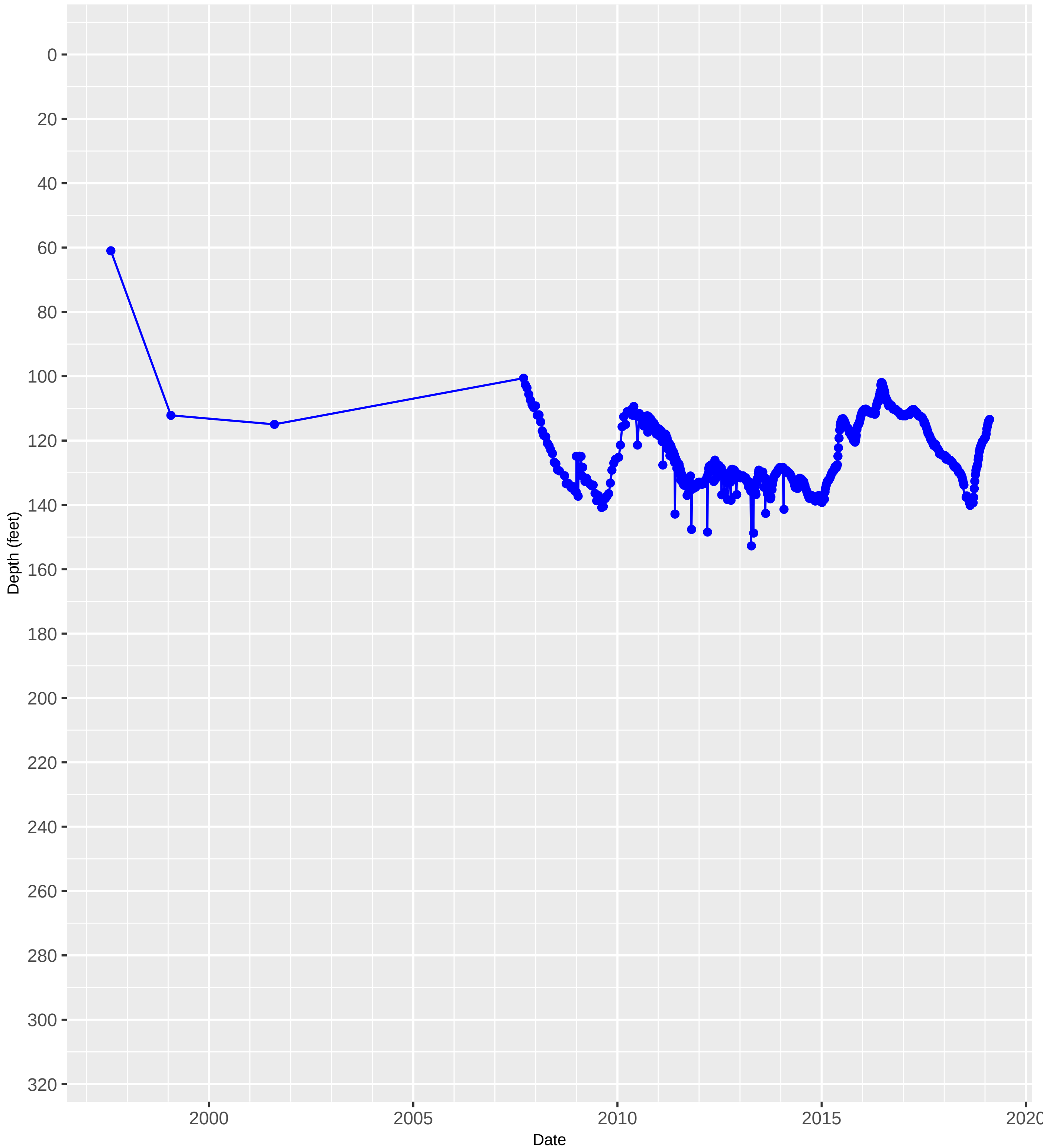
6803109 Hydrograph in 218CCRK − Cow Creek Limestone located in Kendall County



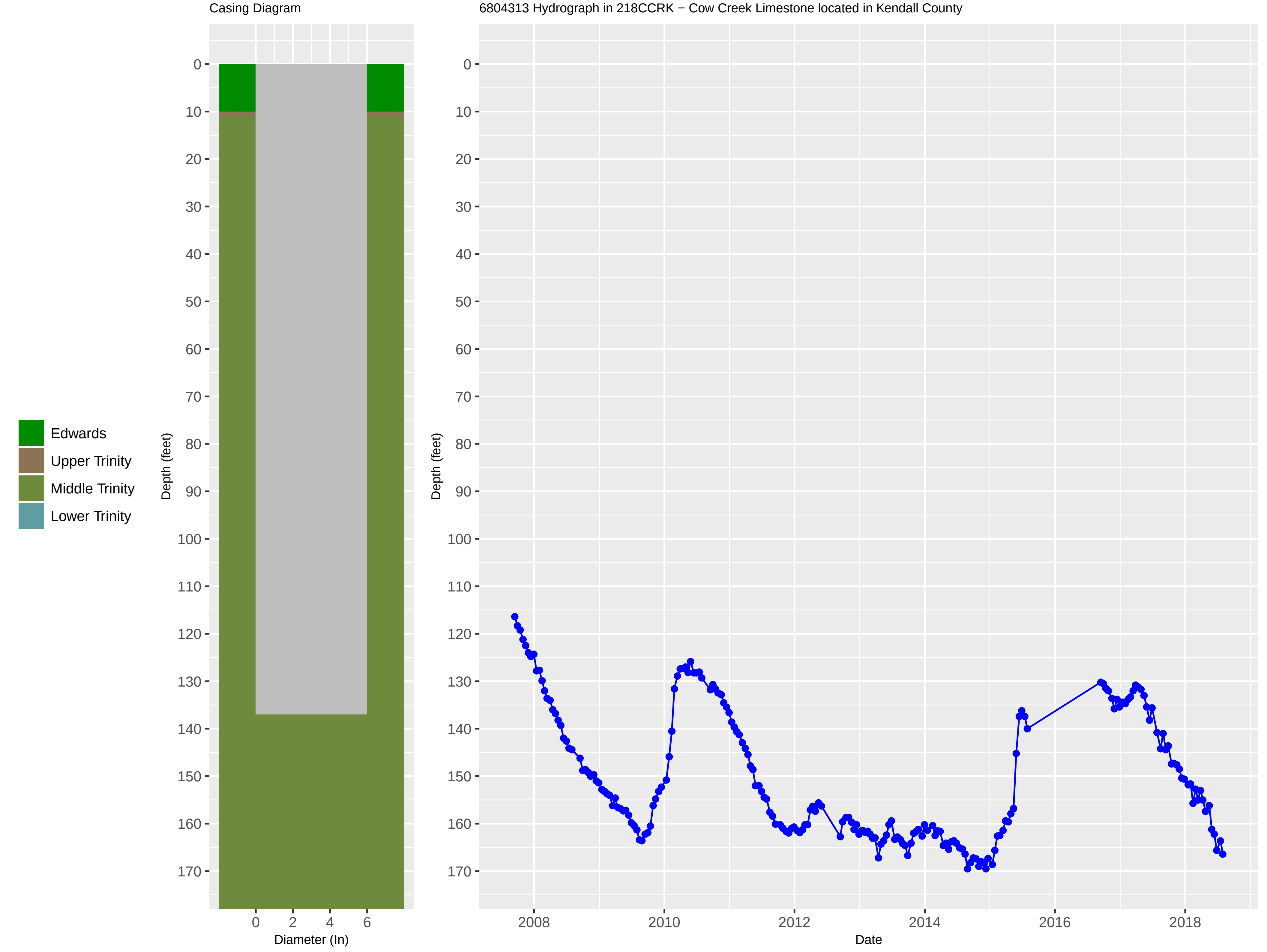
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

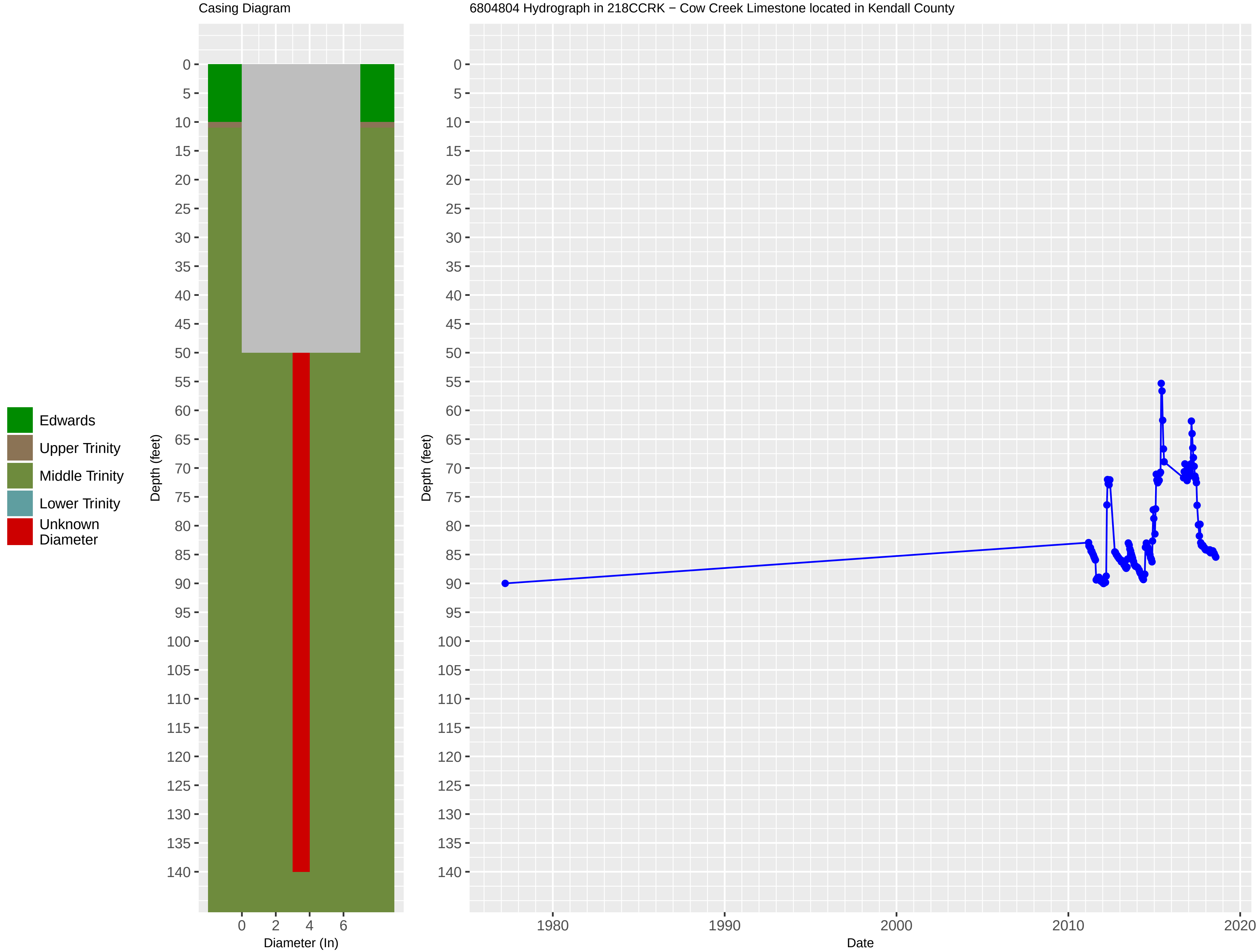
6804312 Hydrograph in 218CCRK − Cow Creek Limestone located in Kendall County



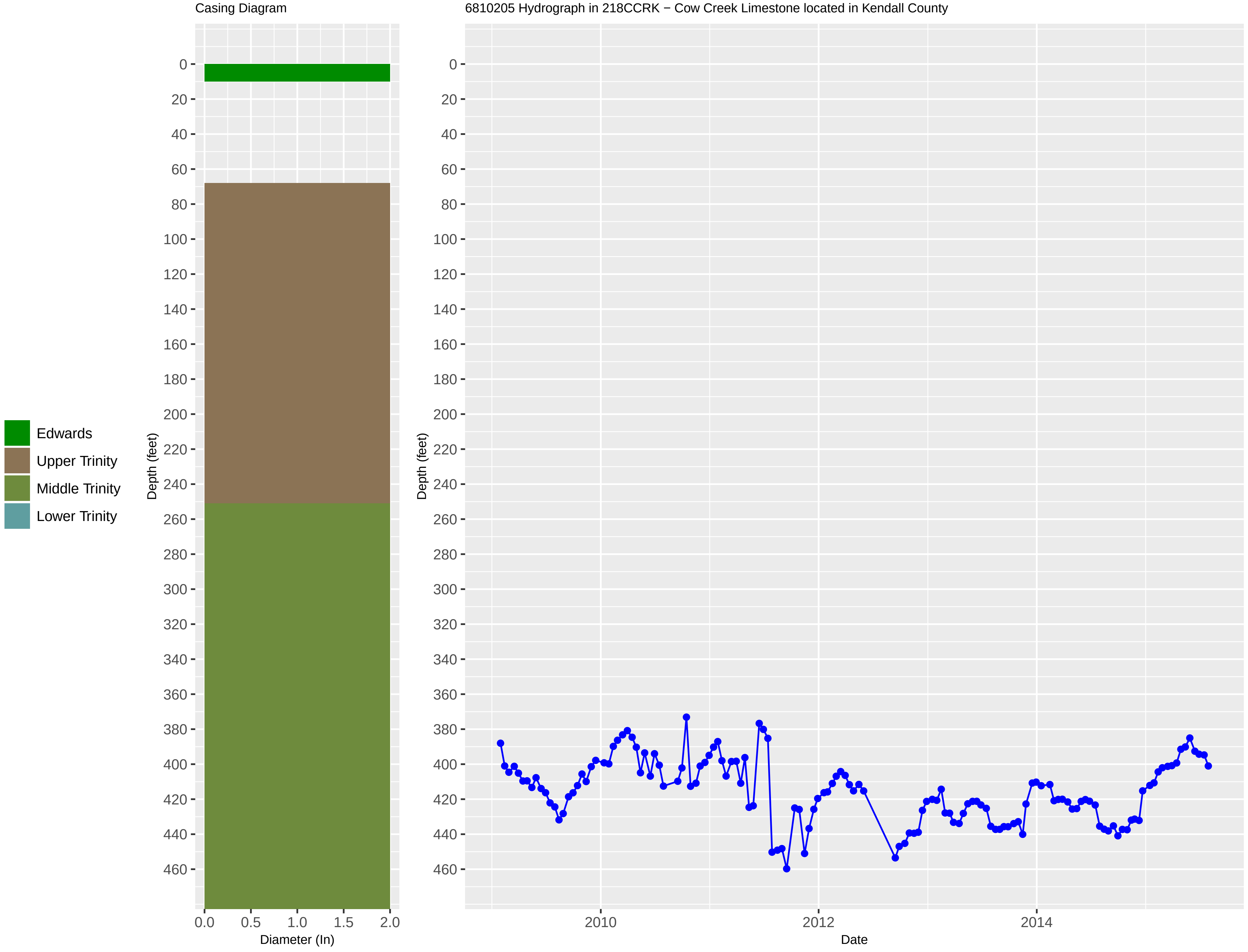
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



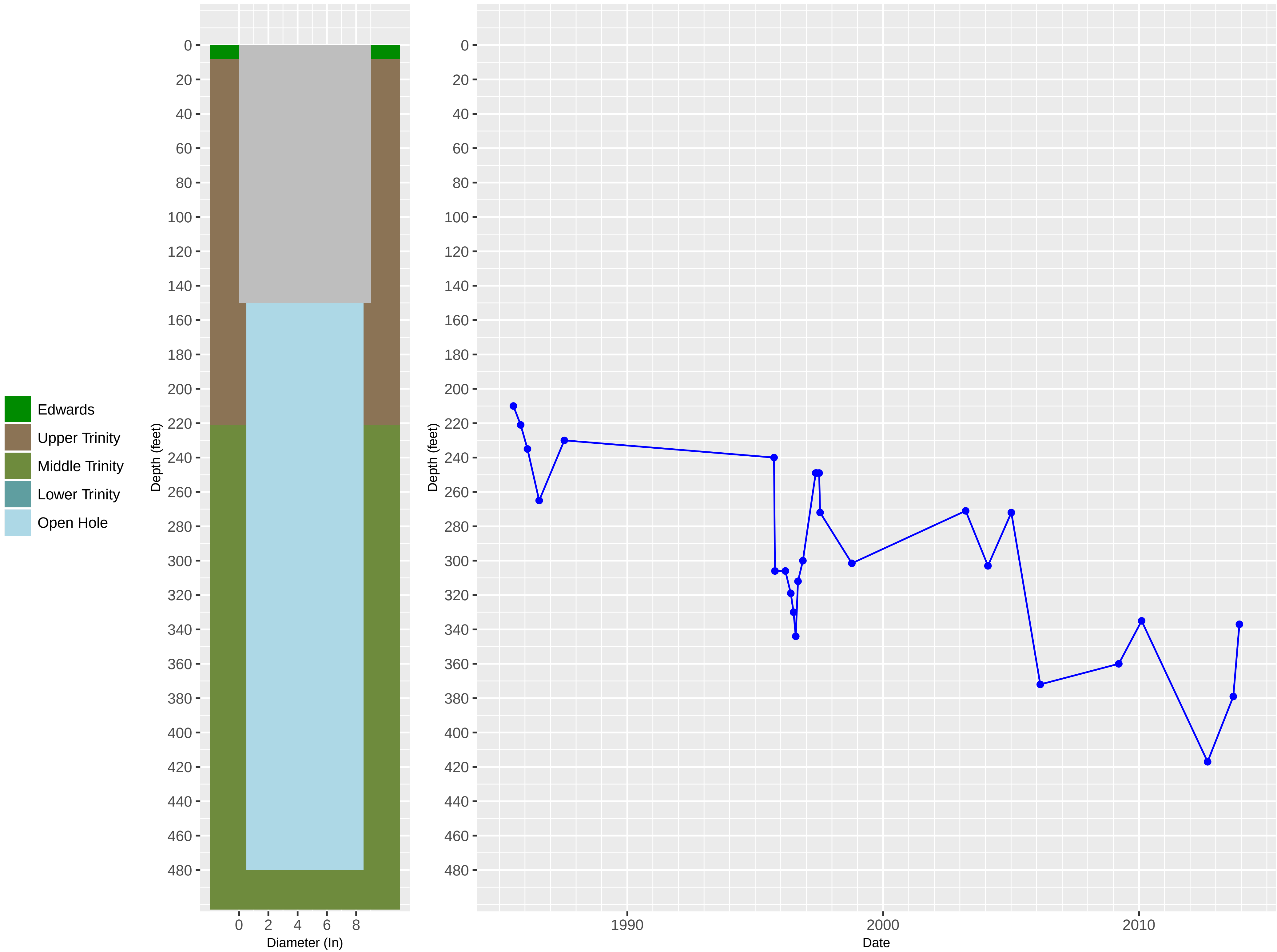
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



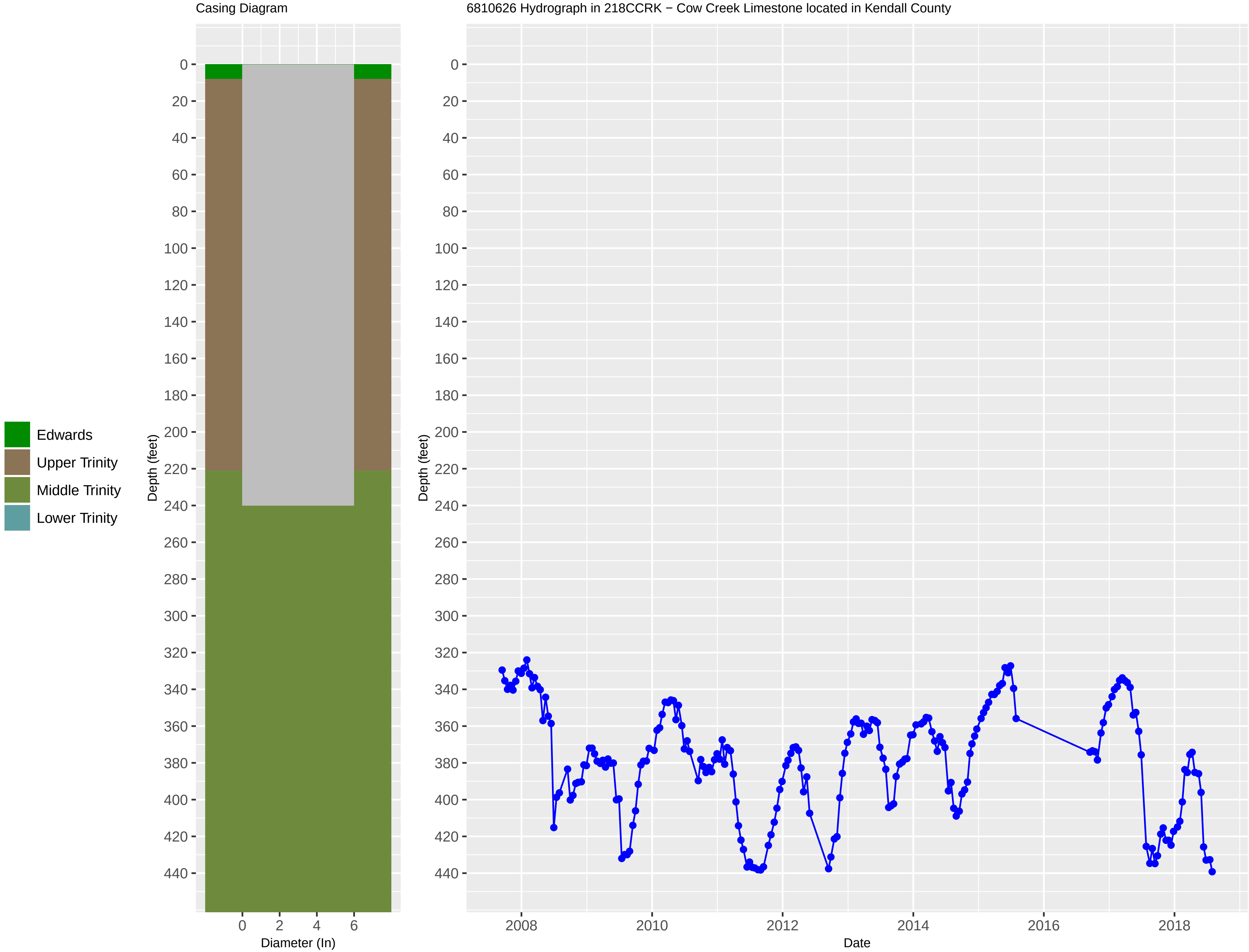
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

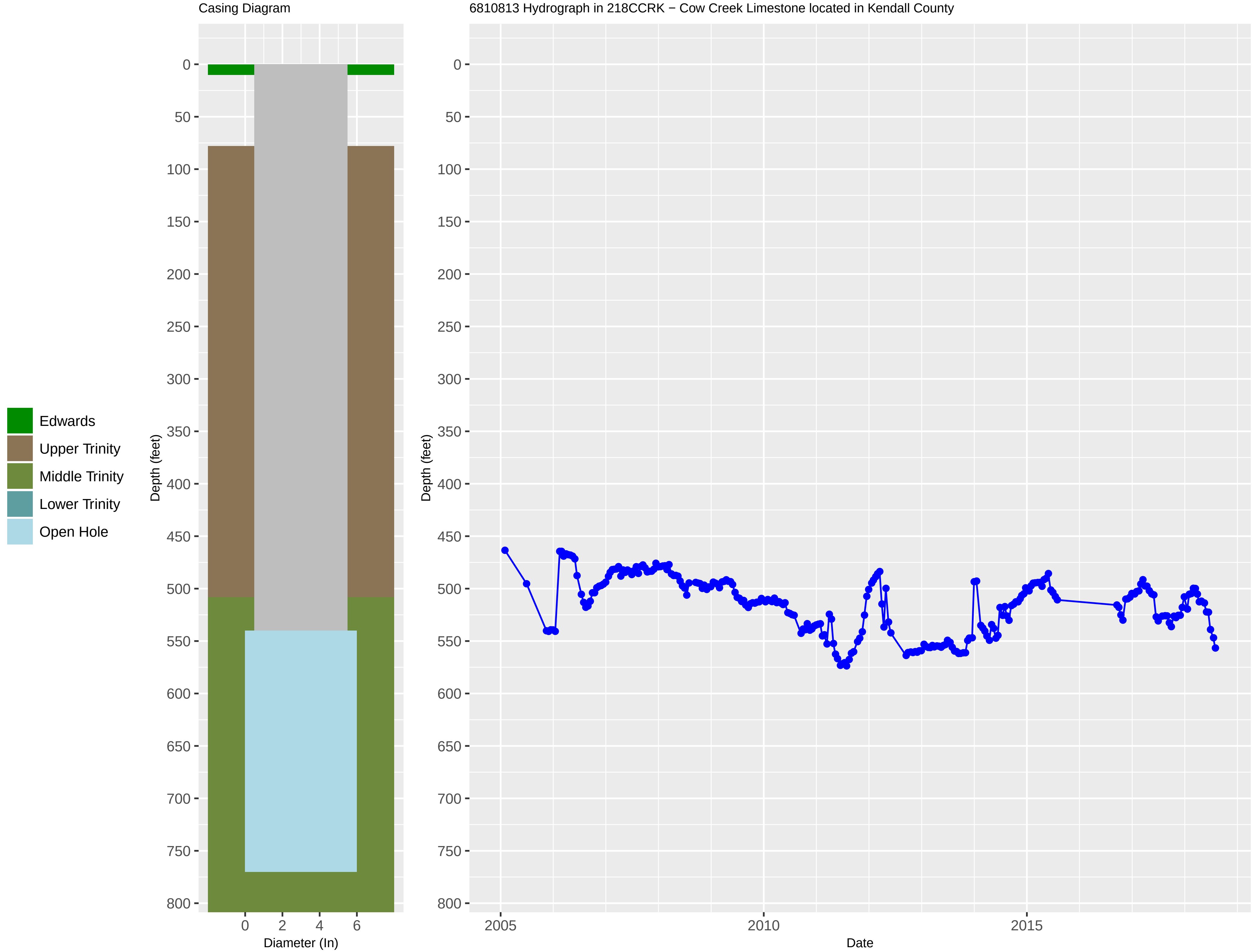
6810623 Hydrograph in 218CCRK − Cow Creek Limestone located in Kendall County



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

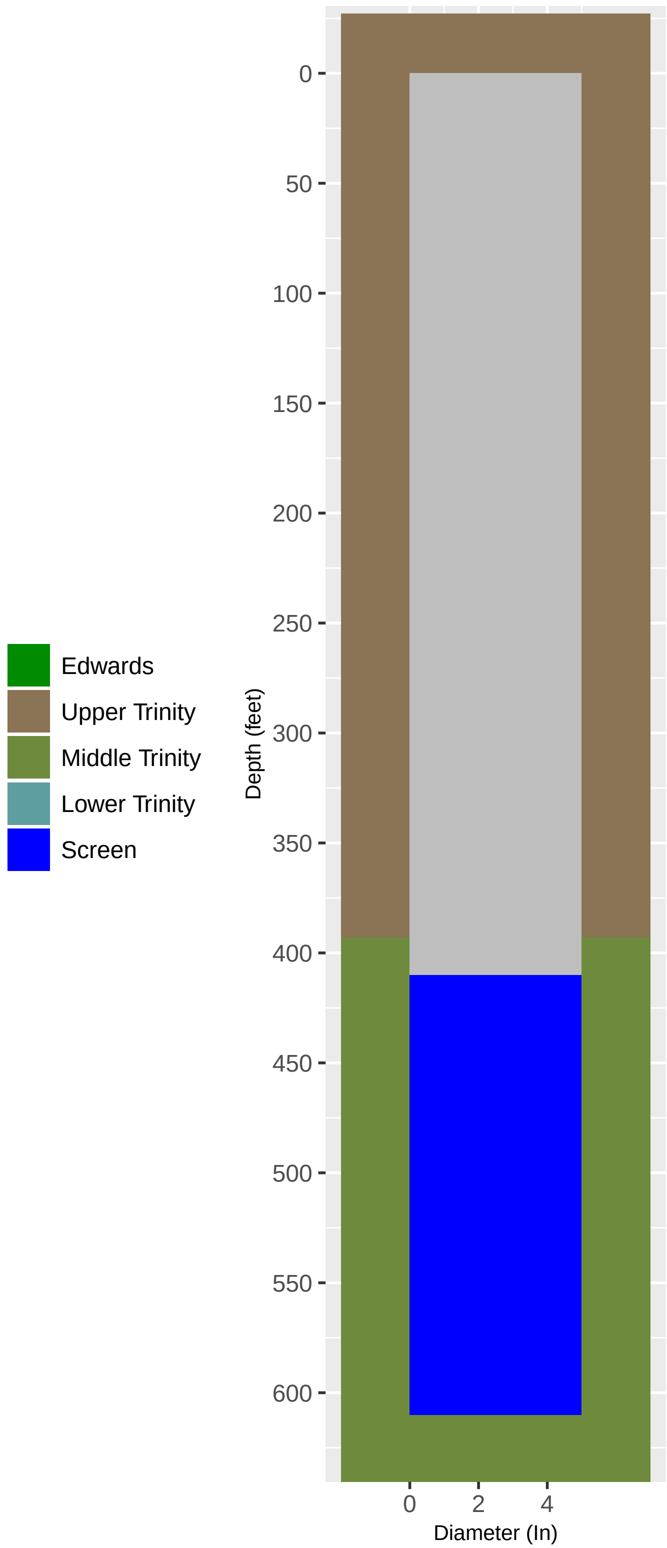


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

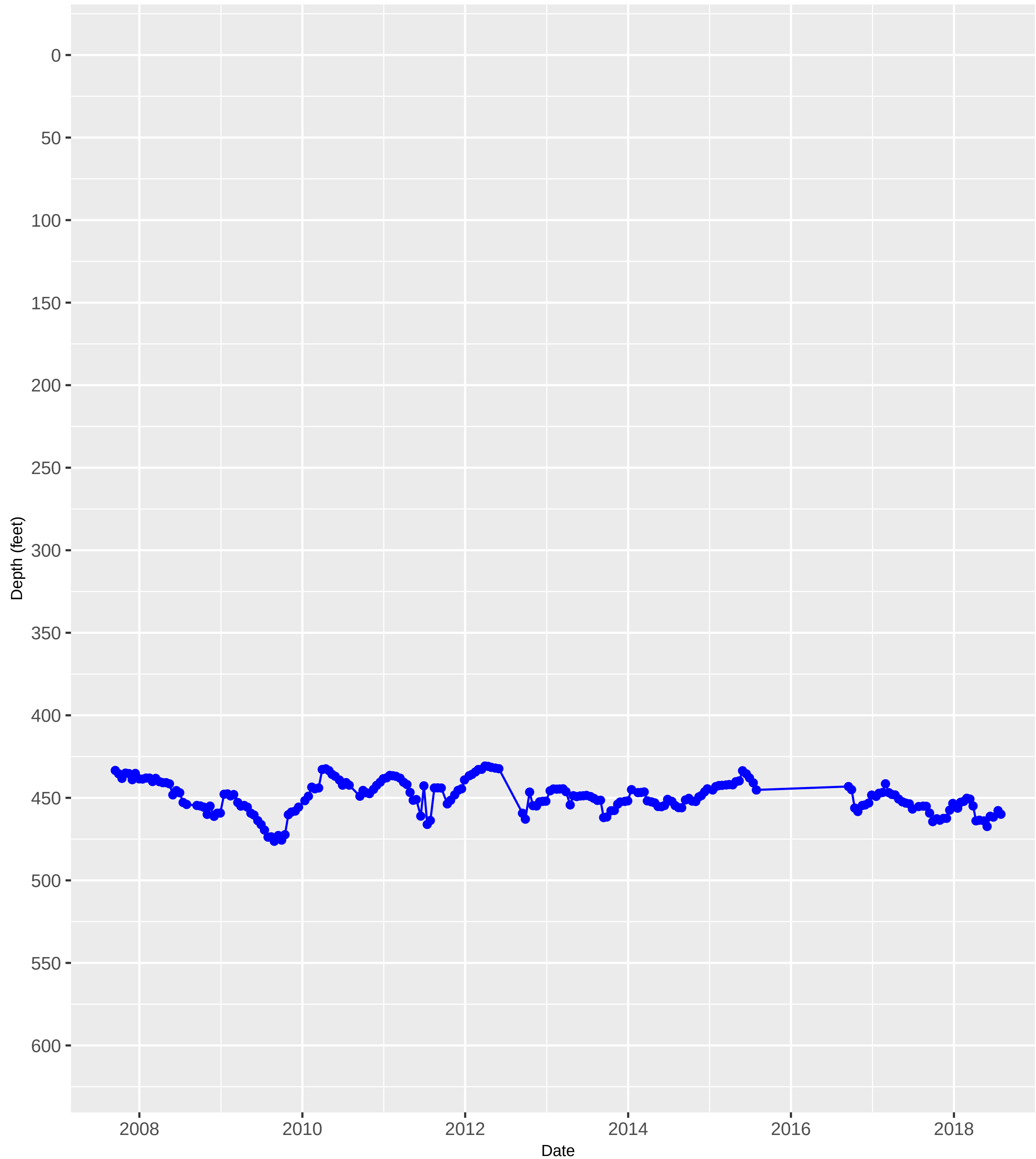


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

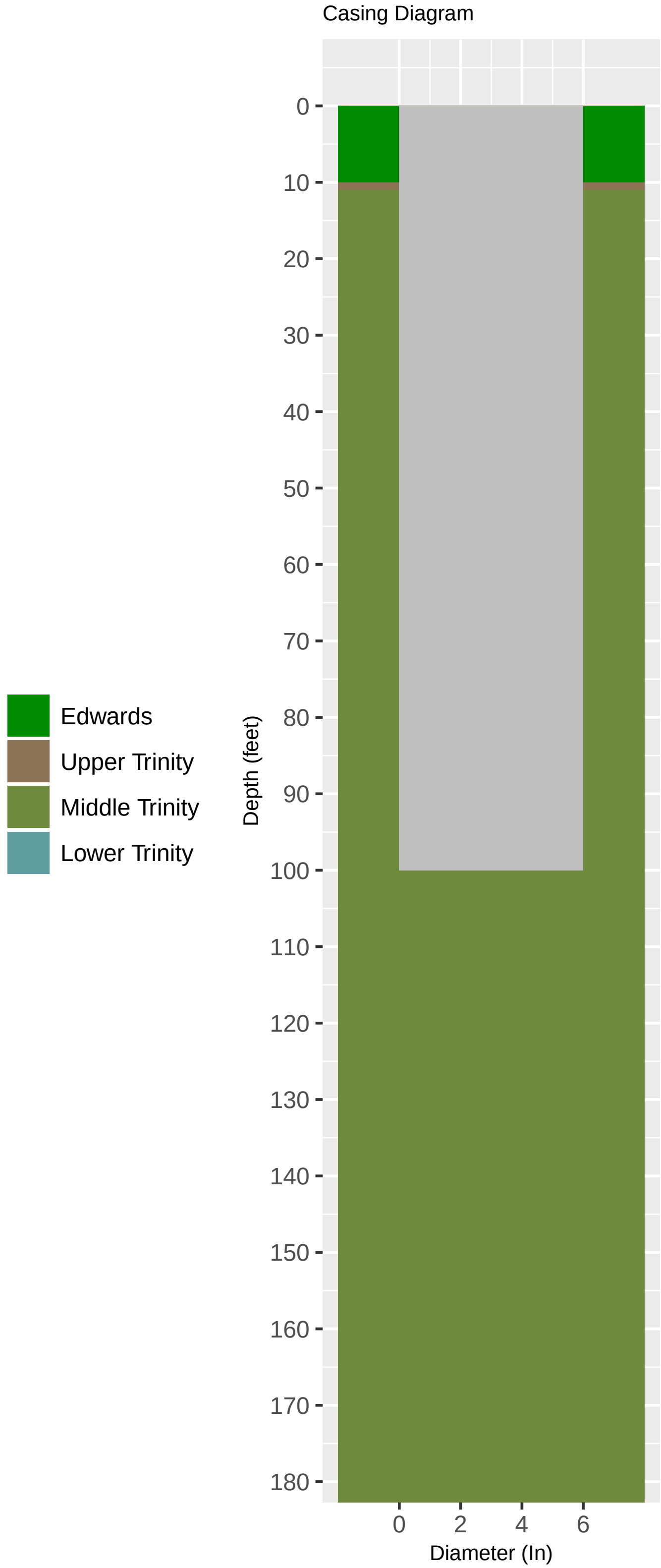
Casing Diagram

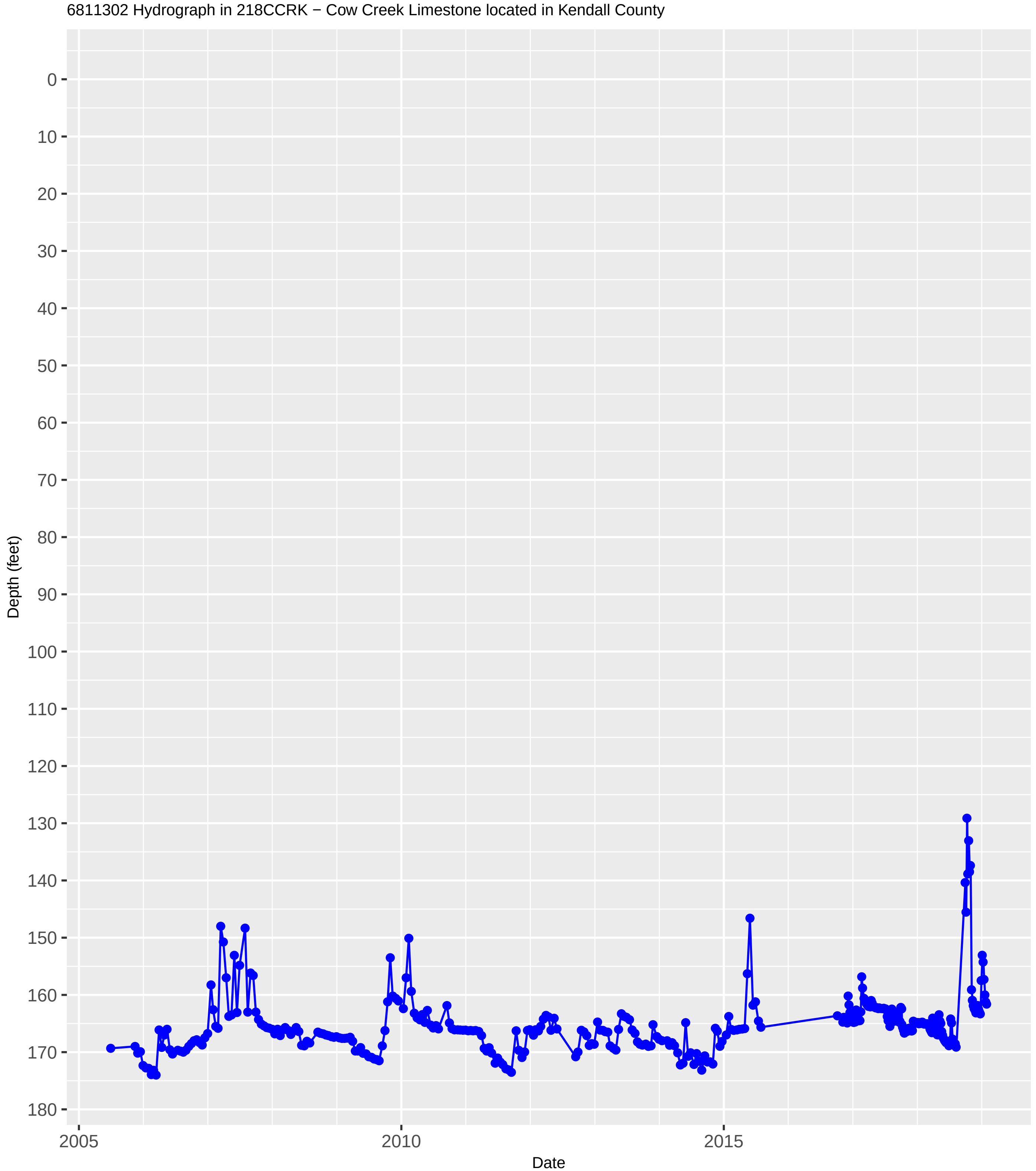


6810912 Hydrograph in 218CCRK − Cow Creek Limestone located in Kendall County

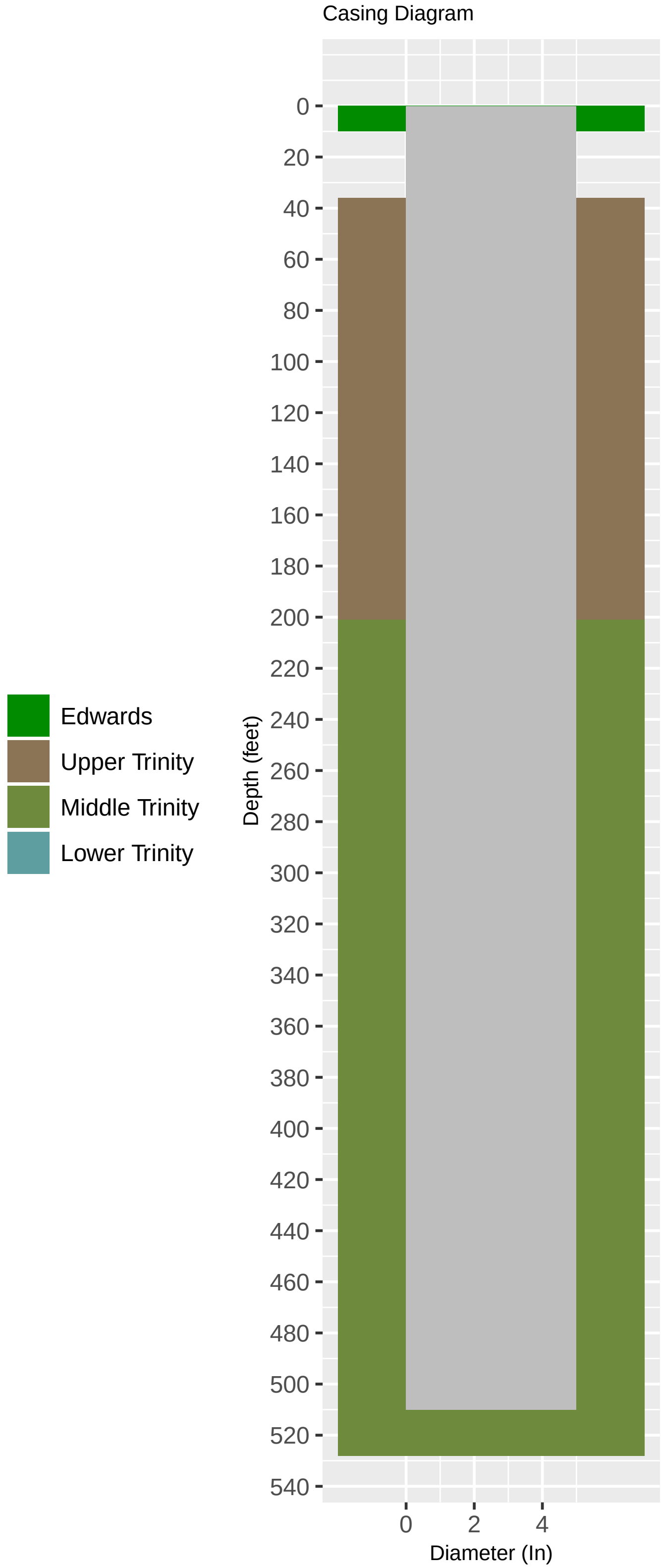


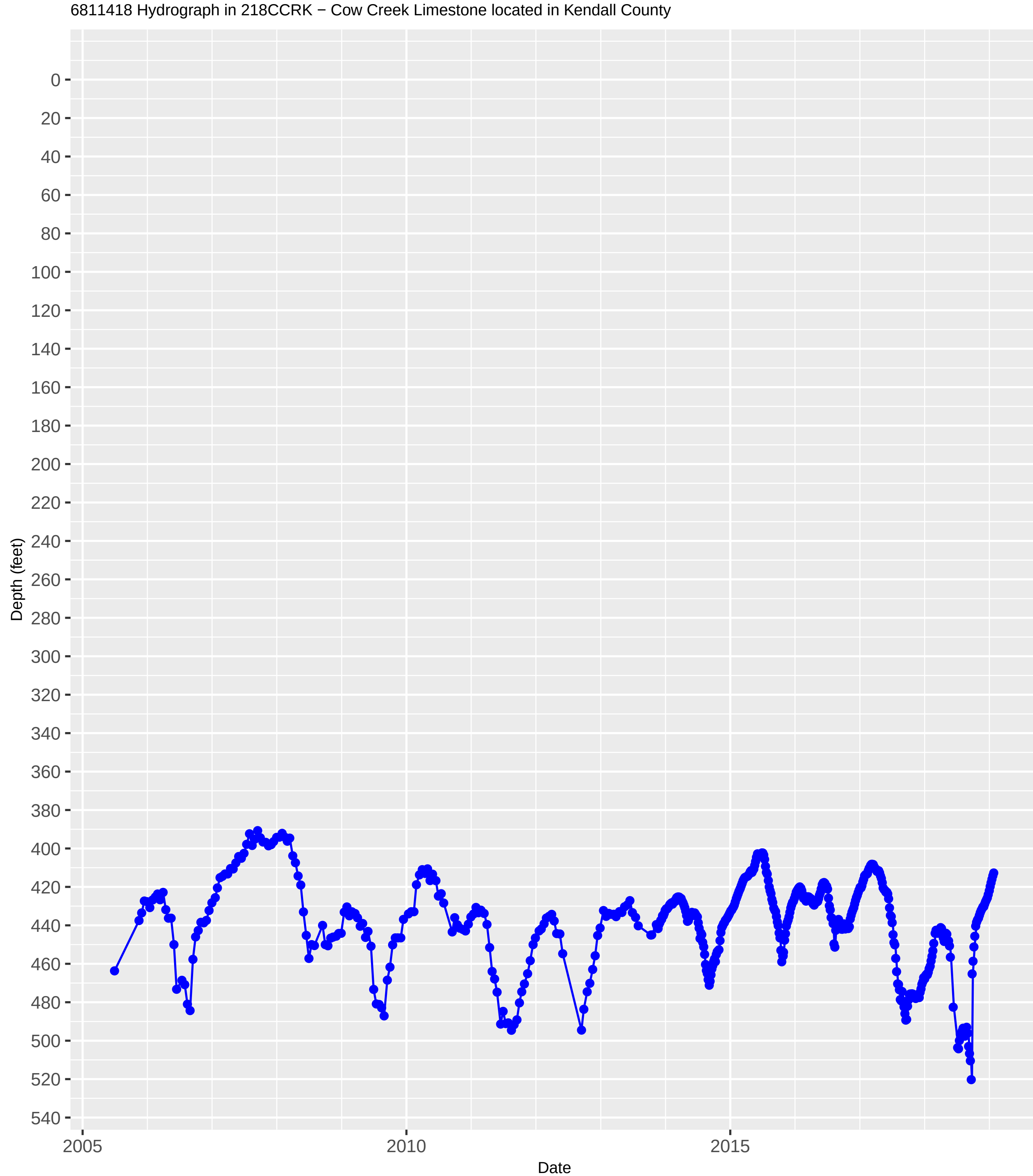
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



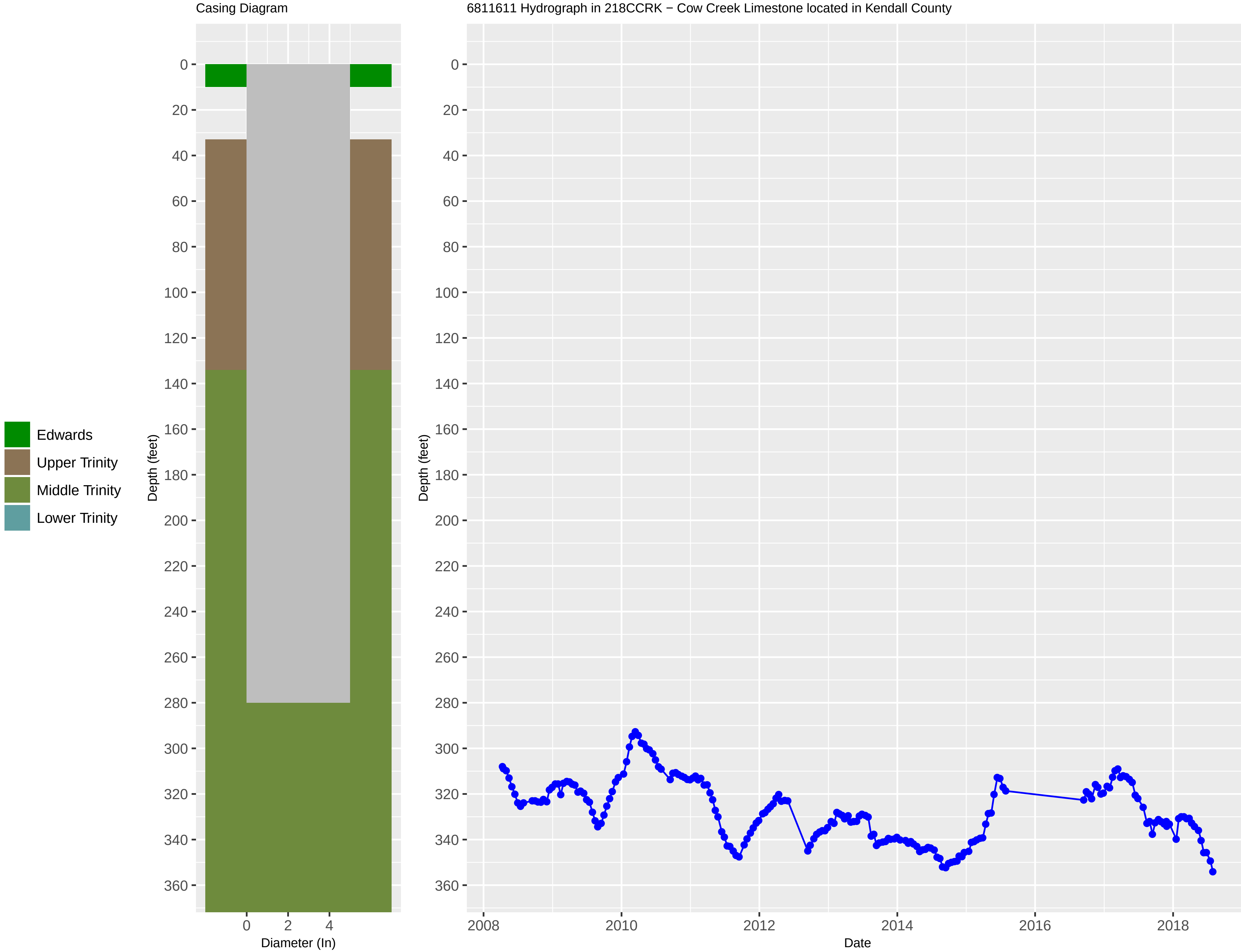


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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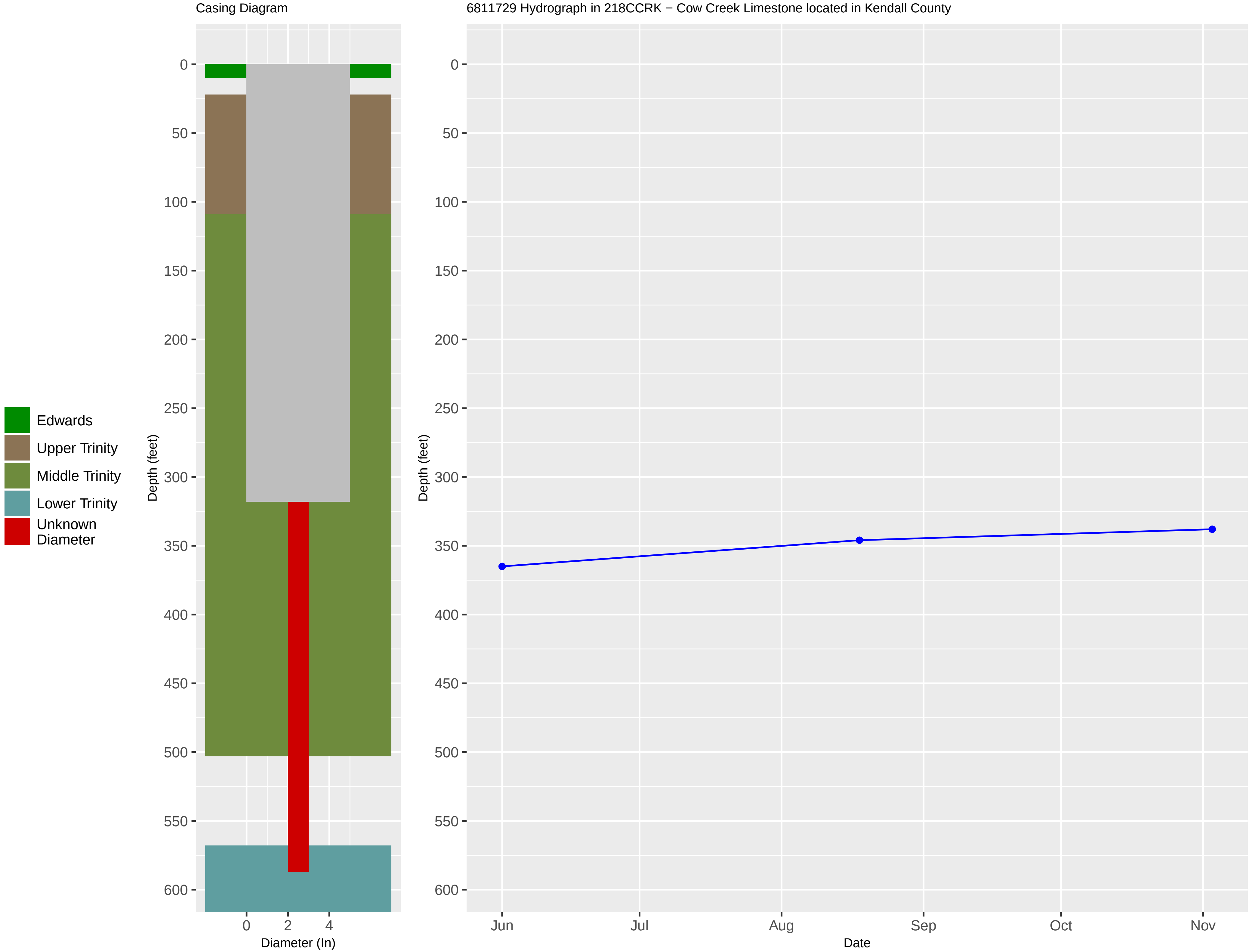
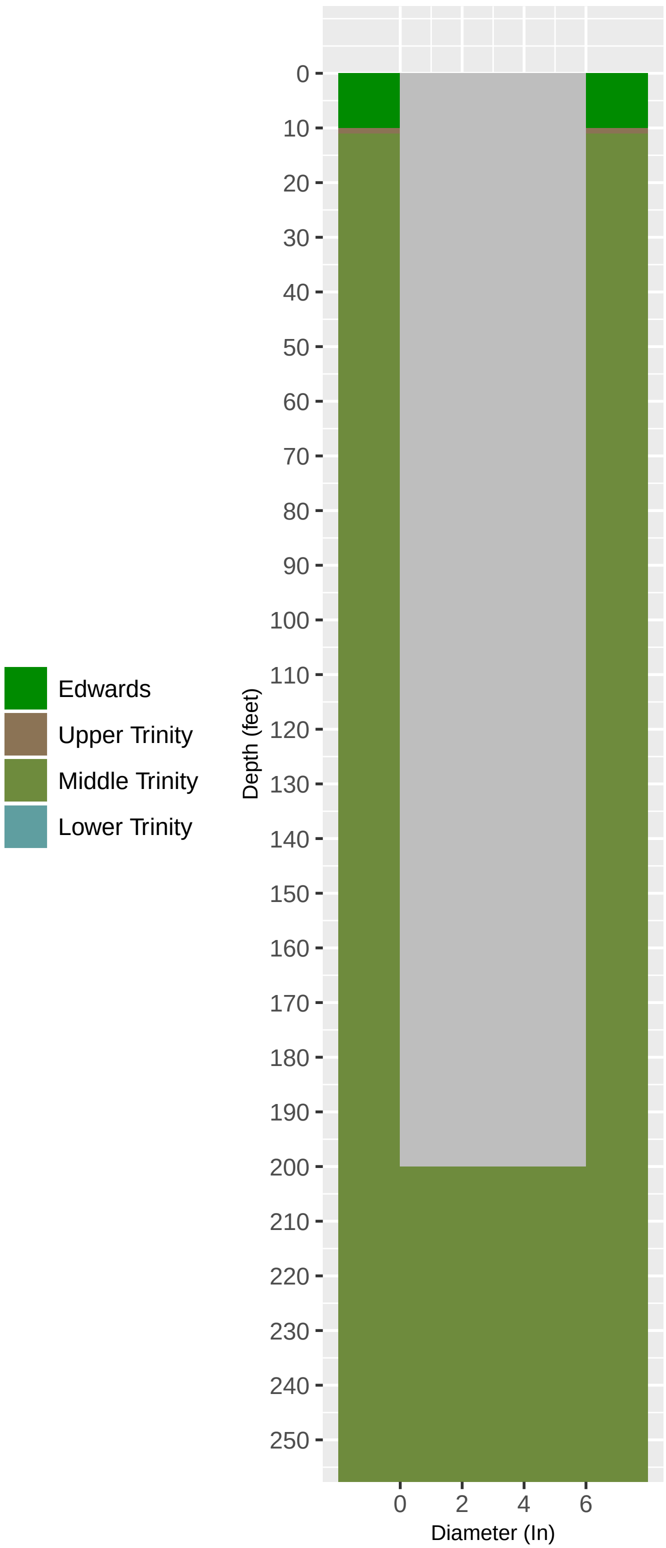
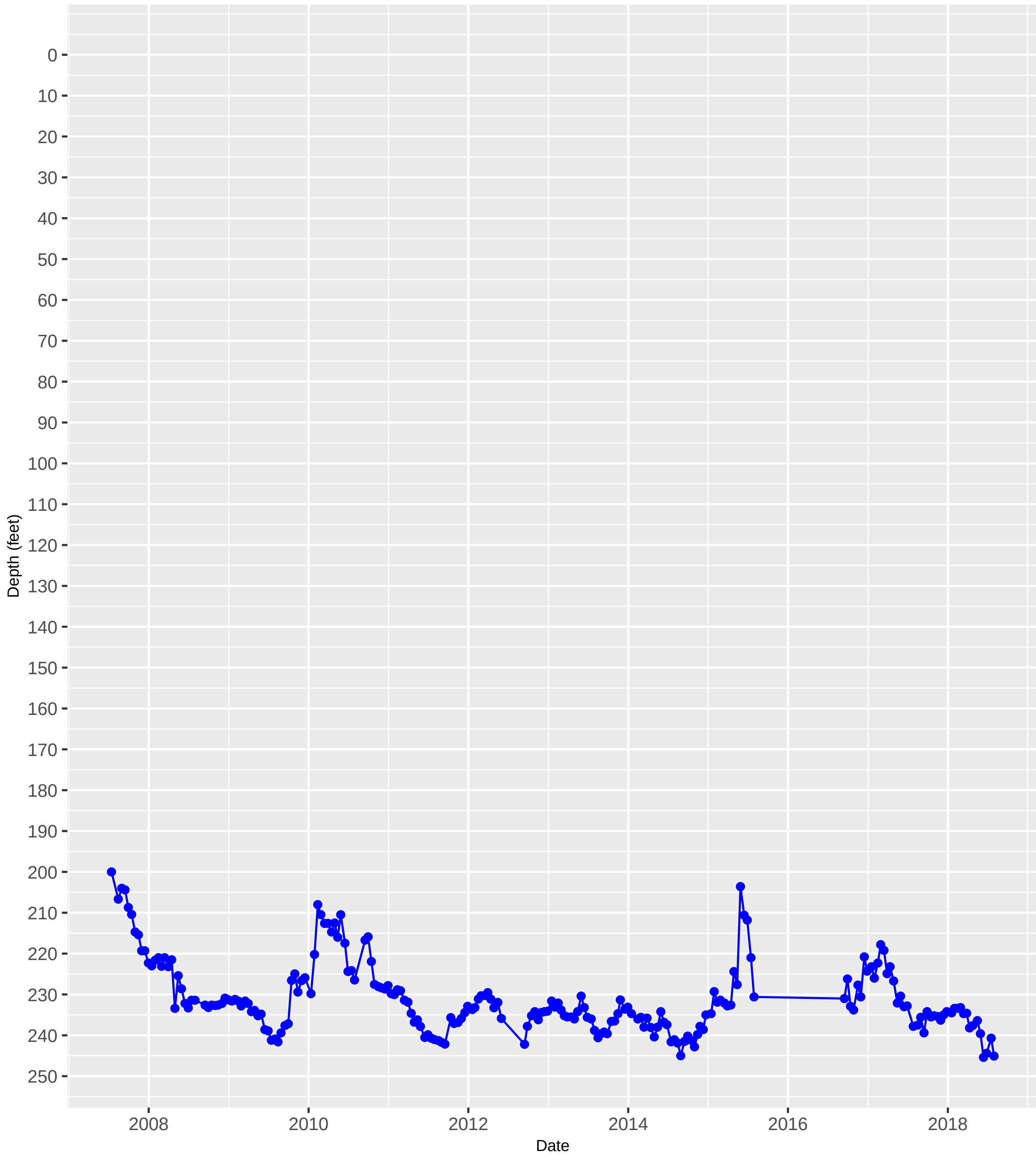


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

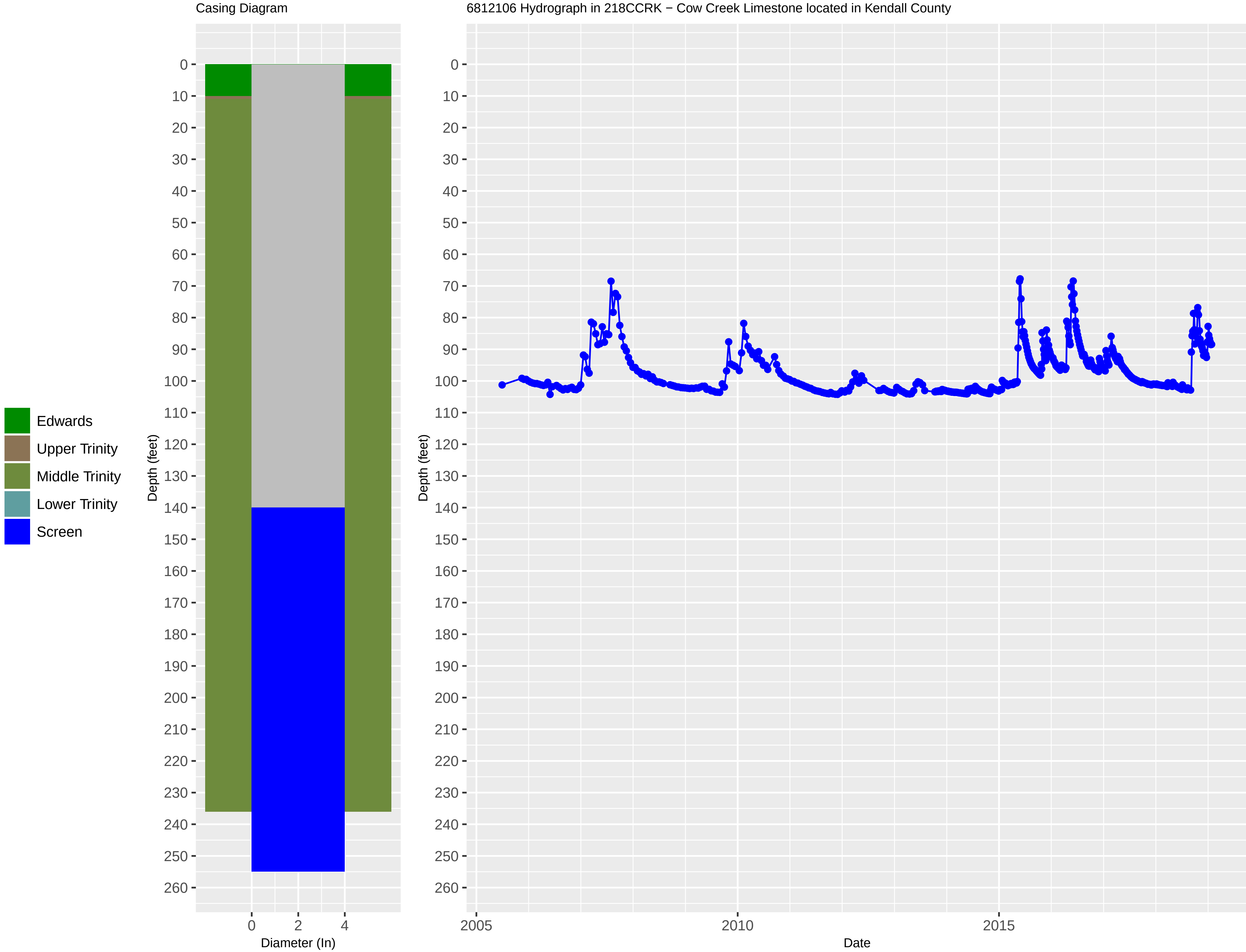
Casing Diagram



6811814 Hydrograph in 218CCRK − Cow Creek Limestone located in Kendall County



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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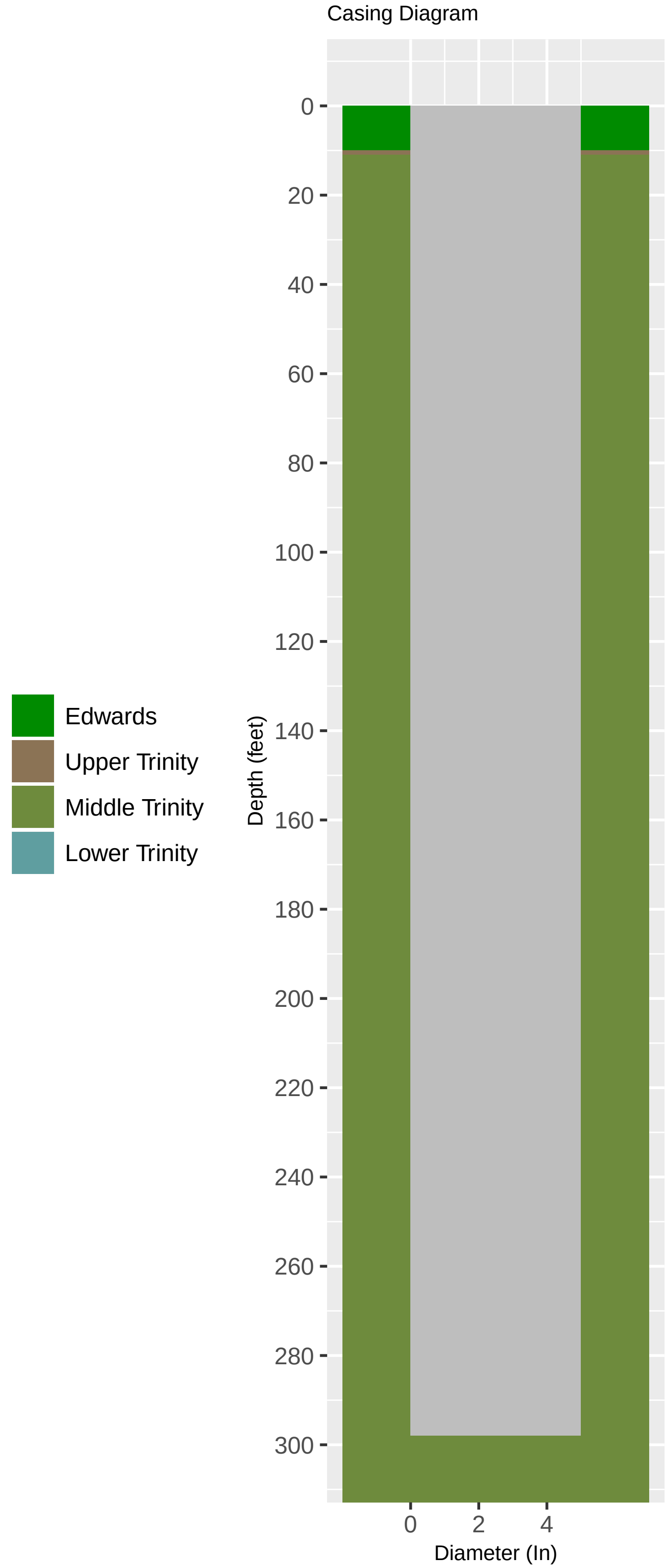
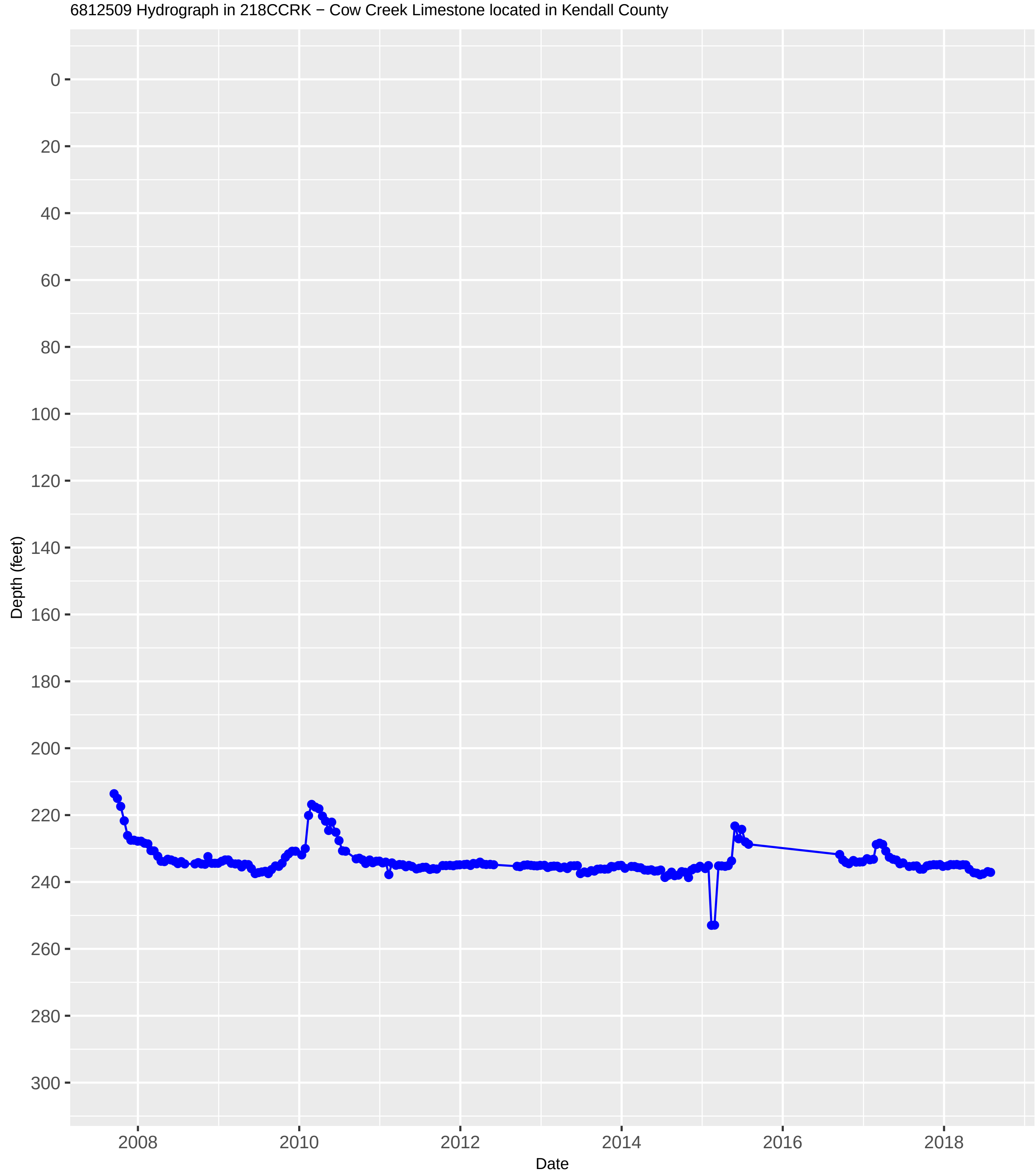
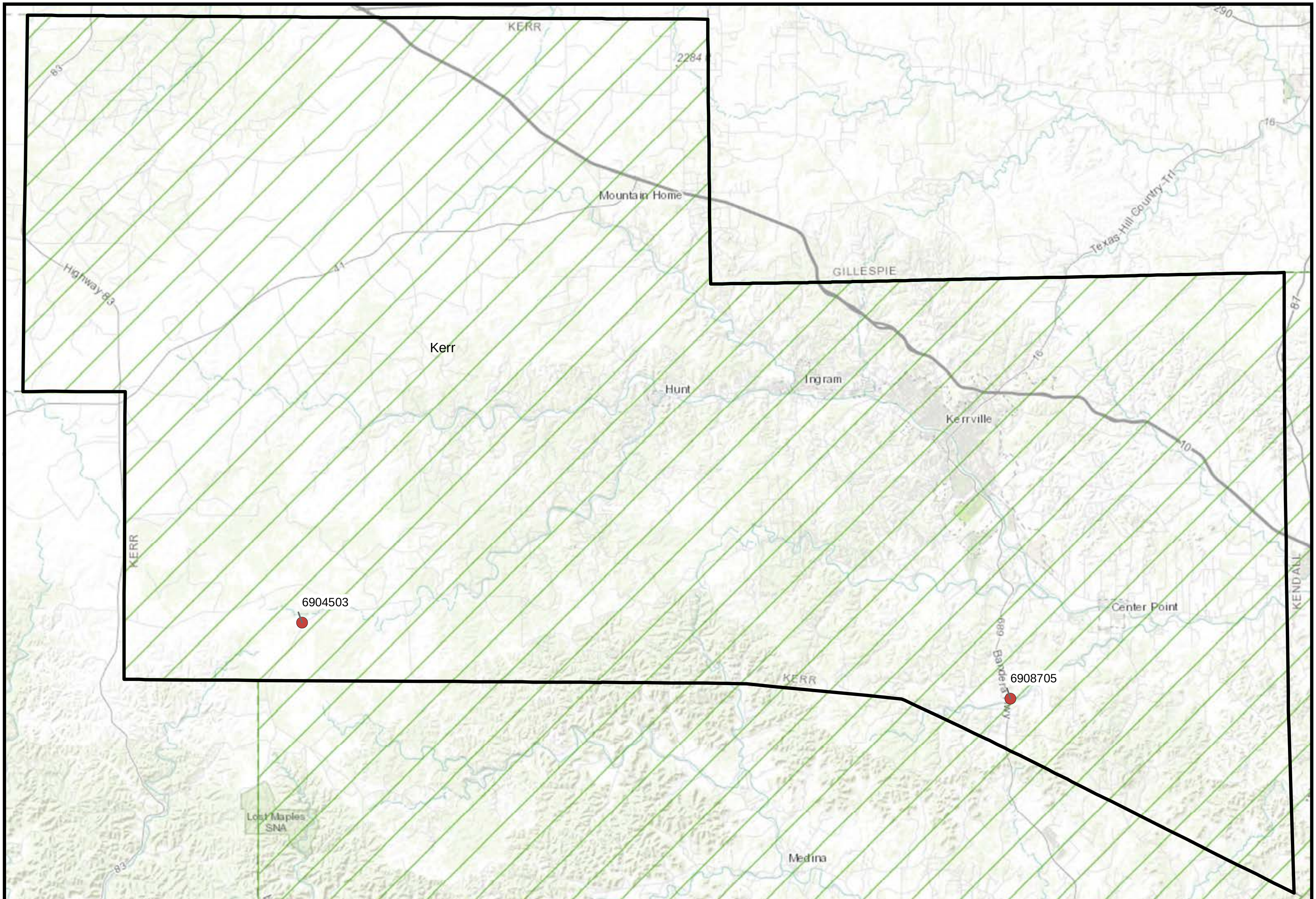




The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



Aquifer

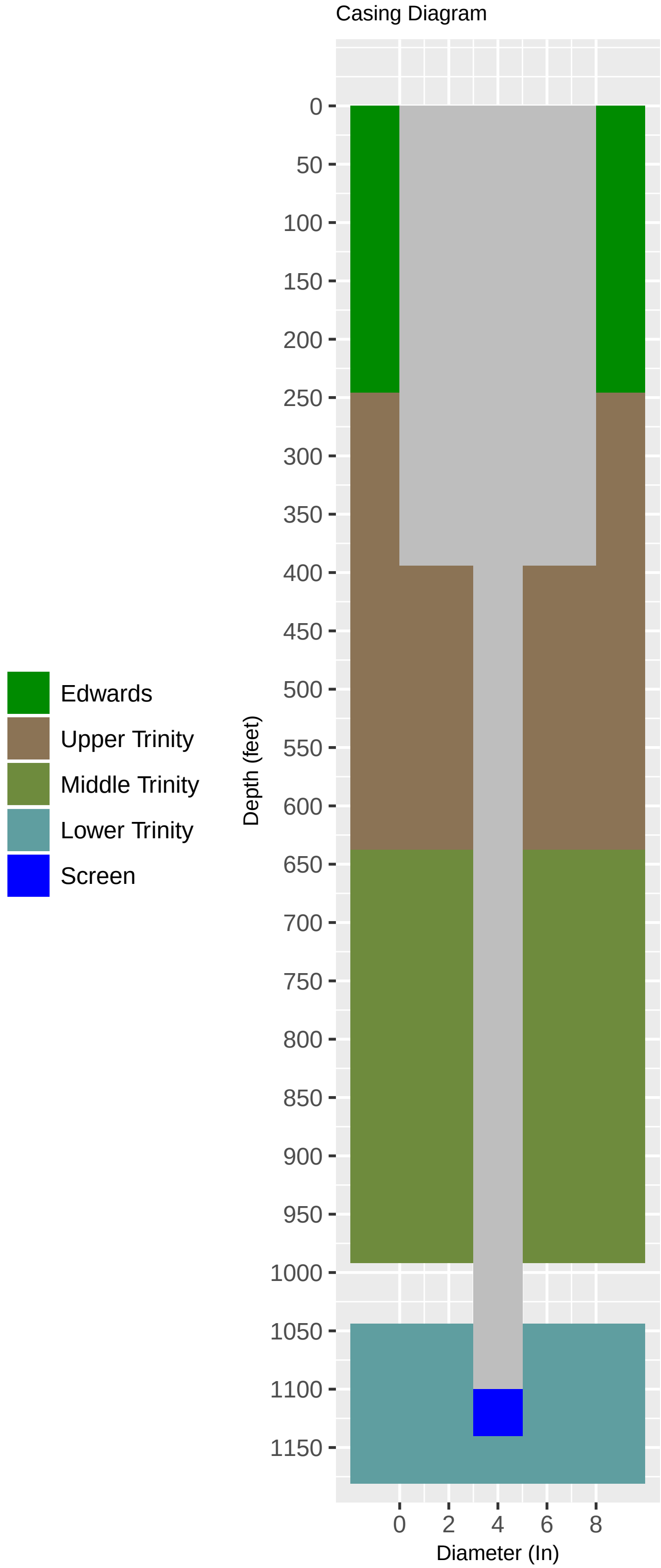
● 218CCRK - Cow Creek Limestone

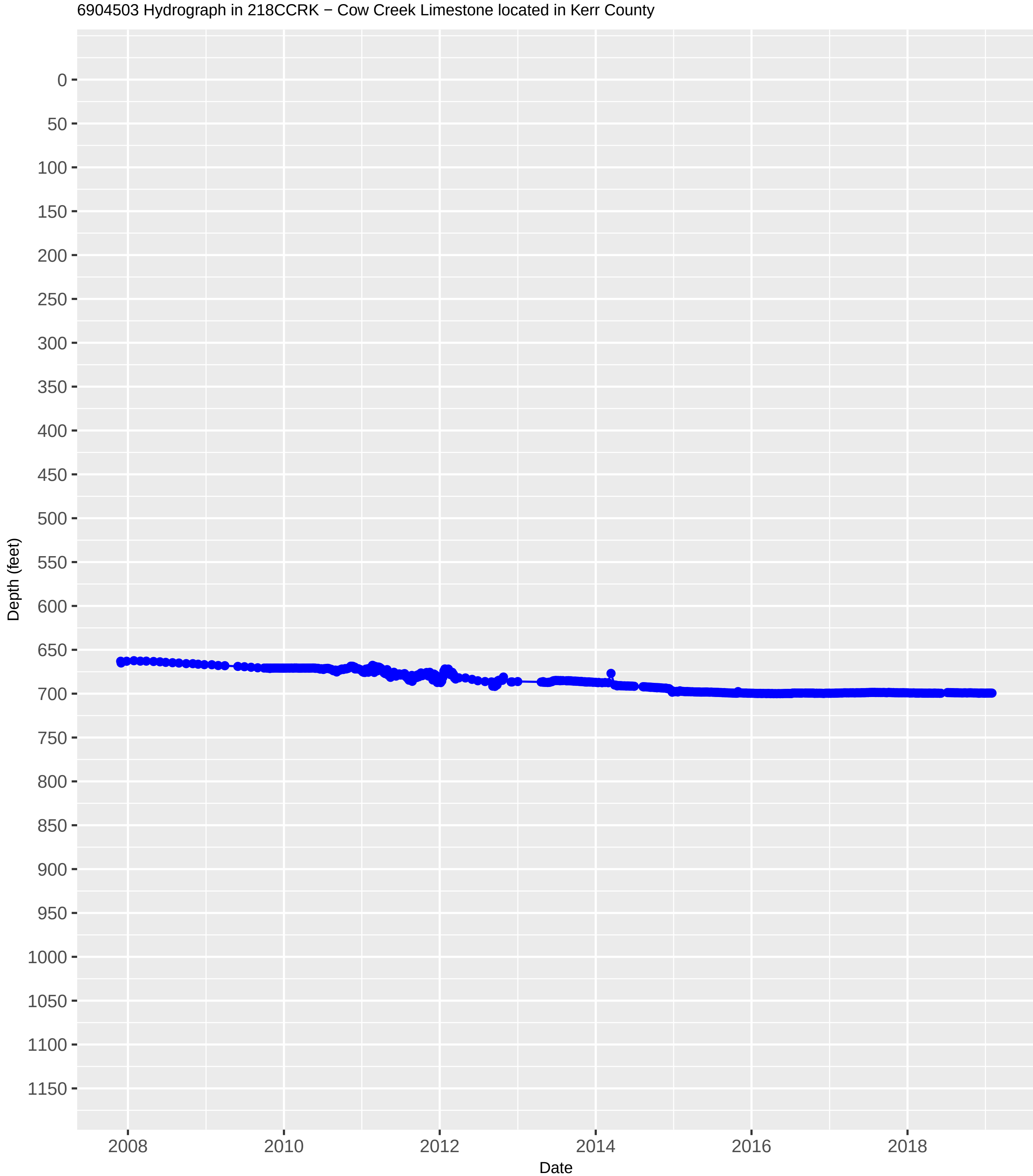
GMA 9

N

0 1 2 4 Miles

Map of Hydrograph Well Locations in Kerr County
218CCRK
Cow Creek Limestone





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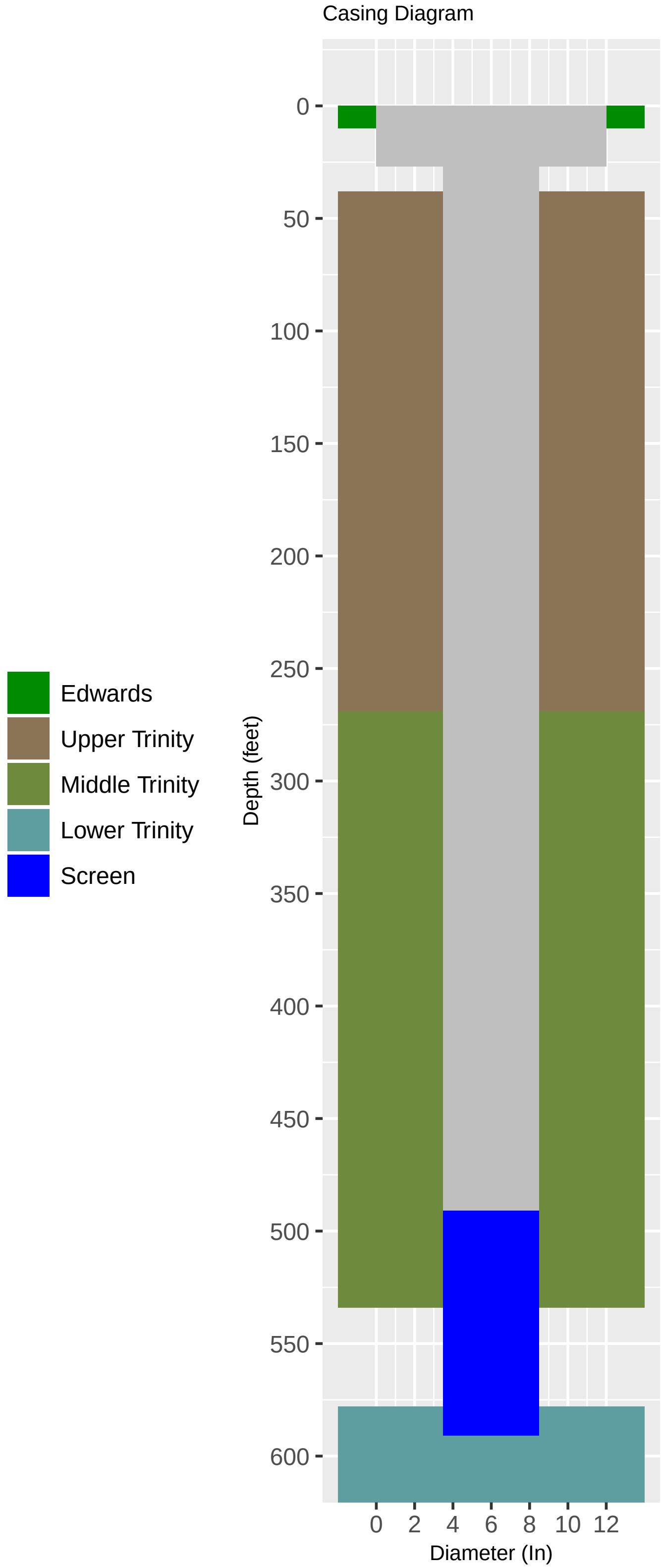

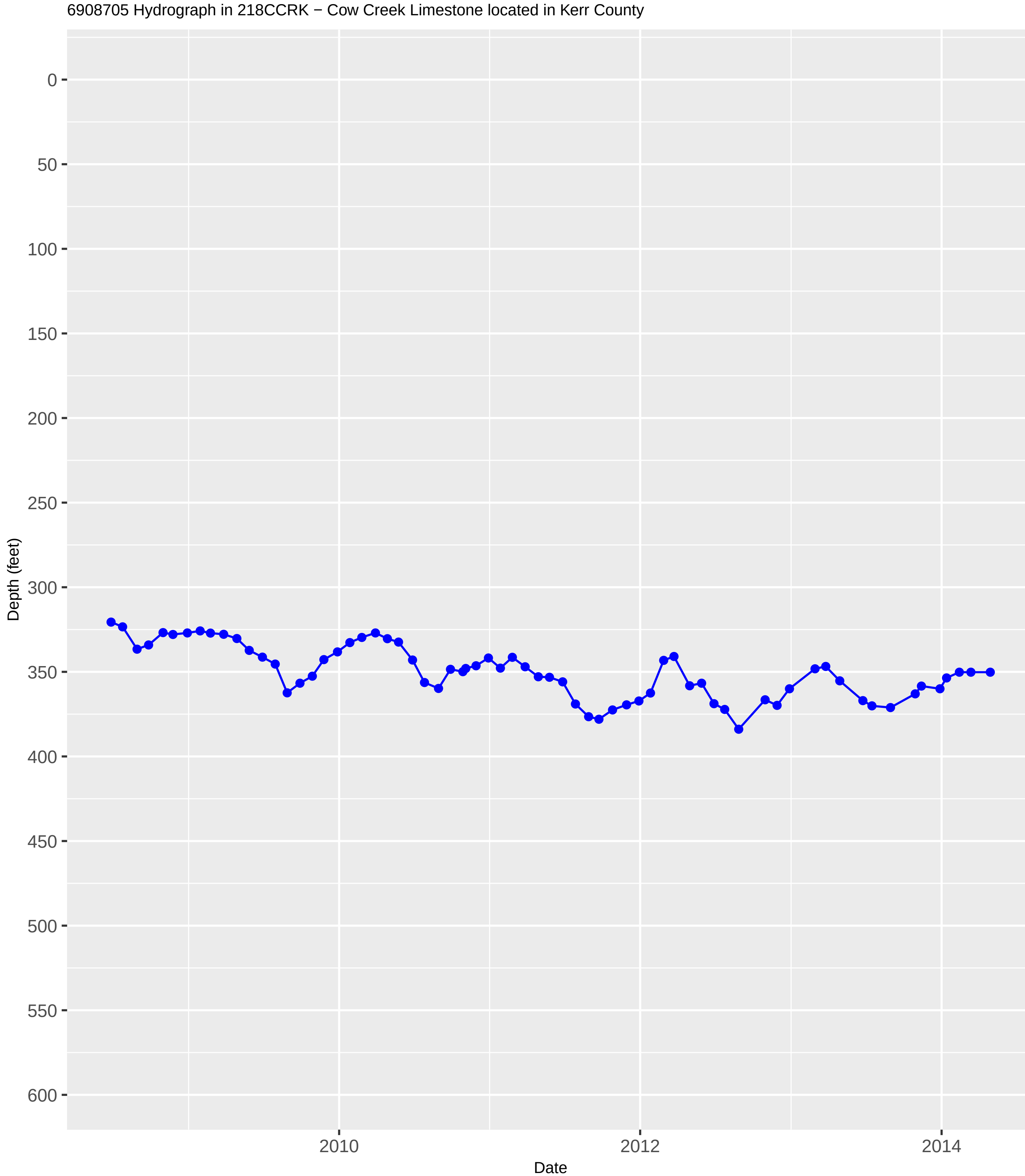

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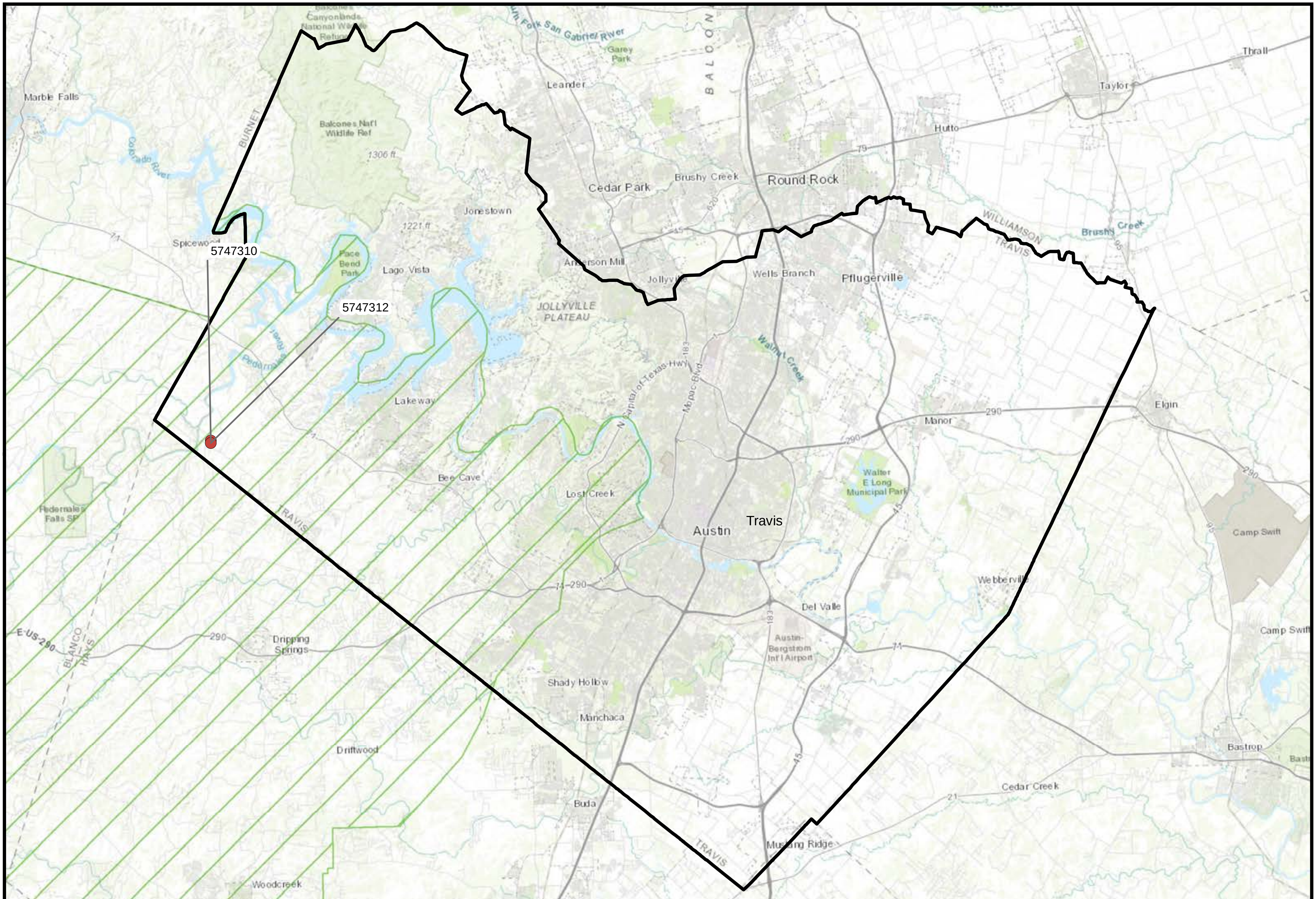


Aquifer

218CCRK - Cow Creek Limestone

GMA 9

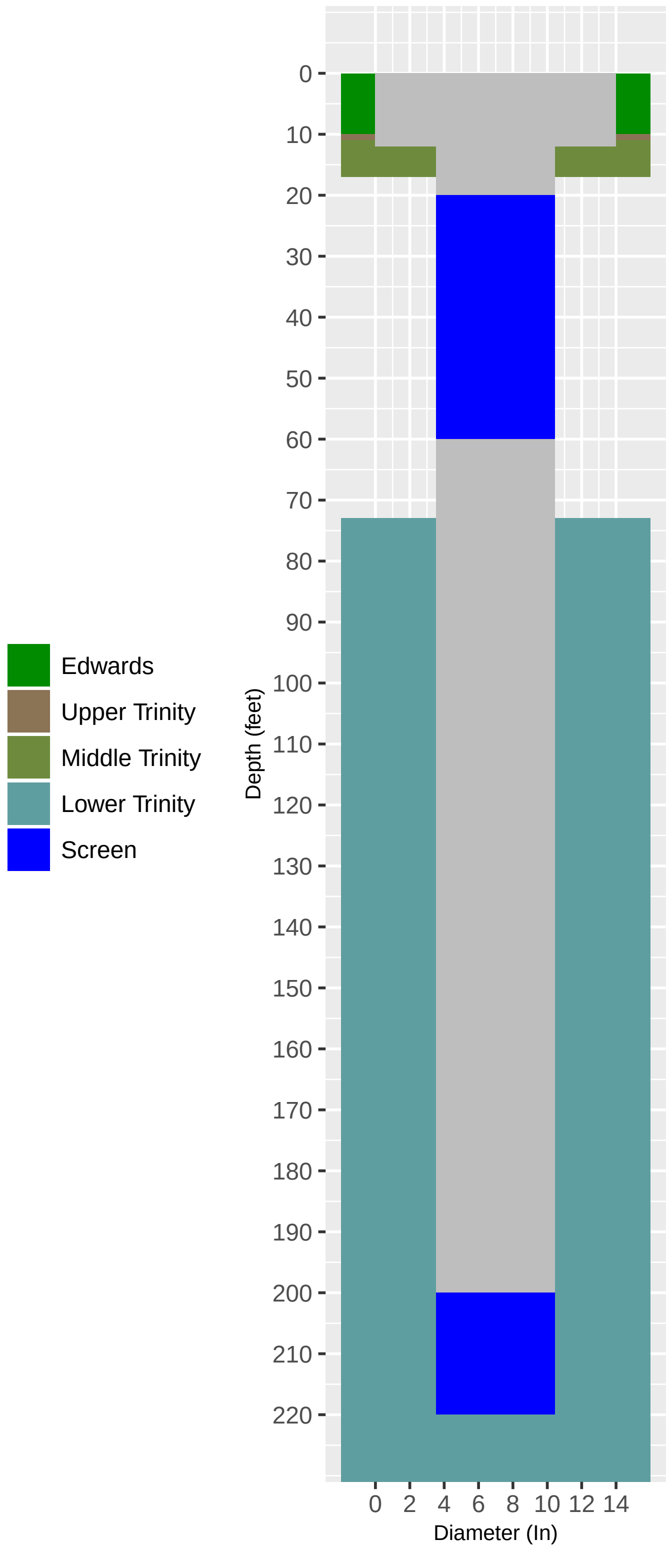
N

0 1 2 4 6

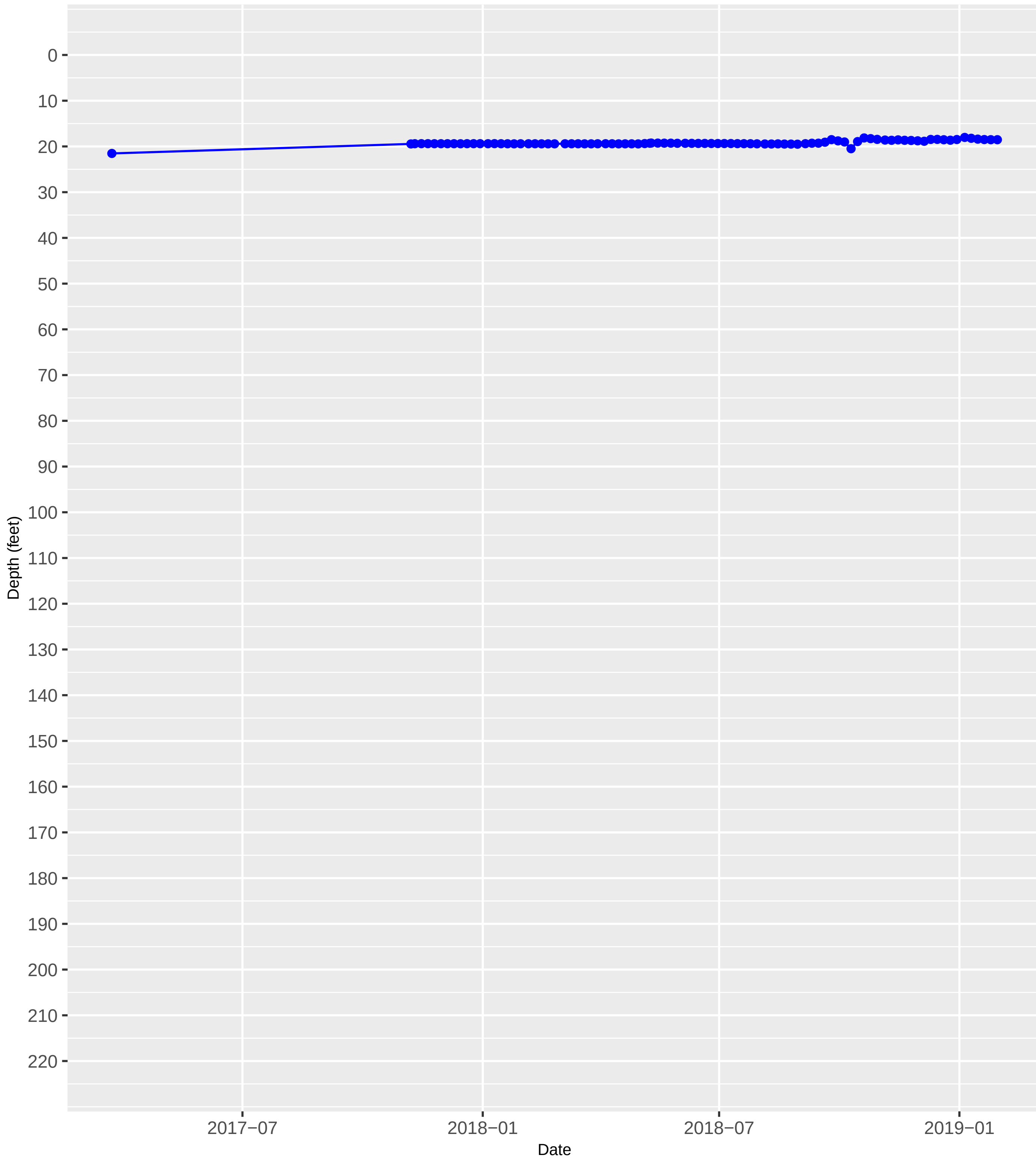
Miles

Map of Hydrograph Well Locations in Travis County
218CCRK
Cow Creek Limestone

Casing Diagram



5747310 Hydrograph in 218CCRK − Cow Creek Limestone located in Travis County



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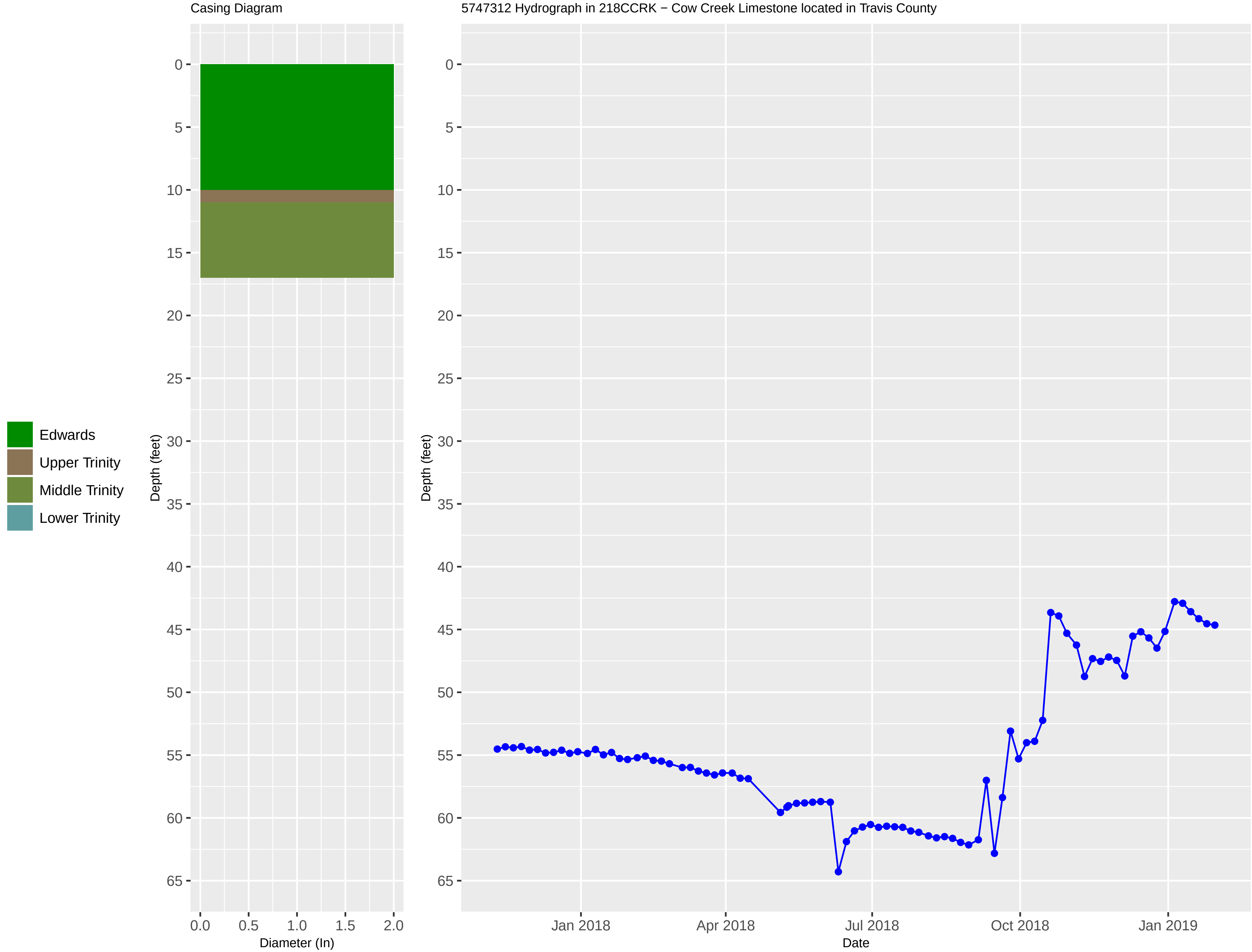
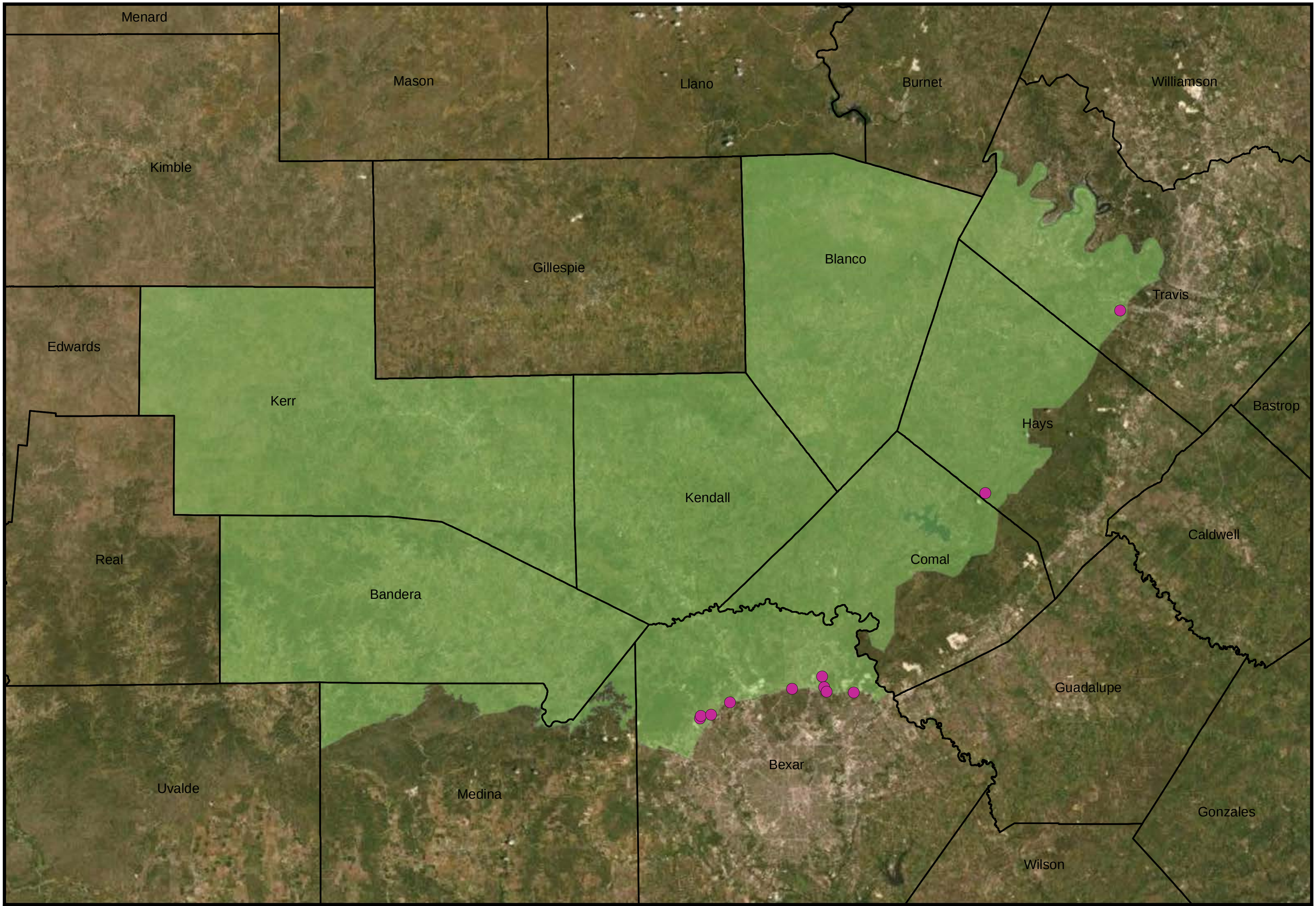


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



Aquifer

218EBFZA - Edwards and Associated Limestones - (Balcones Fault Zone Aquifer)

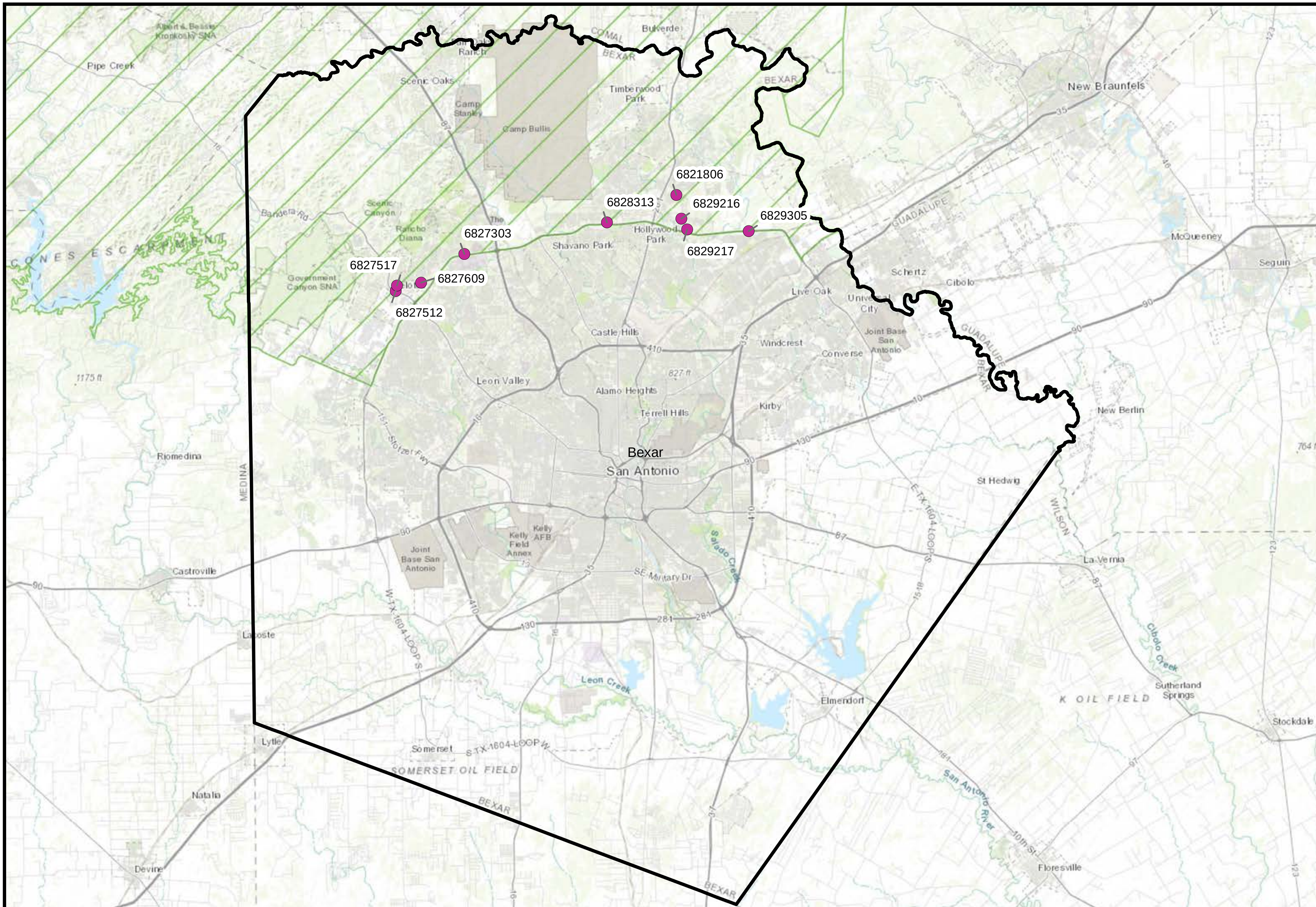
GMA 9

N

0 5 10

Miles

Map of Hydrograph Well Locations
218EBFZA
Edwards and Associated Limestones
(Balcones Fault Zone Aquifer)



Aquifer

● 218EBFZA - Edwards and Associated Limestones - (Balcones Fault Zone Aquifer)

GMA 9

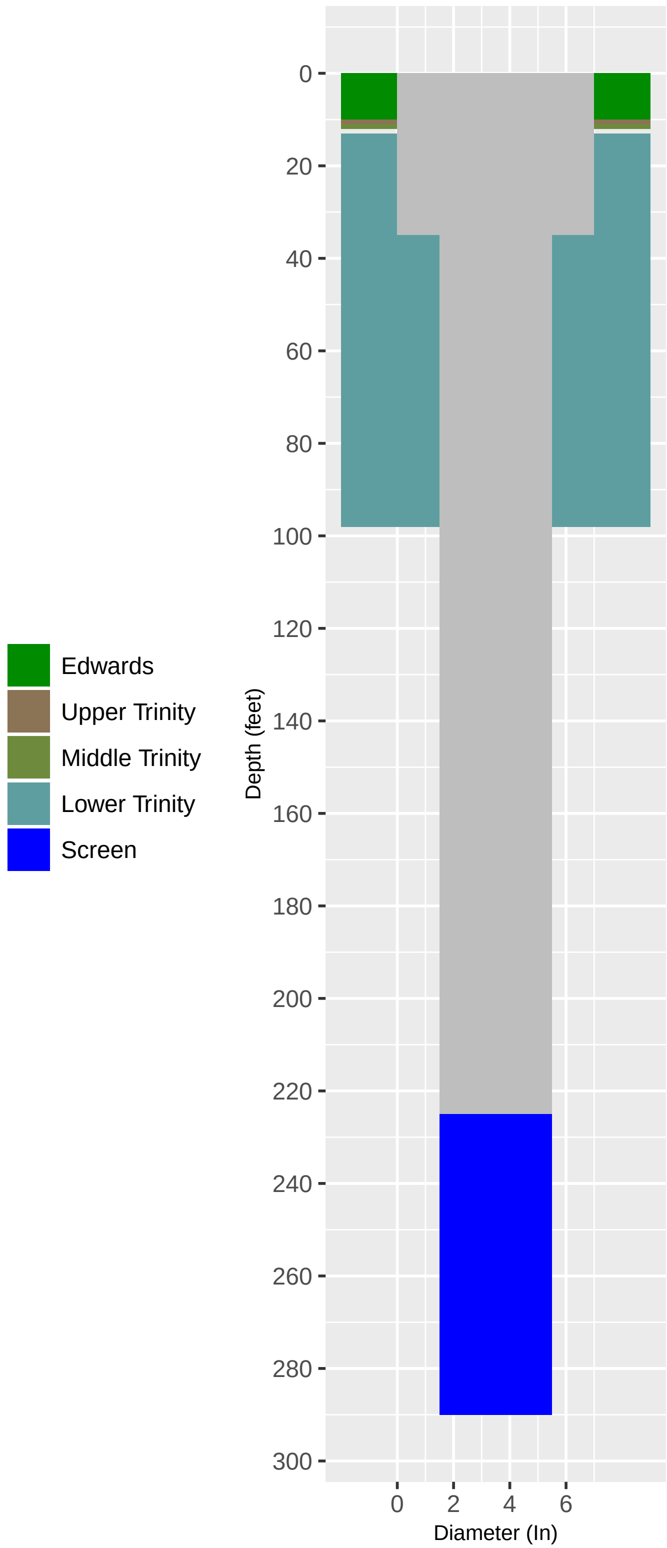
N

0 1 2 4 6

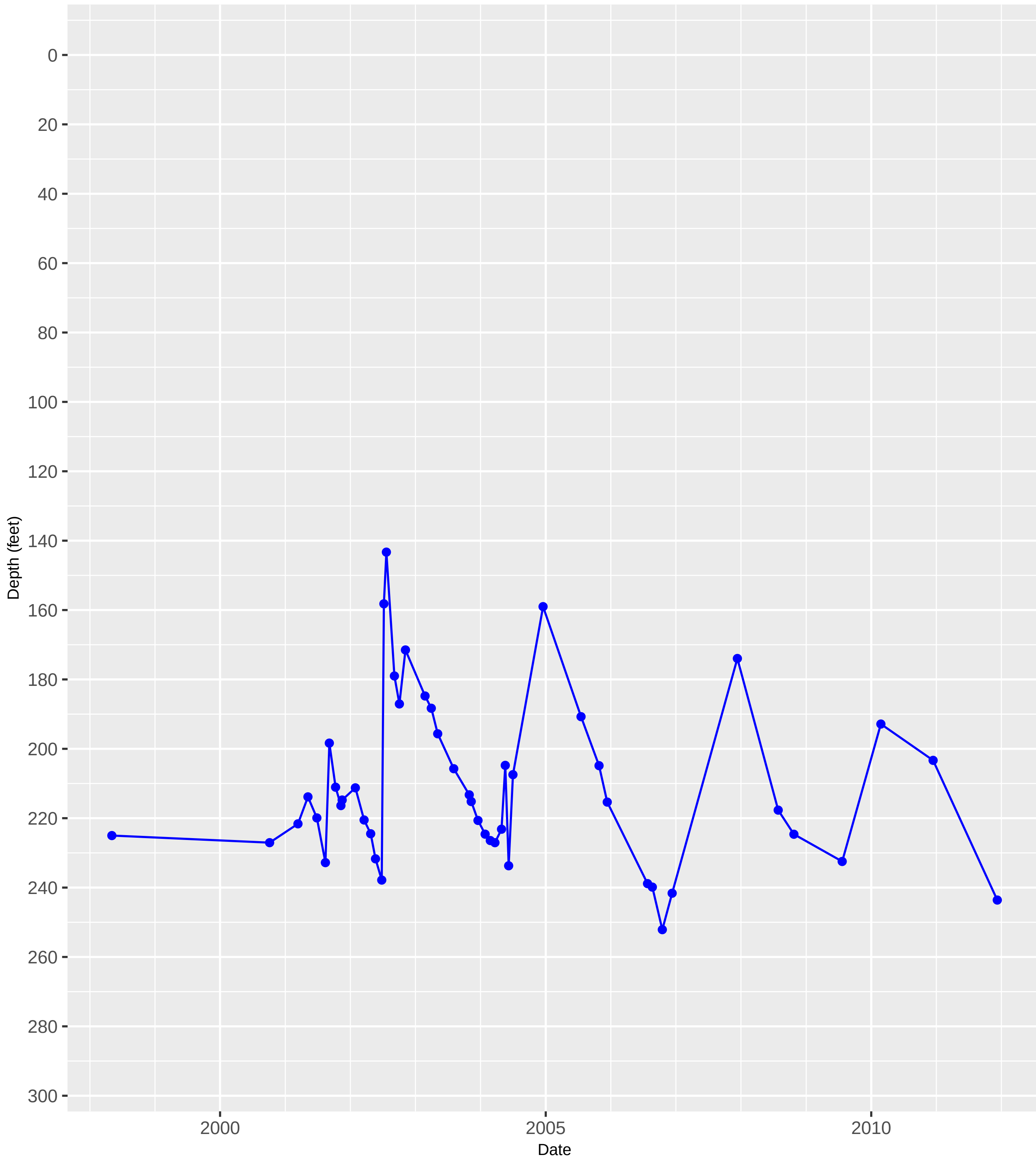
Miles

Map of Hydrograph Well Locations in Bexar County
218EBFZA
Edwards and Associated Limestones
(Balcones Fault Zone Aquifer)

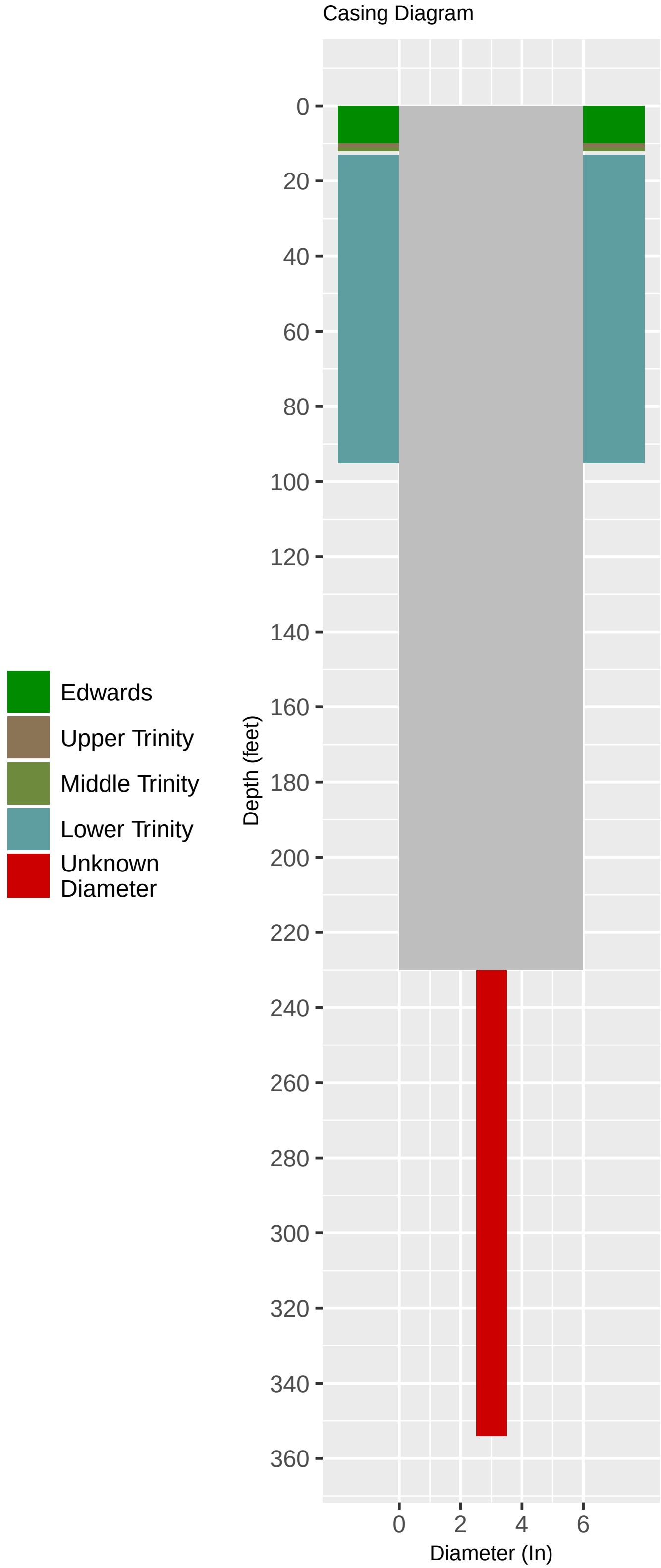
Casing Diagram

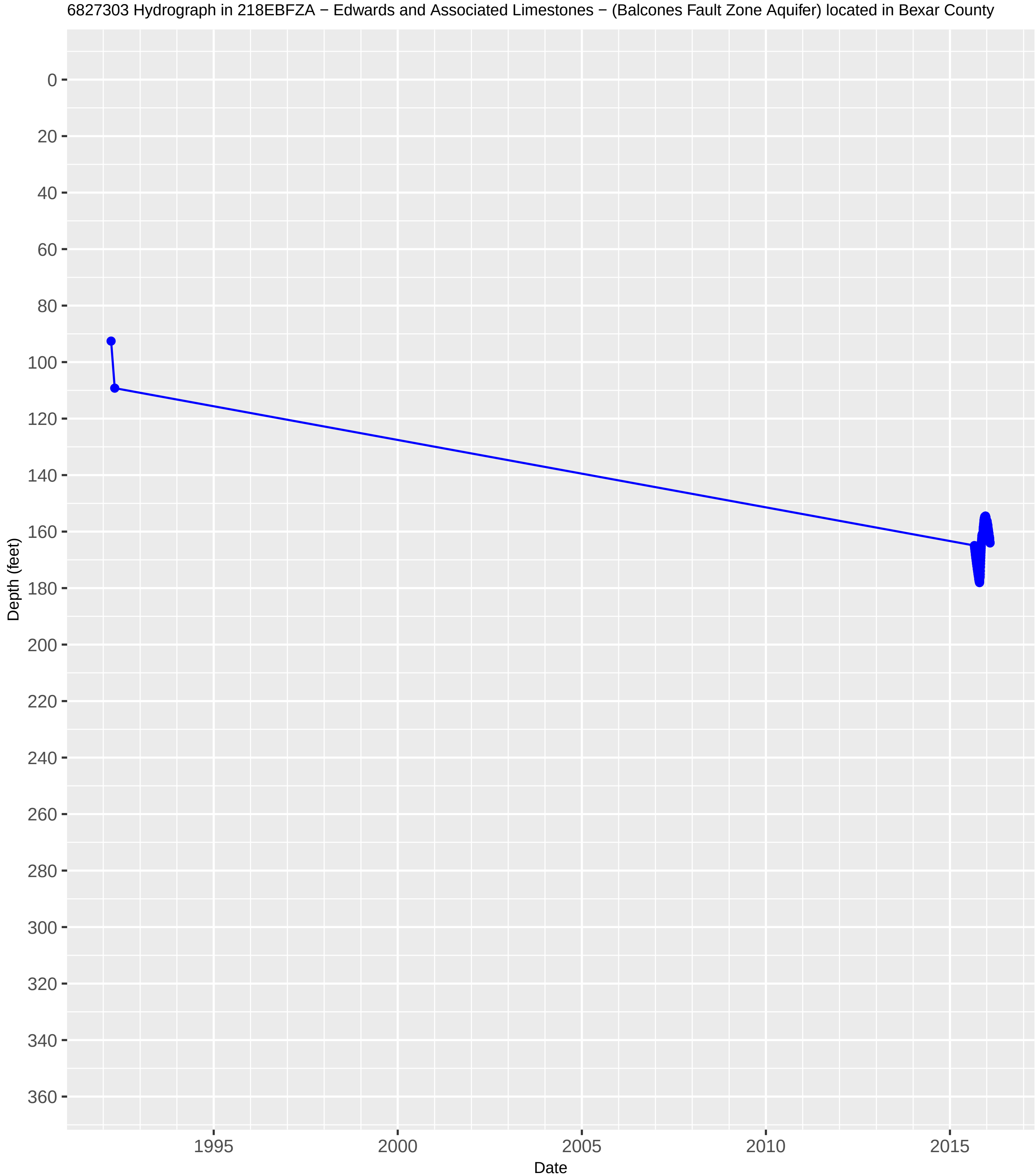


6821806 Hydrograph in 218EBFZA − Edwards and Associated Limestones − (Balcones Fault Zone Aquifer) located in Bexar County

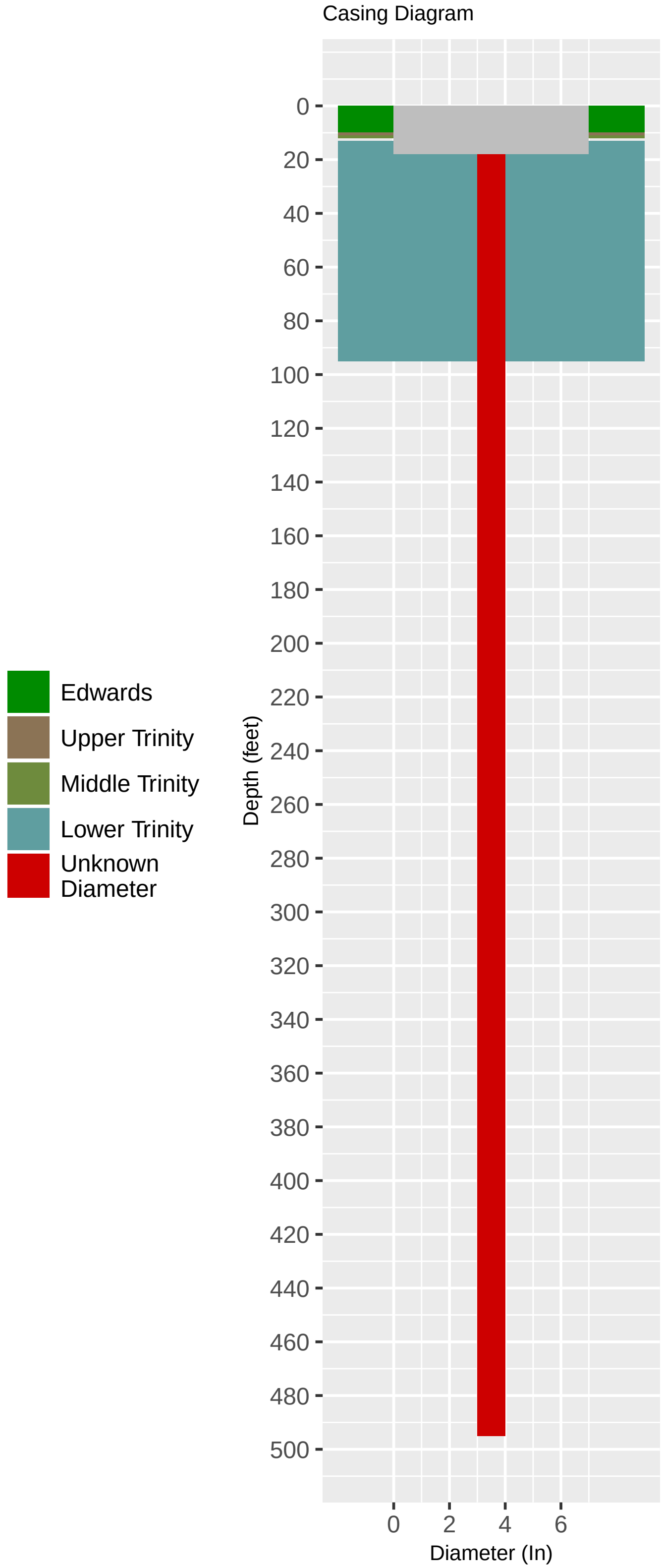


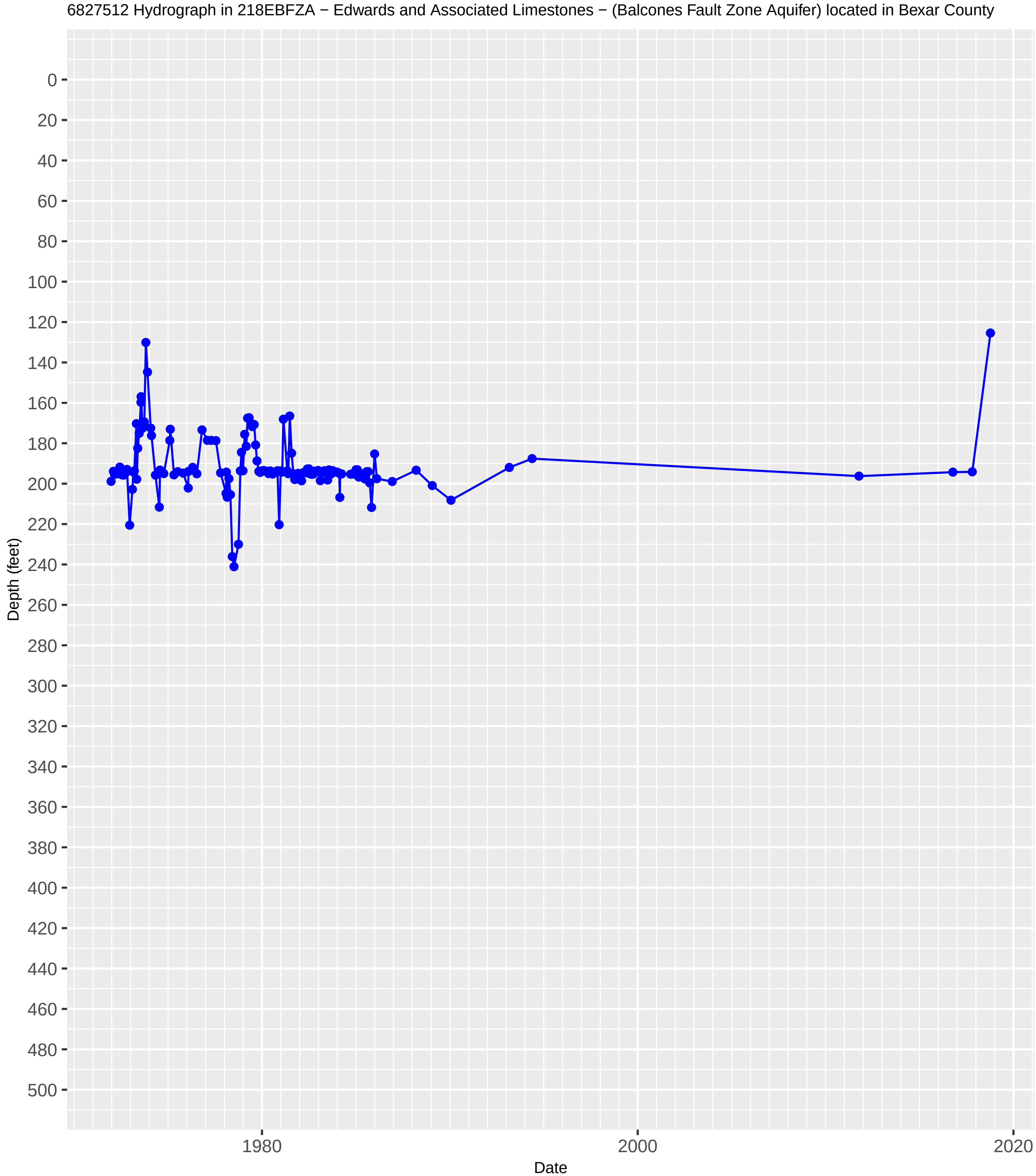
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



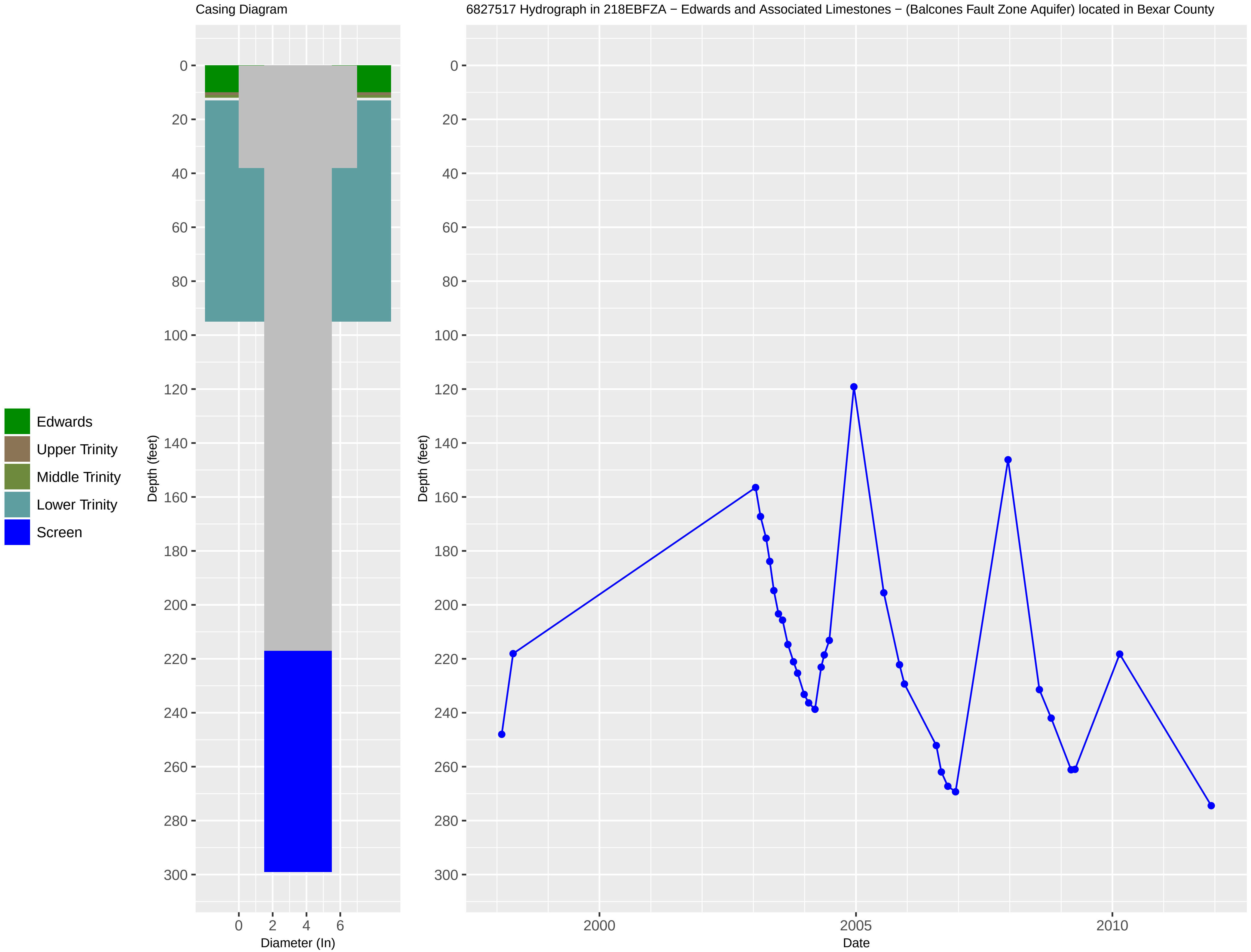


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



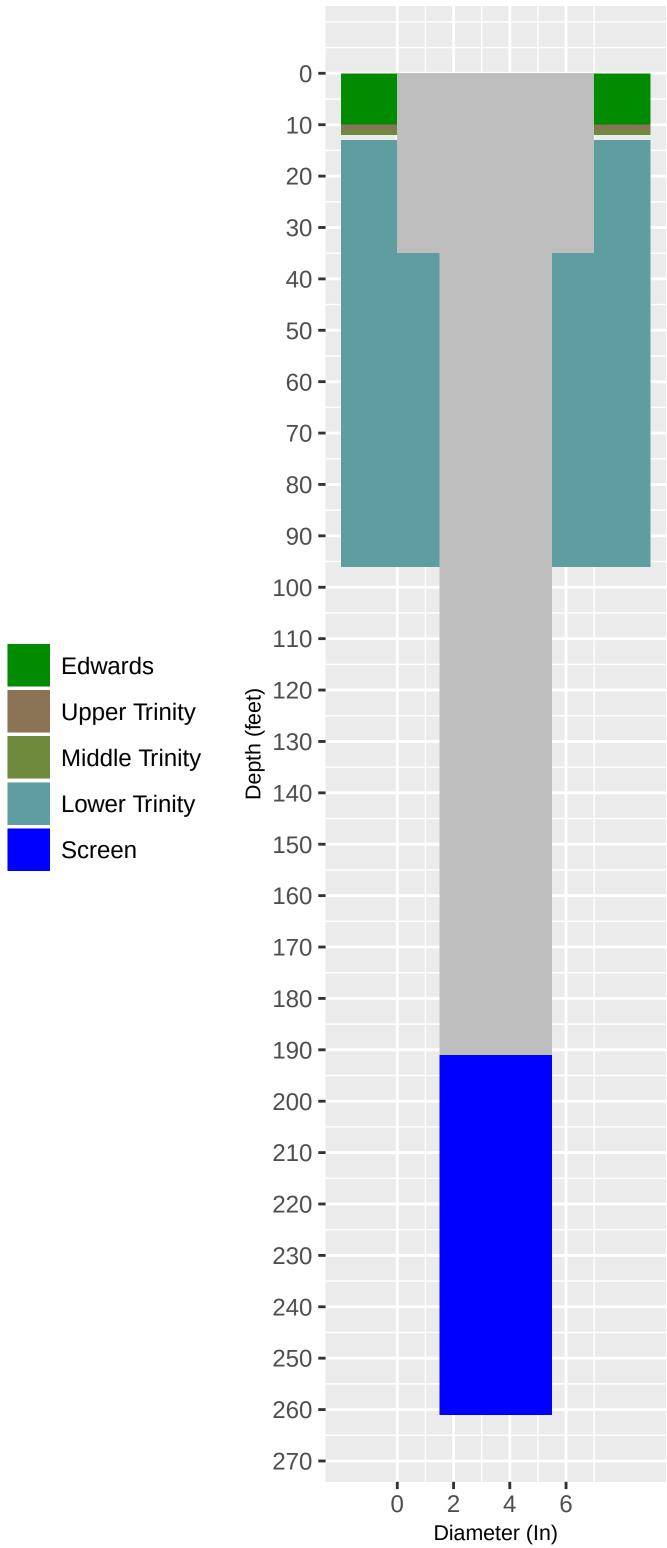


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

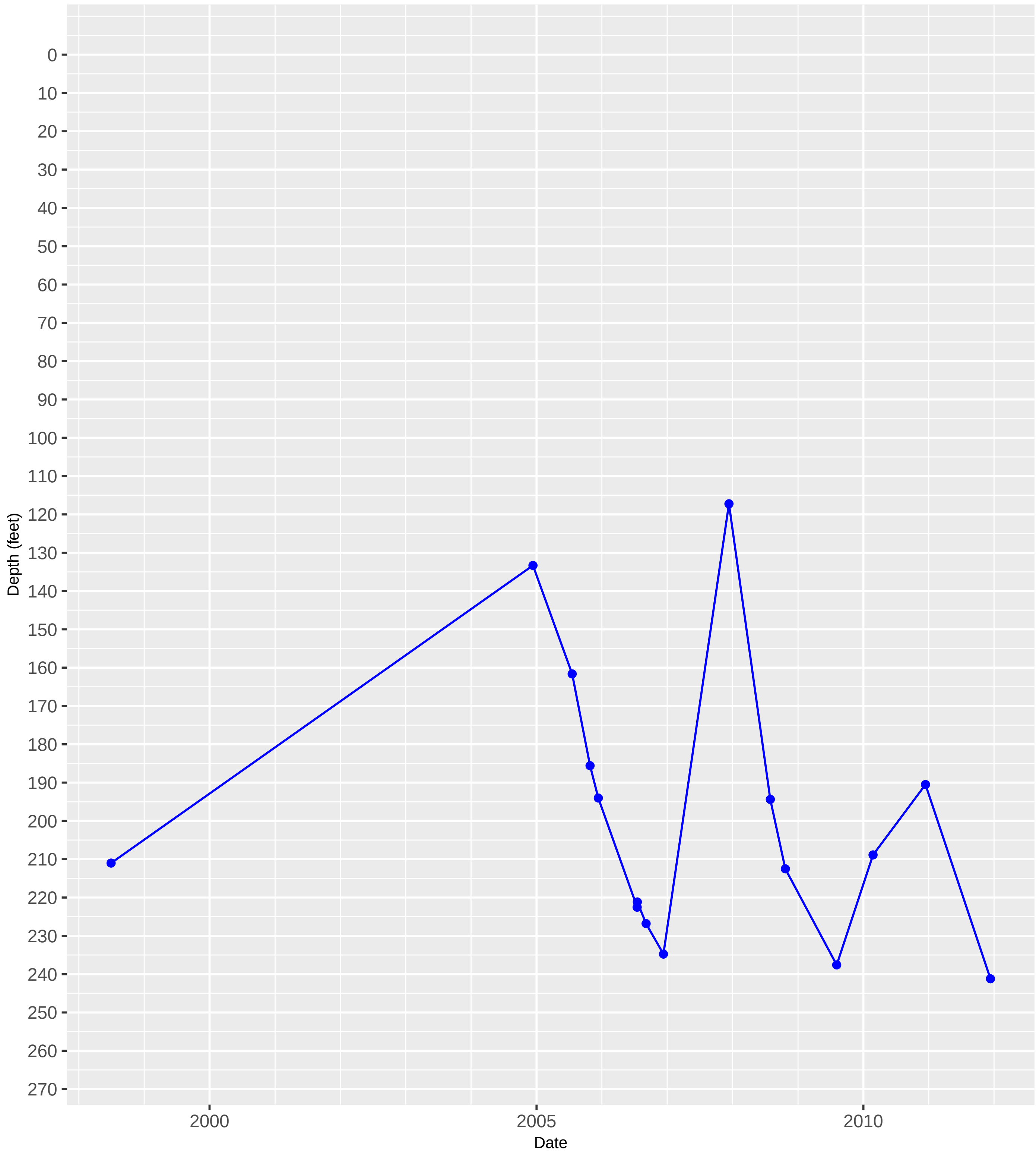


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

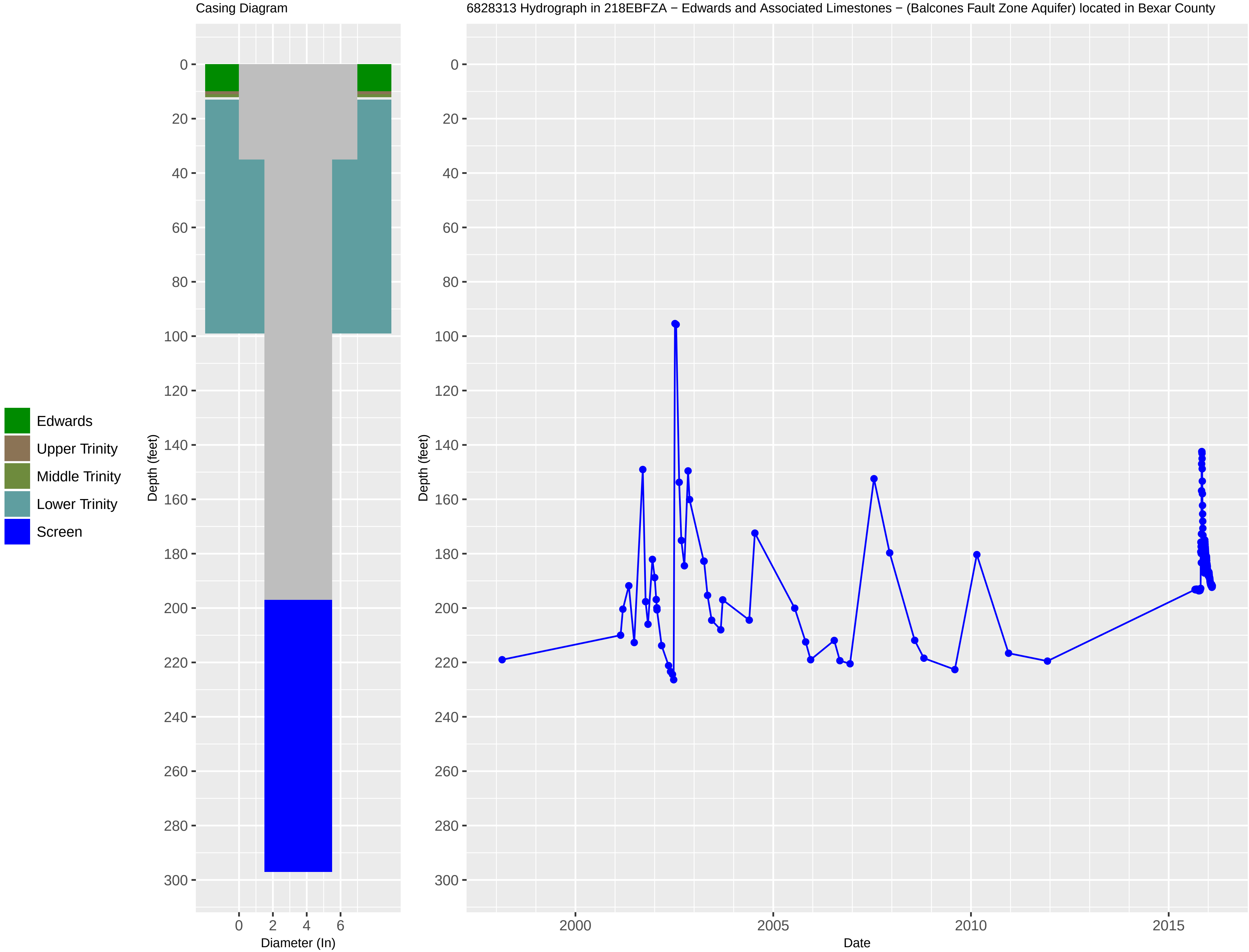
Casing Diagram



6827609 Hydrograph in 218EBFZA − Edwards and Associated Limestones − (Balcones Fault Zone Aquifer) located in Bexar County



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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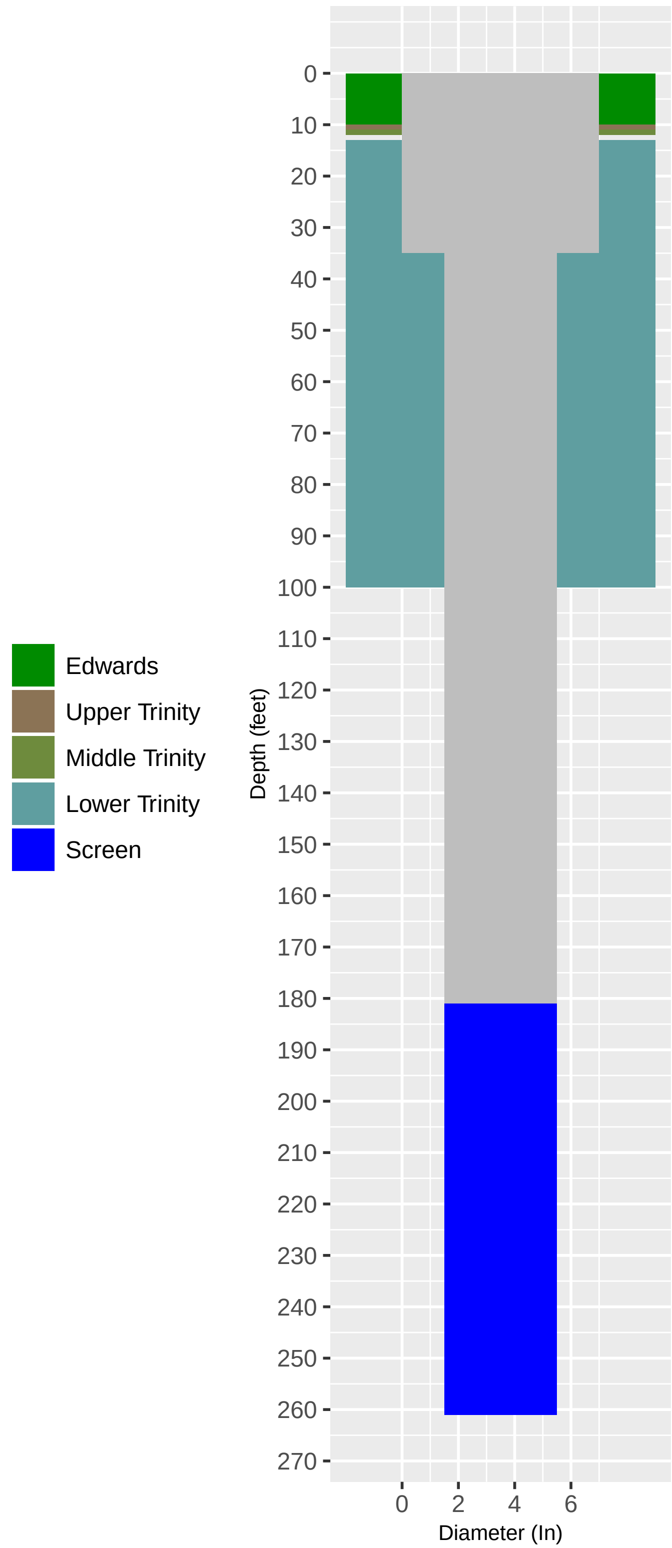
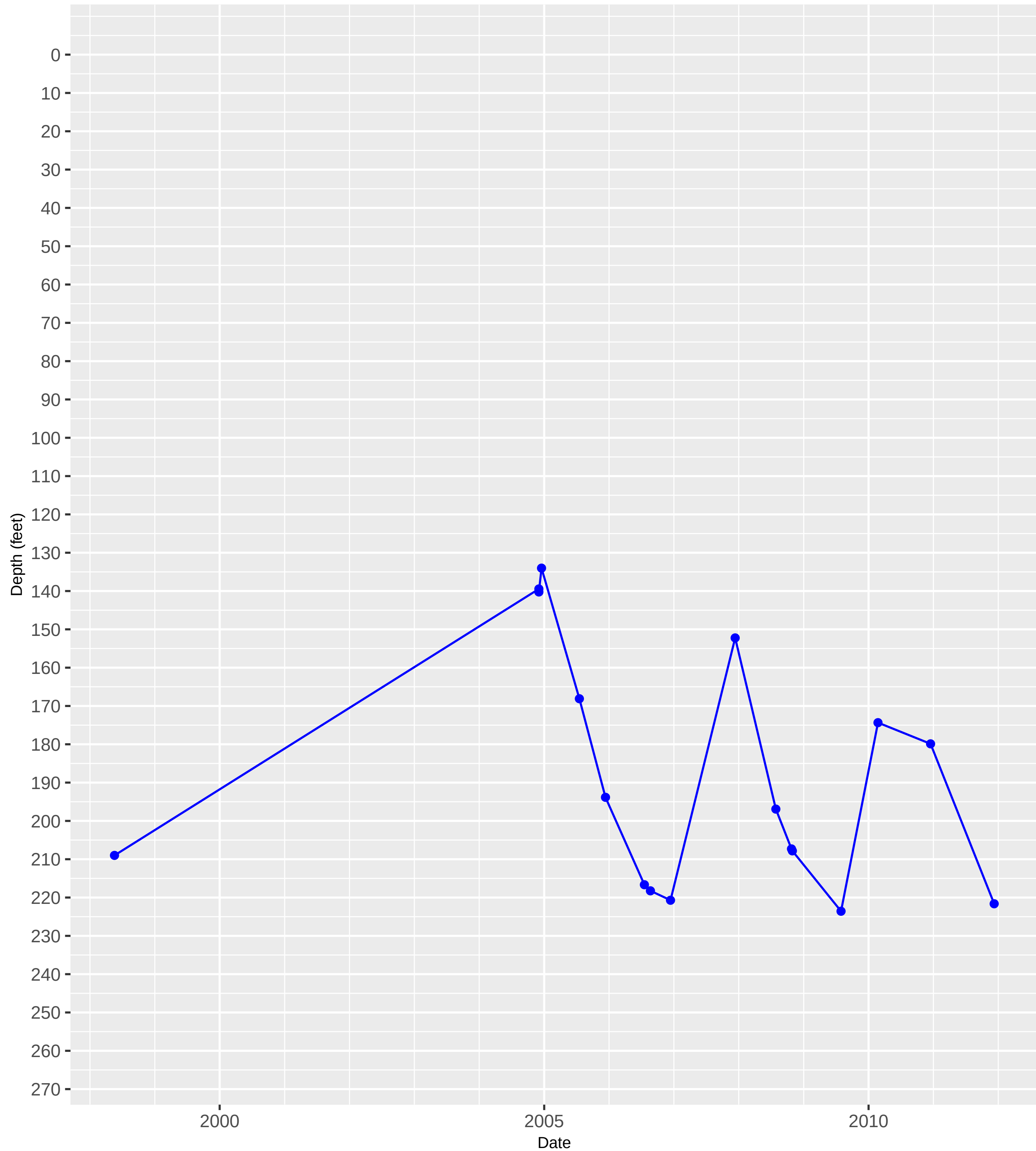
Casing Diagram



6829216 Hydrograph in 218EBFZA − Edwards and Associated Limestones − (Balcones Fault Zone Aquifer) located in Bexar County



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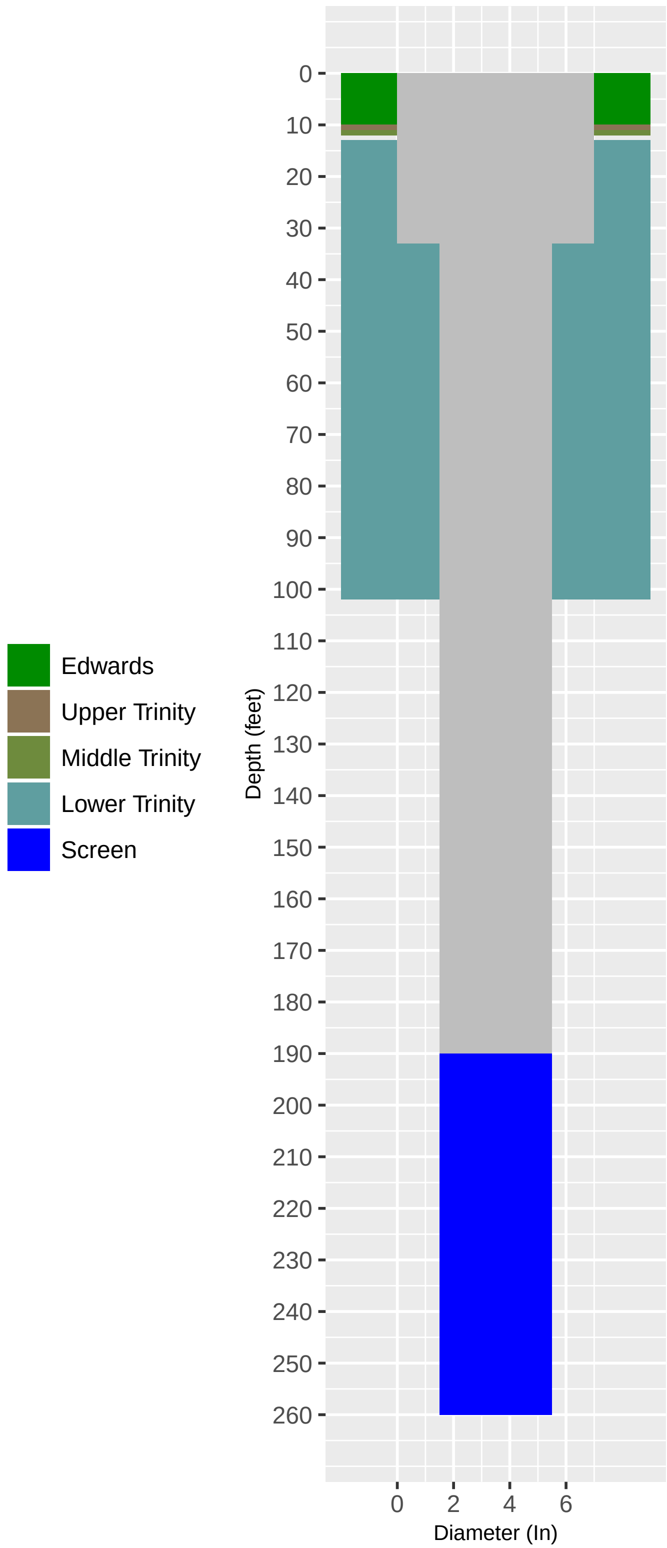
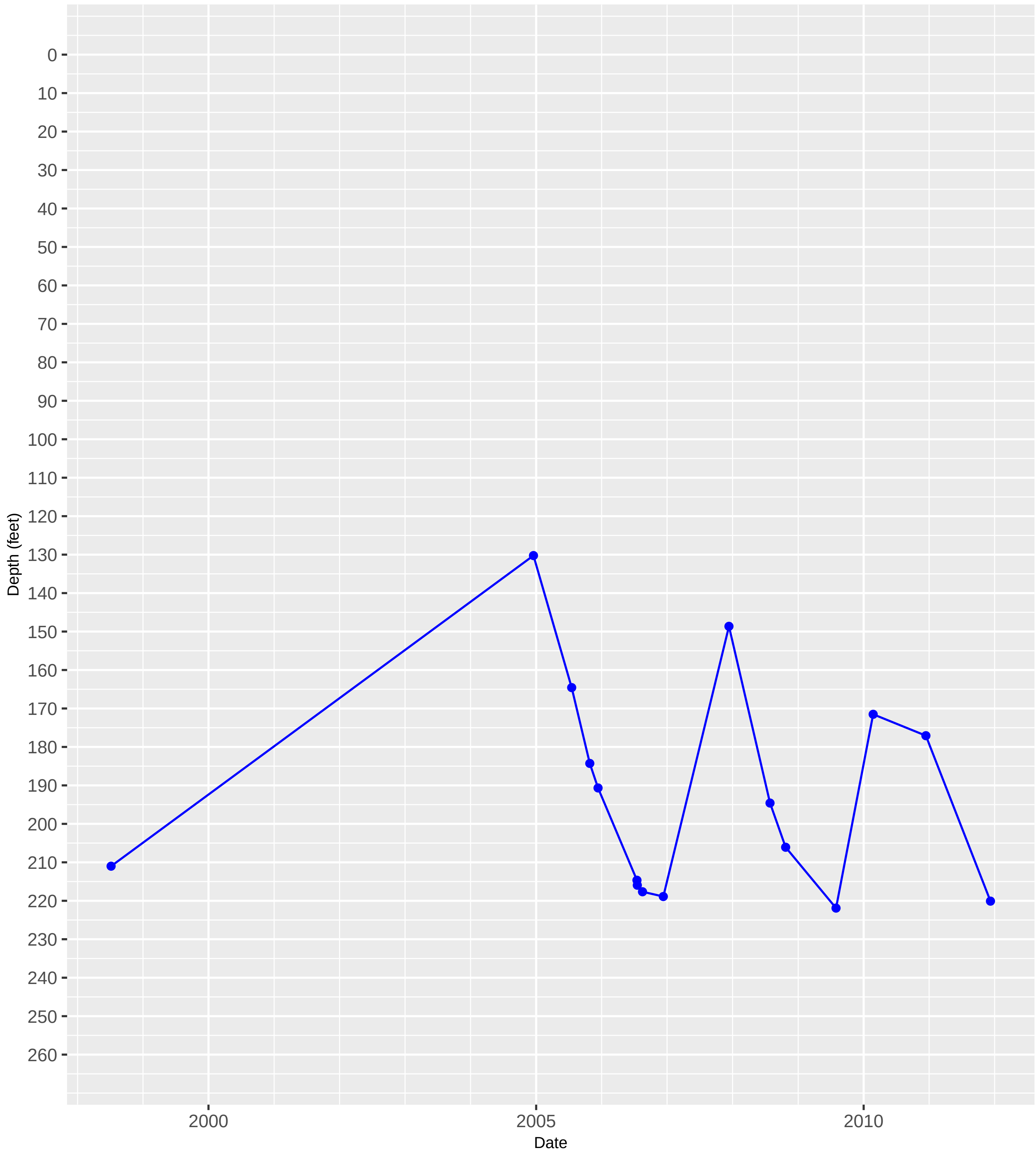
Casing Diagram



6829217 Hydrograph in 218EBFZA − Edwards and Associated Limestones − (Balcones Fault Zone Aquifer) located in Bexar County



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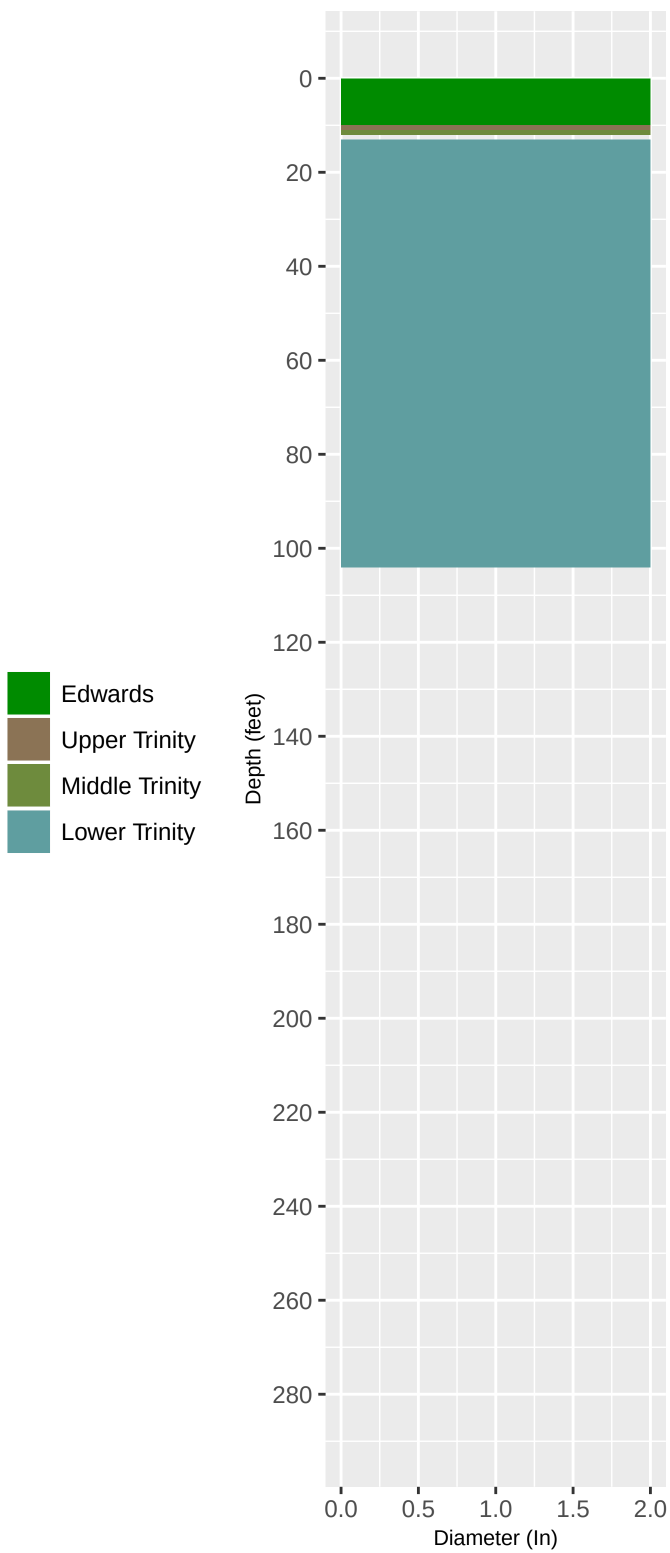

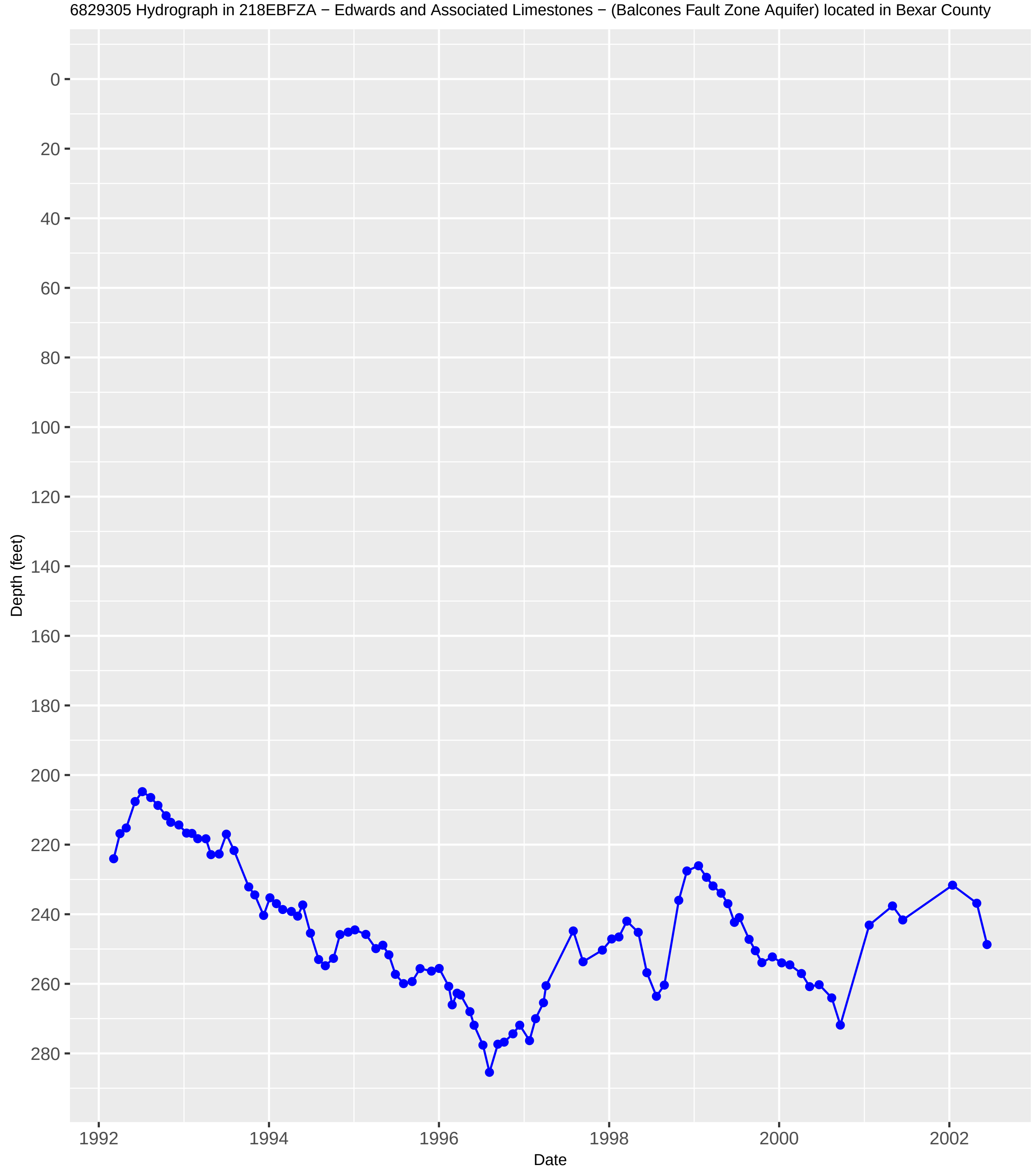

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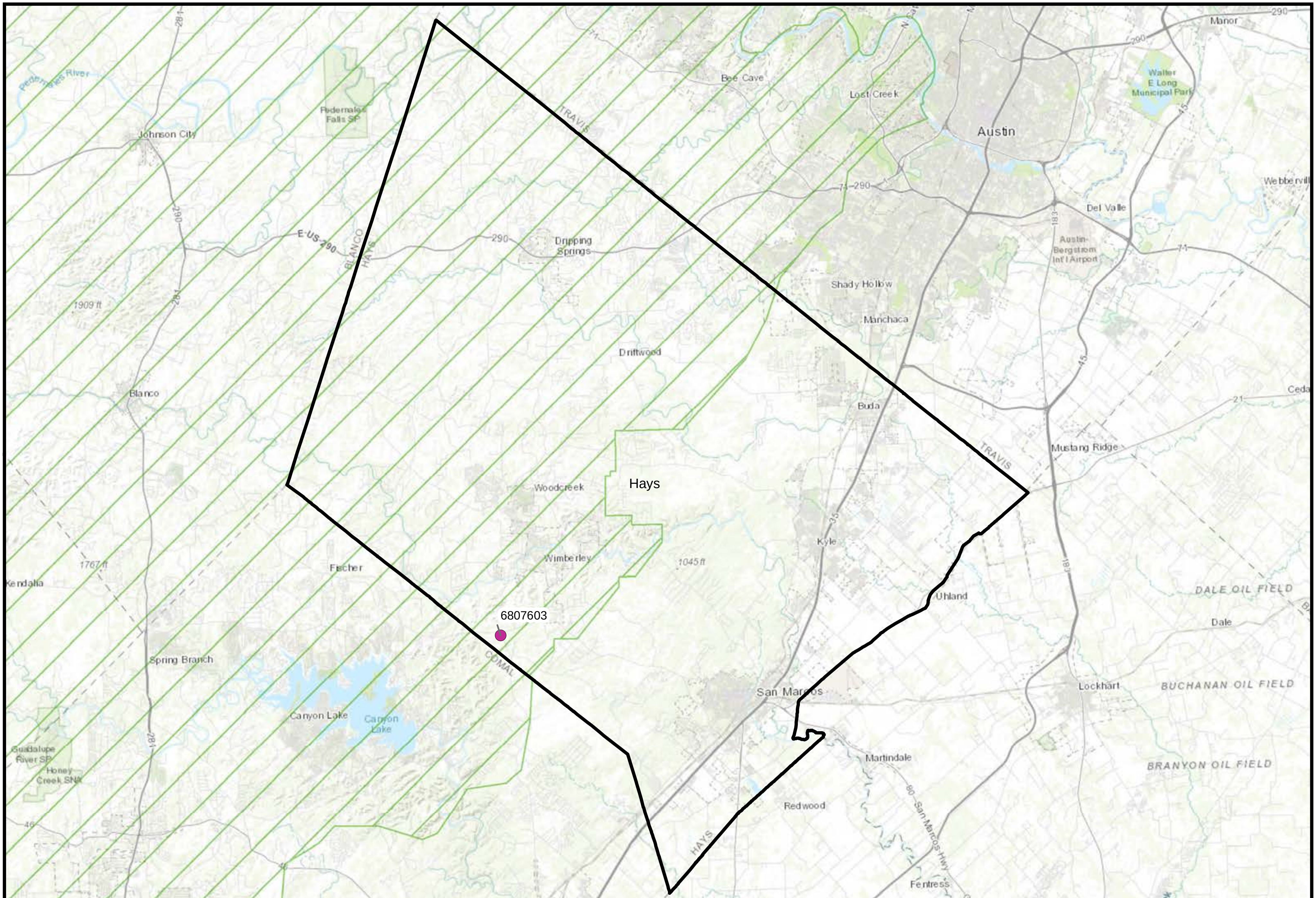


Aquifer

218EBFZA - Edwards and Associated Limestones - (Balcones Fault Zone Aquifer)

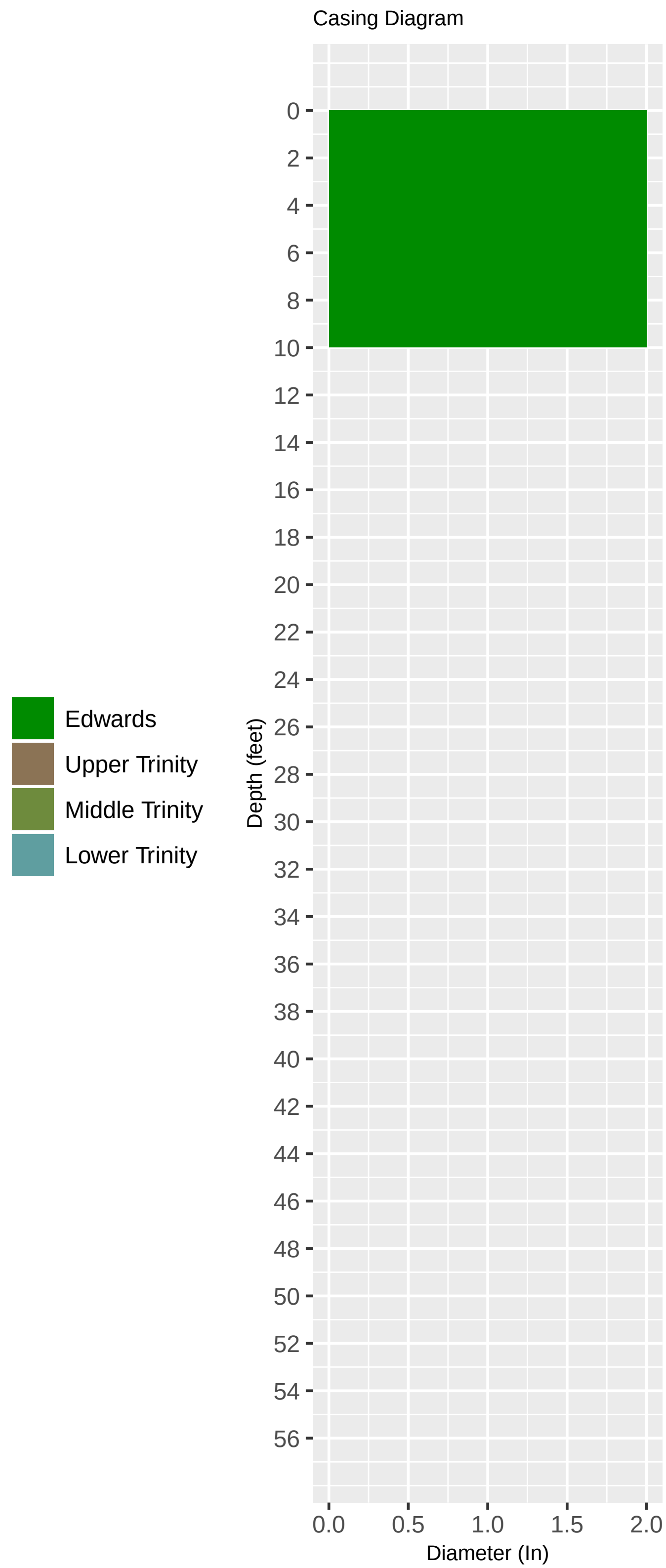
GMA 9

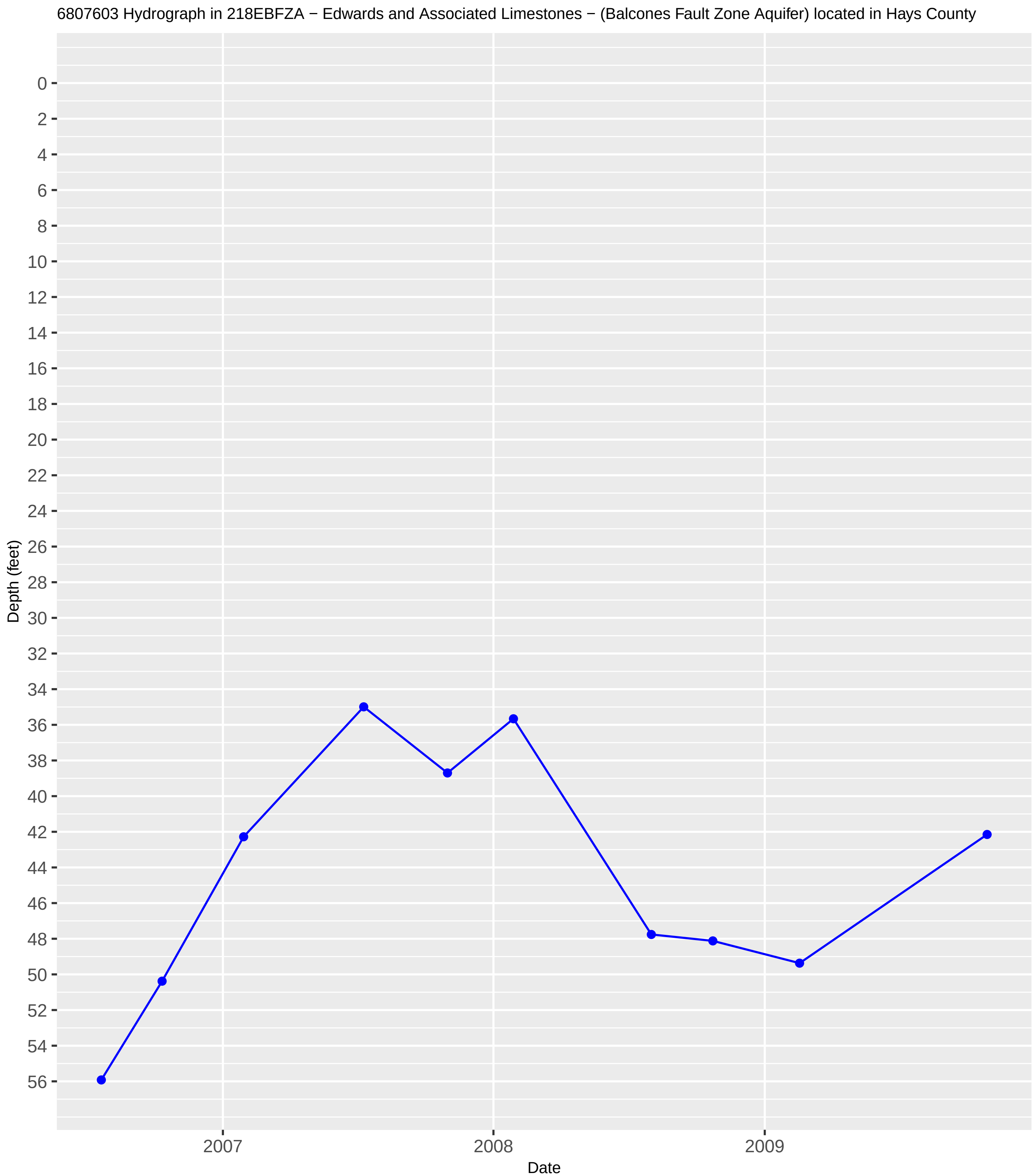
N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Hays County
218EBFZA
Edwards and Associated Limestones
(Balcones Fault Zone Aquifer)





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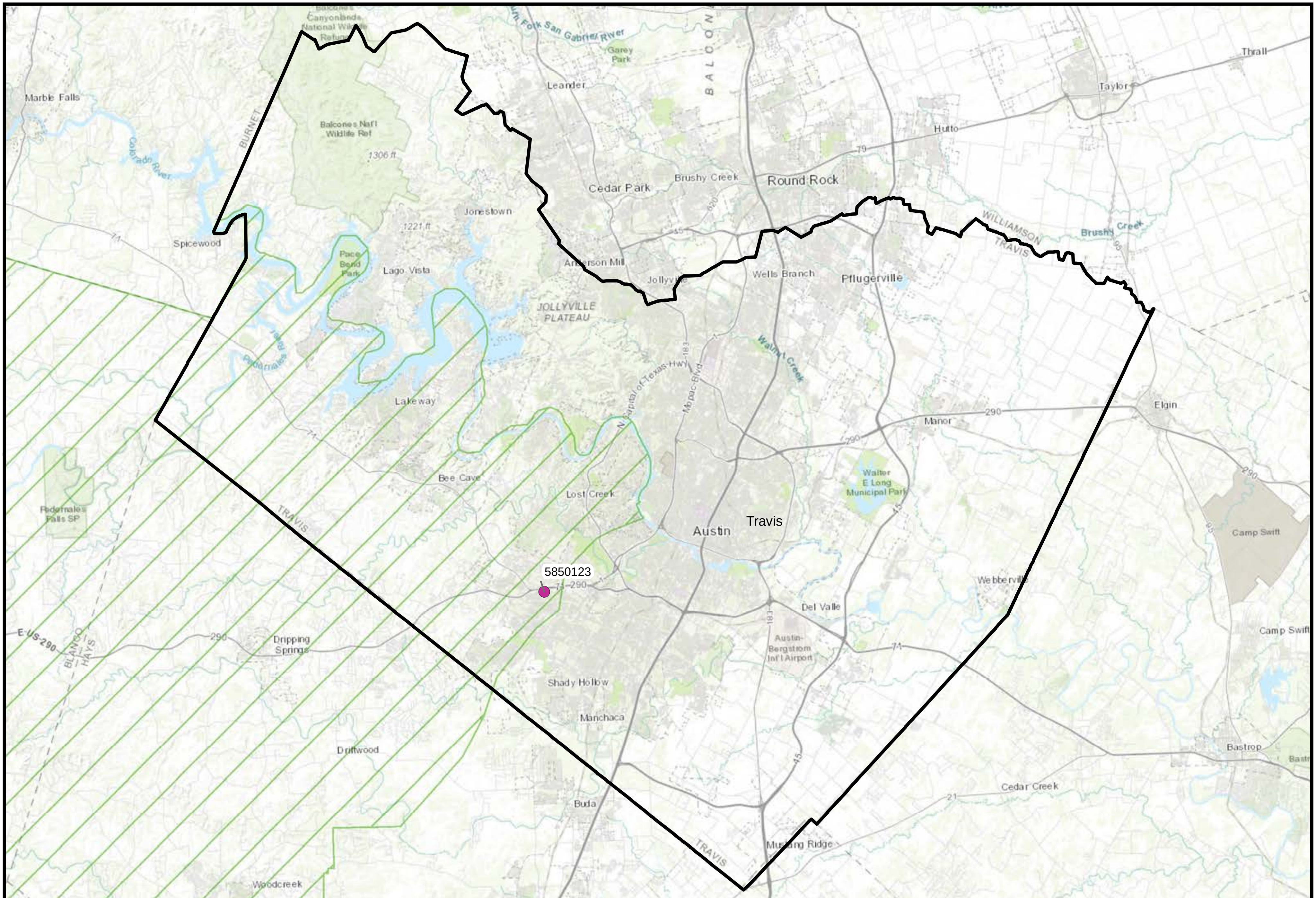


Aquifer

218EBFZA - Edwards and Associated Limestones - (Balcones Fault Zone Aquifer)

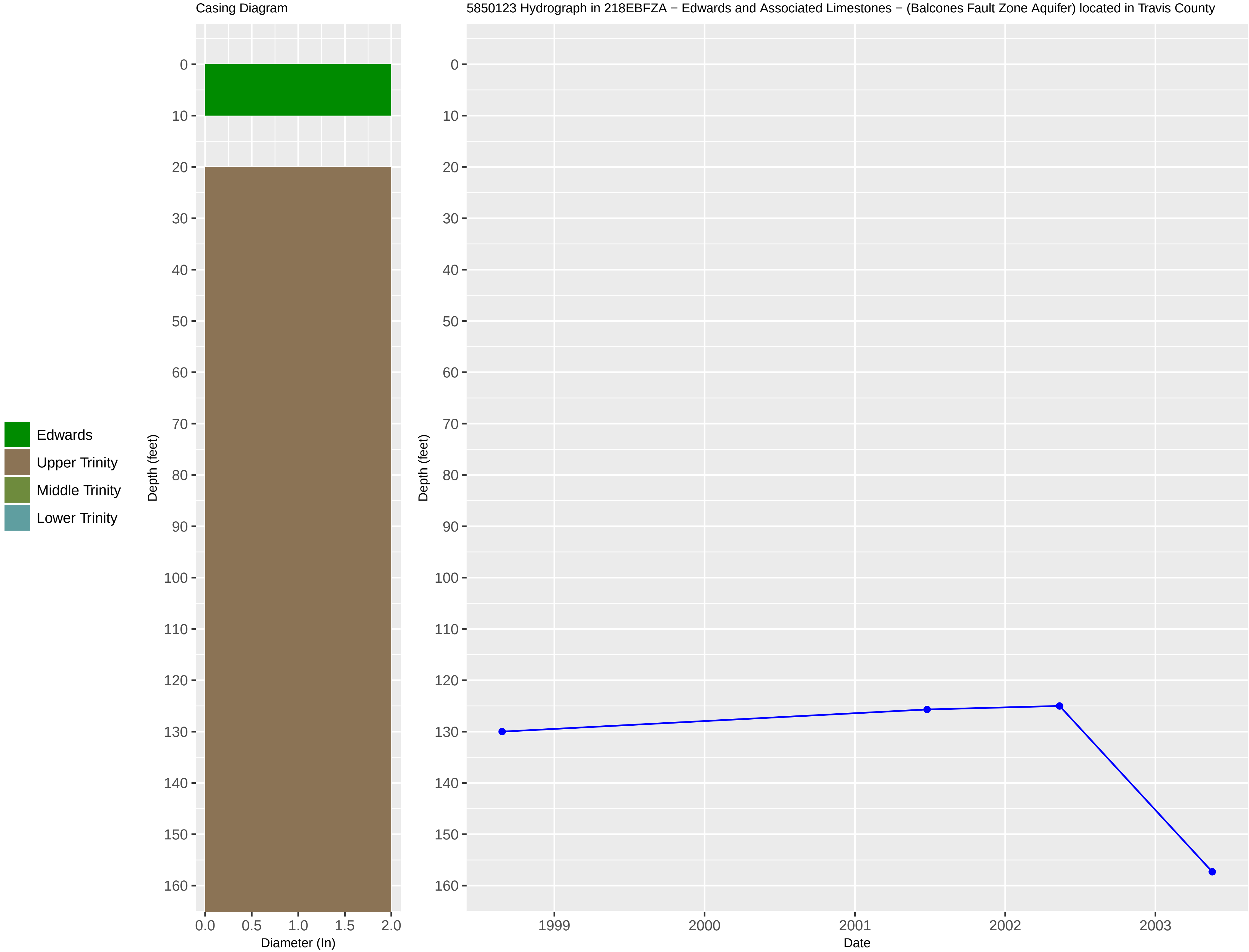
GMA 9

N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Travis County
218EBFZA
Edwards and Associated Limestones
(Balcones Fault Zone Aquifer)



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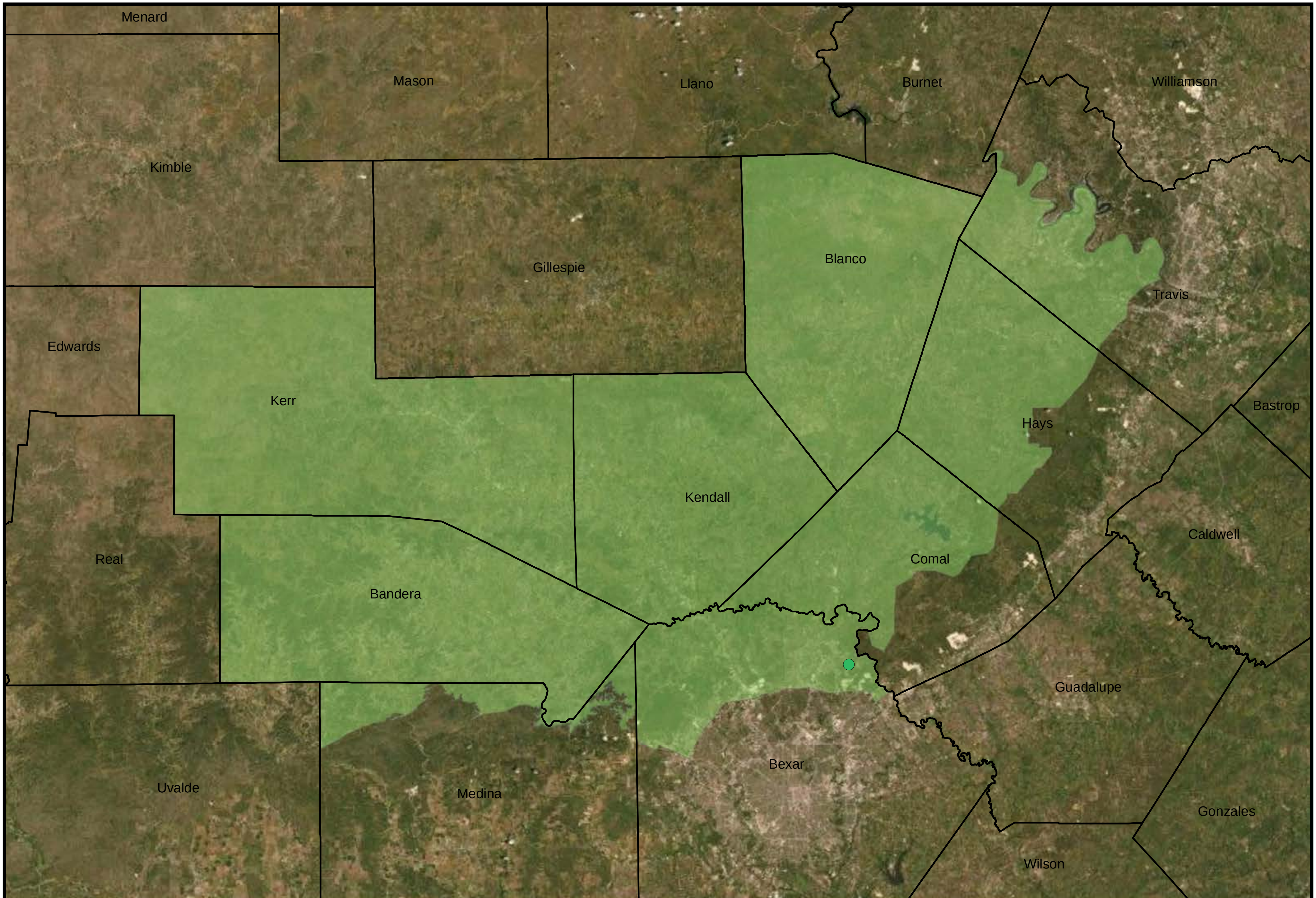


Aquifer

218EDRD - Edwards Limestone

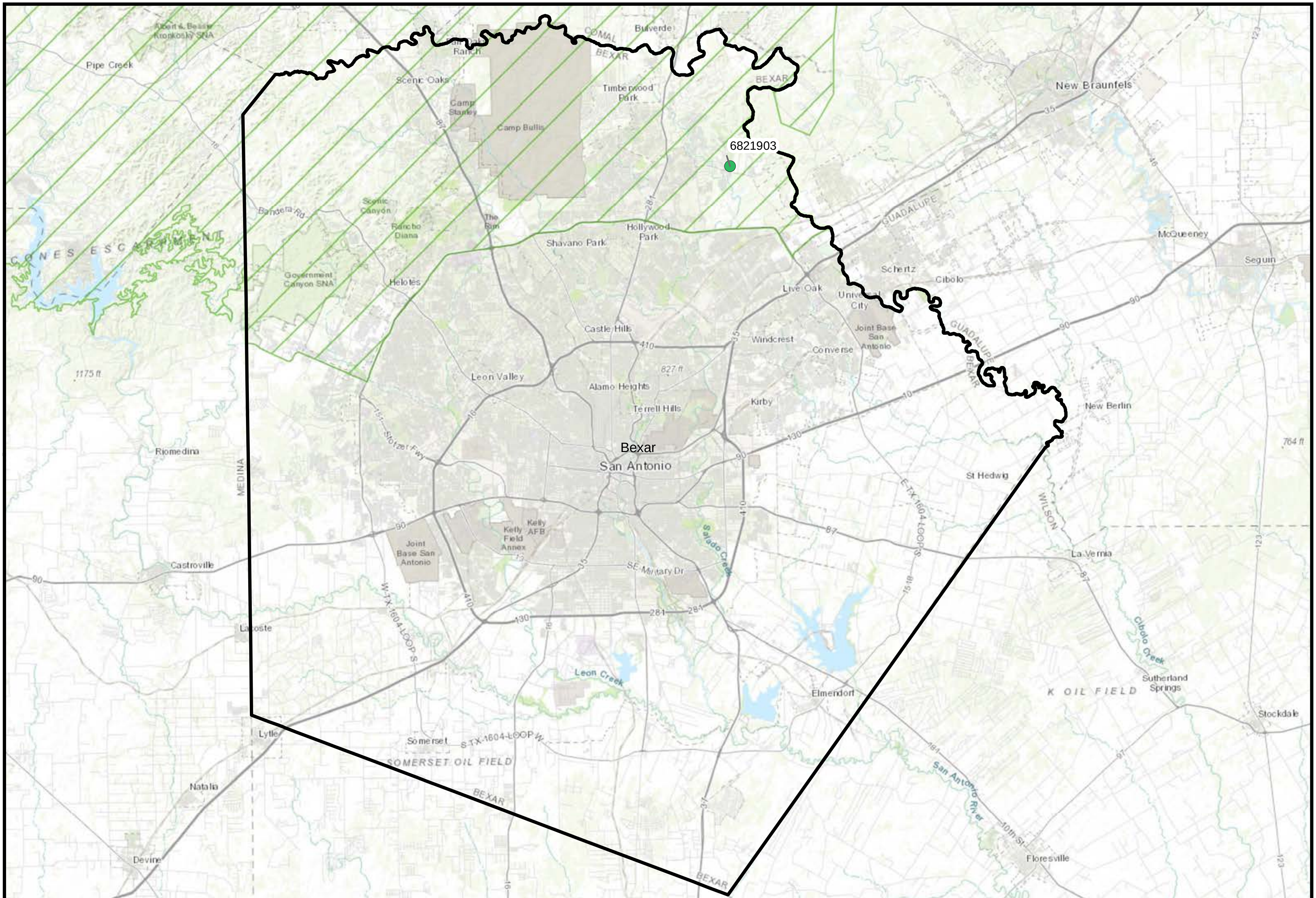
GMA 9

N

0 5 10

Miles

Map of Hydrograph Well Locations
218EDRD
Edwards Limestone



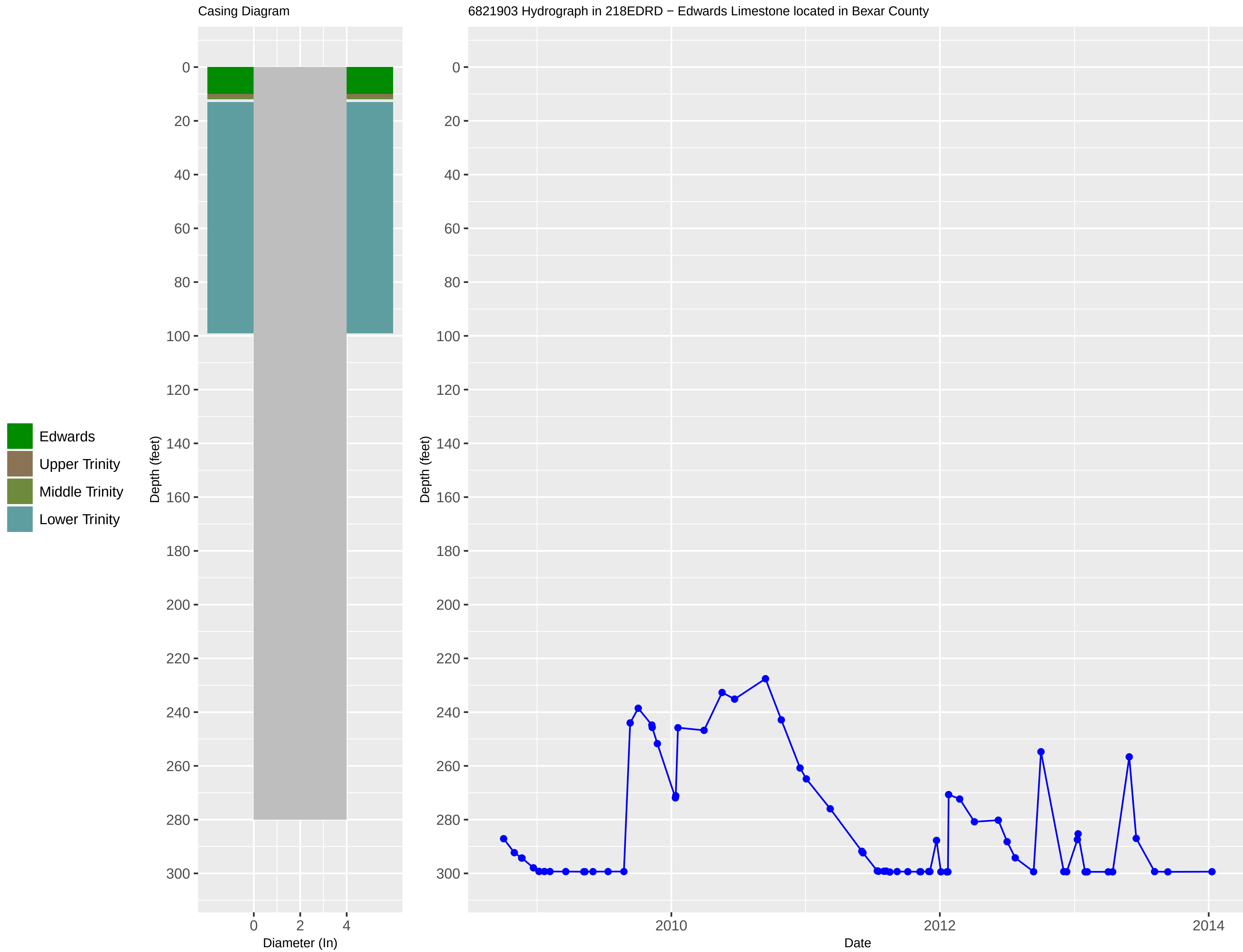
Aquifer	GMA 9
218EDRD - Edwards Limestone	

N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Bexar County
218EDRD
Edwards Limestone



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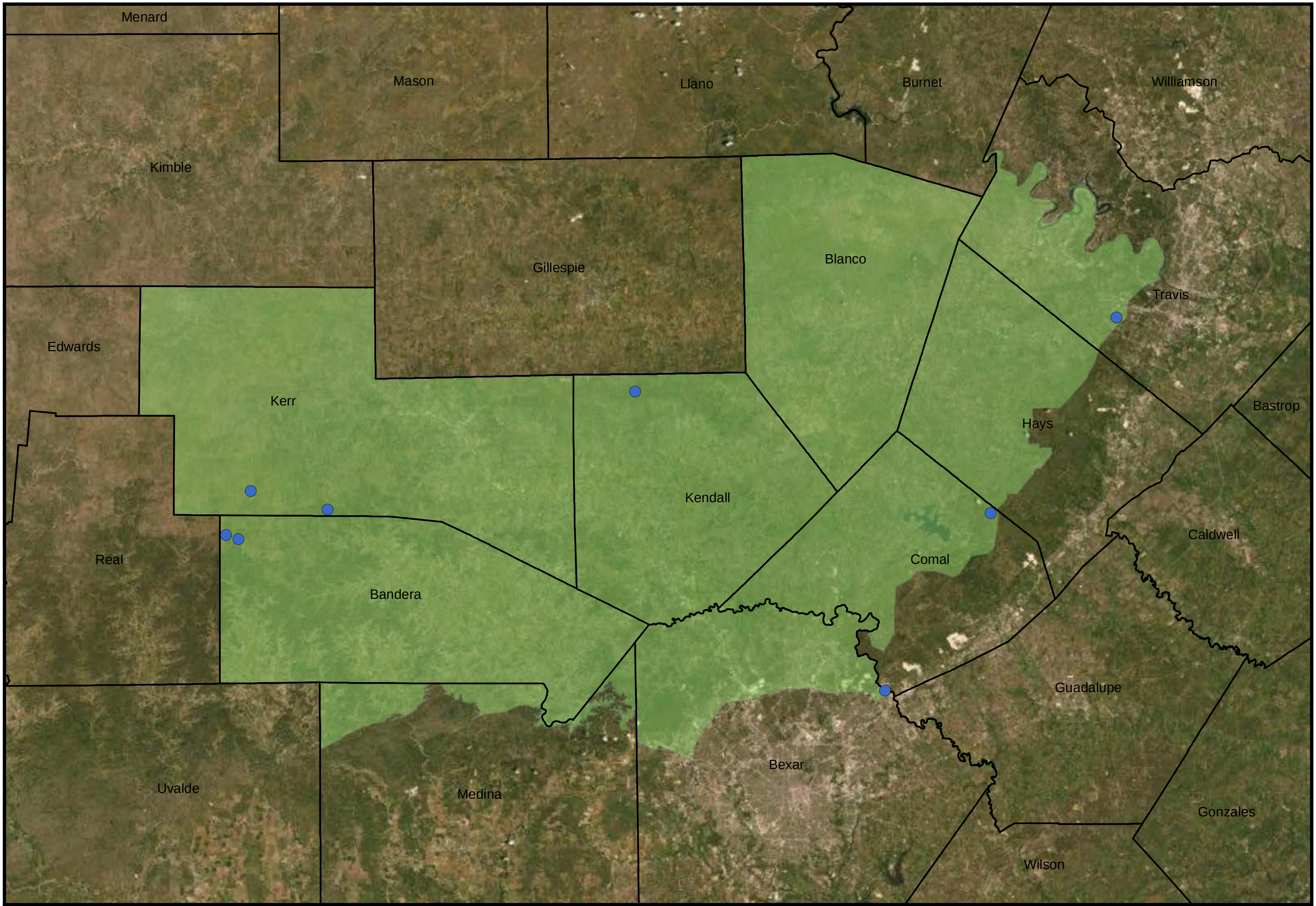


Aquifer

218EDRDA - Edwards and Associated Limestones

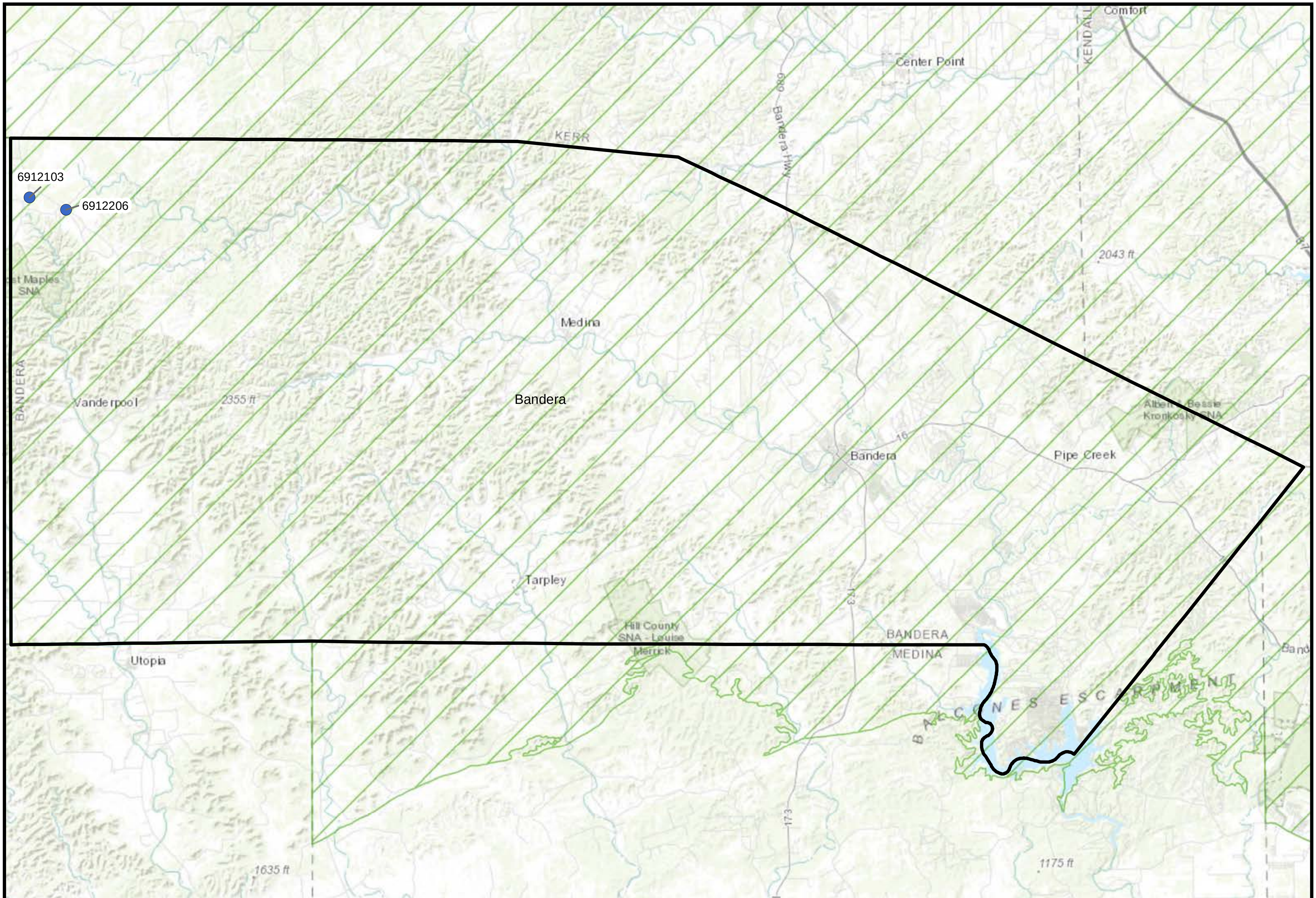
GMA 9

N

0 5 10

Miles

Map of Hydrograph Well Locations
218EDRDA
Edwards and Associated Limestones



Aquifer

218EDRDA - Edwards and Associated Limestones

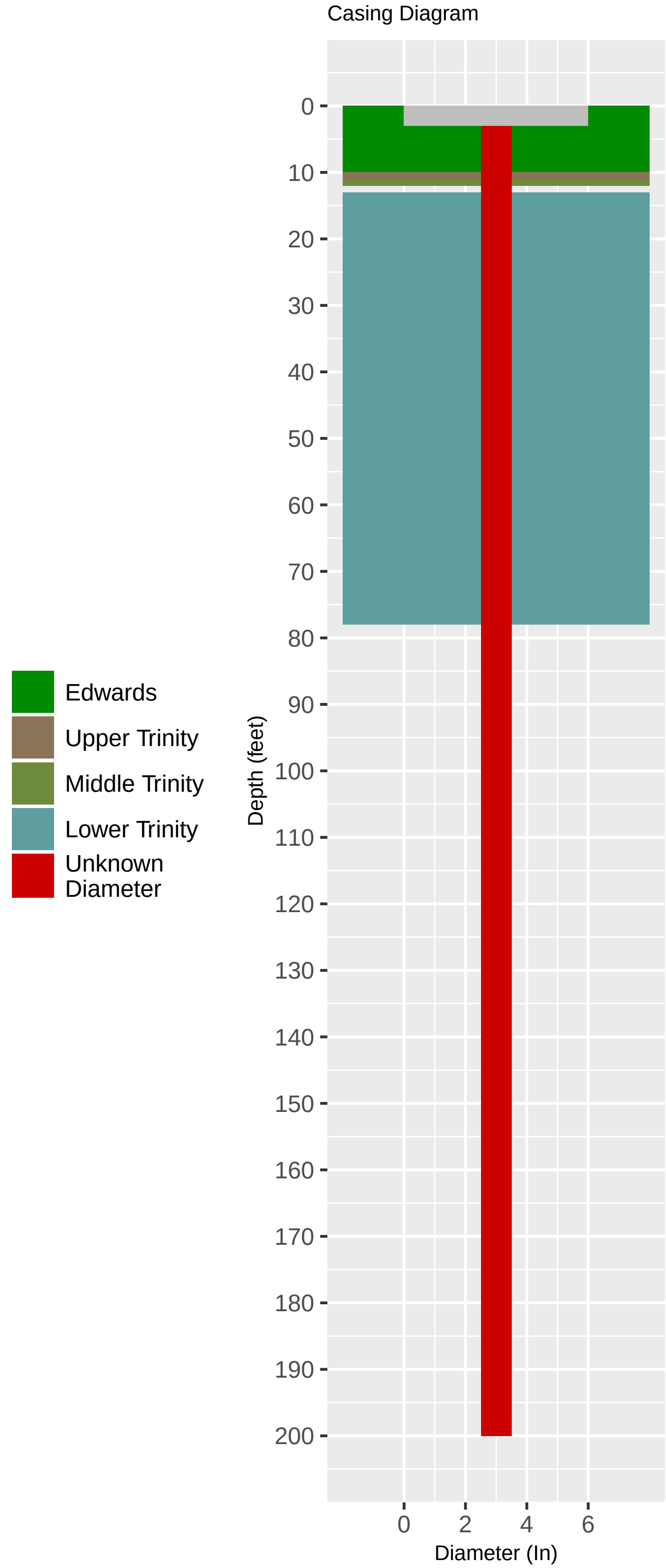
GMA 9

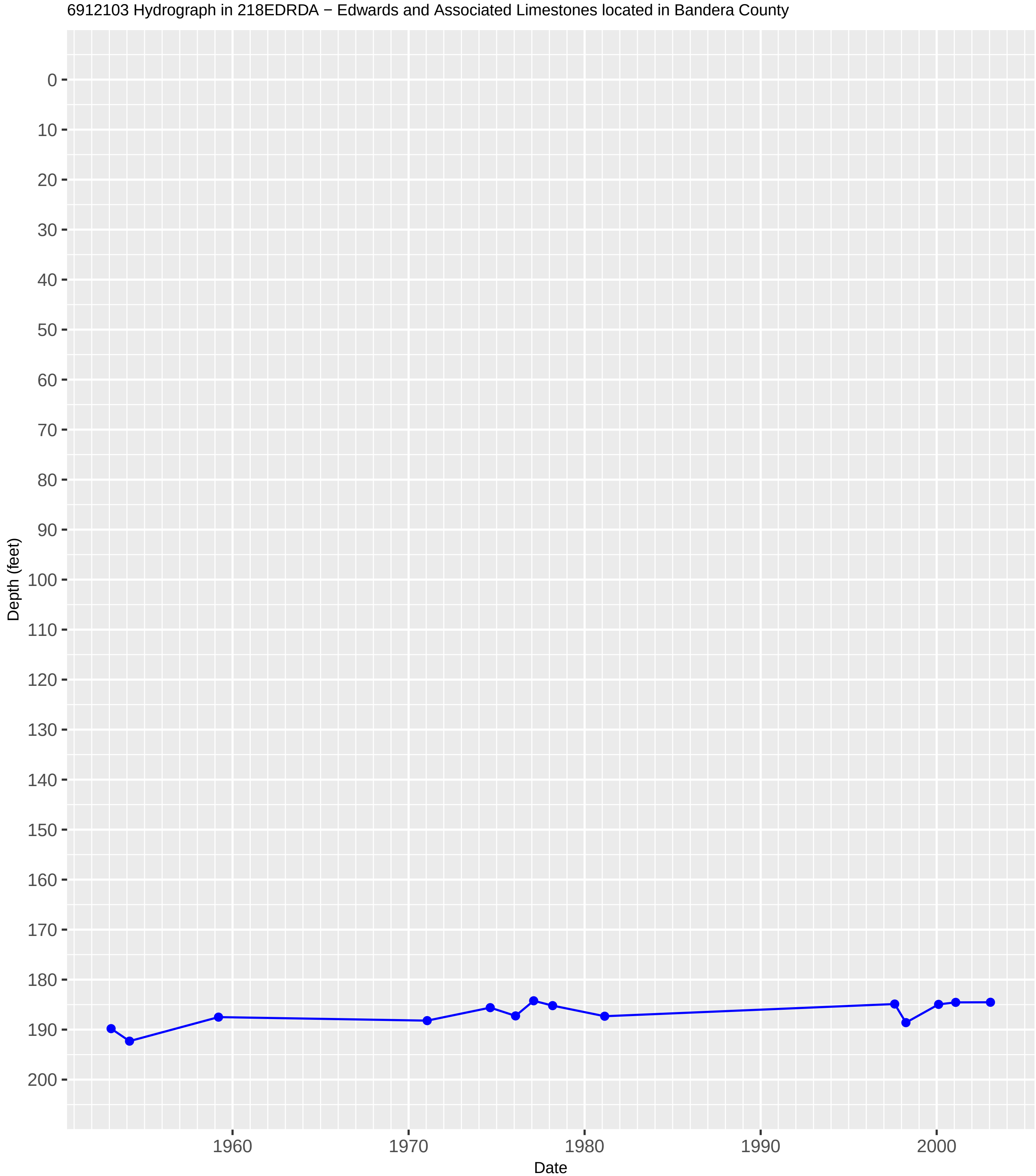
N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Bandera County
218EDRDA
Edwards and Associated Limestones





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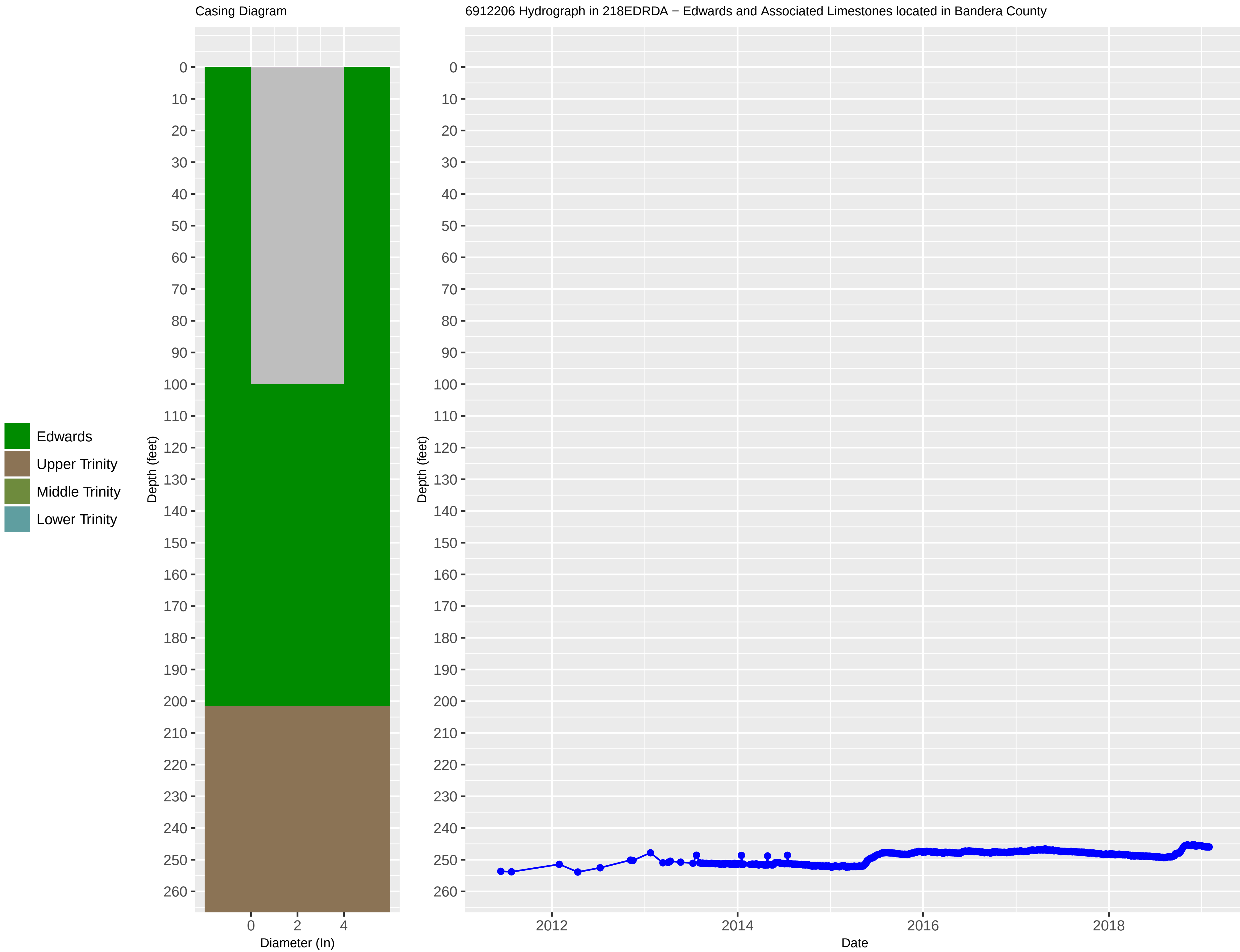

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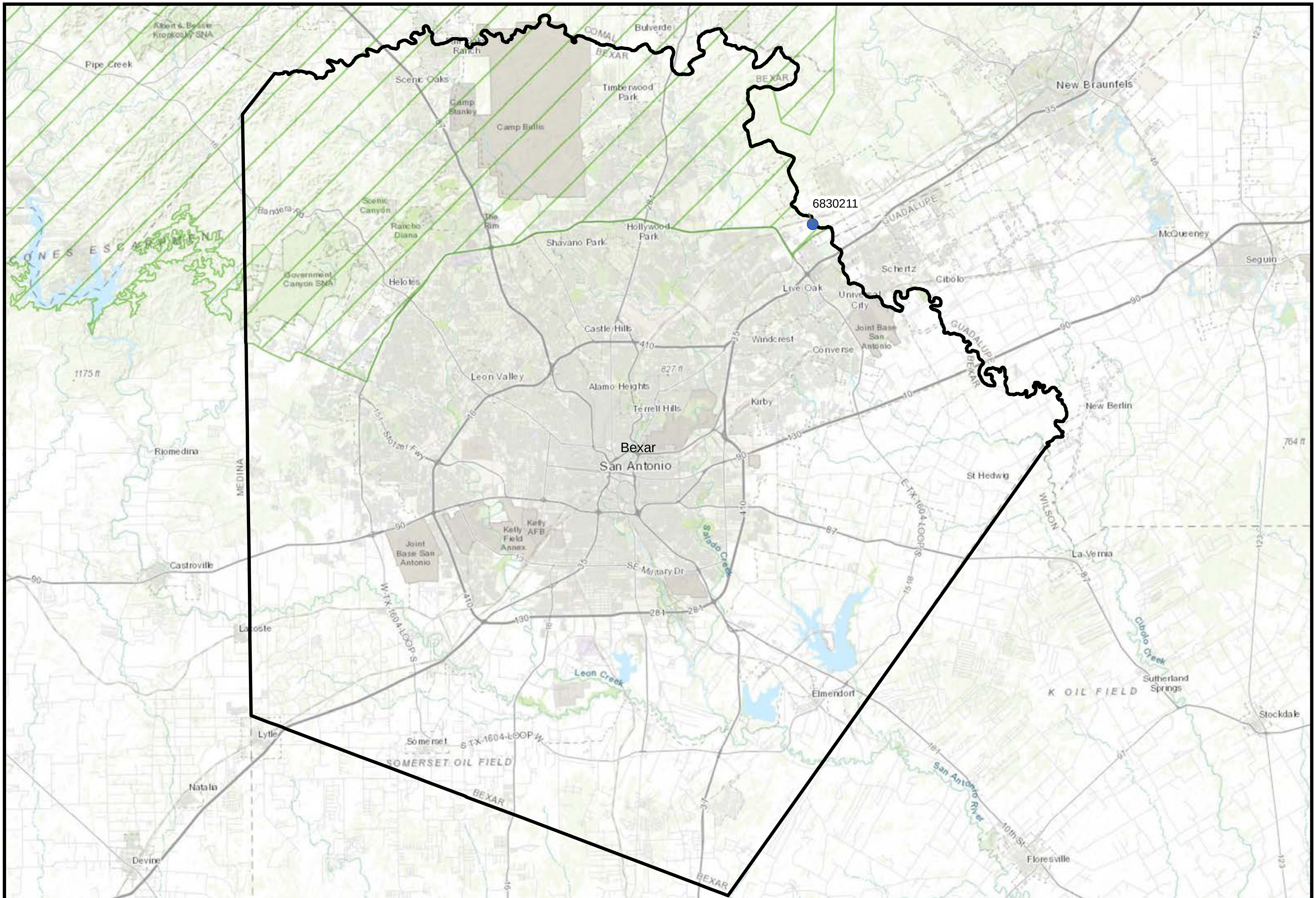


Aquifer

218EDRDA - Edwards and Associated Limestones

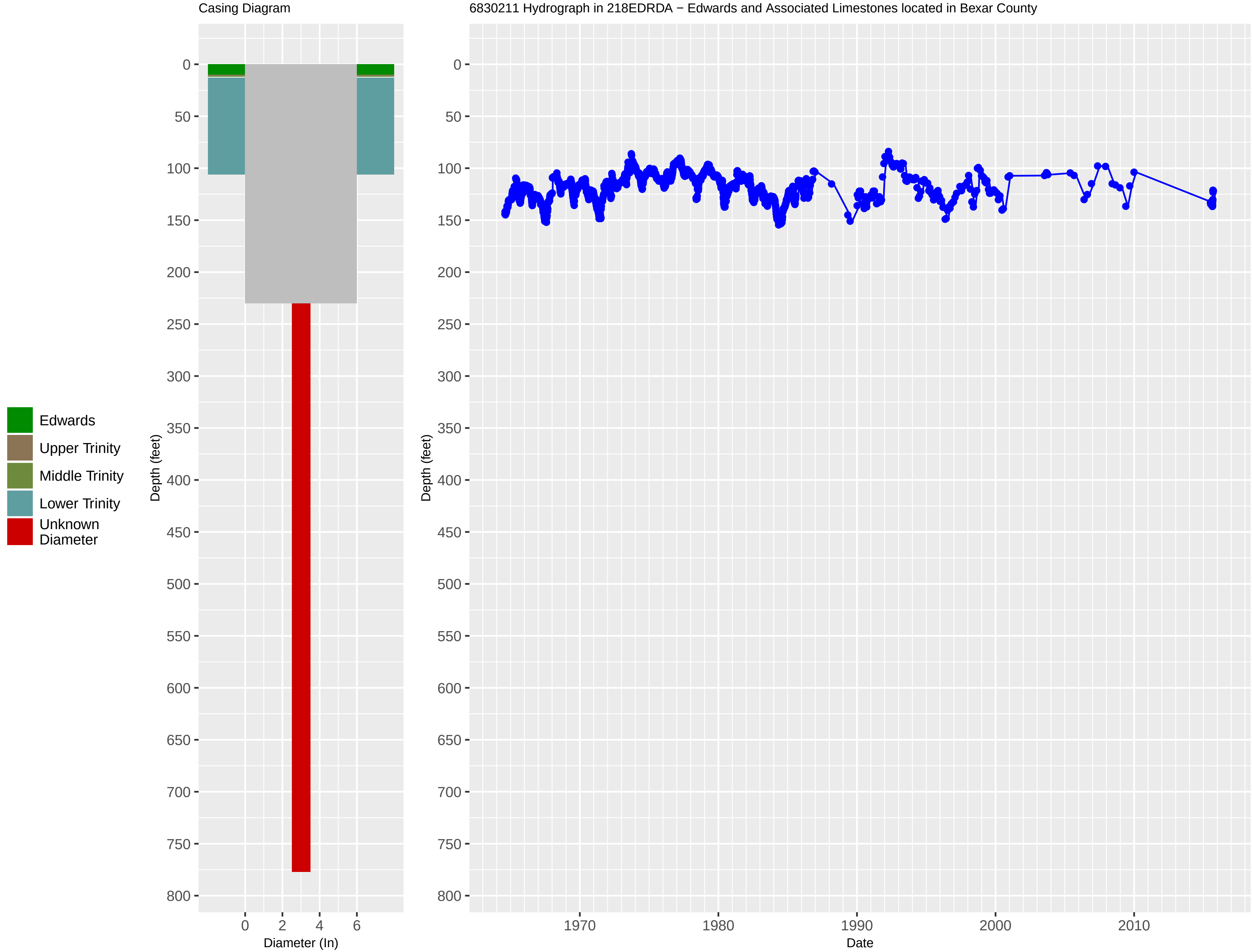
GMA 9

N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Bexar County
218EDRDA
Edwards and Associated Limestones



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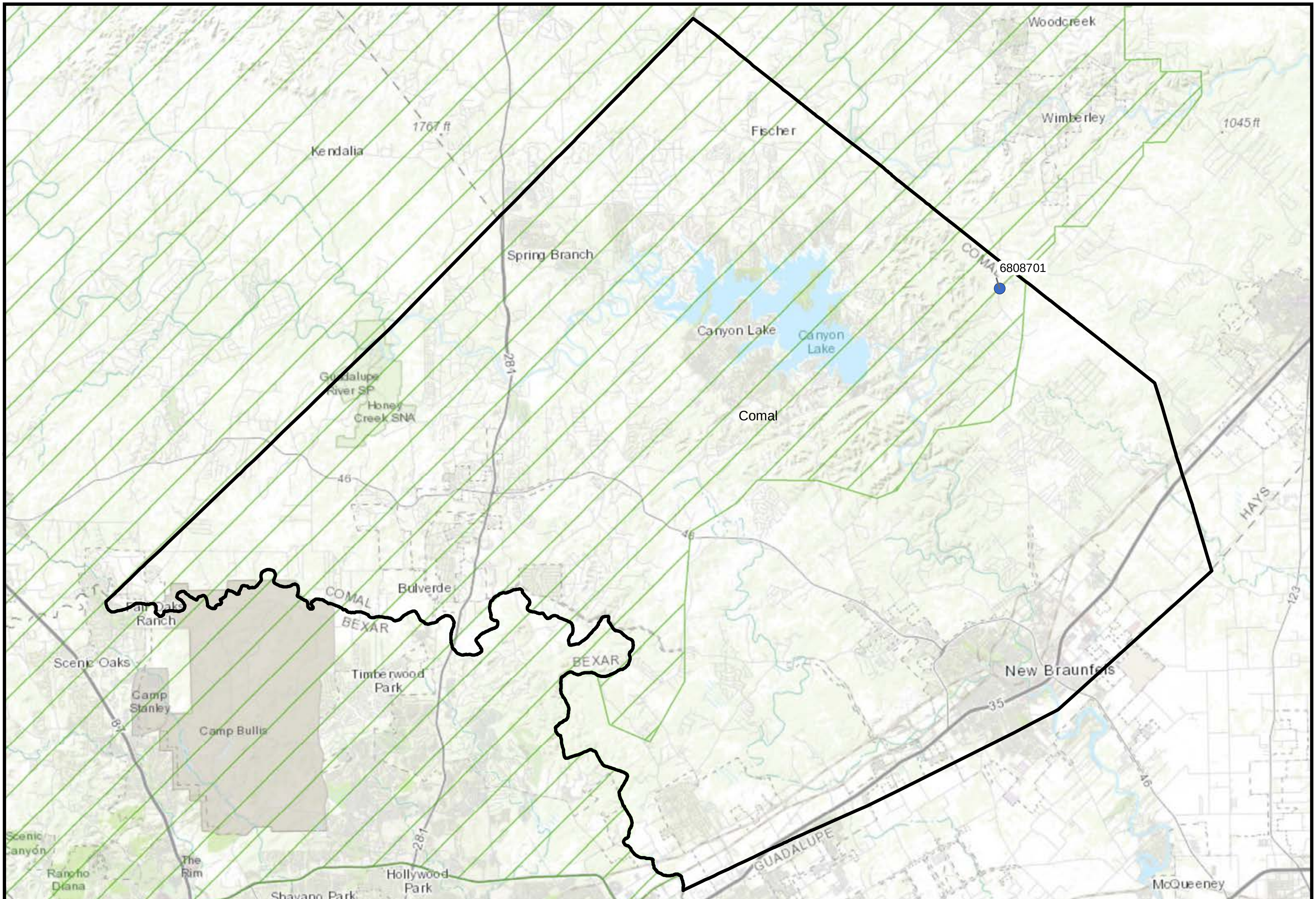


Aquifer

218EDRDA - Edwards and Associated Limestones

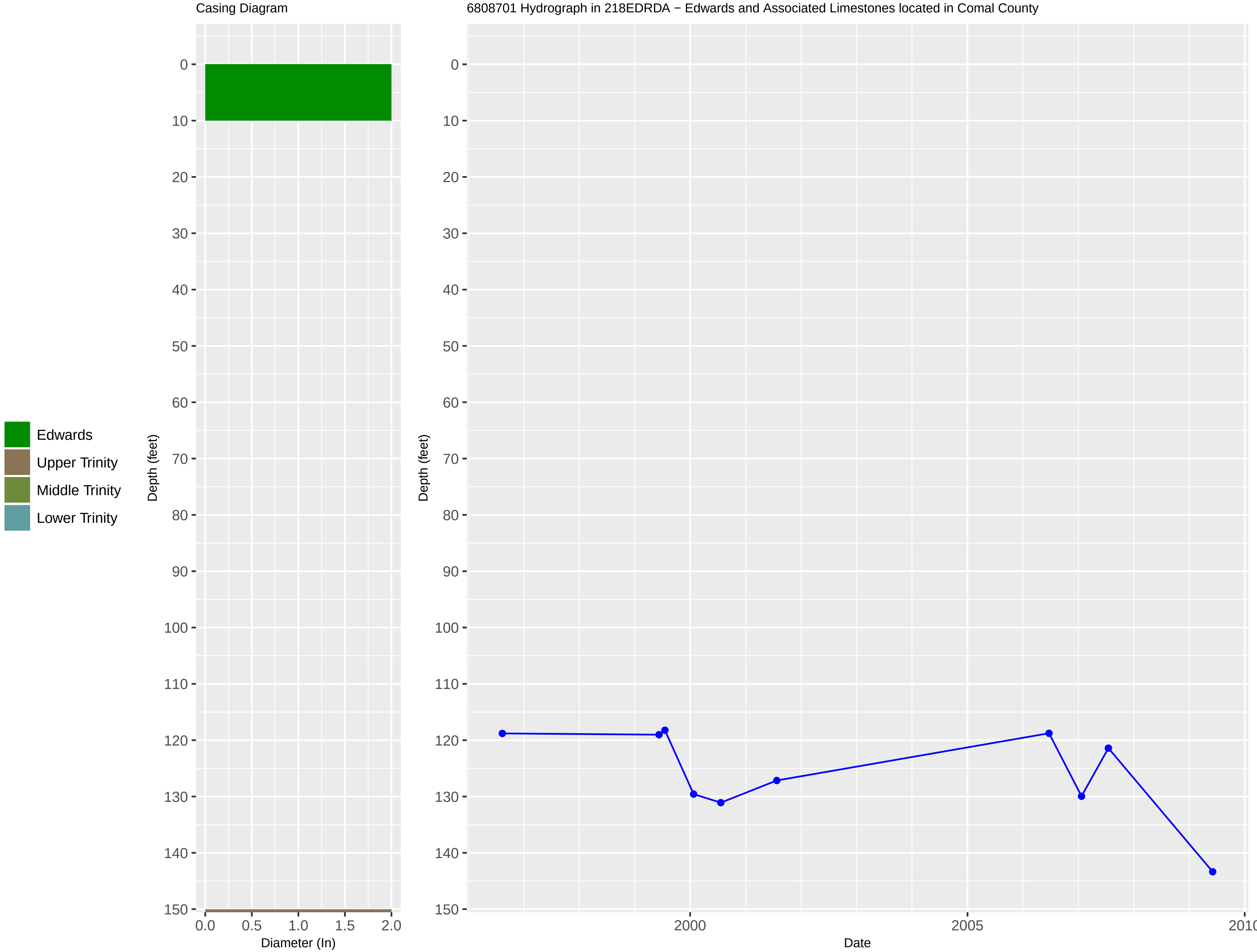
GMA 9

N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Comal County
218EDRDA
Edwards and Associated Limestones



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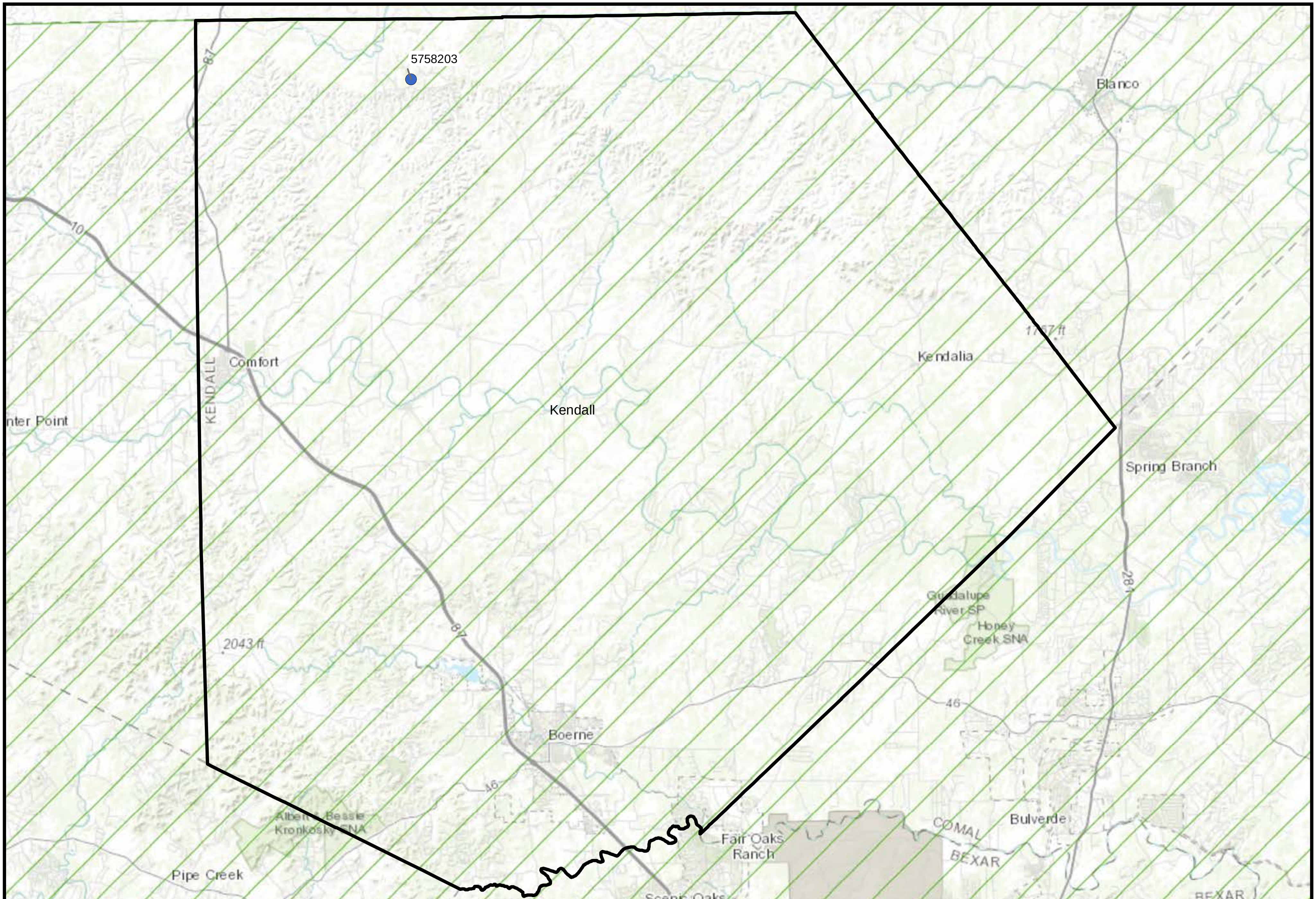


Aquifer

● 218EDRDA - Edwards and Associated Limestones

GMA 9

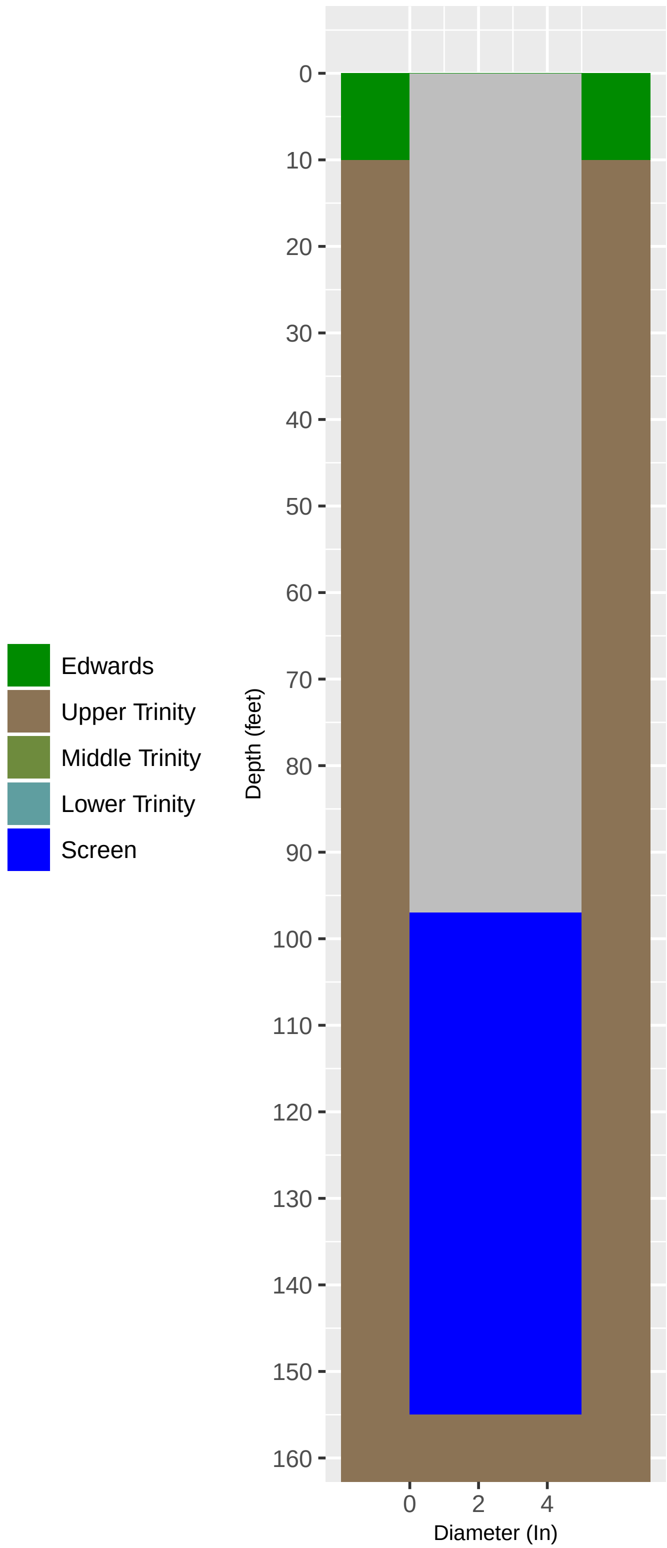
N

0 1 2 4

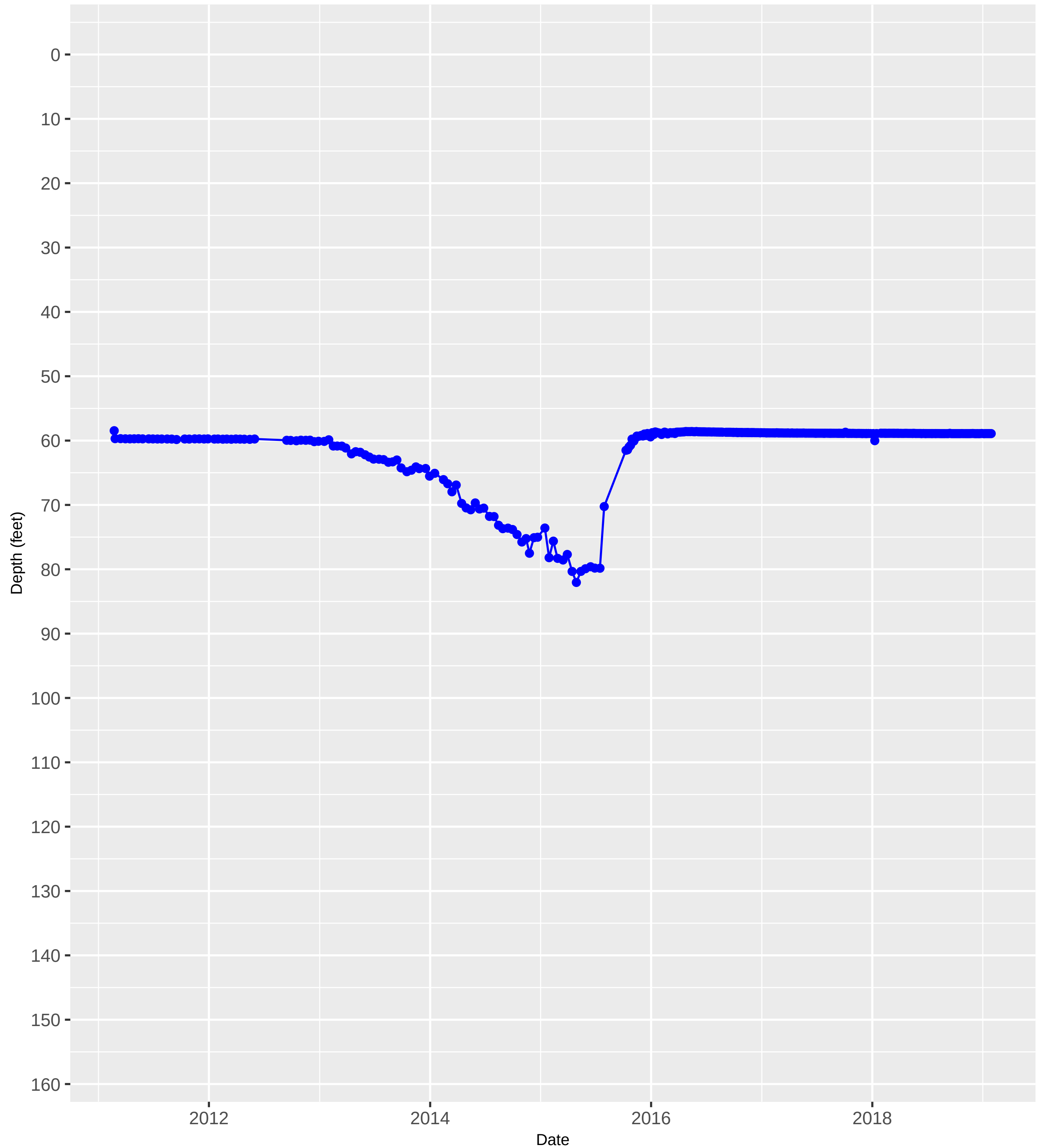
Miles

Map of Hydrograph Well Locations in Kendall County
218EDRDA
Edwards and Associated Limestones

Casing Diagram



5758203 Hydrograph in 218EDRDA − Edwards and Associated Limestones located in Kendall County



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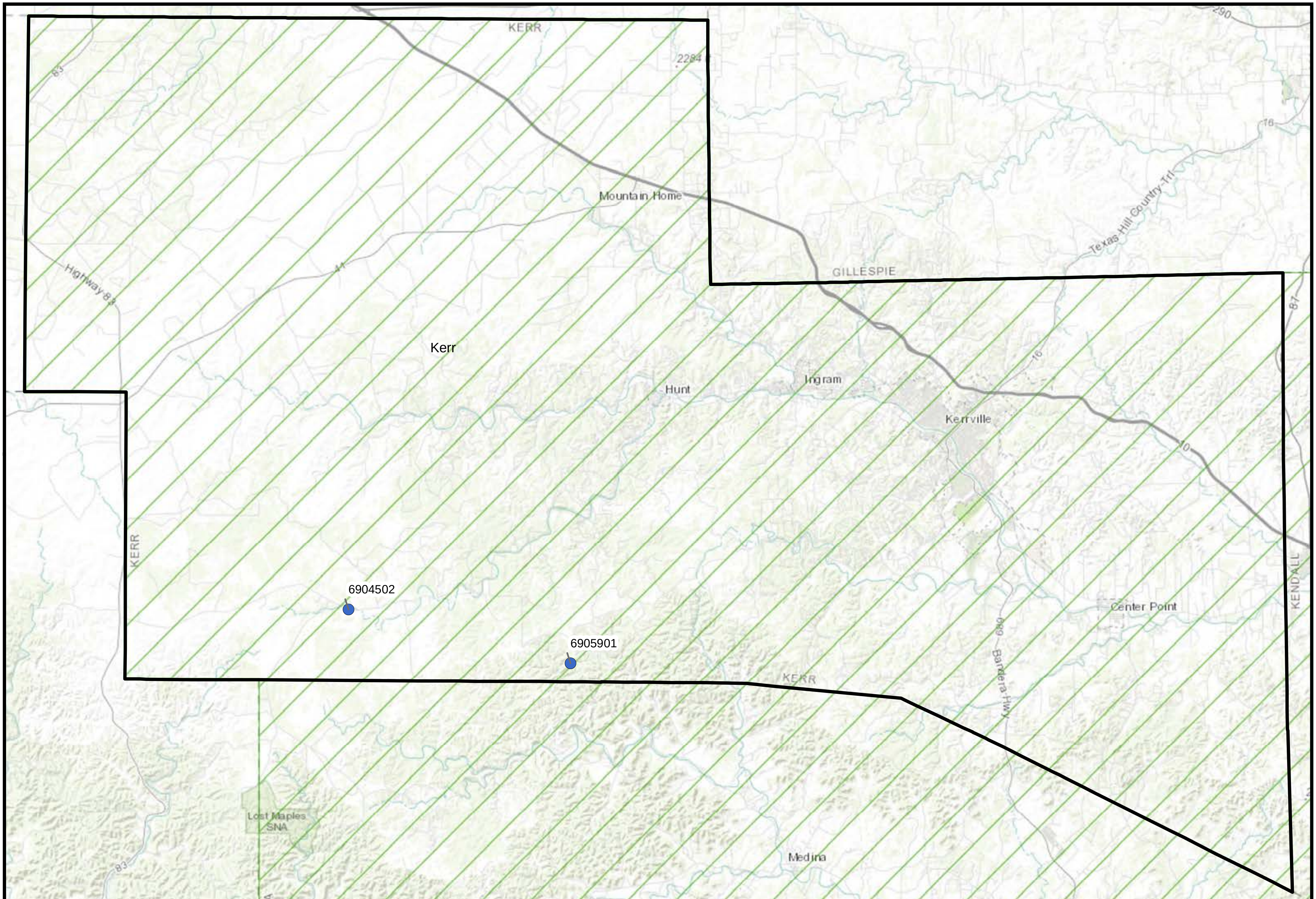


Aquifer

● 218EDRDA - Edwards and Associated Limestones

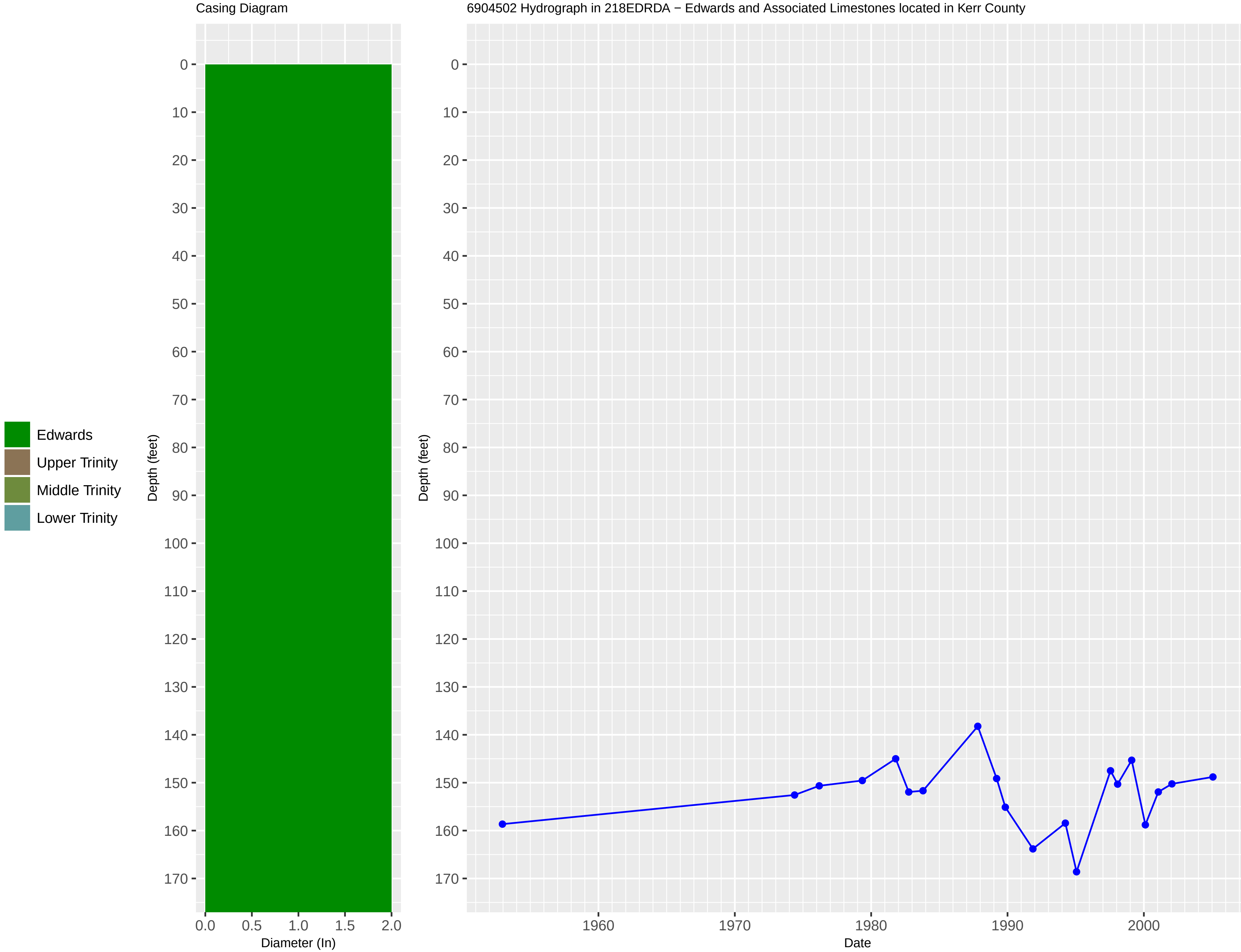
GMA 9

N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Kerr County
218EDRDA
Edwards and Associated Limestones



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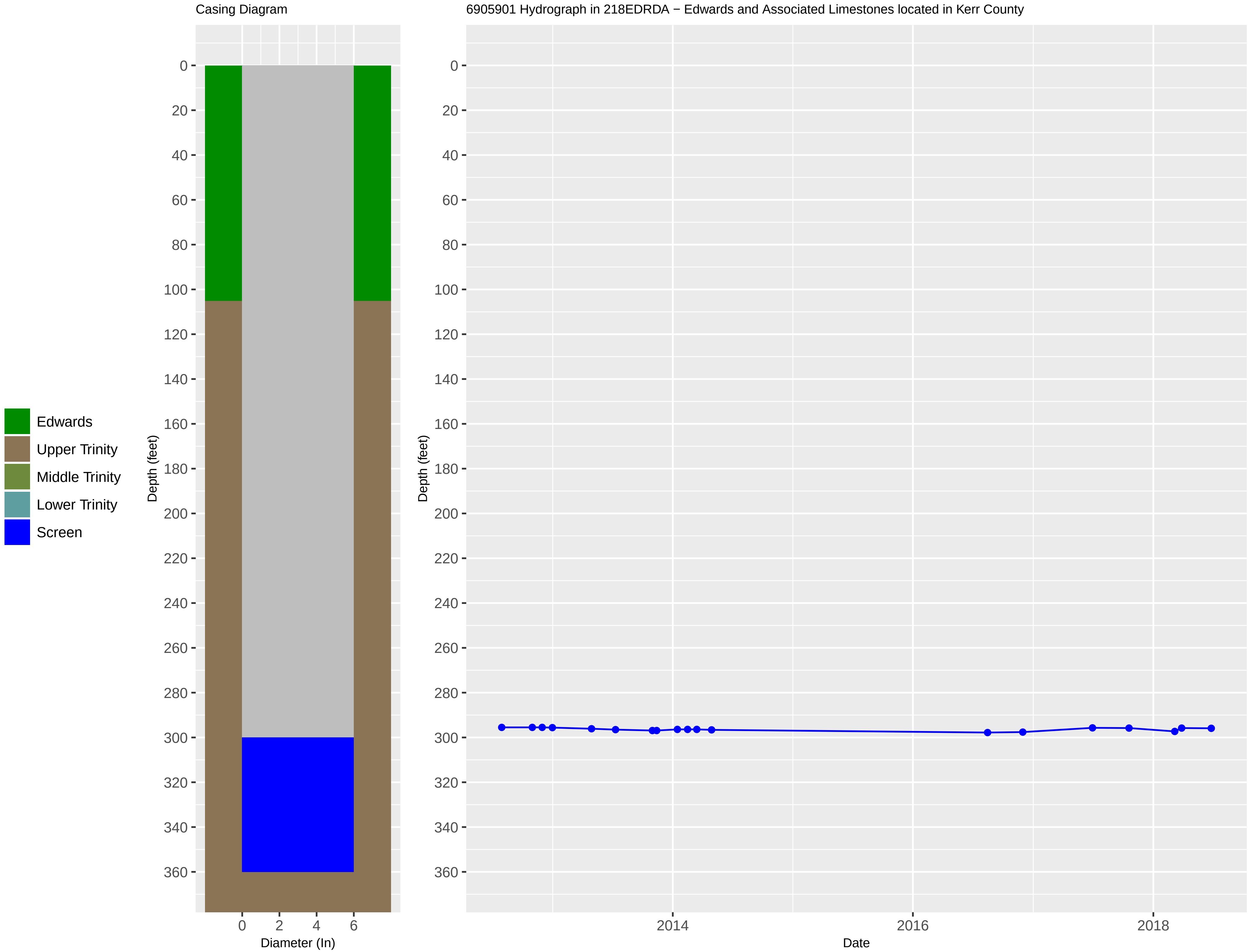

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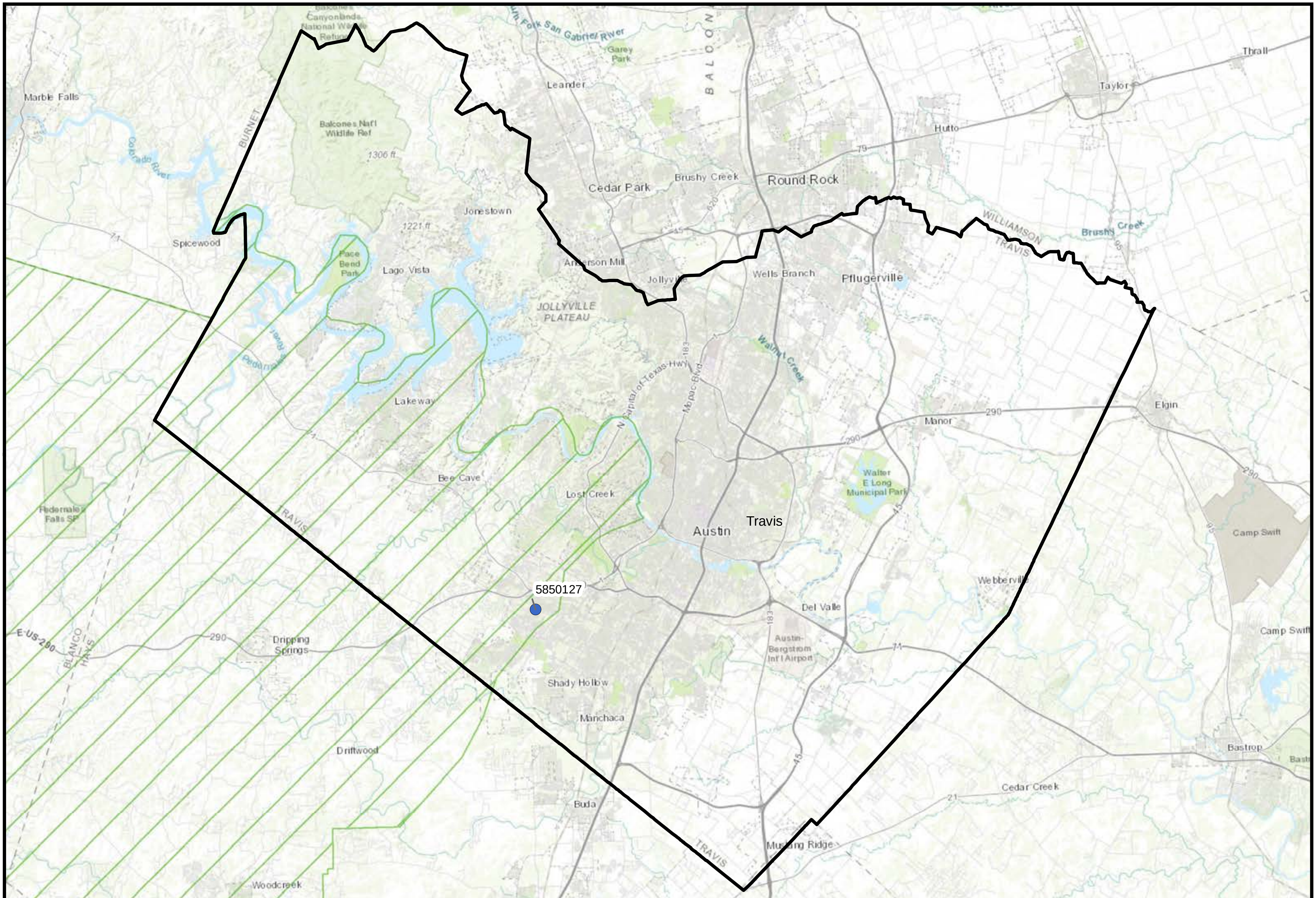


Aquifer

218EDRDA - Edwards and Associated Limestones

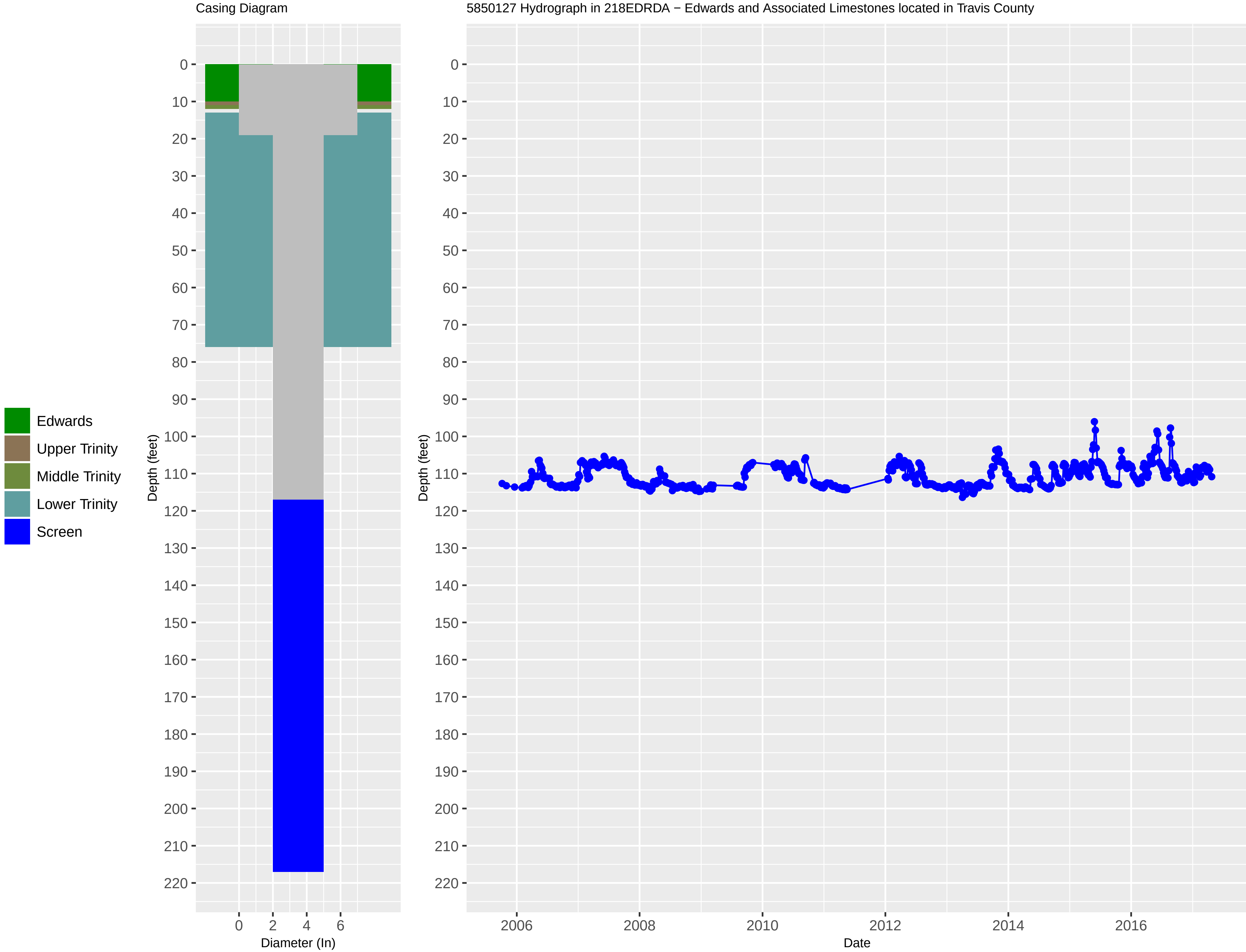
GMA 9

N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Travis County
218EDRDA
Edwards and Associated Limestones



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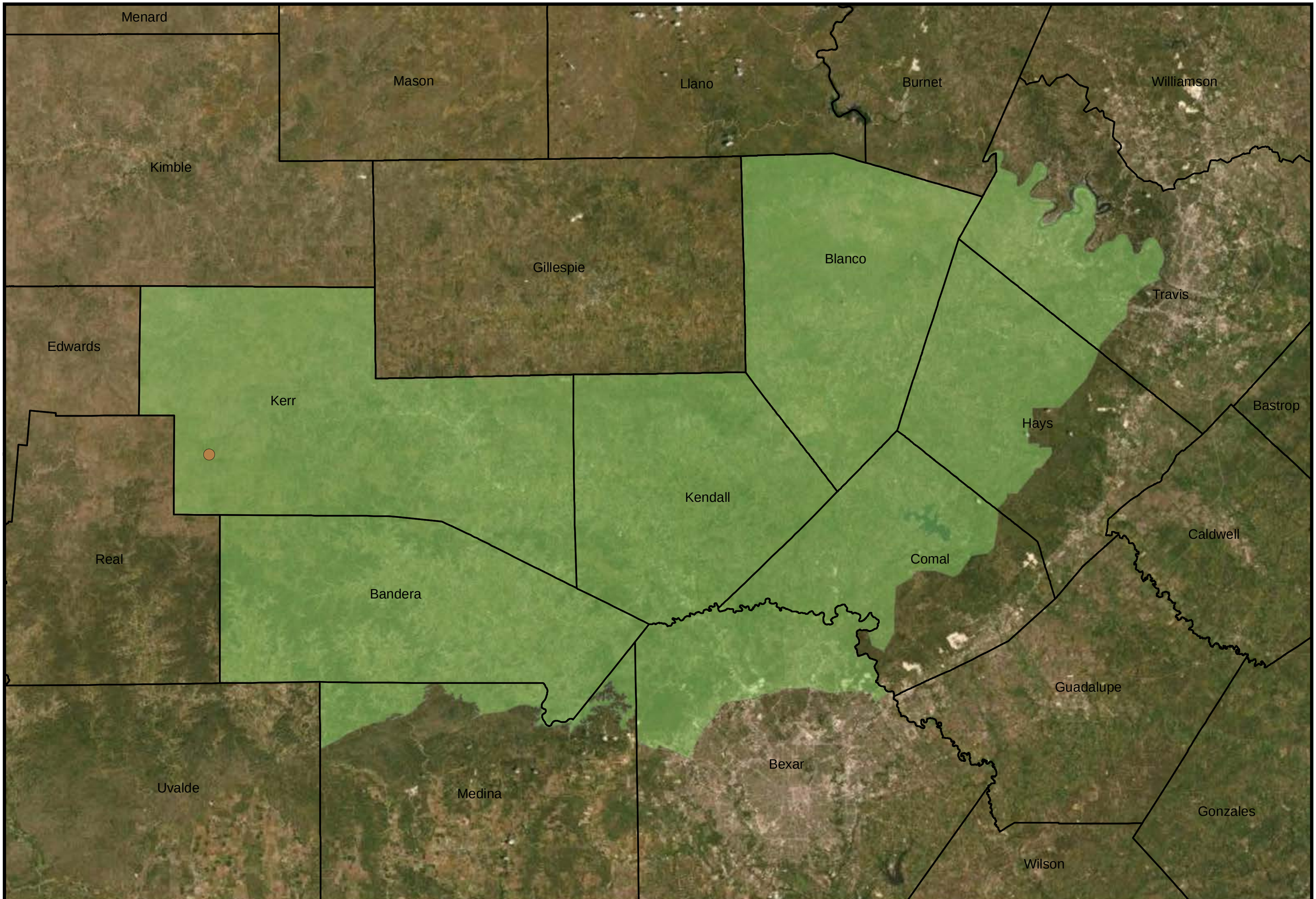


Aquifer

218FKBG - Fredericksburg Group

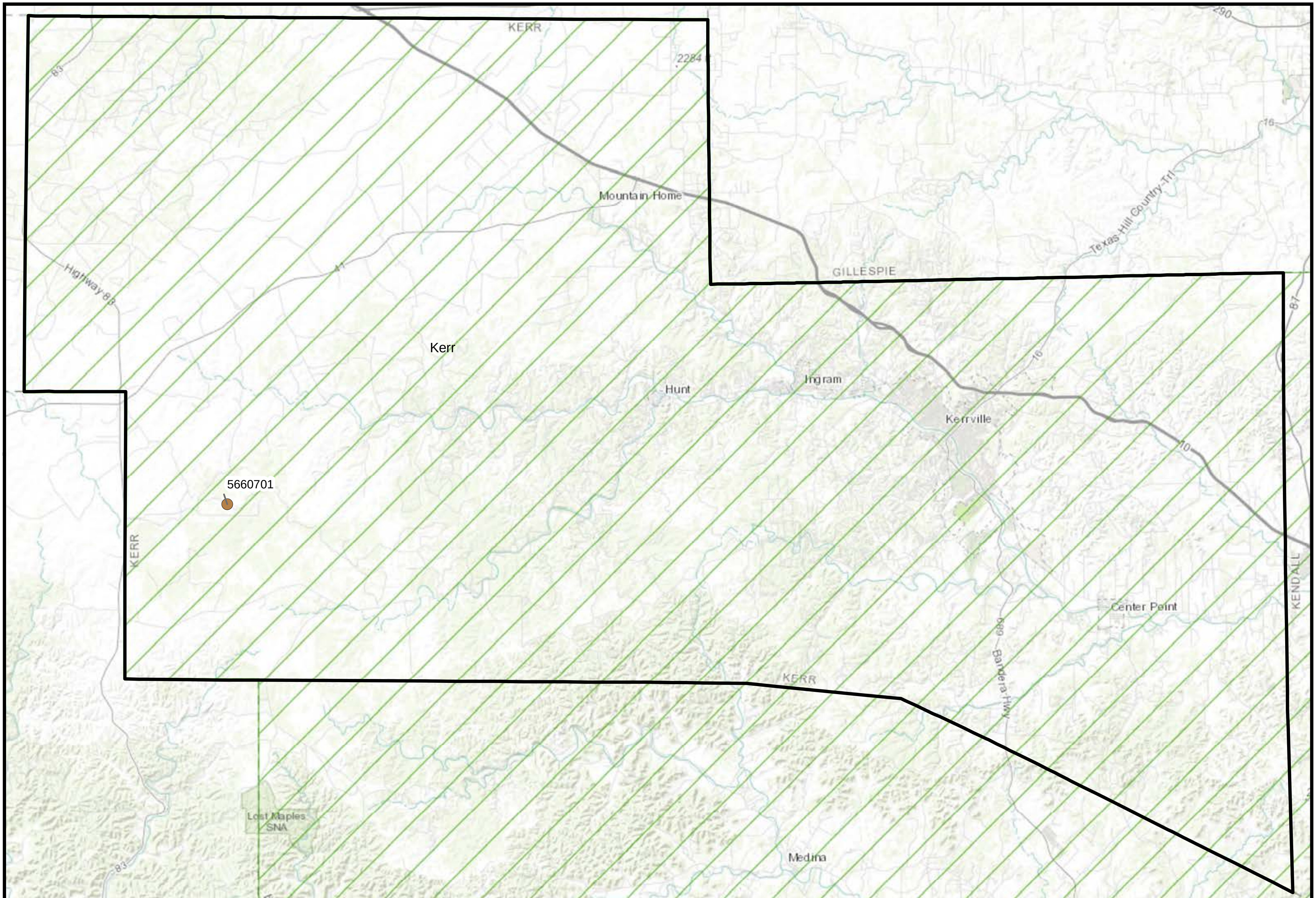
GMA 9

N

0 5 10

Miles

Map of Hydrograph Well Locations
218FKBG
Fredericksburg Group



Aquifer

218FKBG - Fredericksburg Group

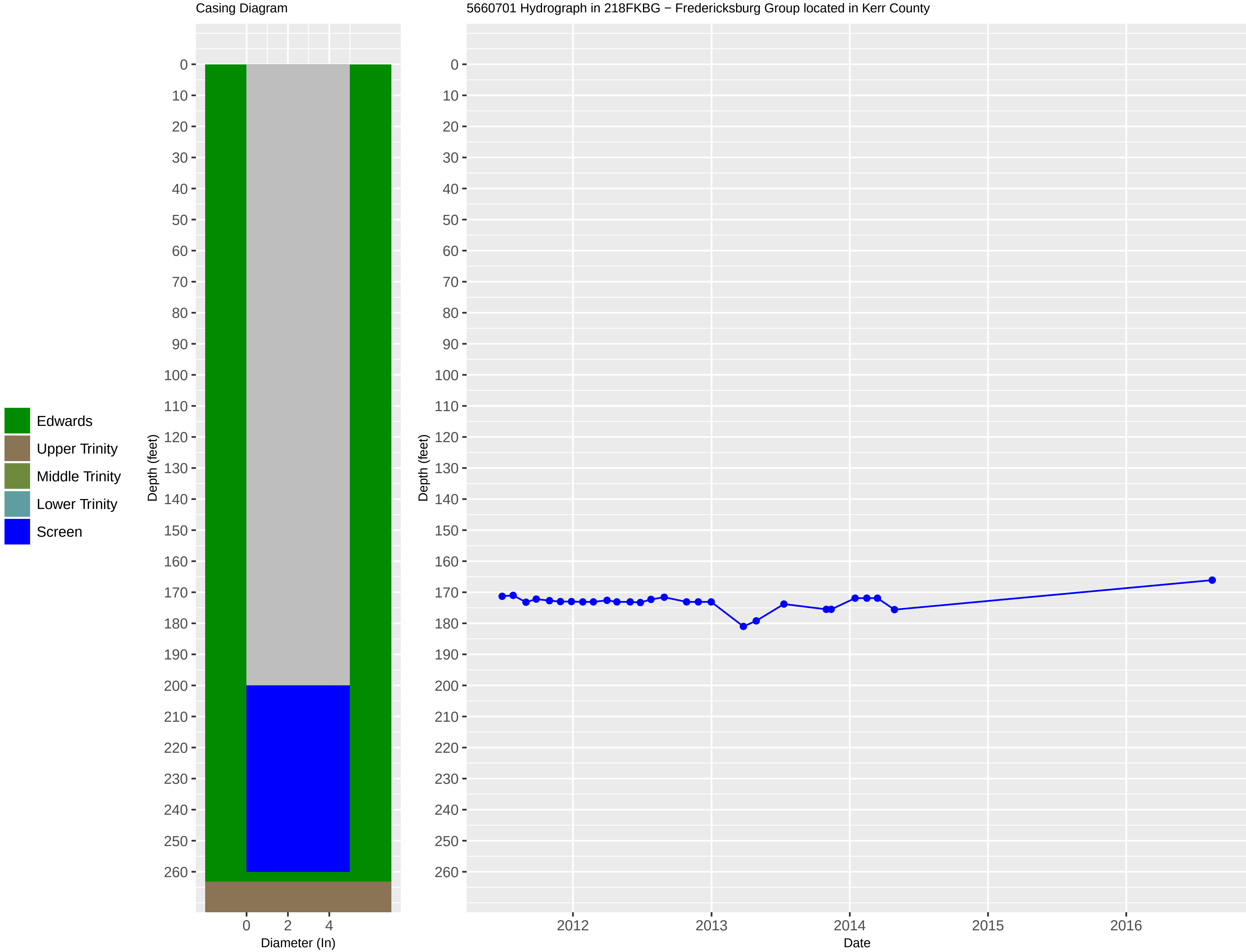
GMA 9

N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Kerr County
218FKBG
Fredericksburg Group



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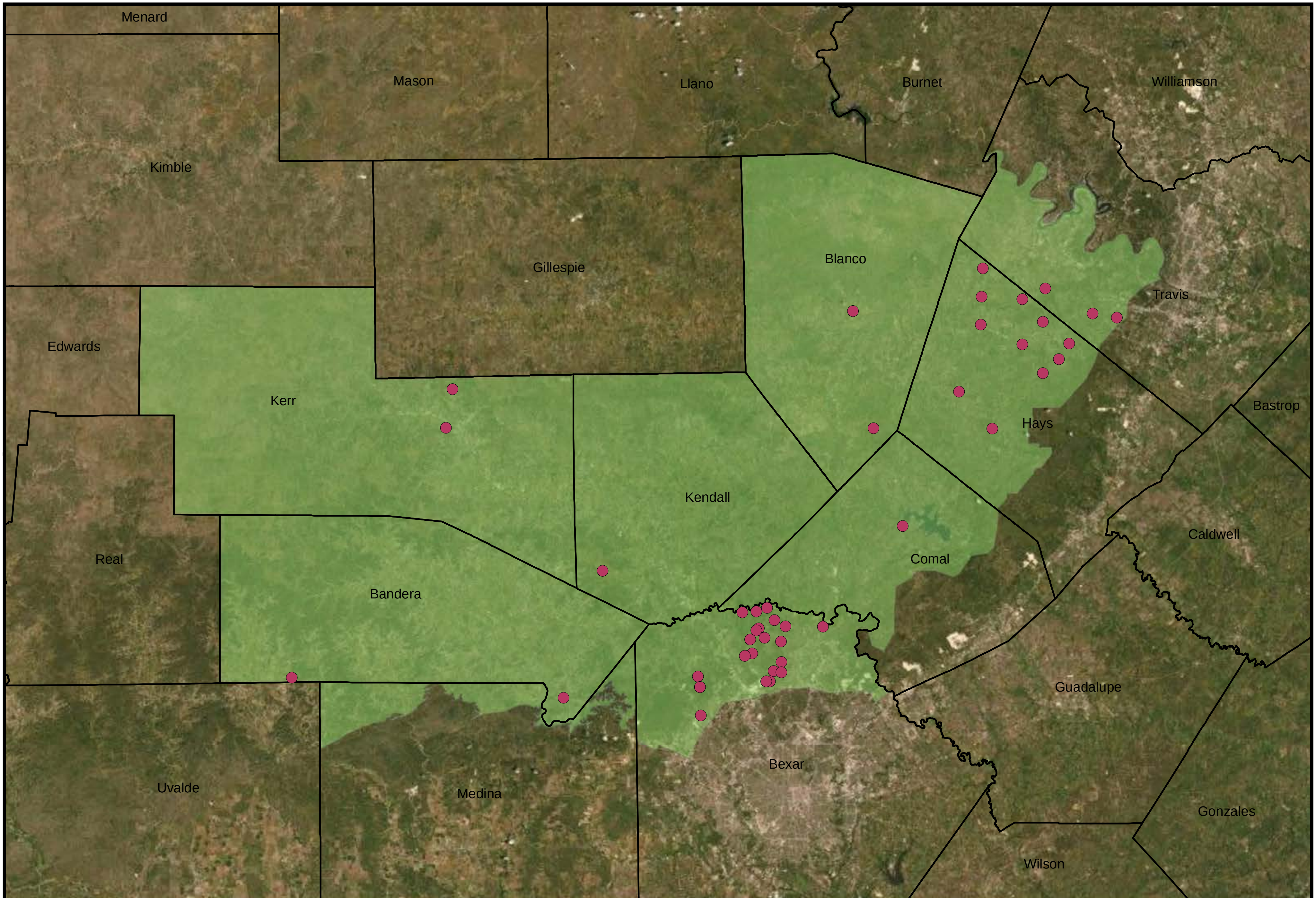


Aquifer

218GLRS - Glen Rose Limestone

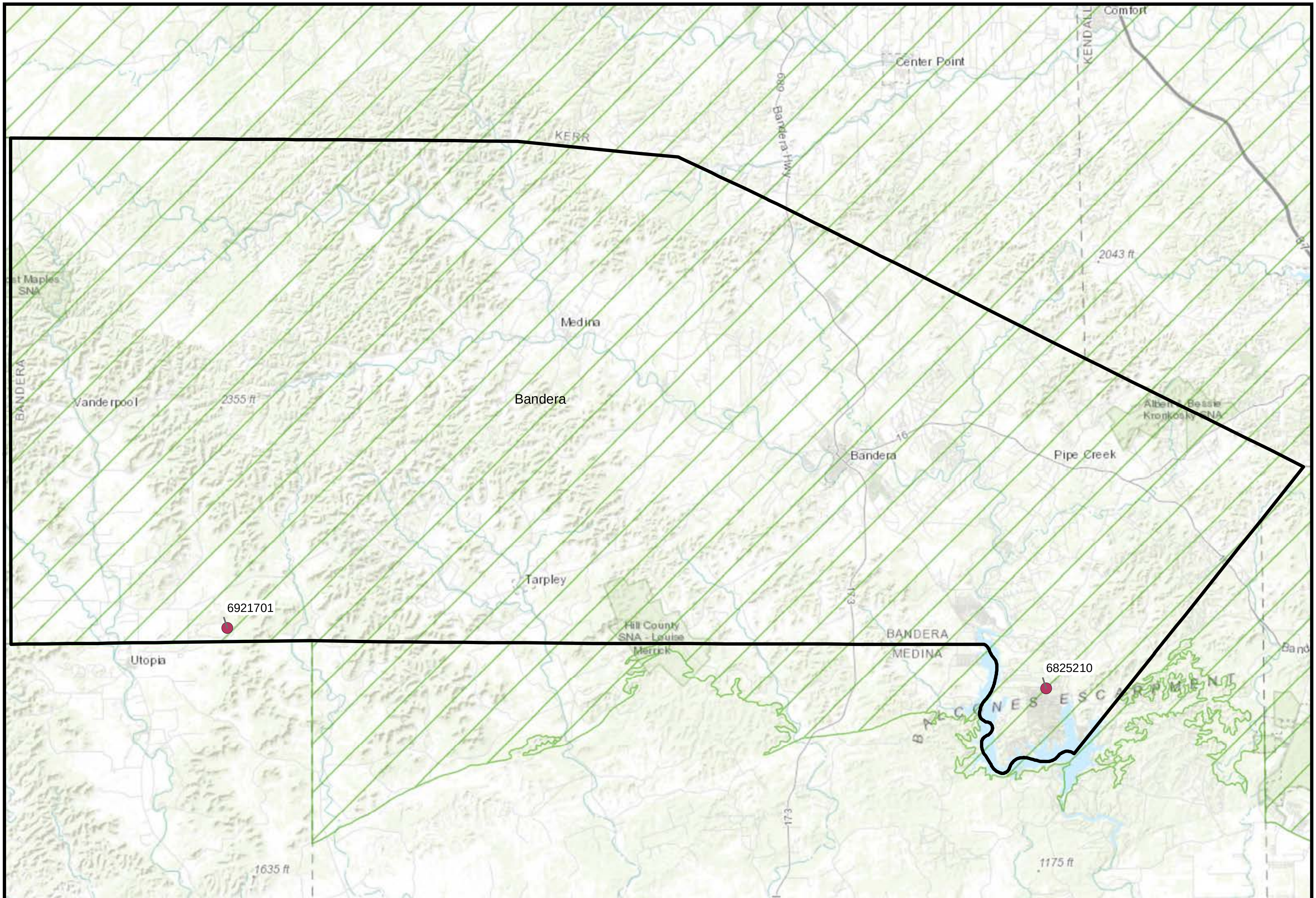
GMA 9

N

0 5 10

Miles

Map of Hydrograph Well Locations
218GLRS
Glen Rose Limestone



Aquifer

218GLRS - Glen Rose Limestone

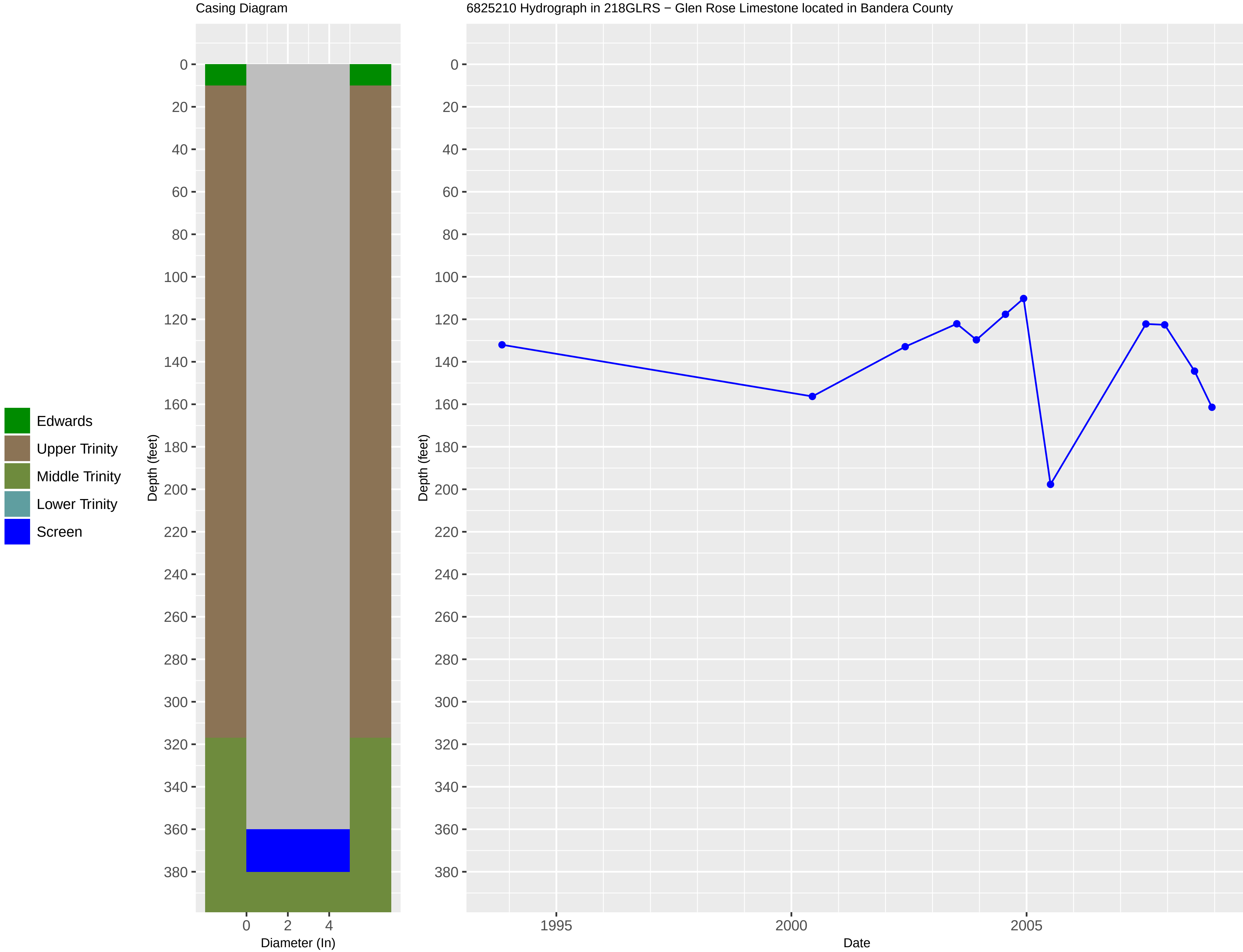
GMA 9

N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Bandera County
218GLRS
Glen Rose Limestone



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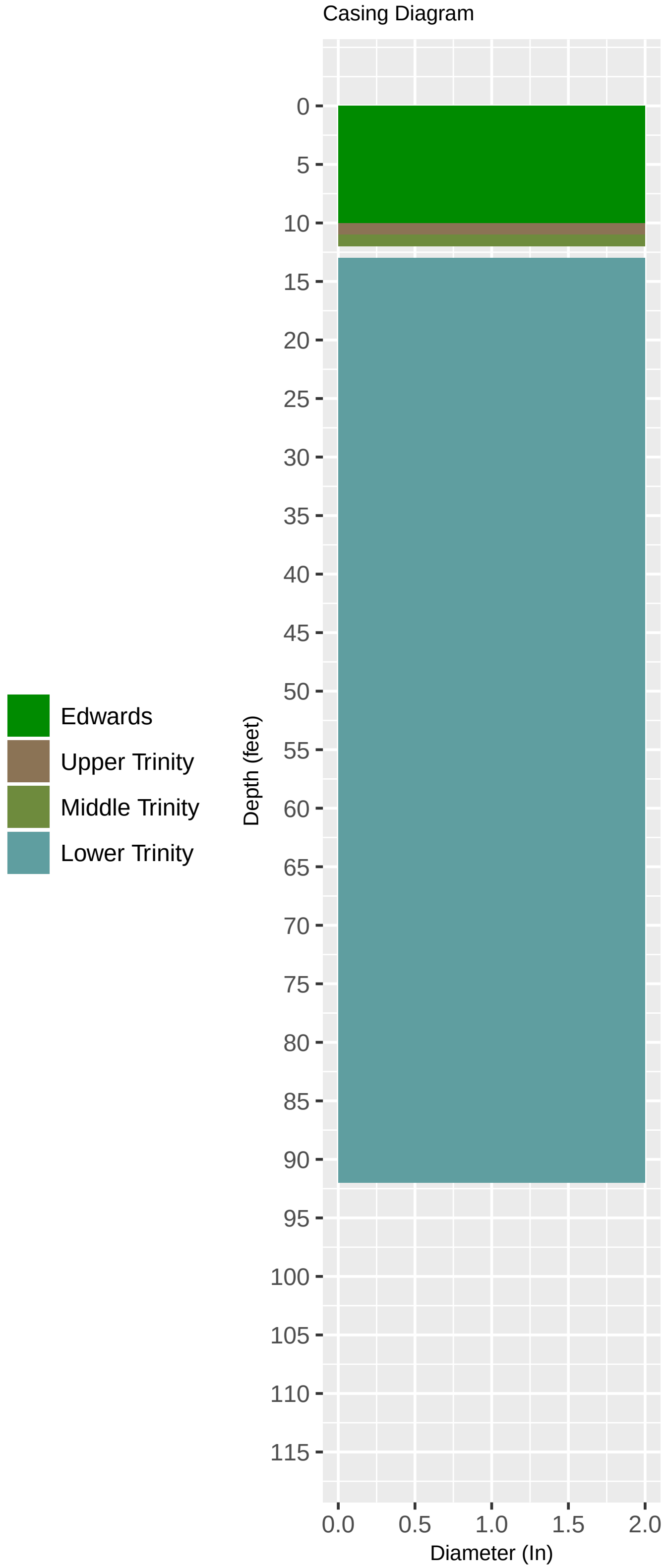

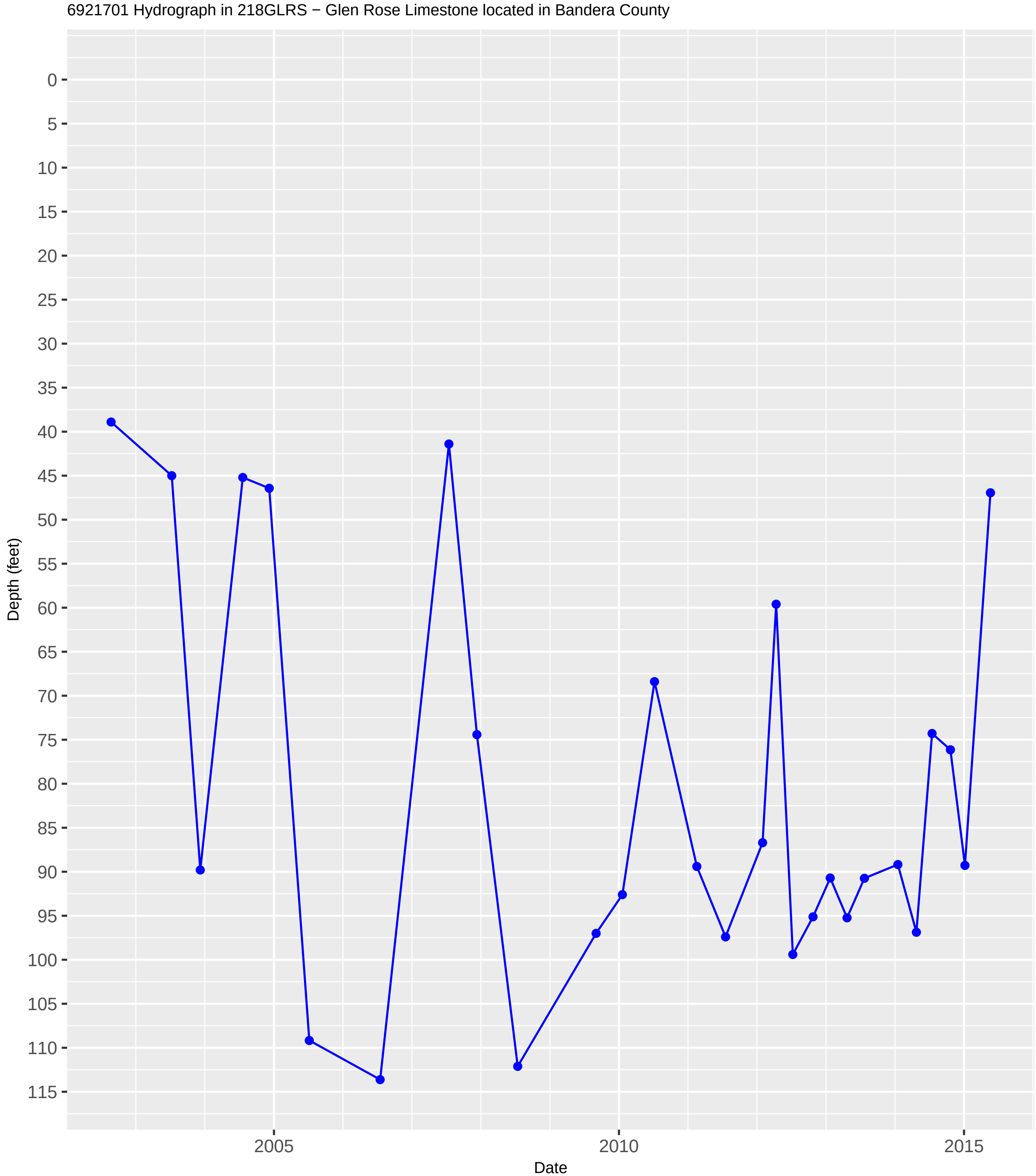

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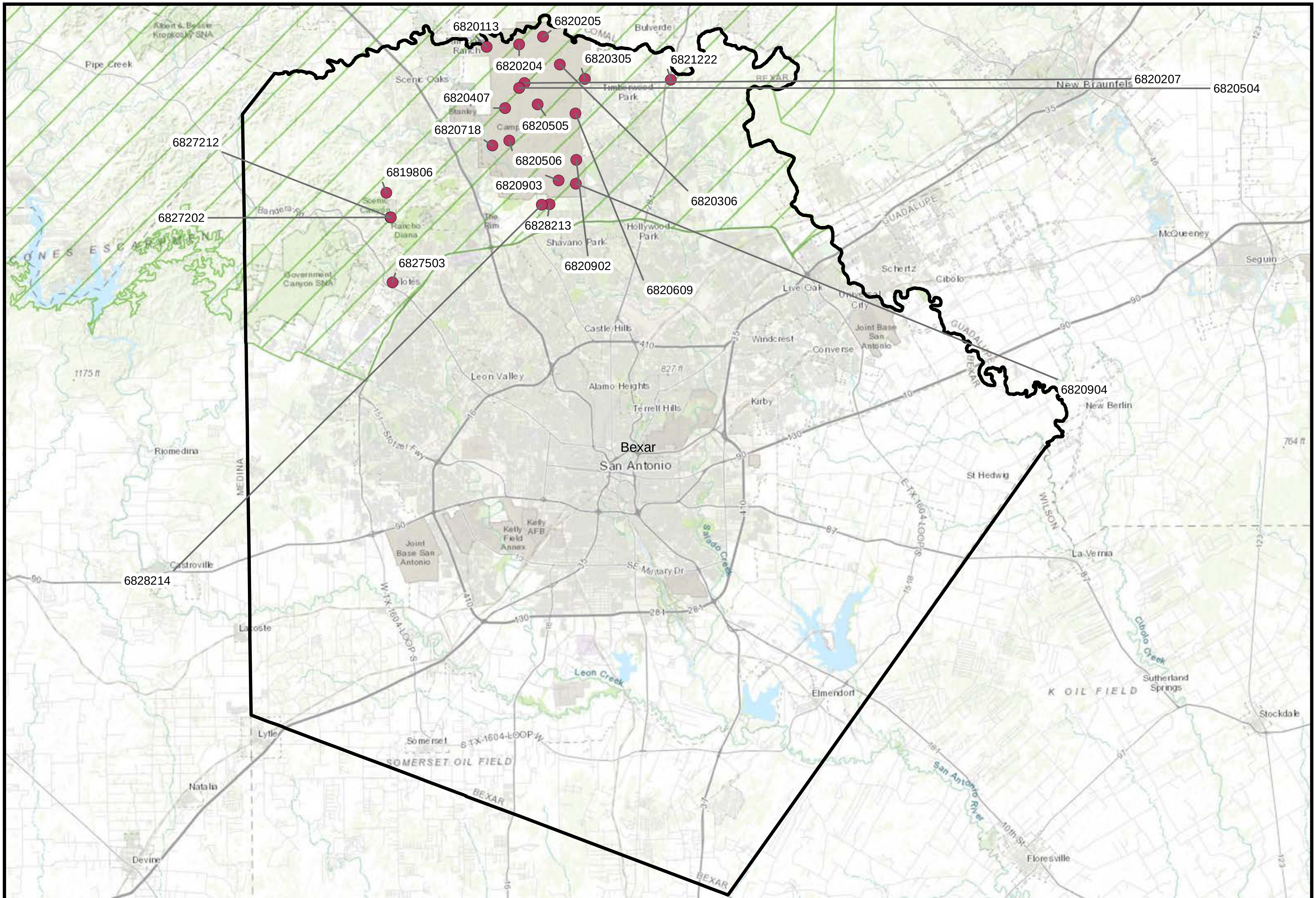


Aquifer

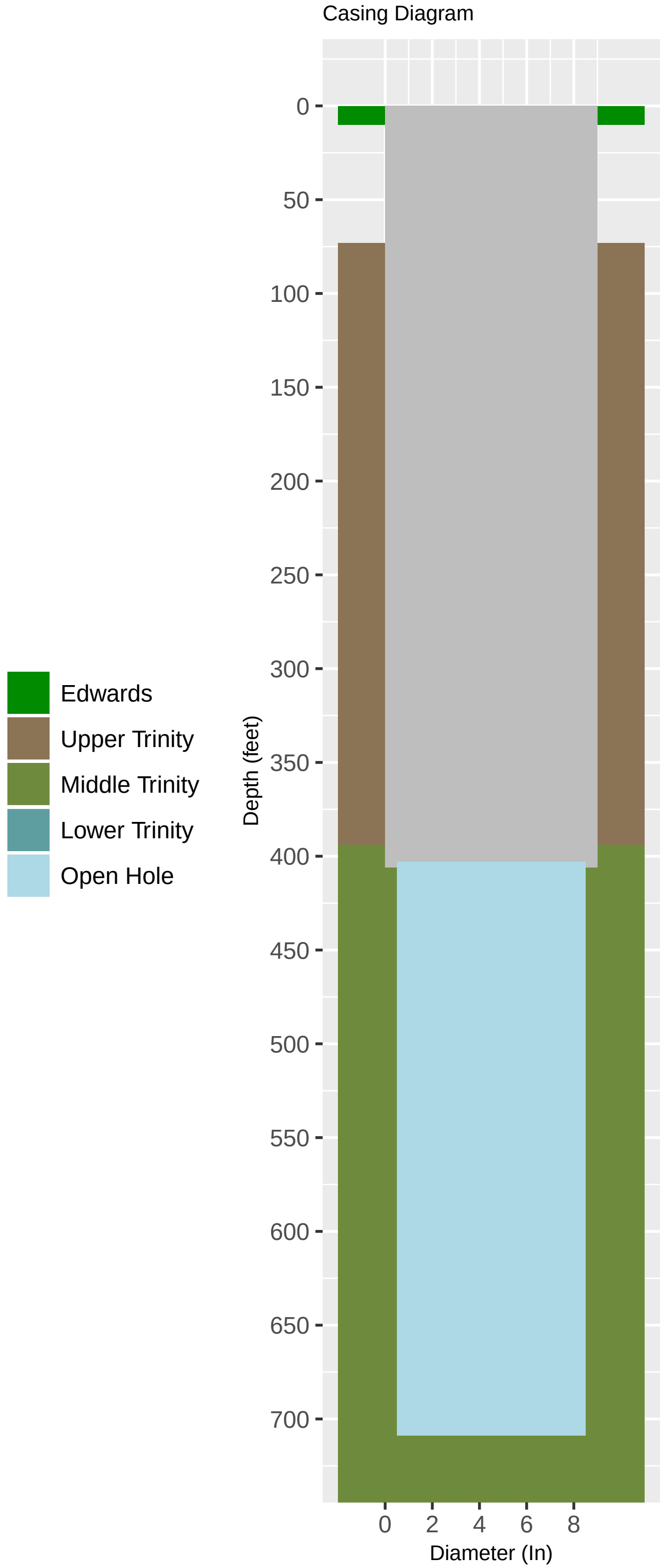
218GLRS - Glen Rose Limestone

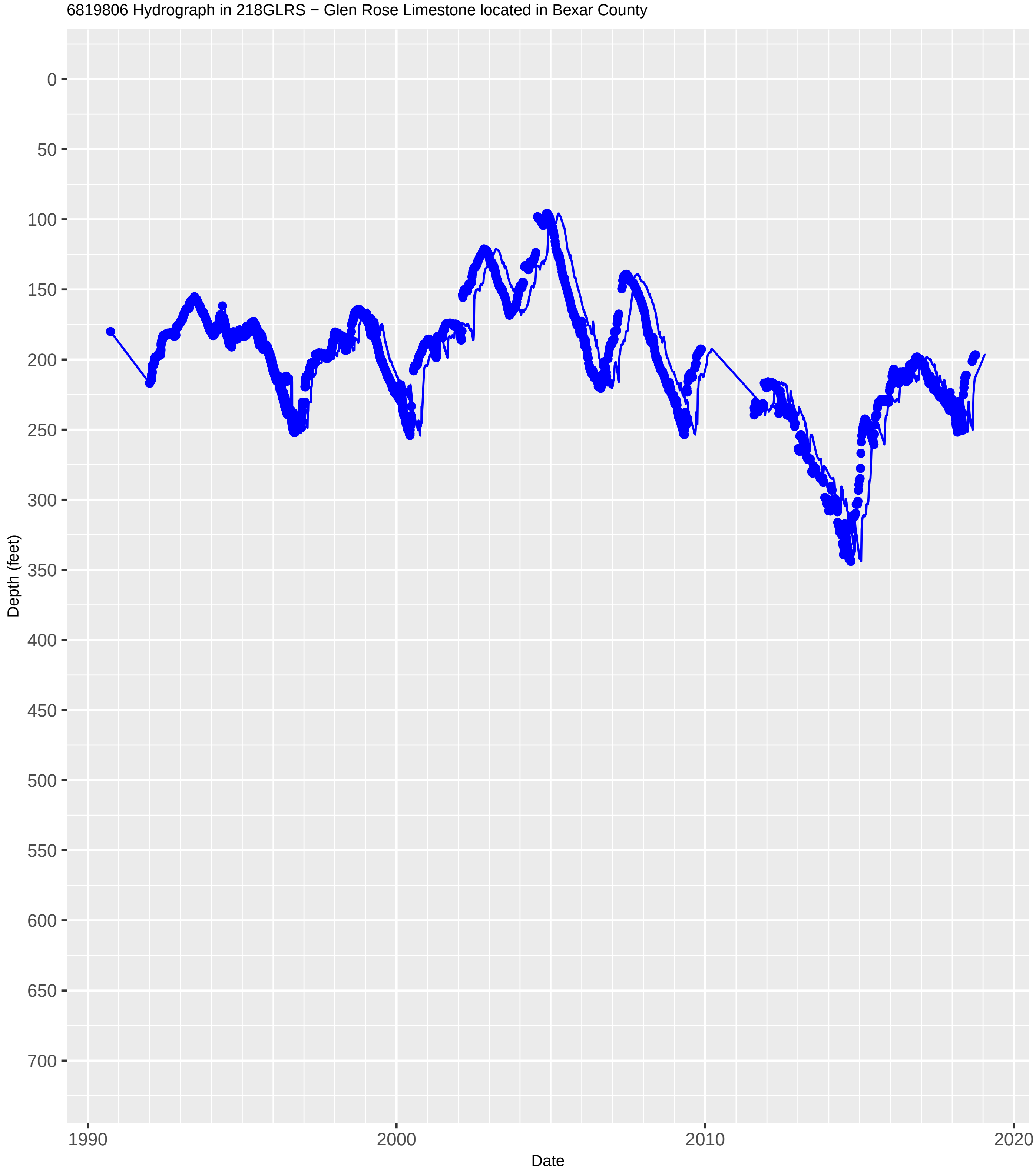
GMA 9

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Bexar County
218GLRS
Glen Rose Limestone

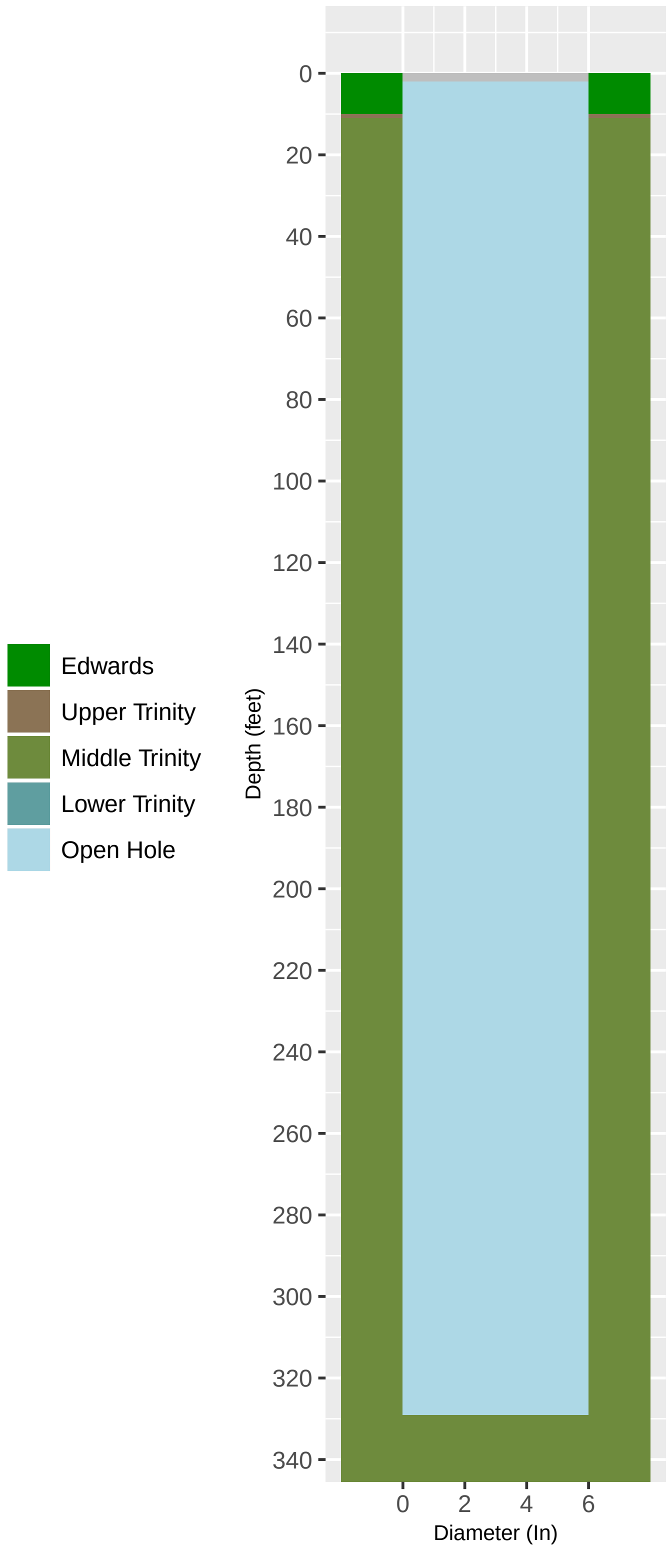


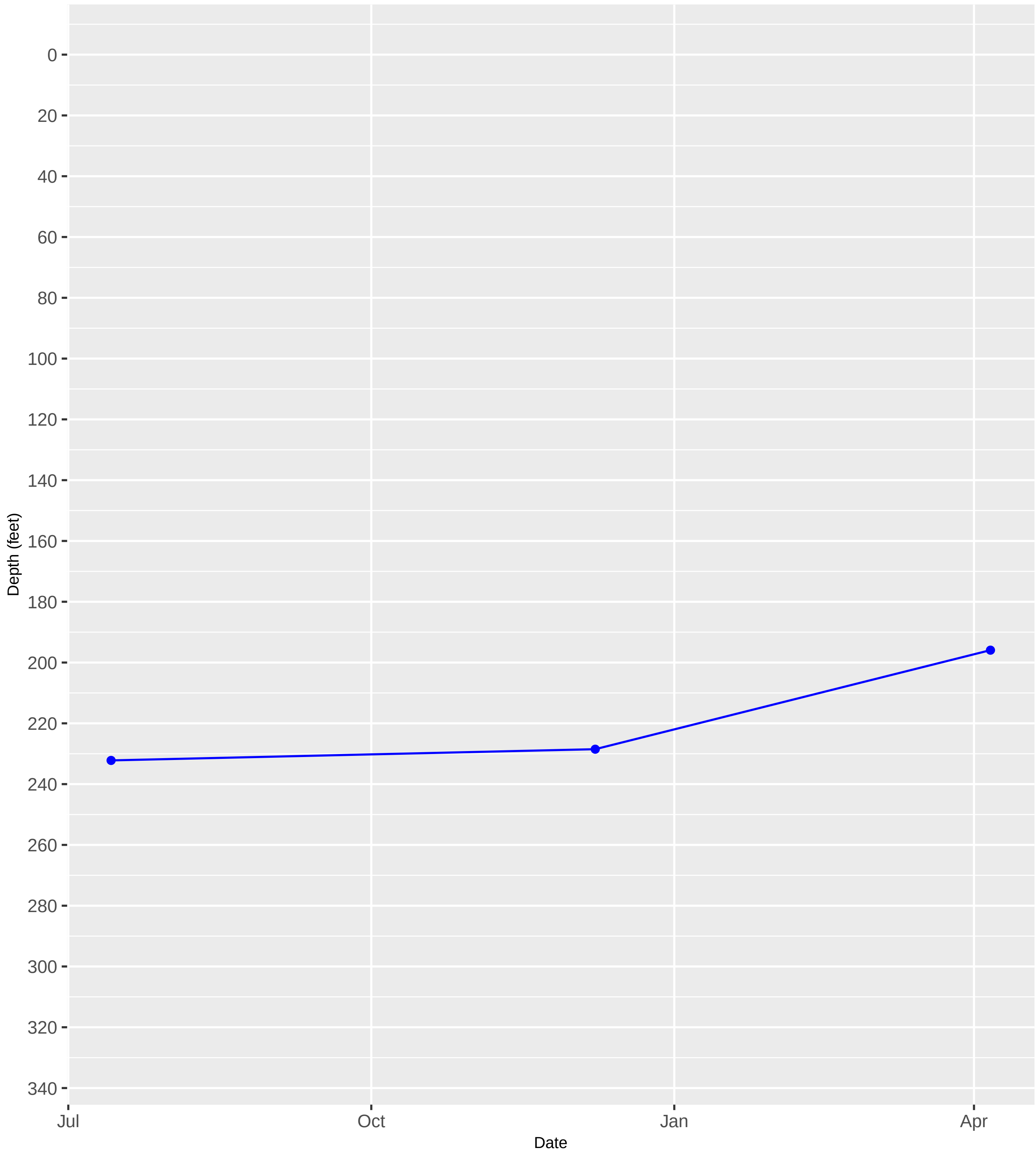


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

6820113 Hydrograph in 218GLRS − Glen Rose Limestone located in Bexar County





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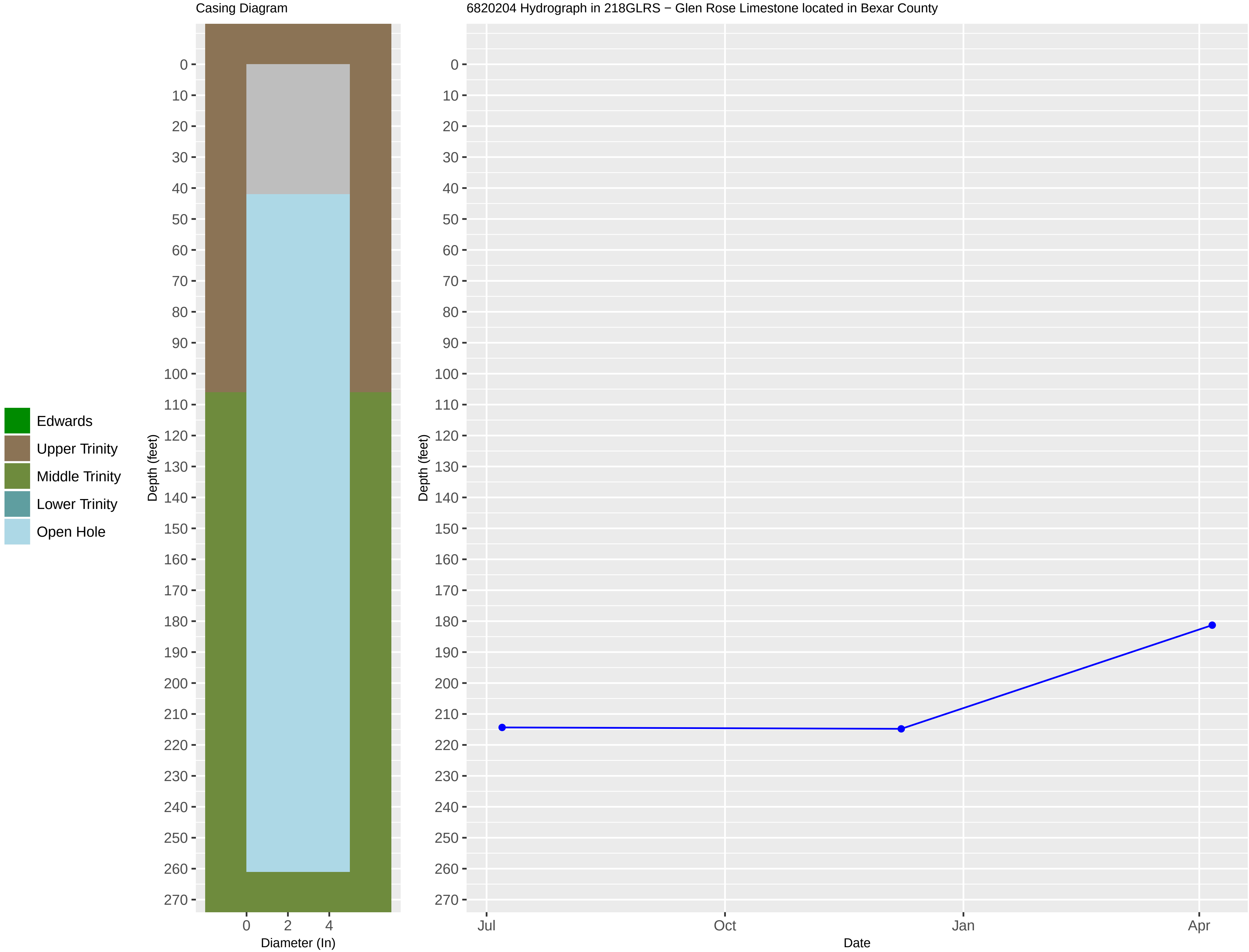

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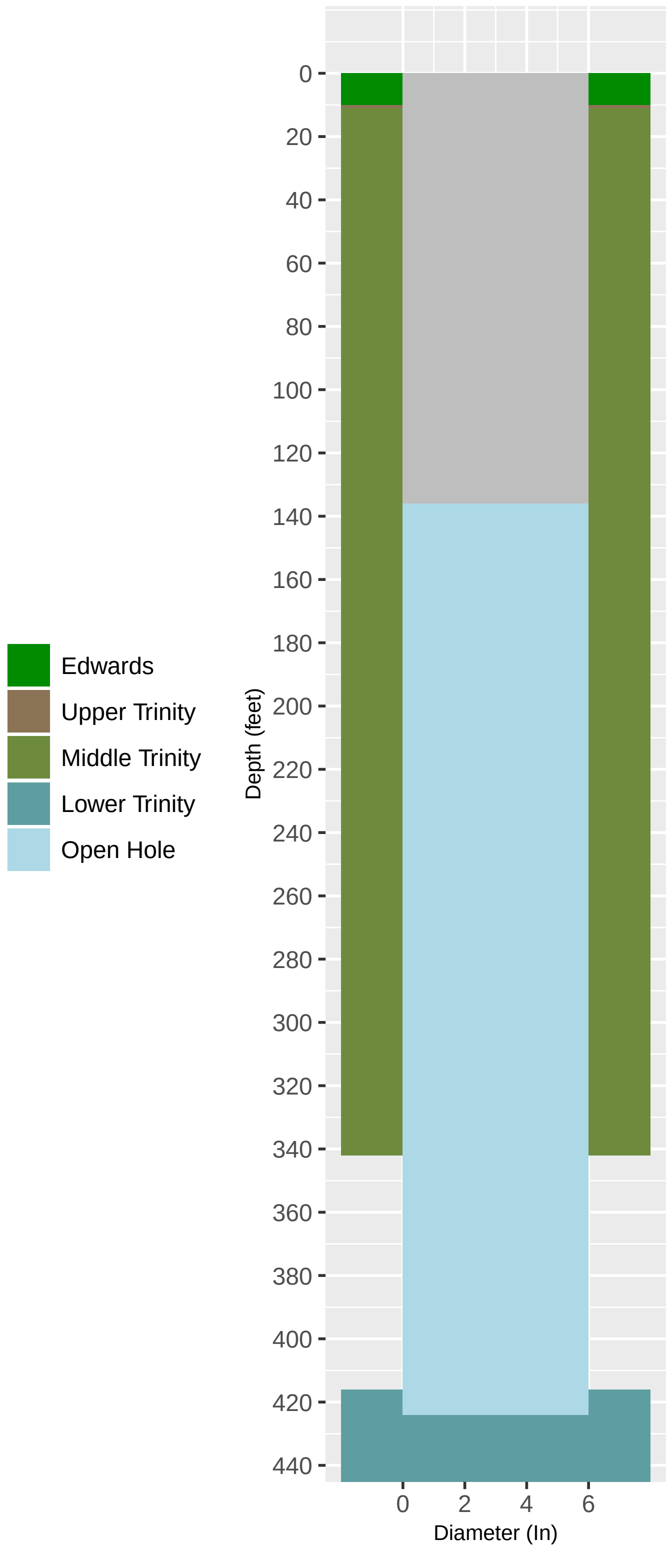
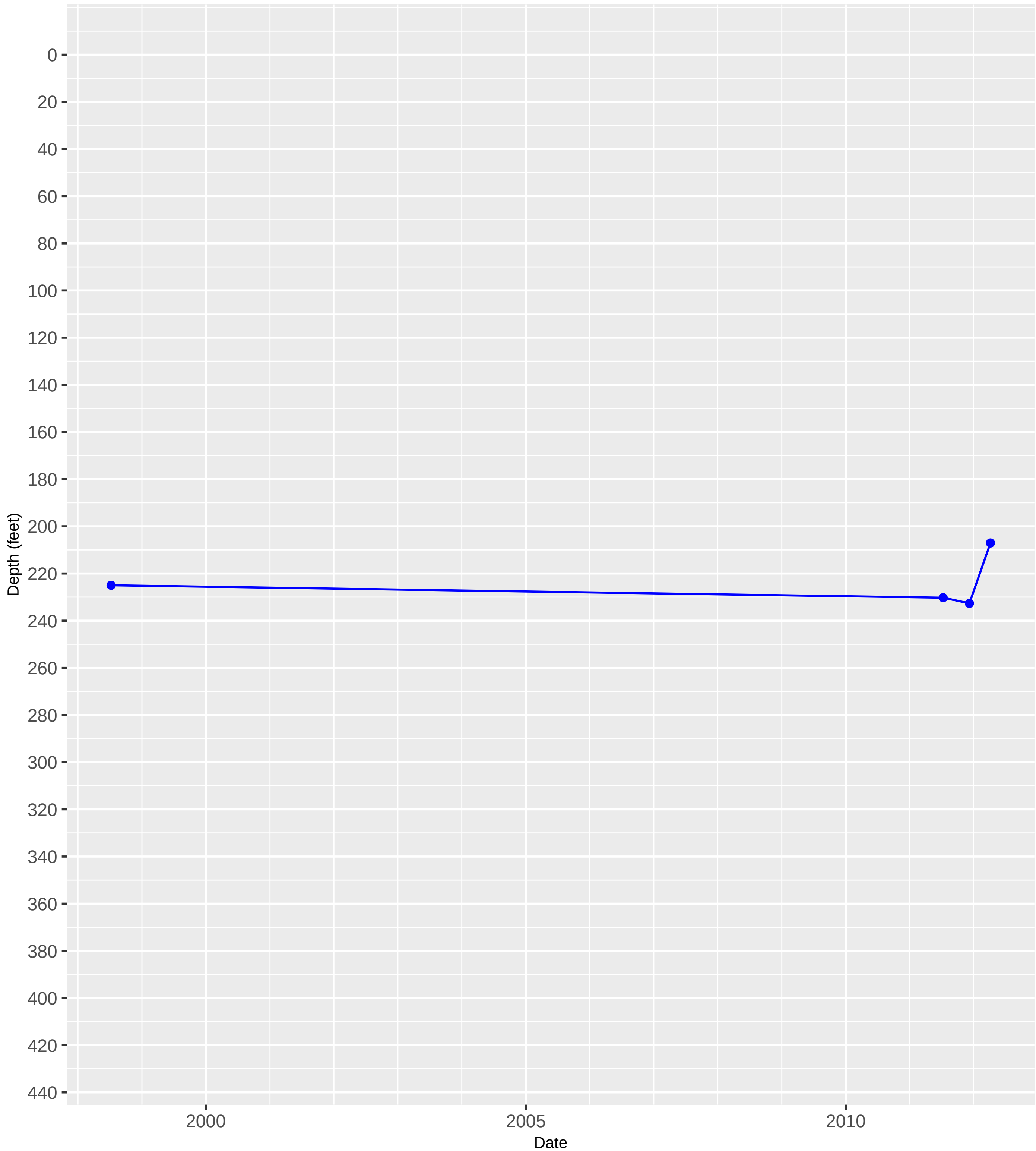
Casing Diagram



6820205 Hydrograph in 218GLRS − Glen Rose Limestone located in Bexar County



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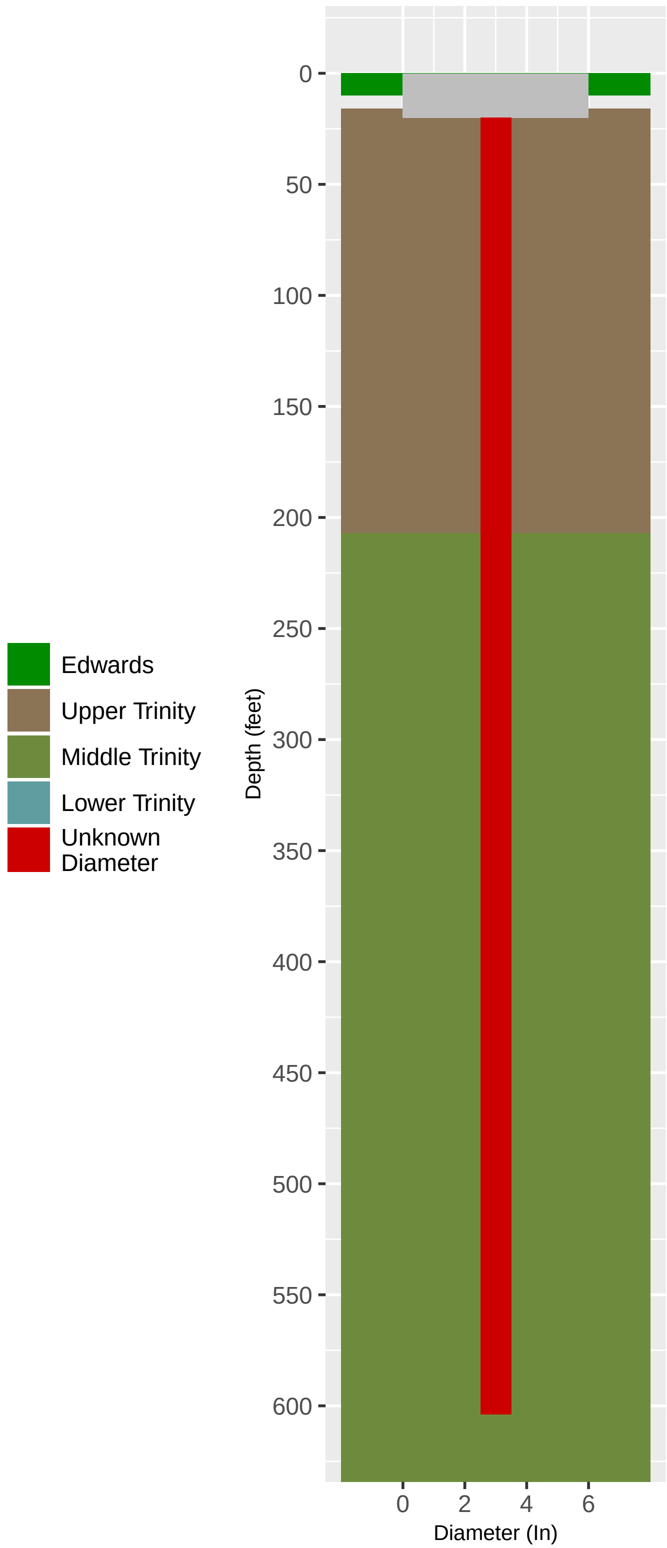
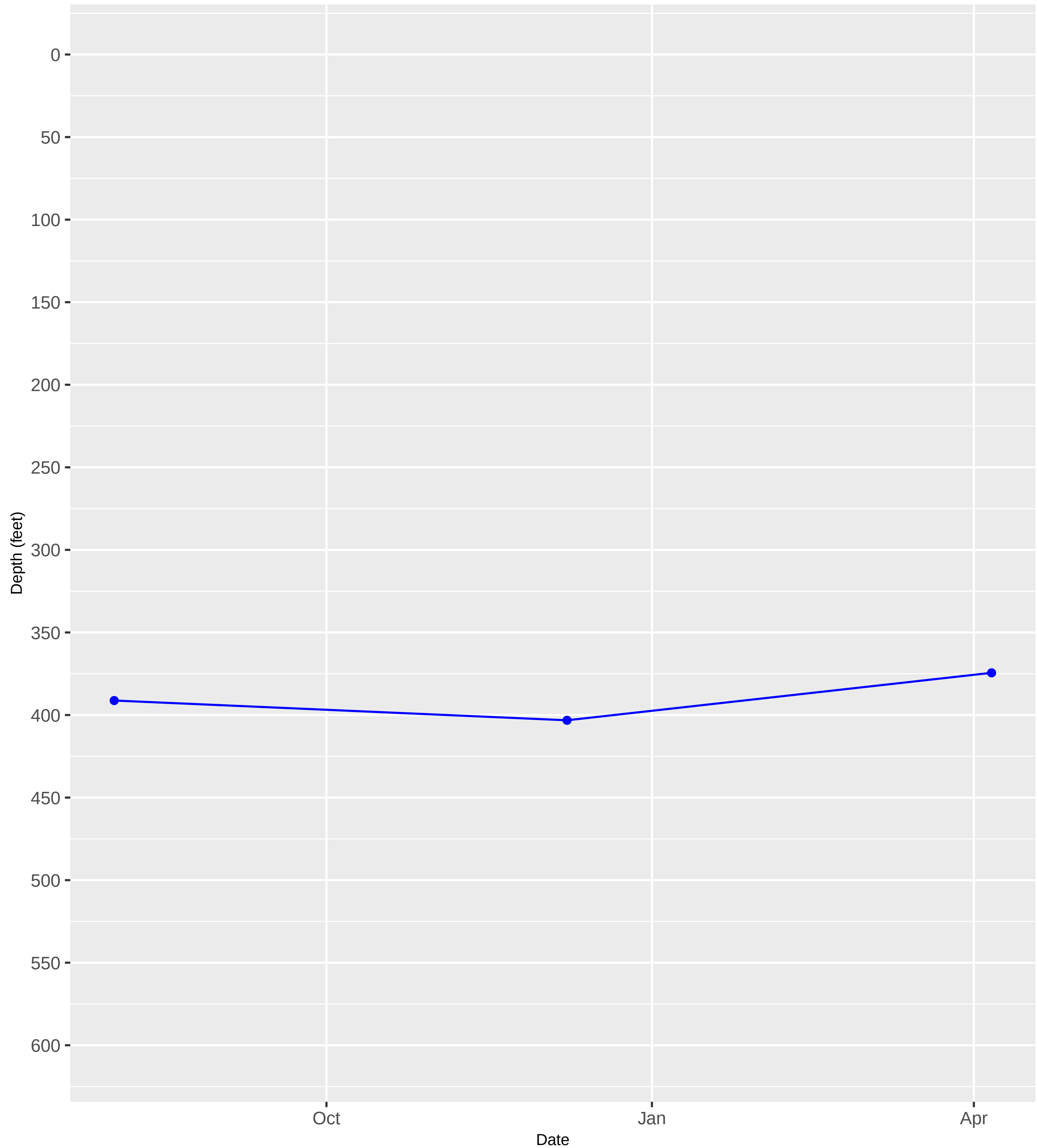
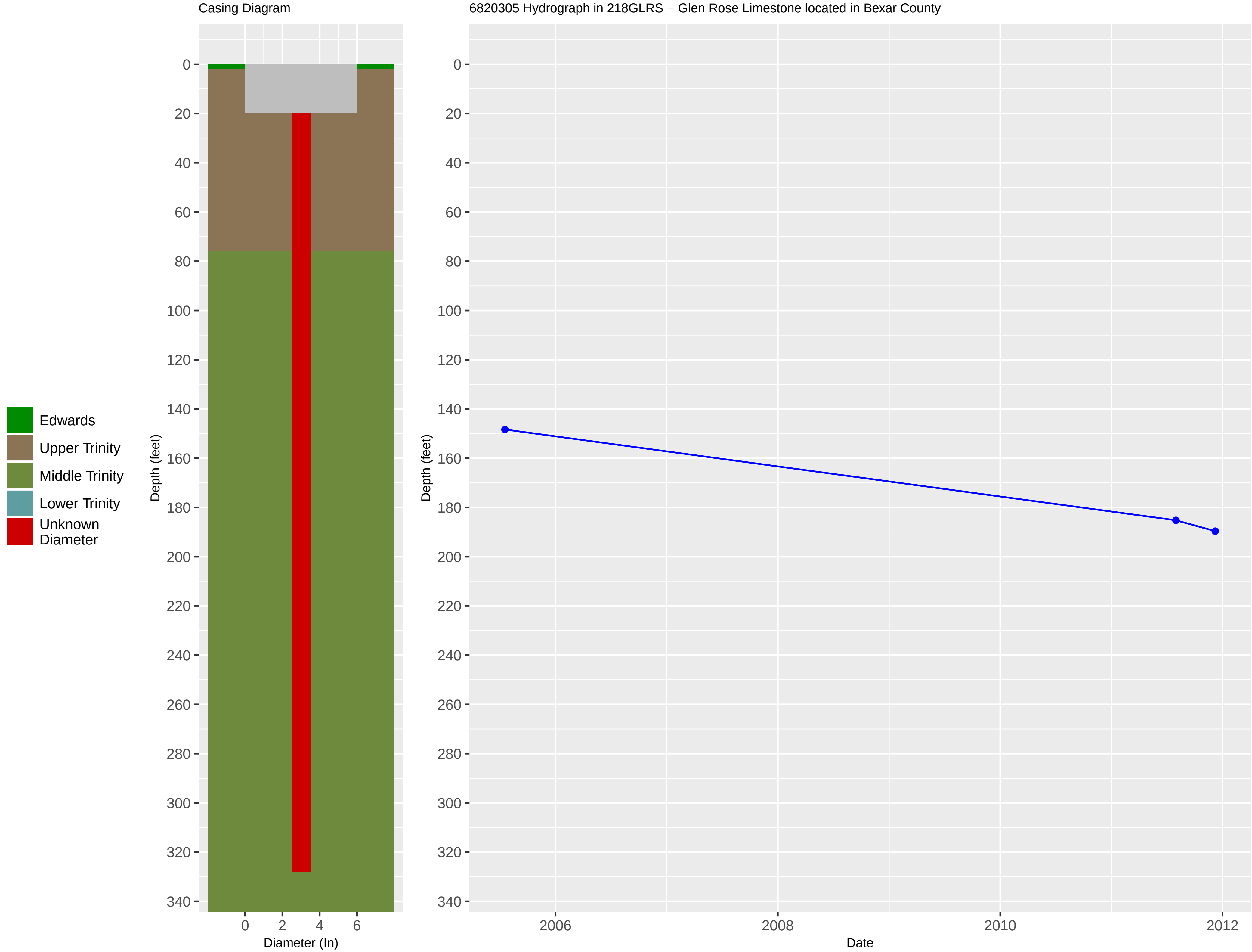
Casing Diagram



6820207 Hydrograph in 218GLRS − Glen Rose Limestone located in Bexar County



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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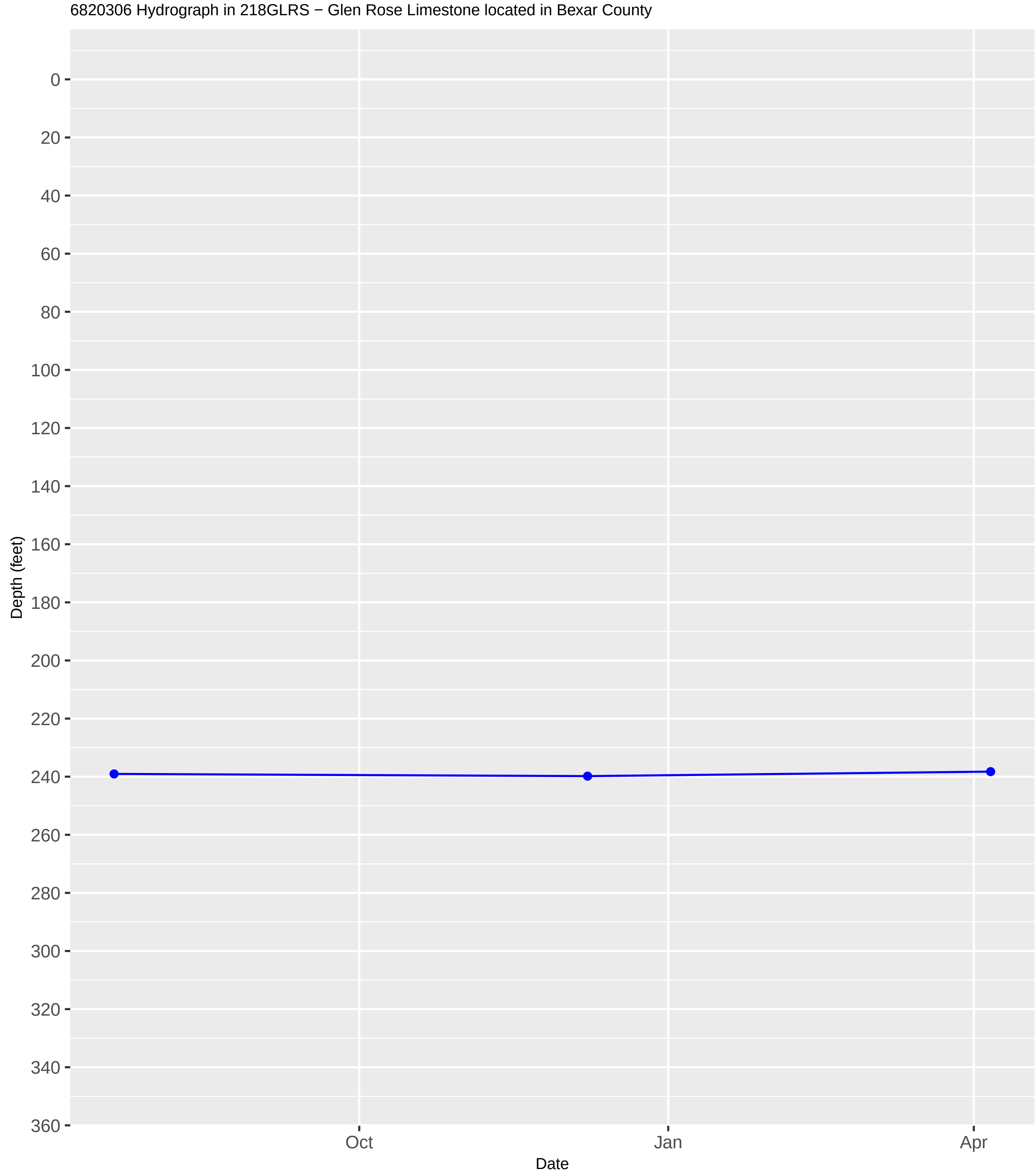

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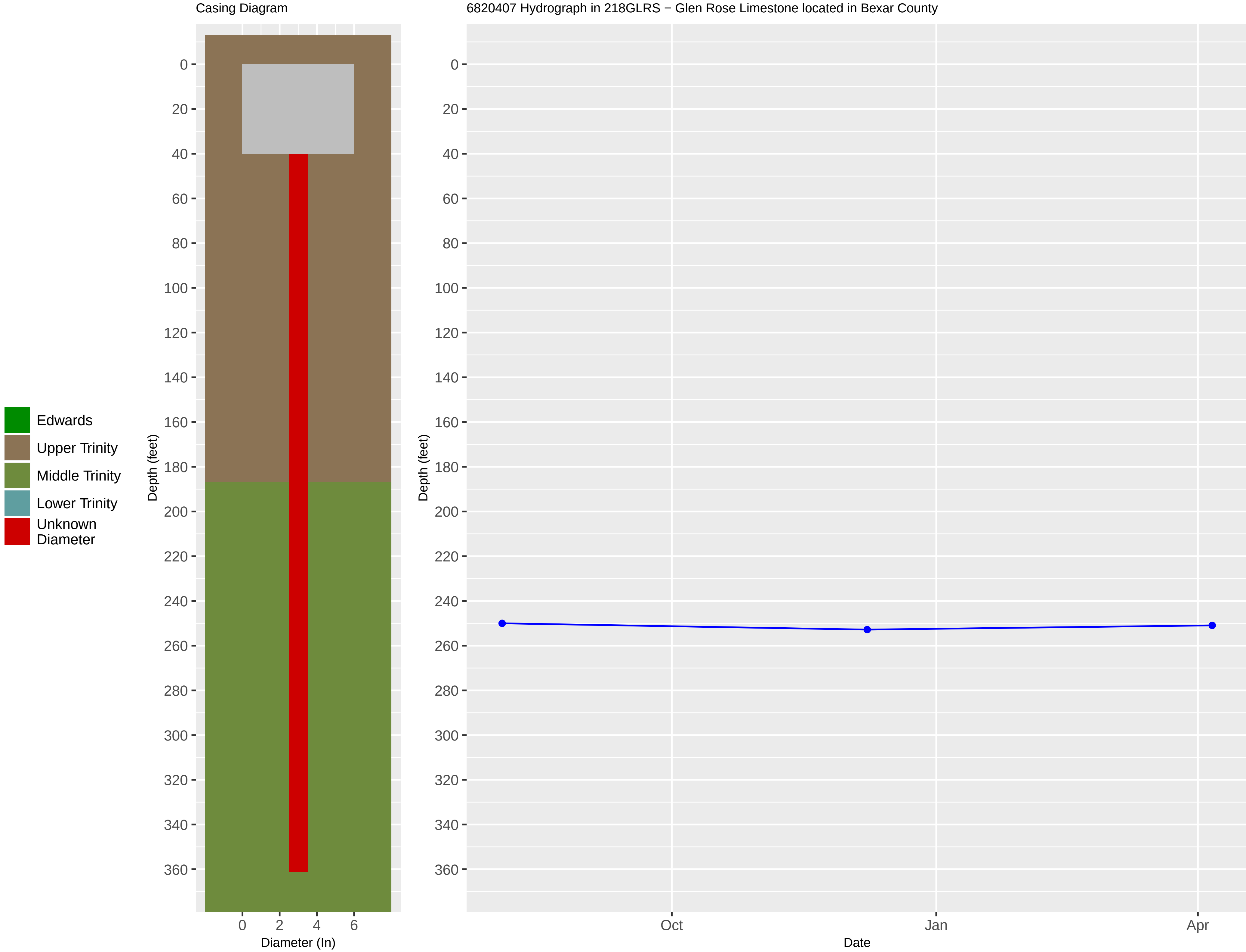
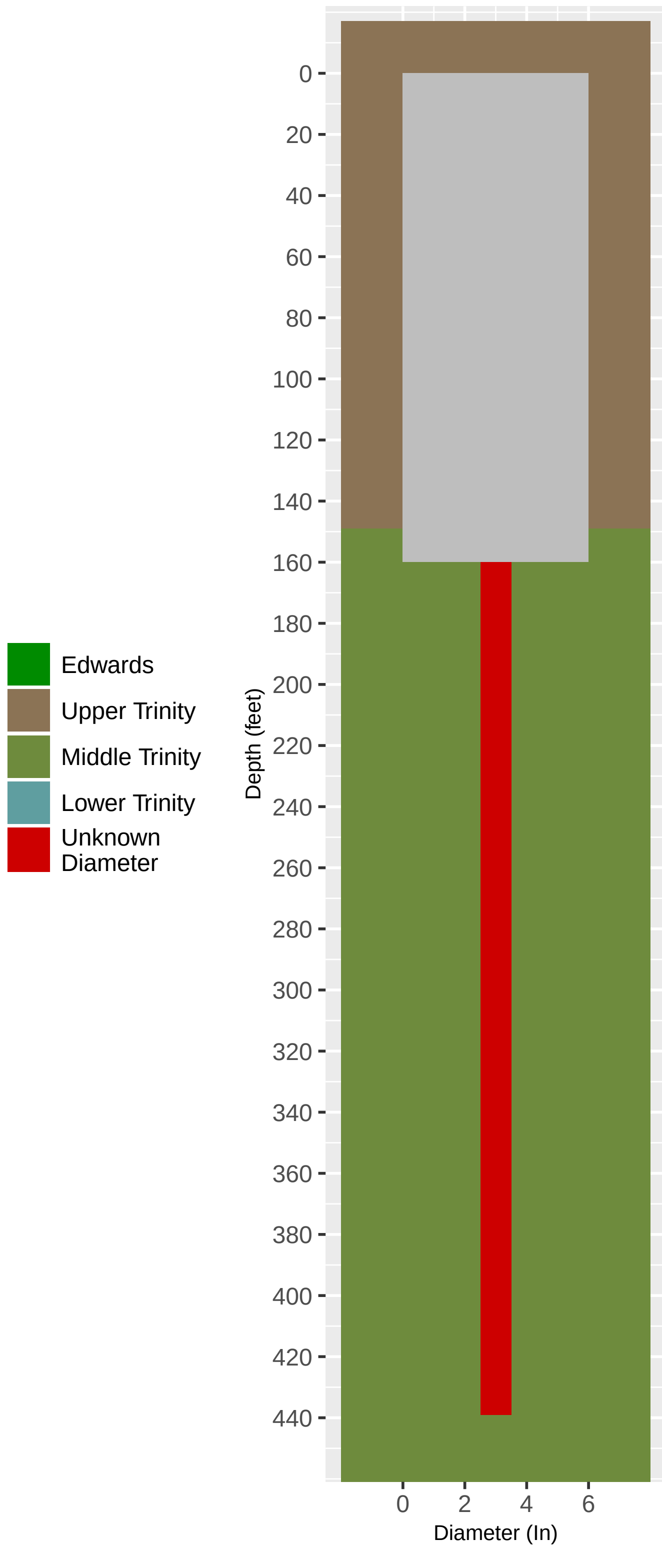
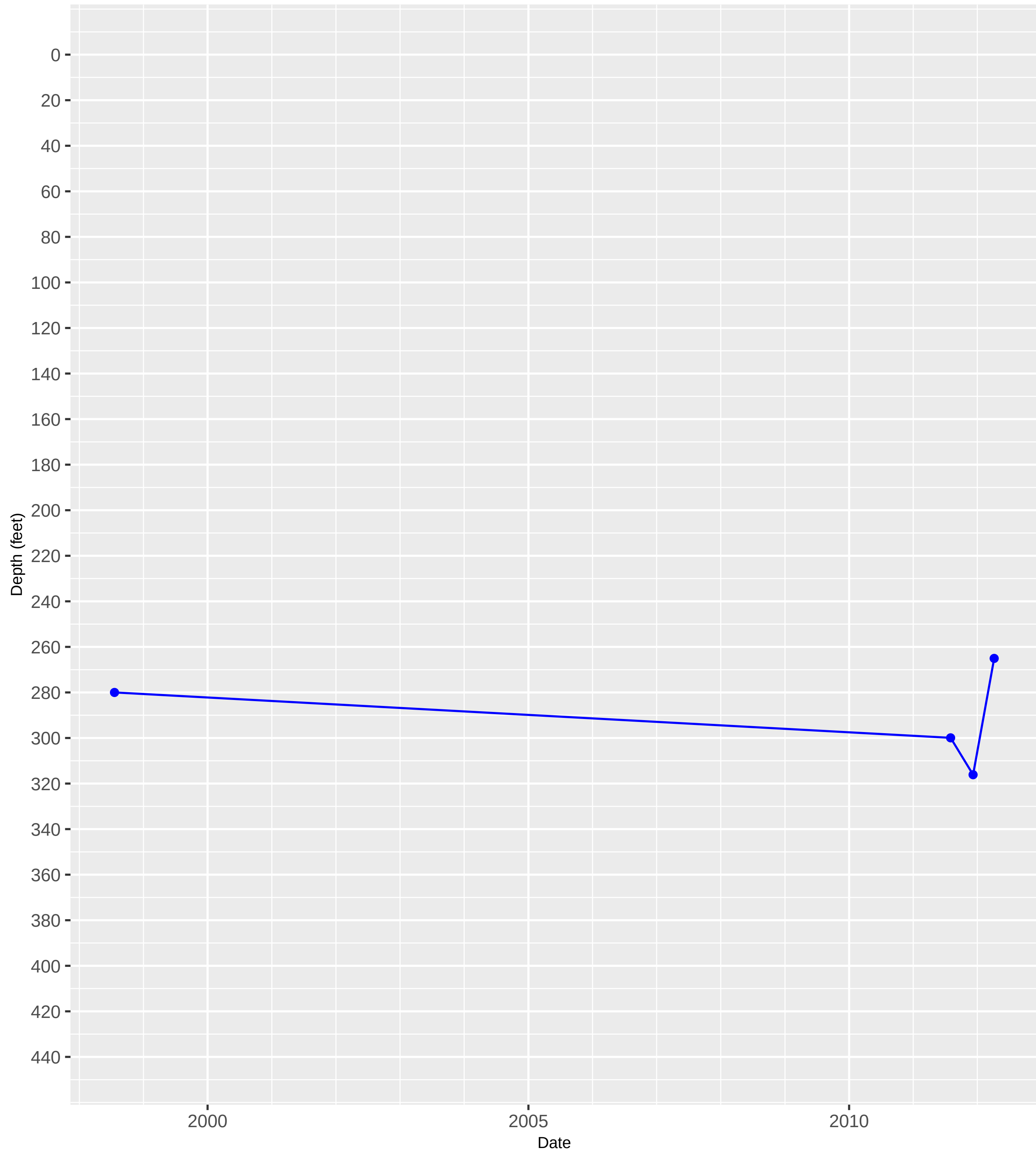


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

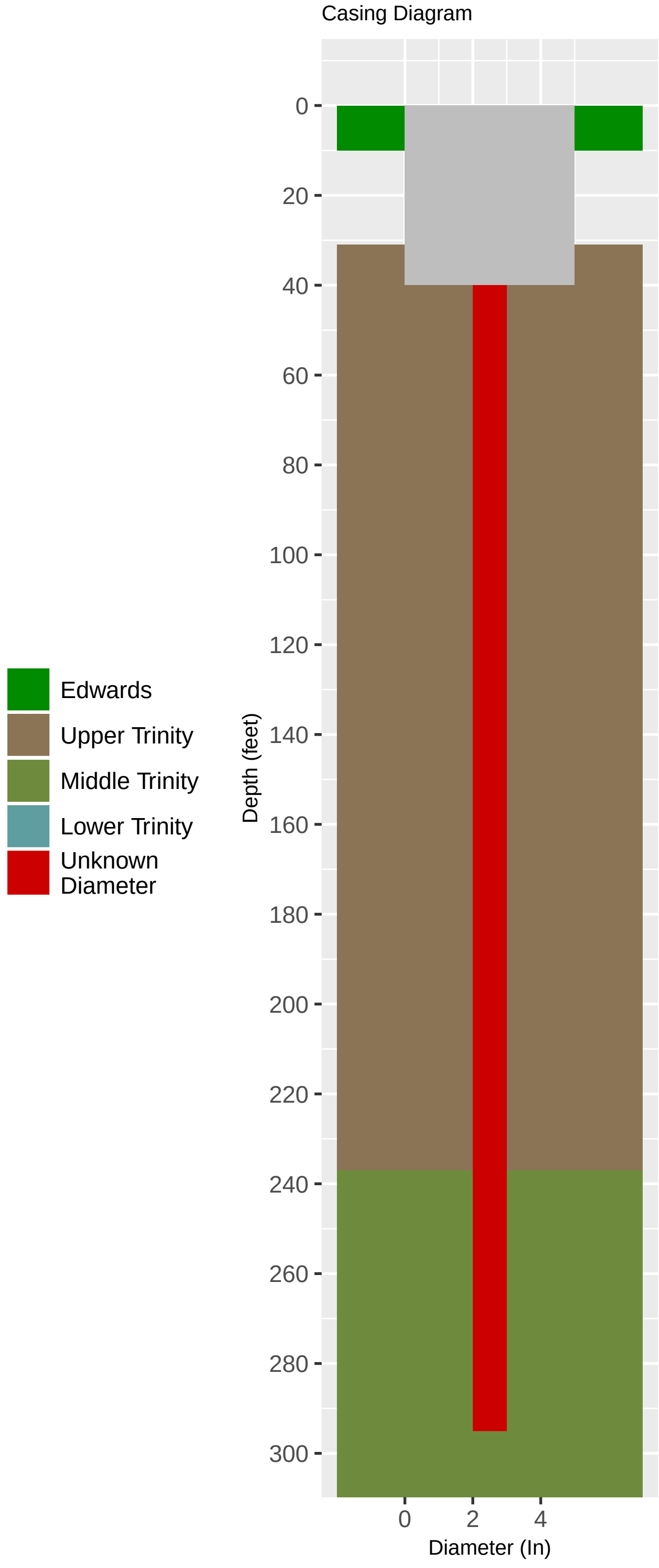
Casing Diagram

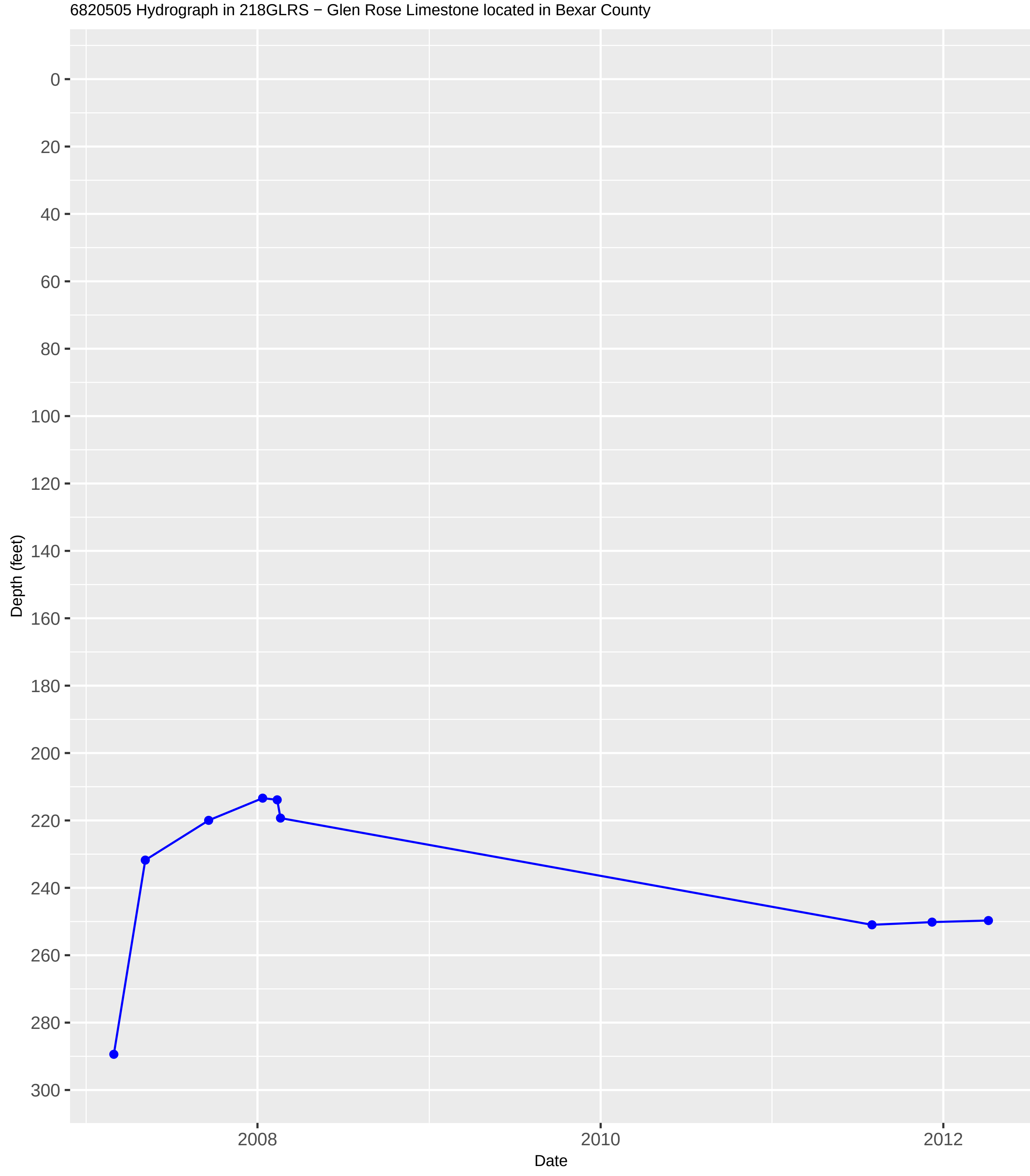
6820504 Hydrograph in 218GLRS − Glen Rose Limestone located in Bexar County



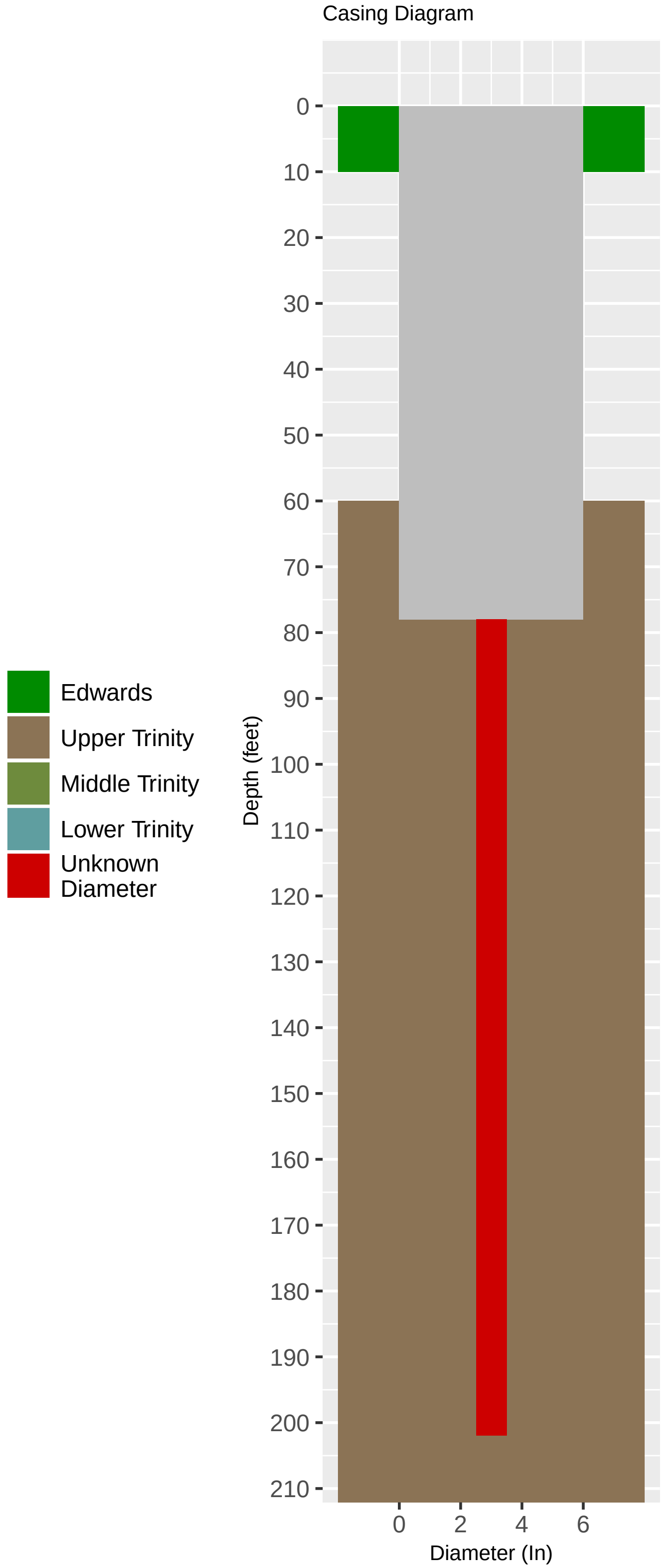


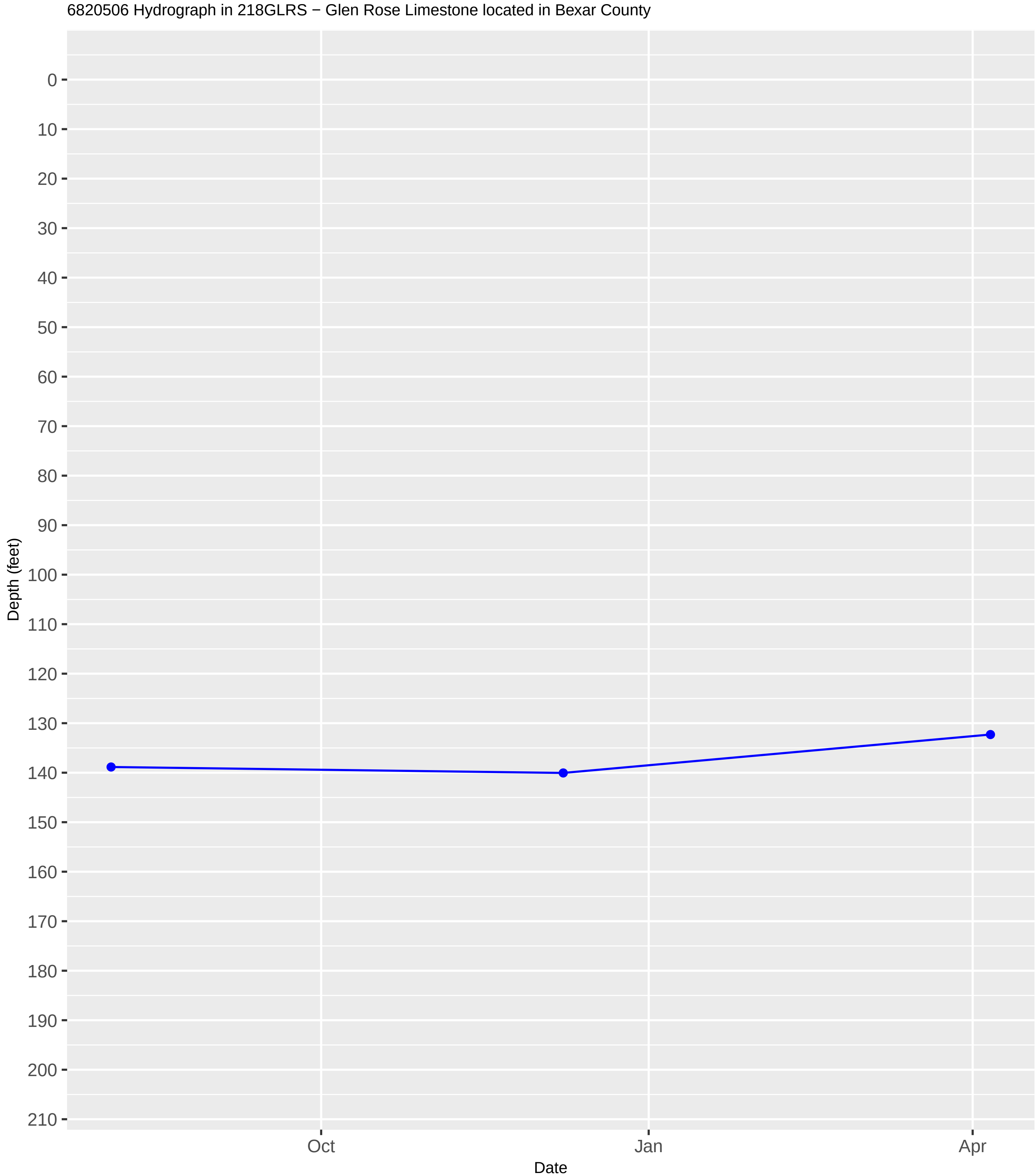
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.





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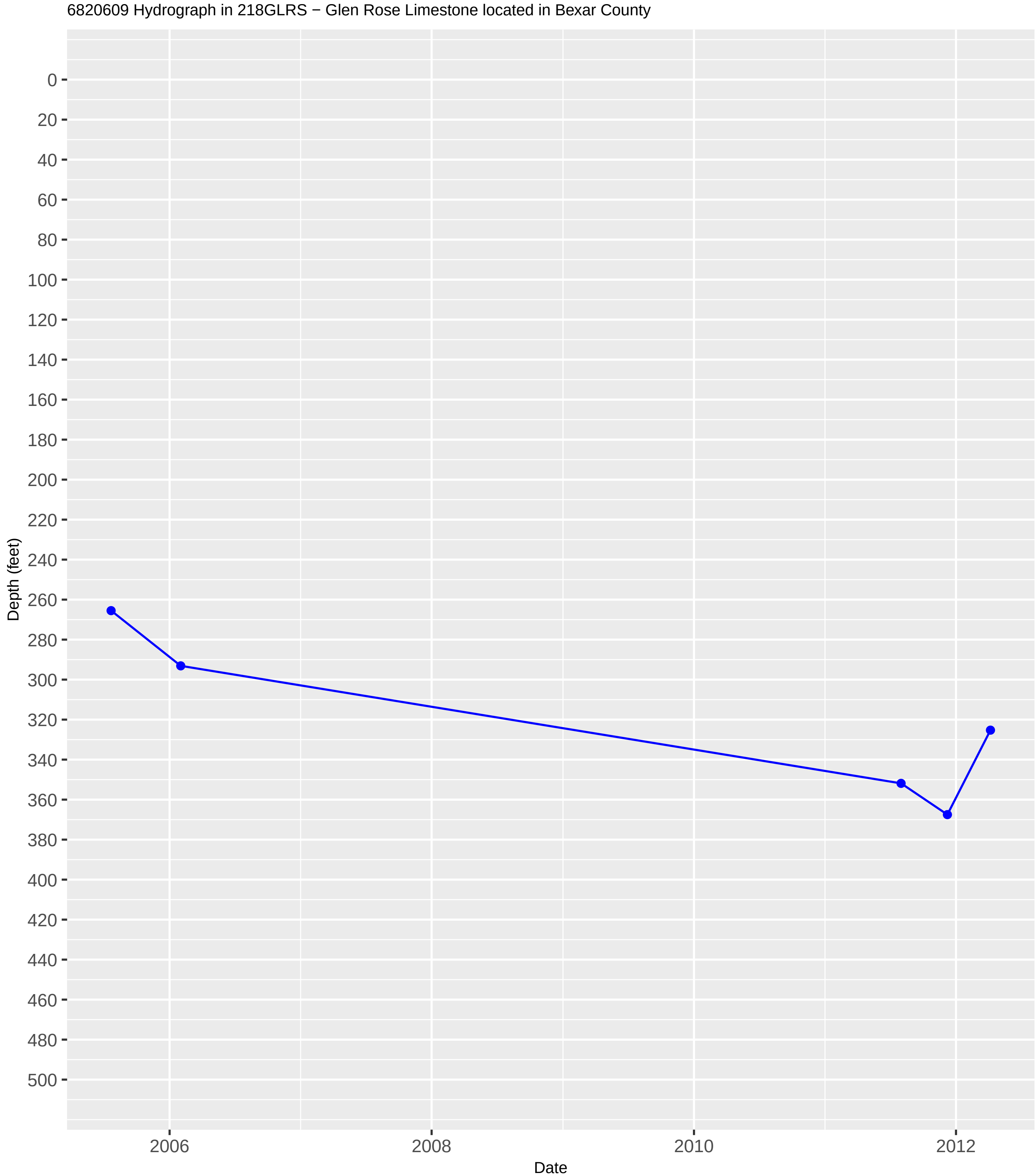
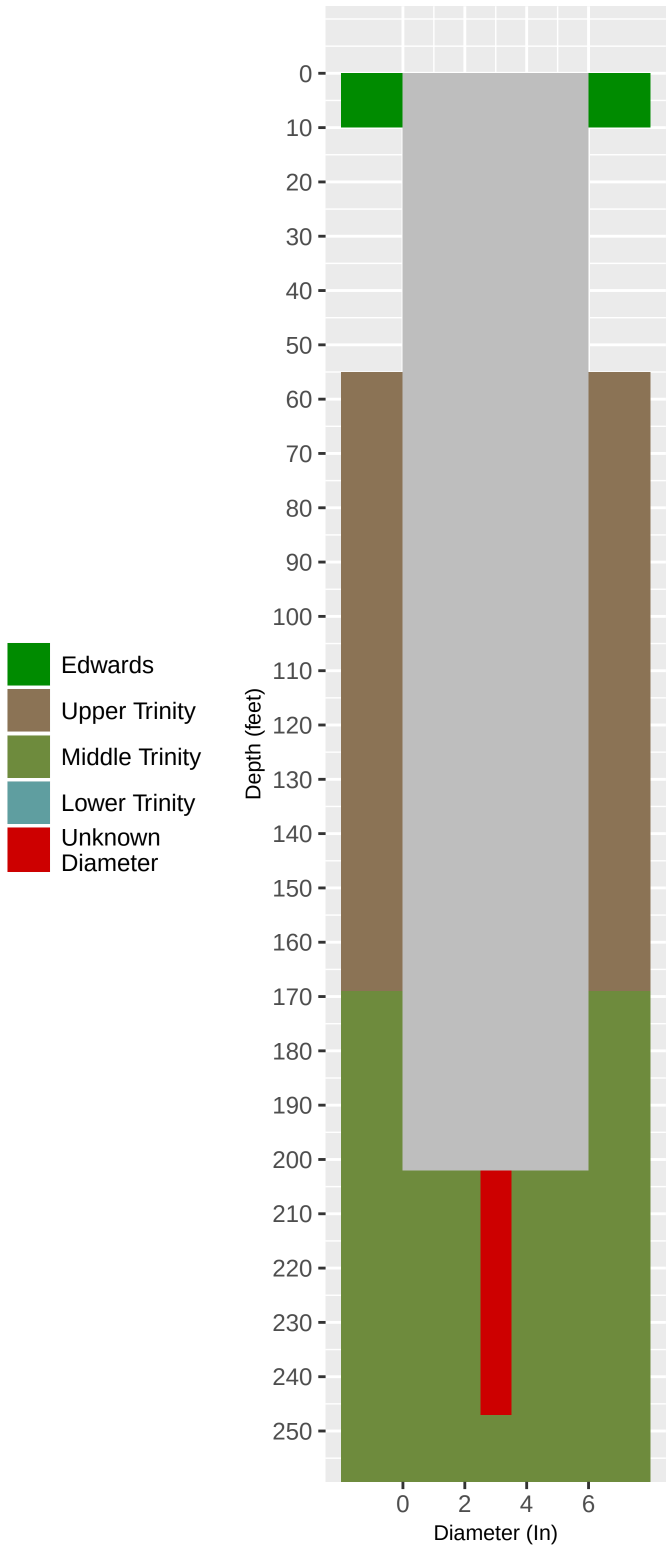
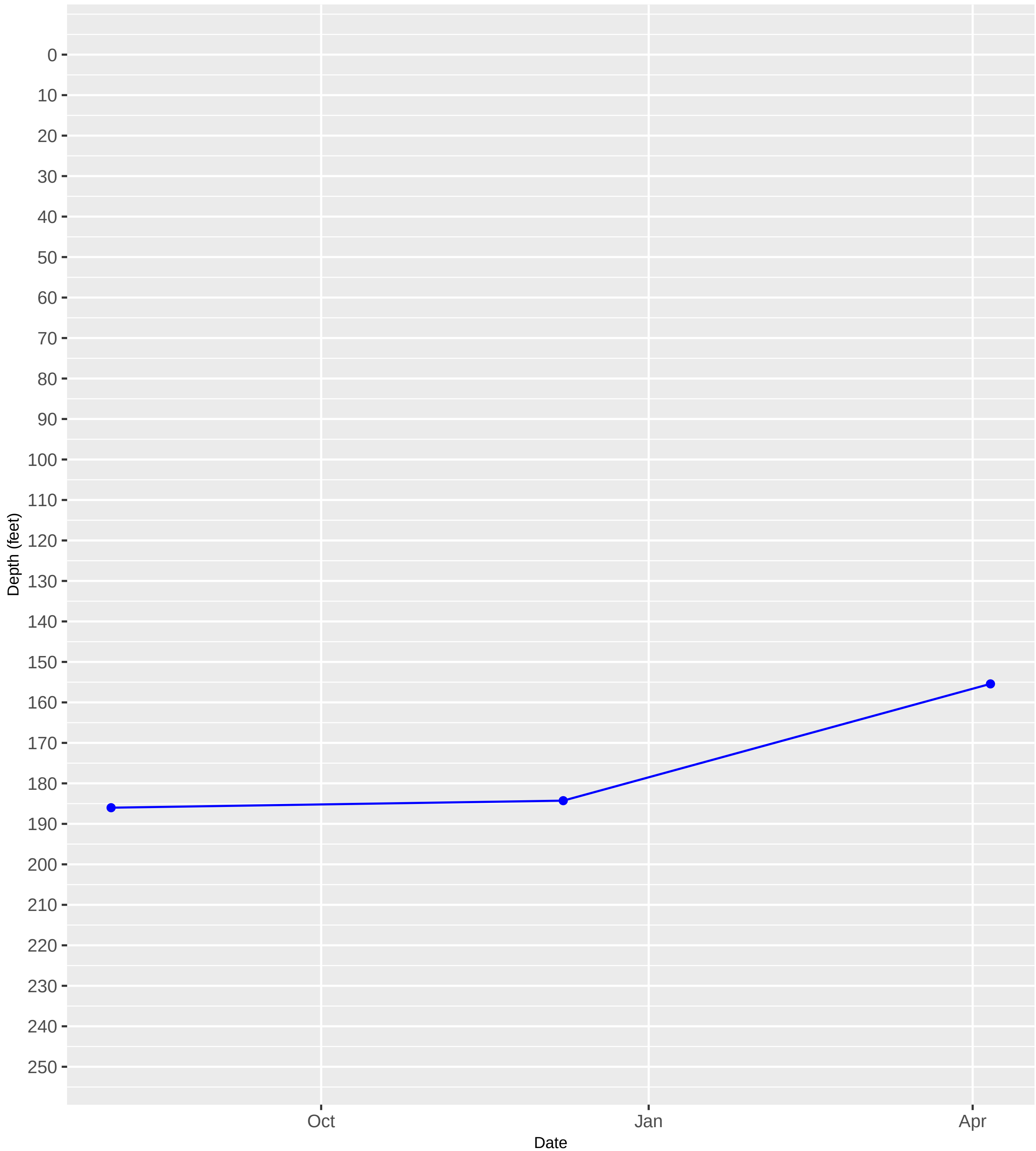


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

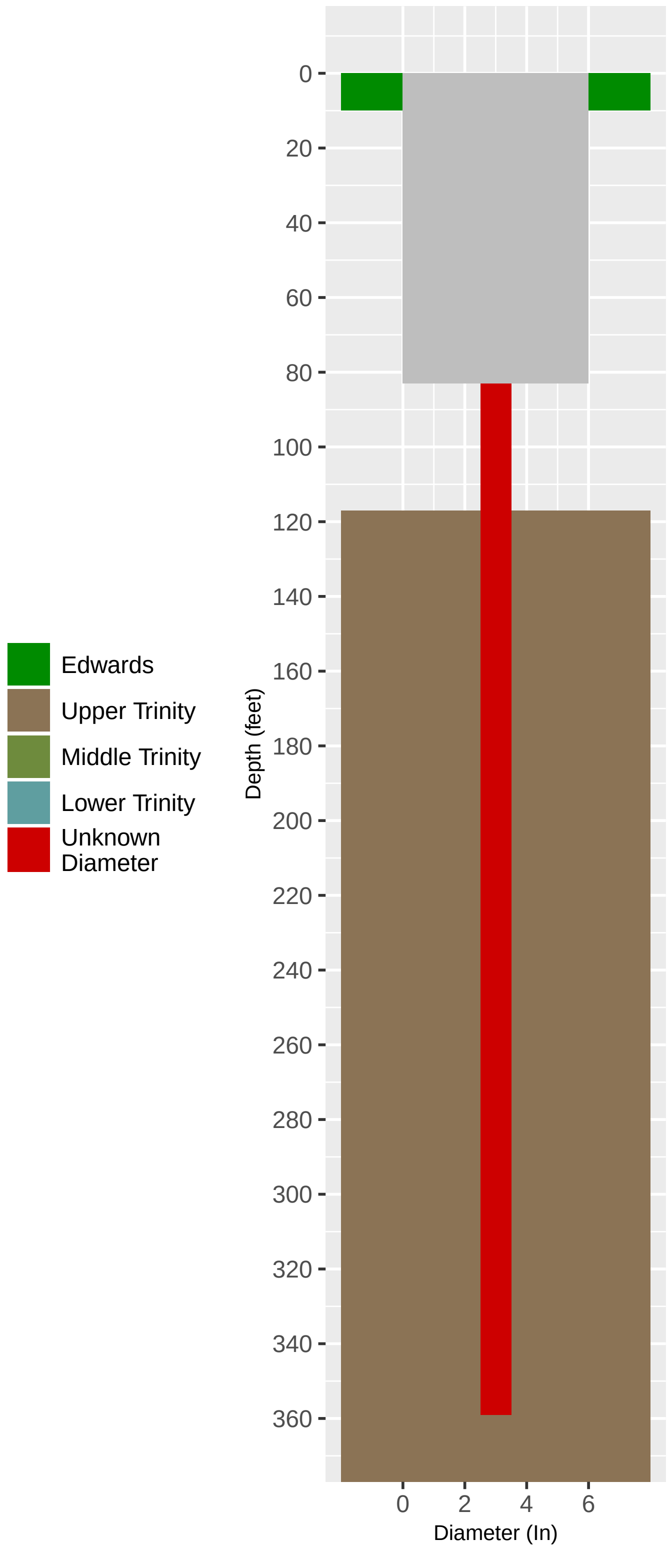


6820718 Hydrograph in 218GLRS − Glen Rose Limestone located in Bexar County

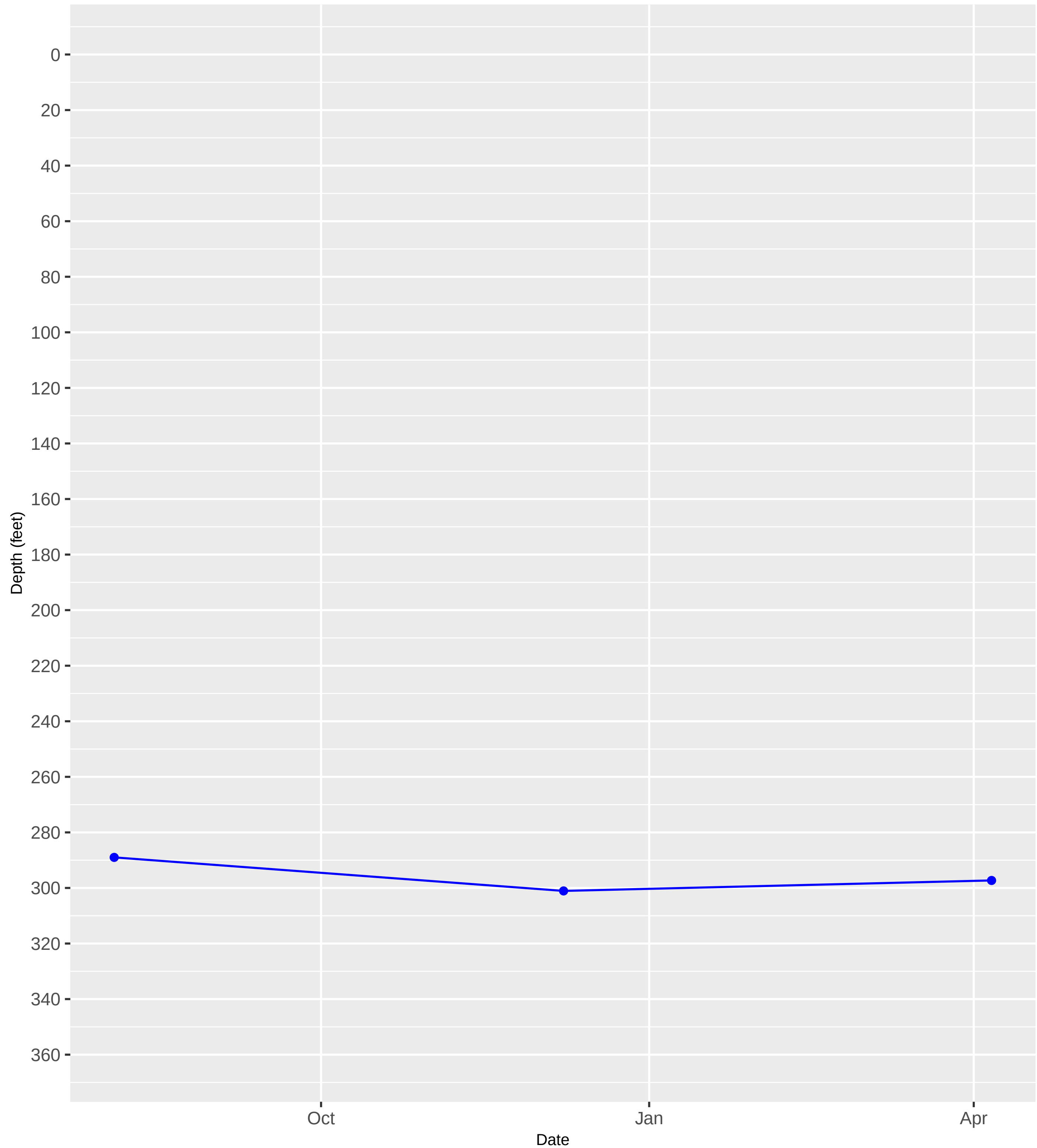


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

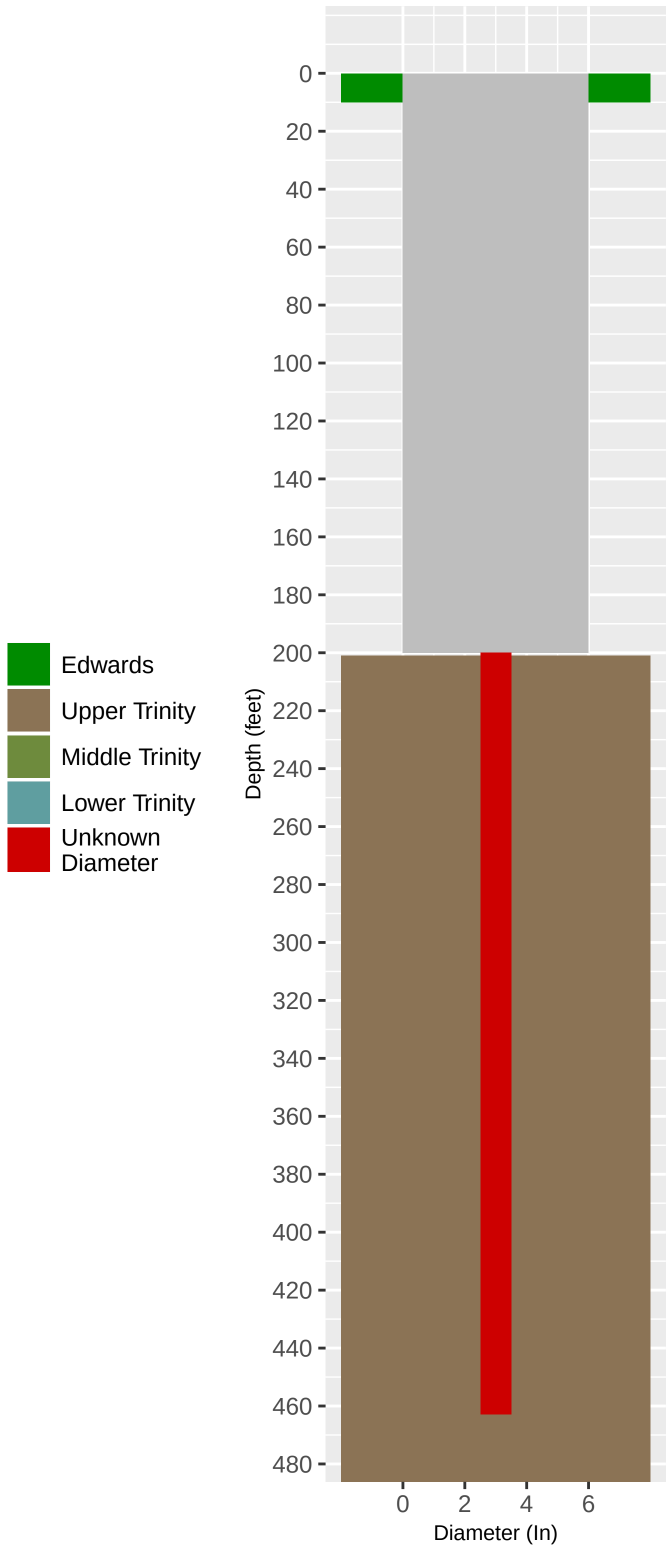


6820902 Hydrograph in 218GLRS − Glen Rose Limestone located in Bexar County

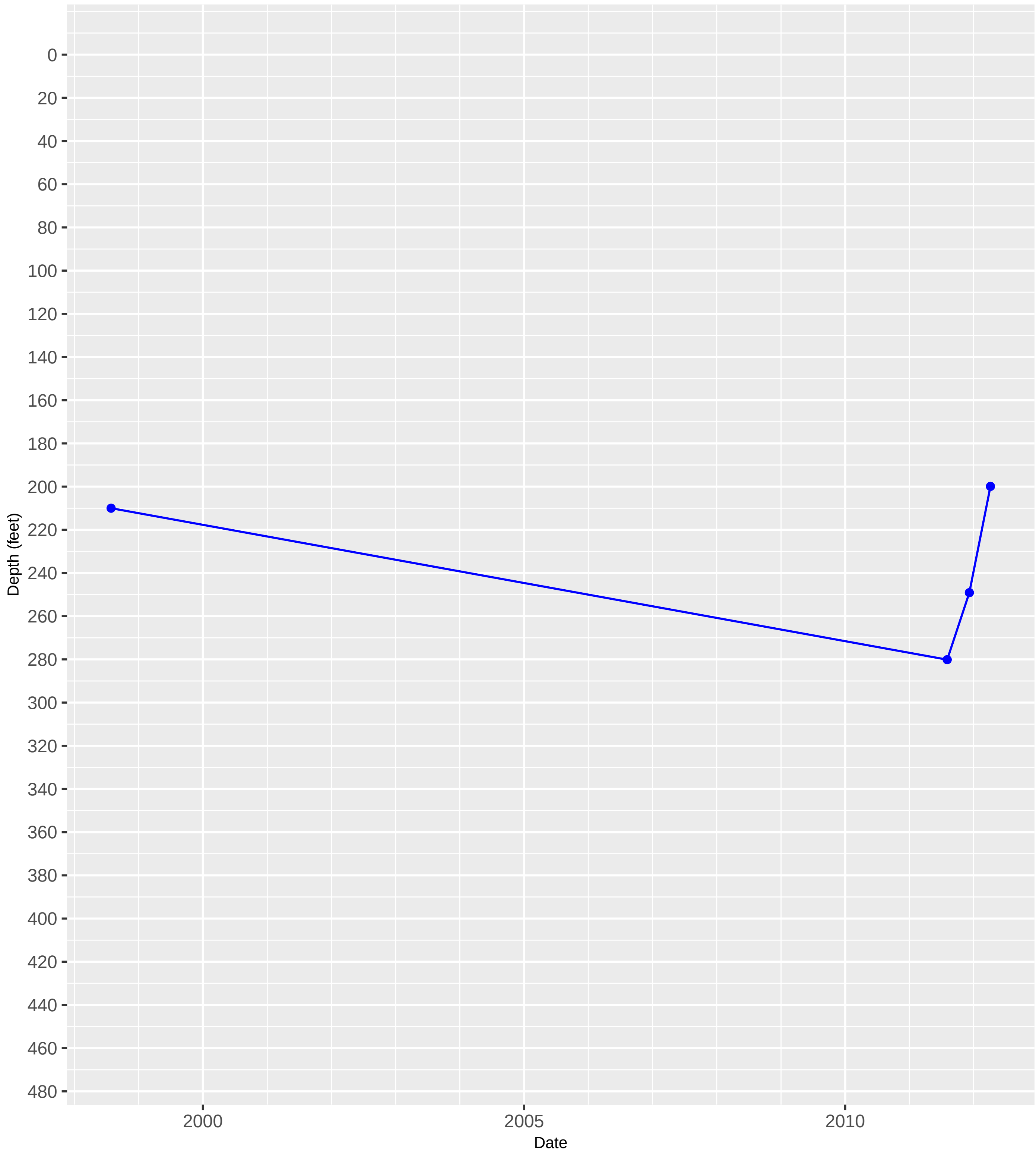


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

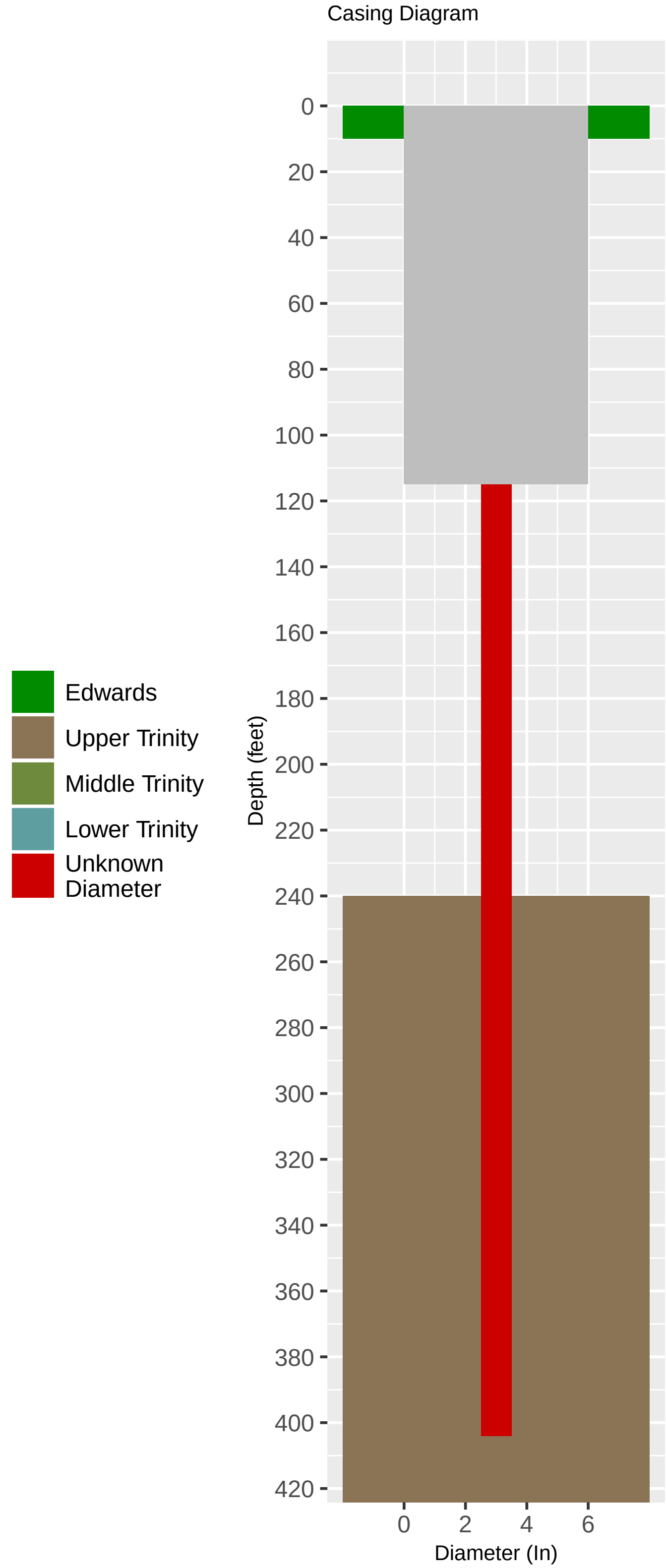
Casing Diagram

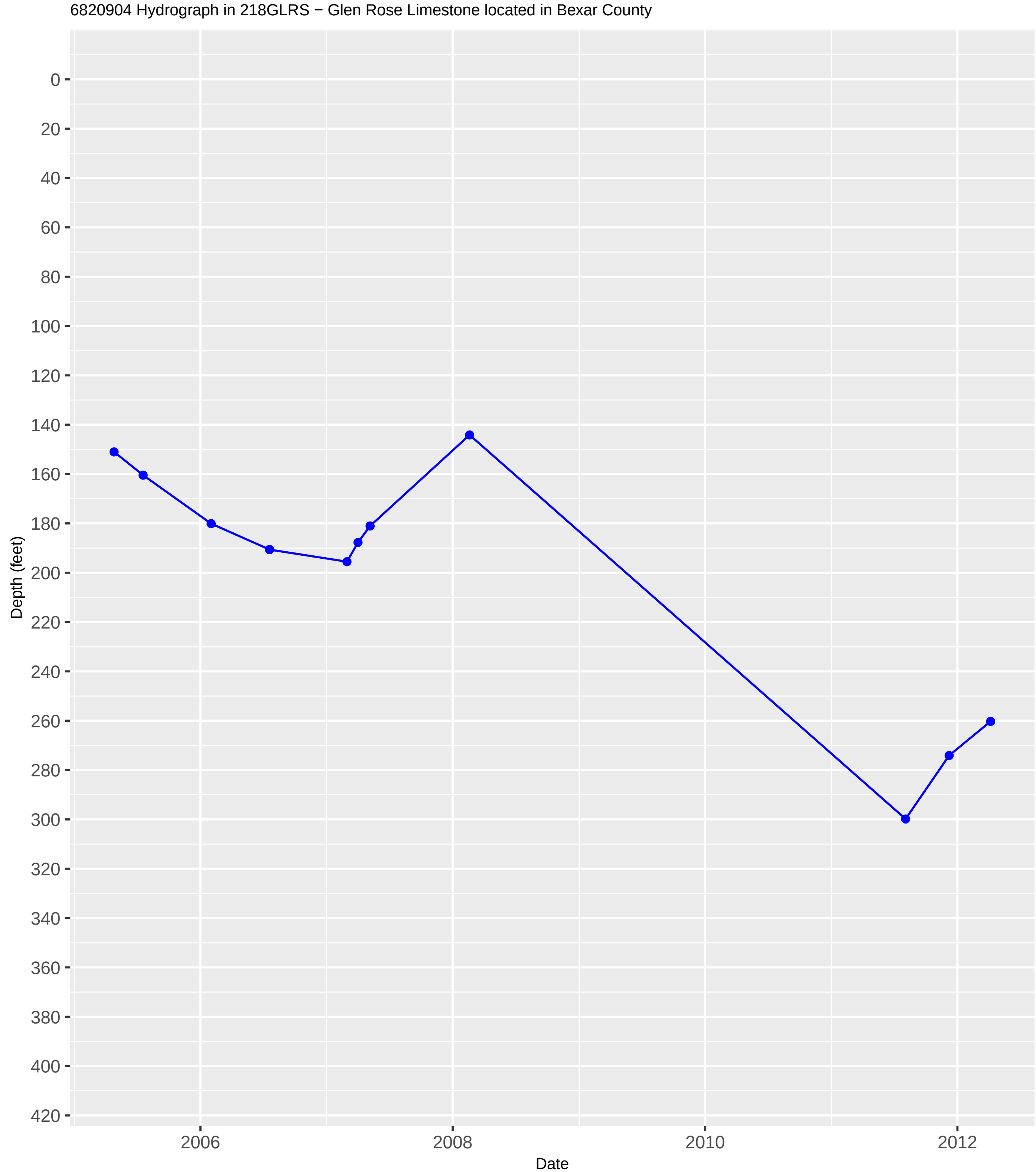


6820903 Hydrograph in 218GLRS − Glen Rose Limestone located in Bexar County

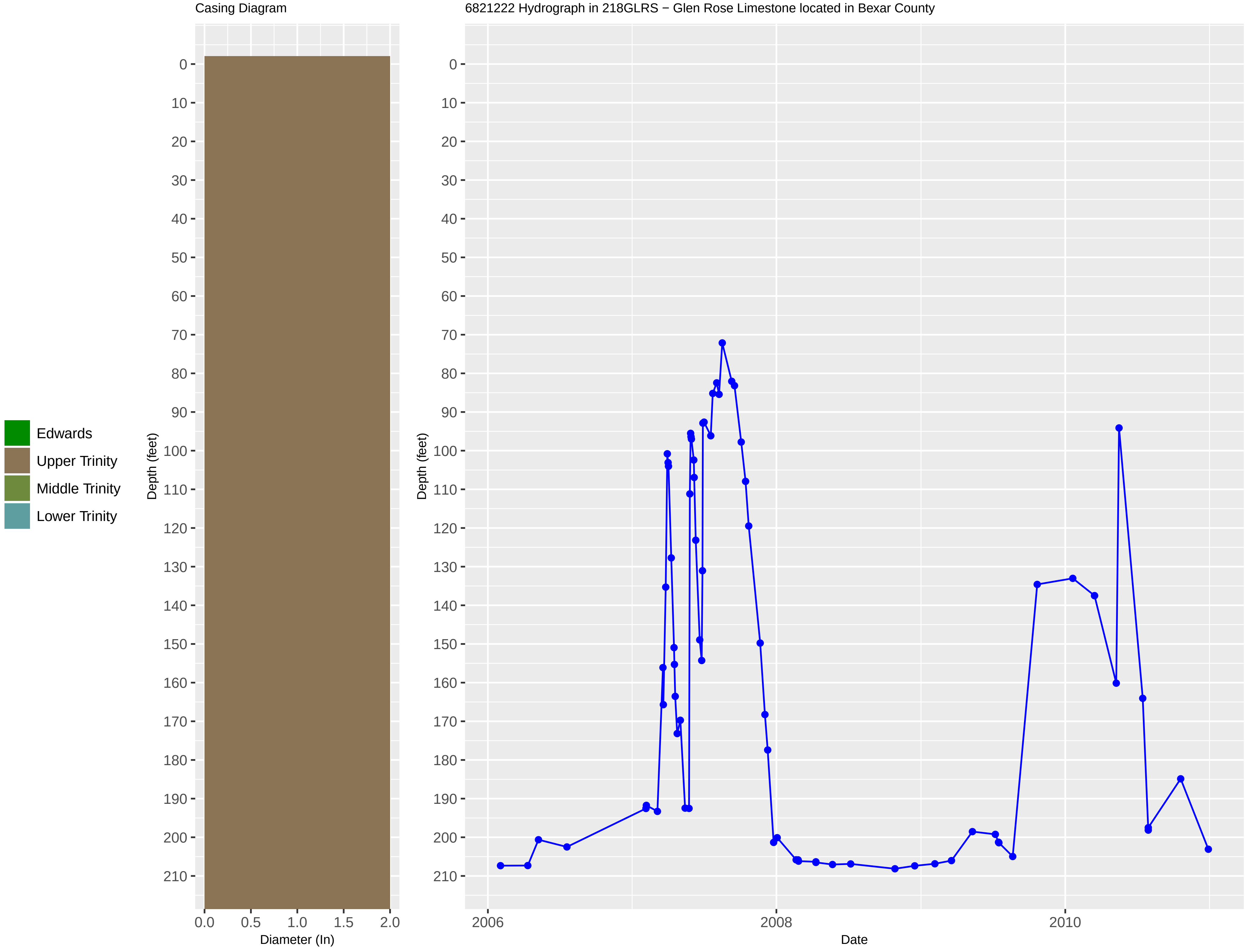


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

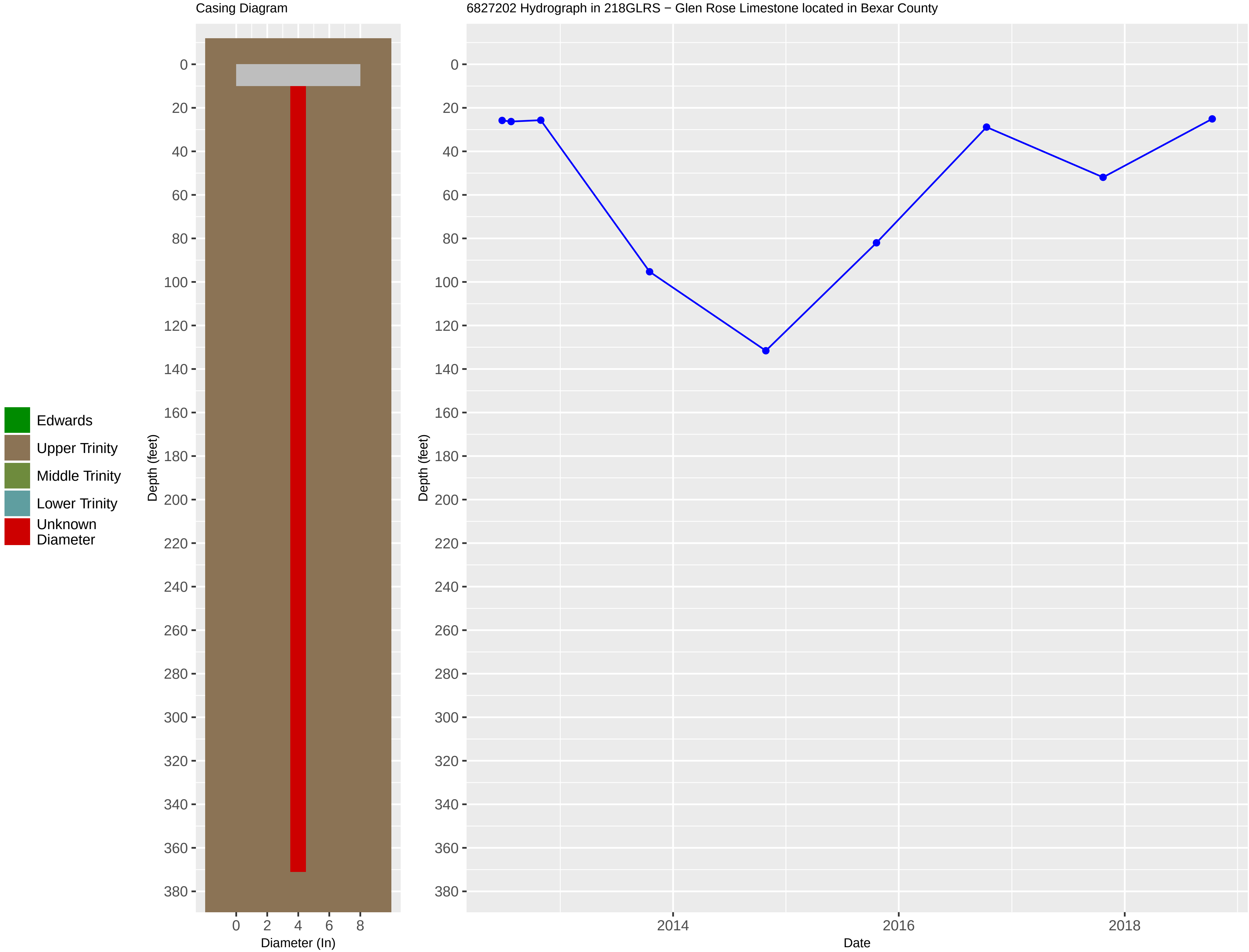




The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

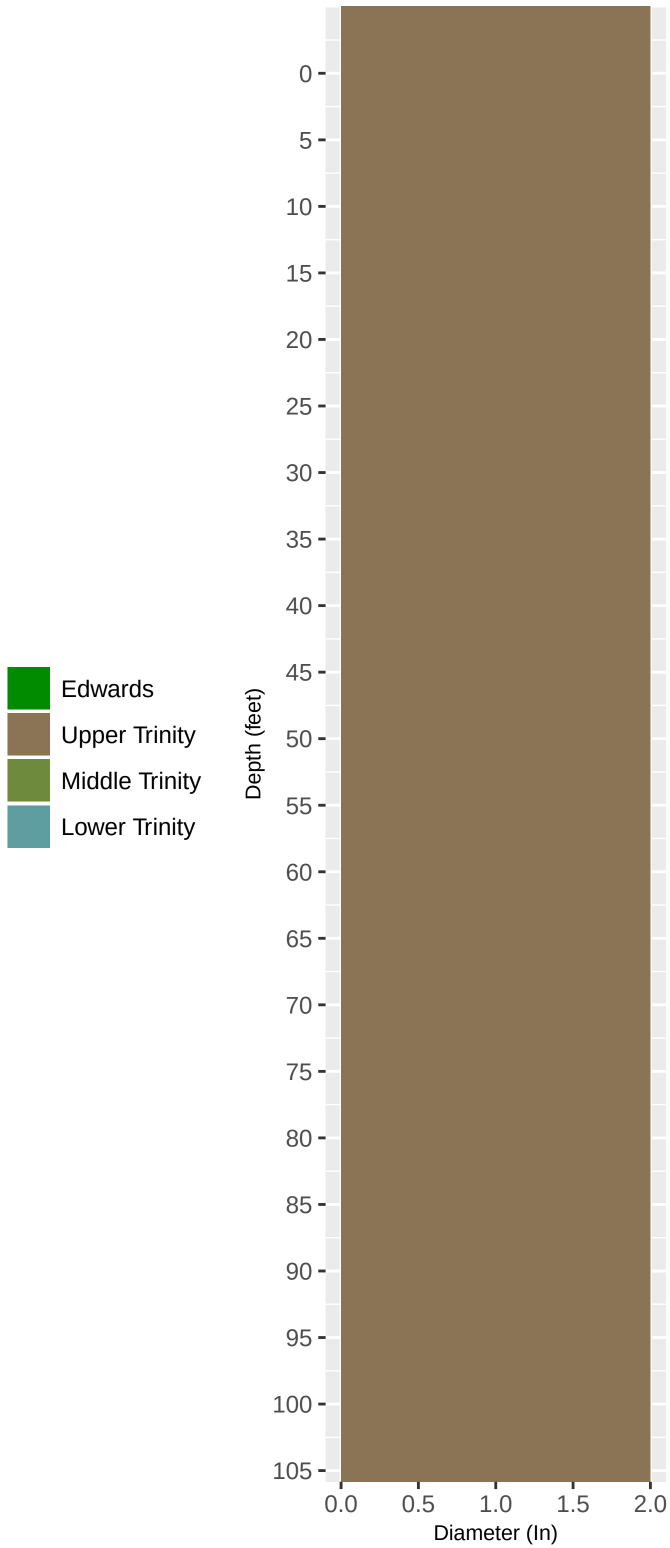


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

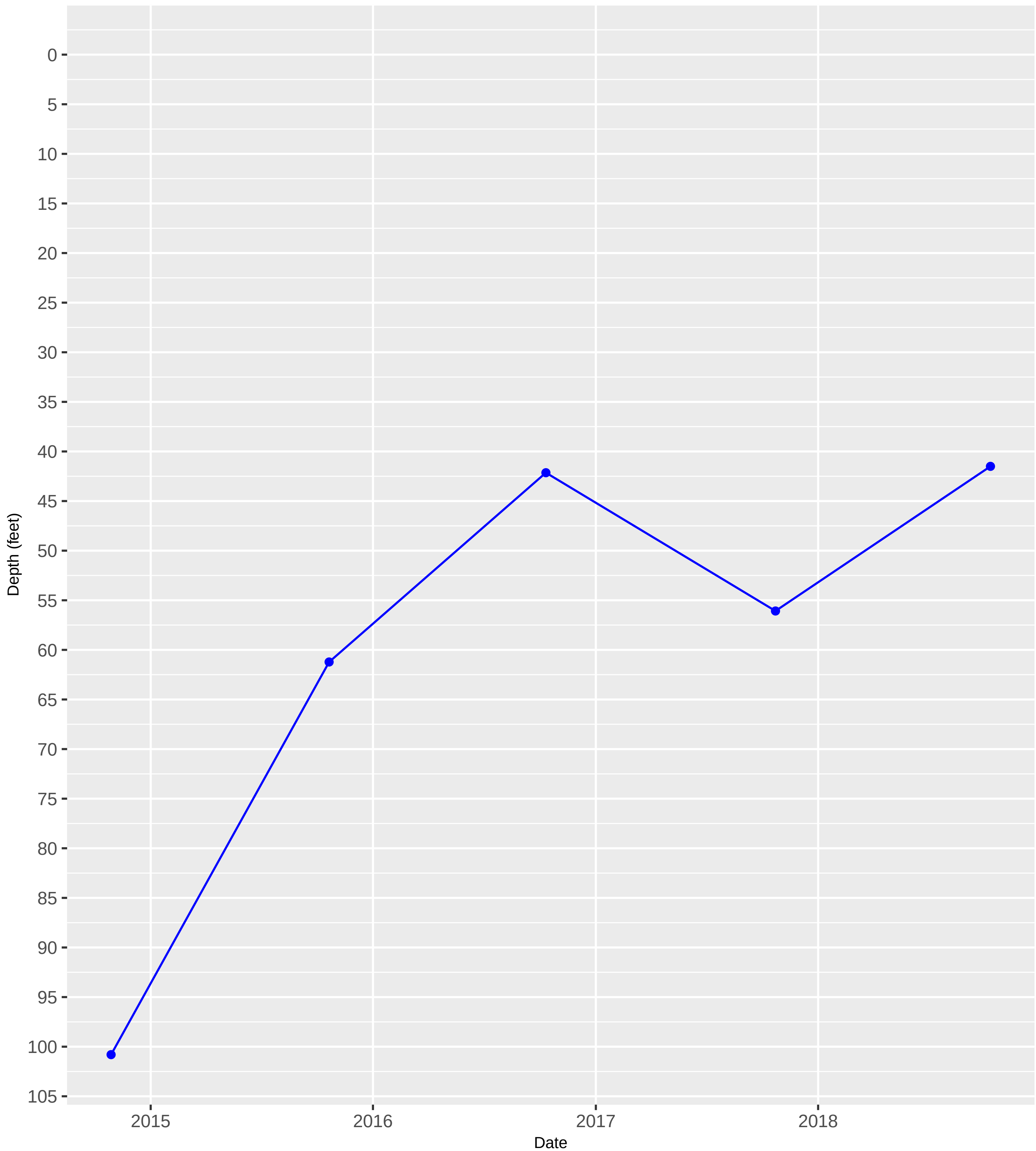


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

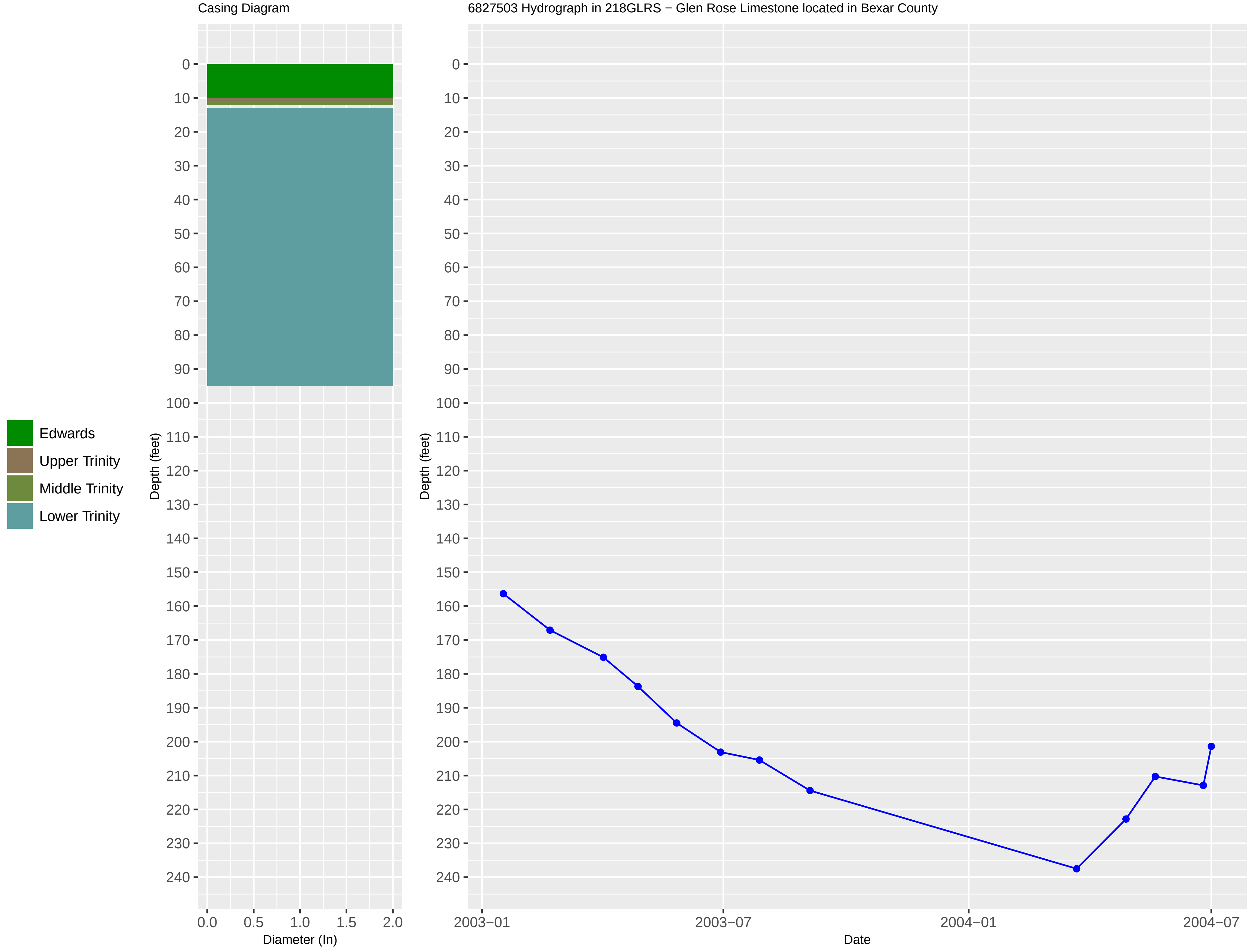
Casing Diagram



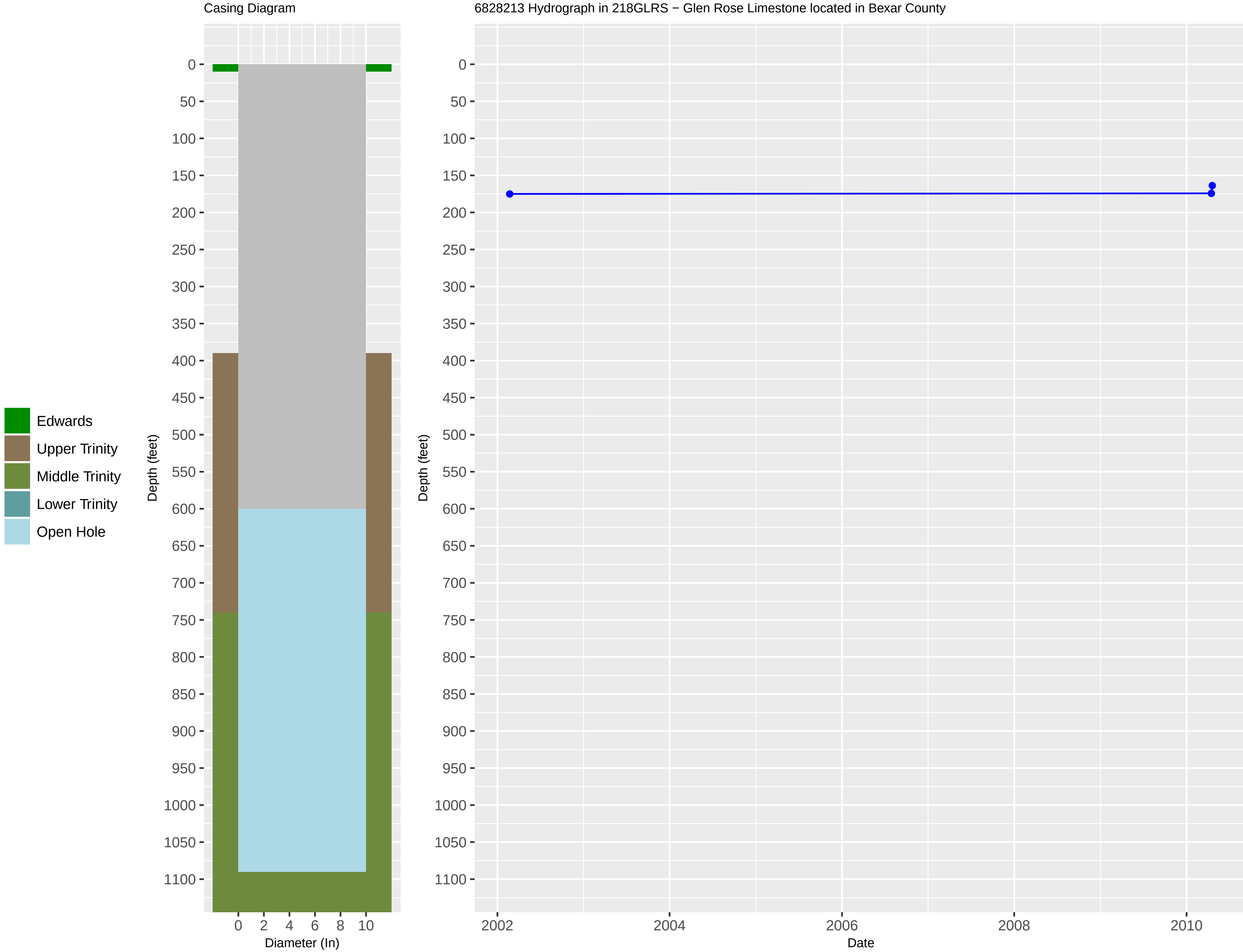
6827212 Hydrograph in 218GLRS − Glen Rose Limestone located in Bexar County



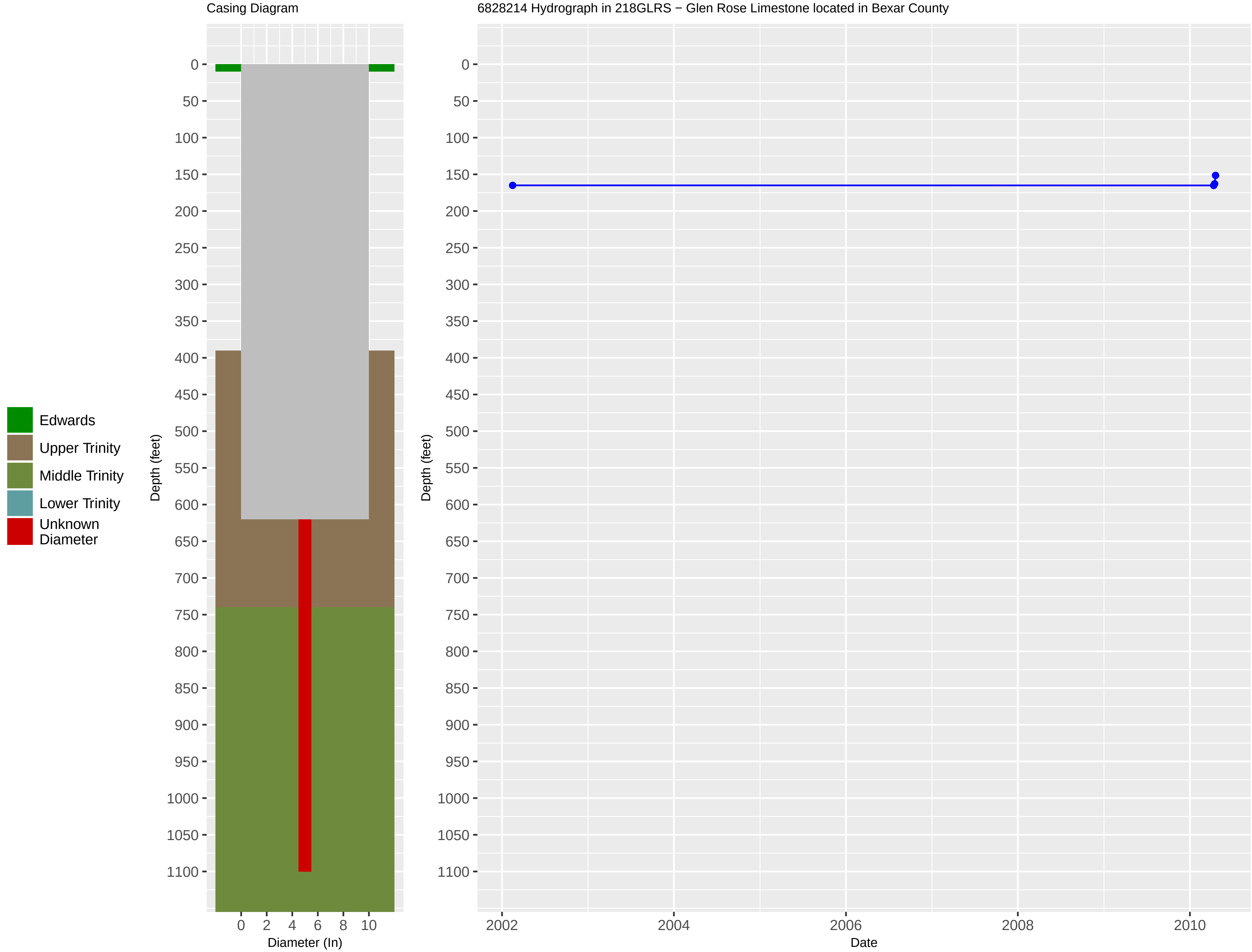
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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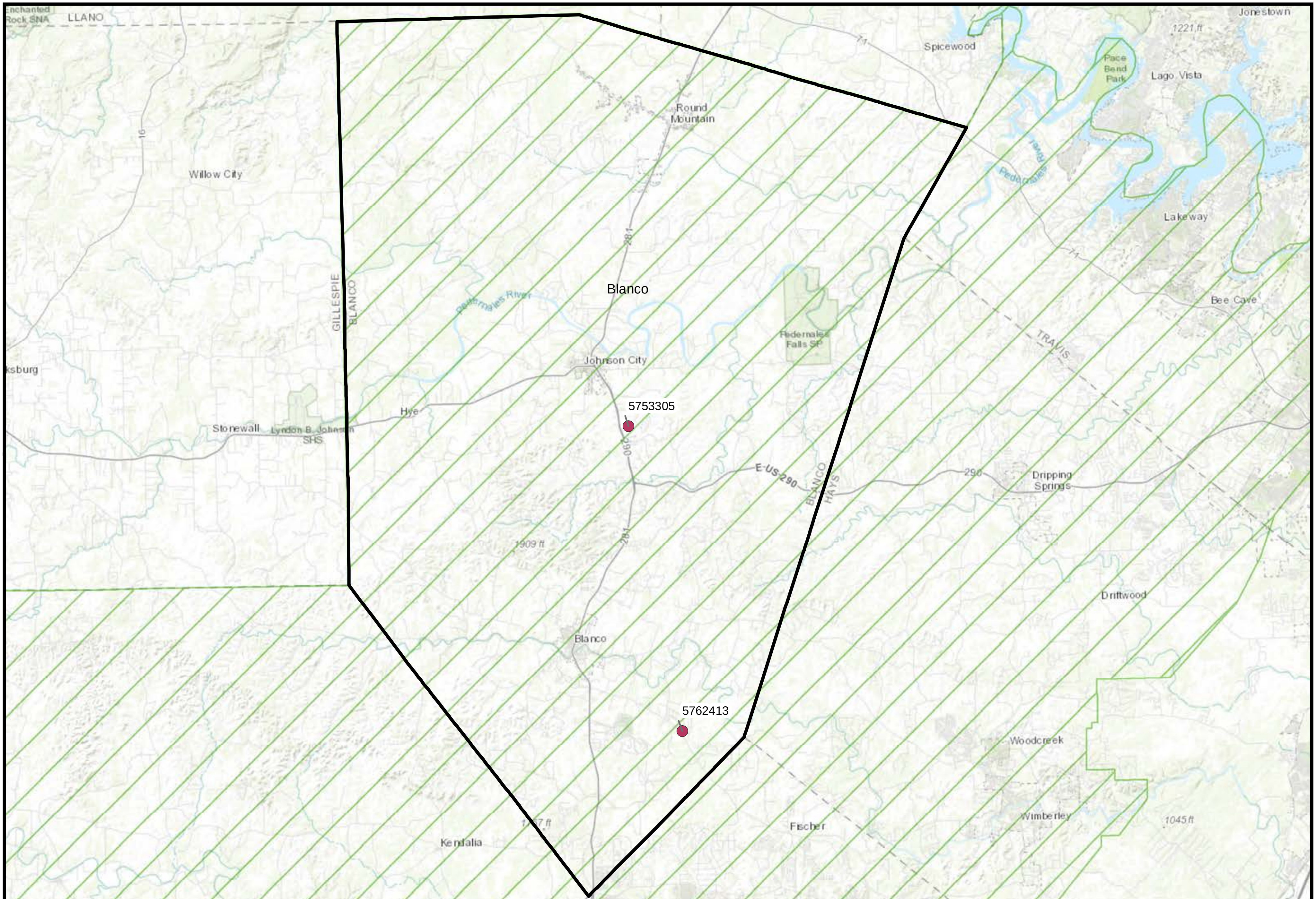


wsp

Aquifer

218GLRS - Glen Rose Limestone

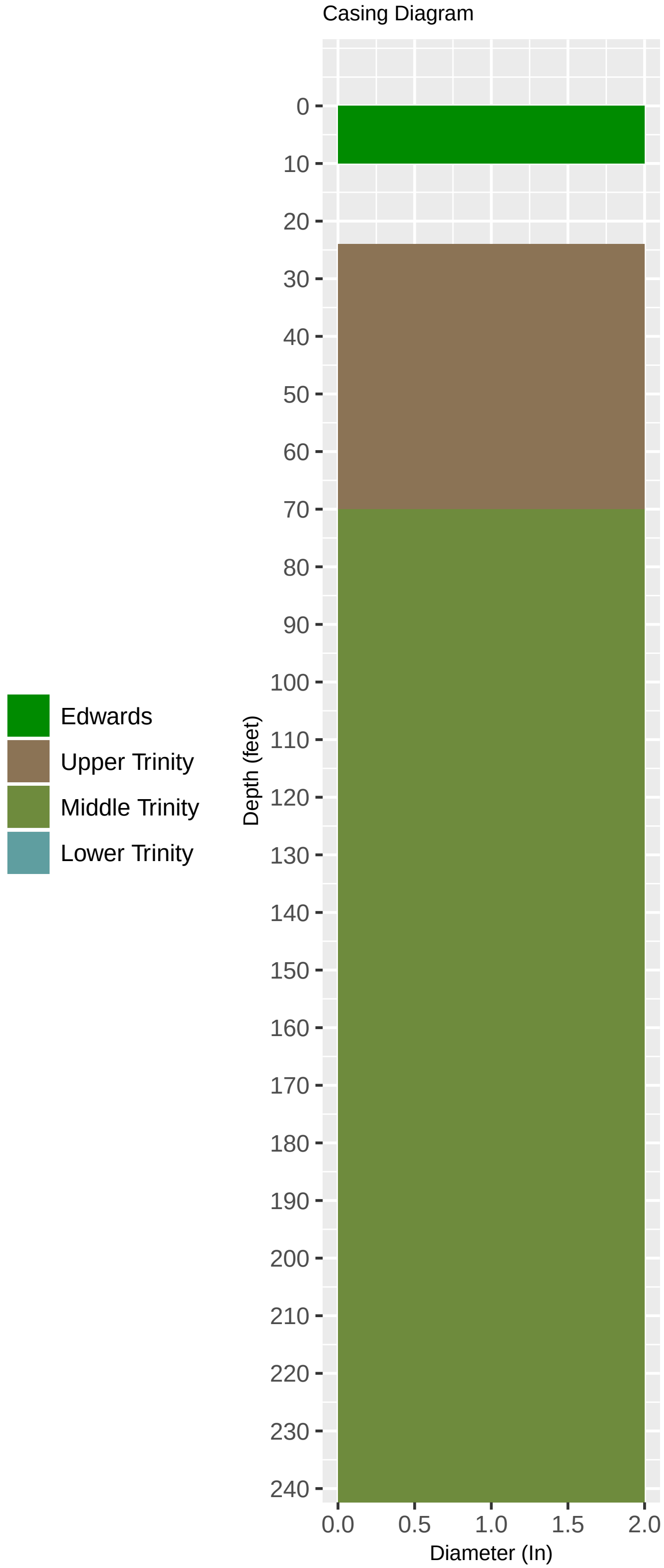
GMA 9

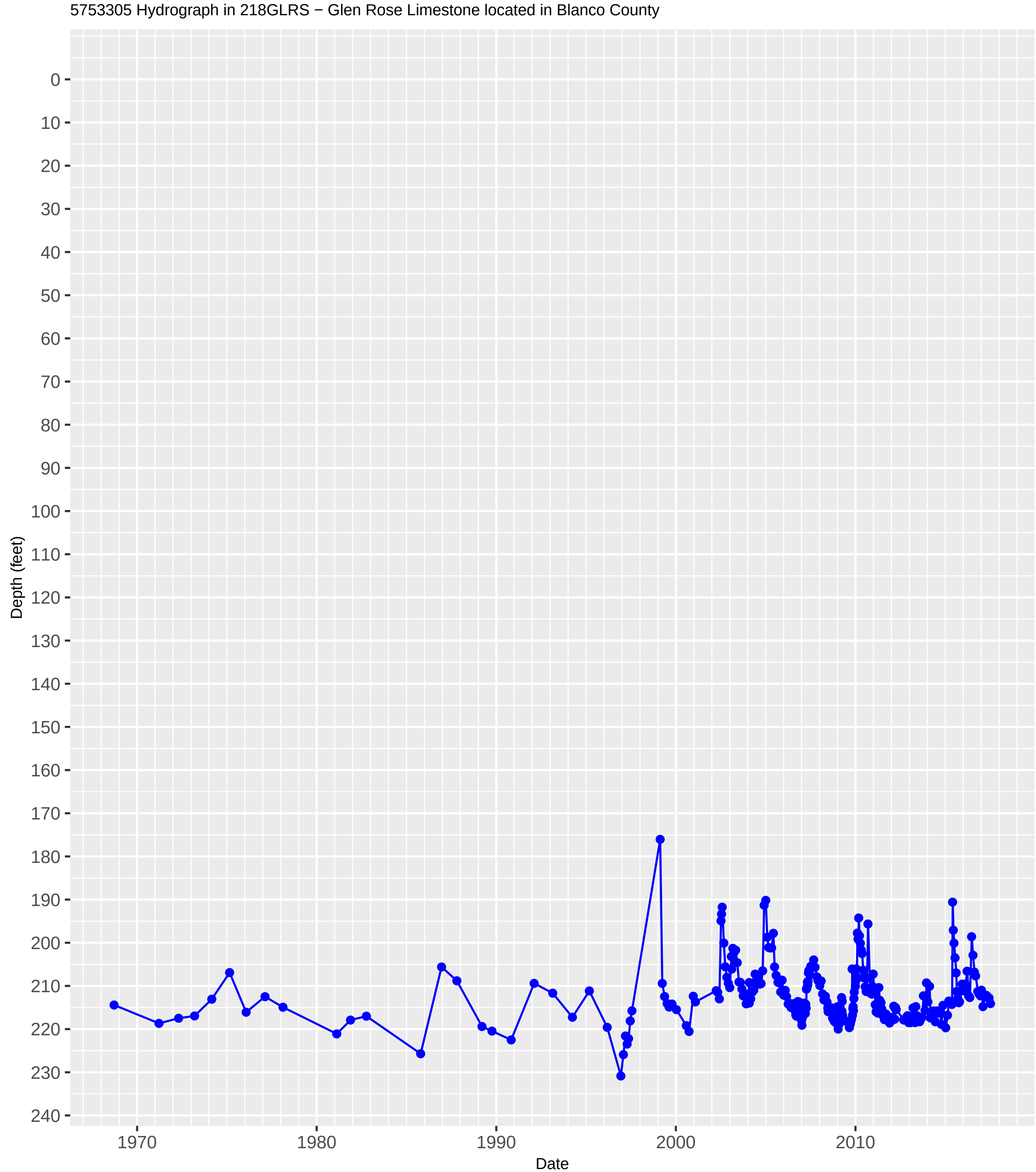
N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Blanco County
218GLRS
Glen Rose Limestone





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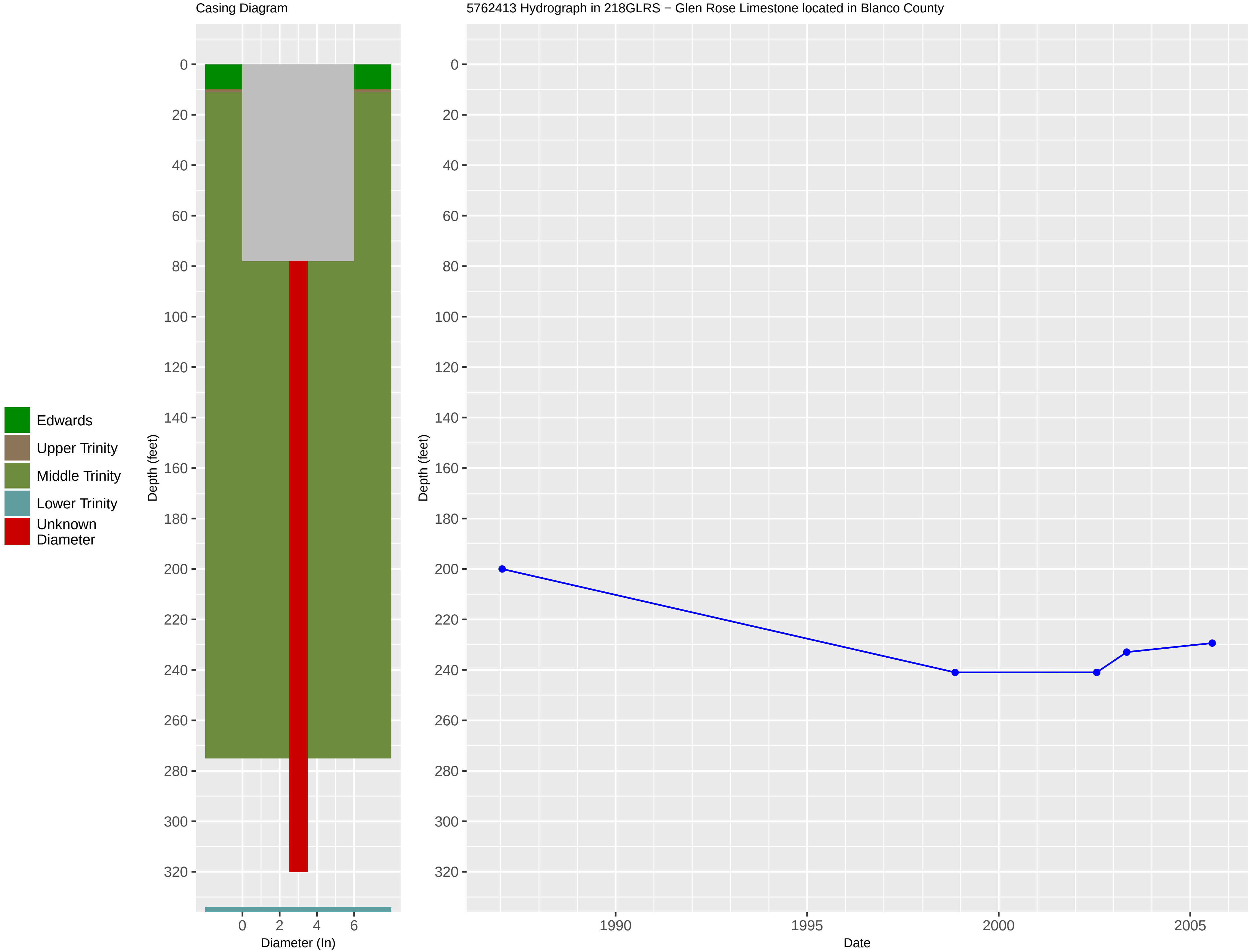

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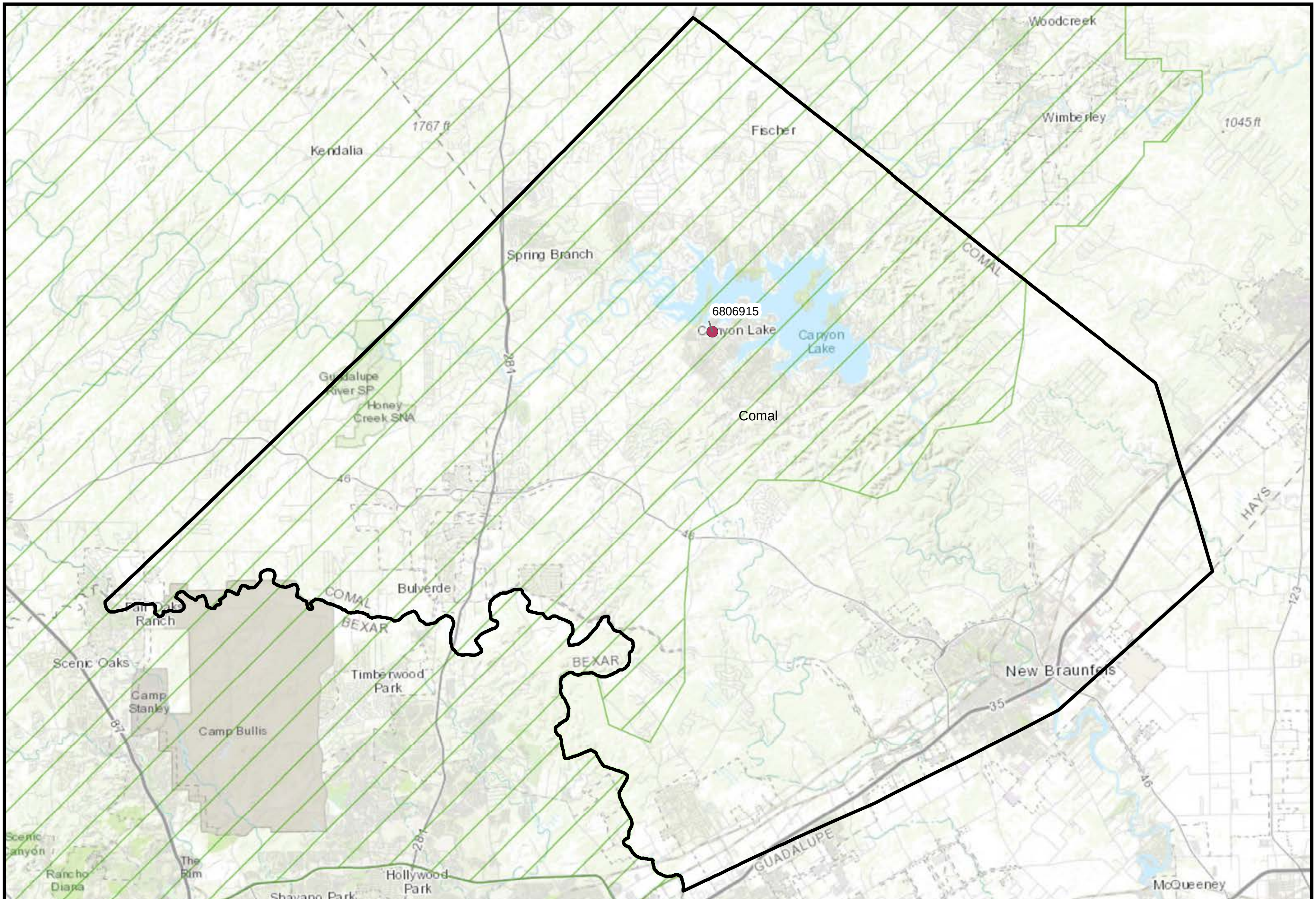


Aquifer

218GLRS - Glen Rose Limestone

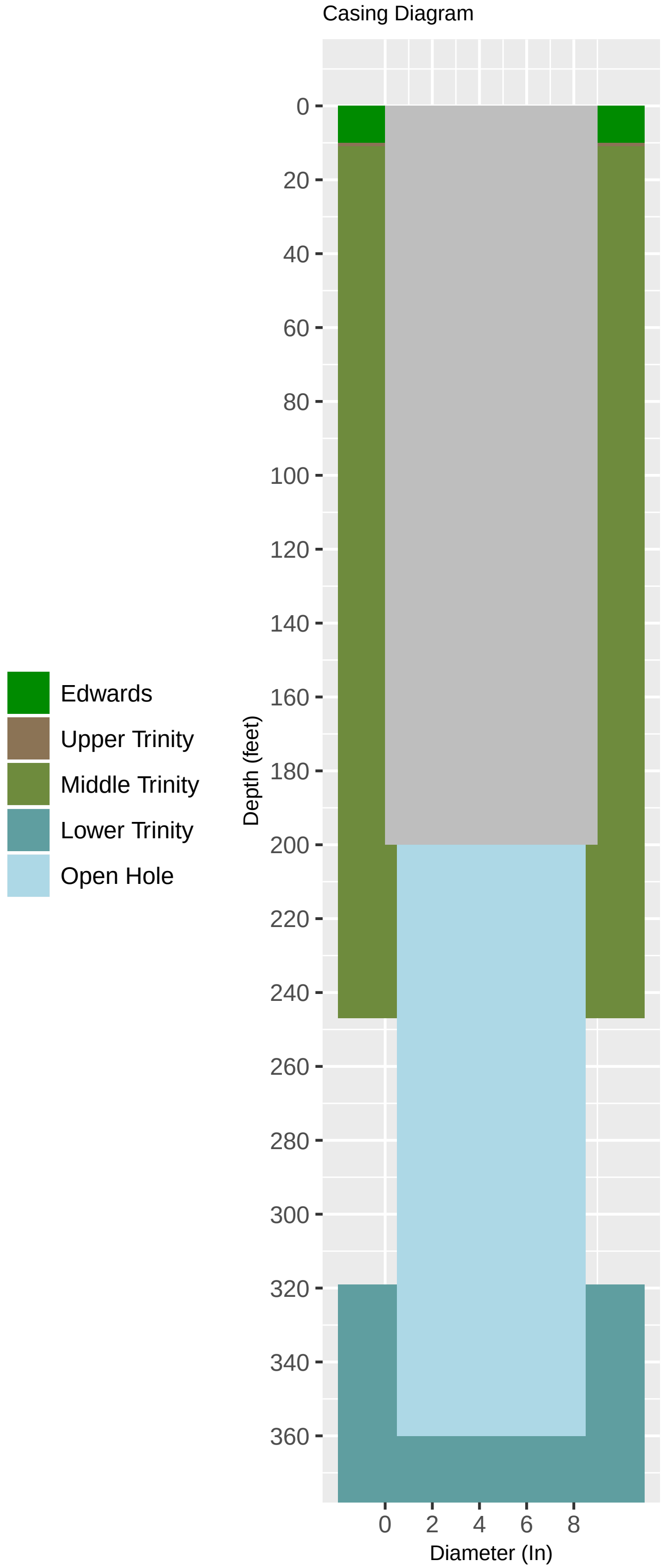
GMA 9

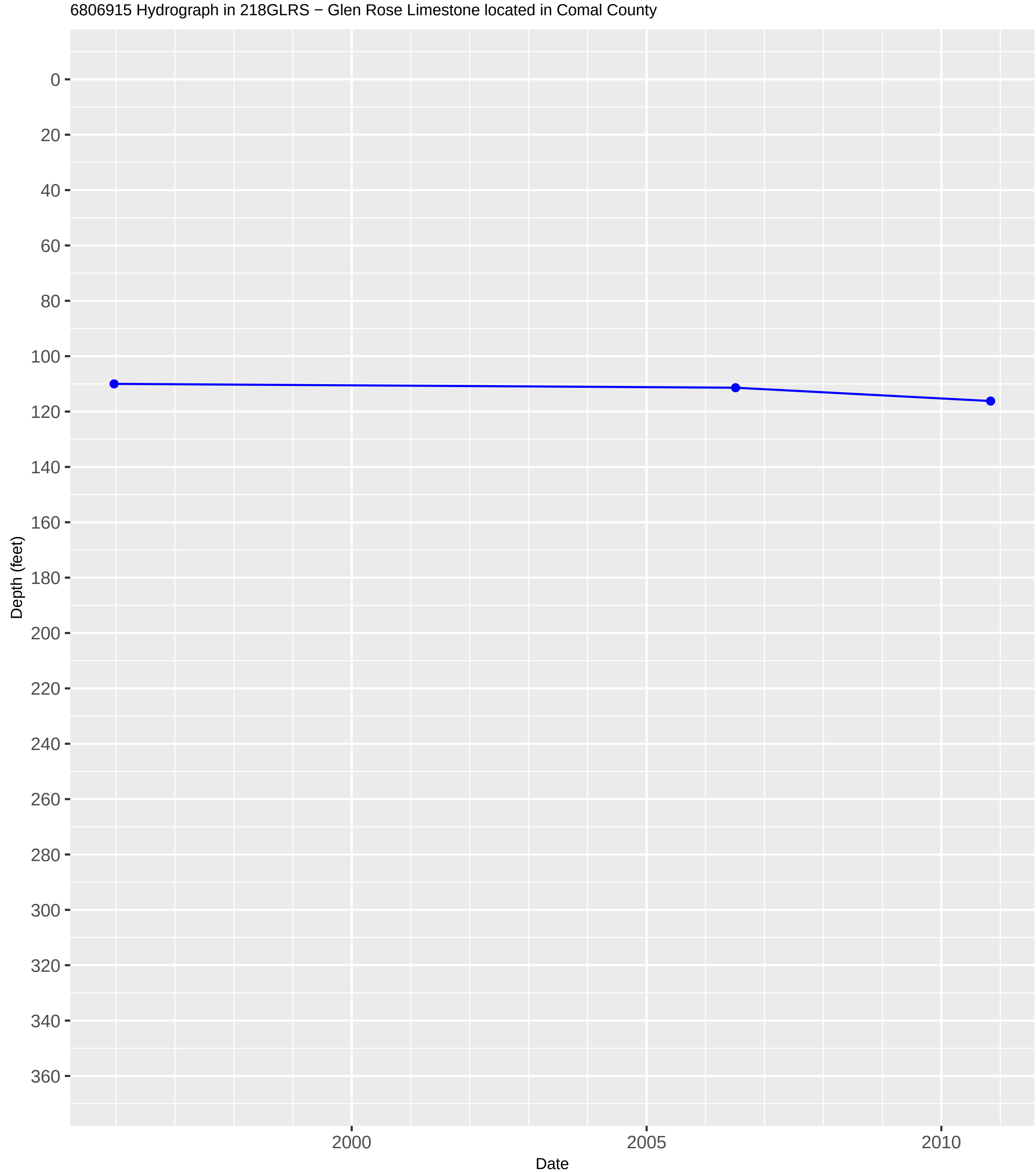
N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Comal County
218GLRS
Glen Rose Limestone





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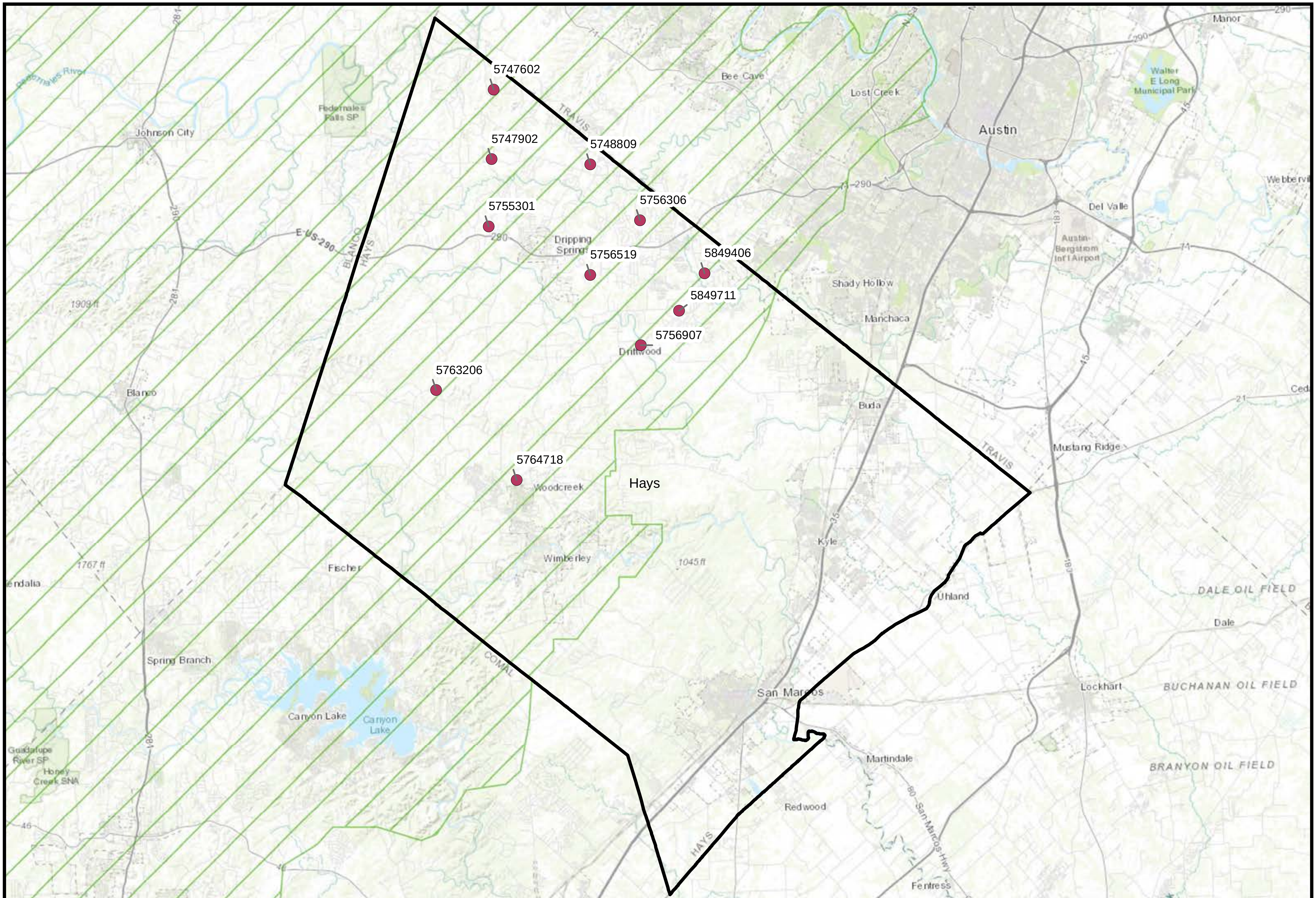


Aquifer

218GLRS - Glen Rose Limestone

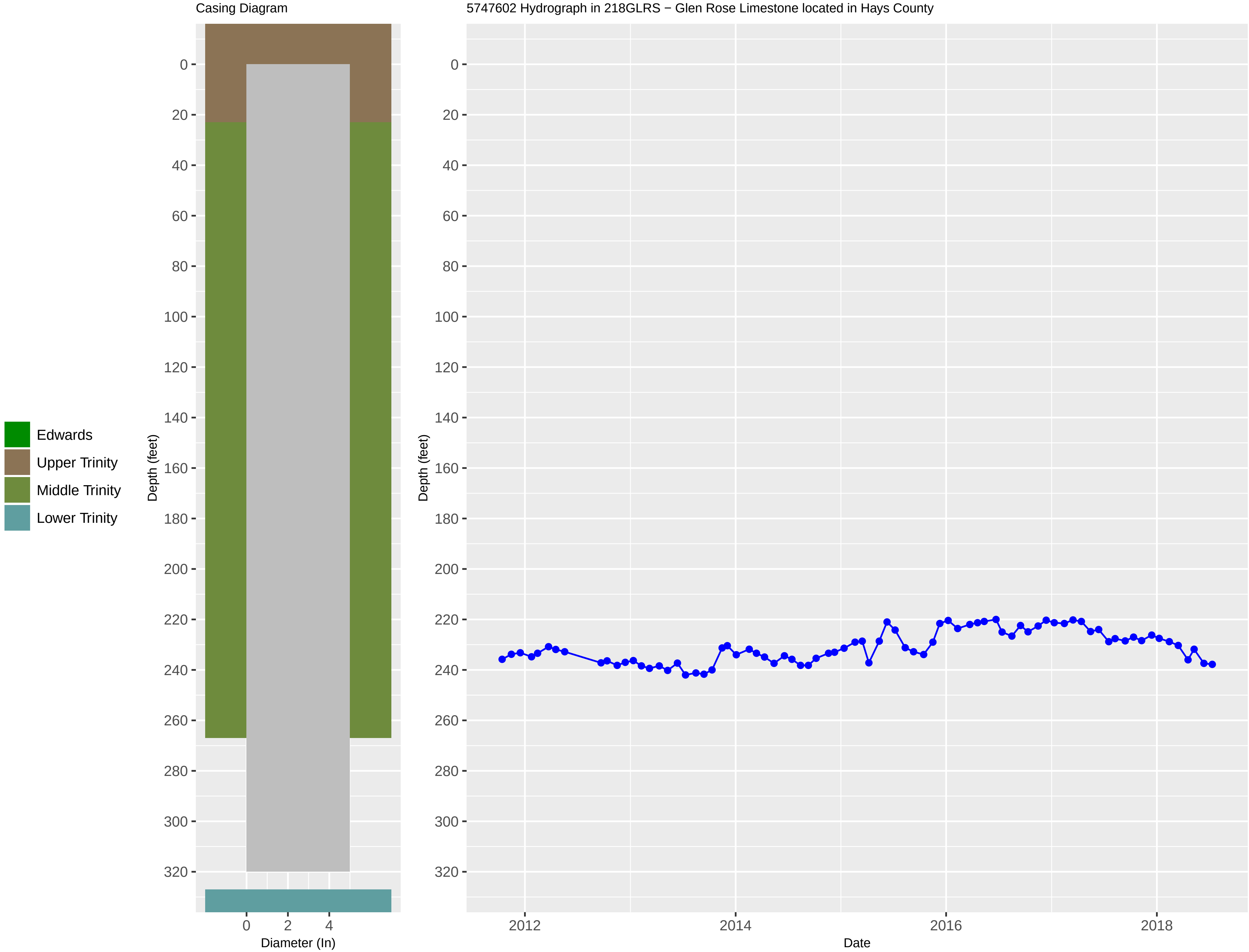
GMA 9

N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Hays County
218GLRS
Glen Rose Limestone



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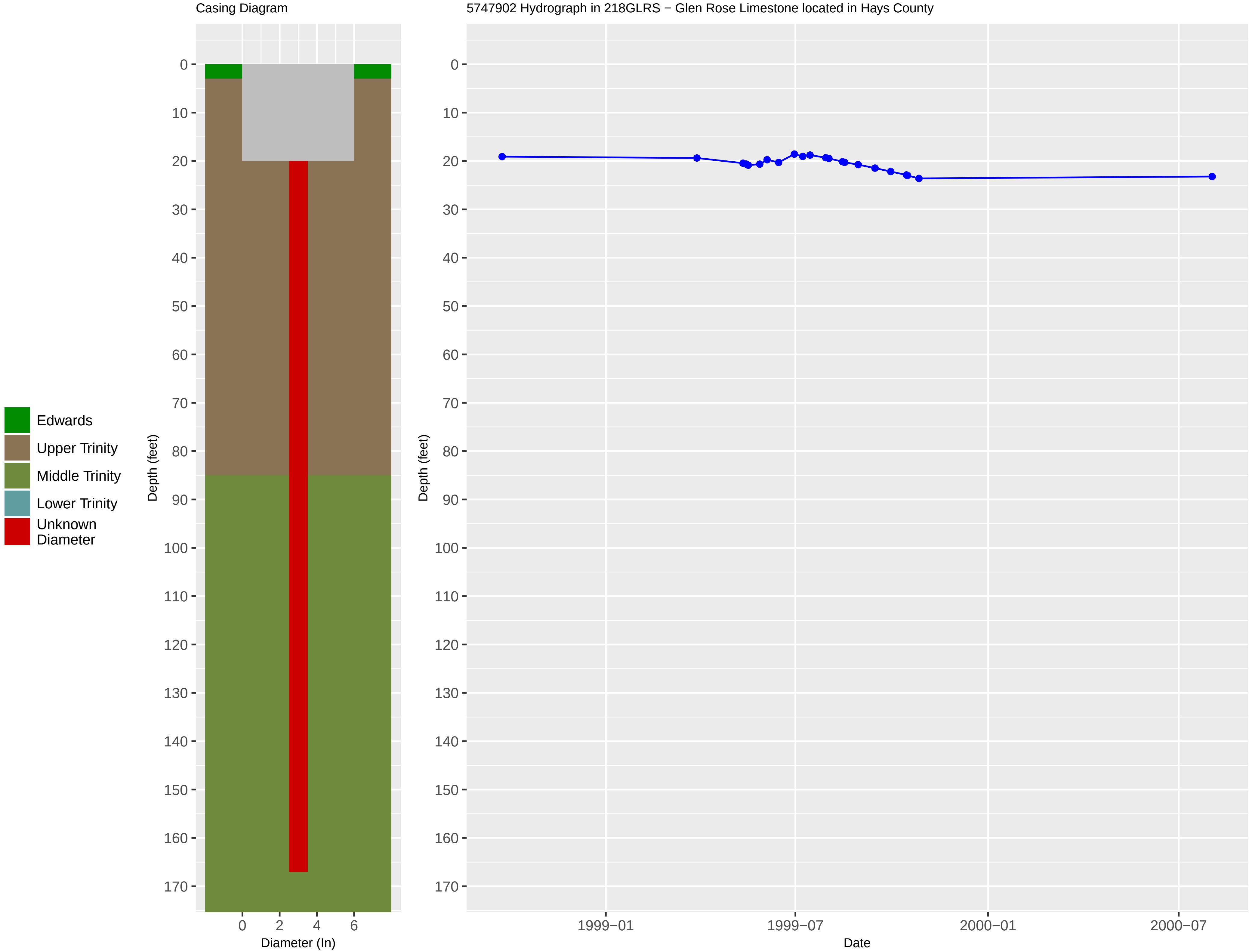

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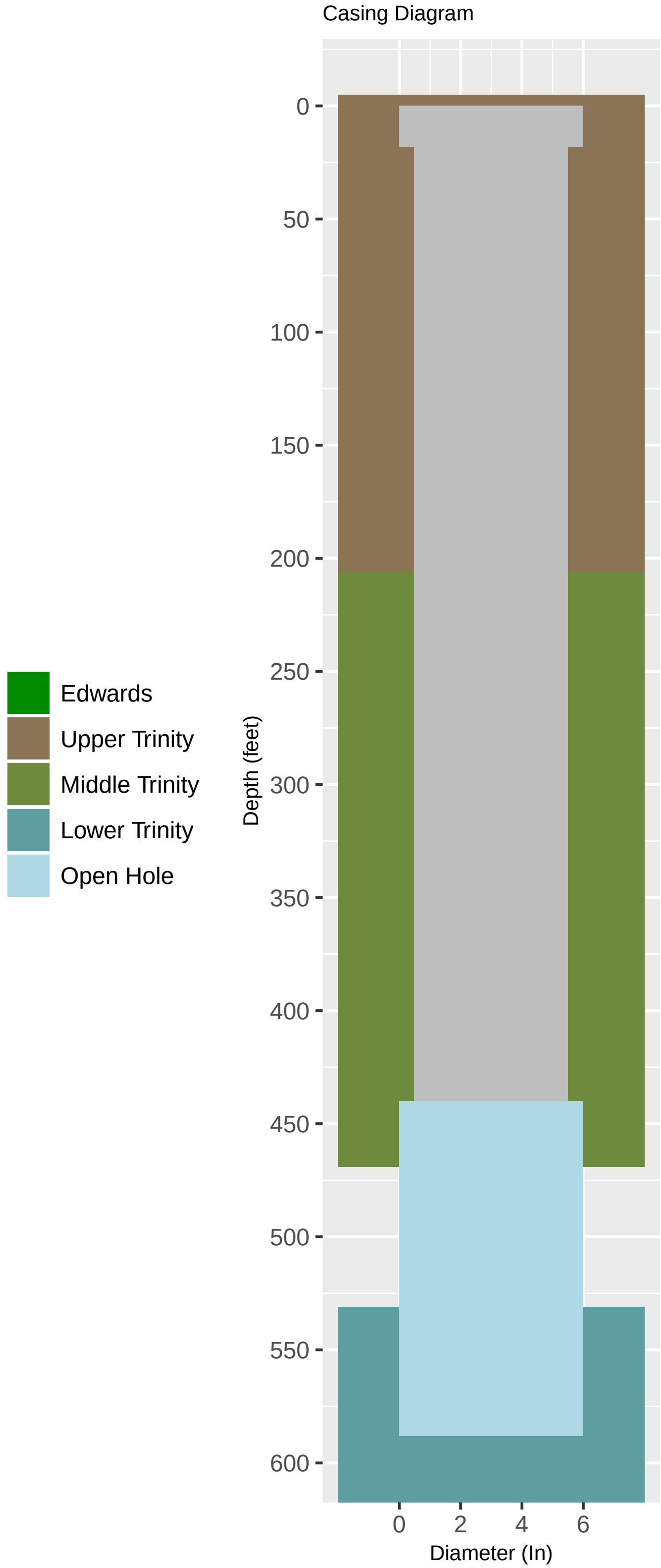

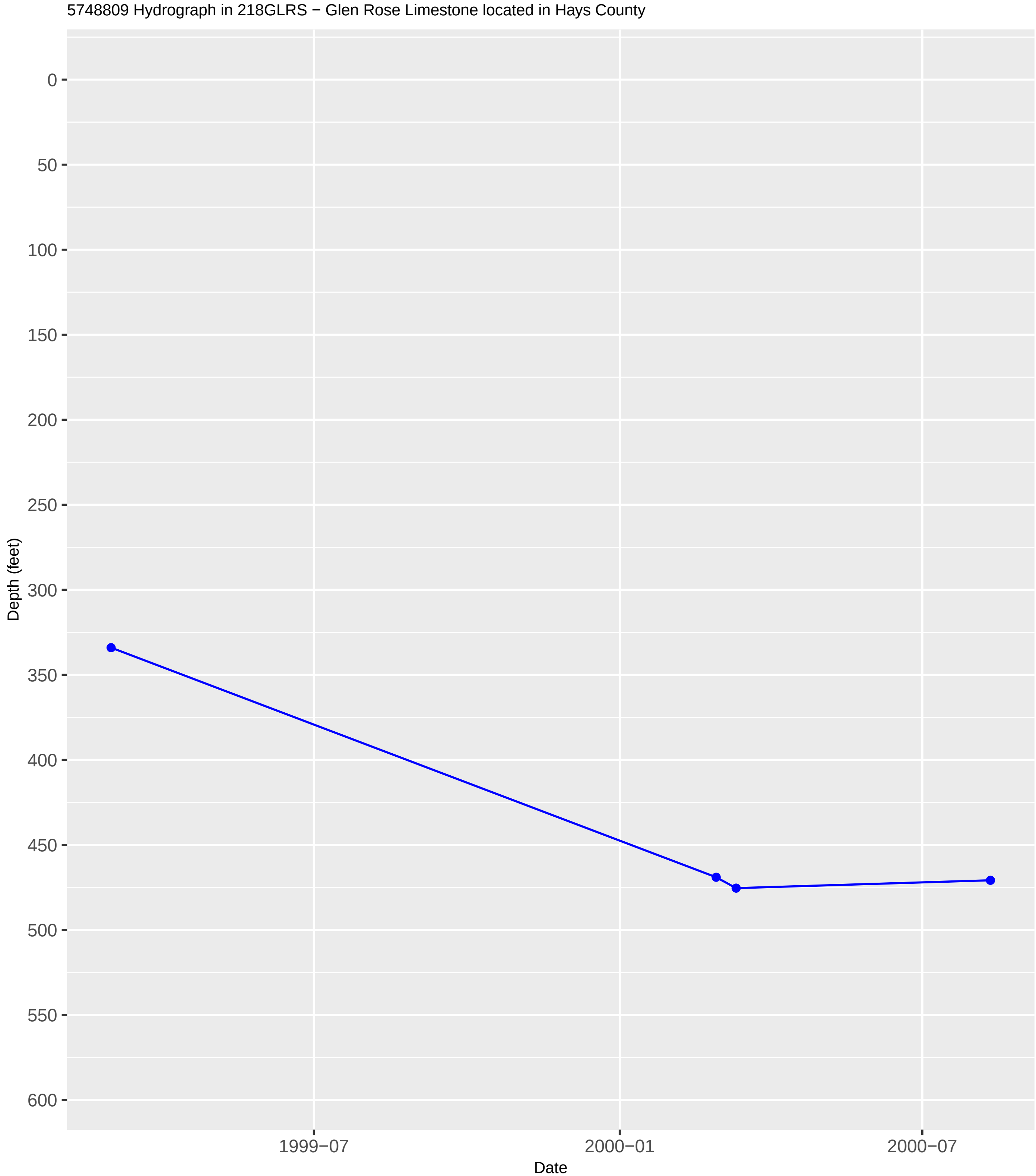

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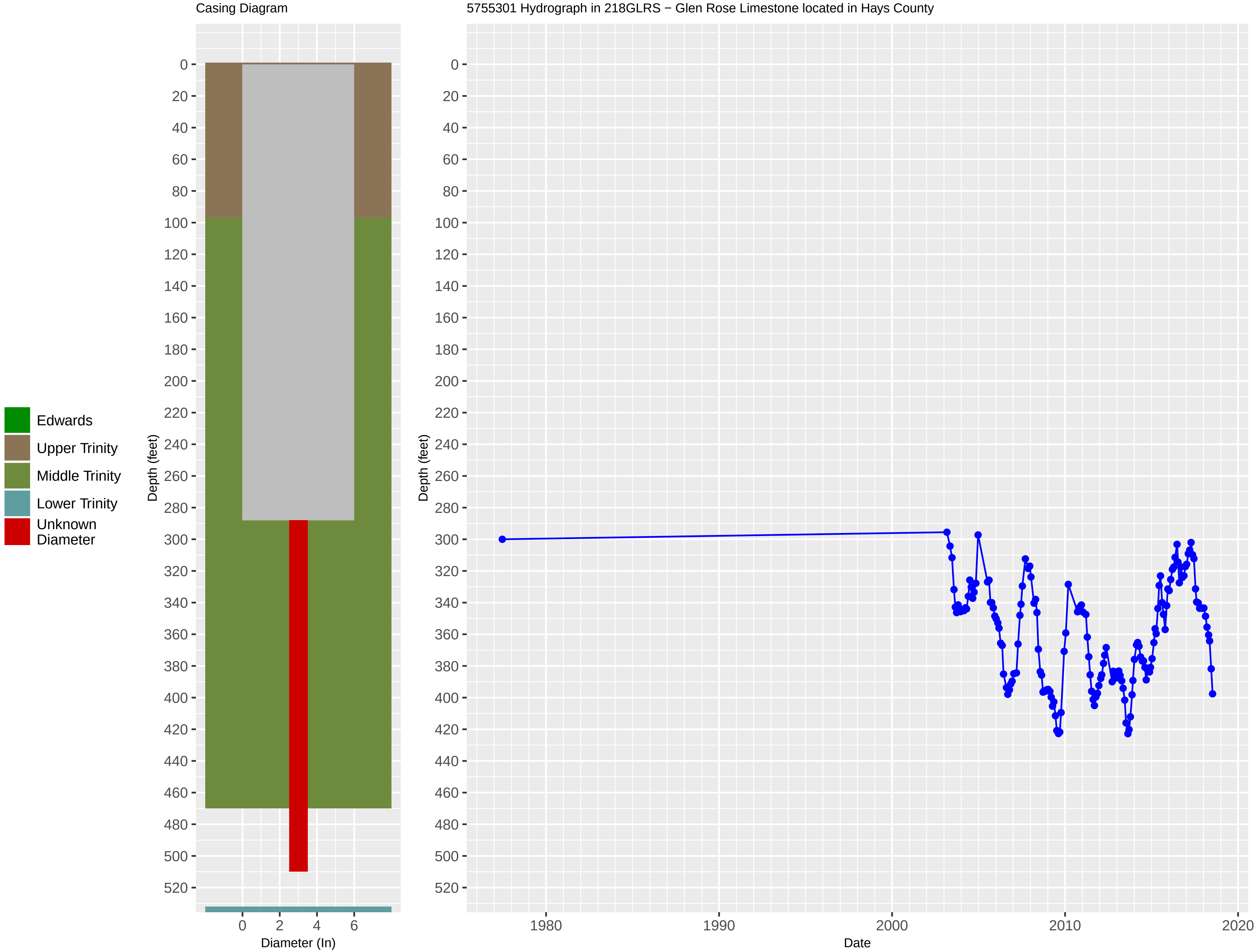

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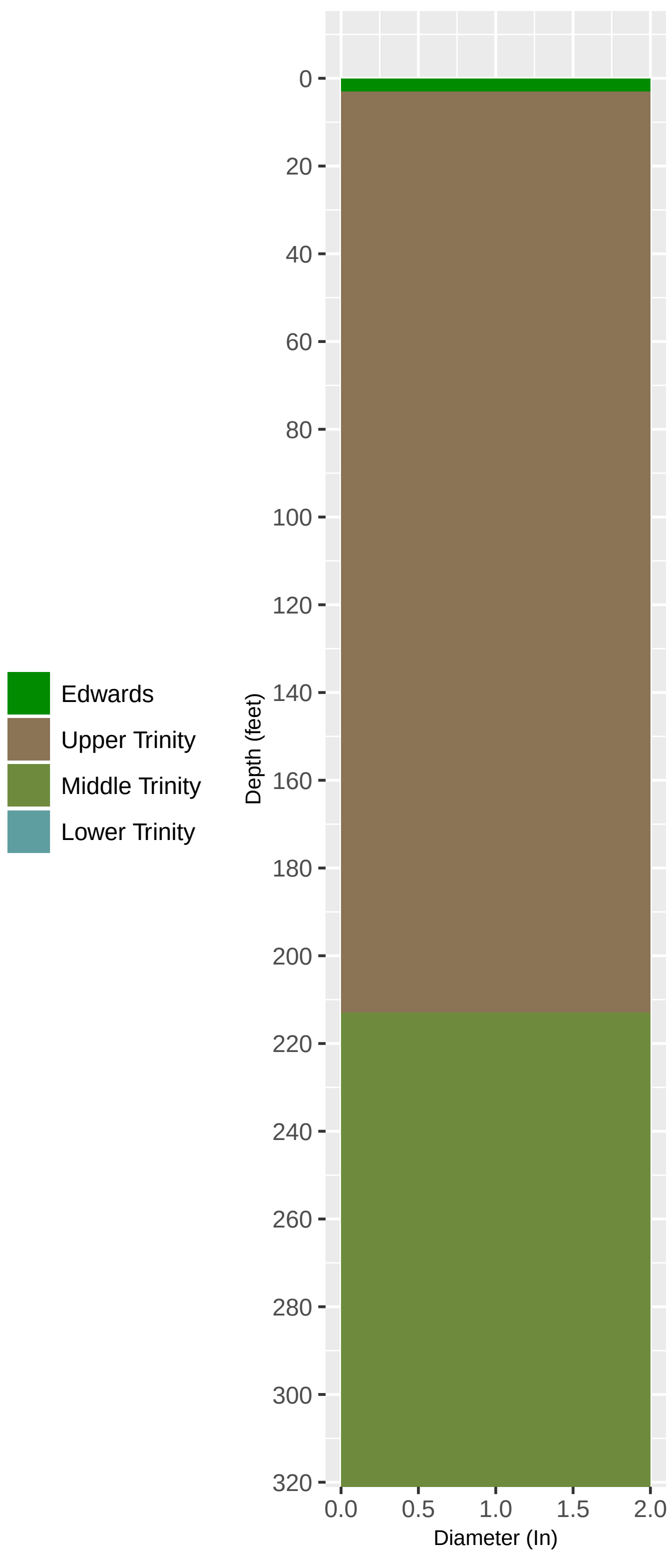
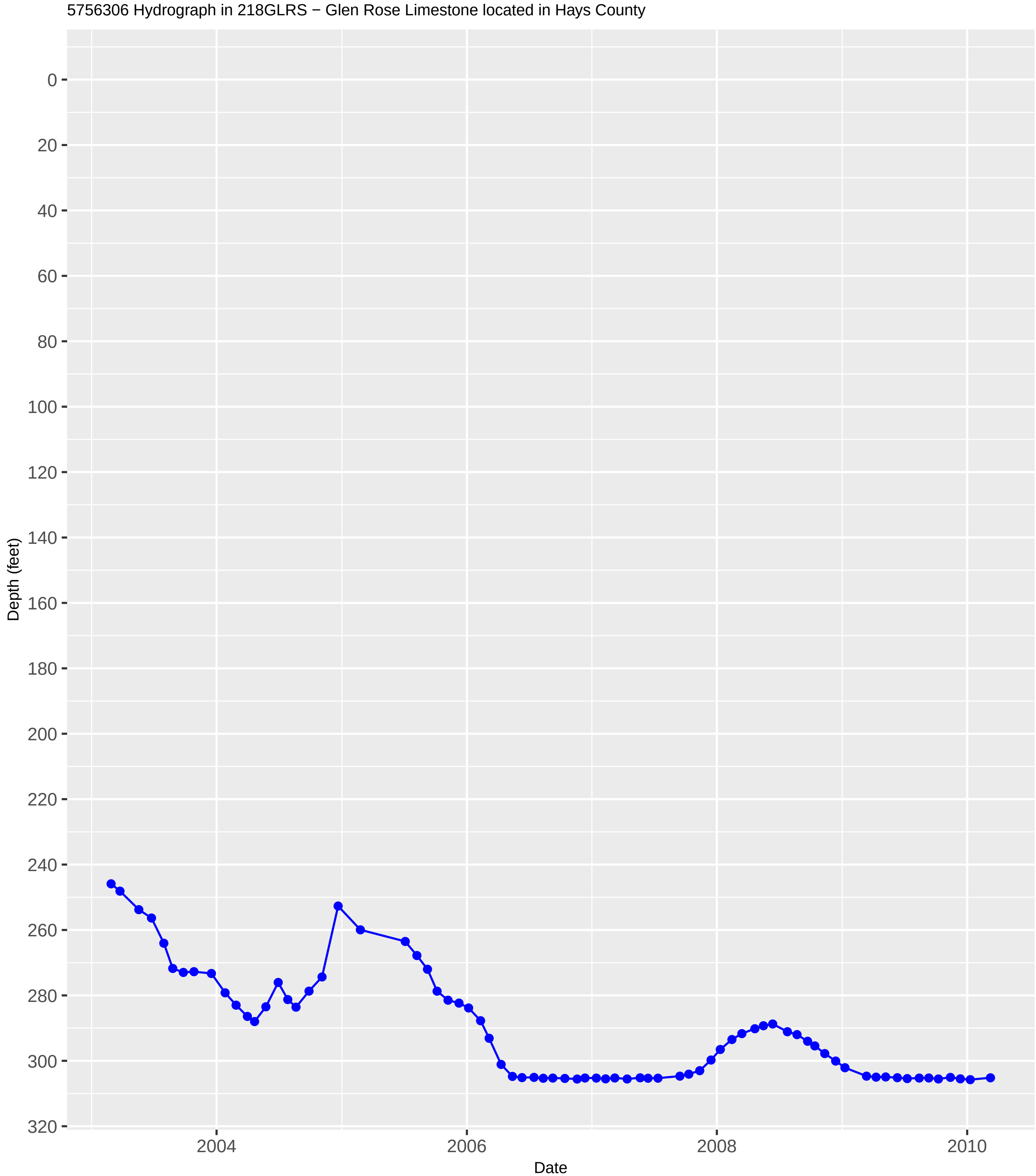
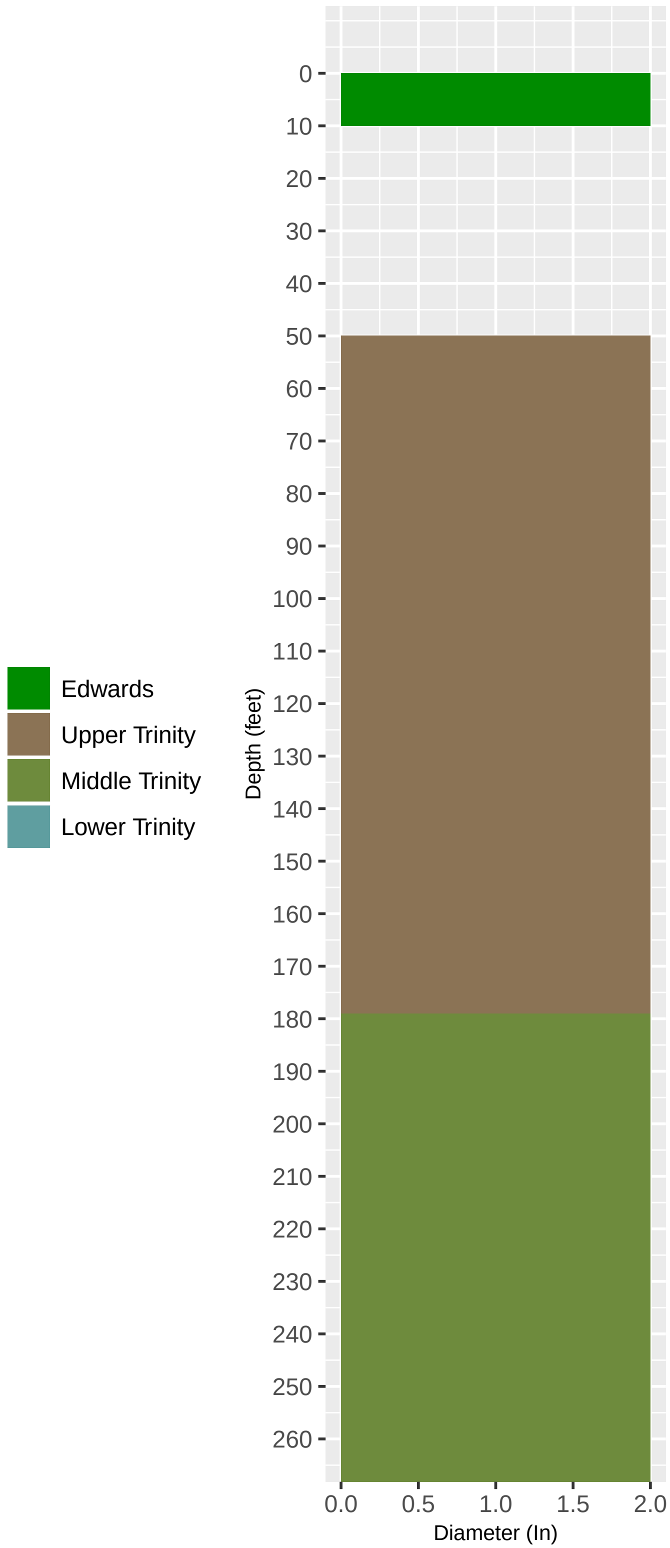


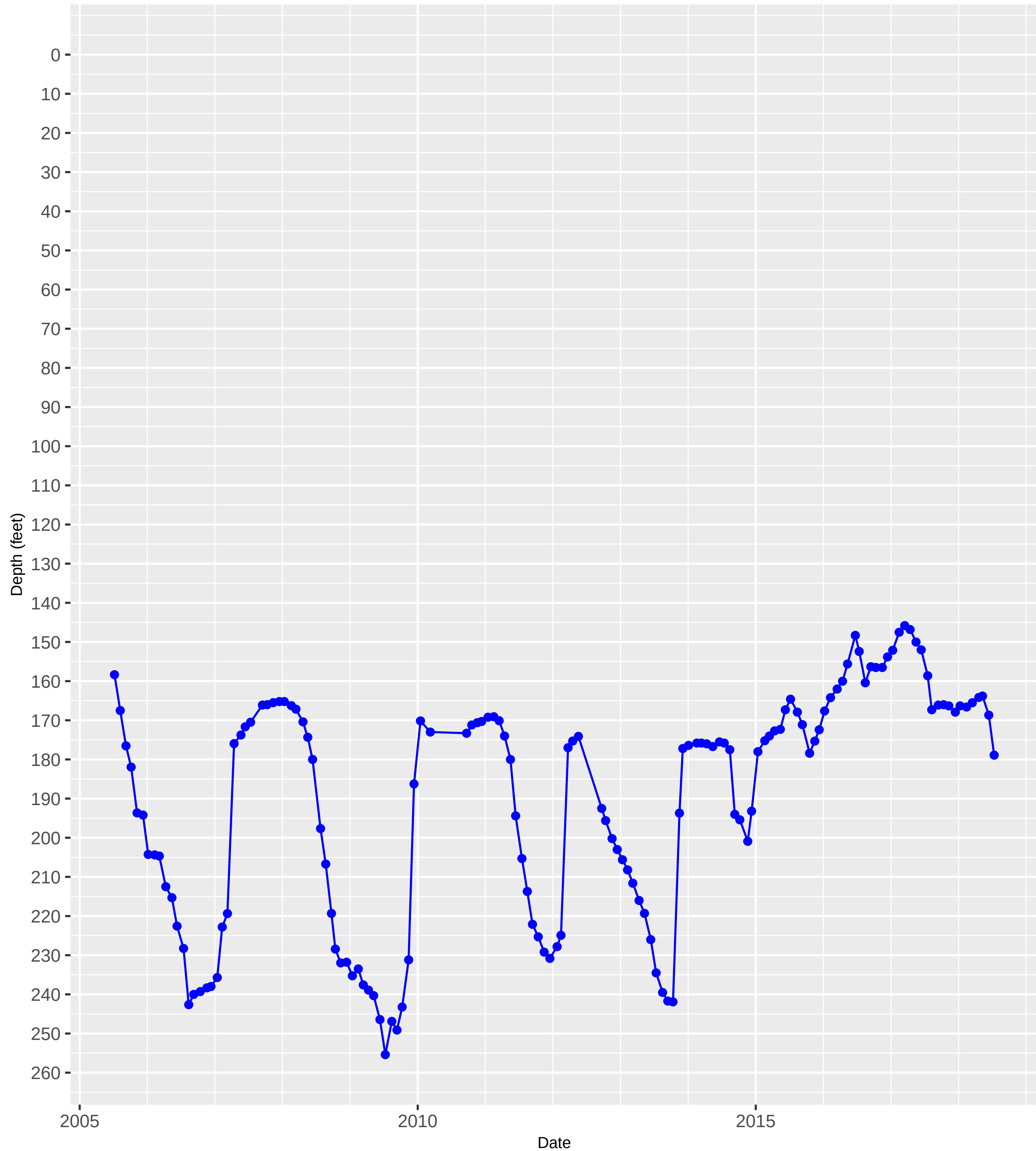


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

5756519 Hydrograph in 218GLRS − Glen Rose Limestone located in Hays County





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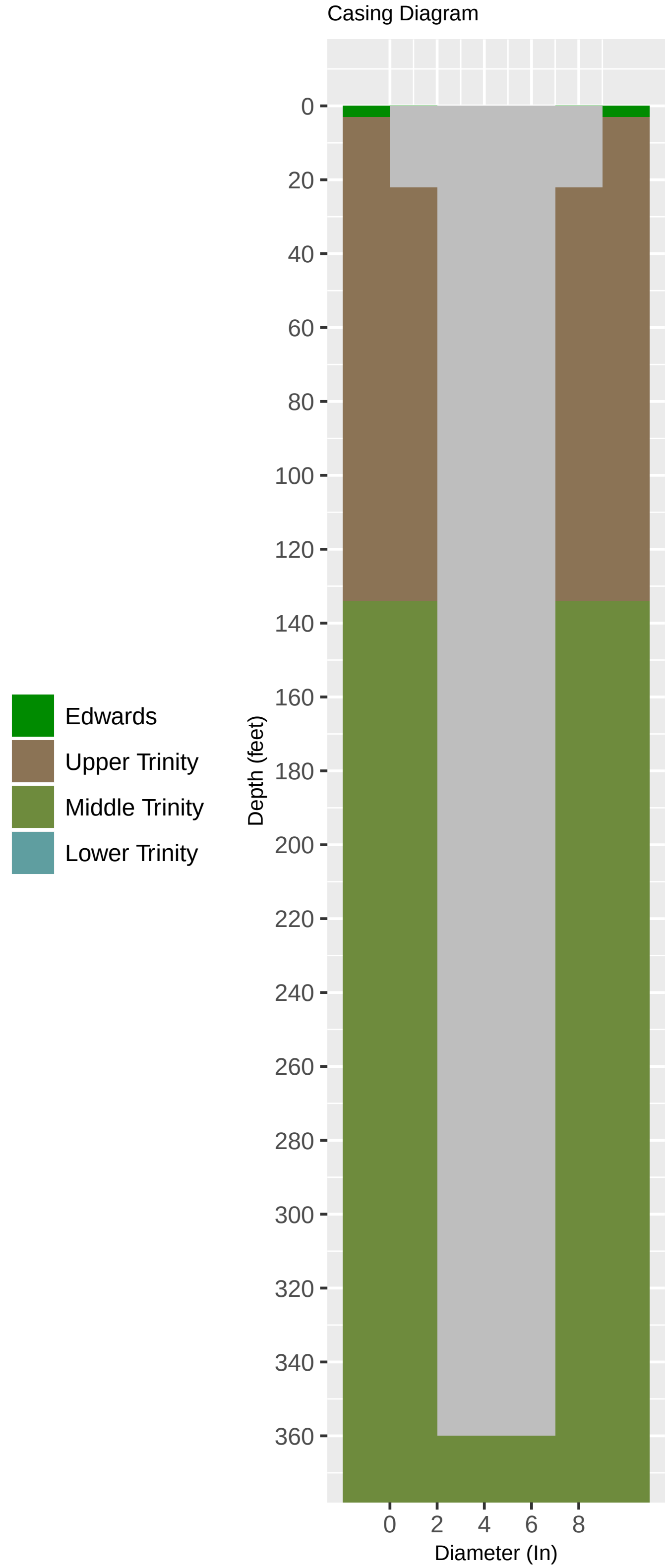

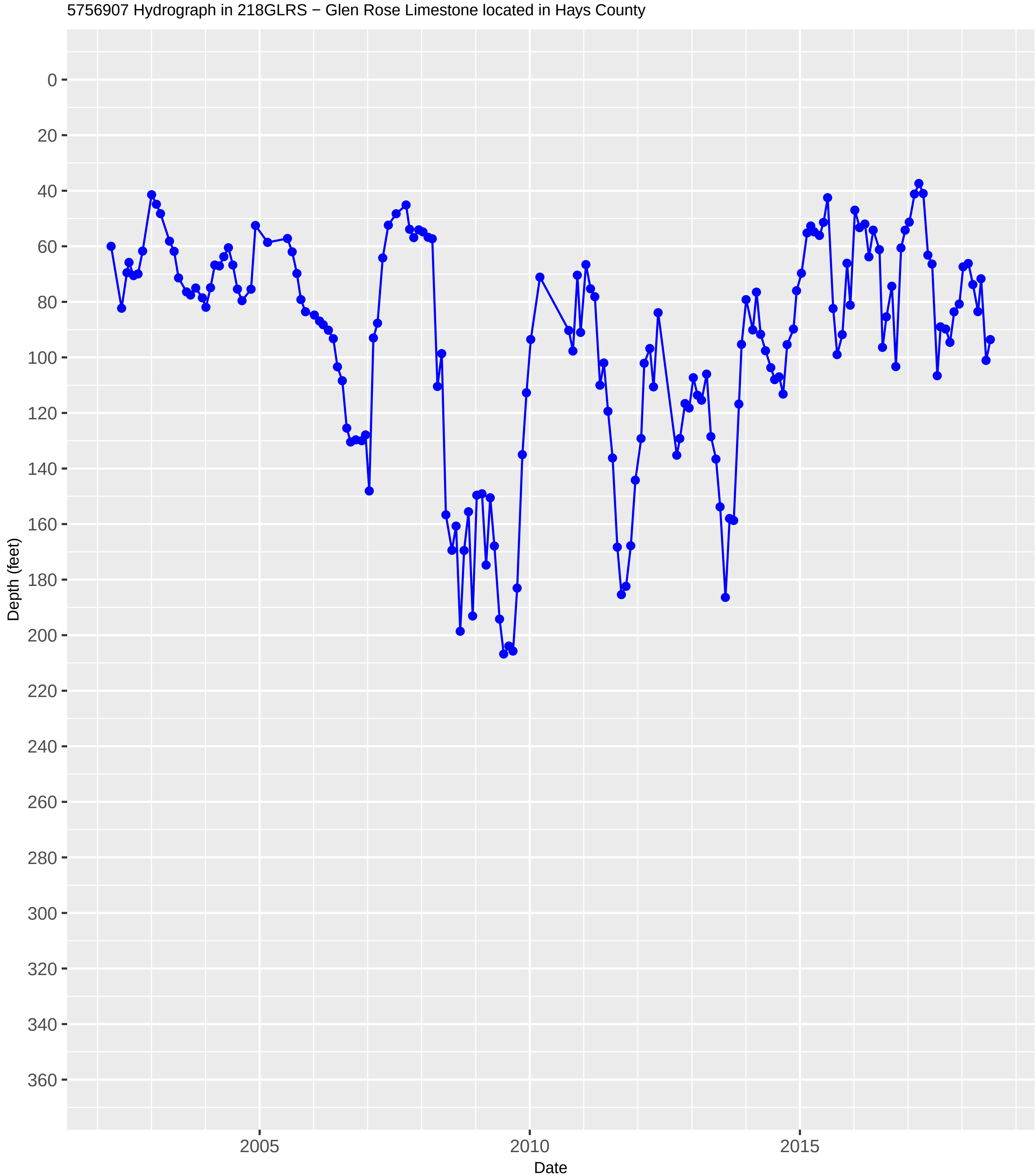

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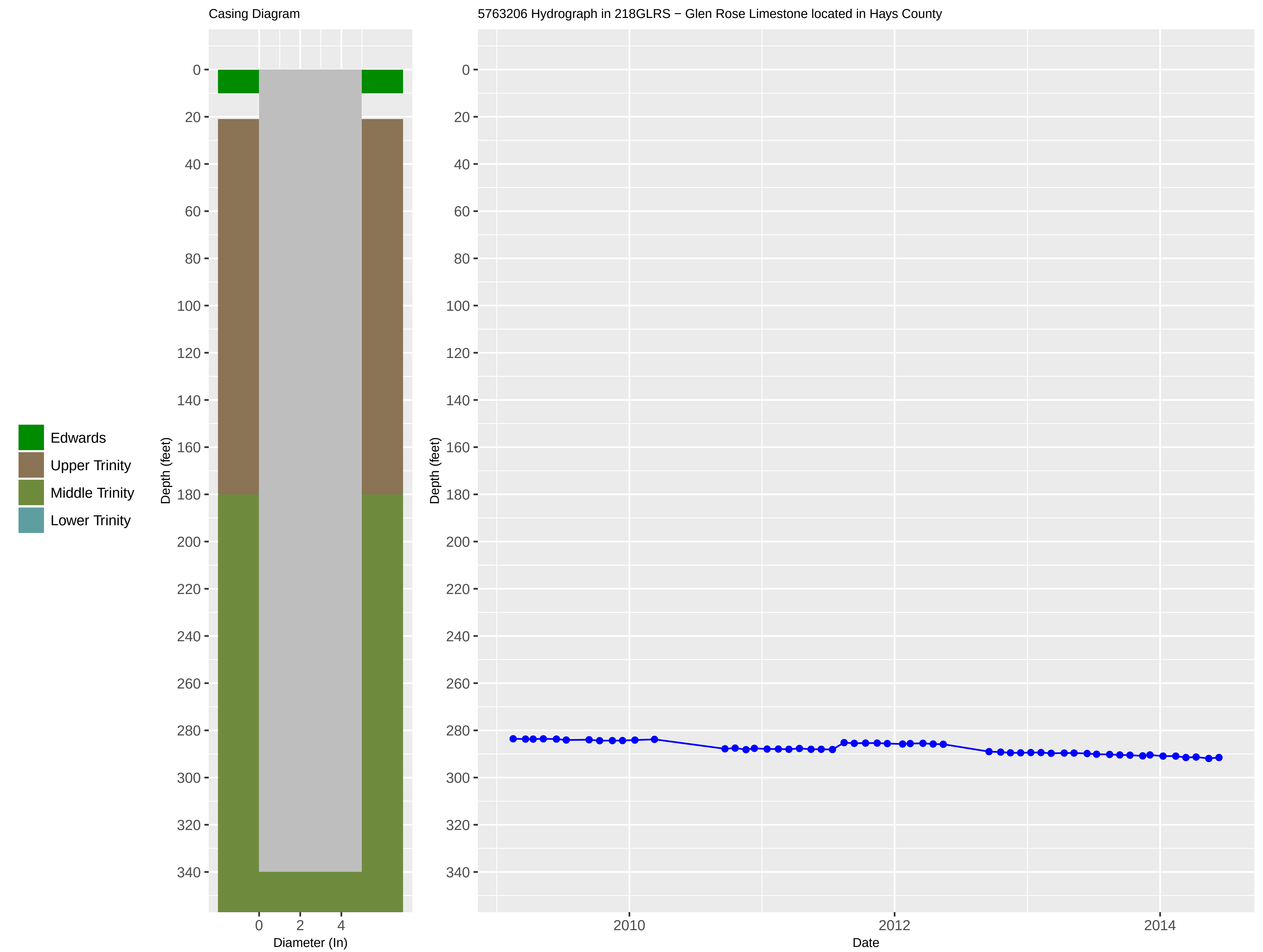

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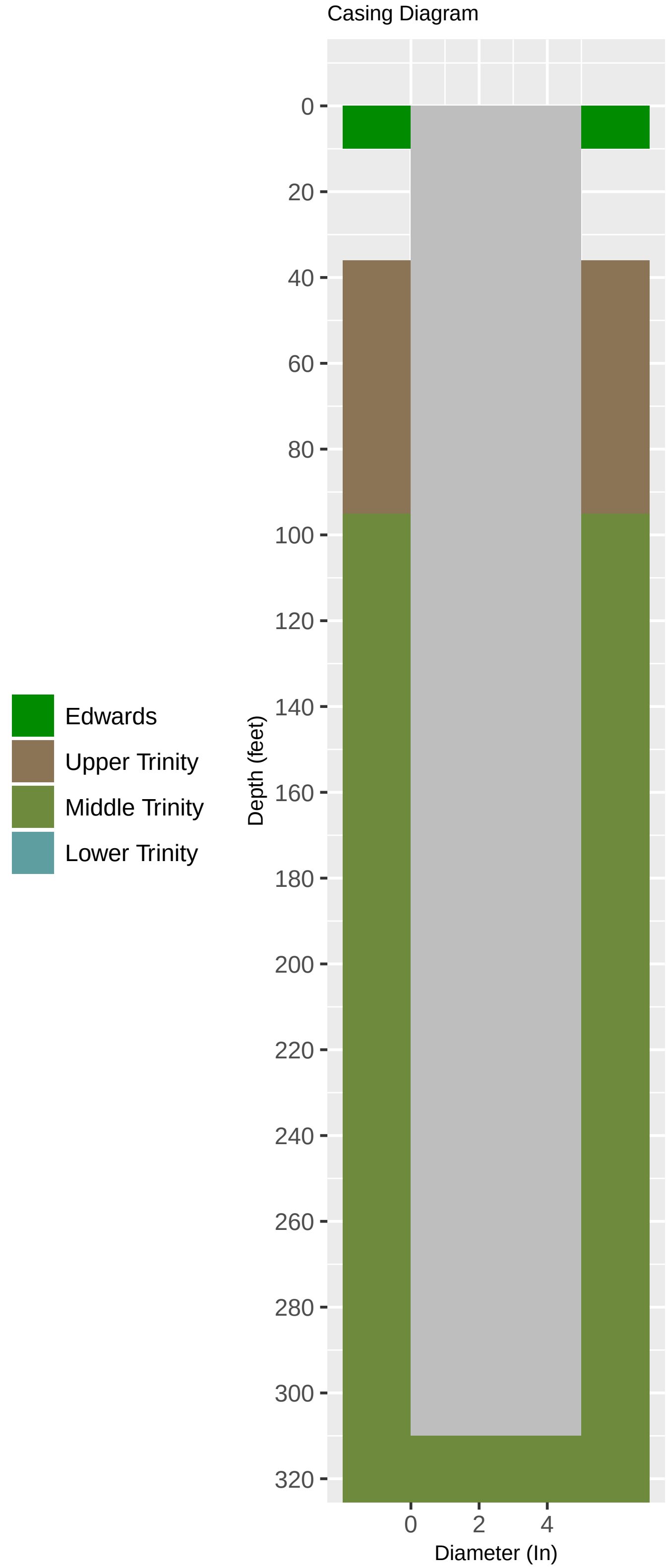

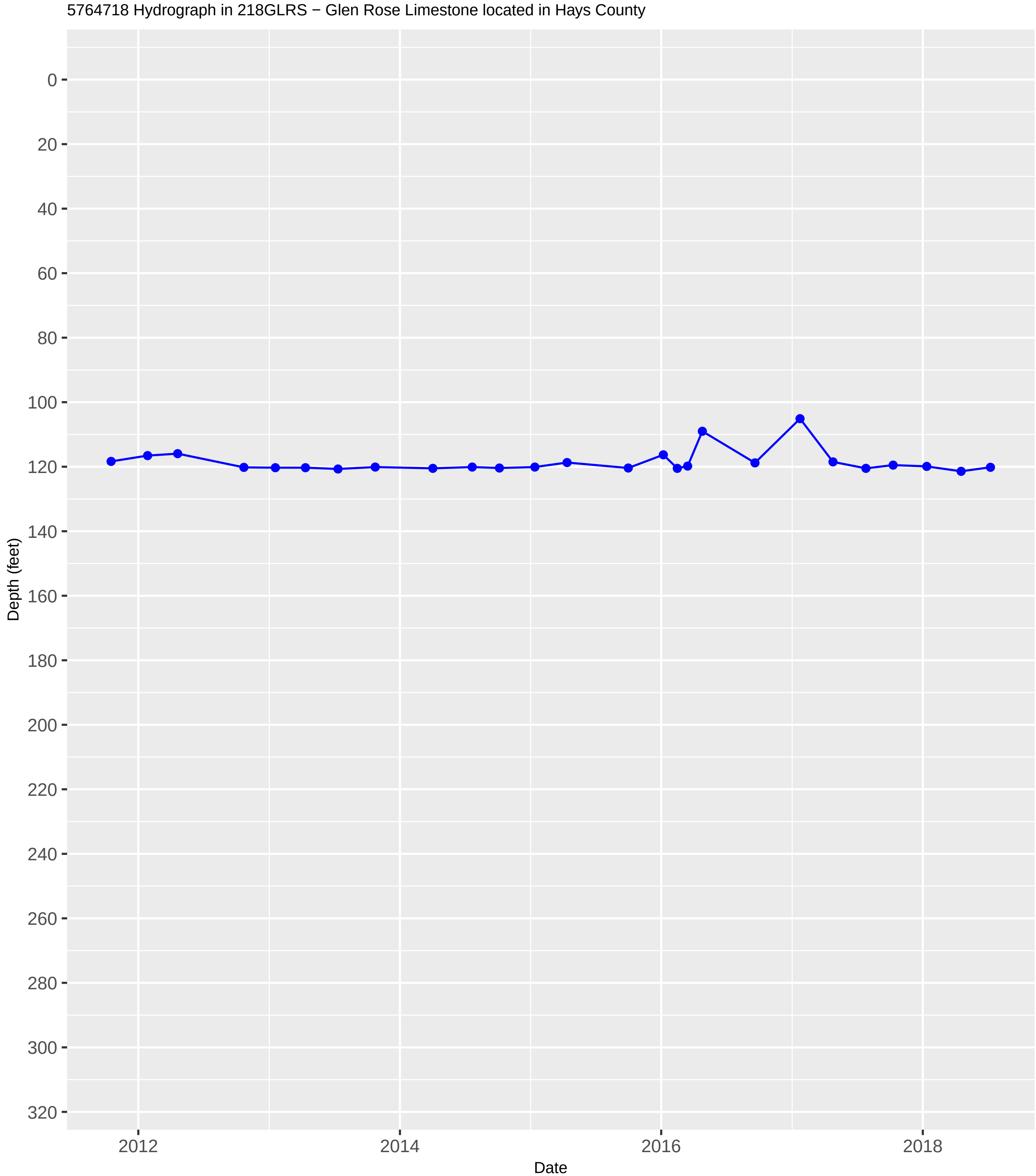

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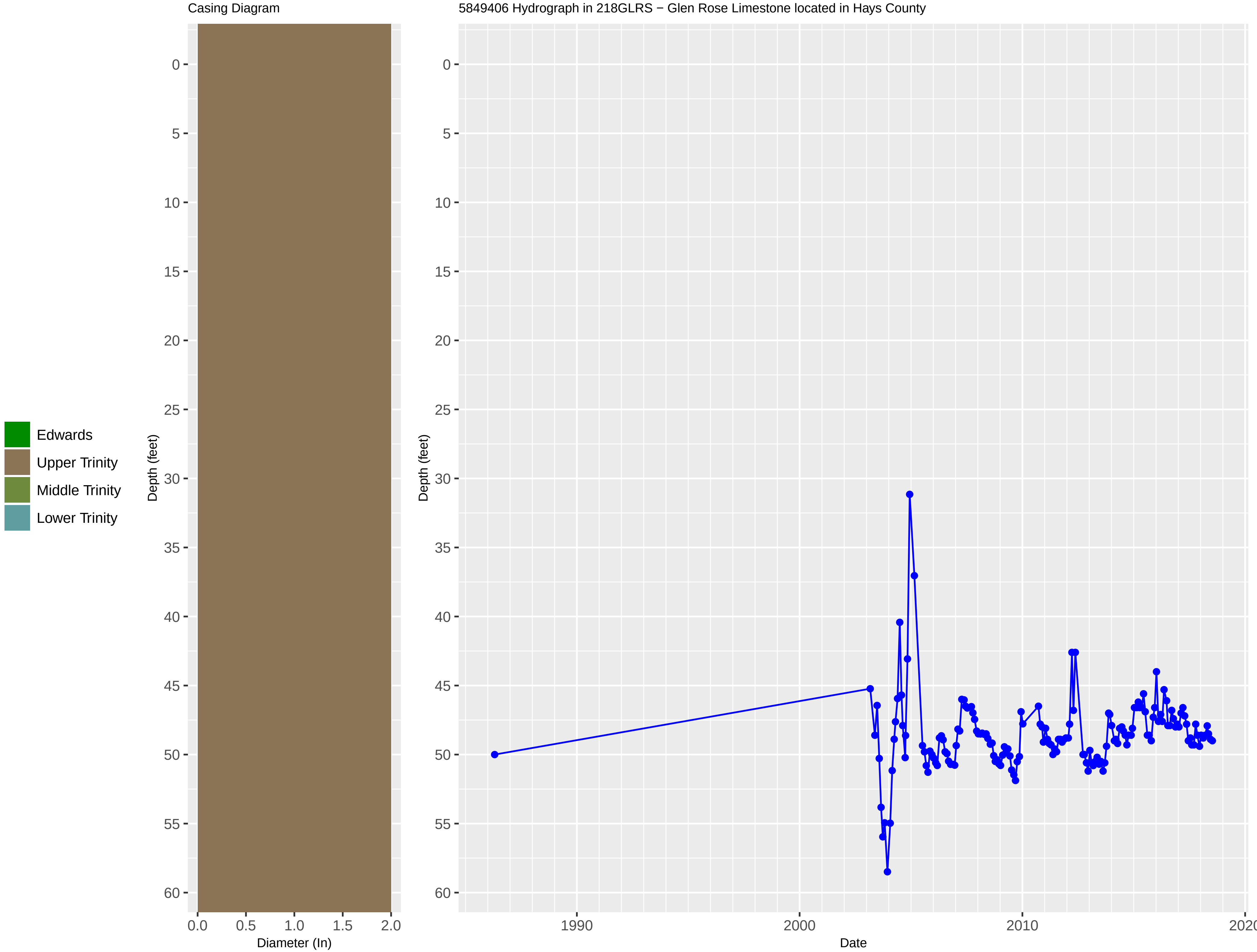

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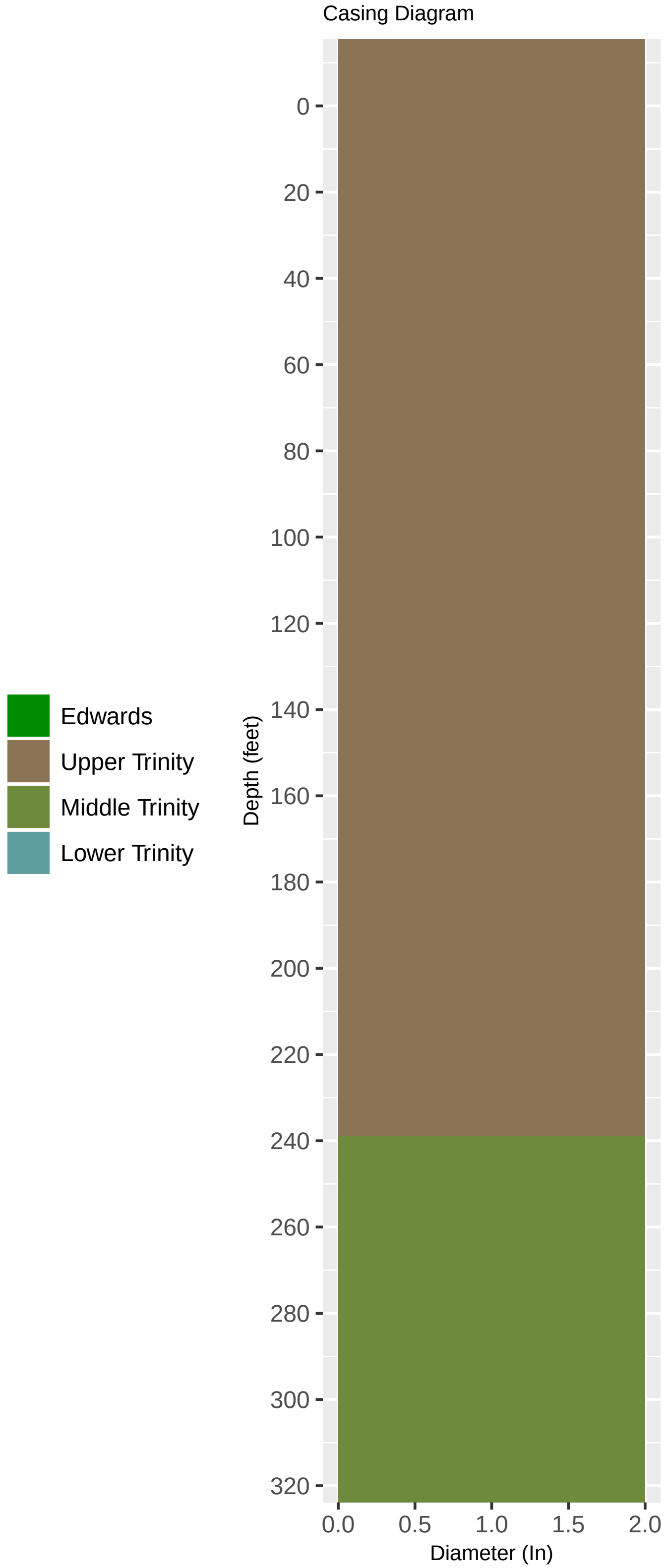

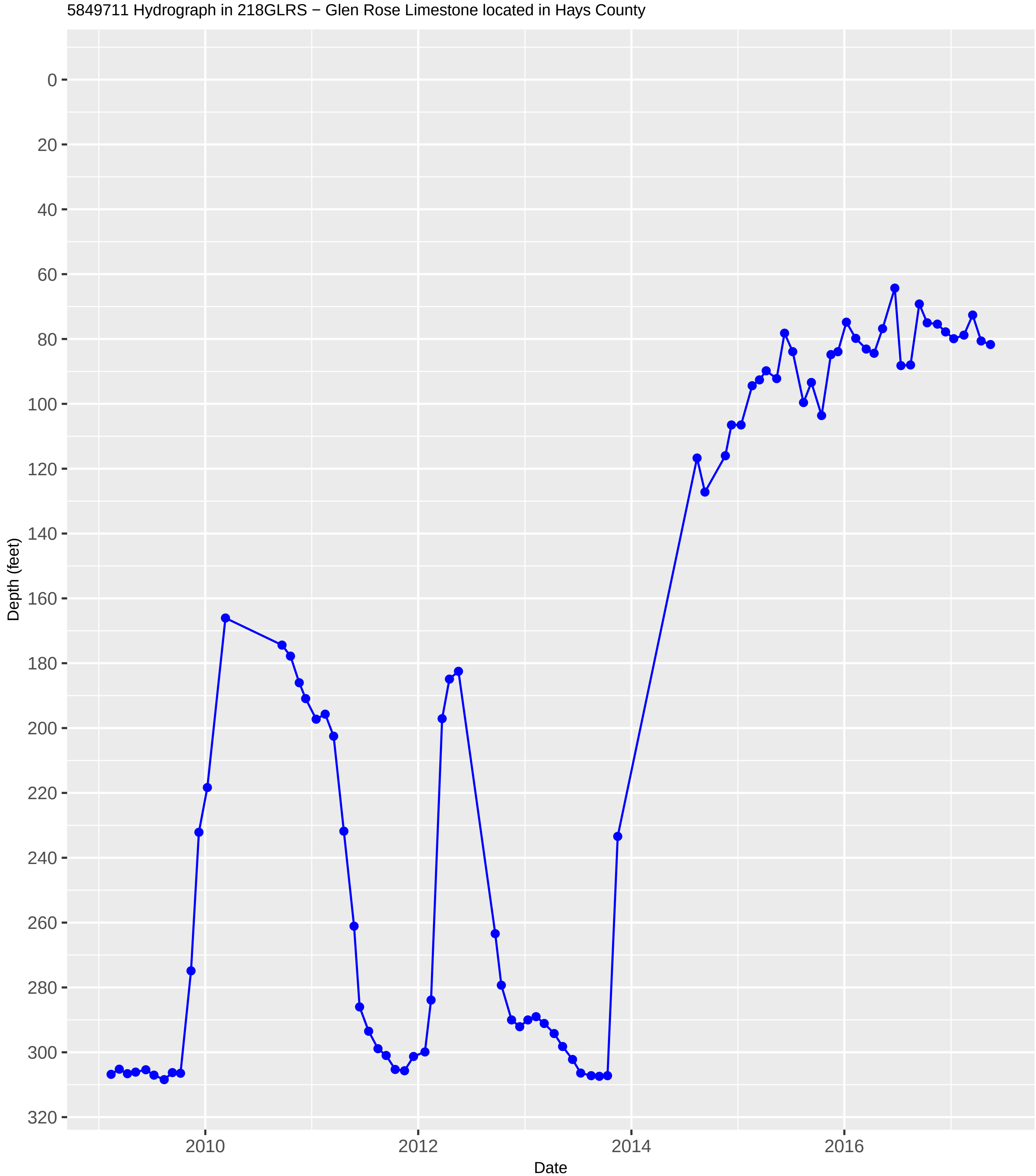

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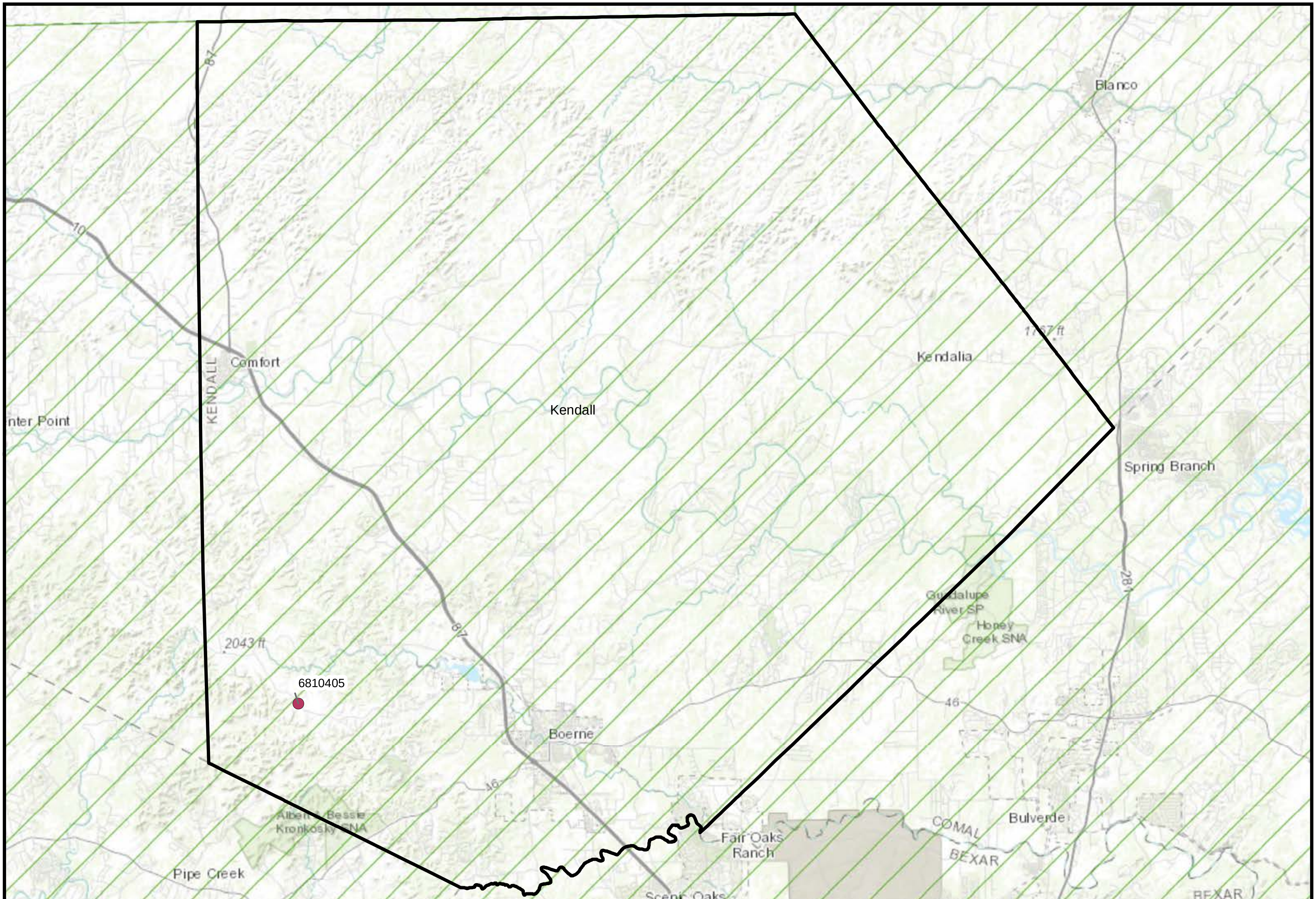


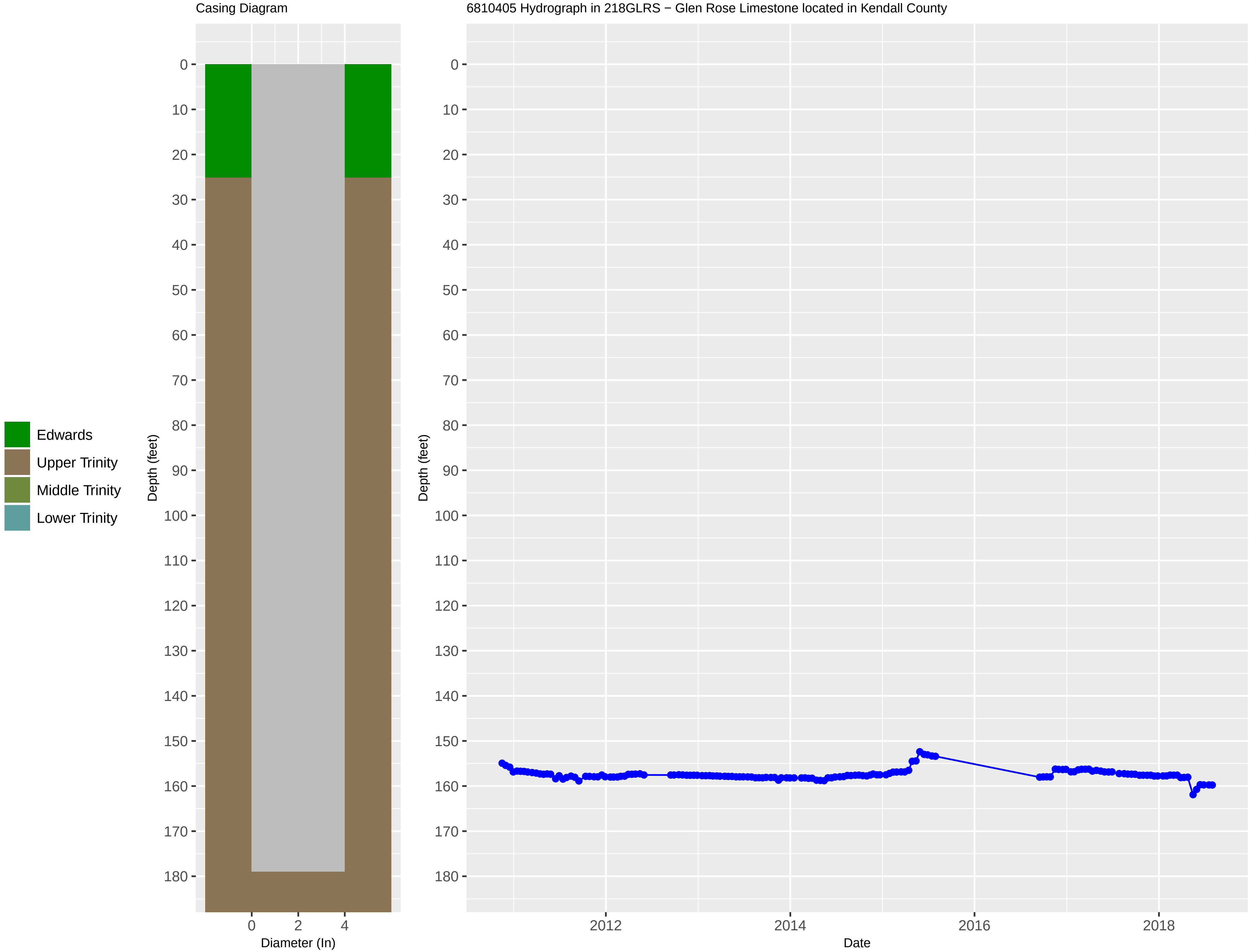
Aquifer

● 218GLRS - Glen Rose Limestone

GMA 9

N
0 1 2 4
Miles

Map of Hydrograph Well Locations in Kendall County
218GLRS
Glen Rose Limestone



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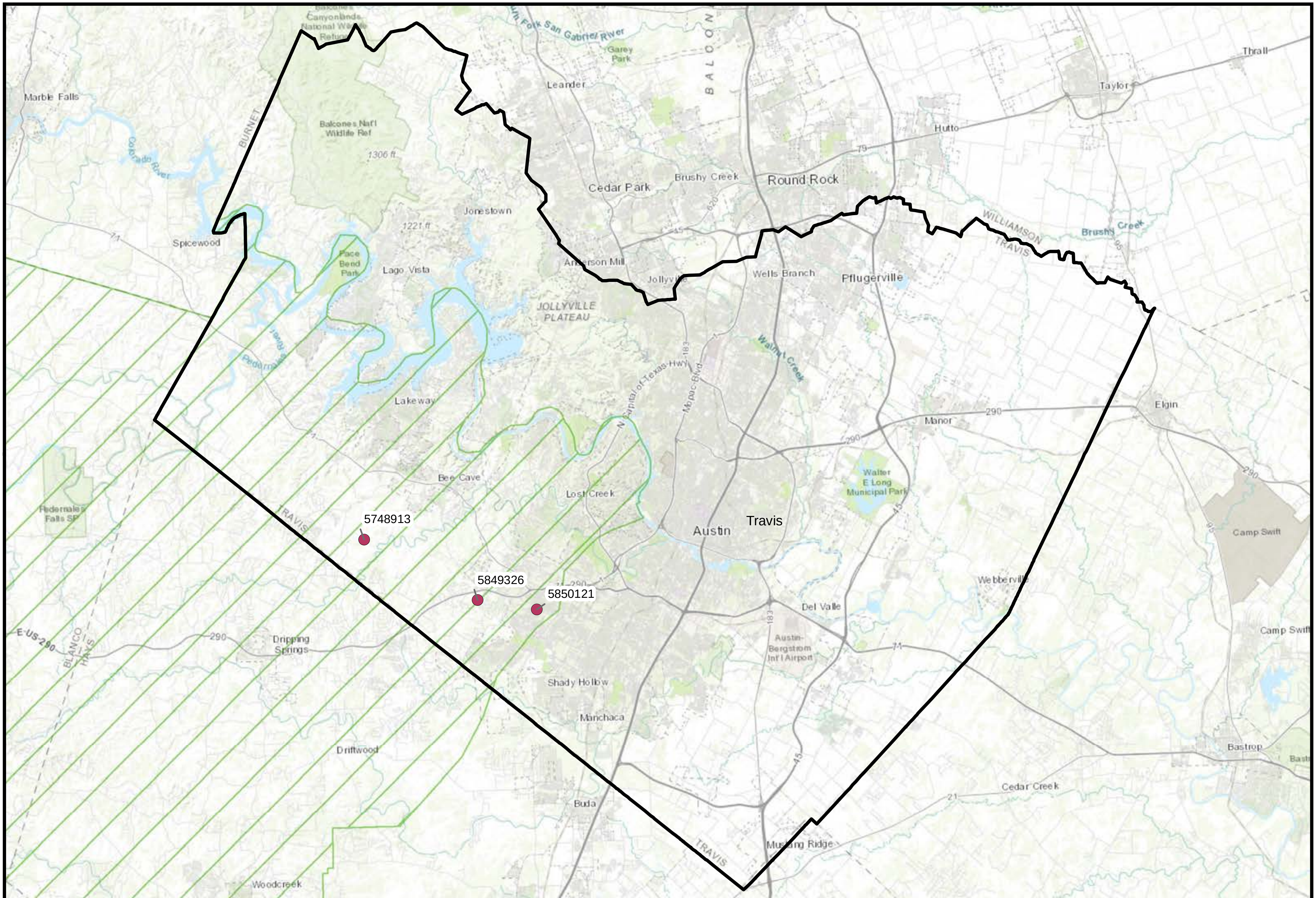


Aquifer

● 218GLRS - Glen Rose Limestone

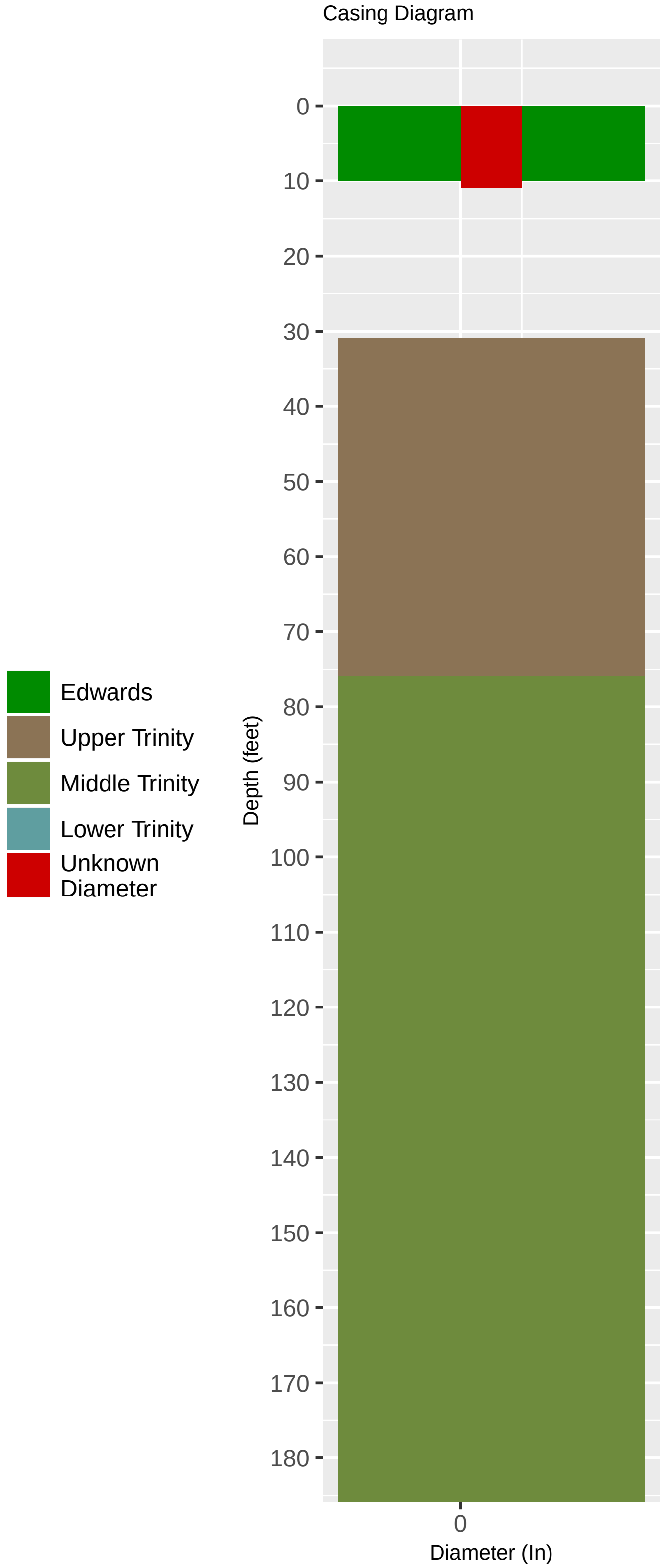
GMA 9

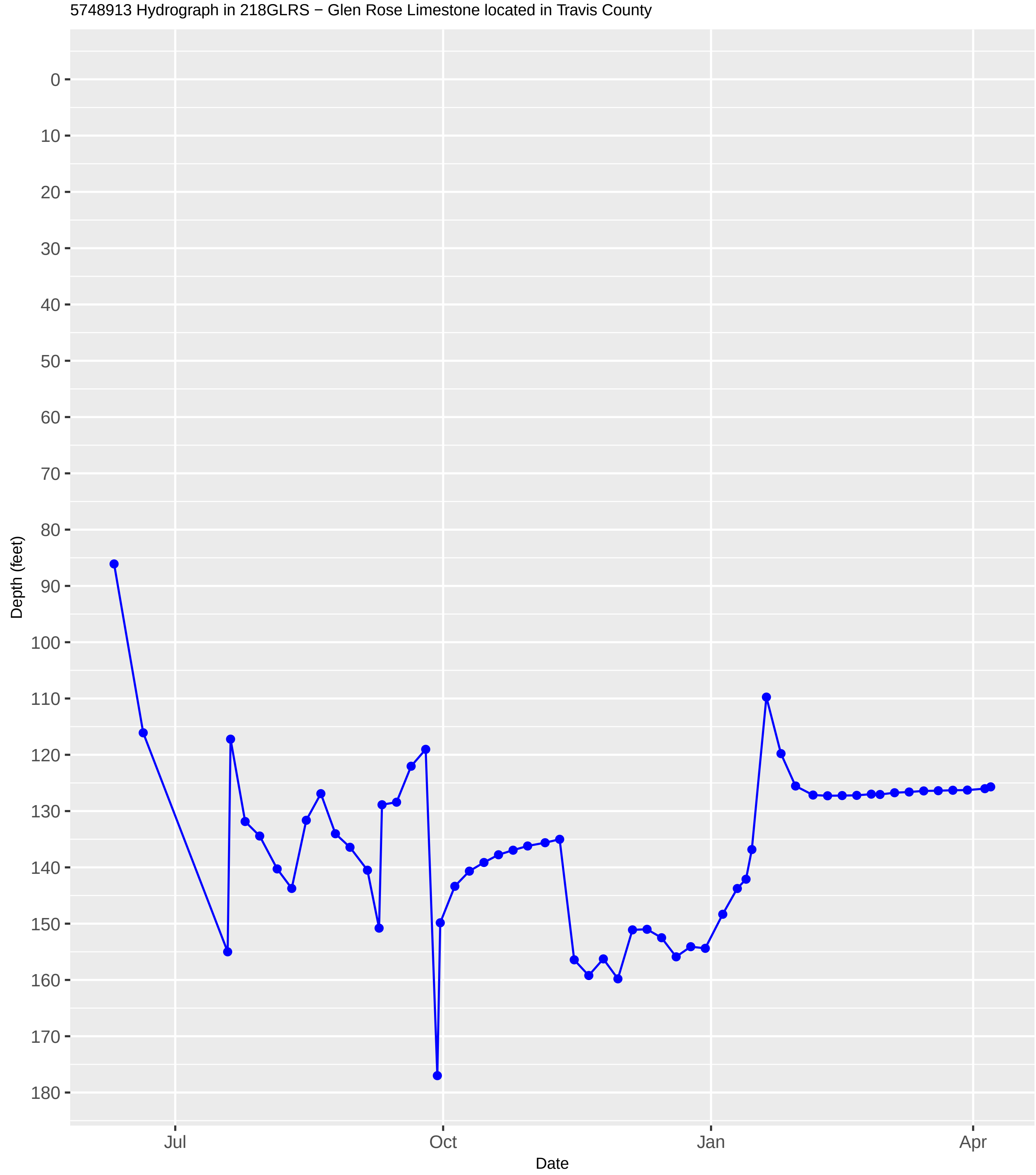
N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Travis County
218GLRS
Glen Rose Limestone





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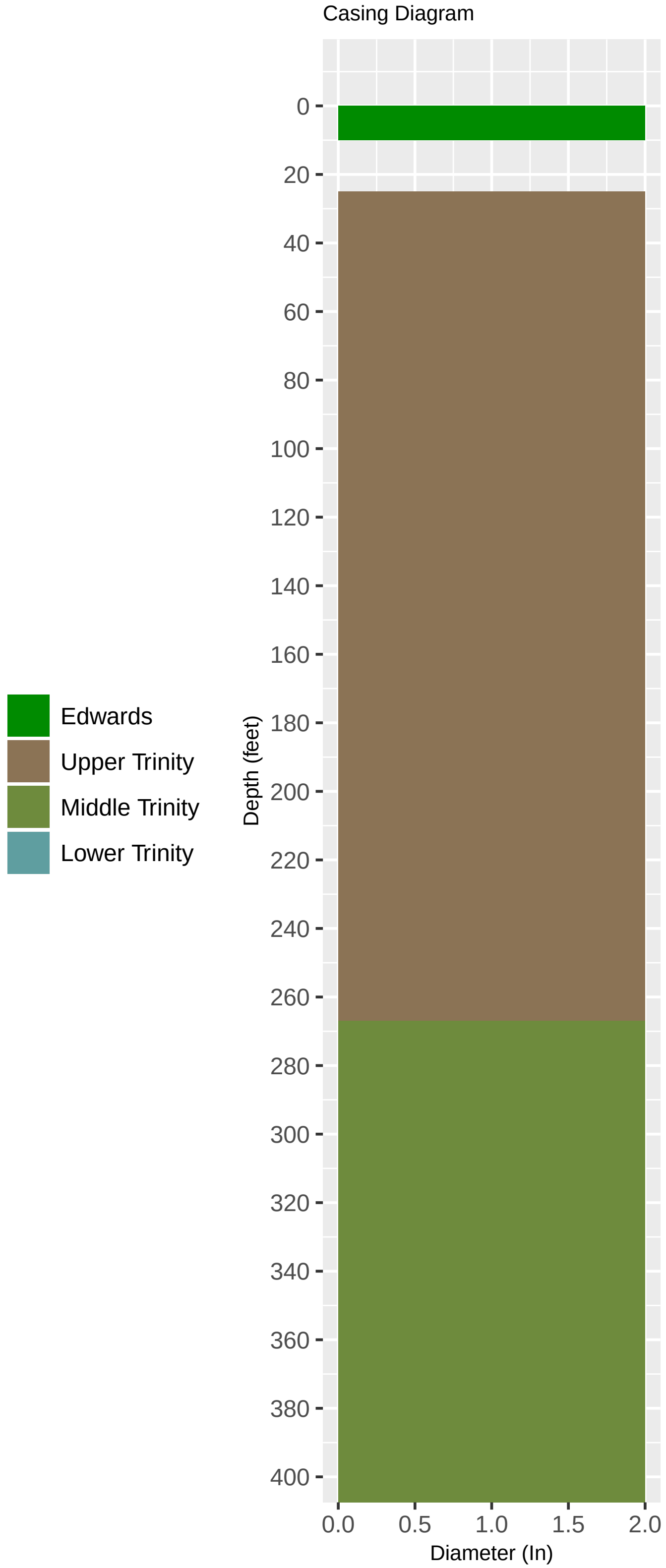
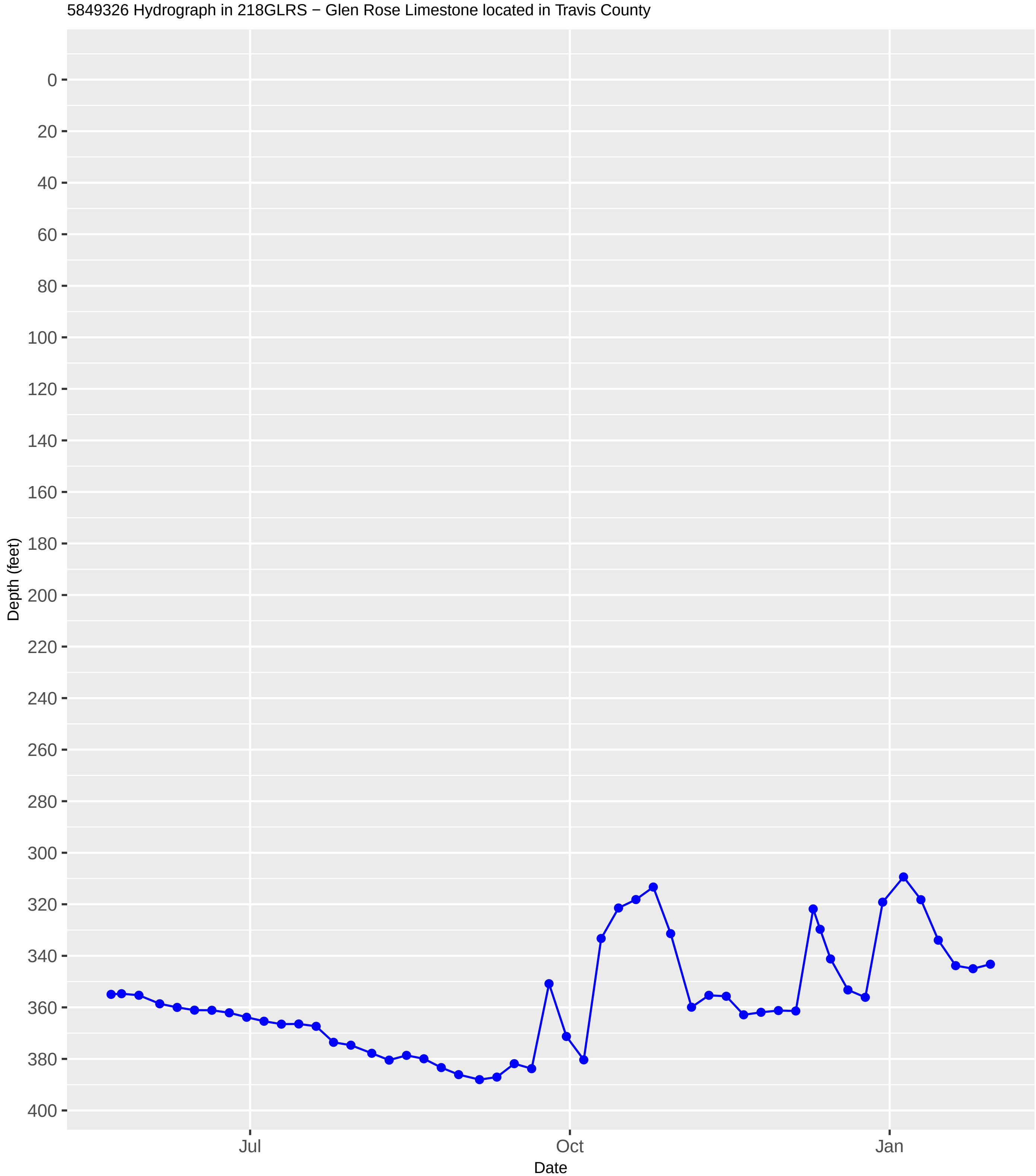
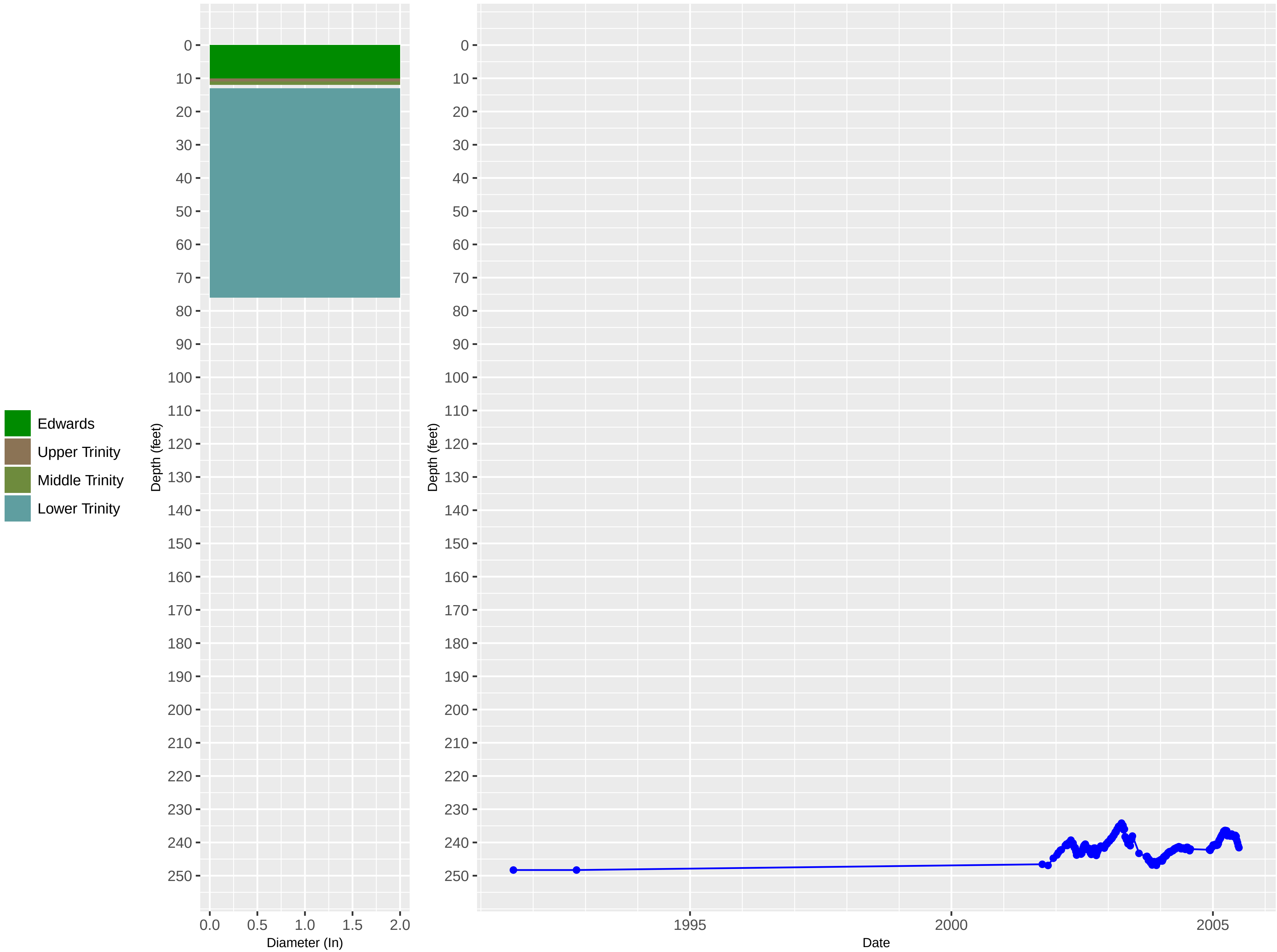




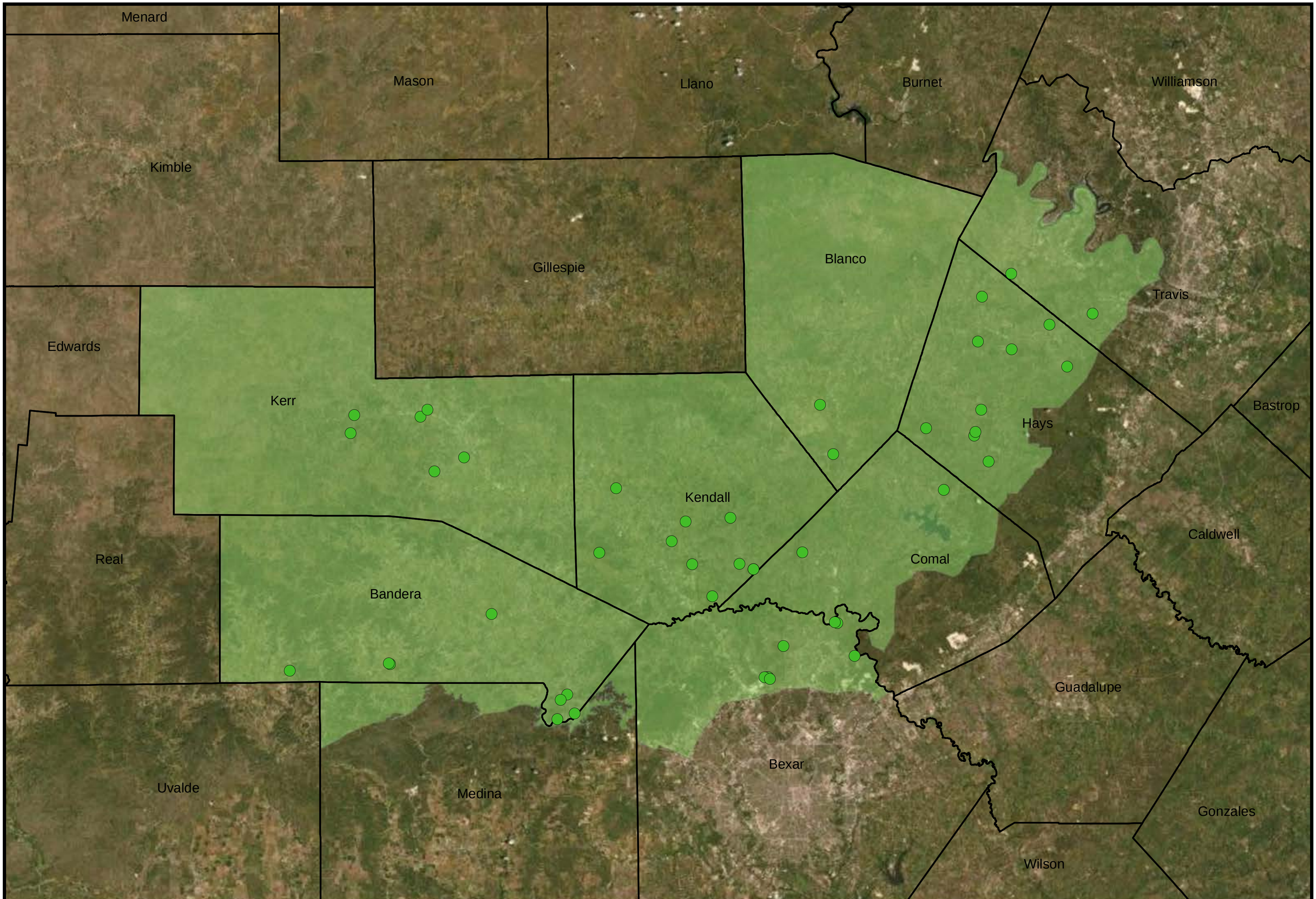
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

5850121 Hydrograph in 218GLRS − Glen Rose Limestone located in Travis County



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



Aquifer

218GLRSL - Glen Rose Limestone, Lower Member

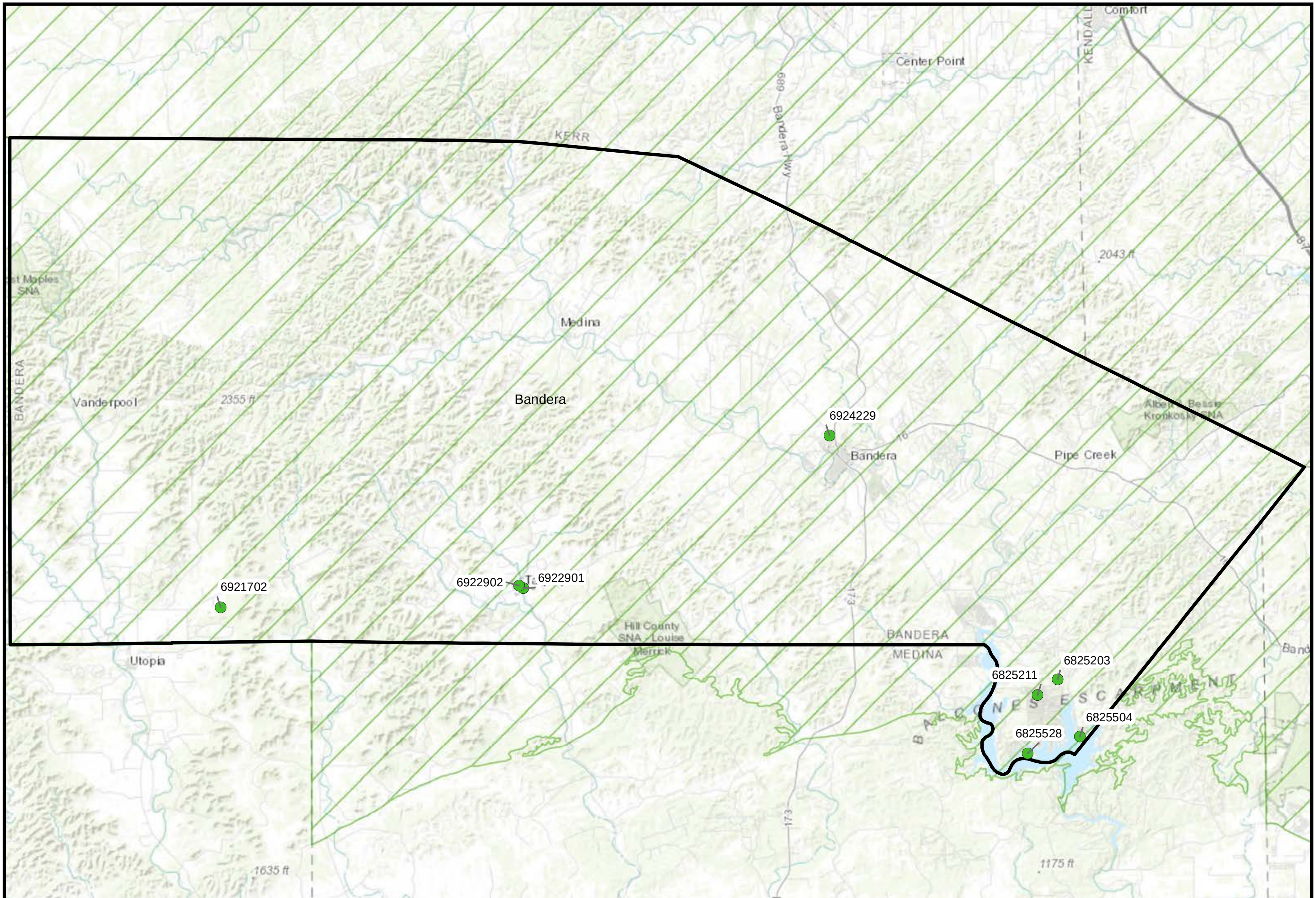
GMA 9

N

0 5 10

Miles

Map of Hydrograph Well Locations
218GLRSL
Glen Rose Limestone, Lower Member



Aquifer

218GLRSL - Glen Rose Limestone, Lower Member

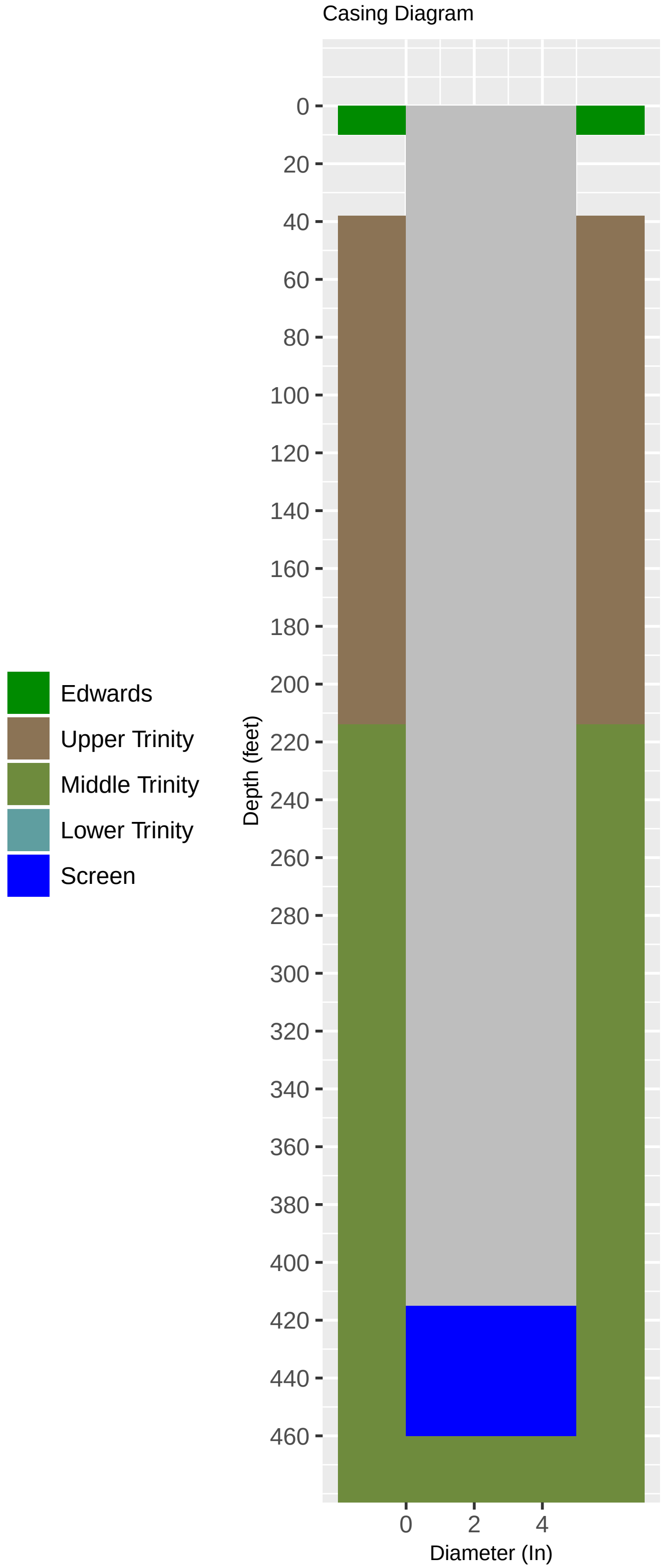
GMA 9

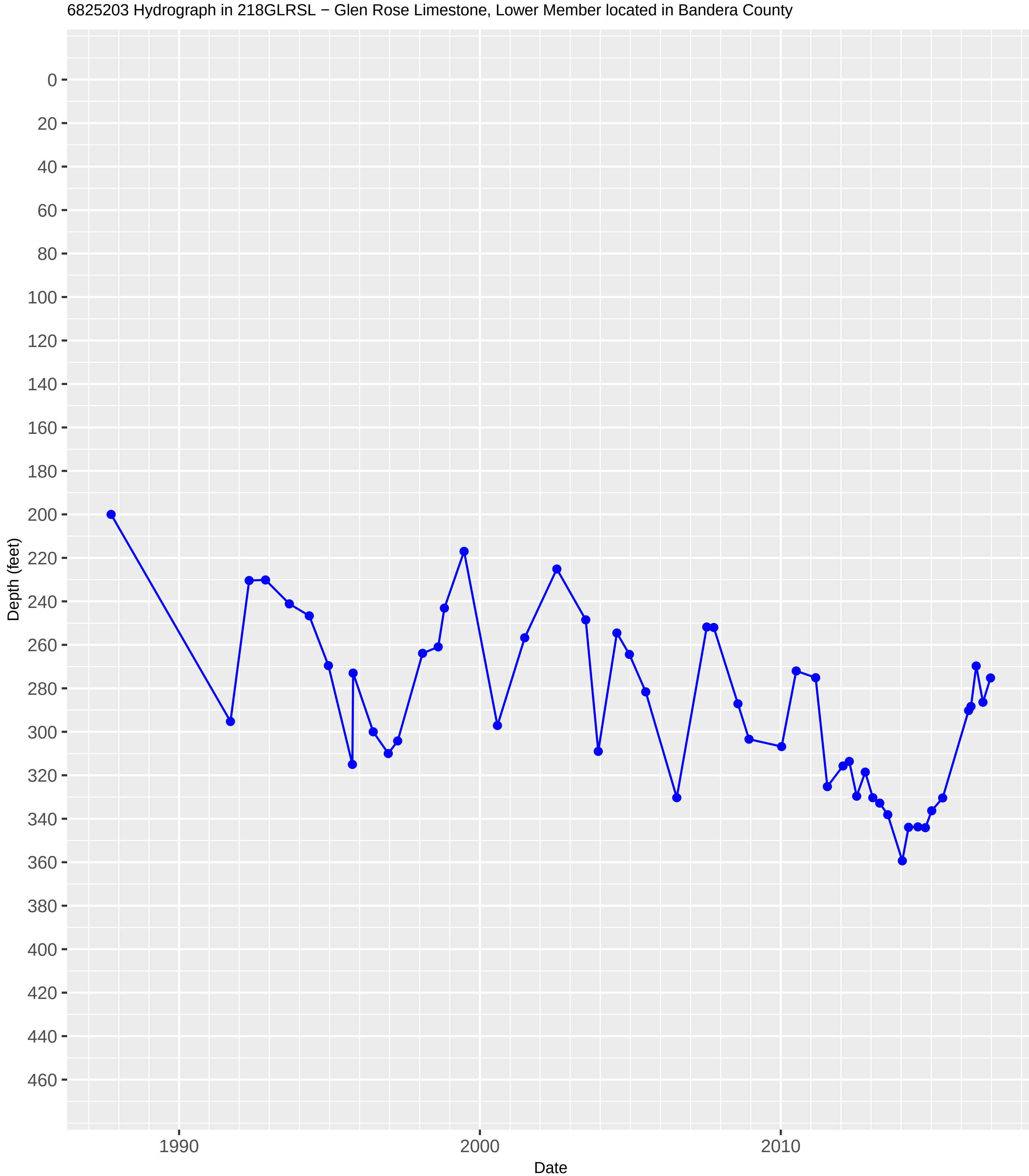
N

0 1 2 4

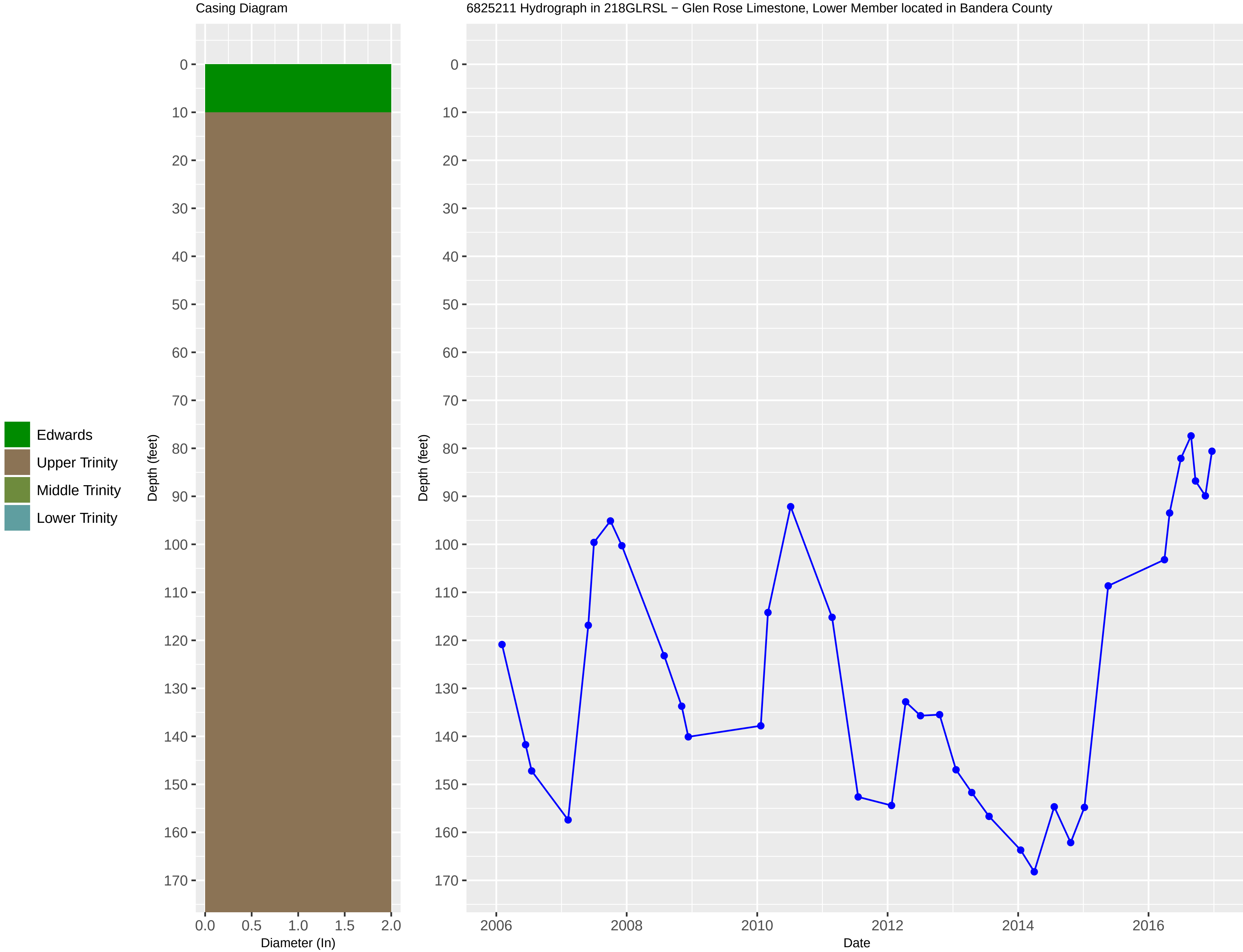
Miles

Map of Hydrograph Well Locations in Bandera County
218GLRSL
Glen Rose Limestone, Lower Member





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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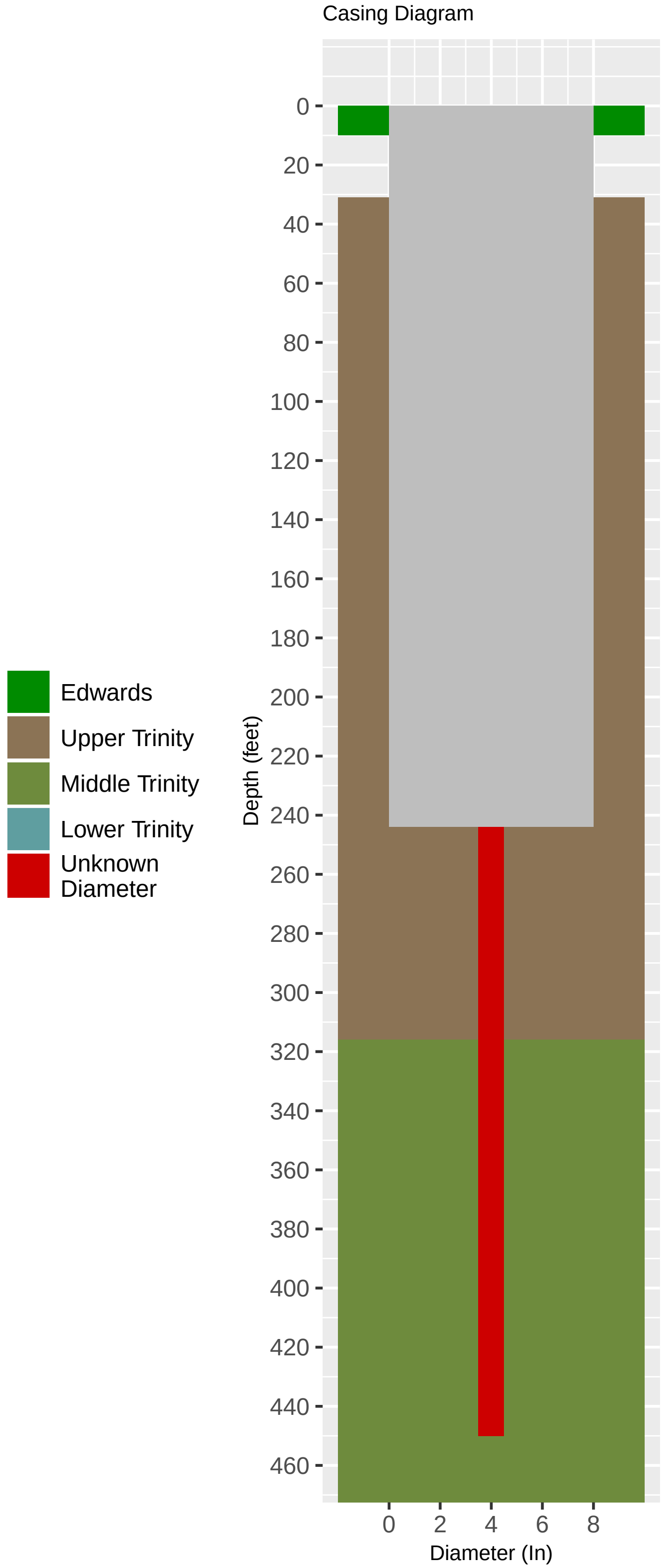

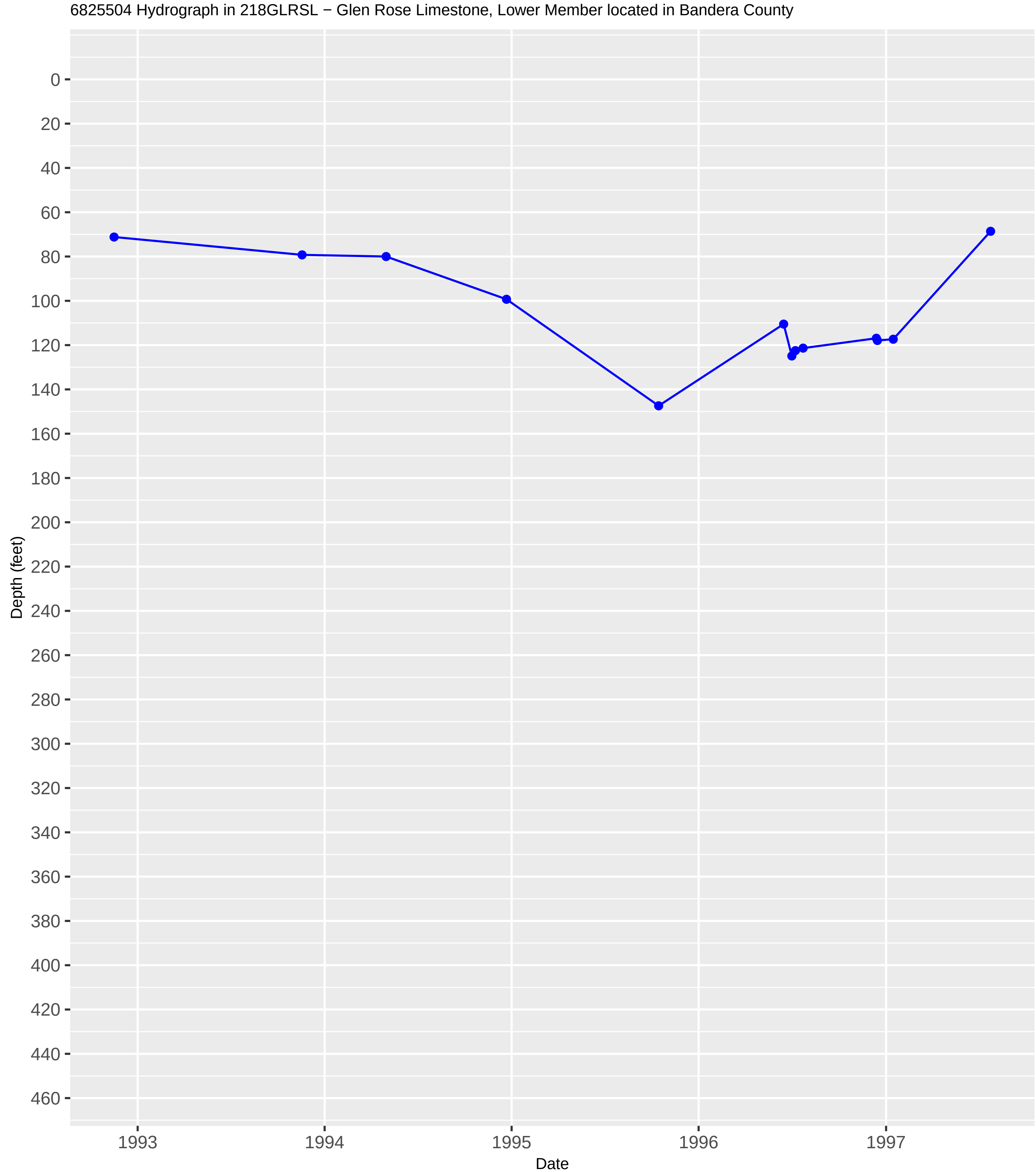

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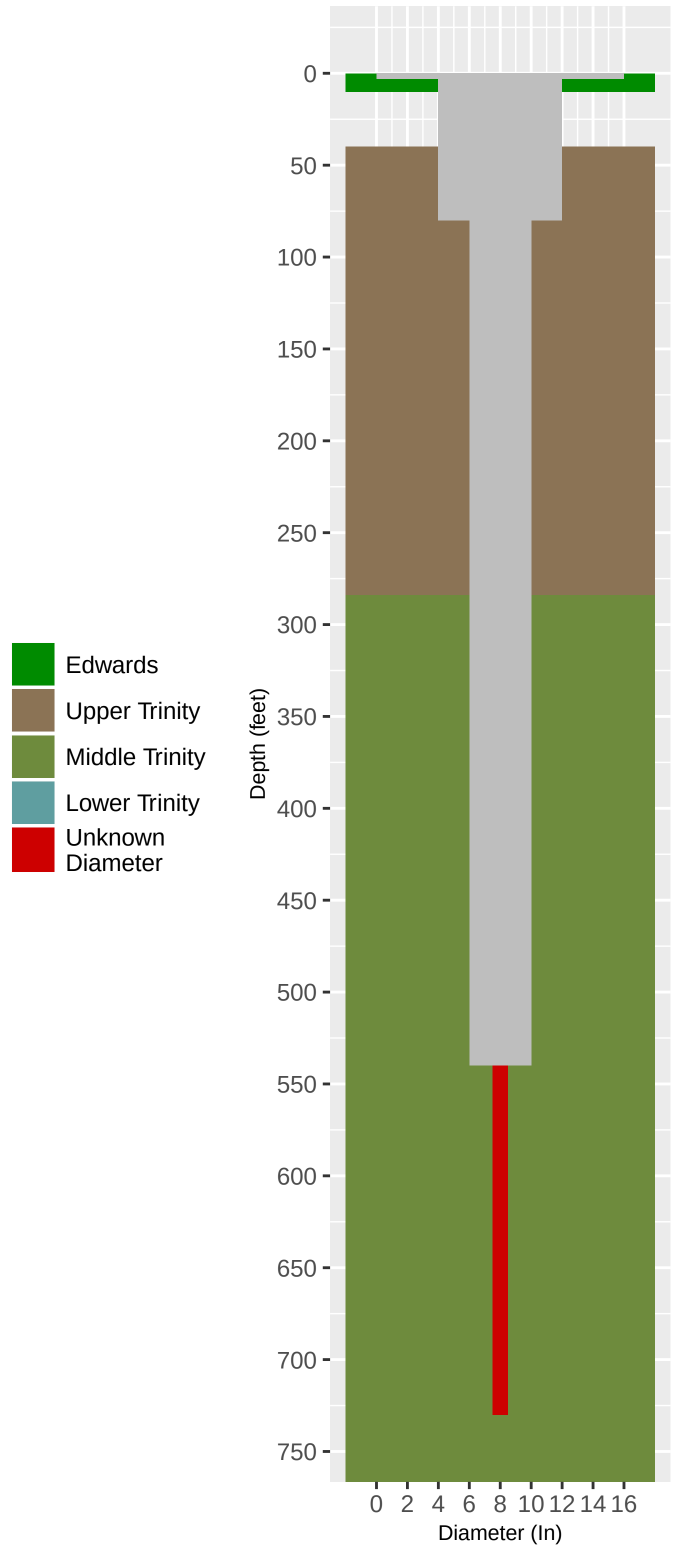
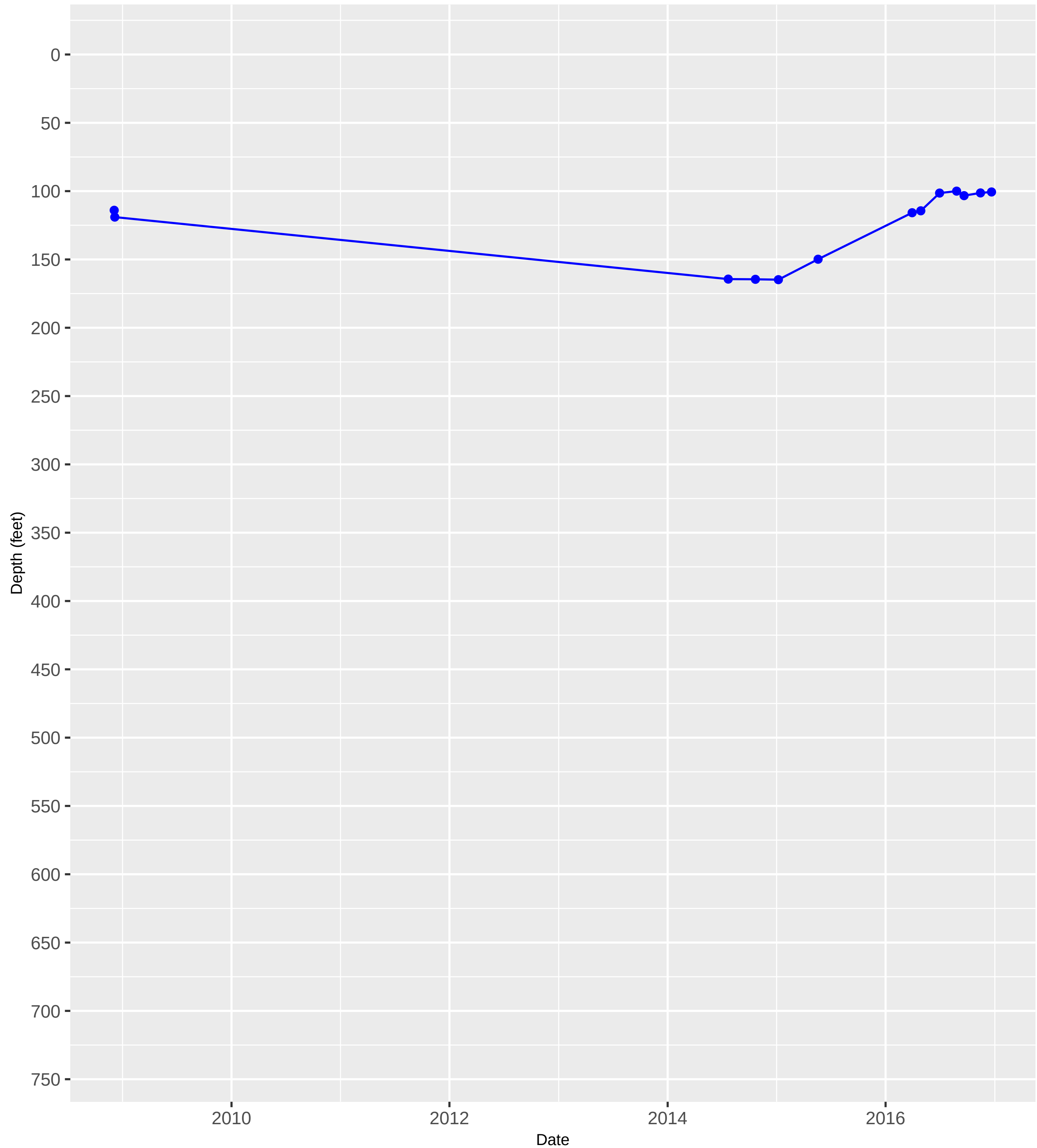
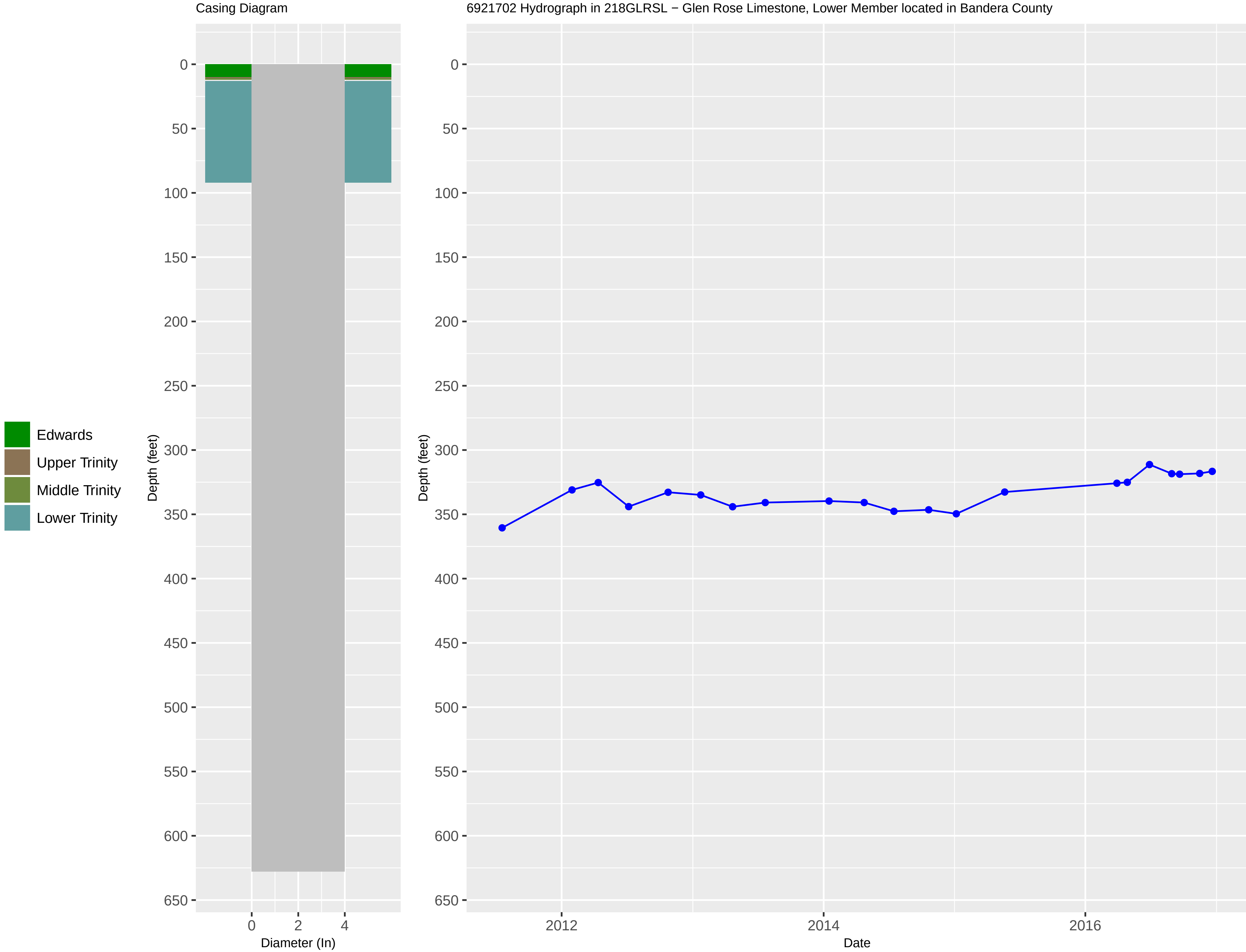
Casing Diagram



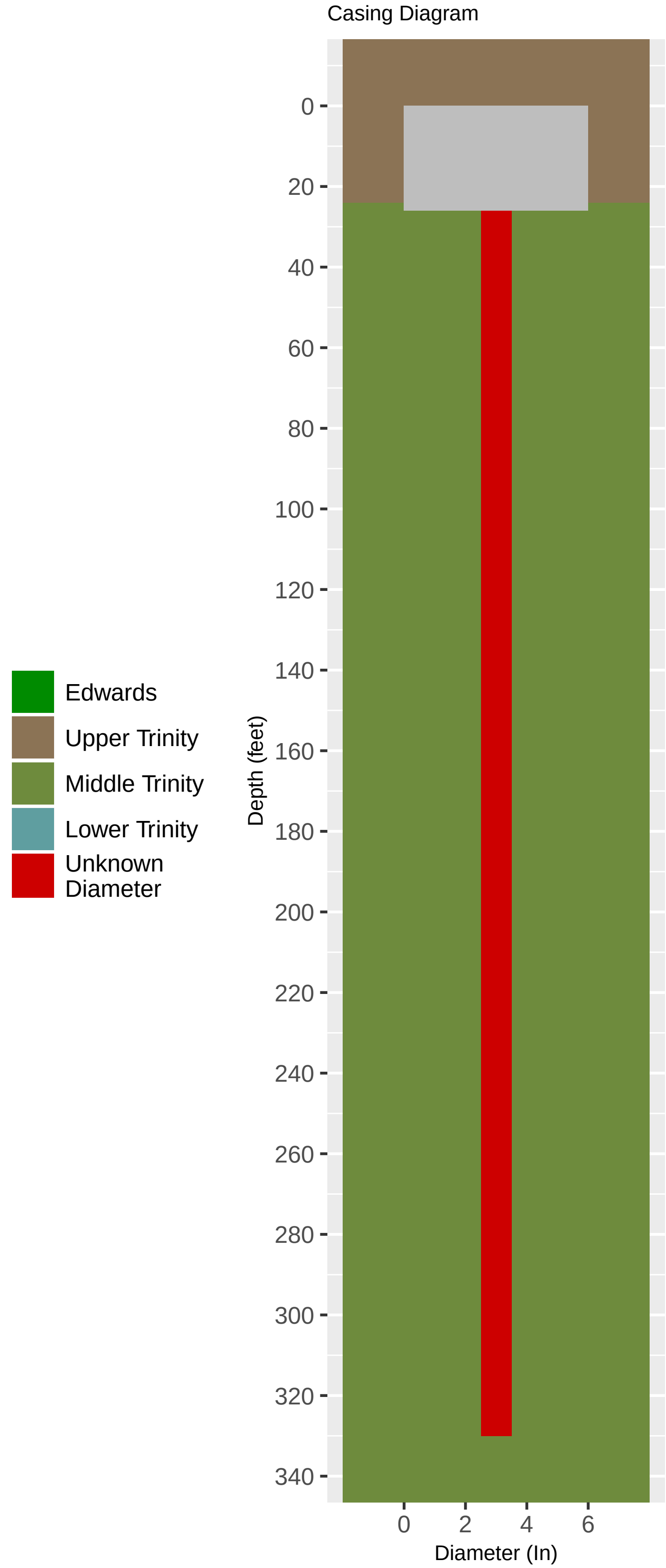
6825528 Hydrograph in 218GLRSL − Glen Rose Limestone, Lower Member located in Bandera County

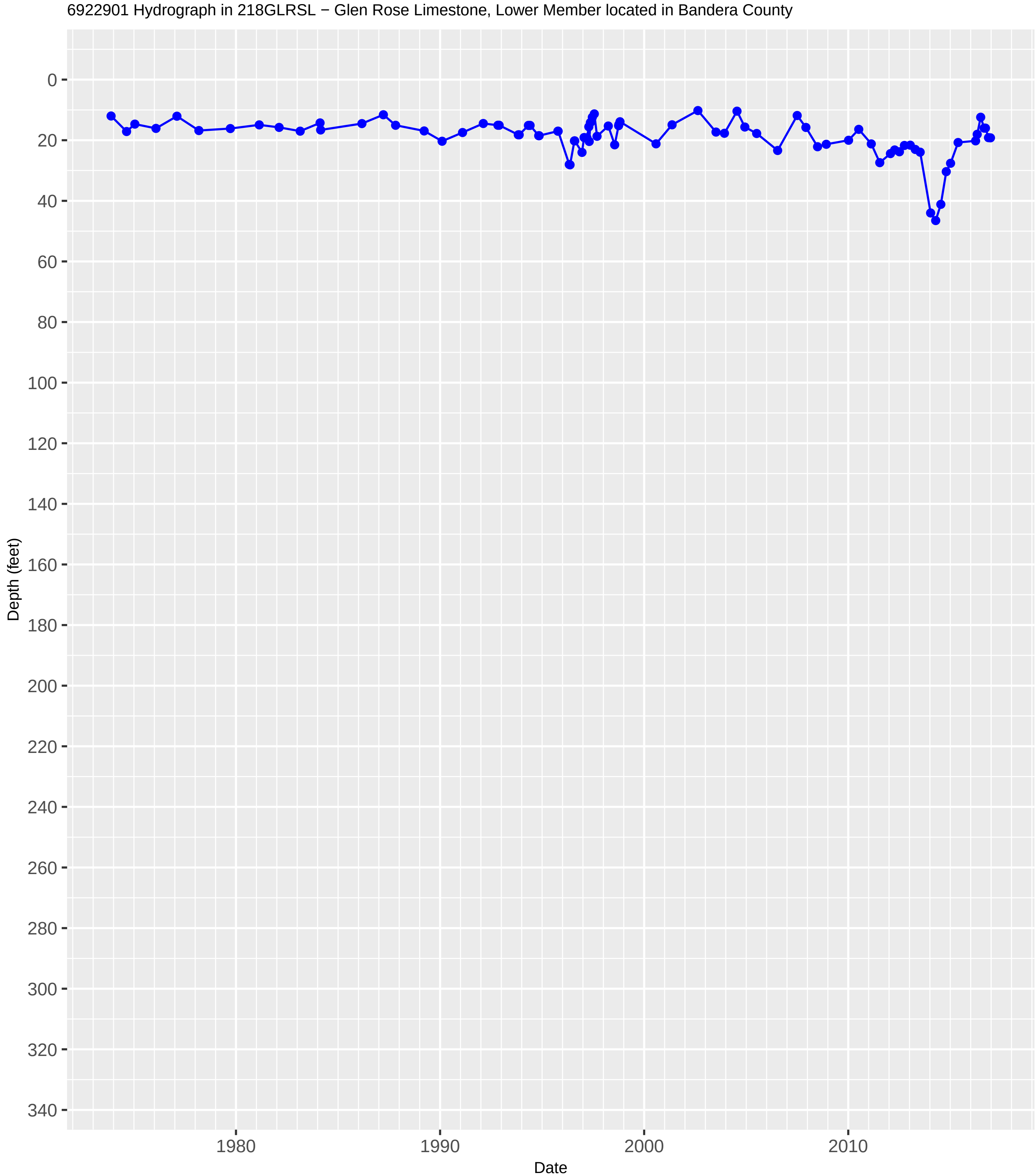


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

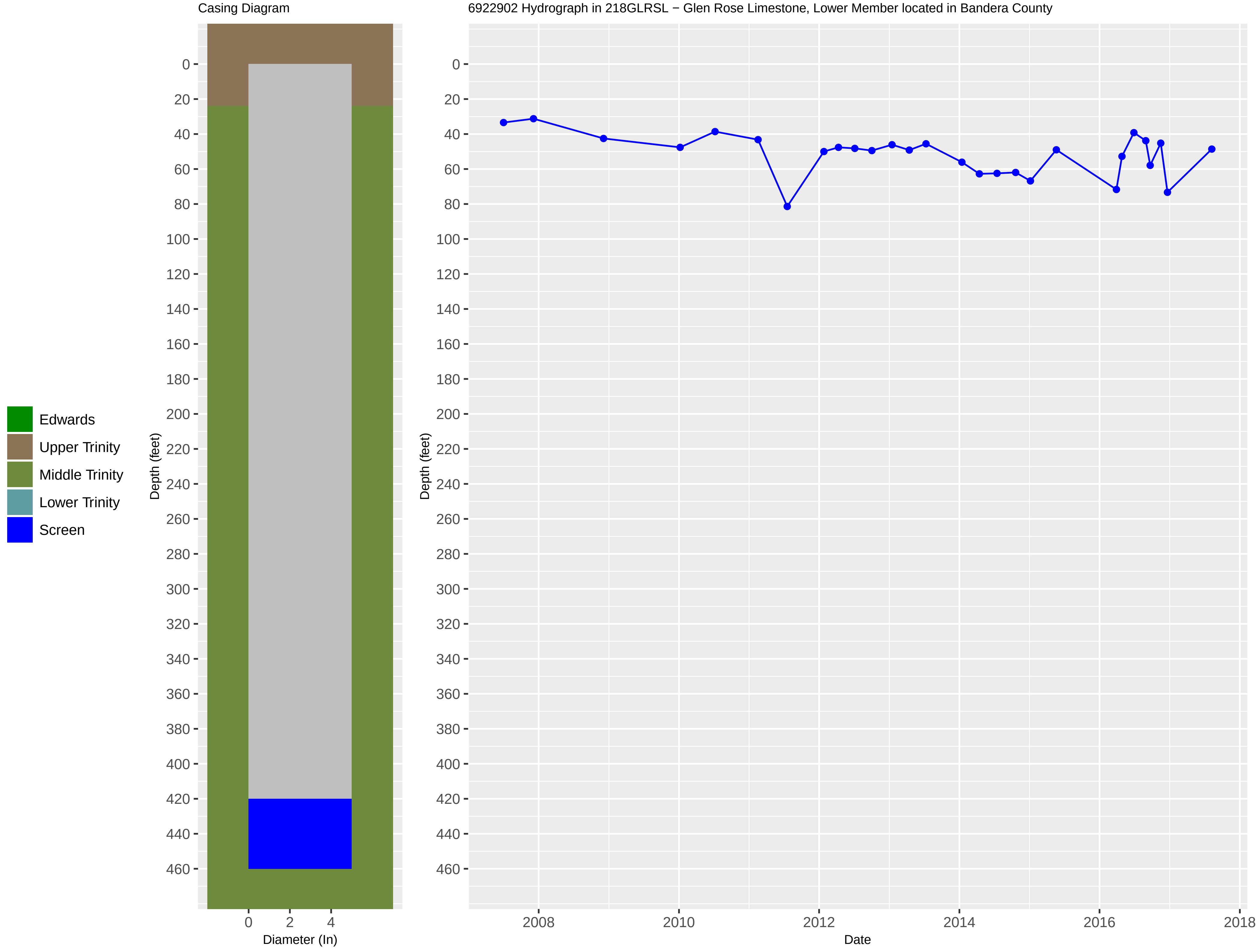


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

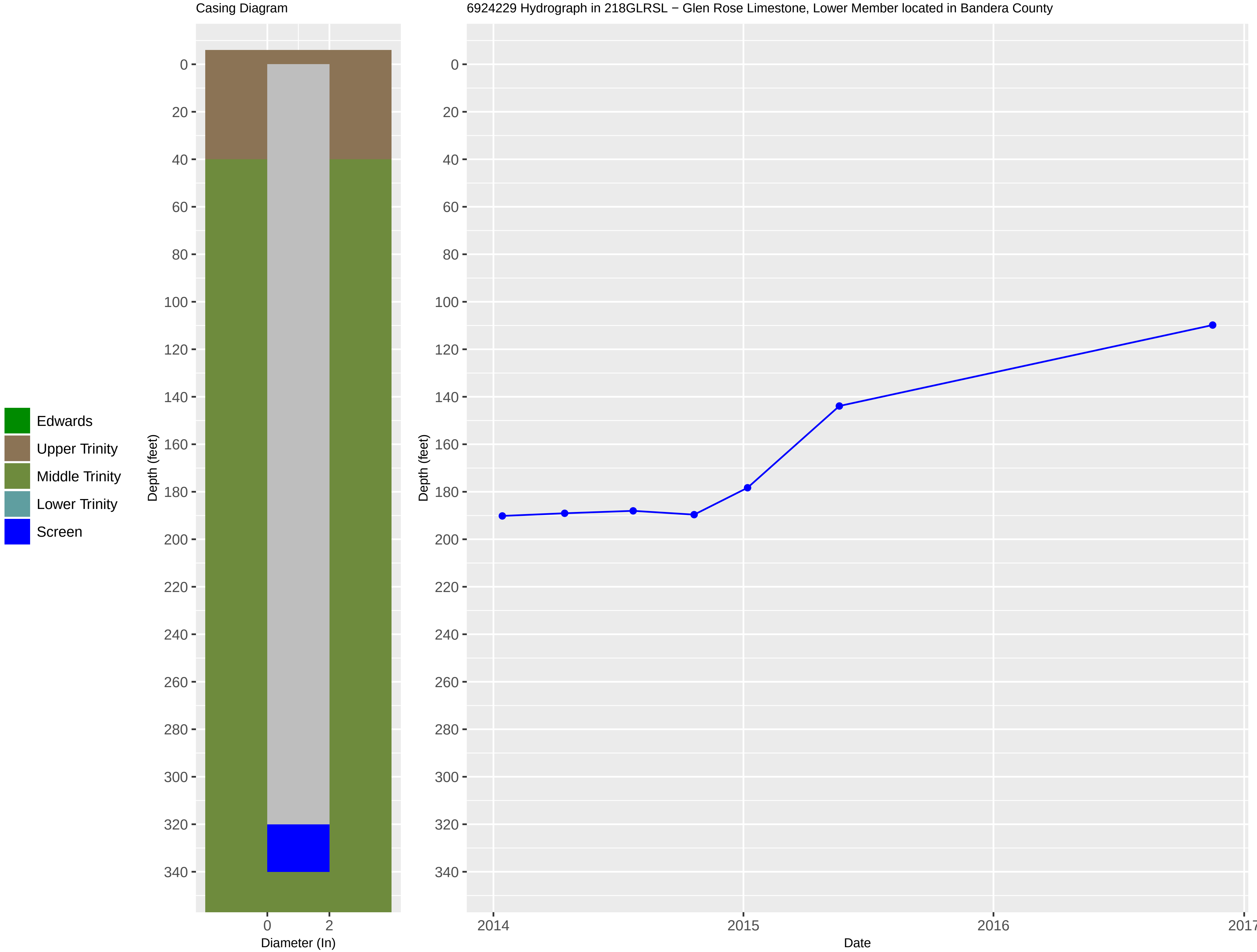




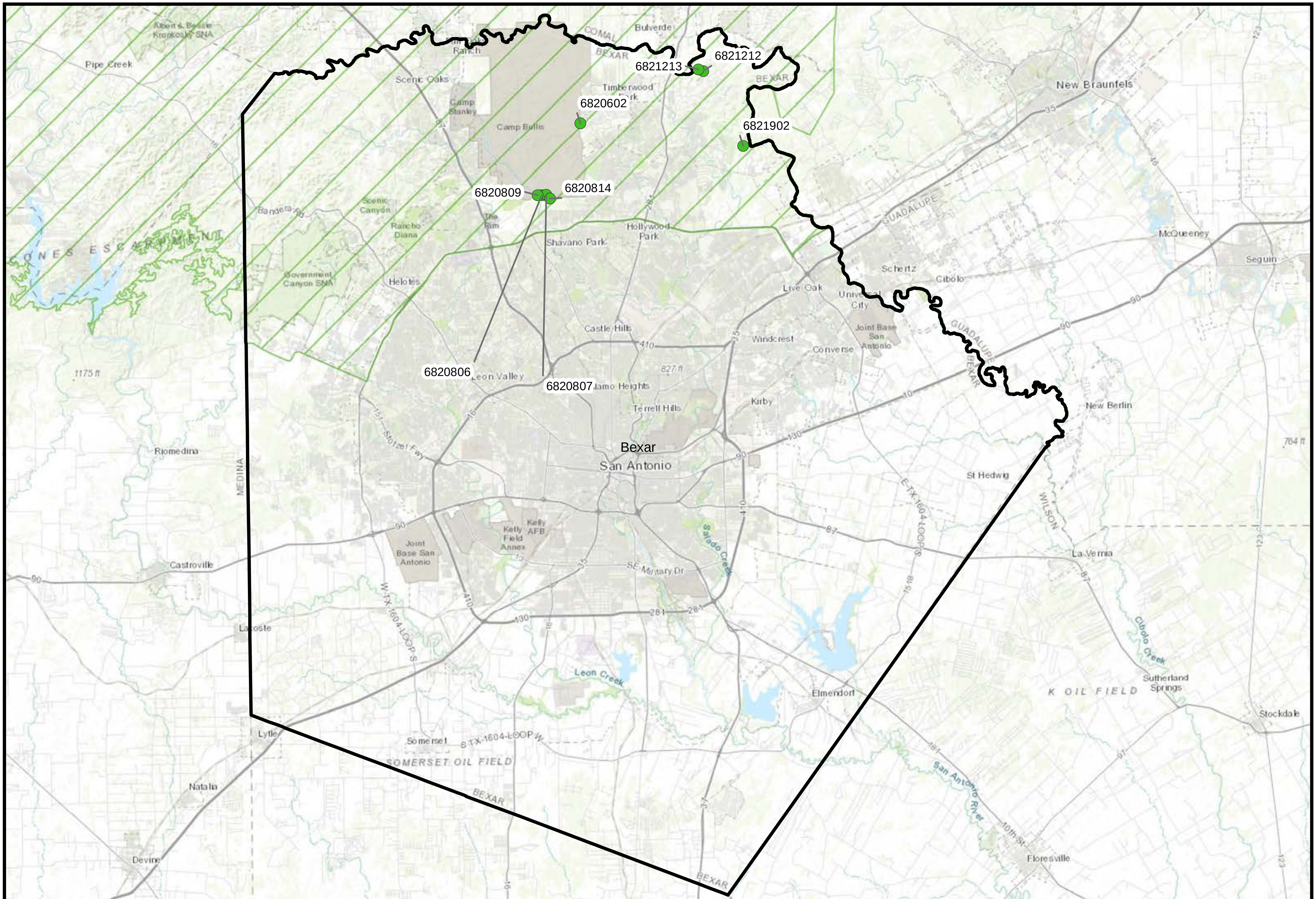
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

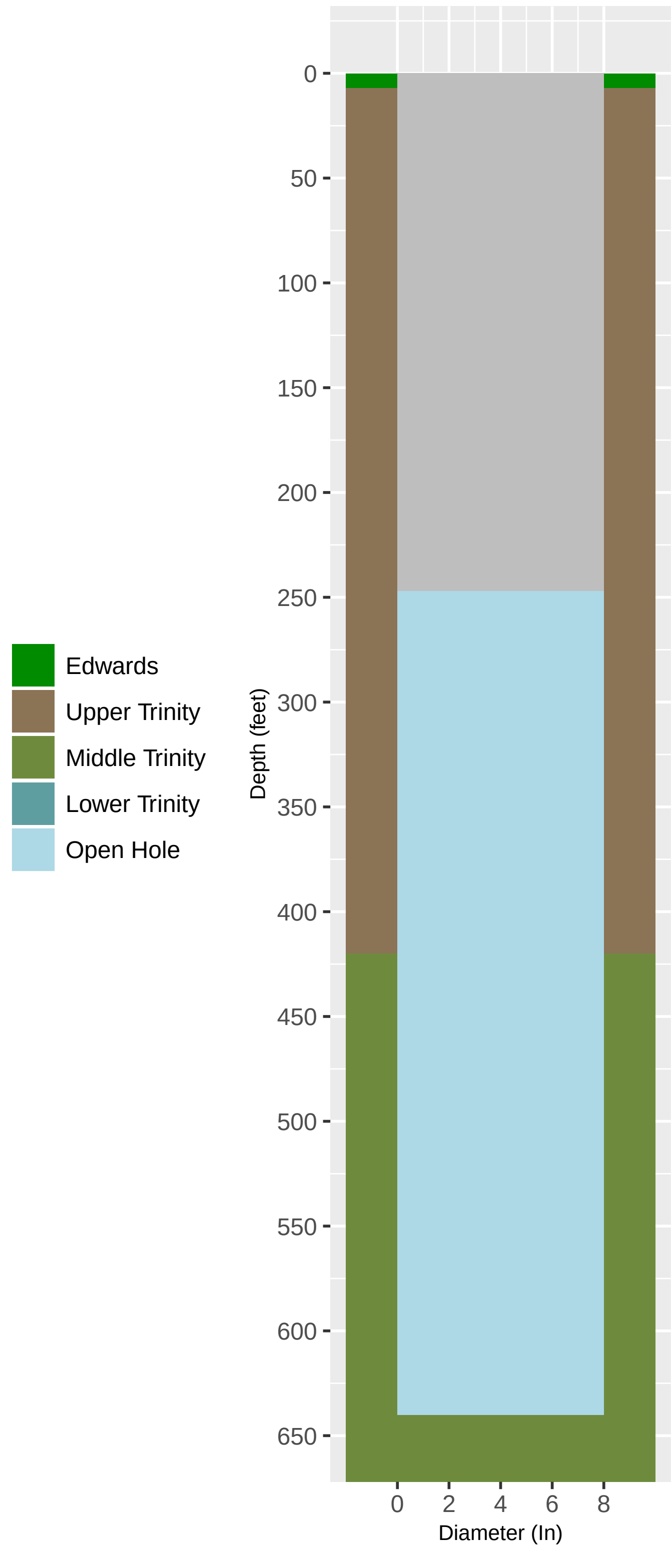


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

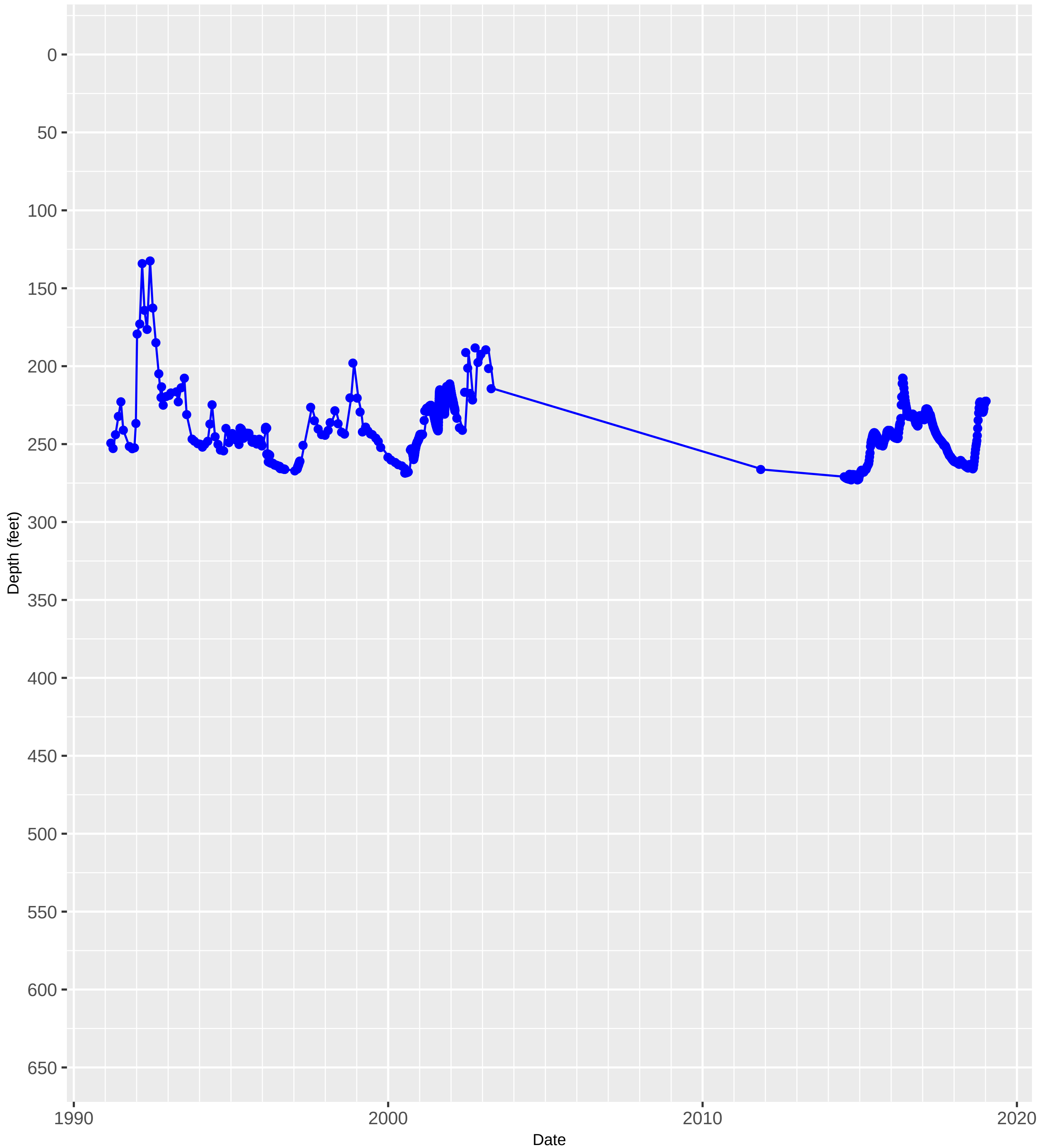


Map of Hydrograph Well Locations in Bexar County
218GLRSL
Glen Rose Limestone, Lower Member

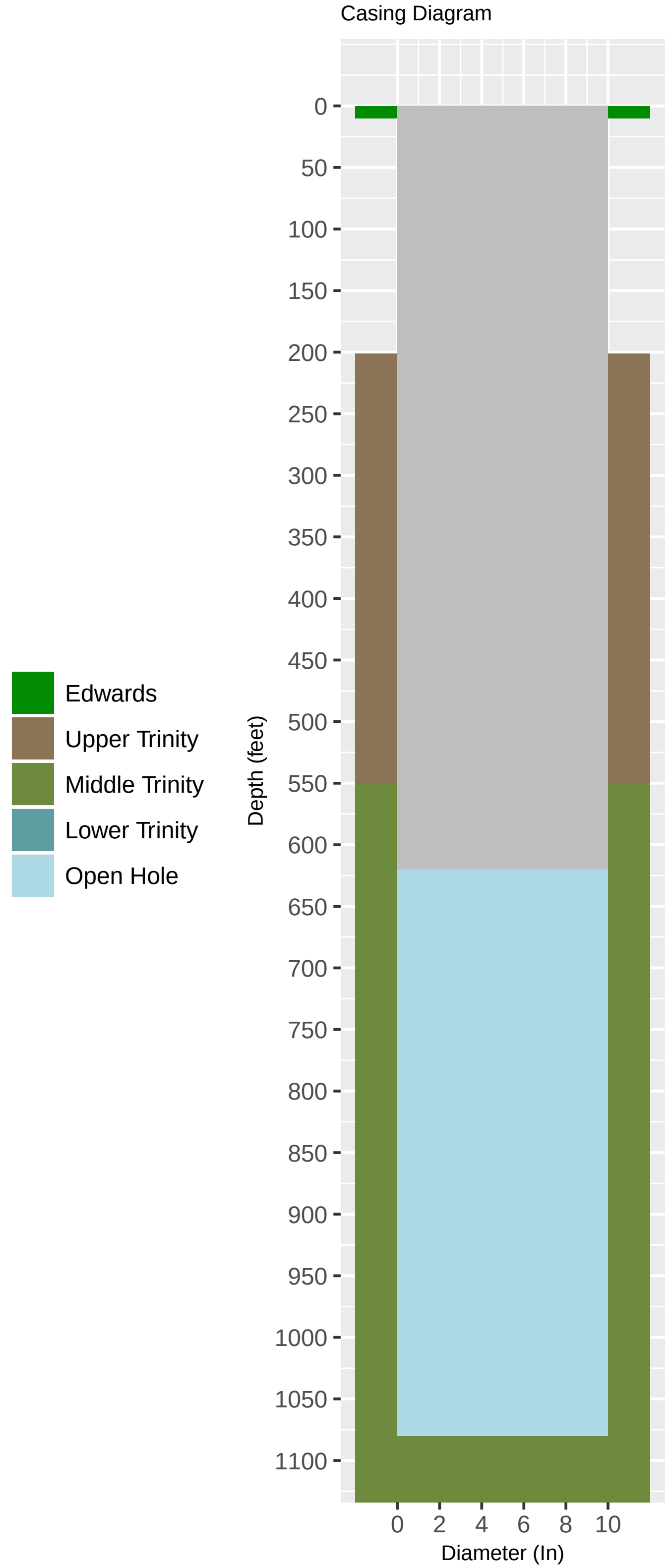
Casing Diagram

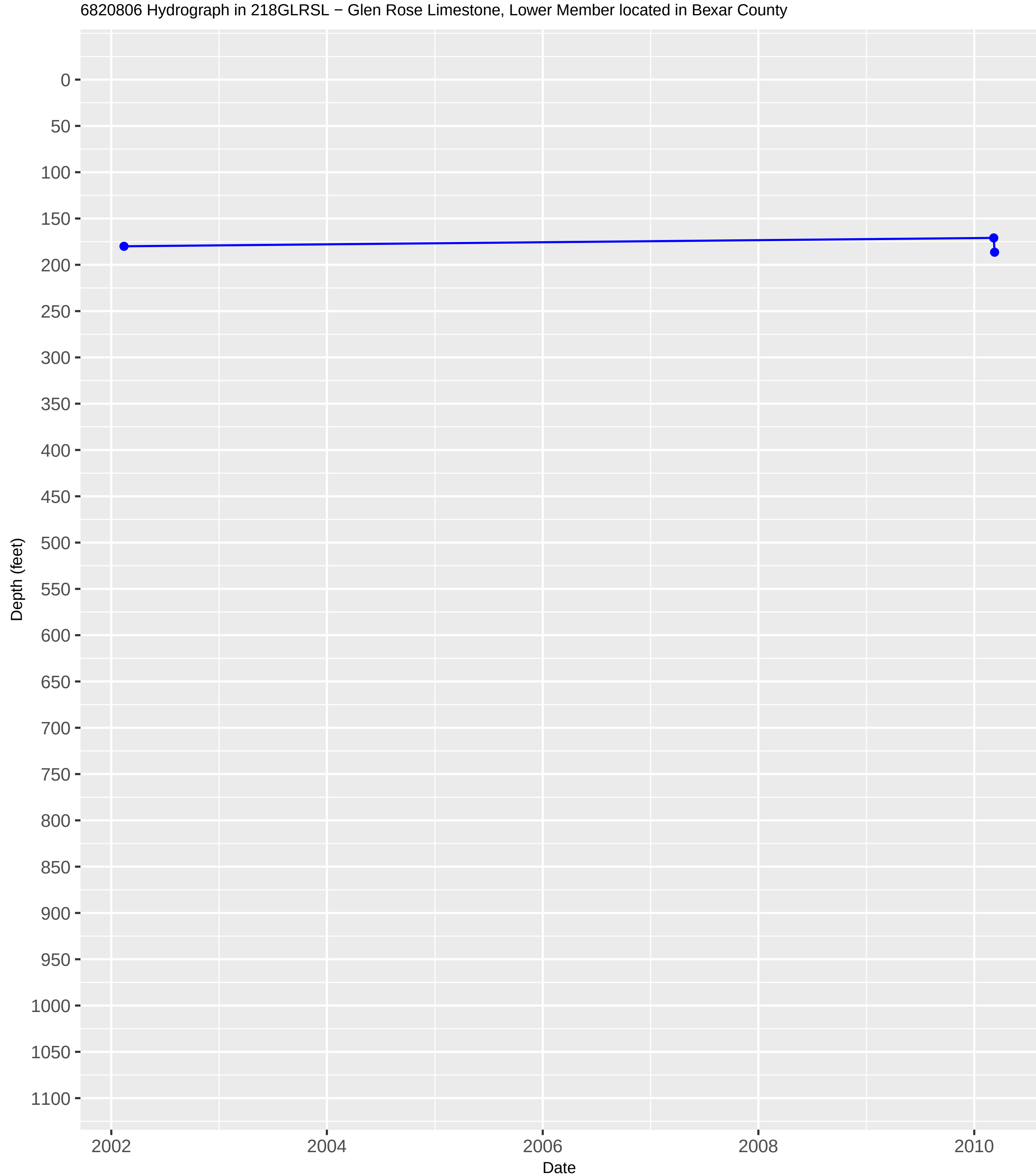


6820602 Hydrograph in 218GLRSL − Glen Rose Limestone, Lower Member located in Bexar County

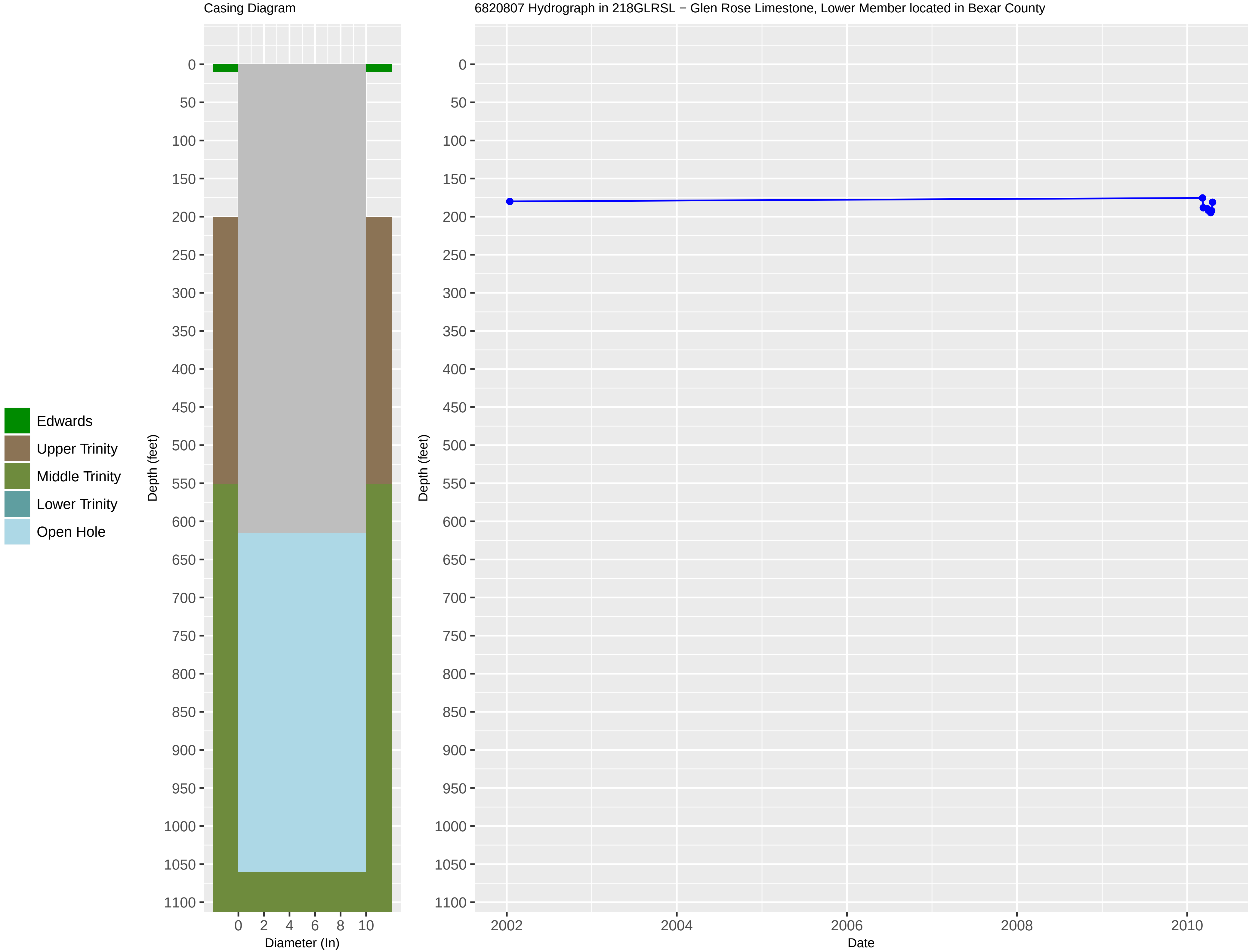


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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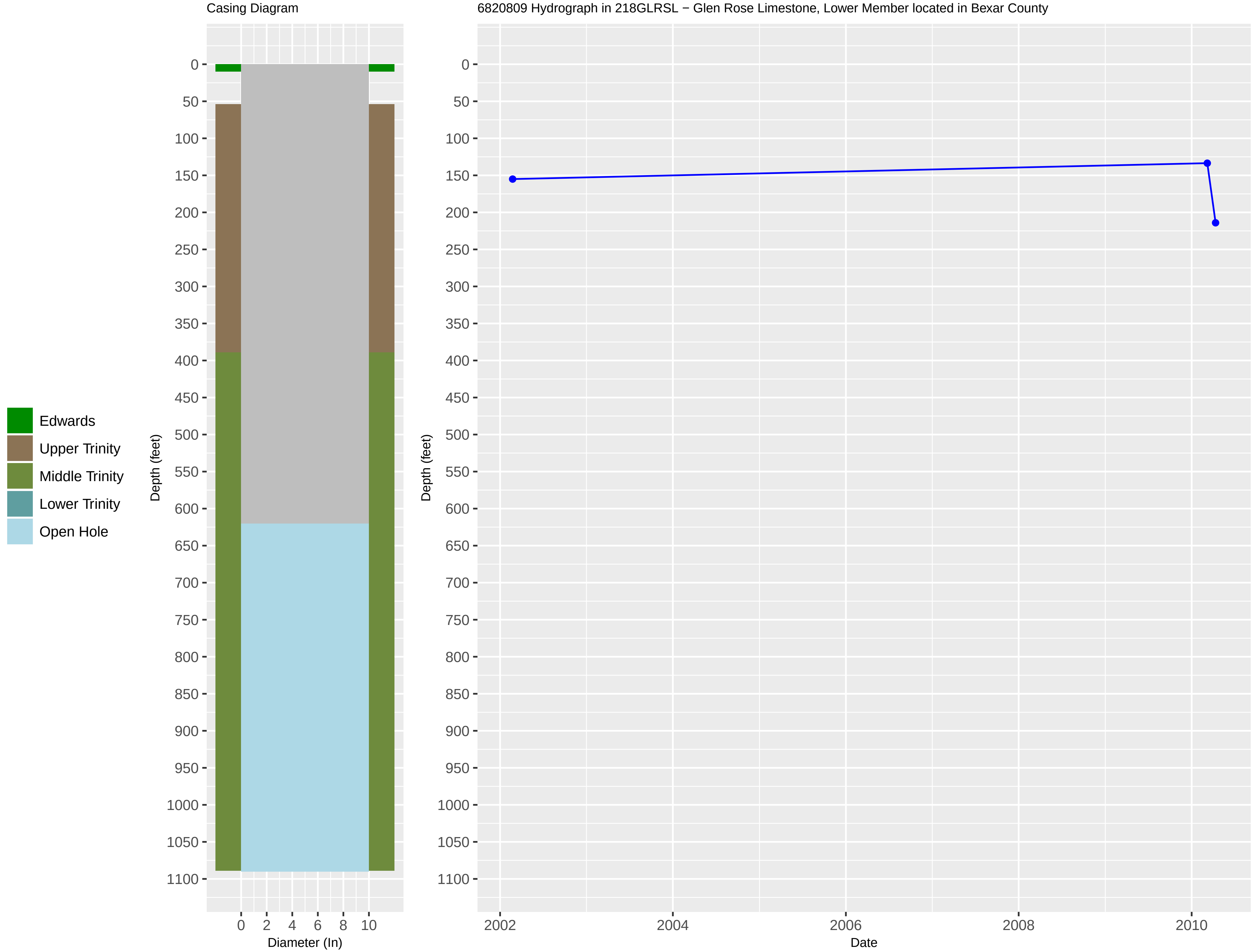
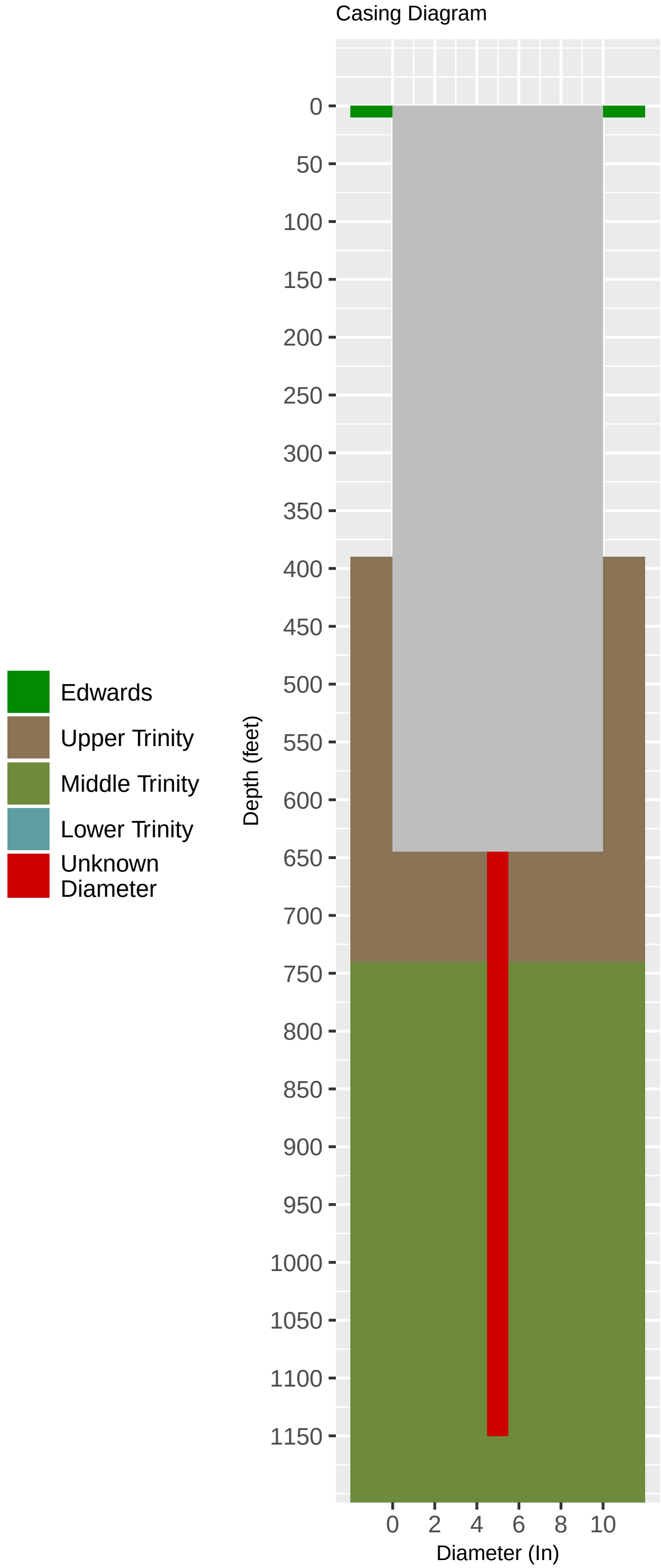
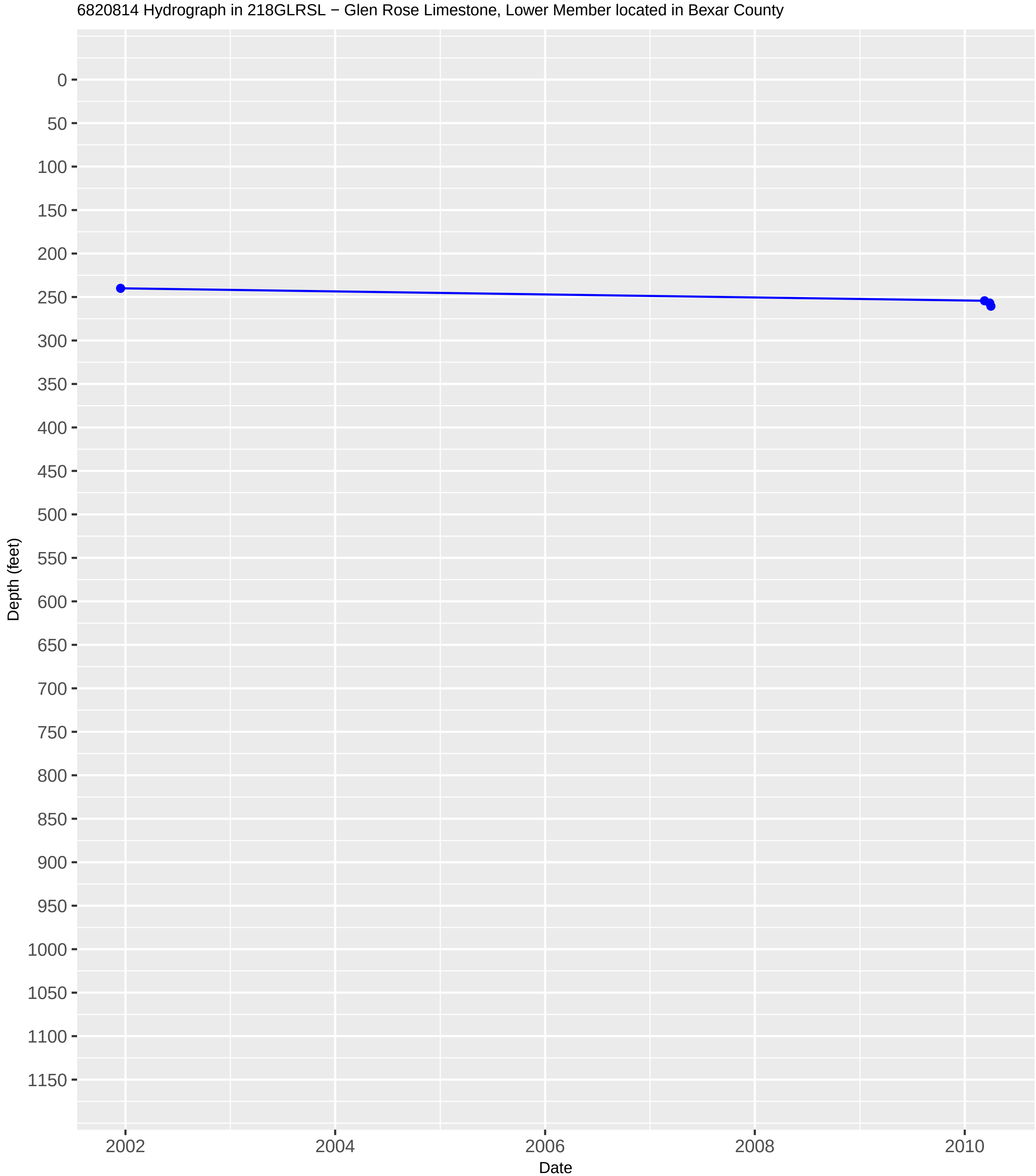
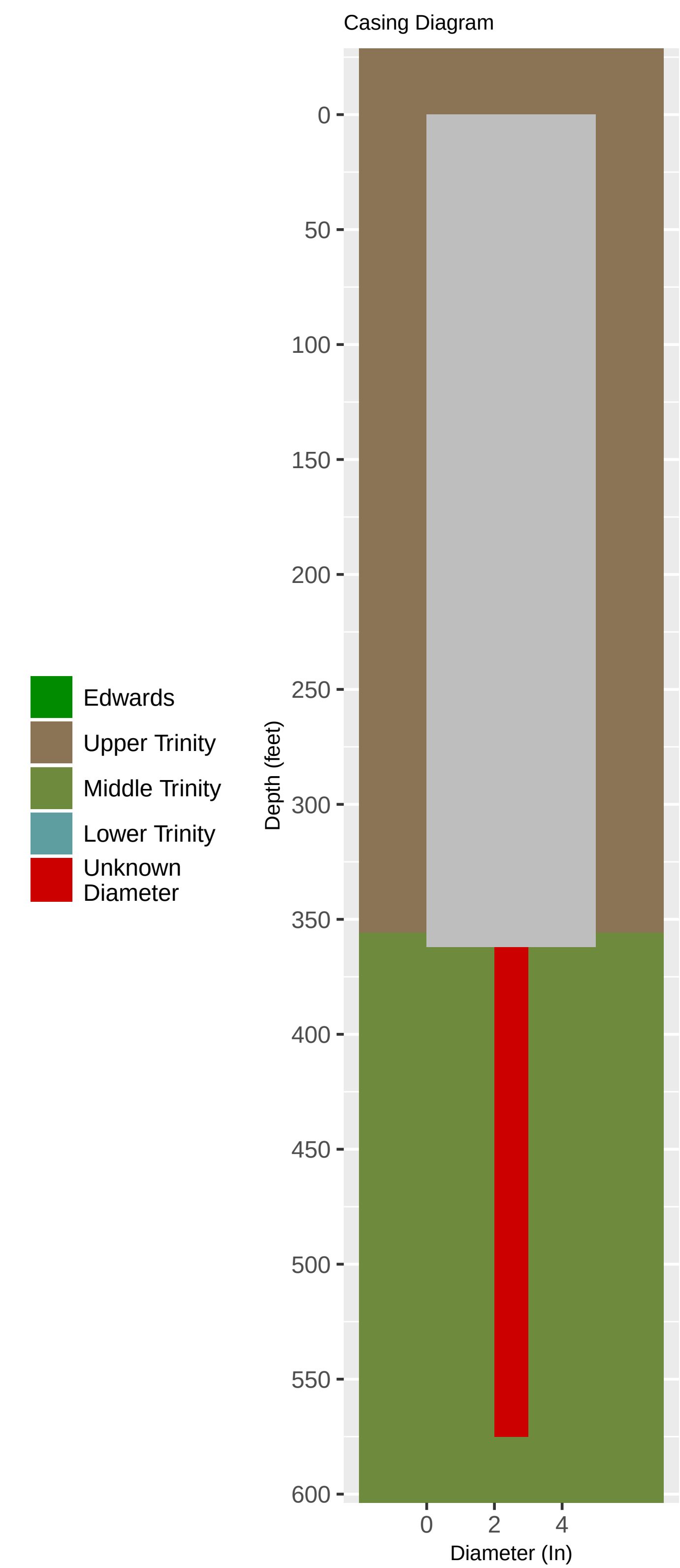


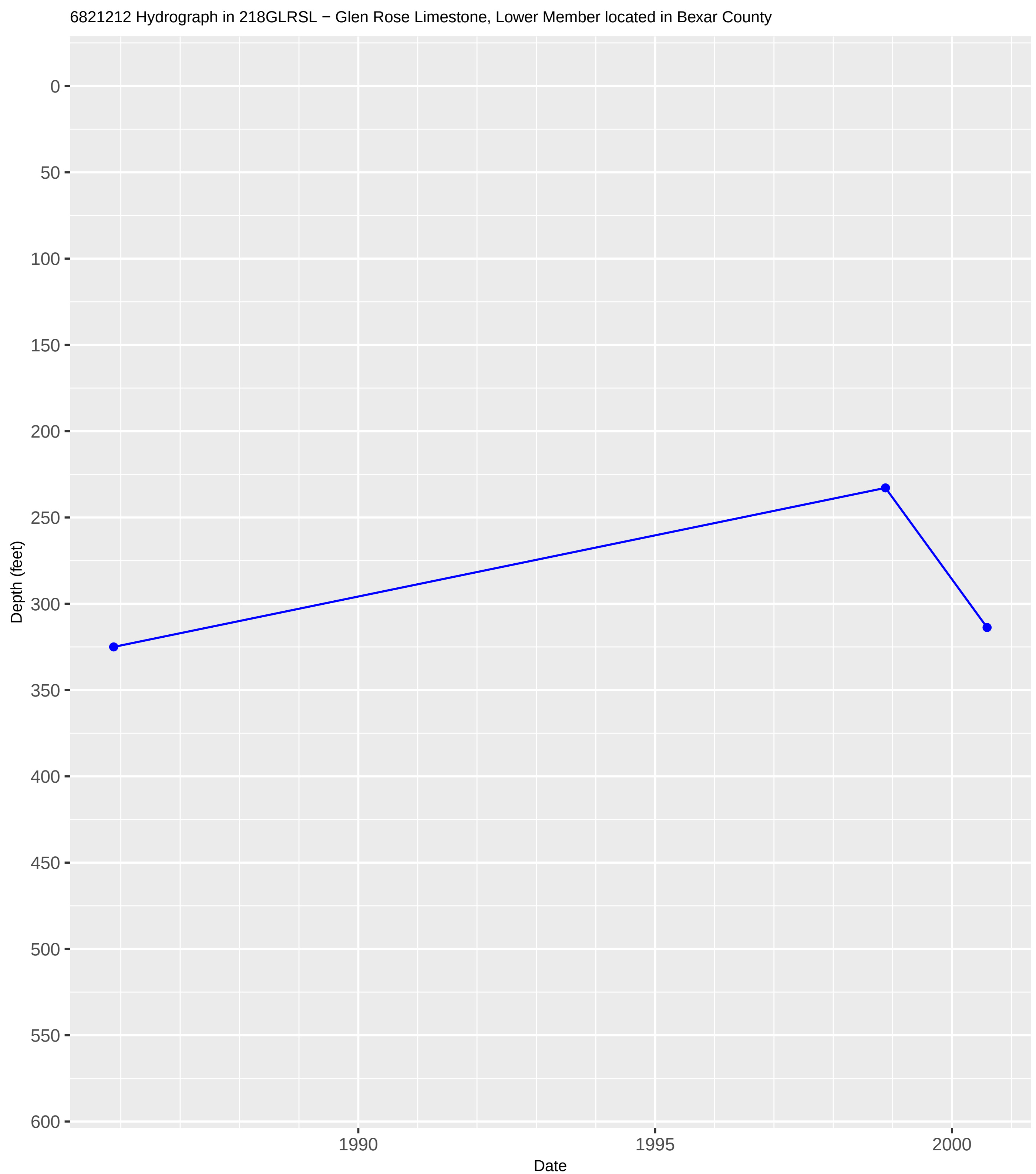
The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



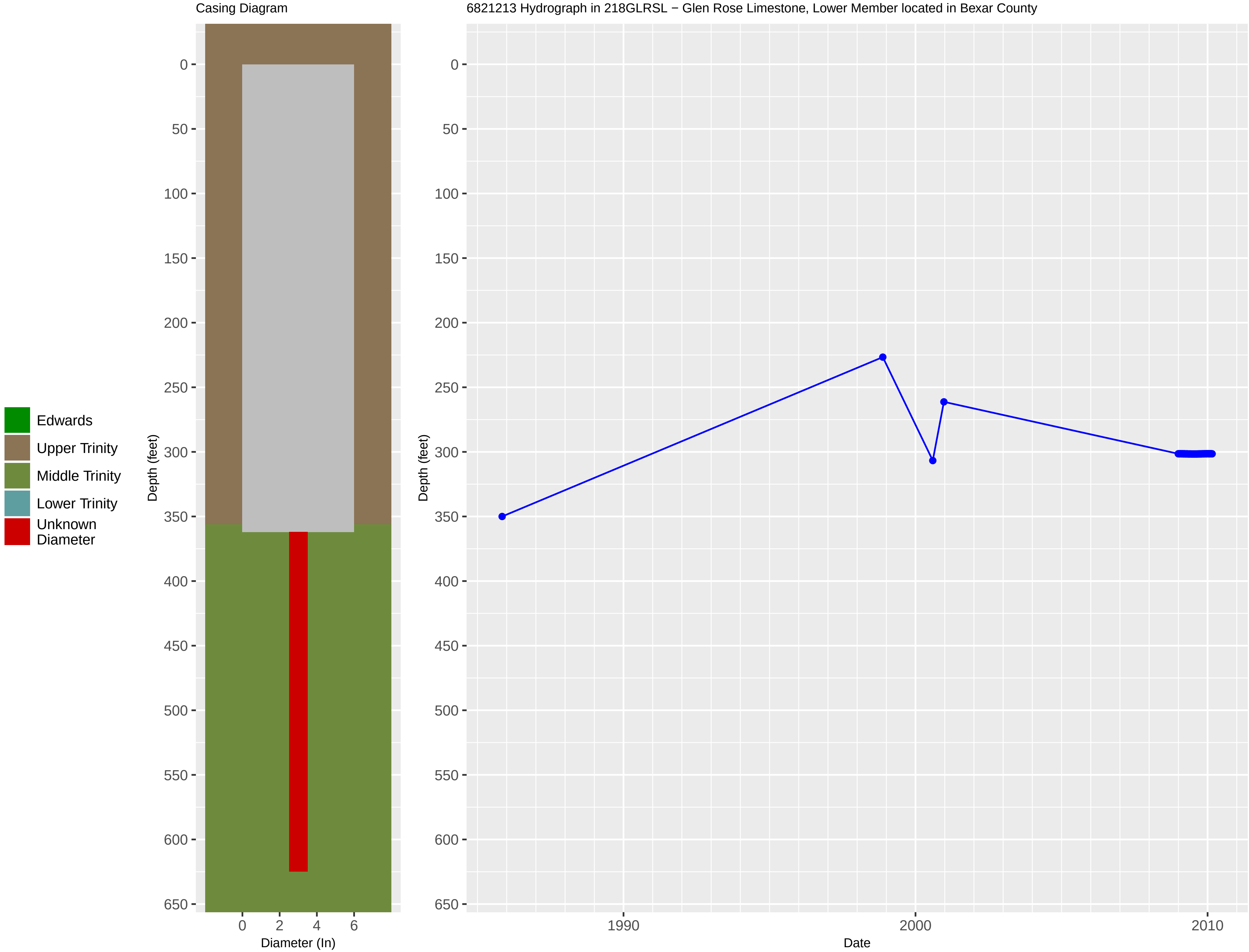


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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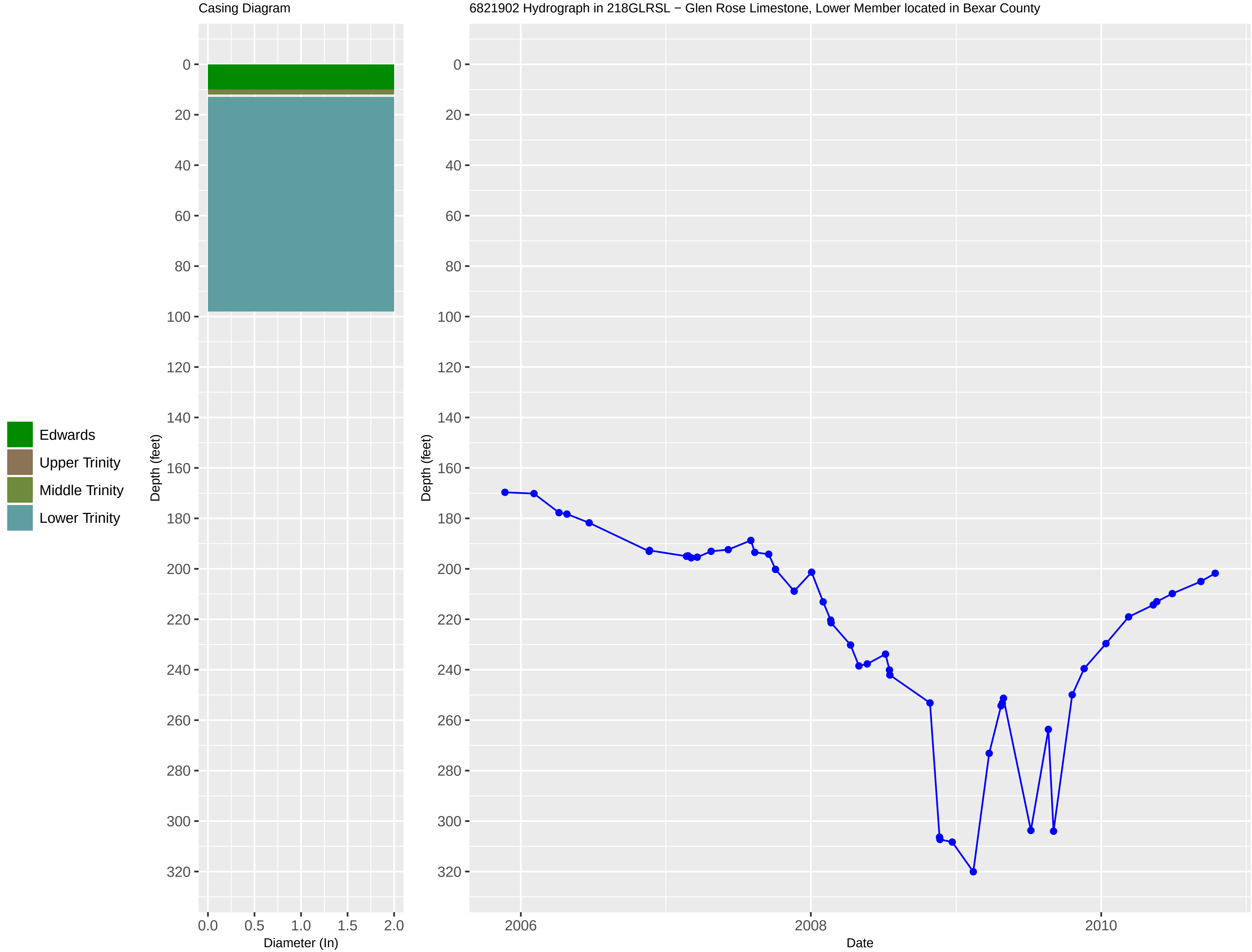

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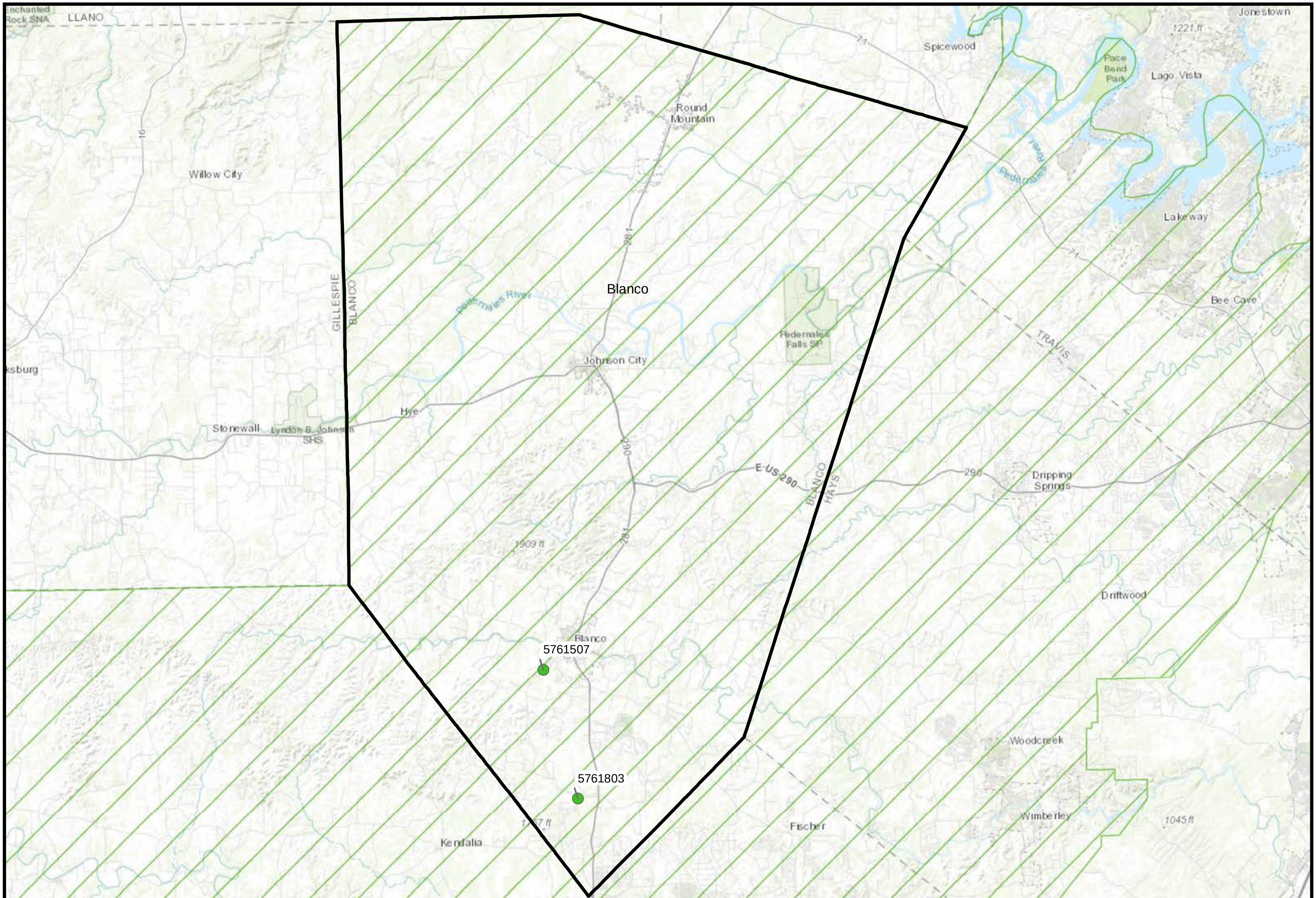


Aquifer

218GLRSL - Glen Rose Limestone, Lower Member

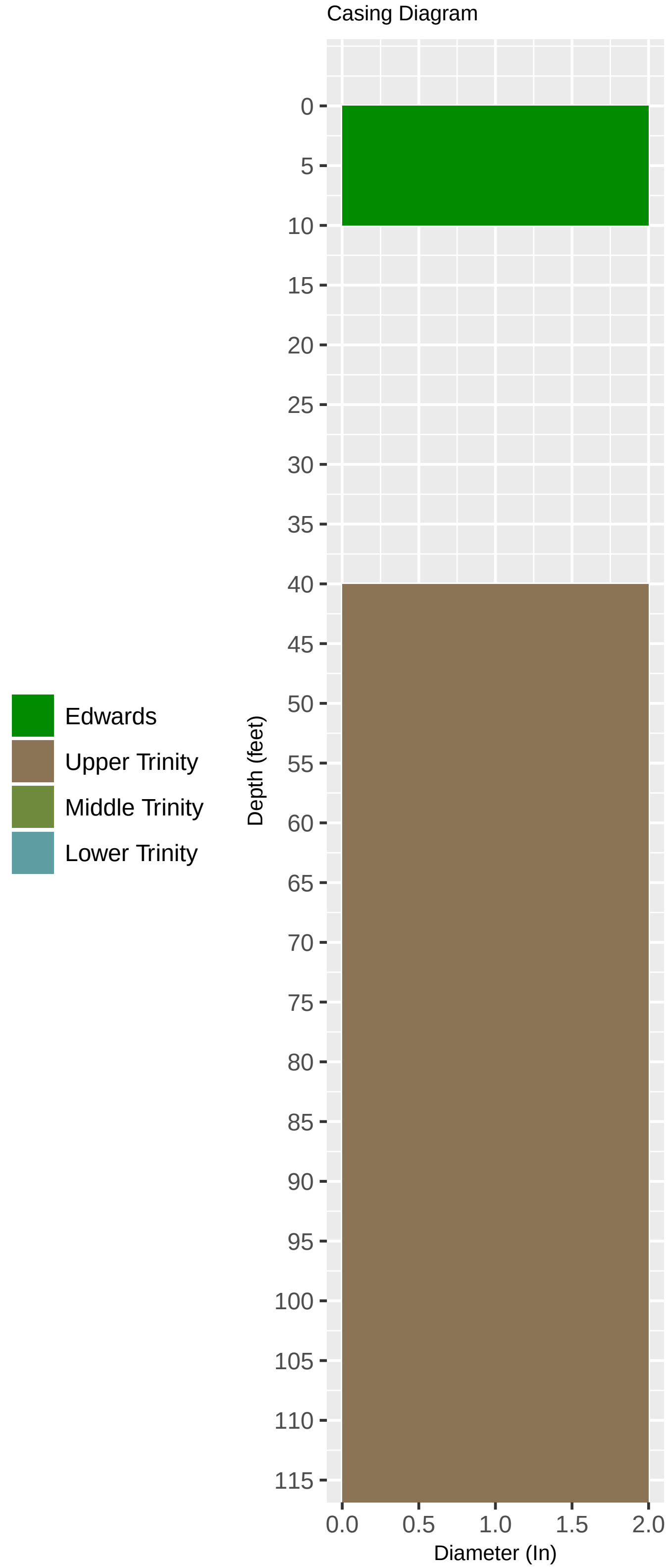
GMA 9

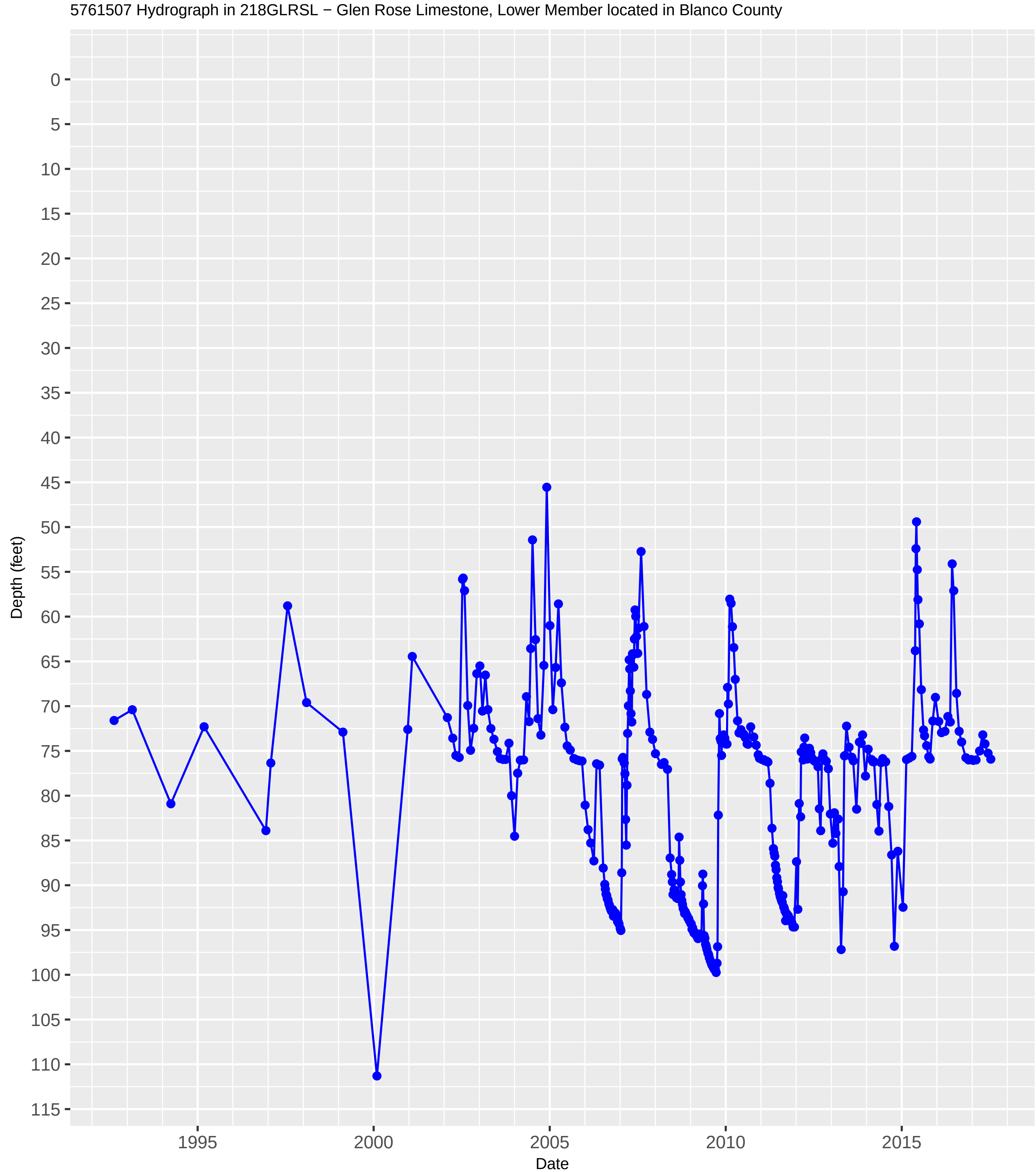
N

0 1 2 4 6

Miles

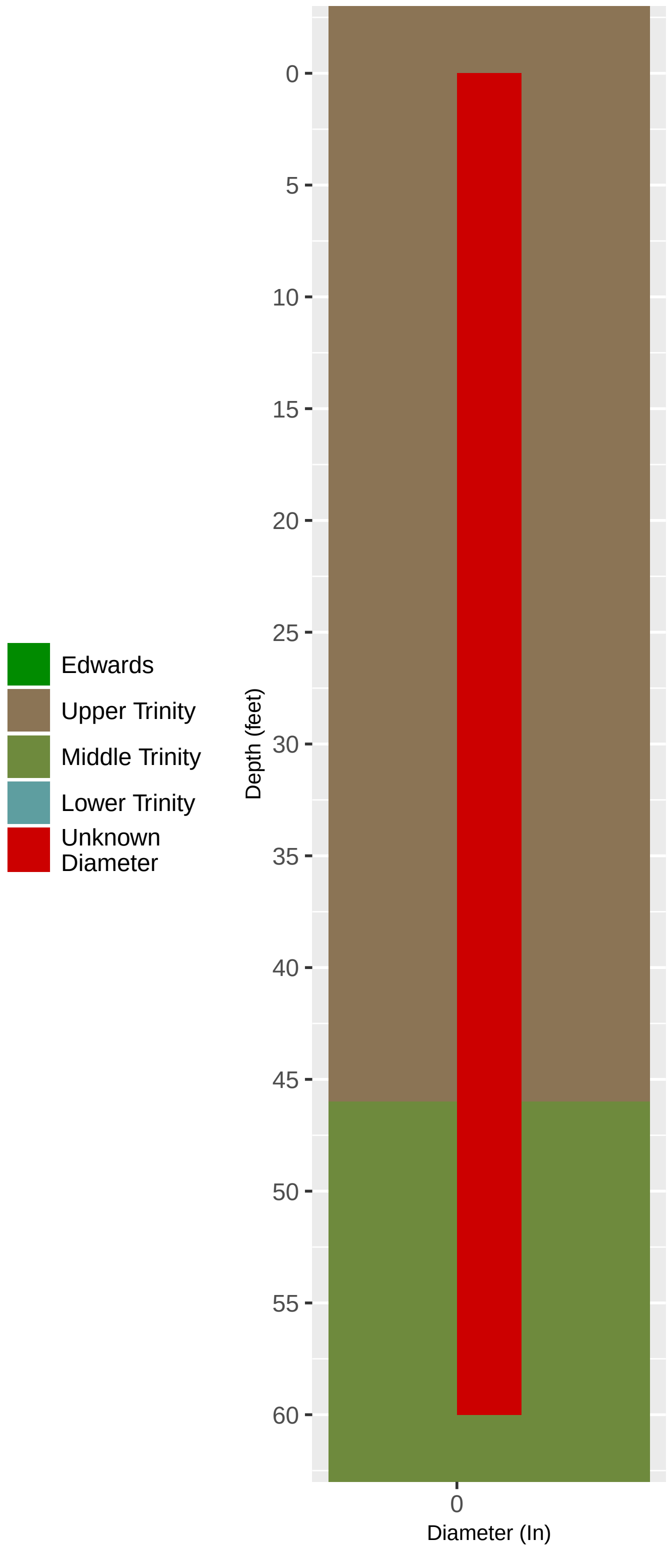
Map of Hydrograph Well Locations in Blanco County
218GLRSL
Glen Rose Limestone, Lower Member



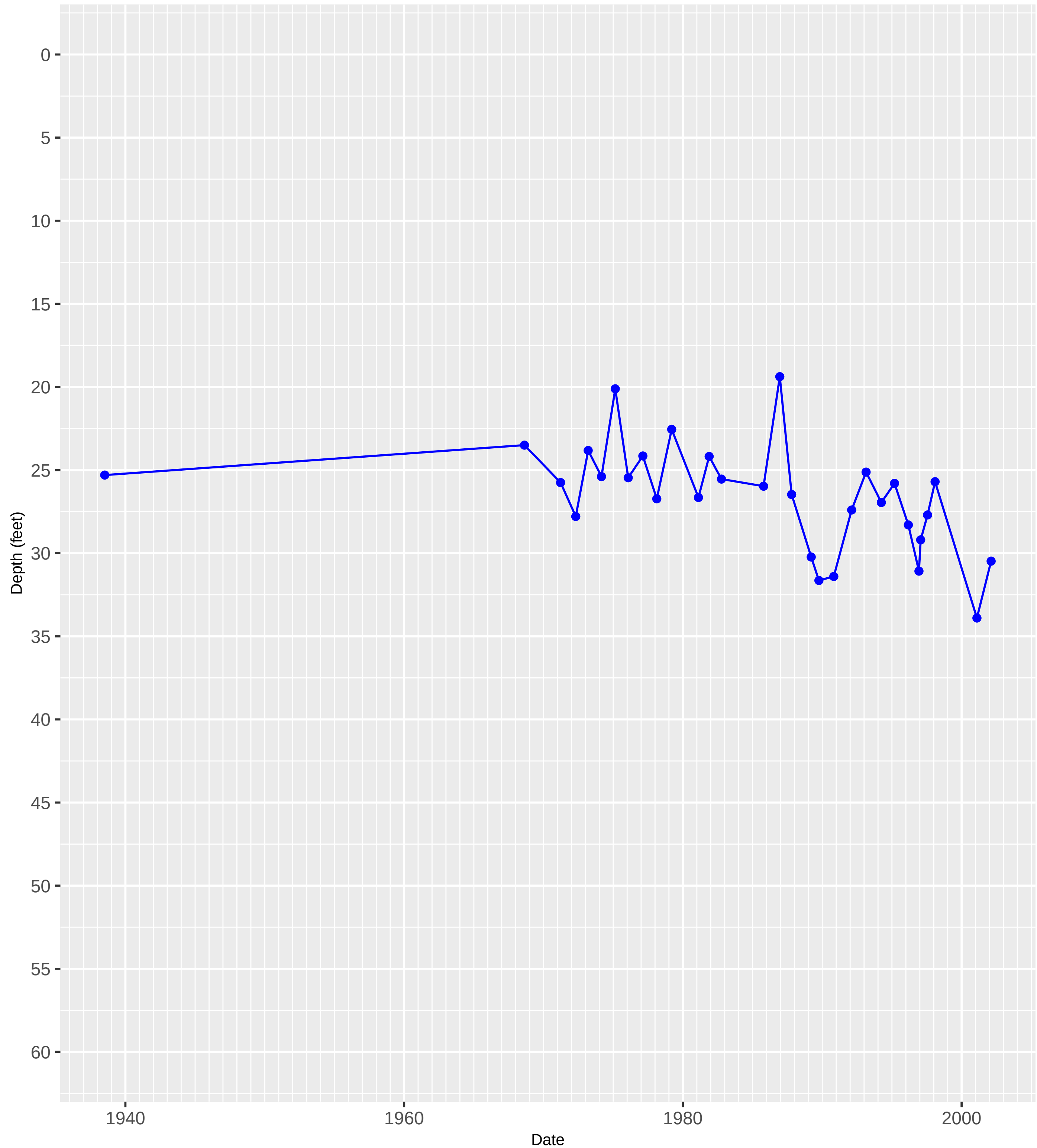


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram



5761803 Hydrograph in 218GLRSL − Glen Rose Limestone, Lower Member located in Blanco County



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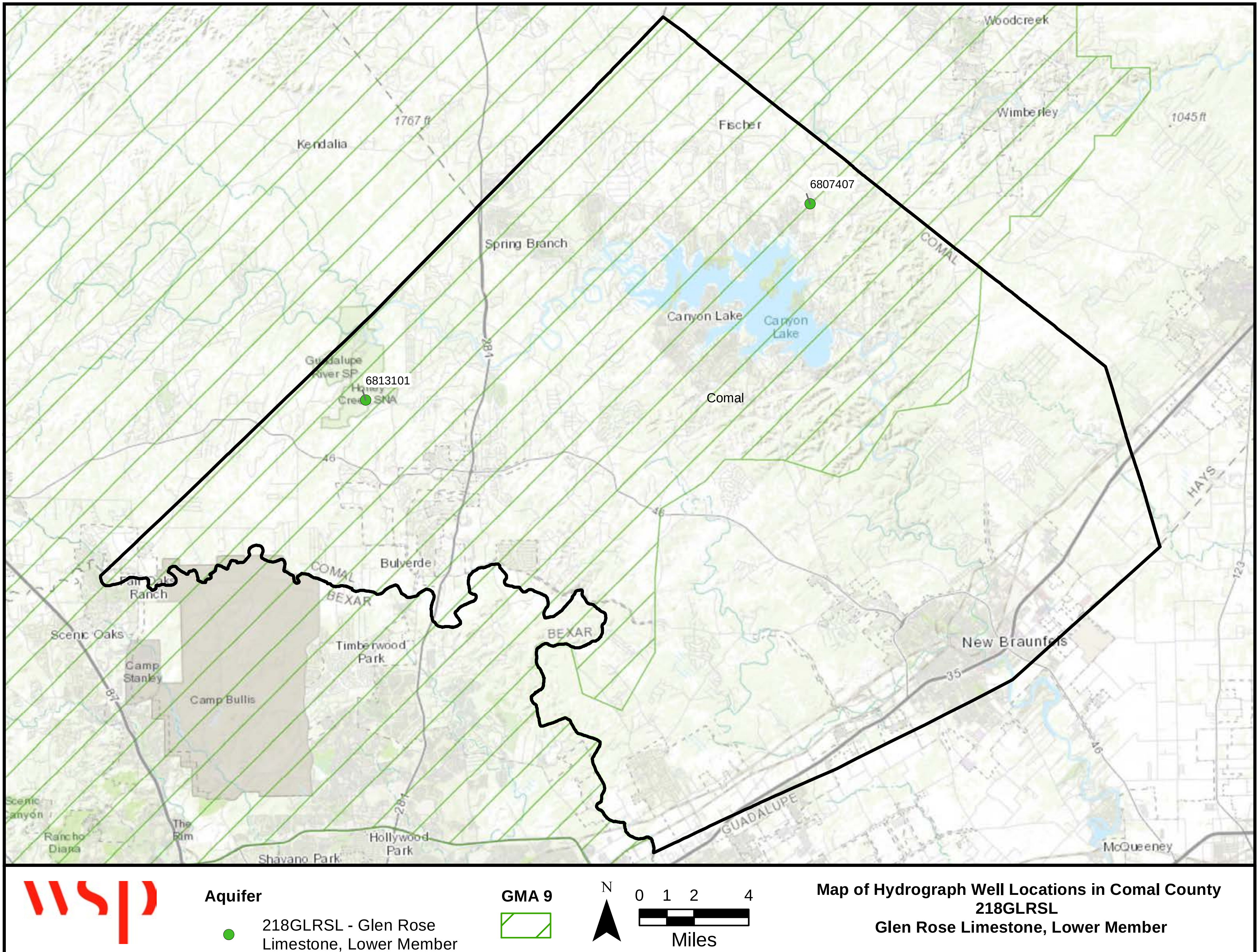
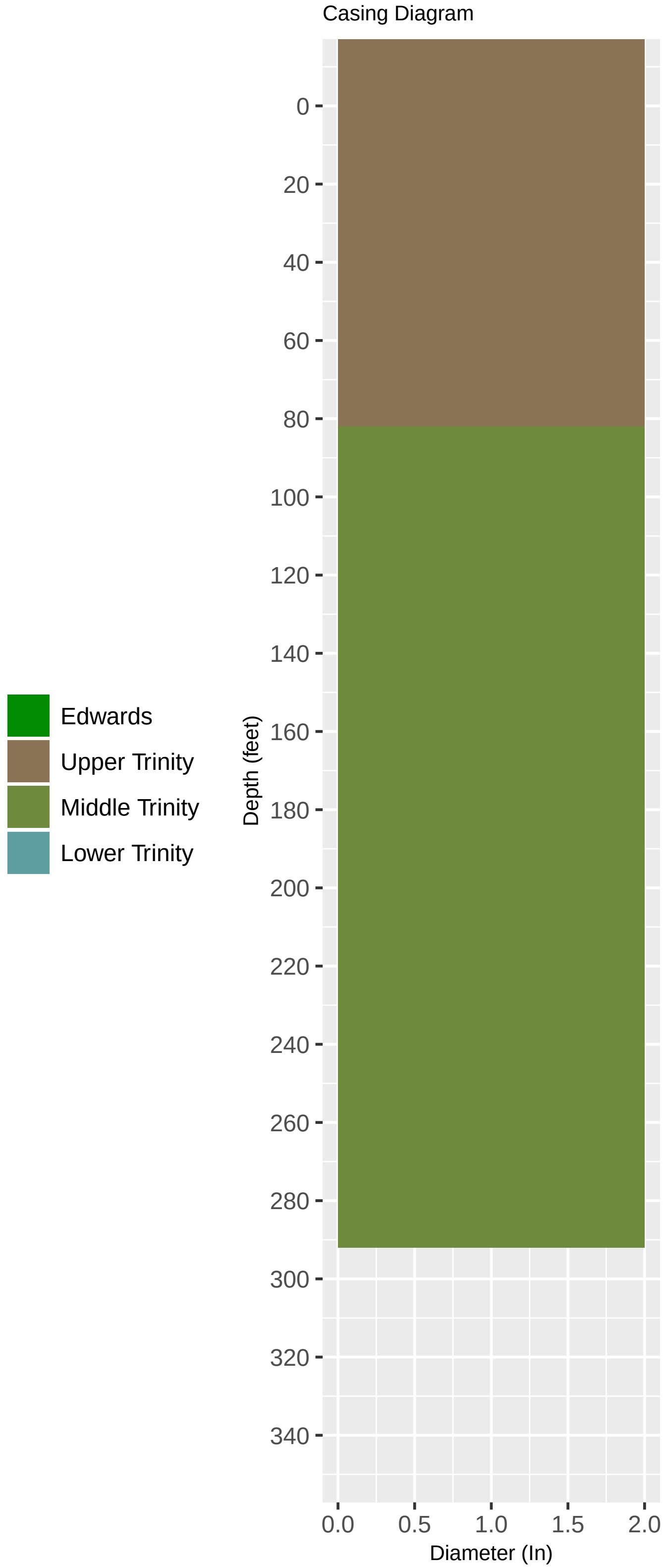
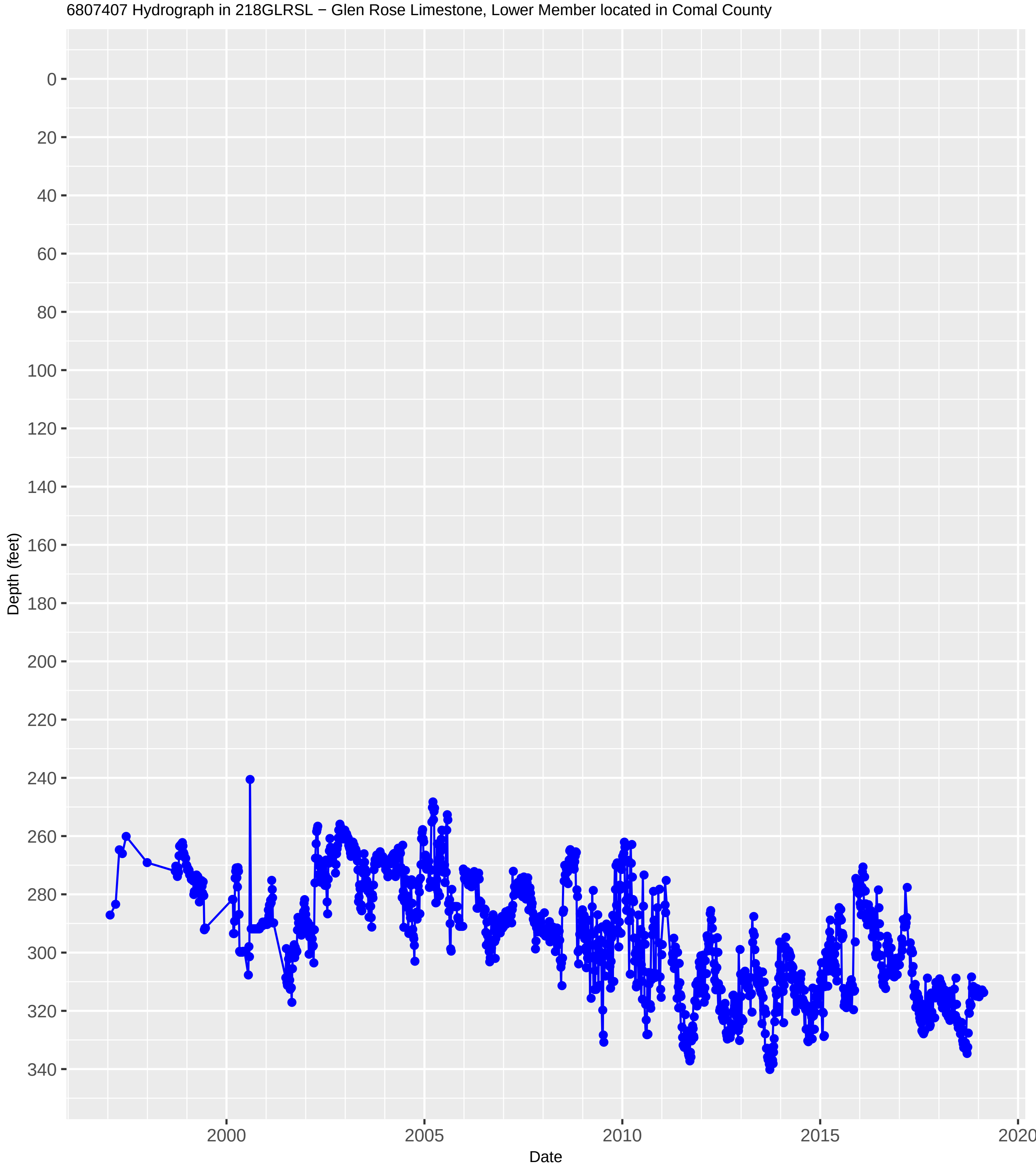


Map of Hydrograph Well Locations in Comal County
218GLRSL
Glen Rose Limestone, Lower Member





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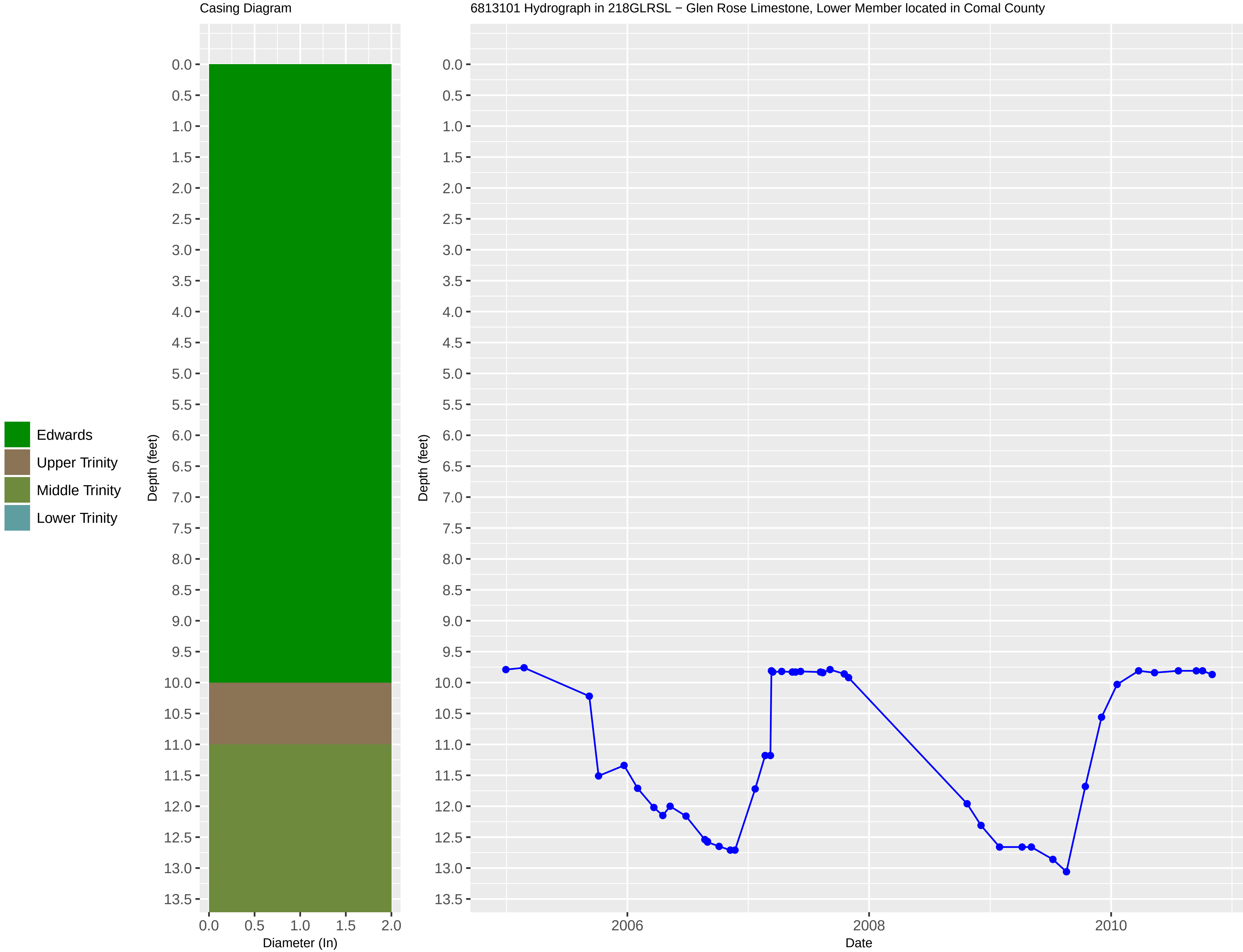

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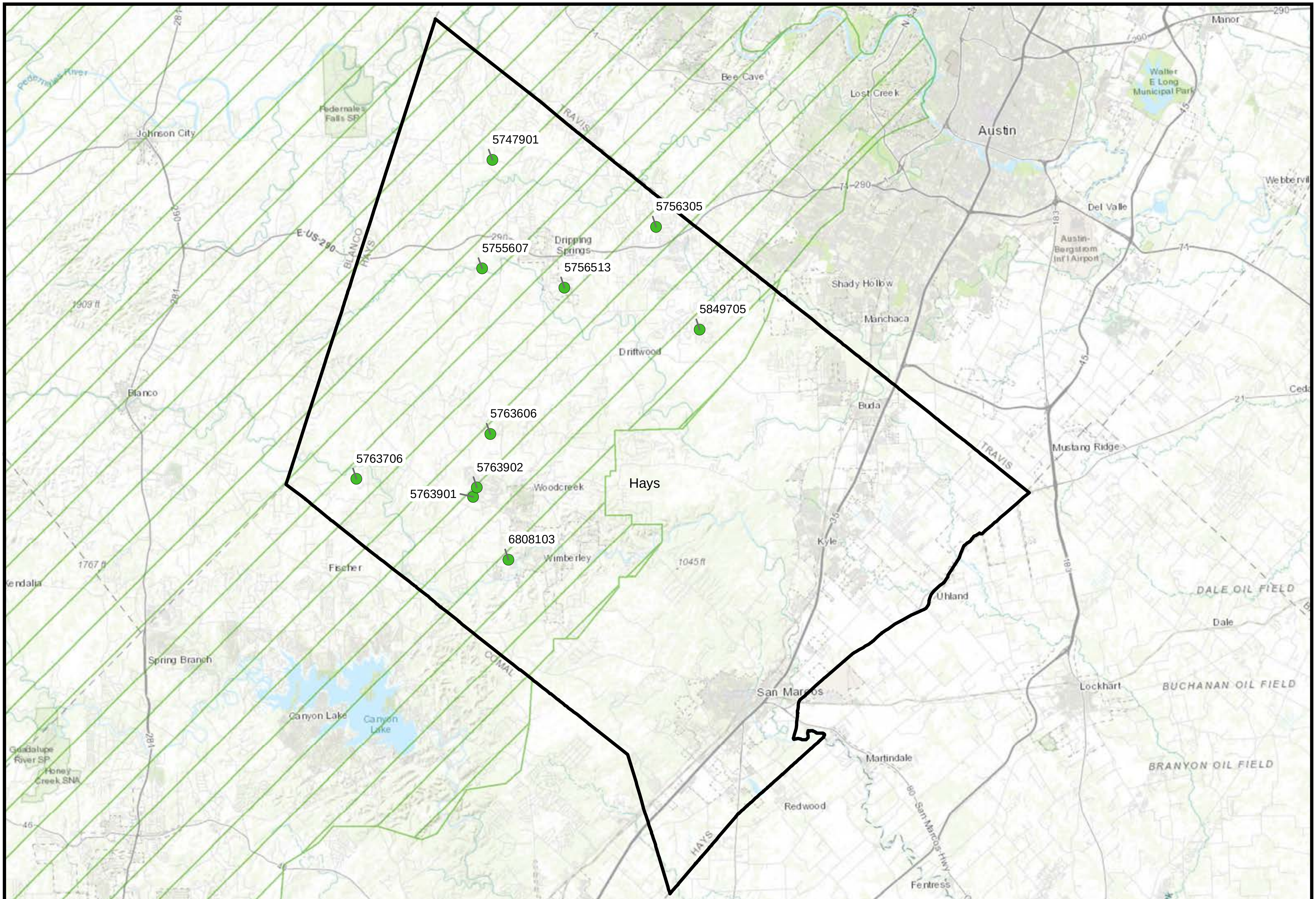


Aquifer

218GLRSL - Glen Rose Limestone, Lower Member

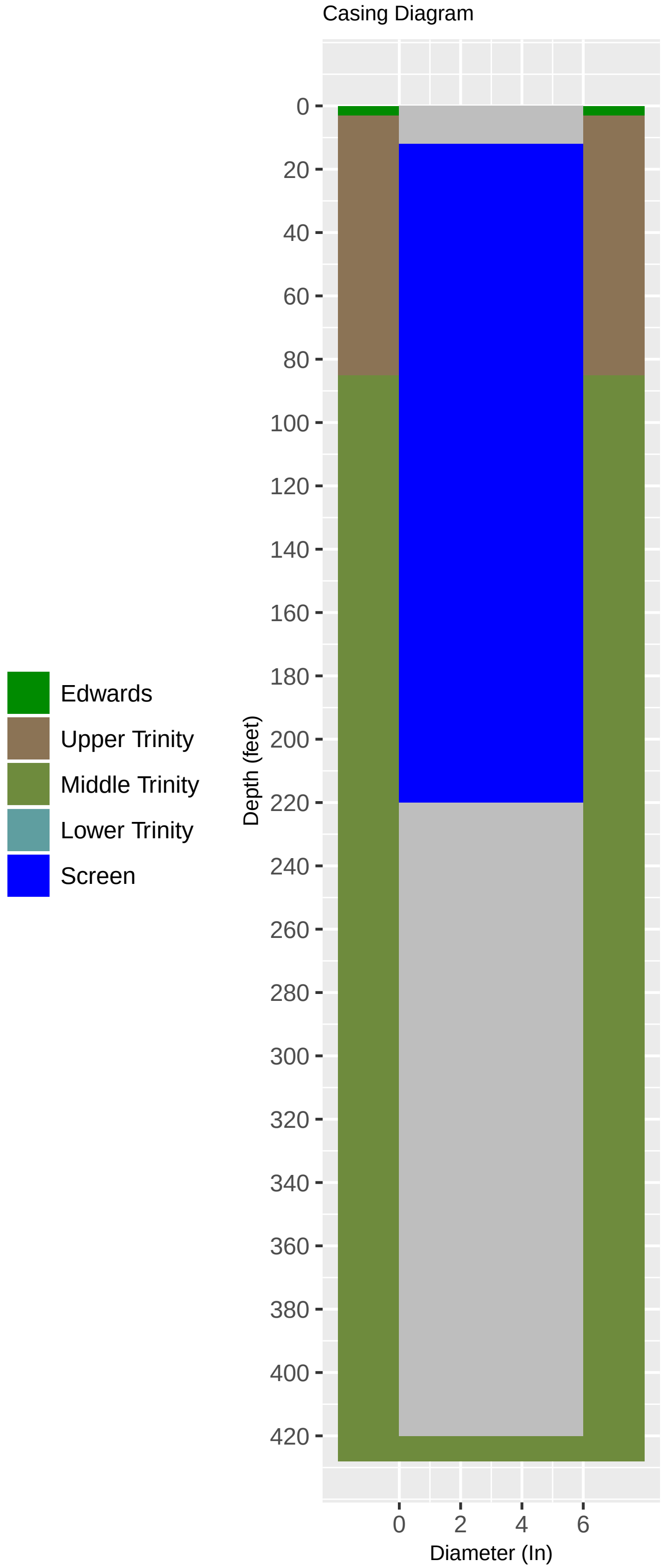
GMA 9

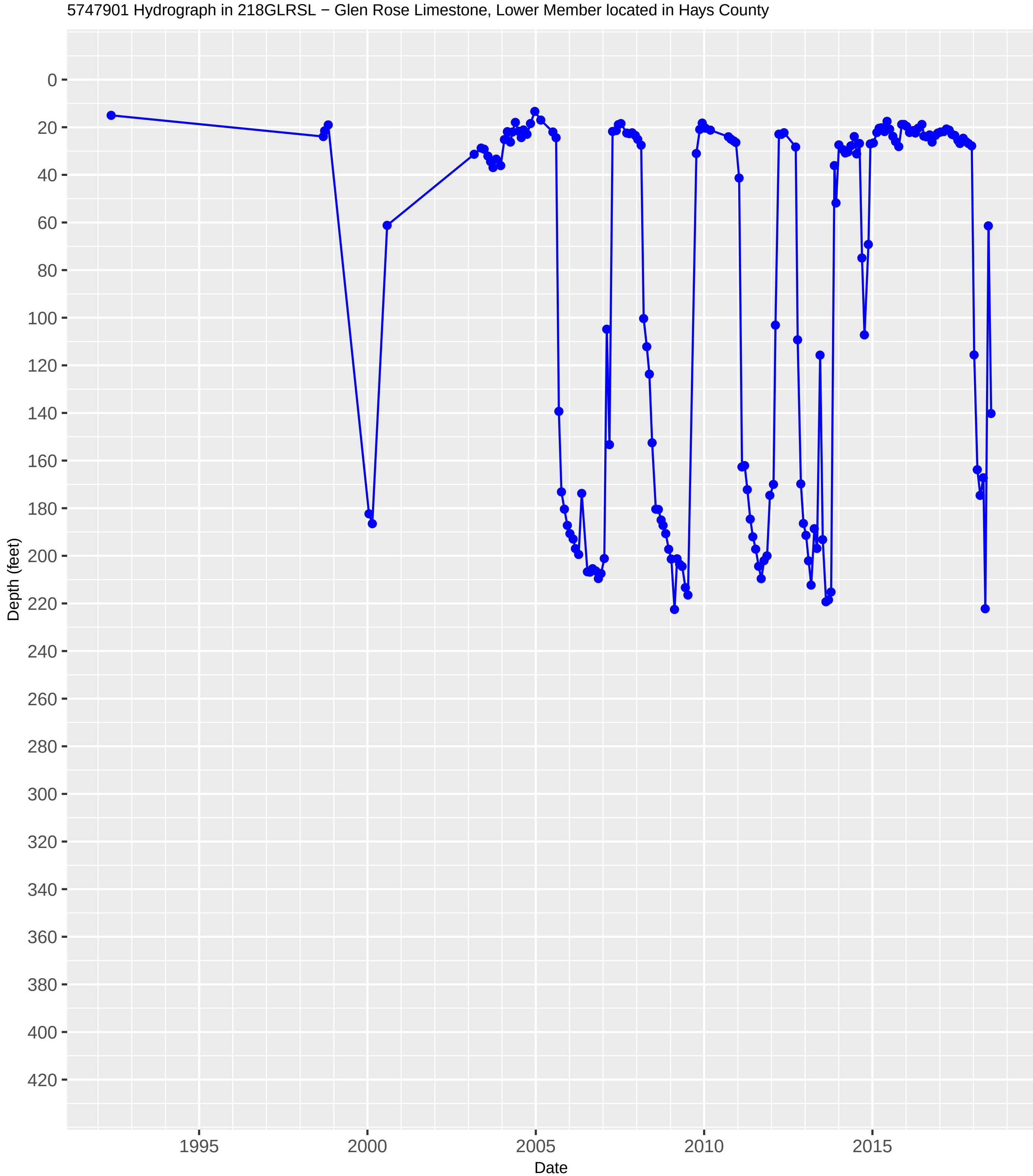
N

0 1 2 4 6

Miles

Map of Hydrograph Well Locations in Hays County
218GLRSL
Glen Rose Limestone, Lower Member





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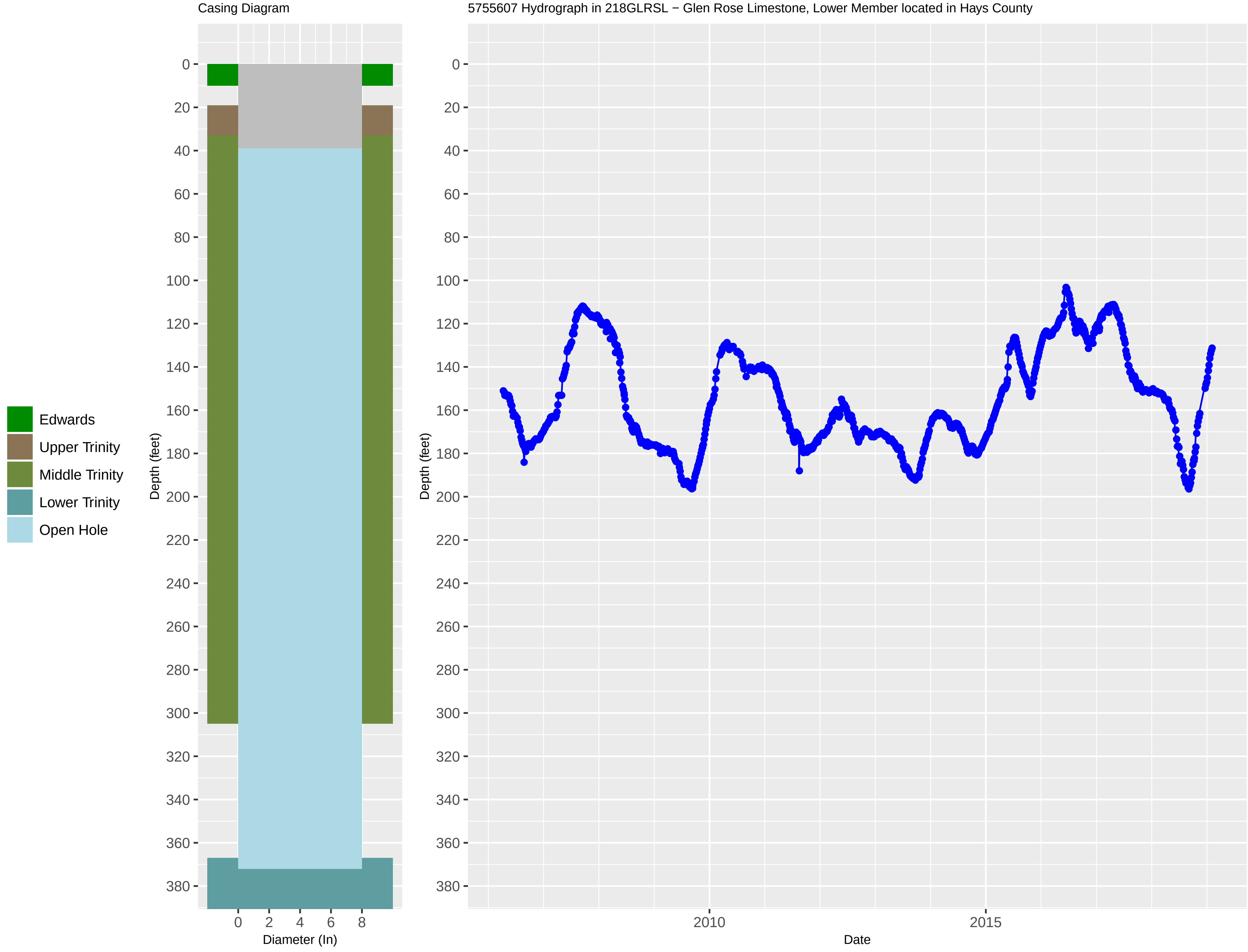

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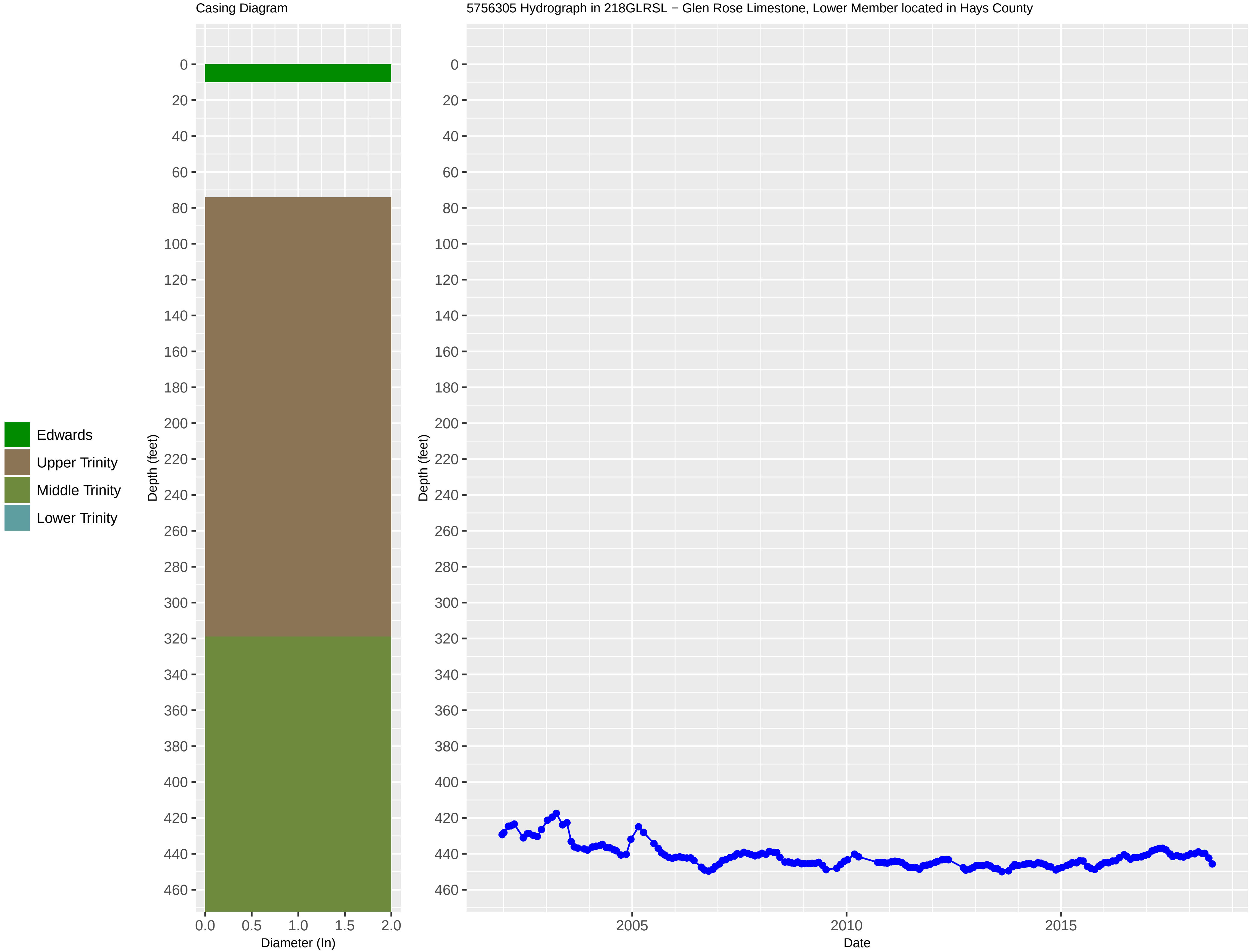

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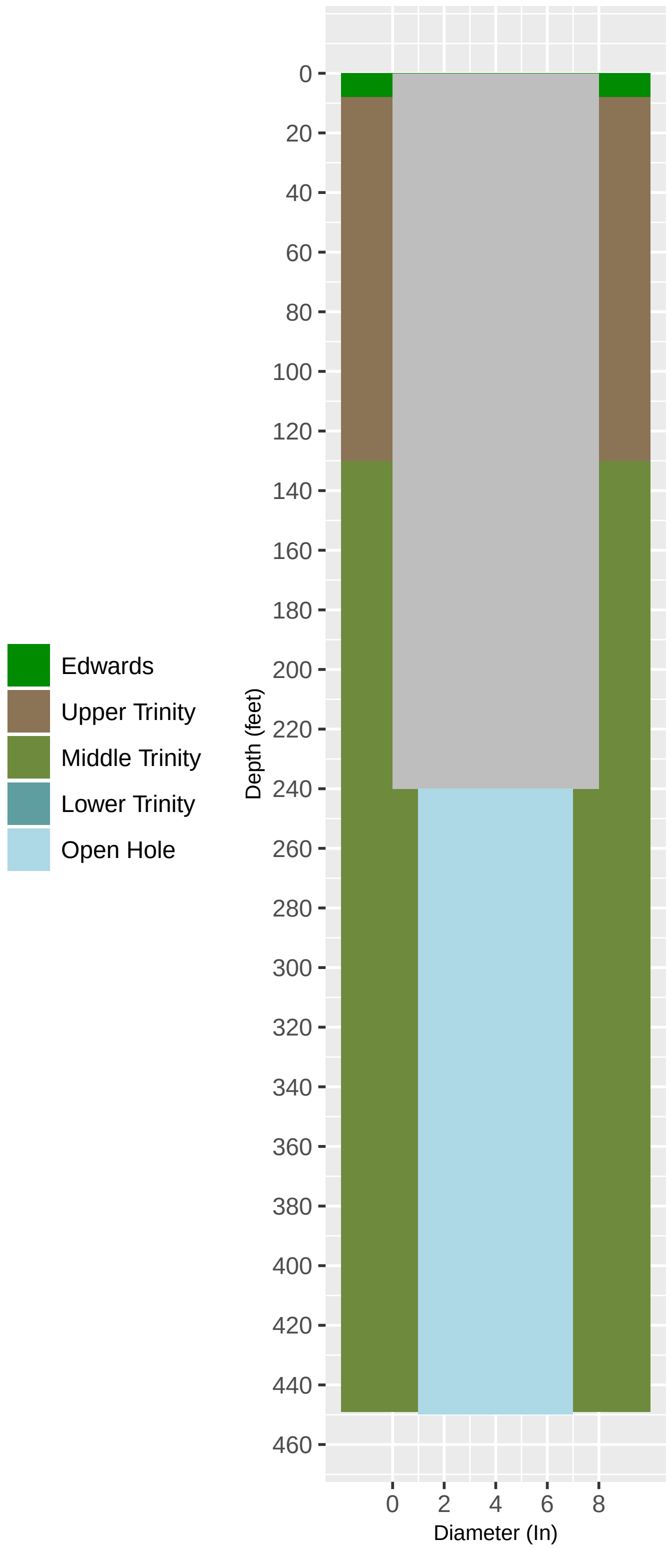
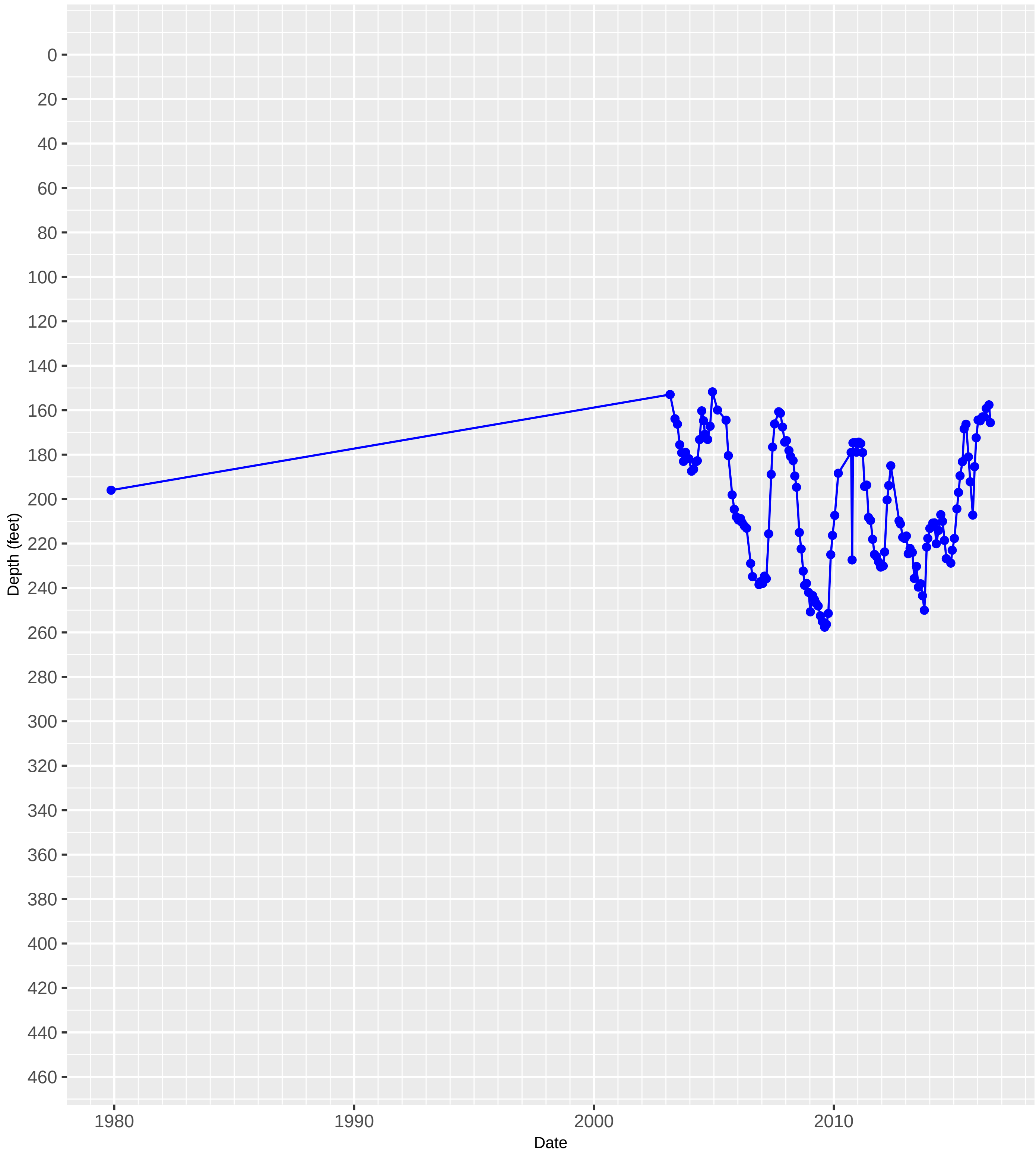
Casing Diagram



5756513 Hydrograph in 218GLRSL − Glen Rose Limestone, Lower Member located in Hays County



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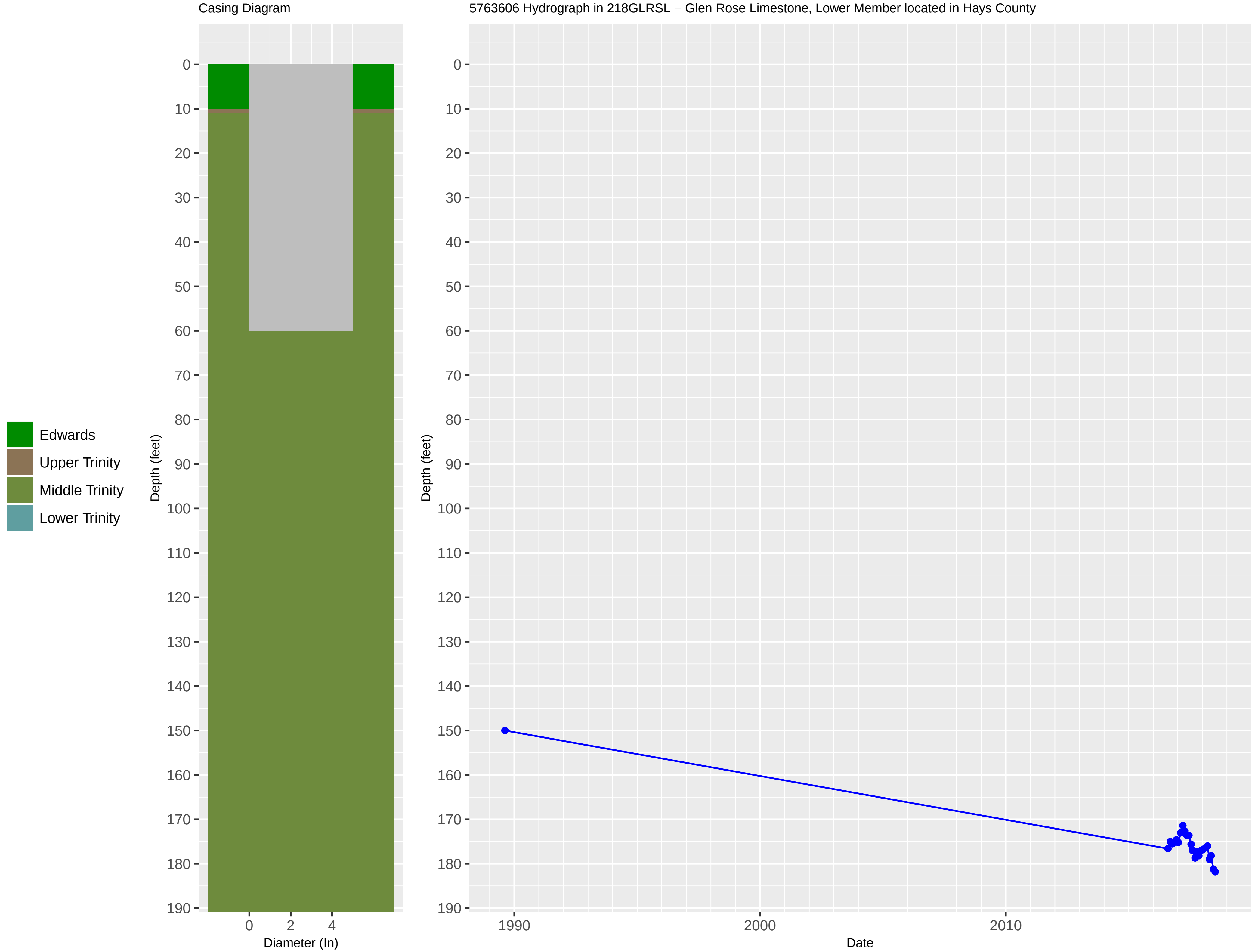
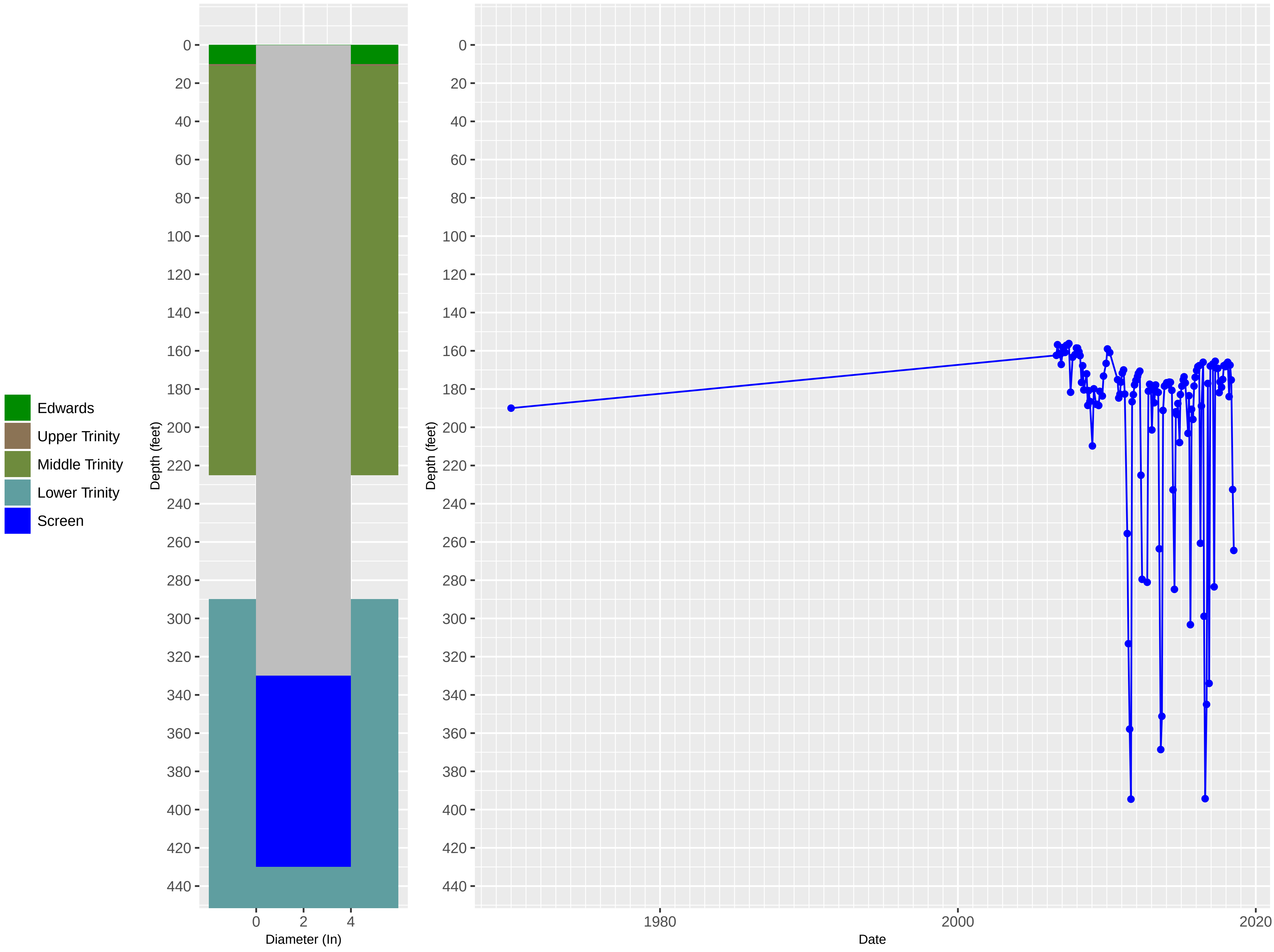


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

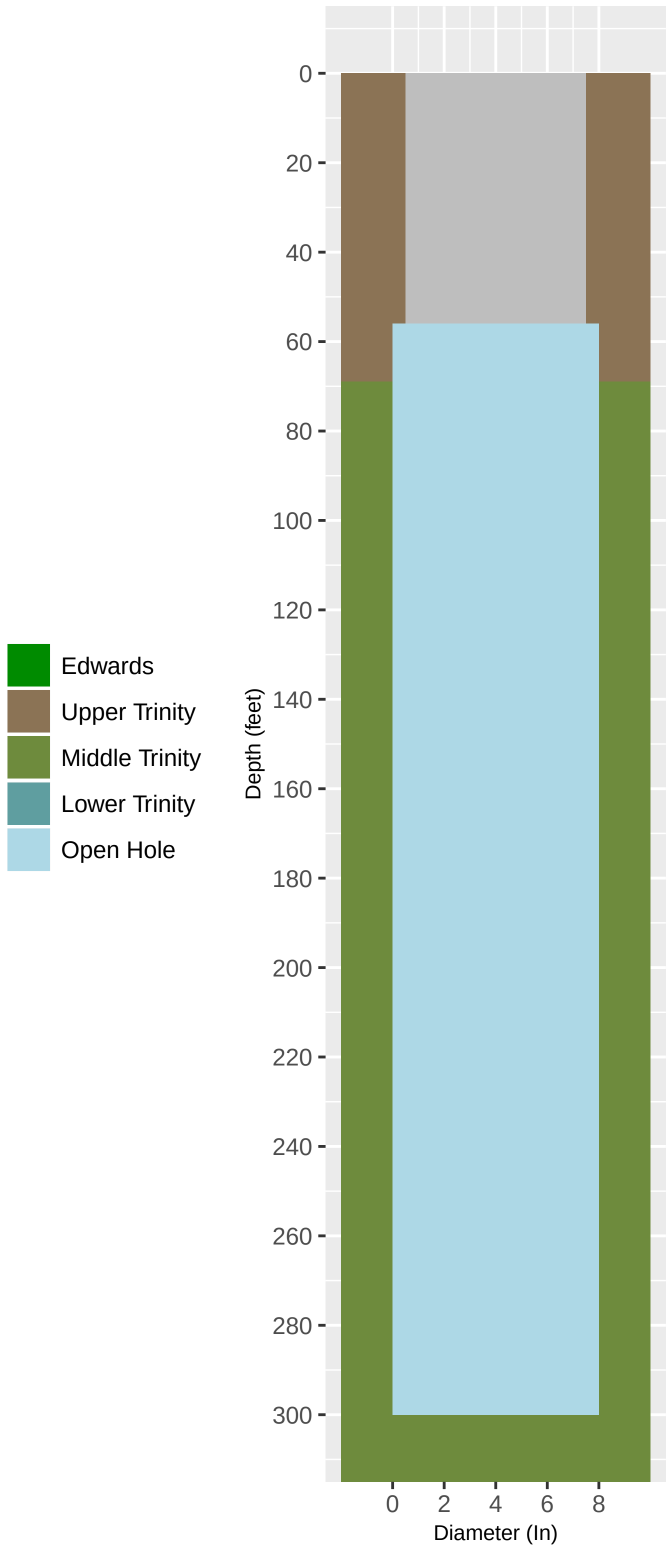
Casing Diagram

5763706 Hydrograph in 218GLRSL − Glen Rose Limestone, Lower Member located in Hays County

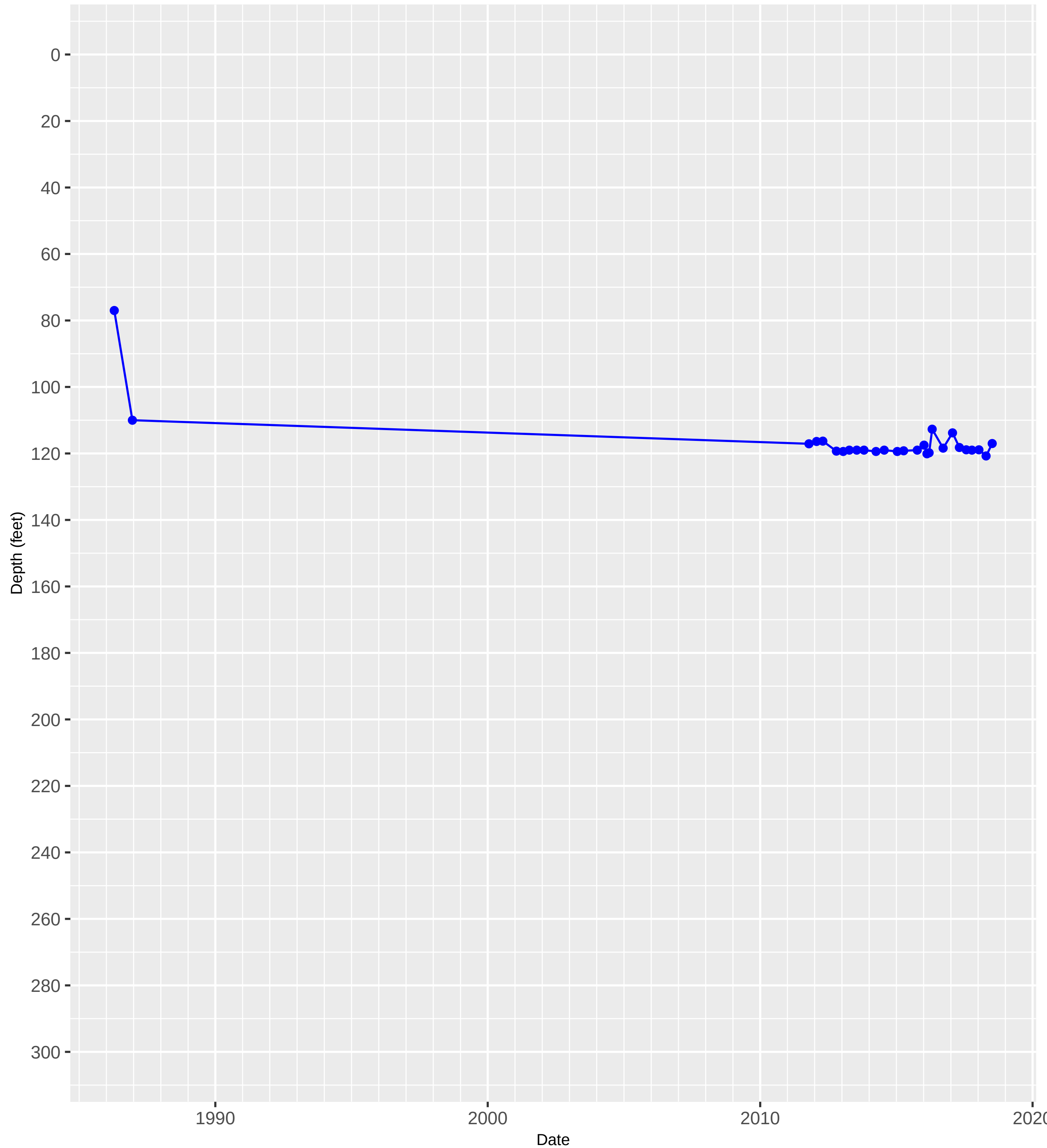


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

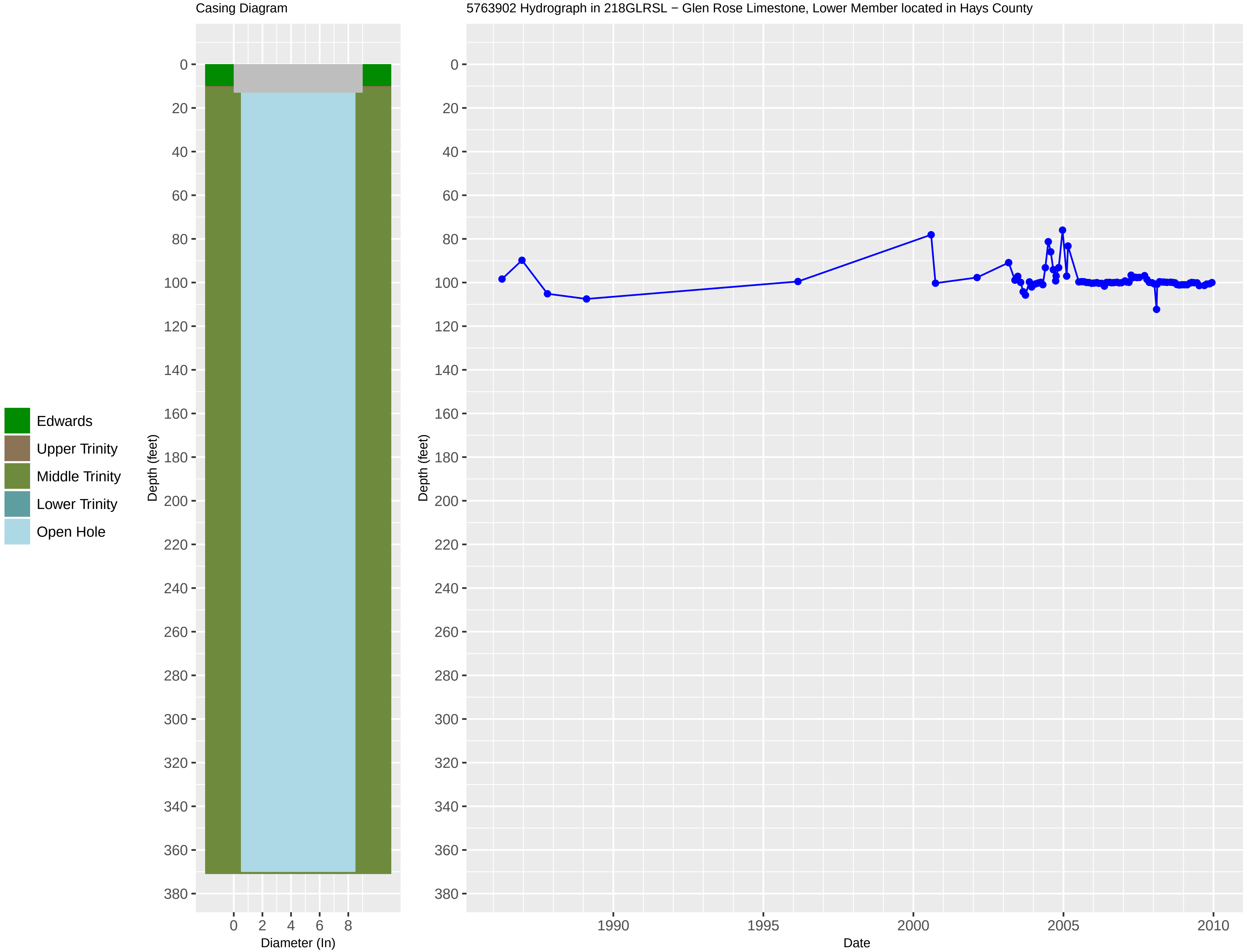
Casing Diagram



5763901 Hydrograph in 218GLRSL − Glen Rose Limestone, Lower Member located in Hays County



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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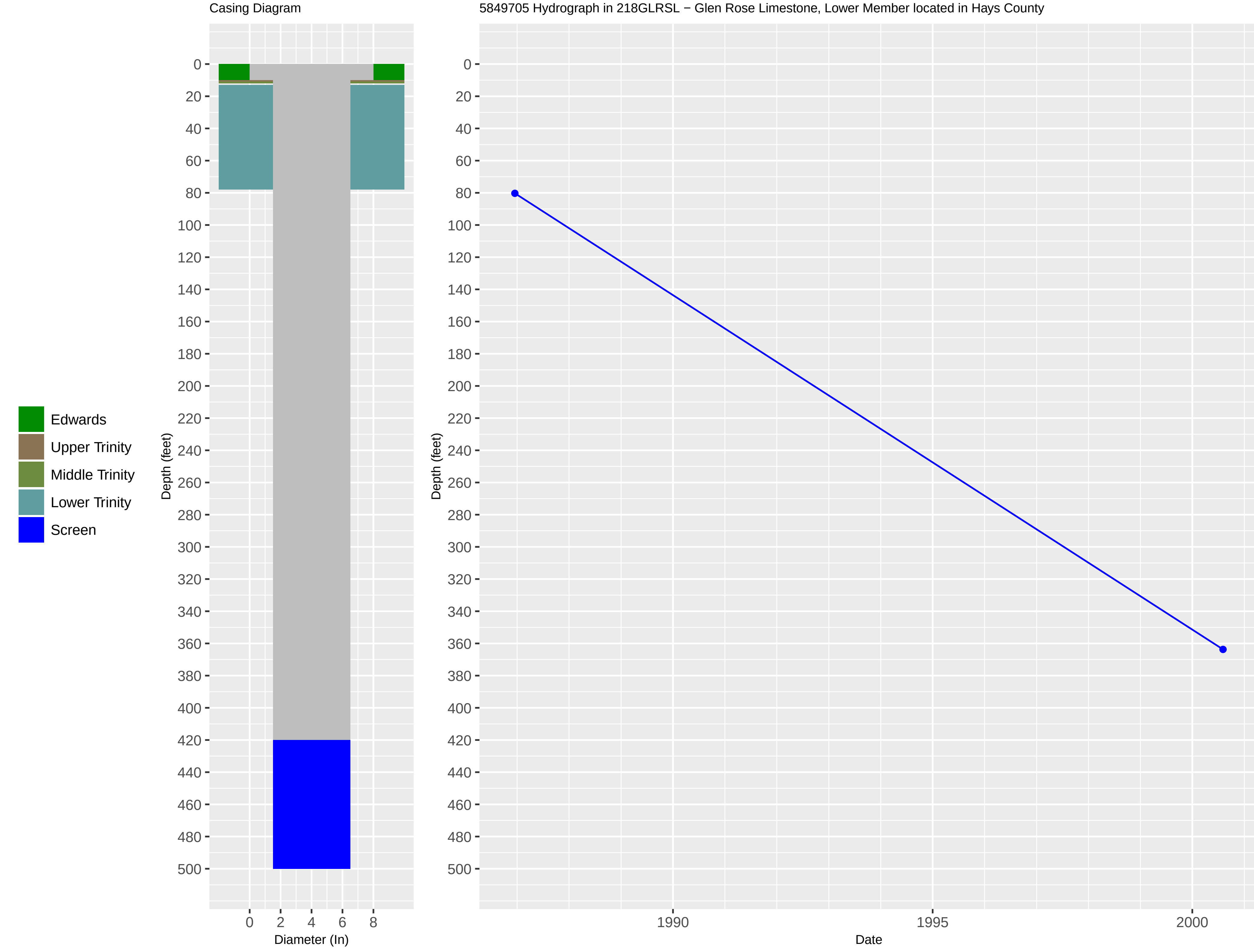

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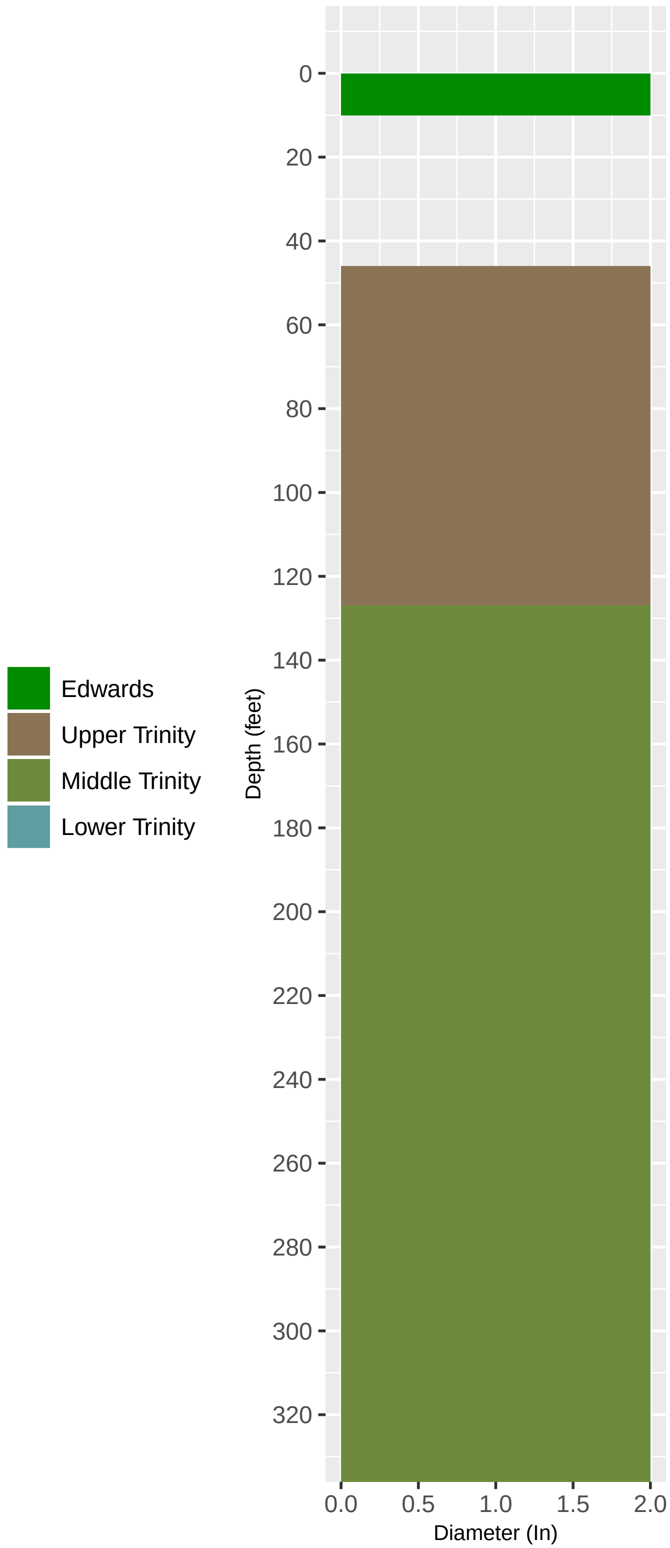
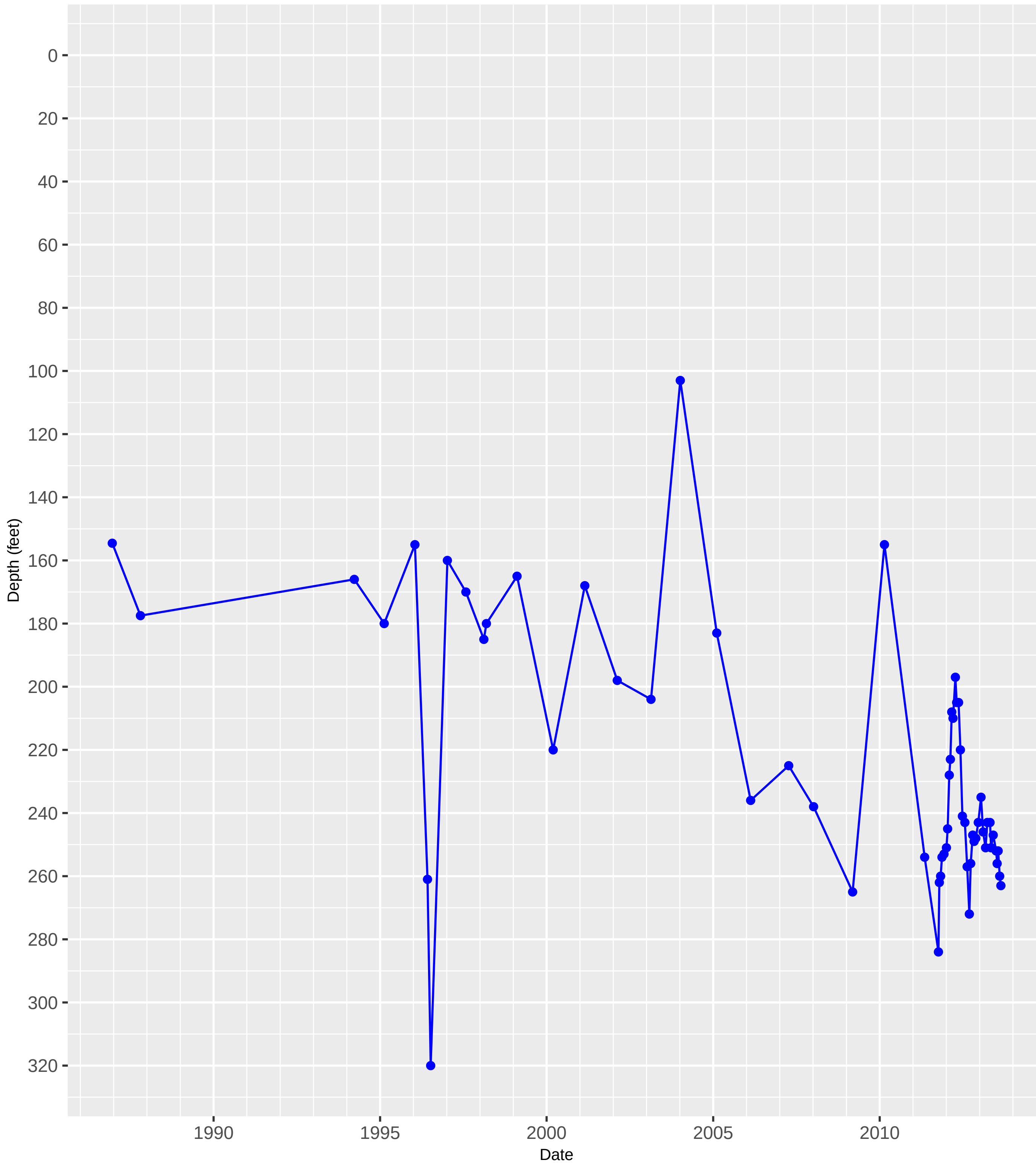
Casing Diagram



6808103 Hydrograph in 218GLRSL − Glen Rose Limestone, Lower Member located in Hays County



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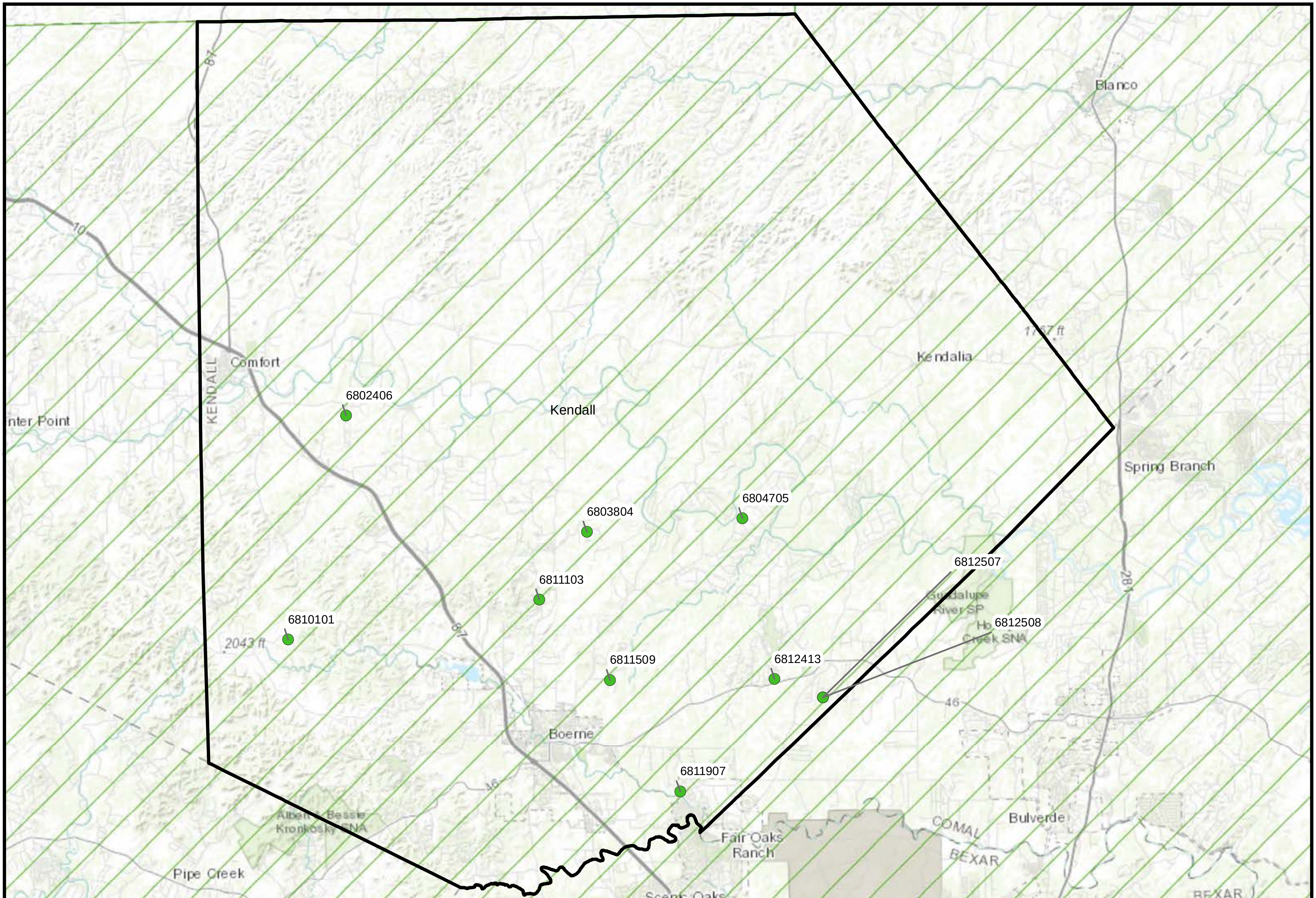
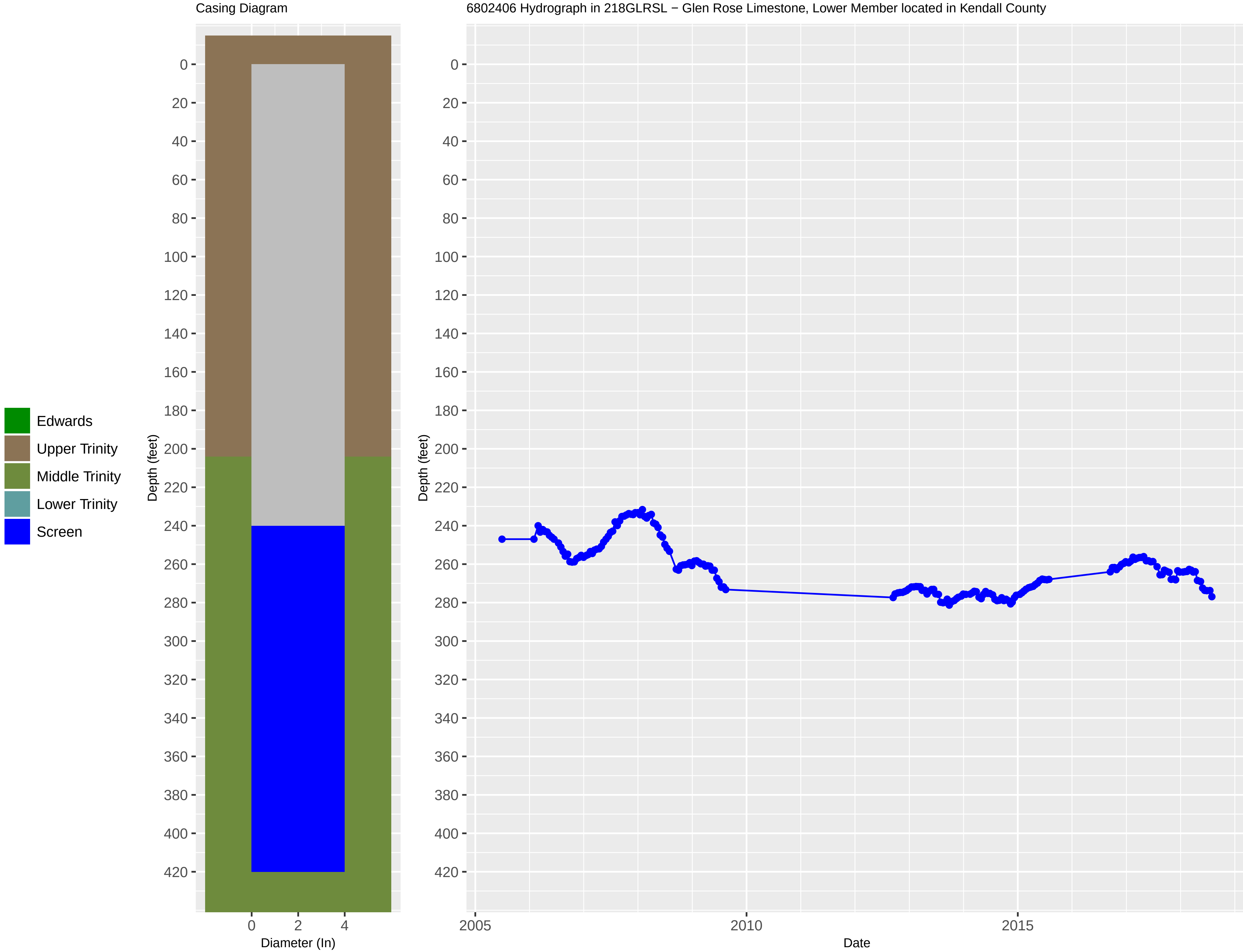


Map of Hydrograph Well Locations in Kendall County
218GLRSL
Glen Rose Limestone, Lower Member



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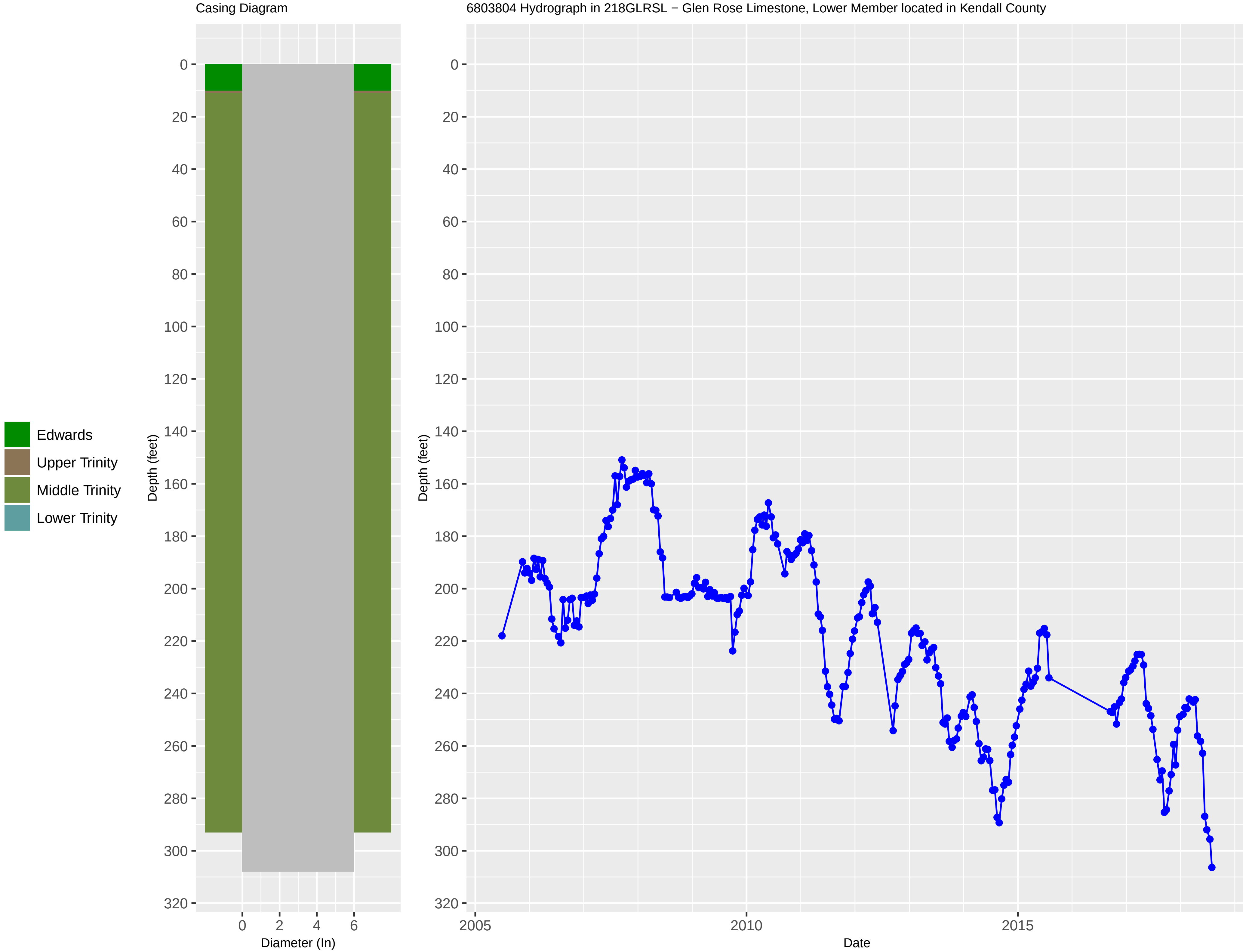

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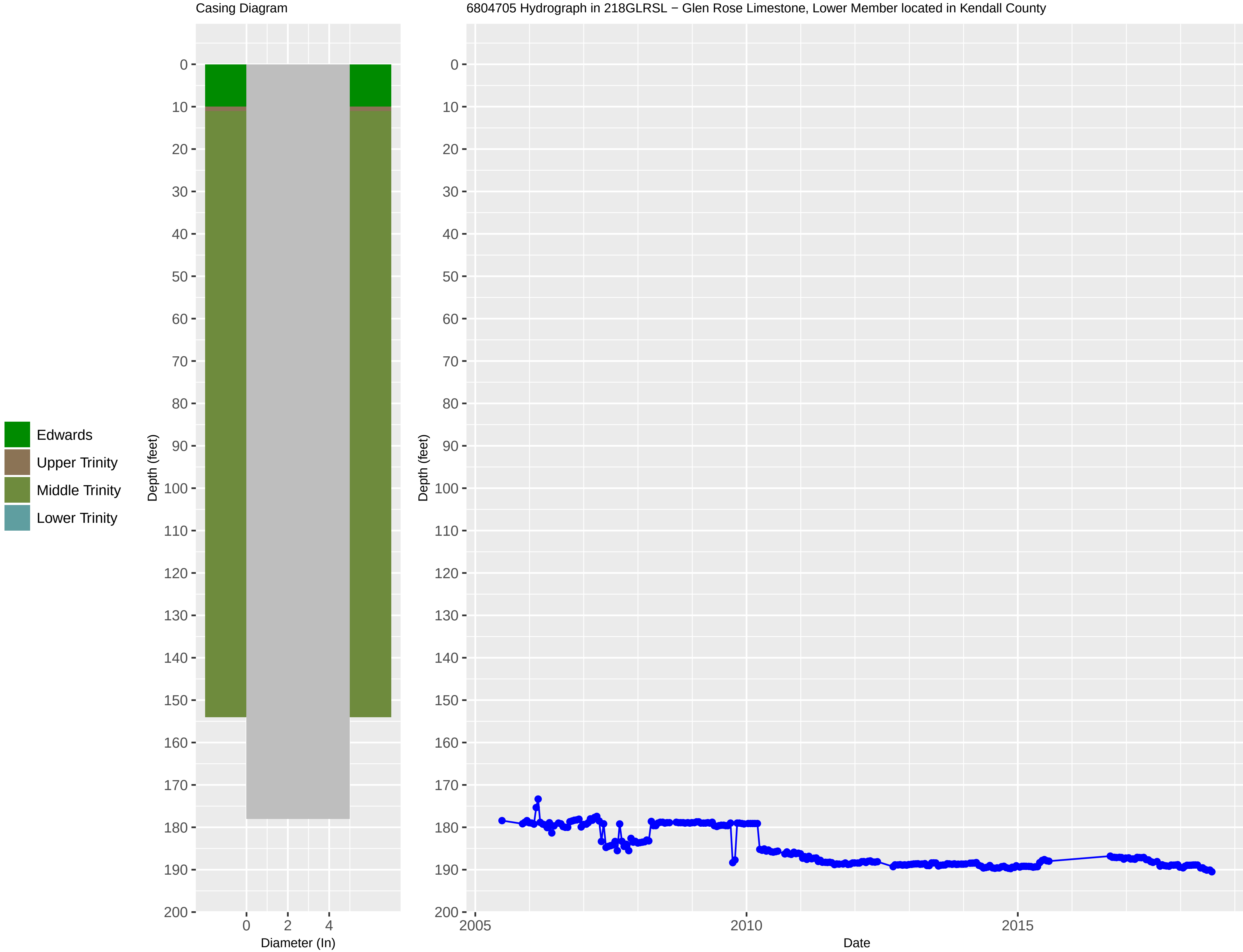

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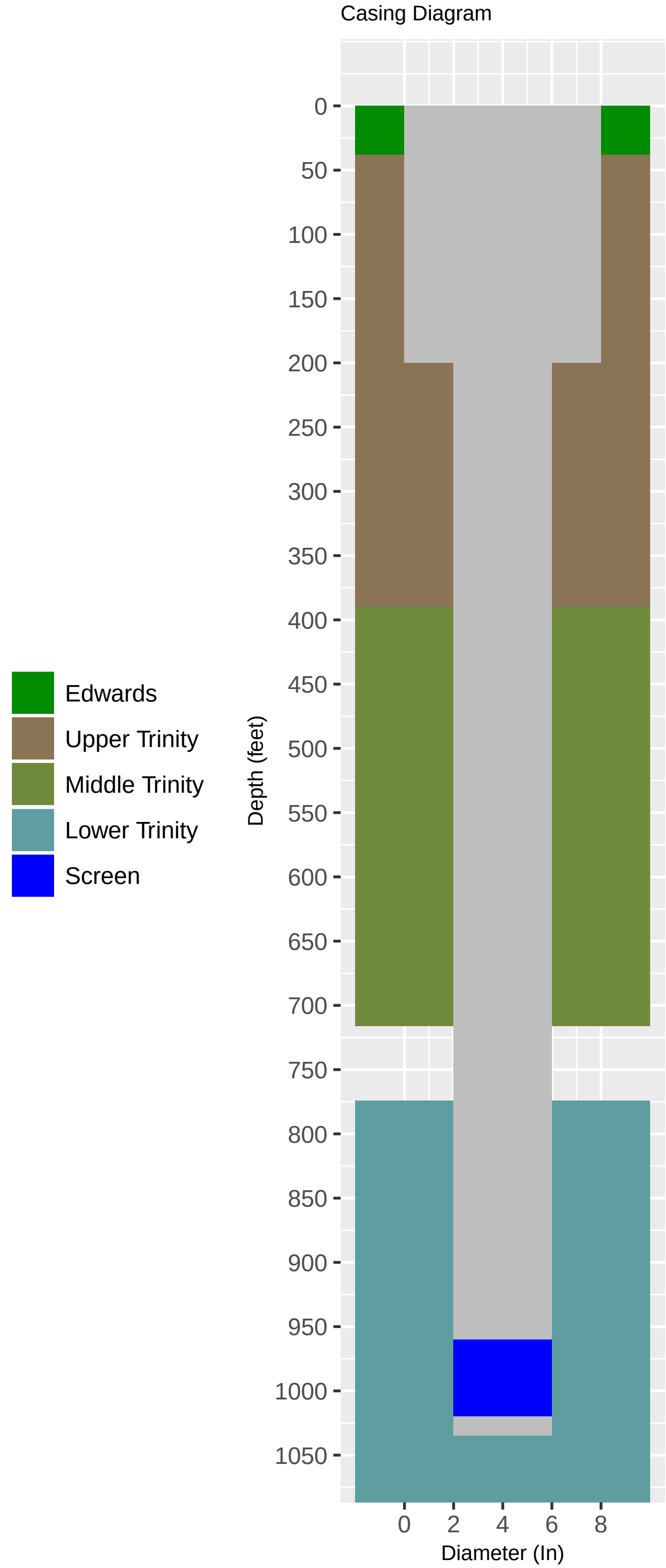

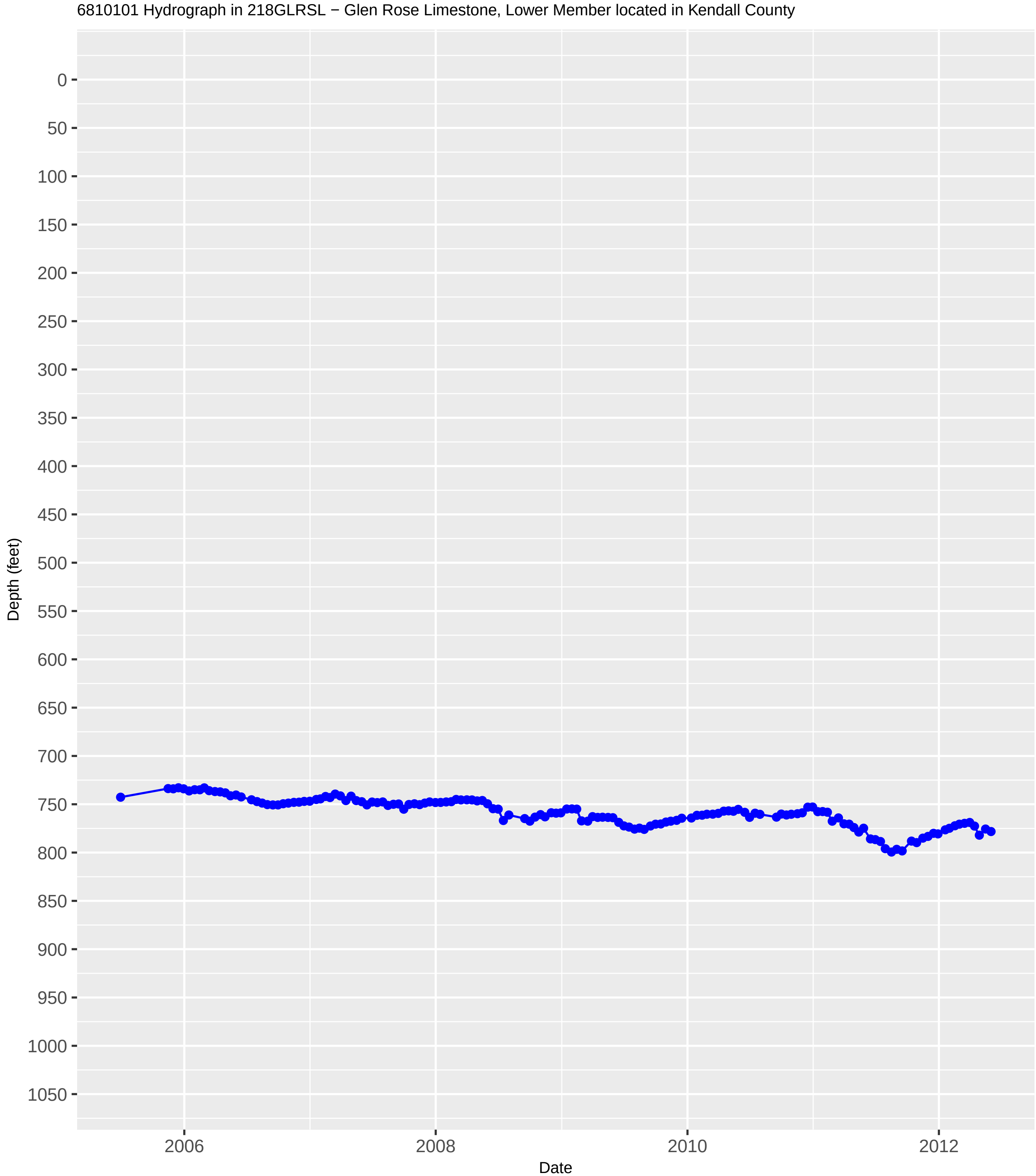

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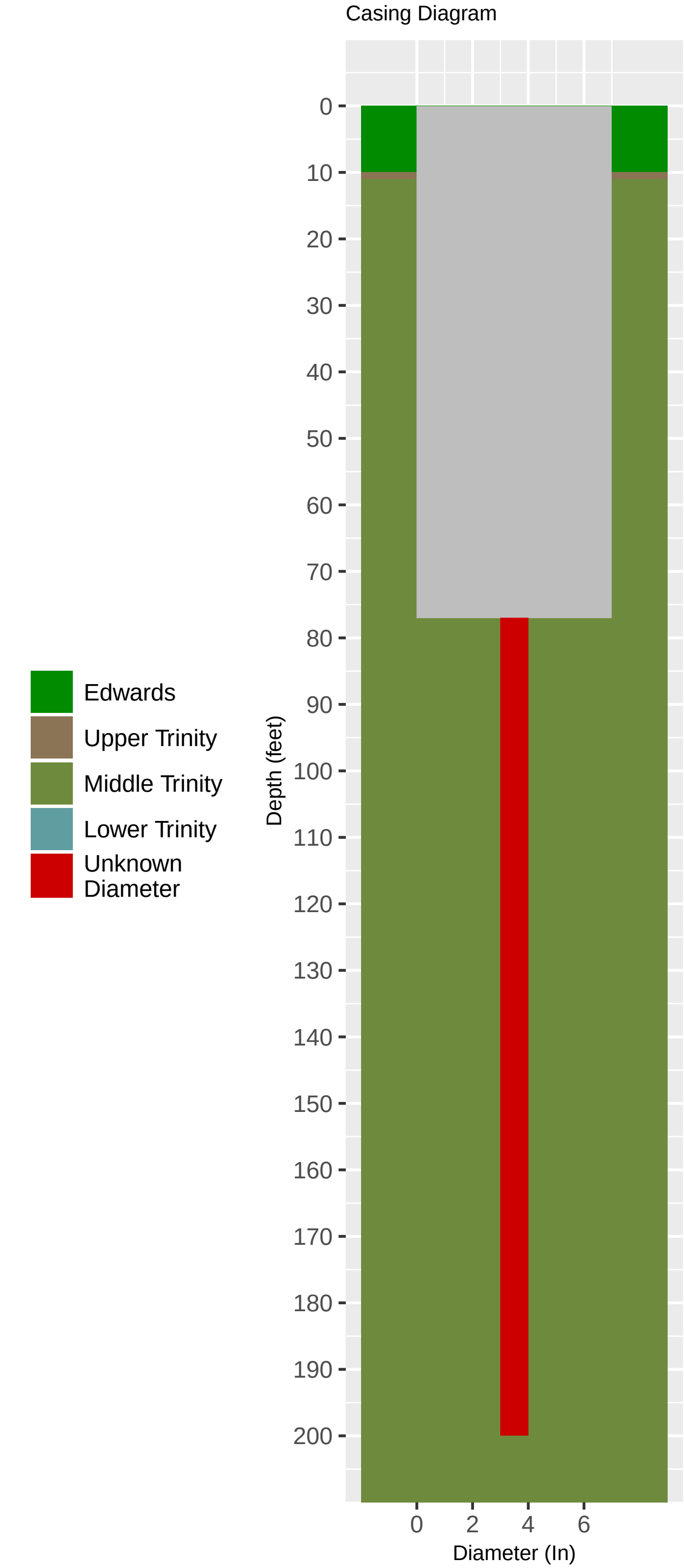
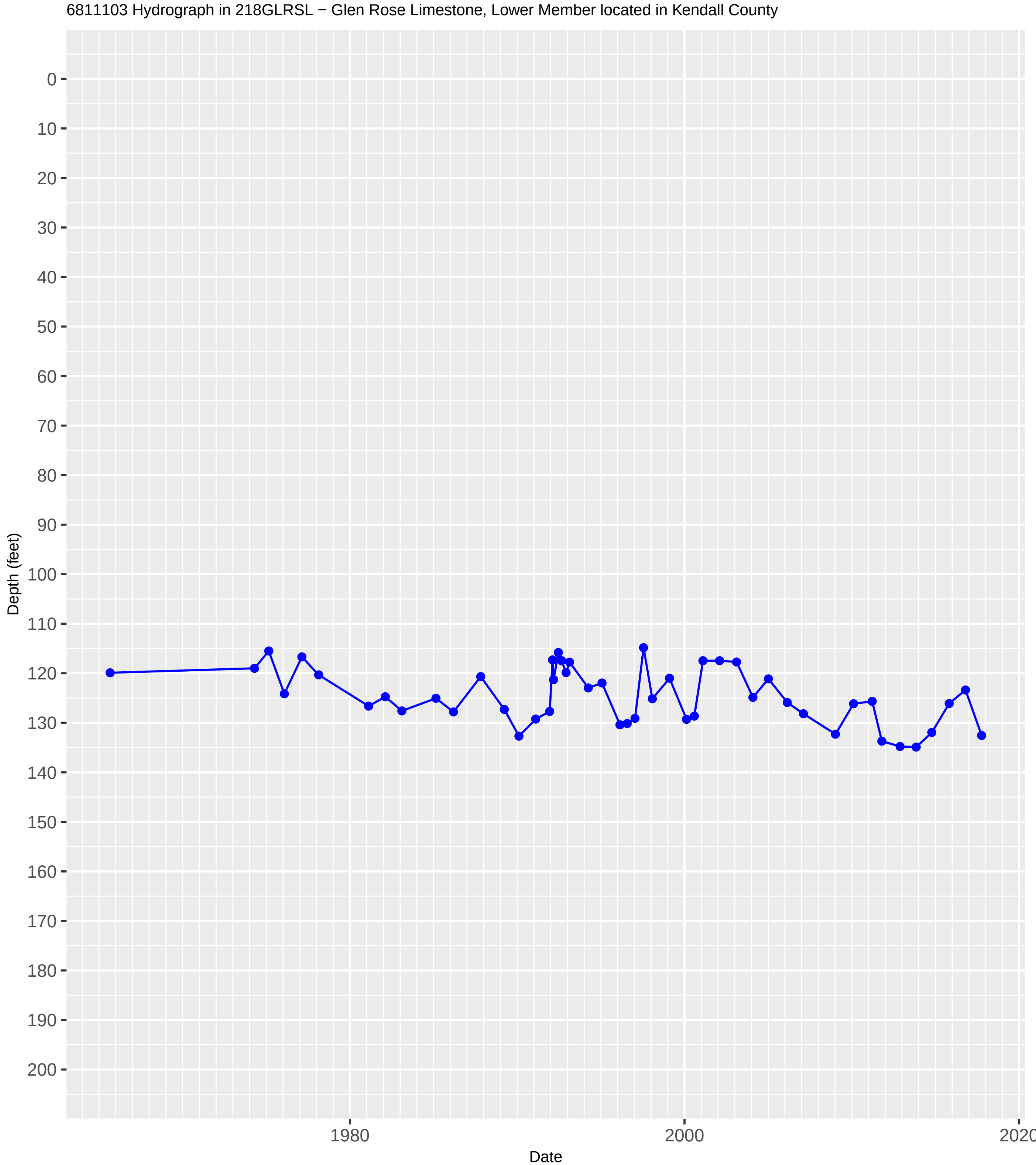
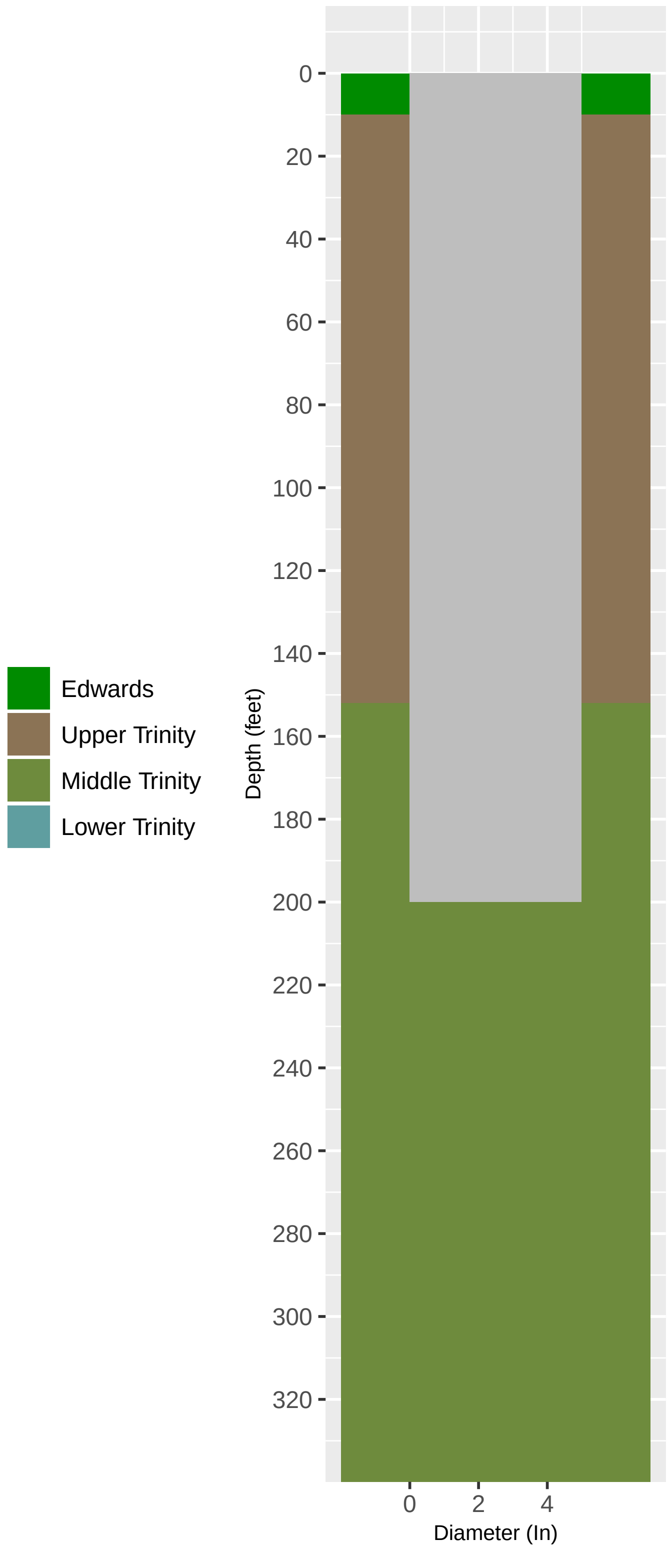


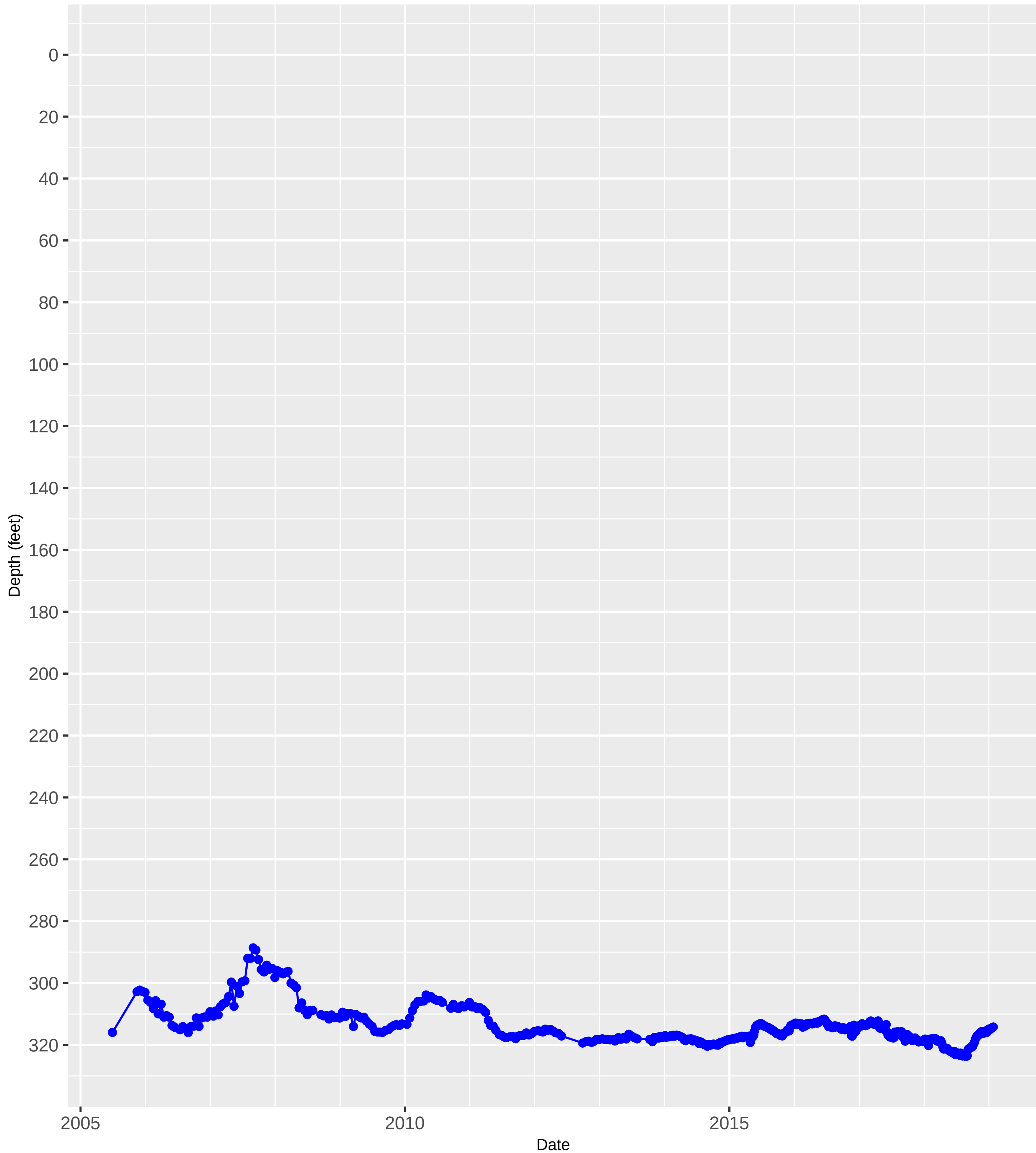


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

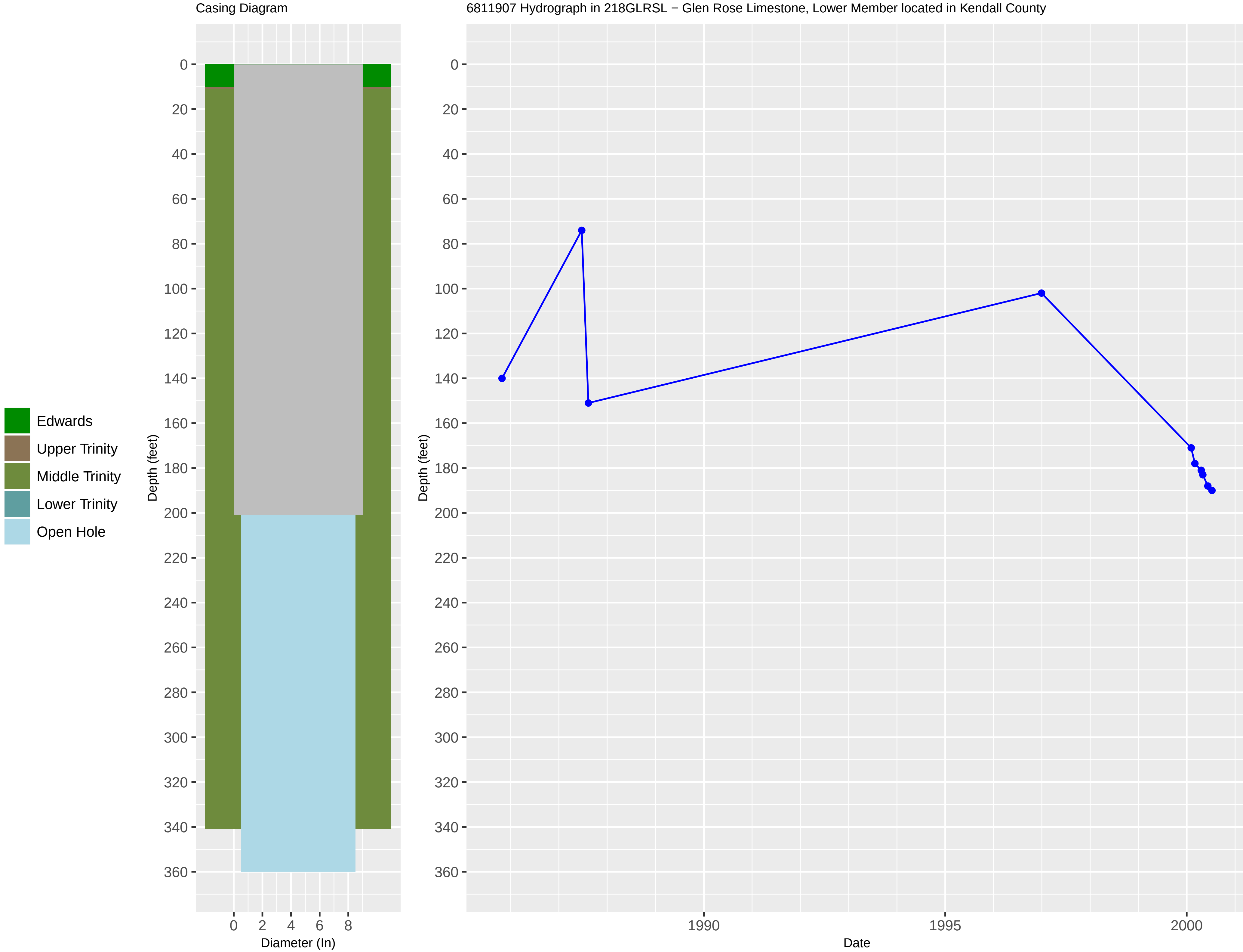
Casing Diagram

6811509 Hydrograph in 218GLRSL − Glen Rose Limestone, Lower Member located in Kendall County





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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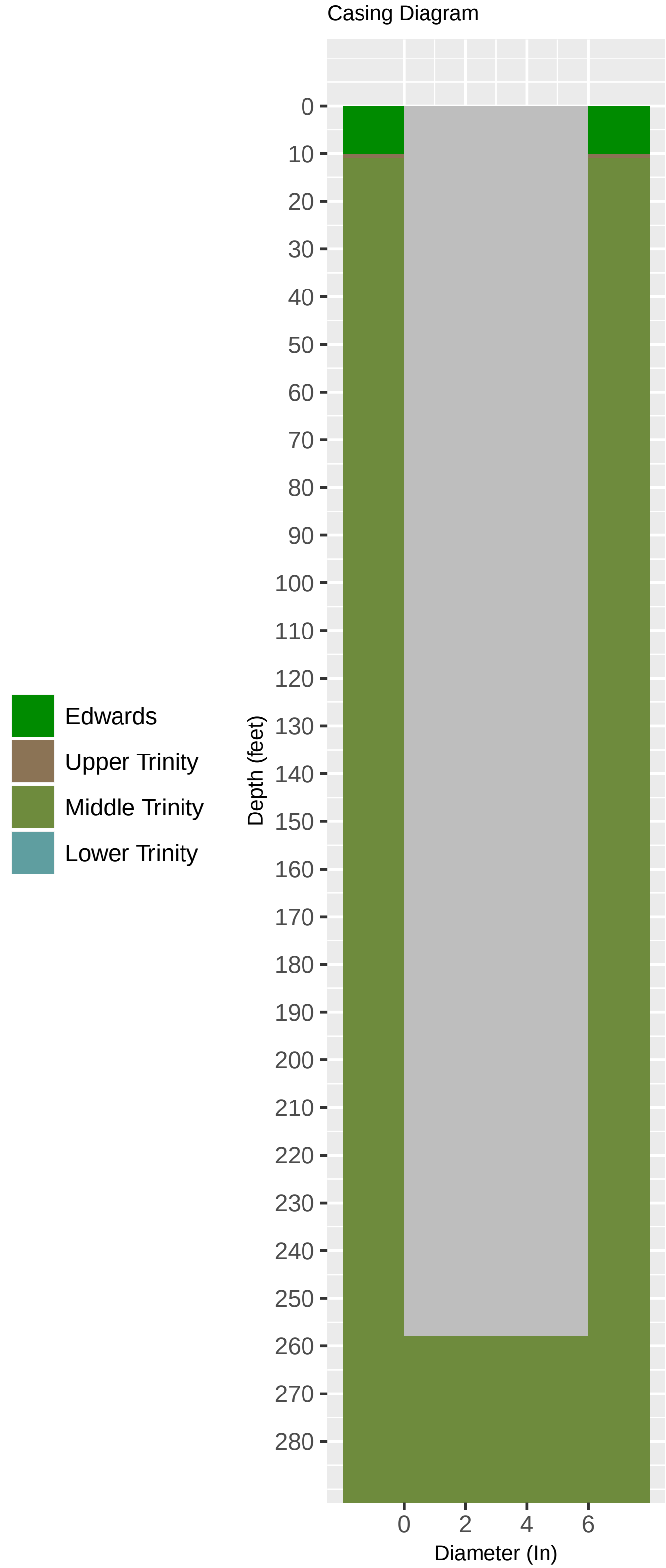

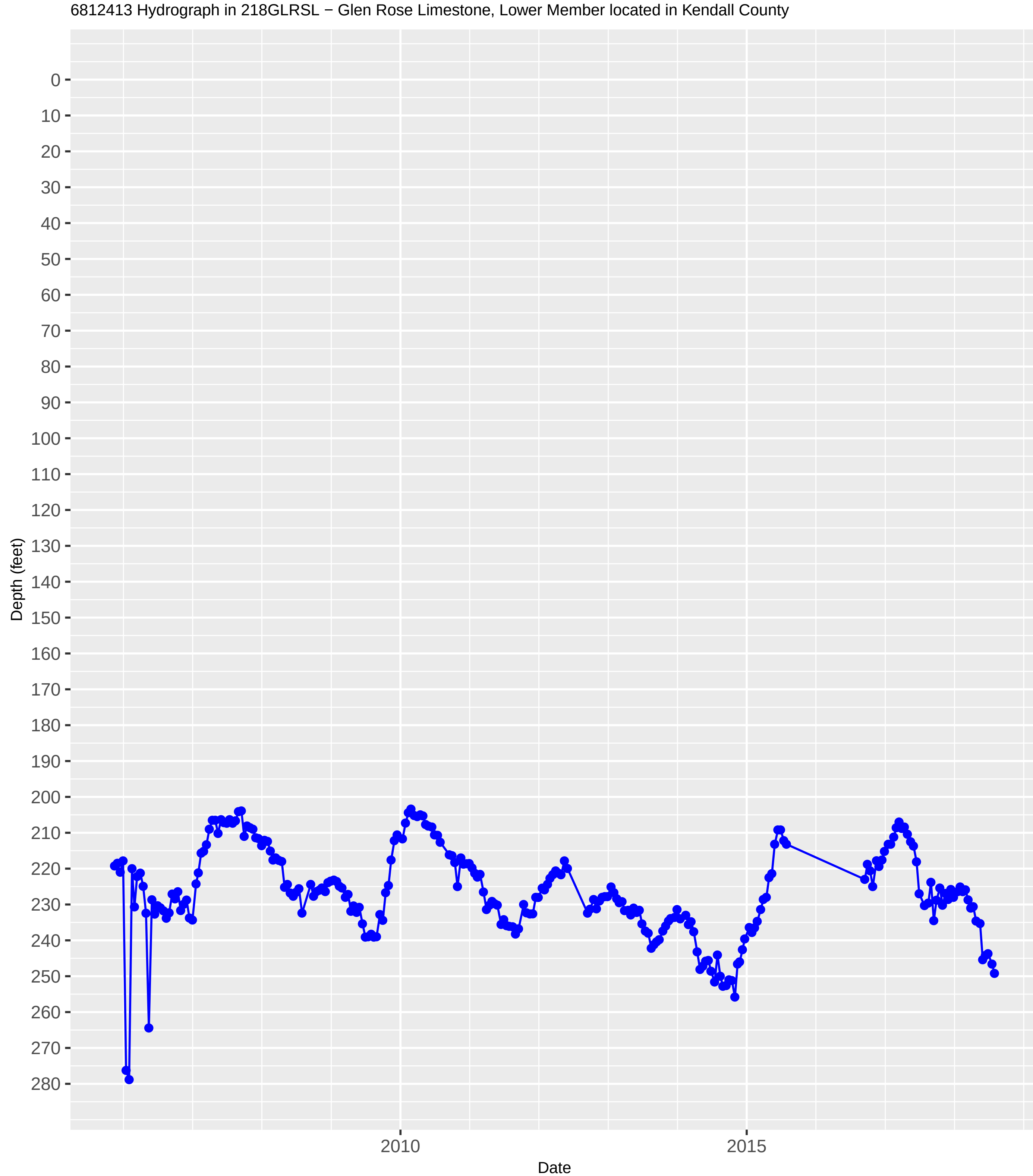

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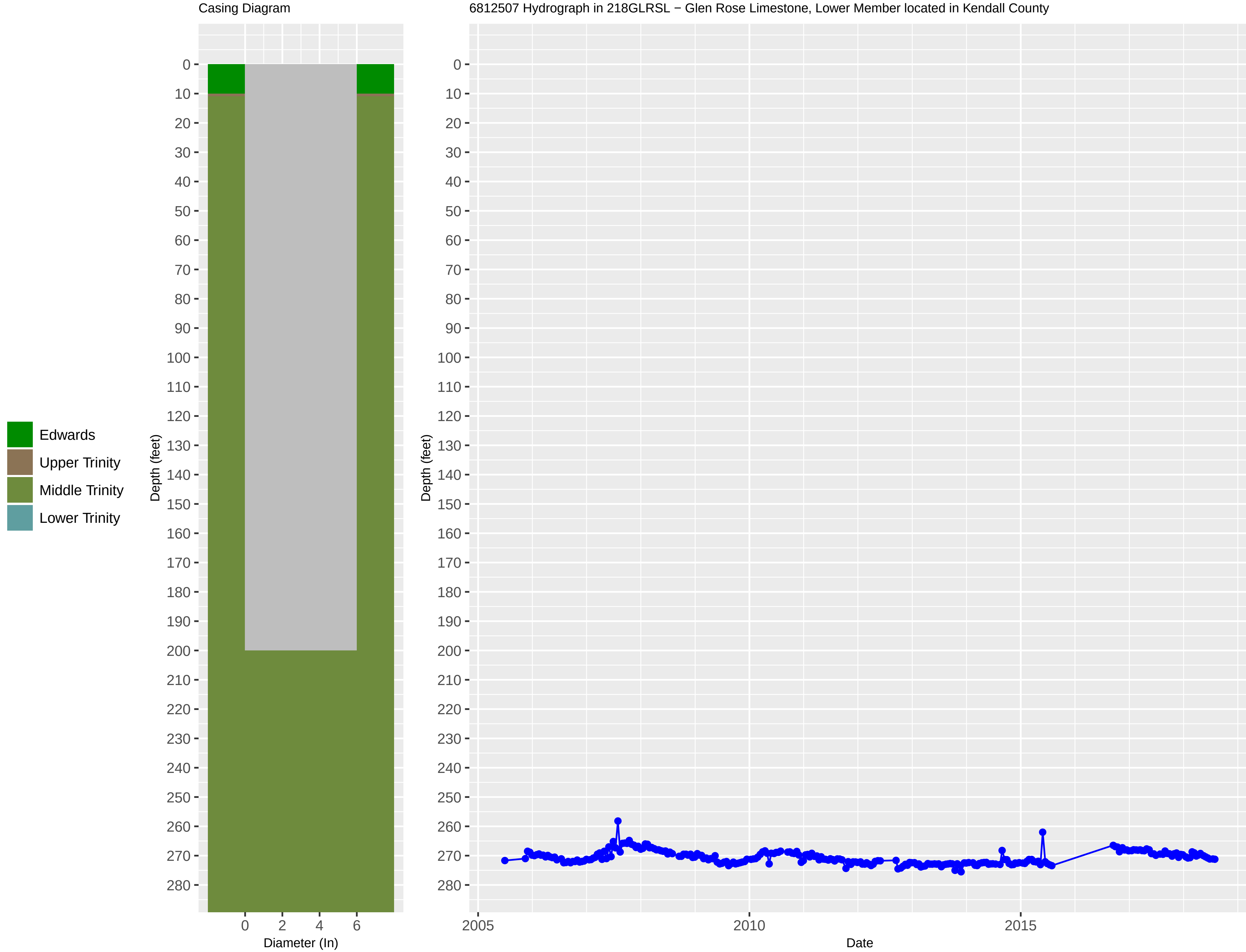

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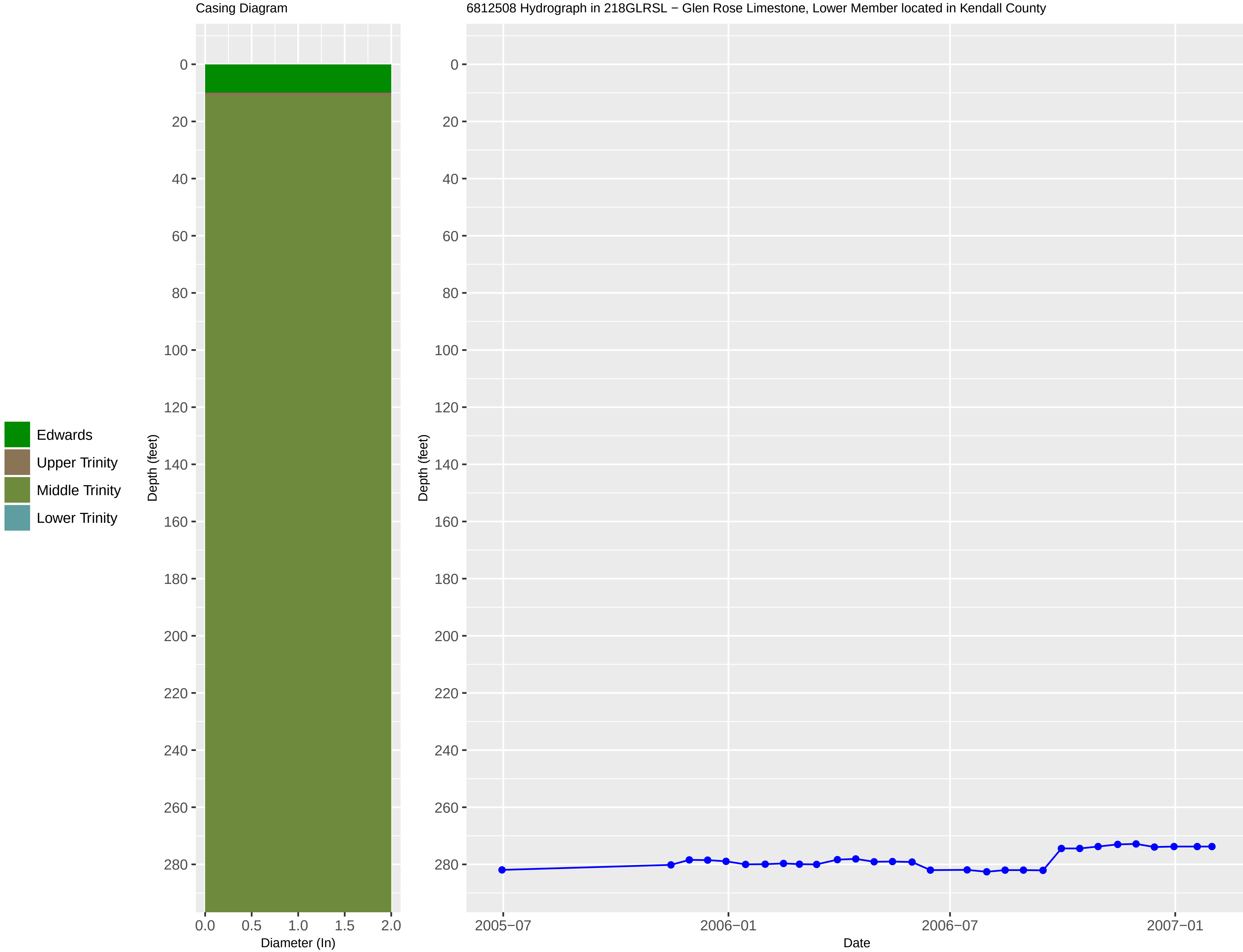

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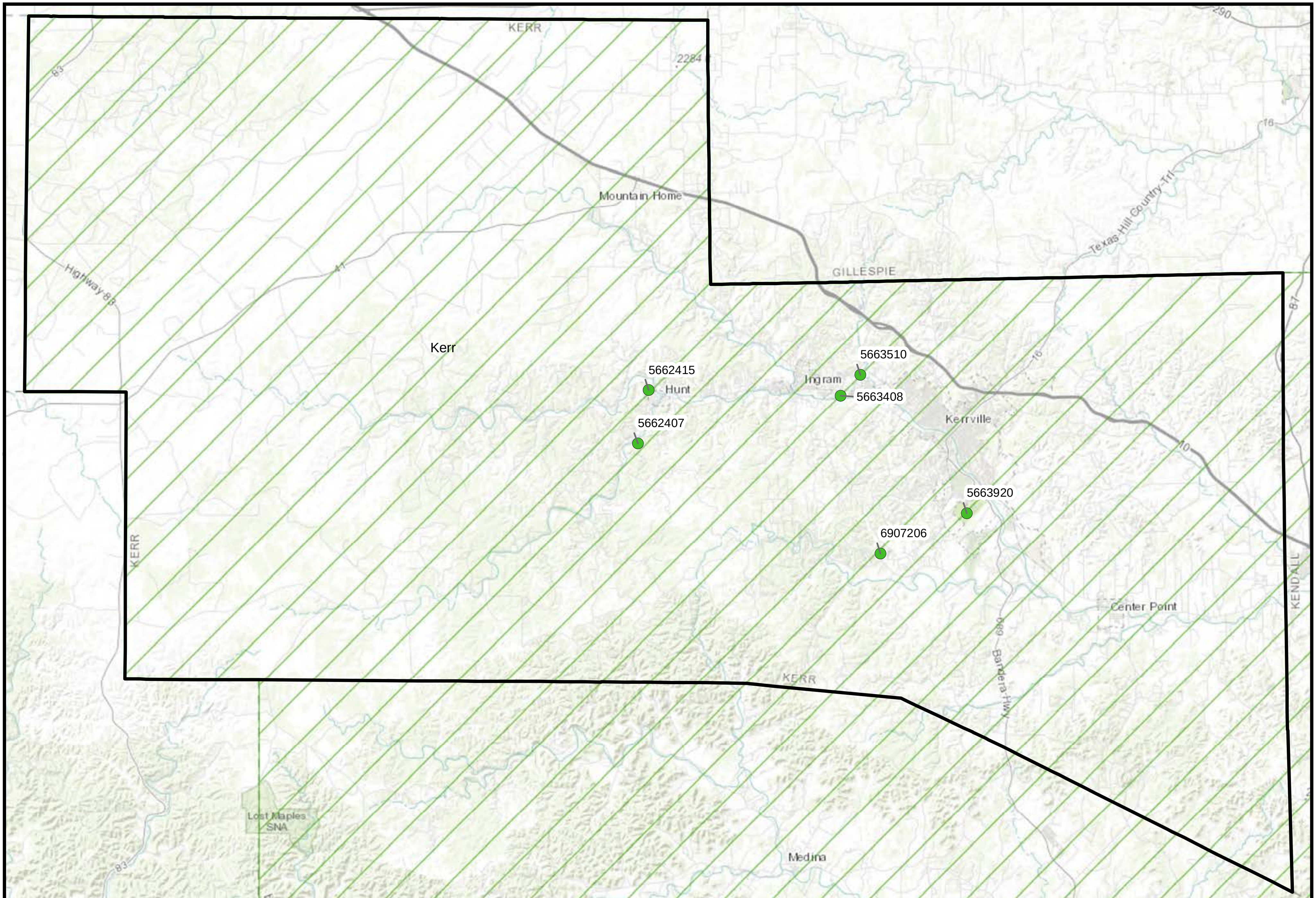


Aquifer

218GLRSL - Glen Rose Limestone, Lower Member

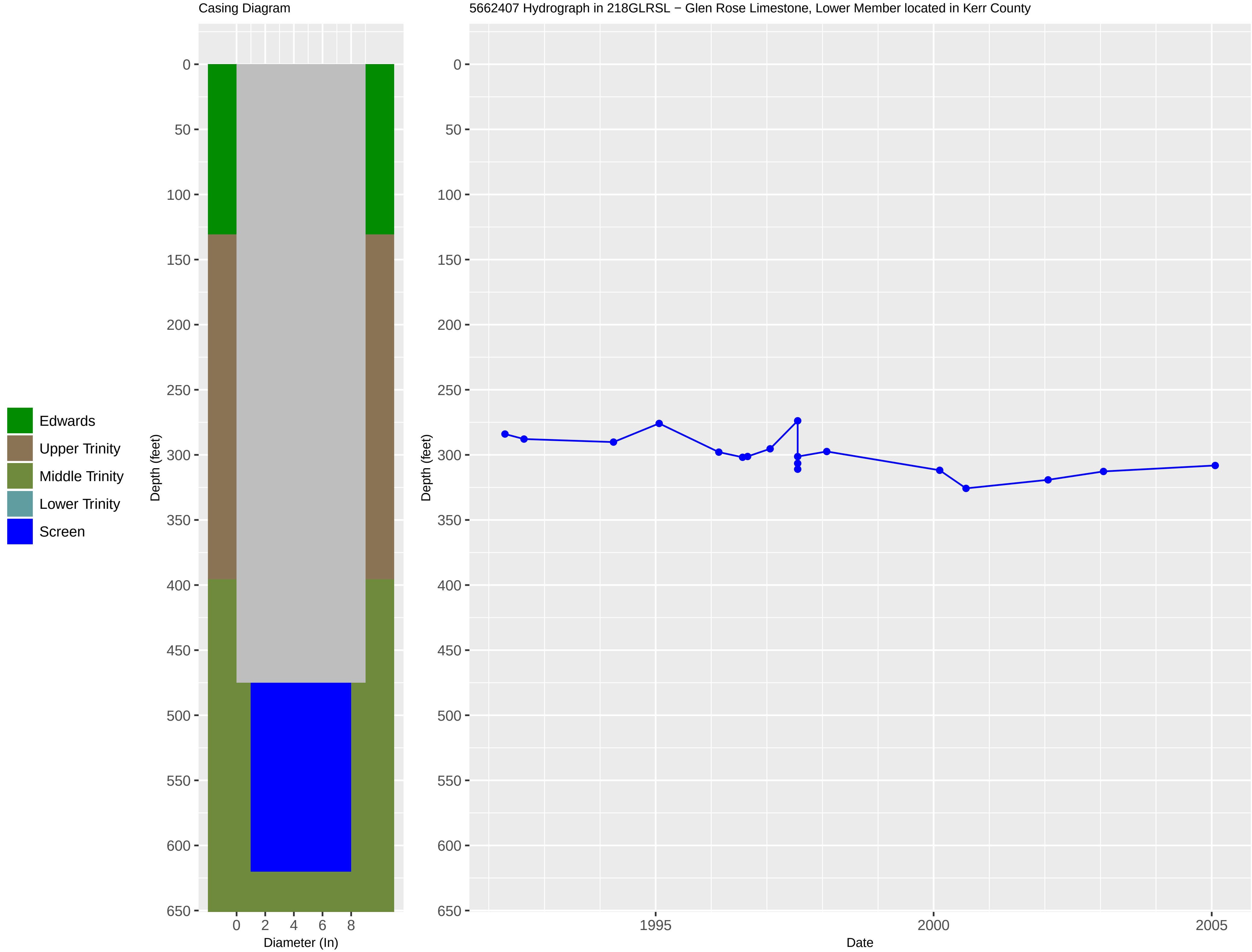
GMA 9

N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Kerr County
218GLRSL
Glen Rose Limestone, Lower Member



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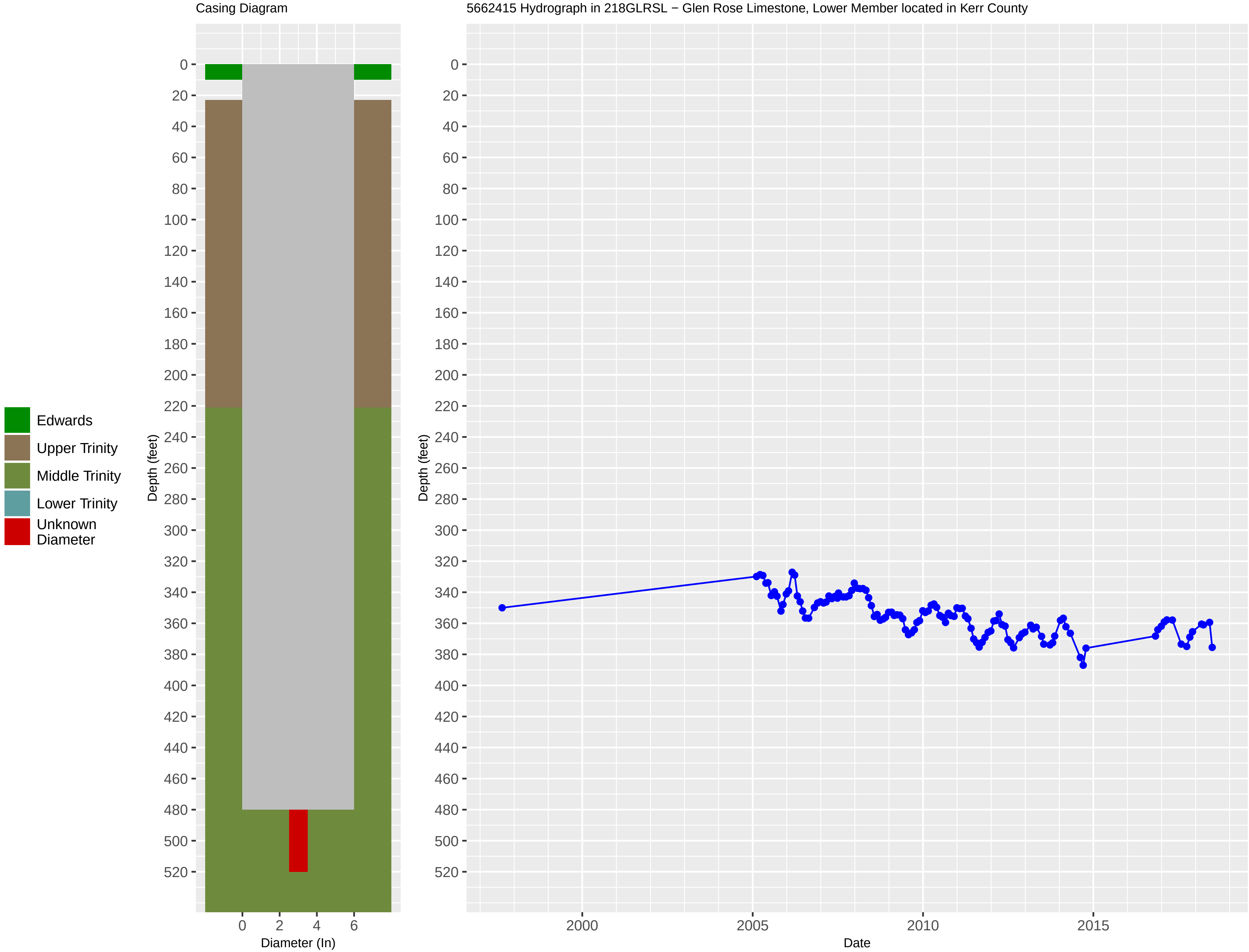

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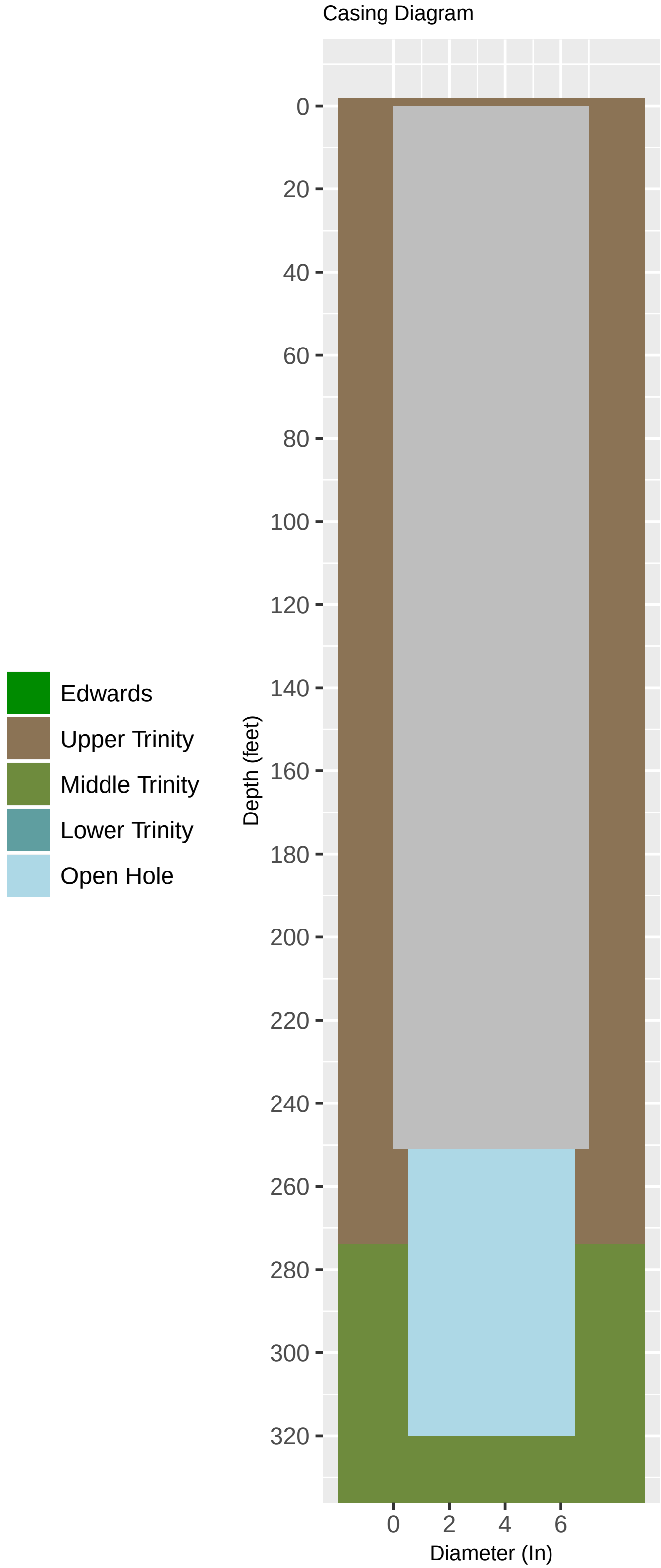
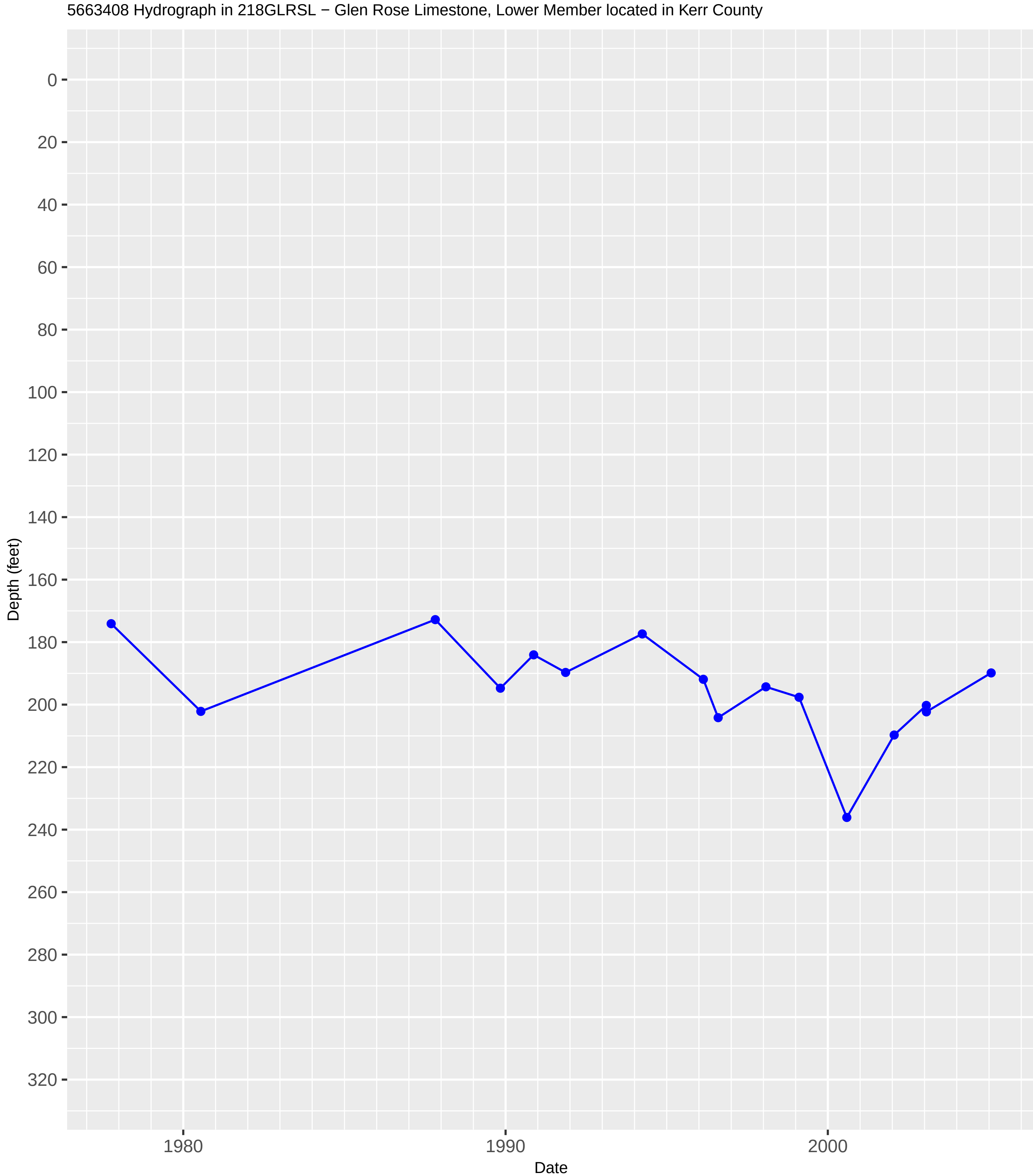
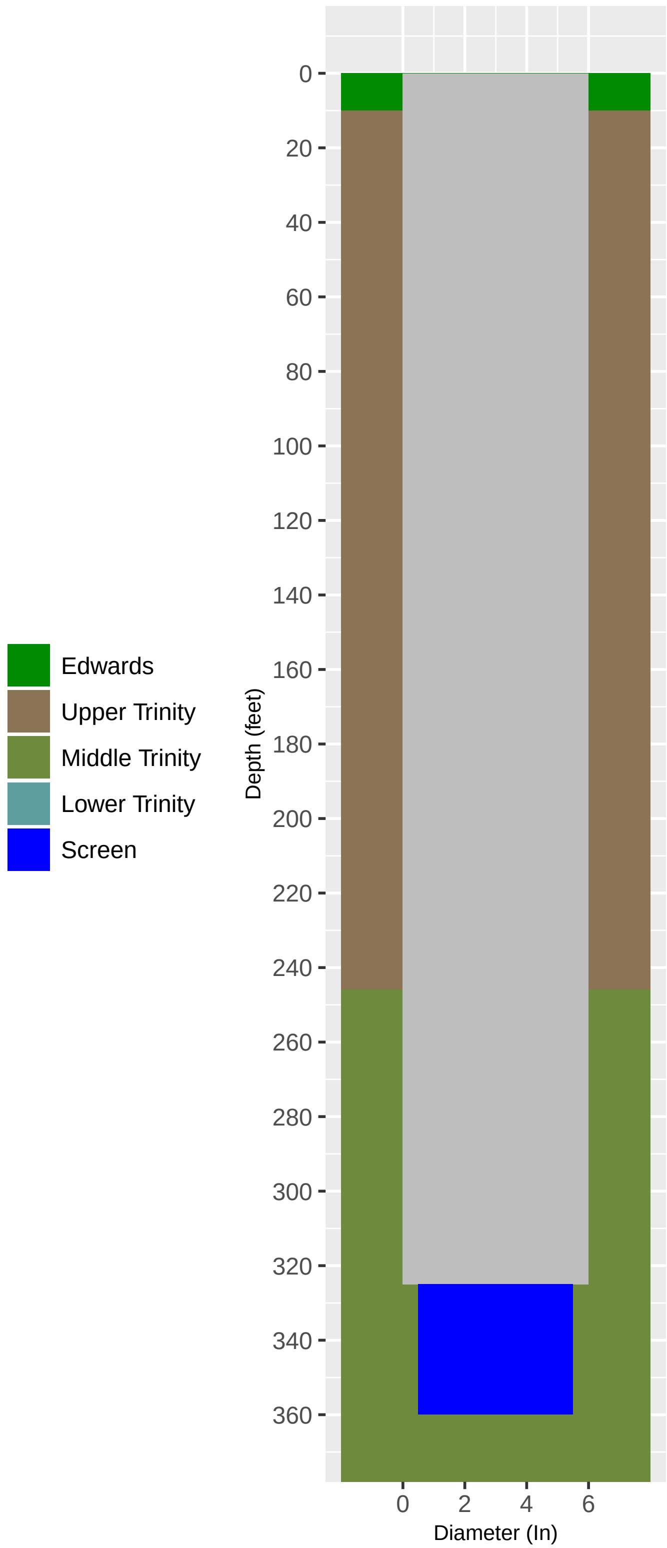


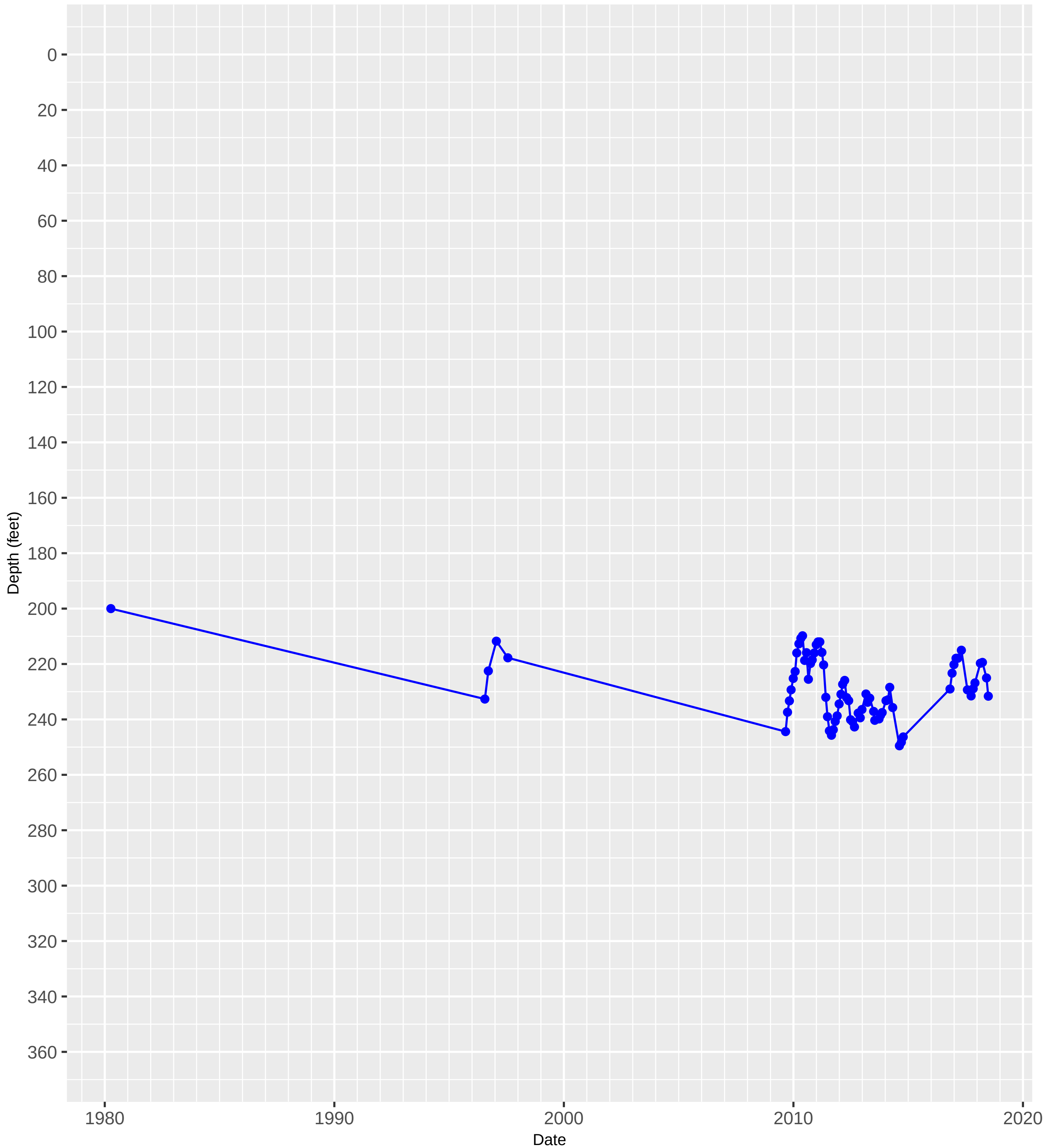


The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram



5663510 Hydrograph in 218GLRSL − Glen Rose Limestone, Lower Member located in Kerr County



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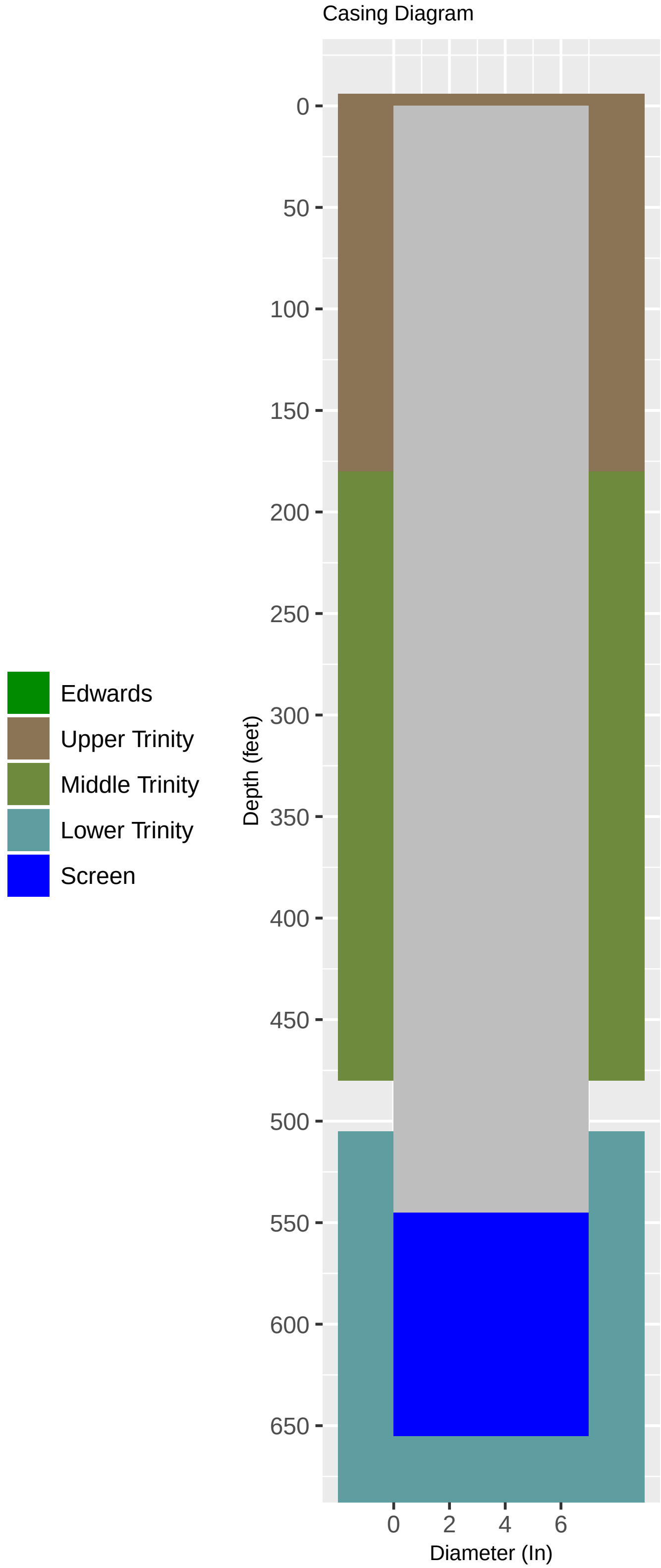

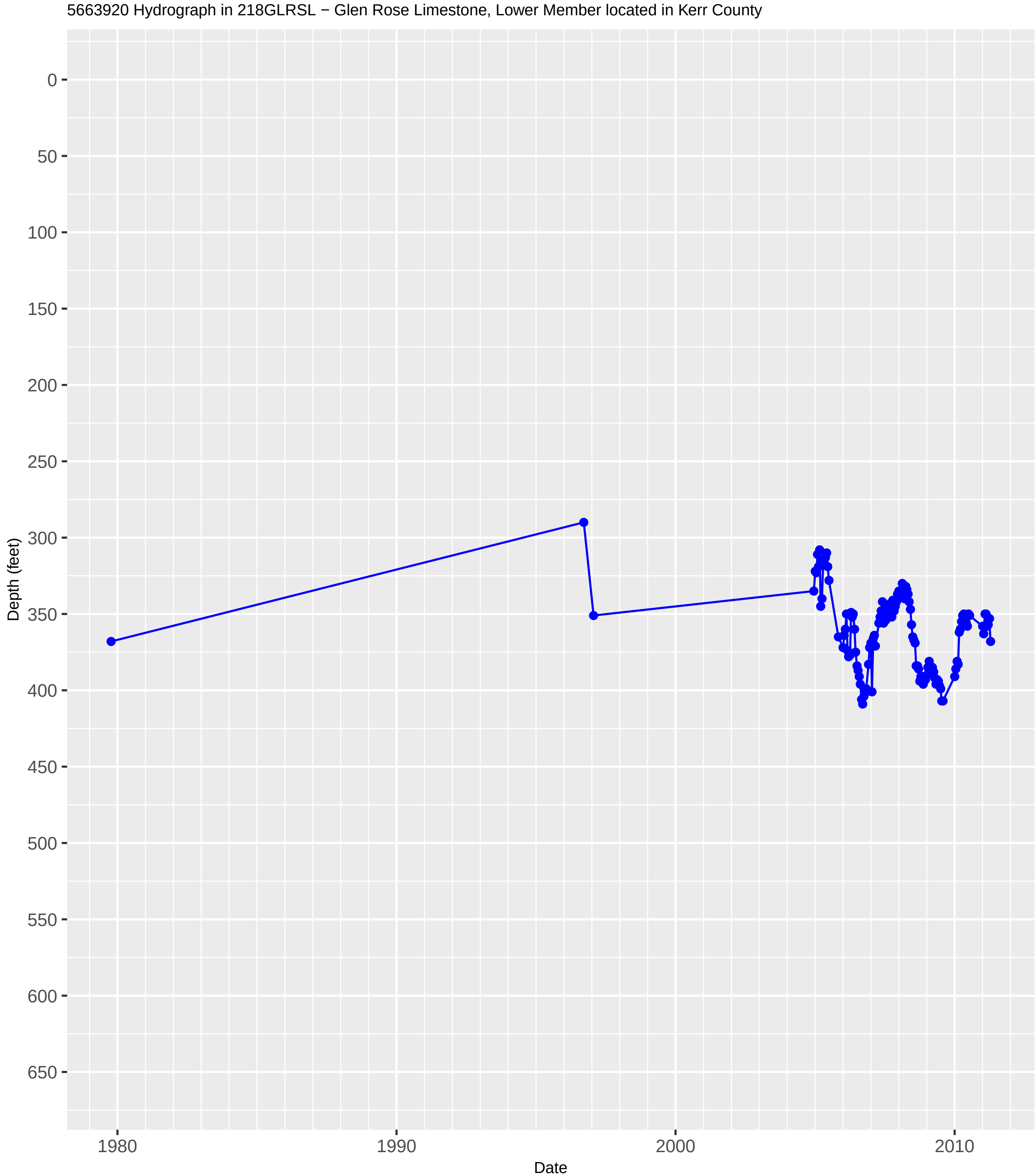

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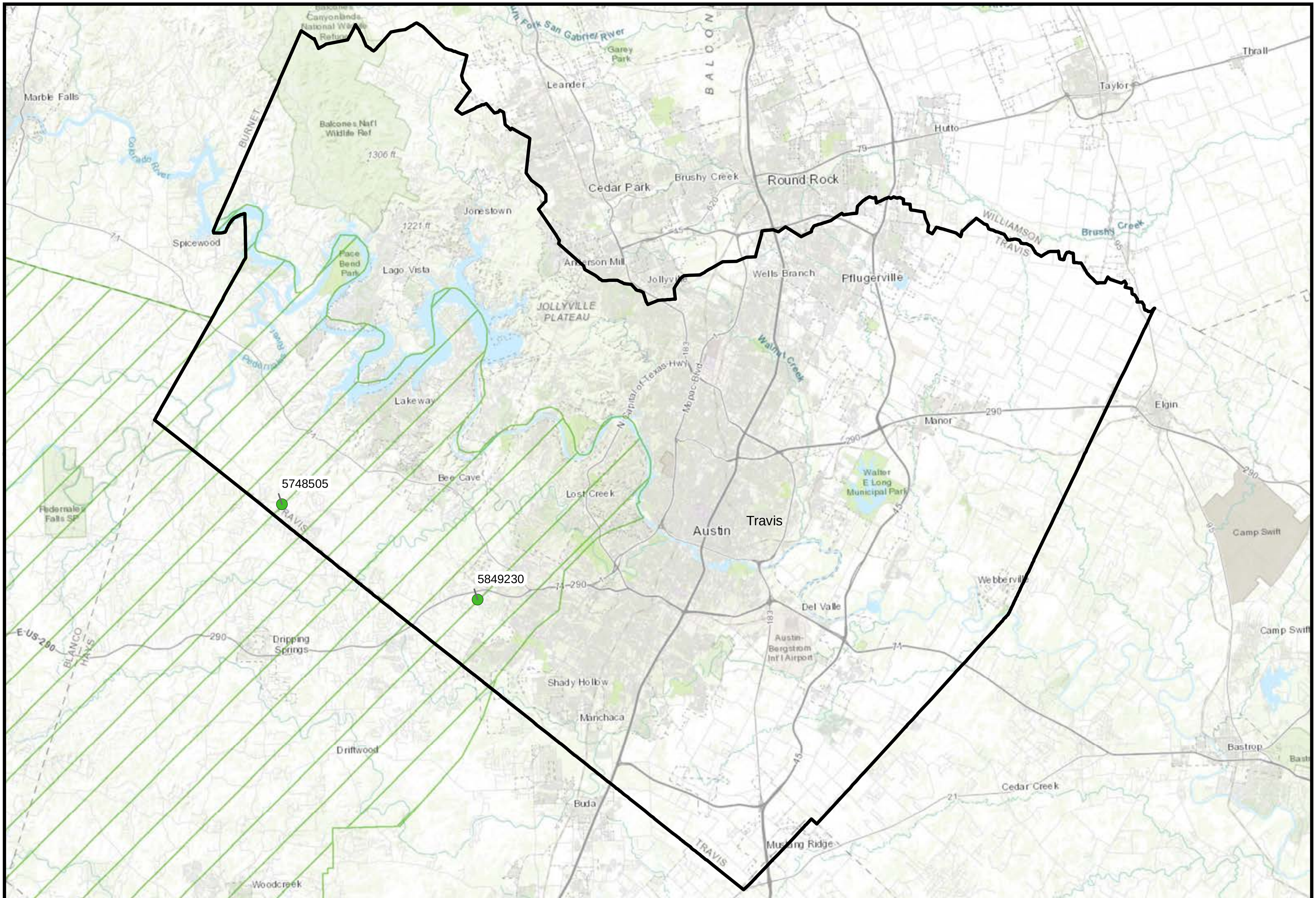


Aquifer

218GLRSL - Glen Rose Limestone, Lower Member

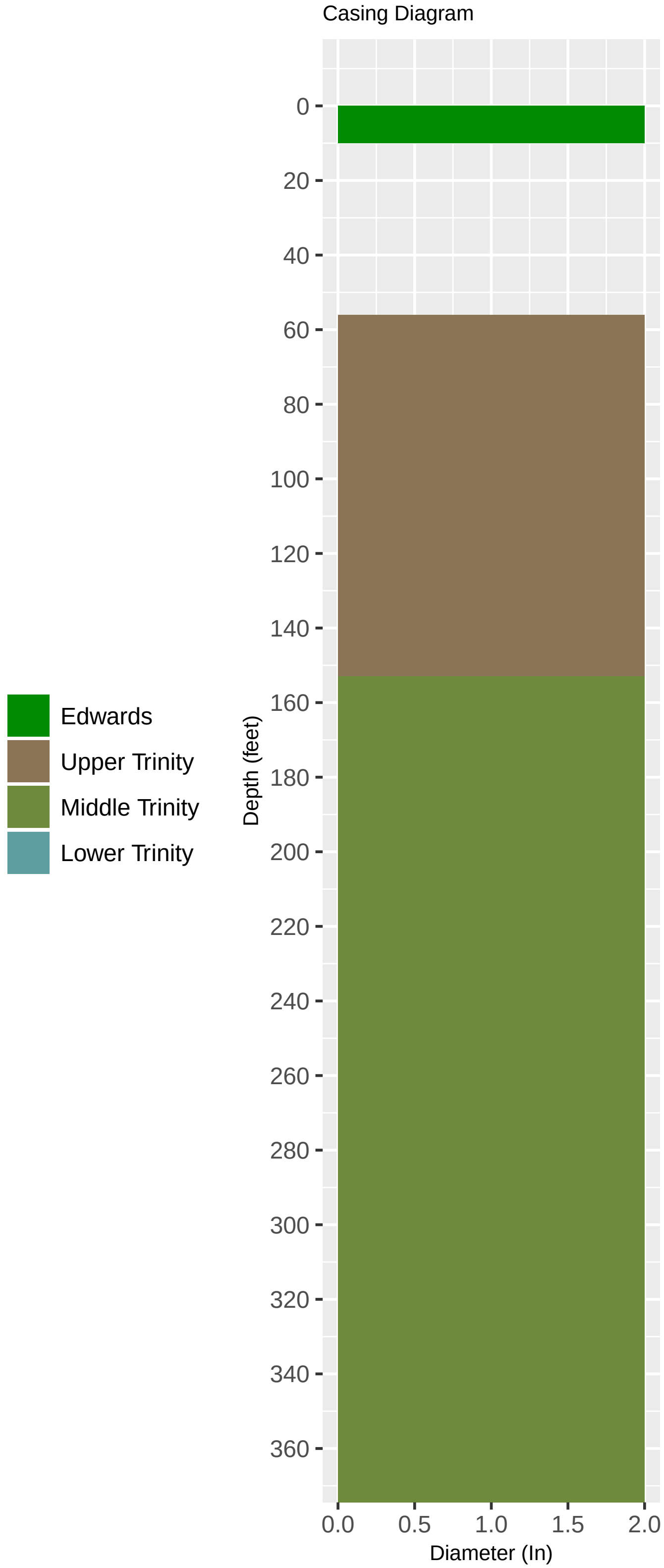
GMA 9

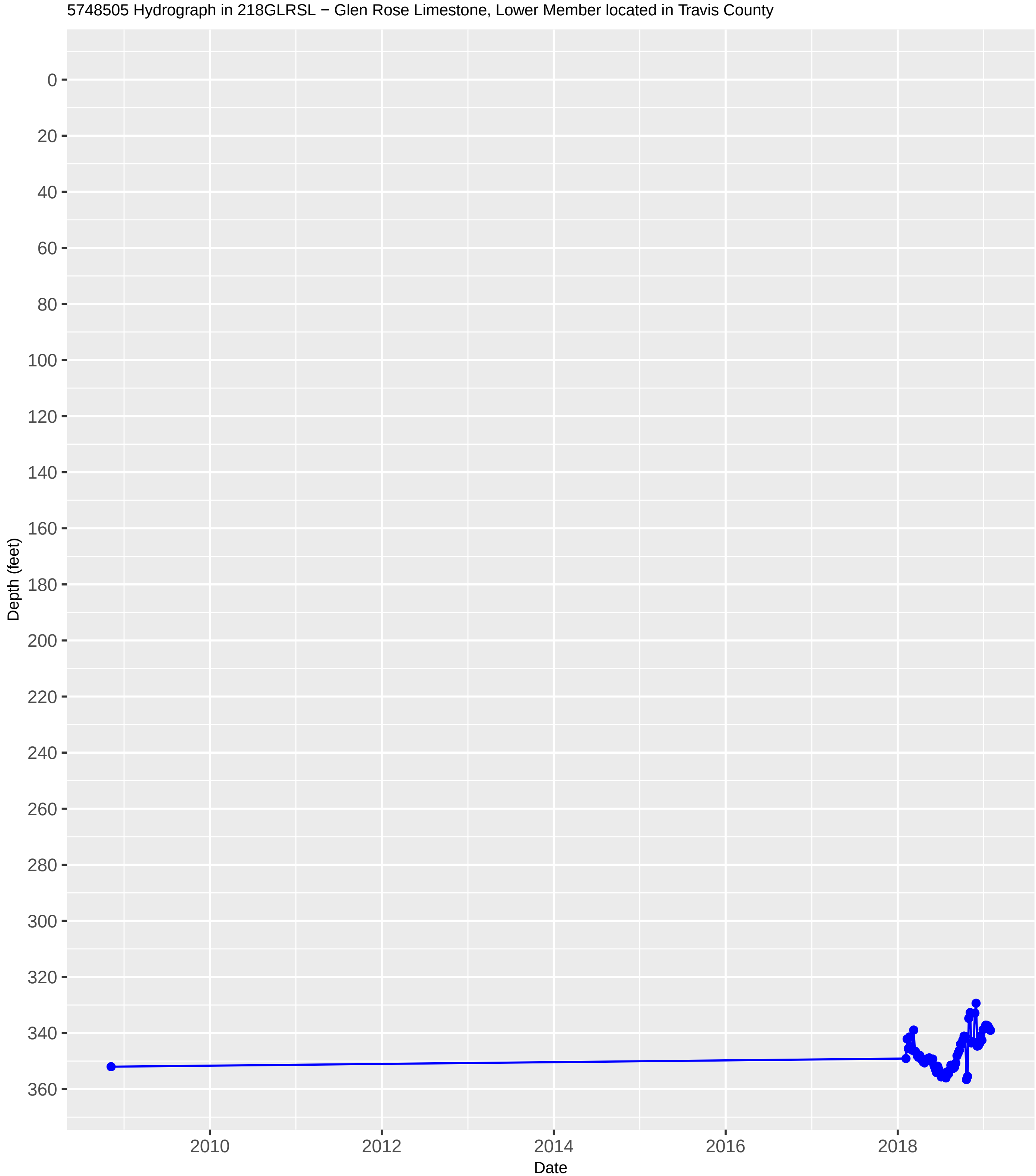
N

0 1 2 4 6

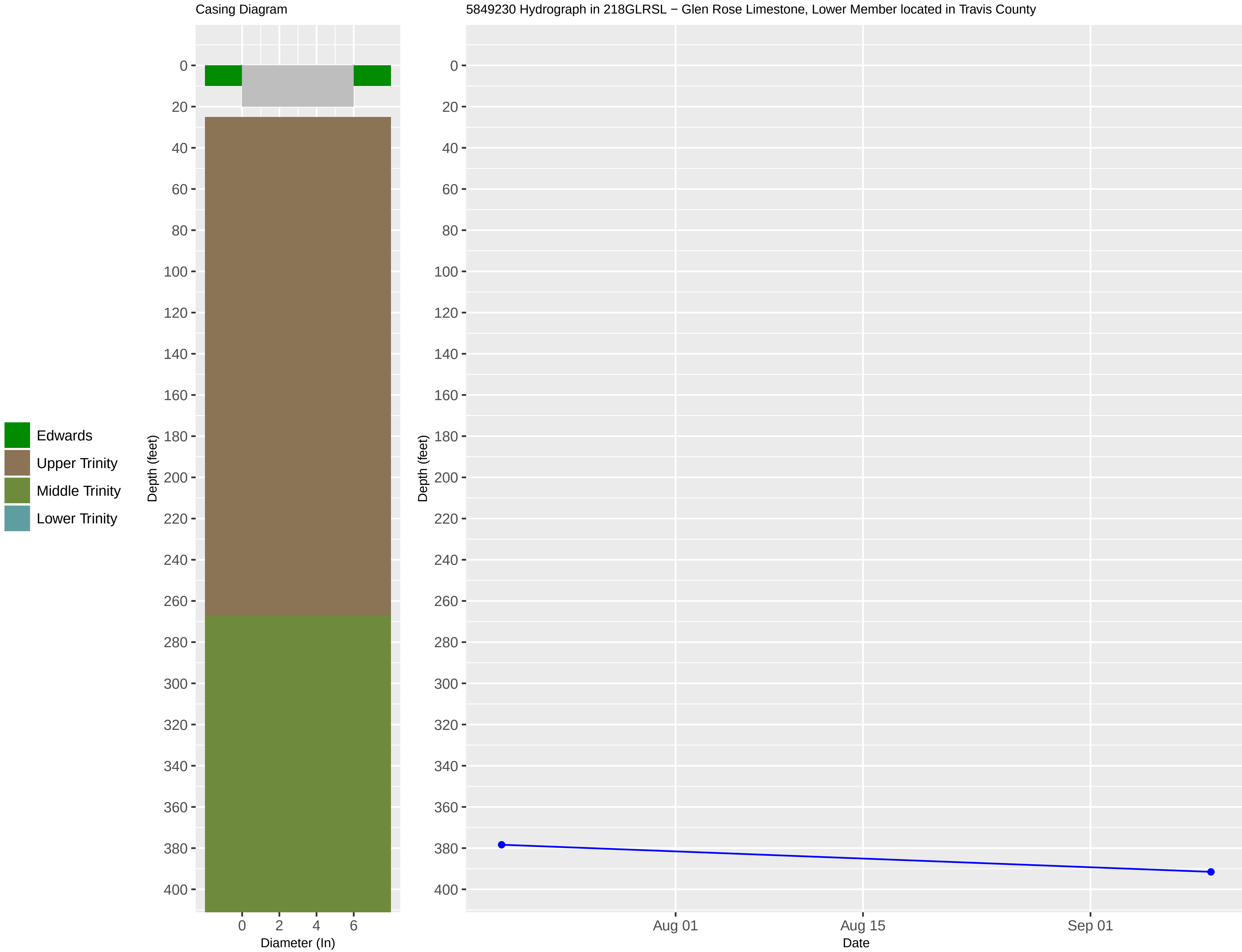
Miles

Map of Hydrograph Well Locations in Travis County
218GLRSL
Glen Rose Limestone, Lower Member





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



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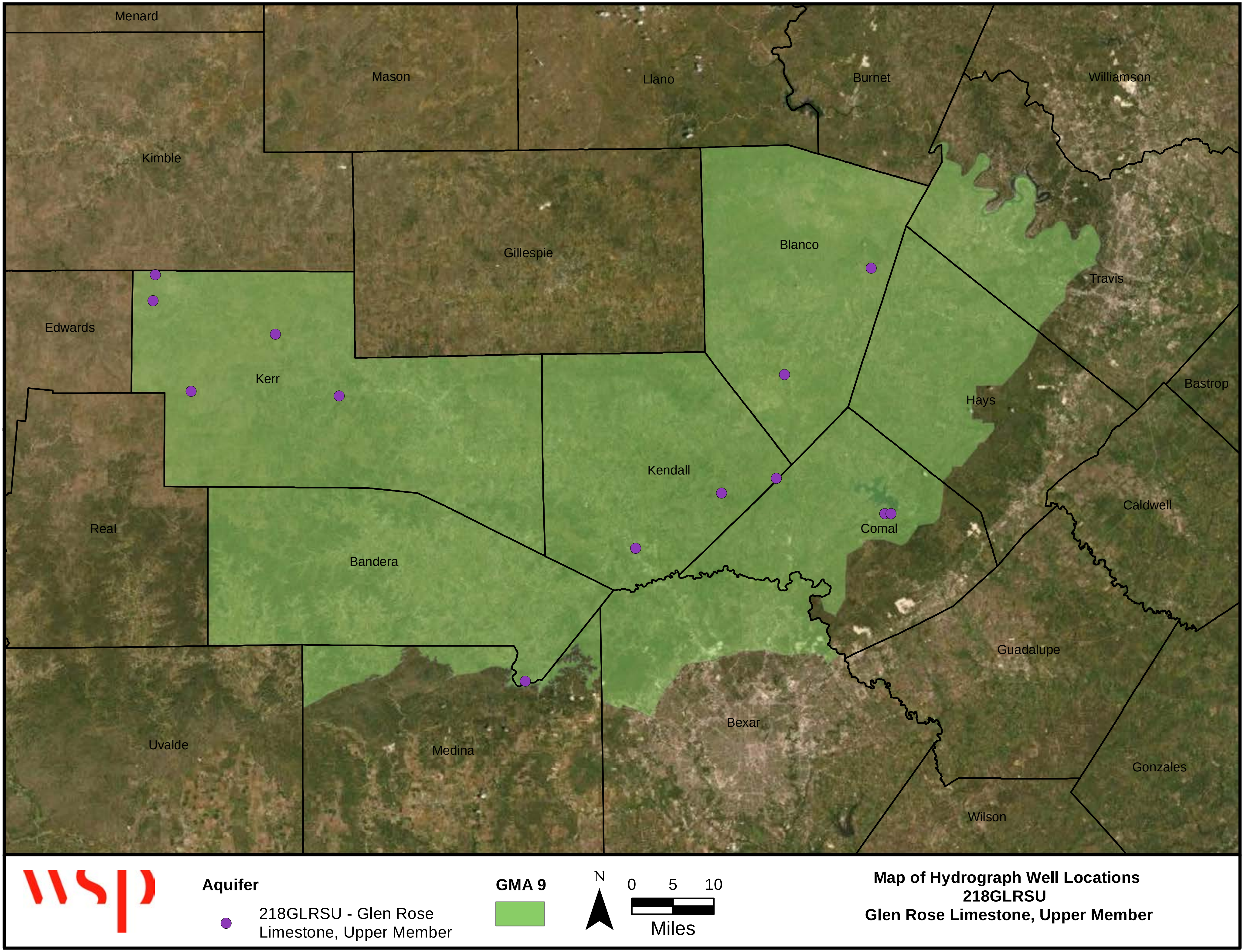
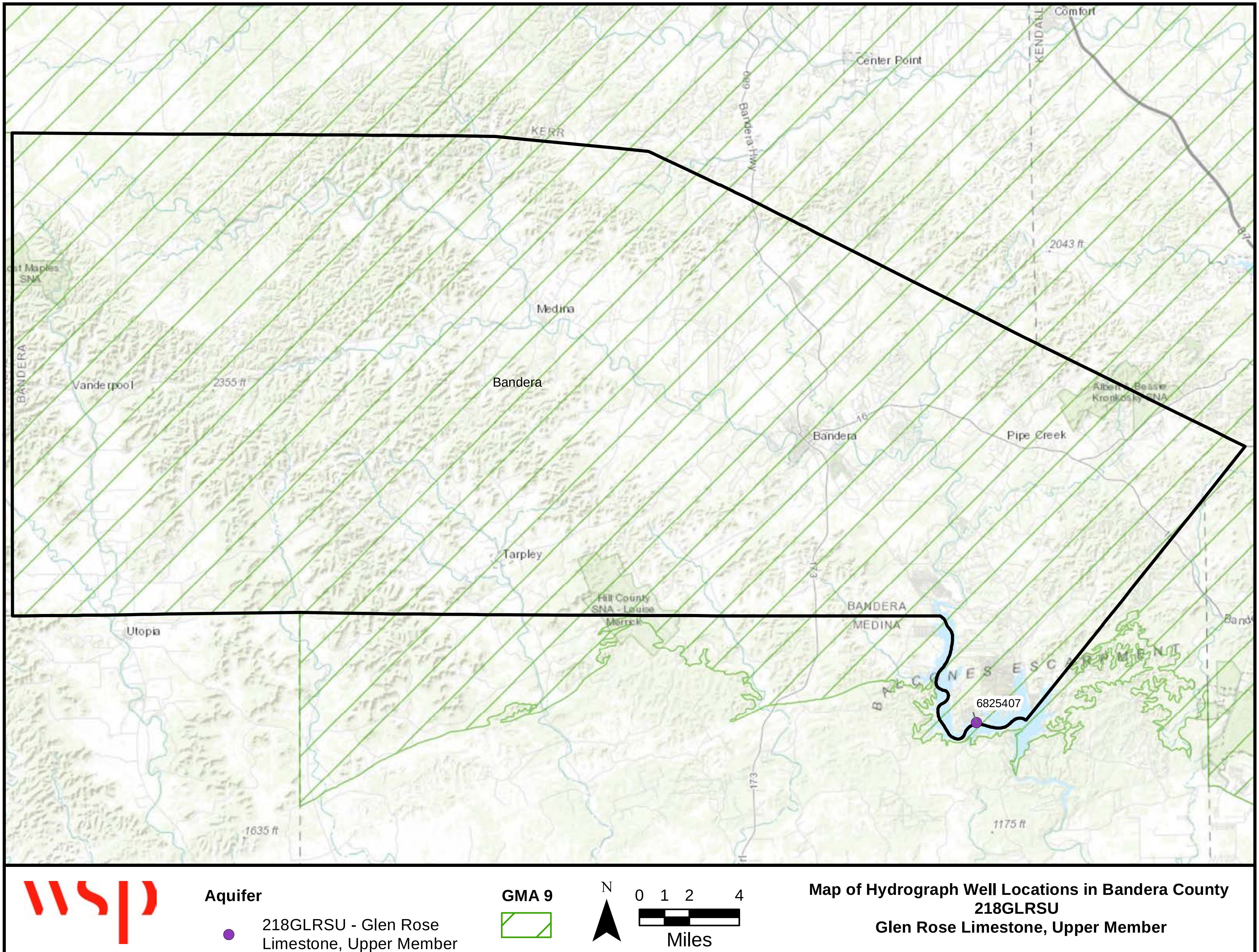
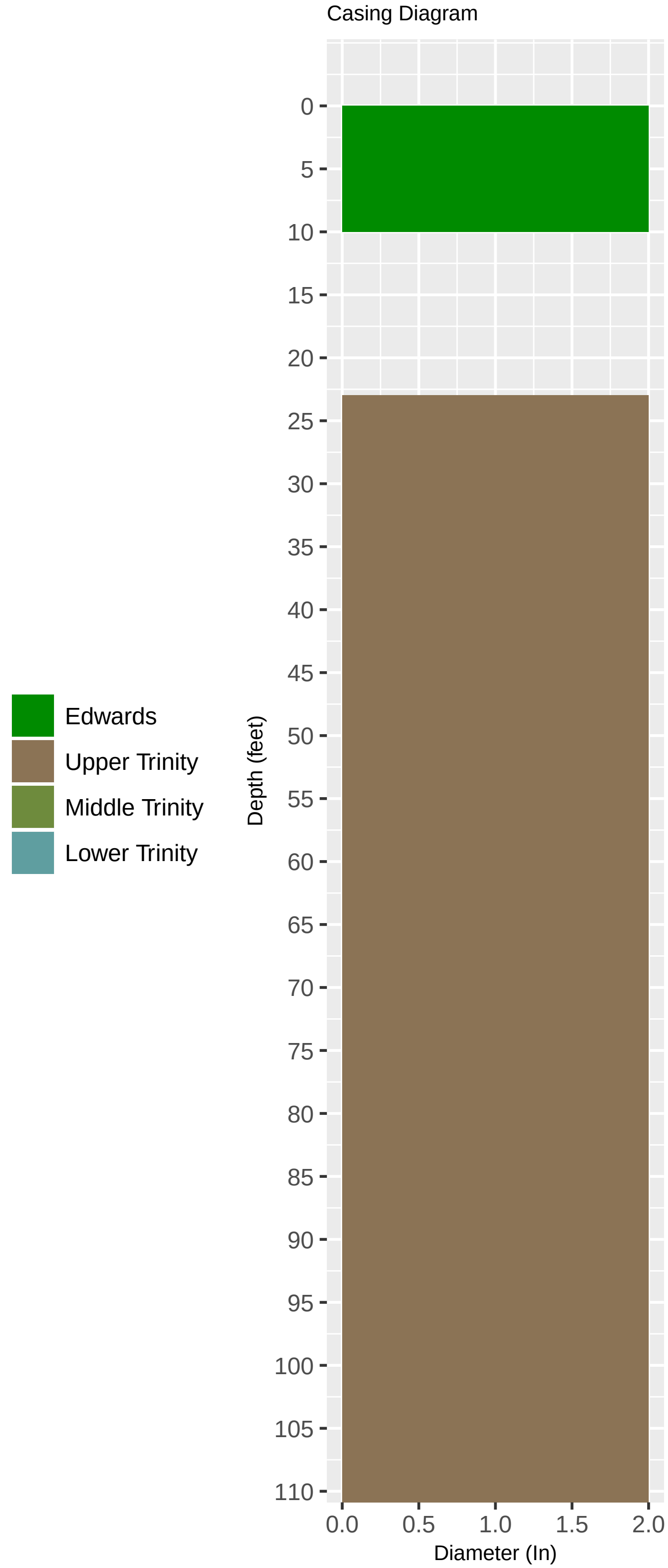
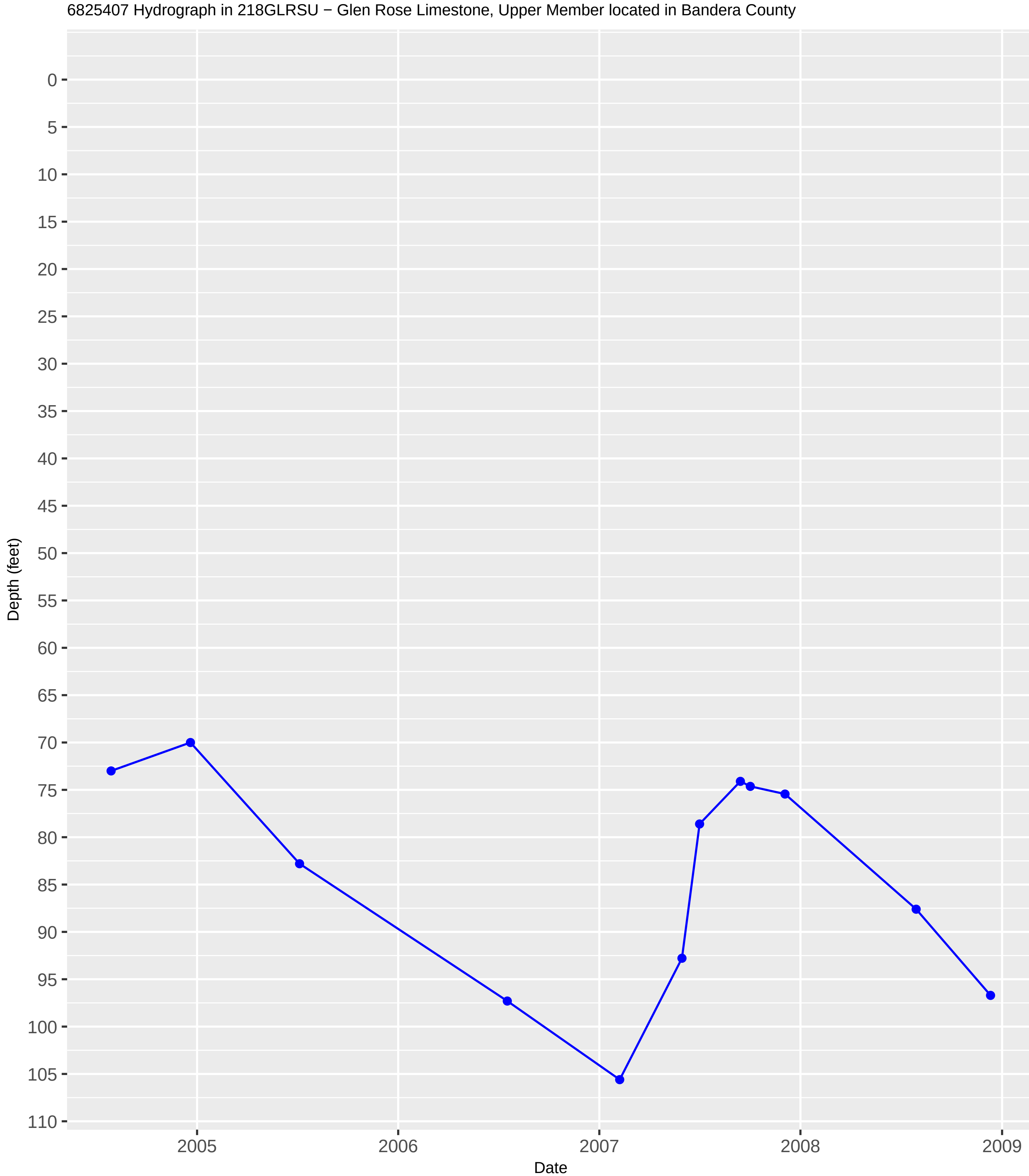


Map of Hydrograph Well Locations
218GLRSU
Glen Rose Limestone, Upper Member

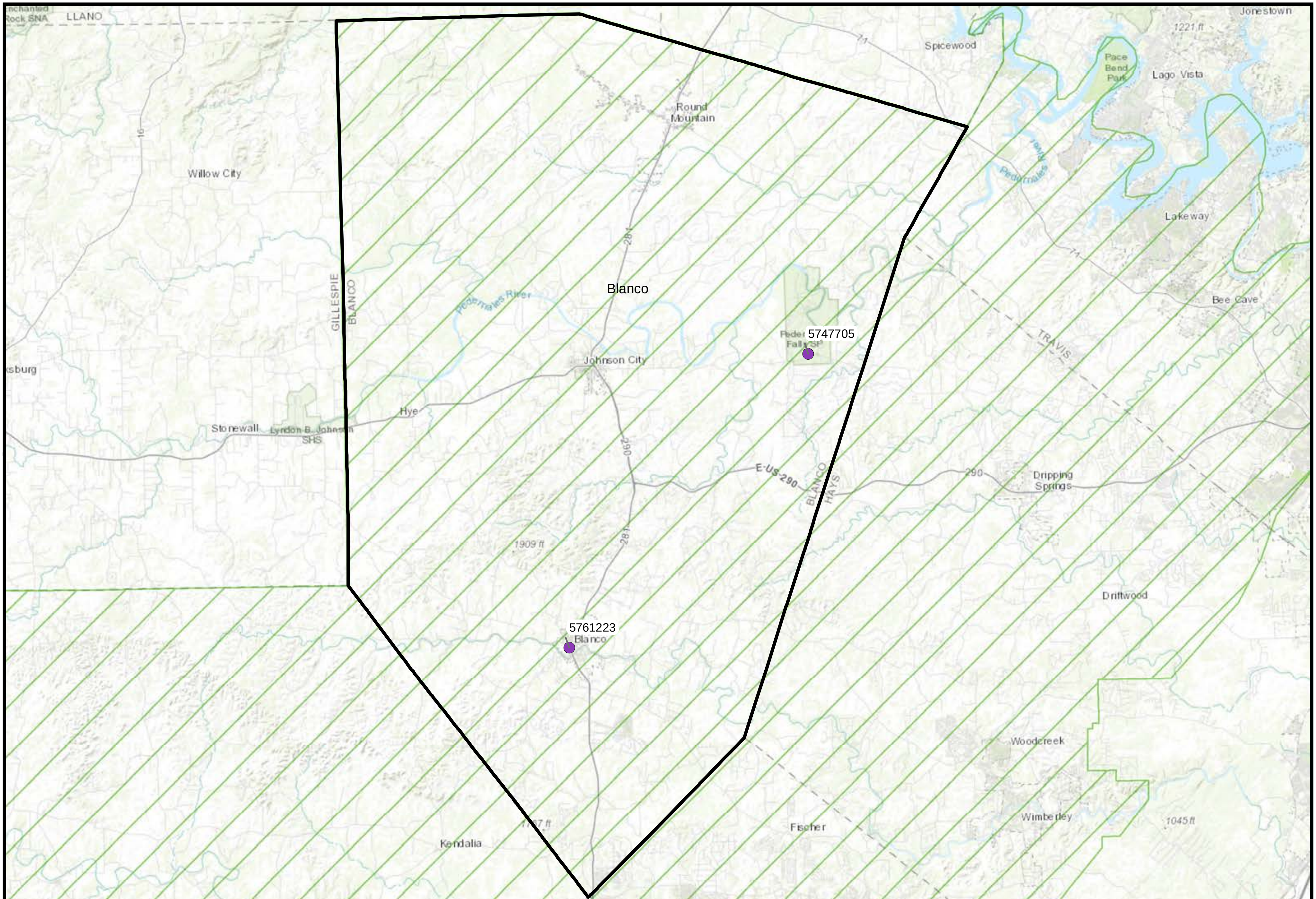


Map of Hydrograph Well Locations in Bandera County
218GLRSU
Glen Rose Limestone, Upper Member





The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.



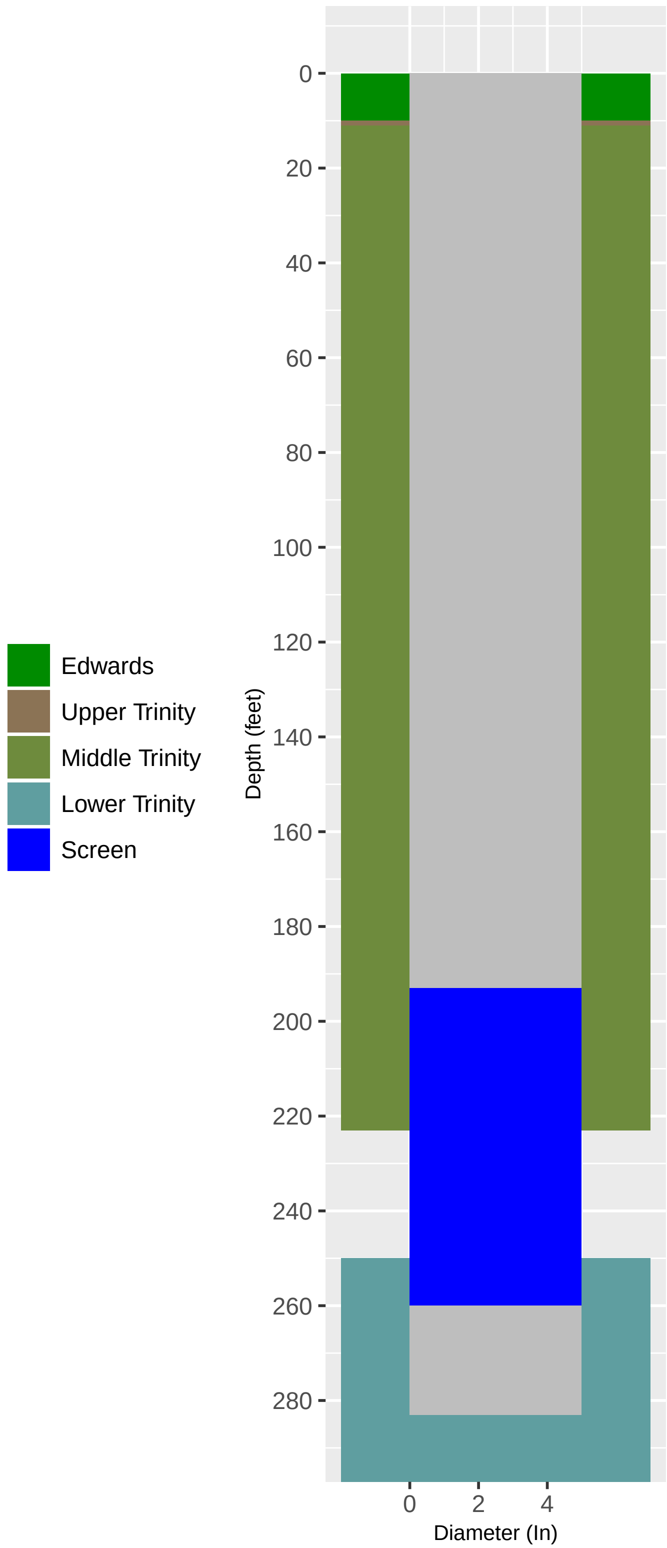
Aquifer

218GLRSU - Glen Rose Limestone, Upper Member

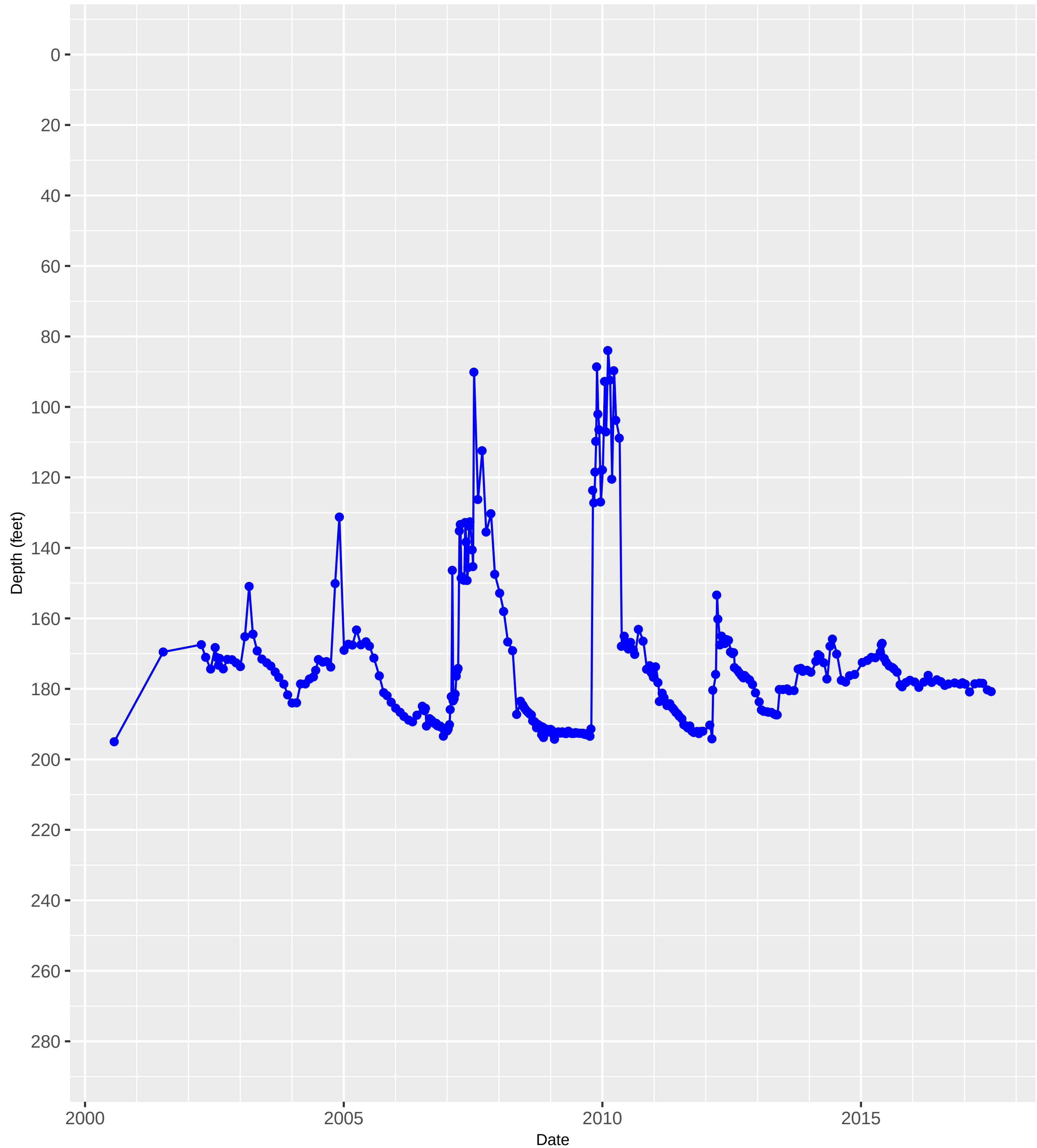
GMA 9

Map of Hydrograph Well Locations in Blanco County
218GLRSU
Glen Rose Limestone, Upper Member

Casing Diagram



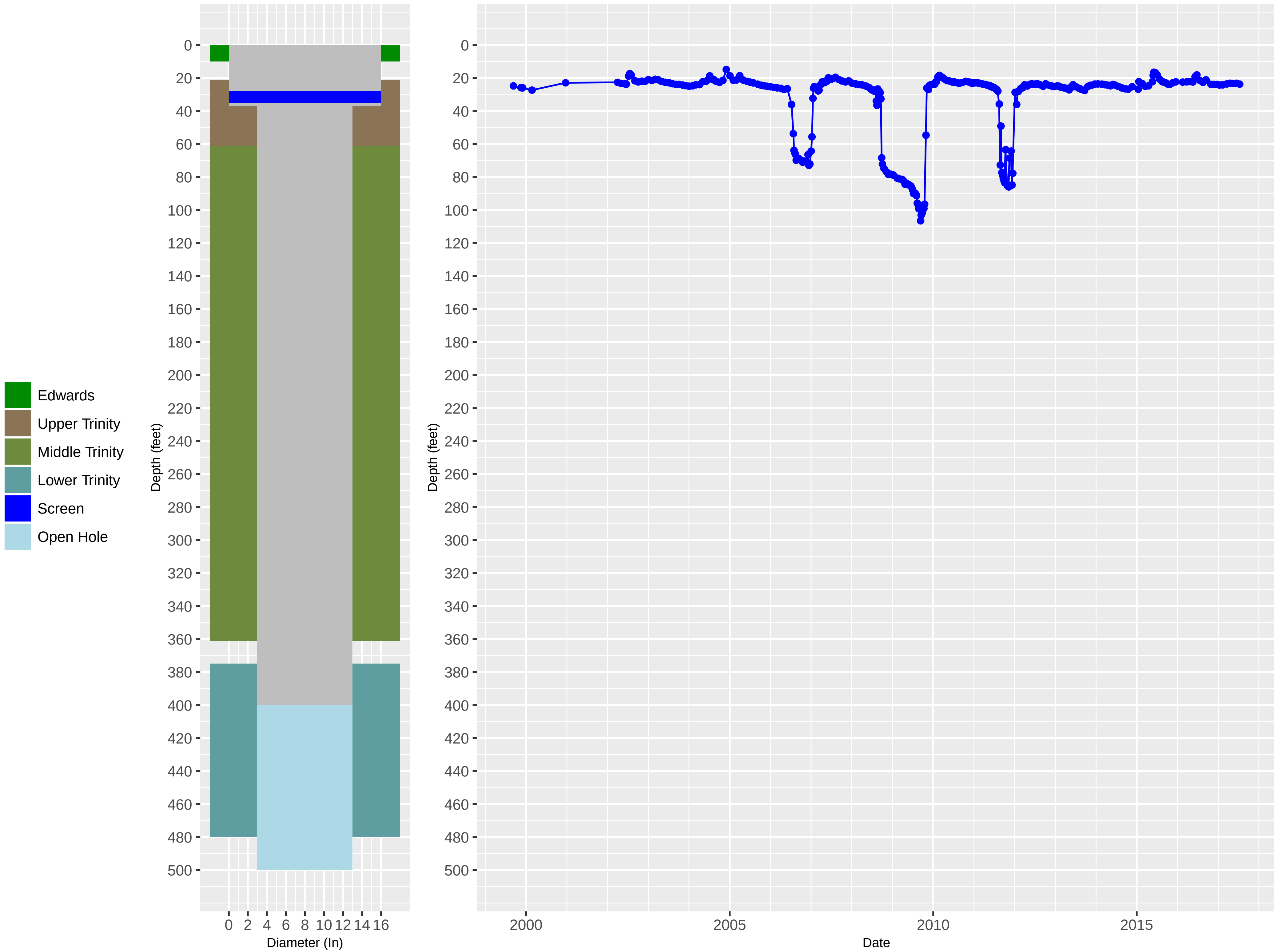
5747705 Hydrograph in 218GLRSU − Glen Rose Limestone, Upper Member located in Blanco County



The Aquifer layers shown in the casing diagram were developed using the THCGAM. In certain cases, assumptions used to develop the THCGAM can cause well casing and screen intervals to not align well with modeled aquifer layers.

Casing Diagram

5761223 Hydrograph in 218GLRSU − Glen Rose Limestone, Upper Member located in Blanco County



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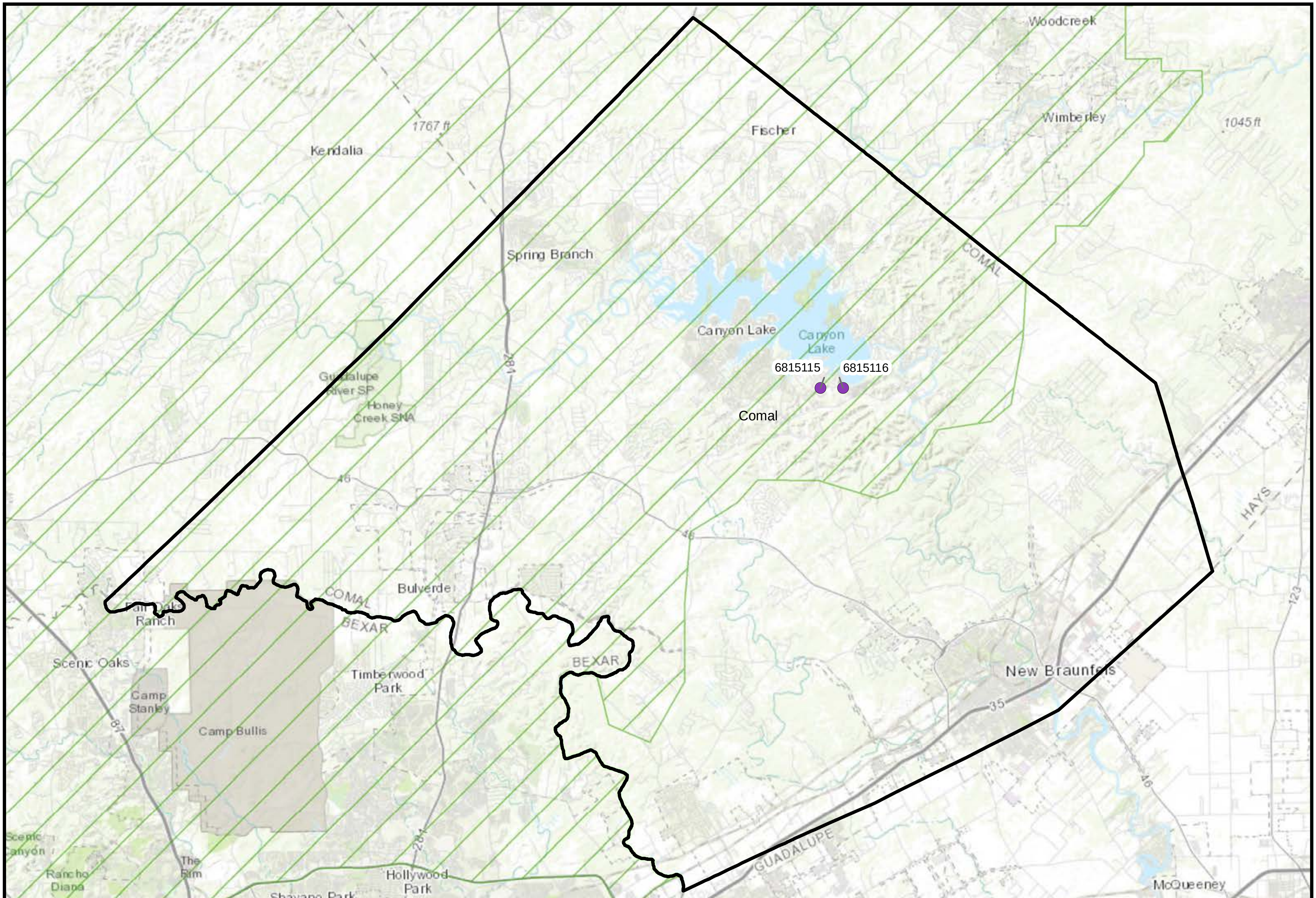


Aquifer

218GLRSU - Glen Rose Limestone, Upper Member

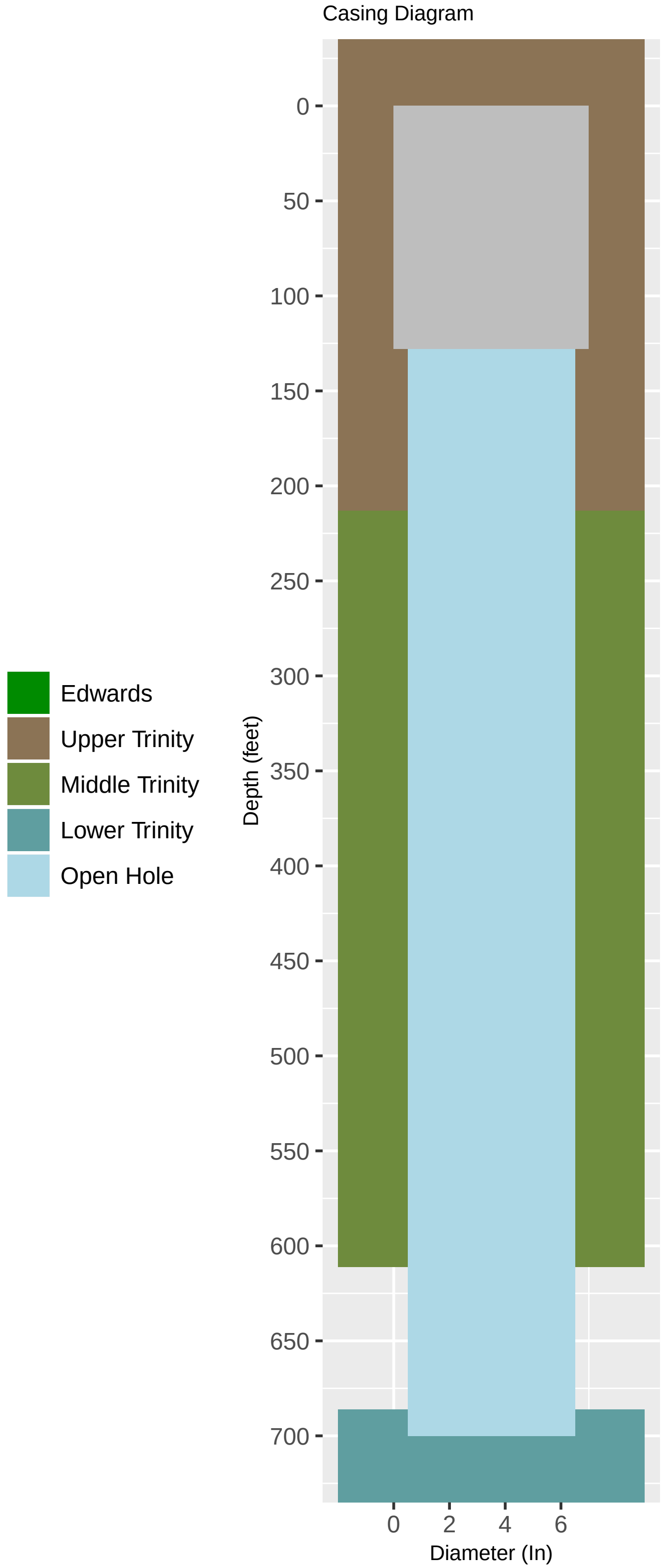
GMA 9

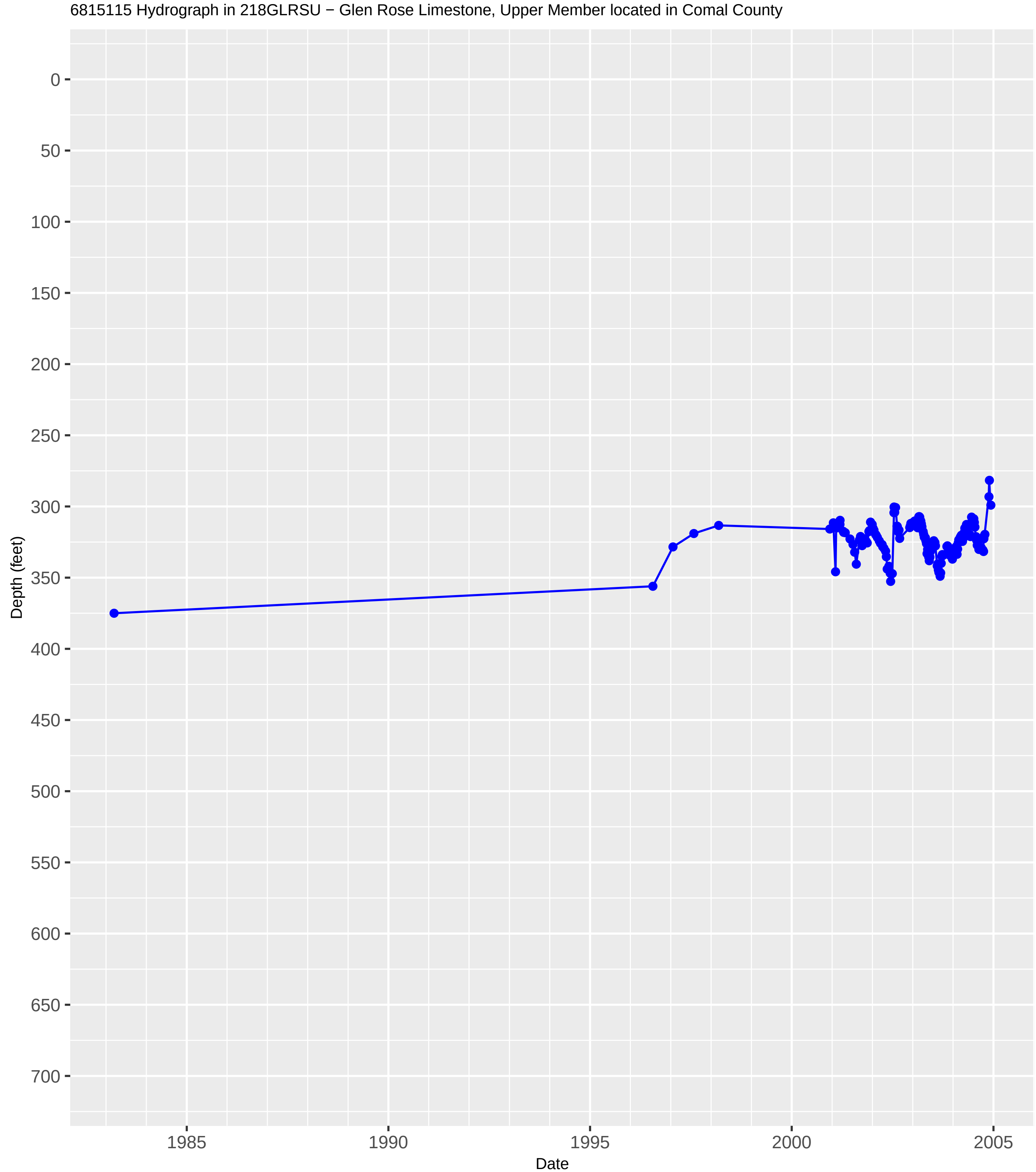
N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Comal County
218GLRSU
Glen Rose Limestone, Upper Member





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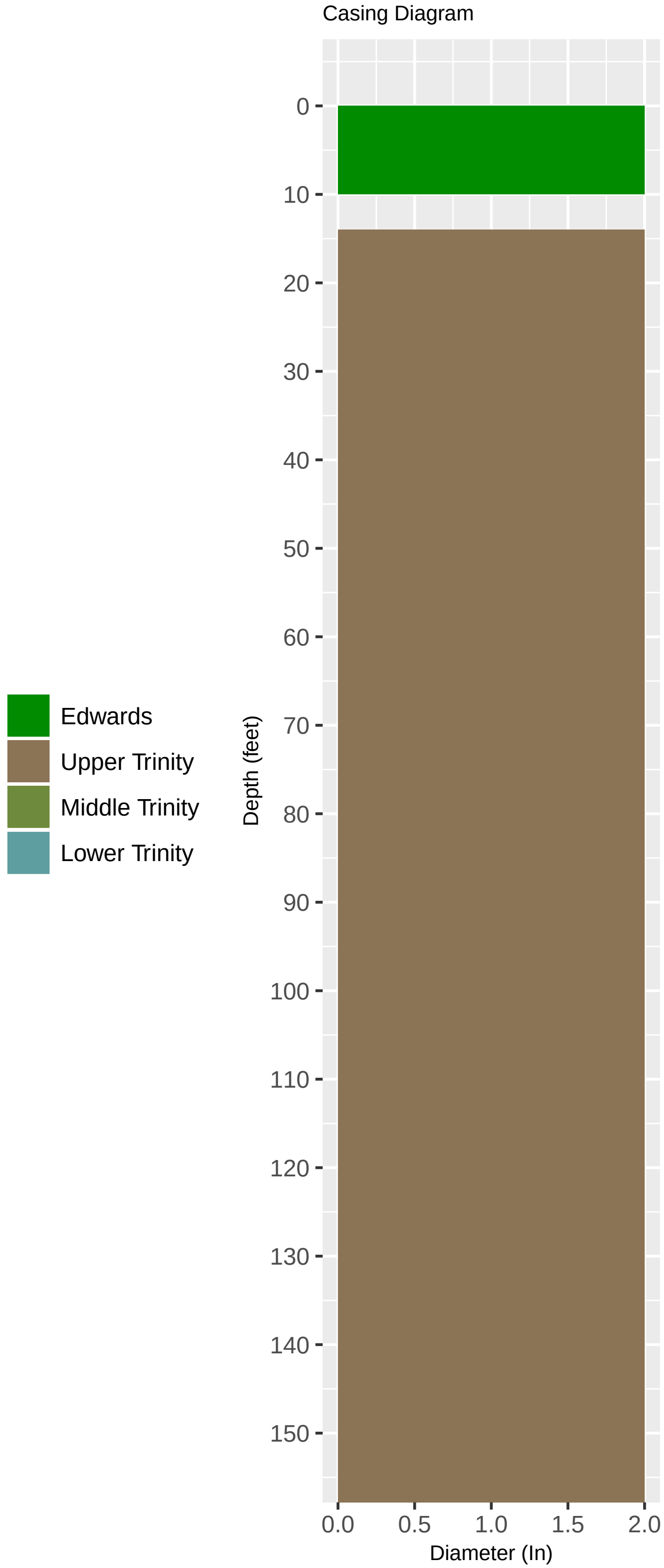

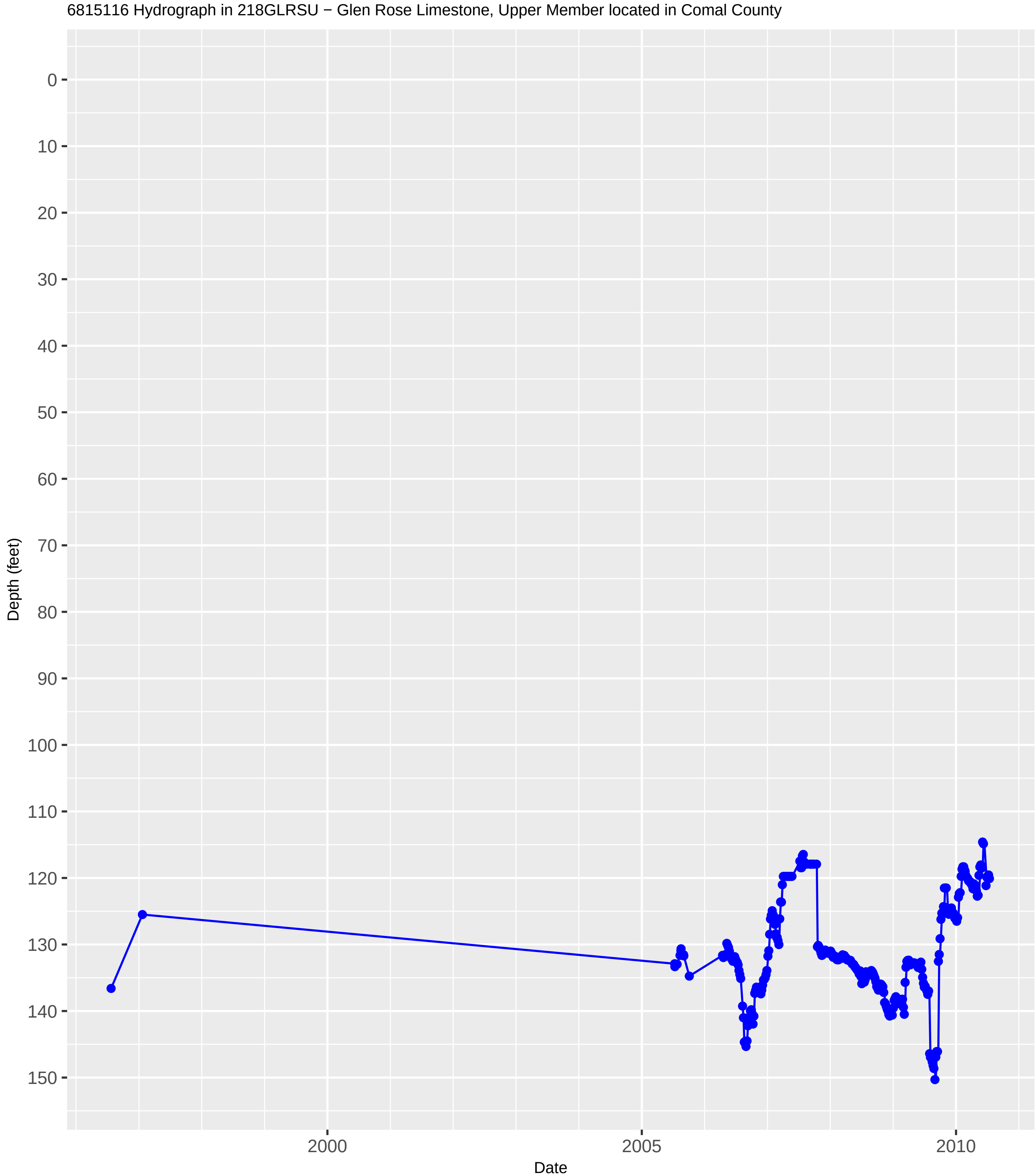

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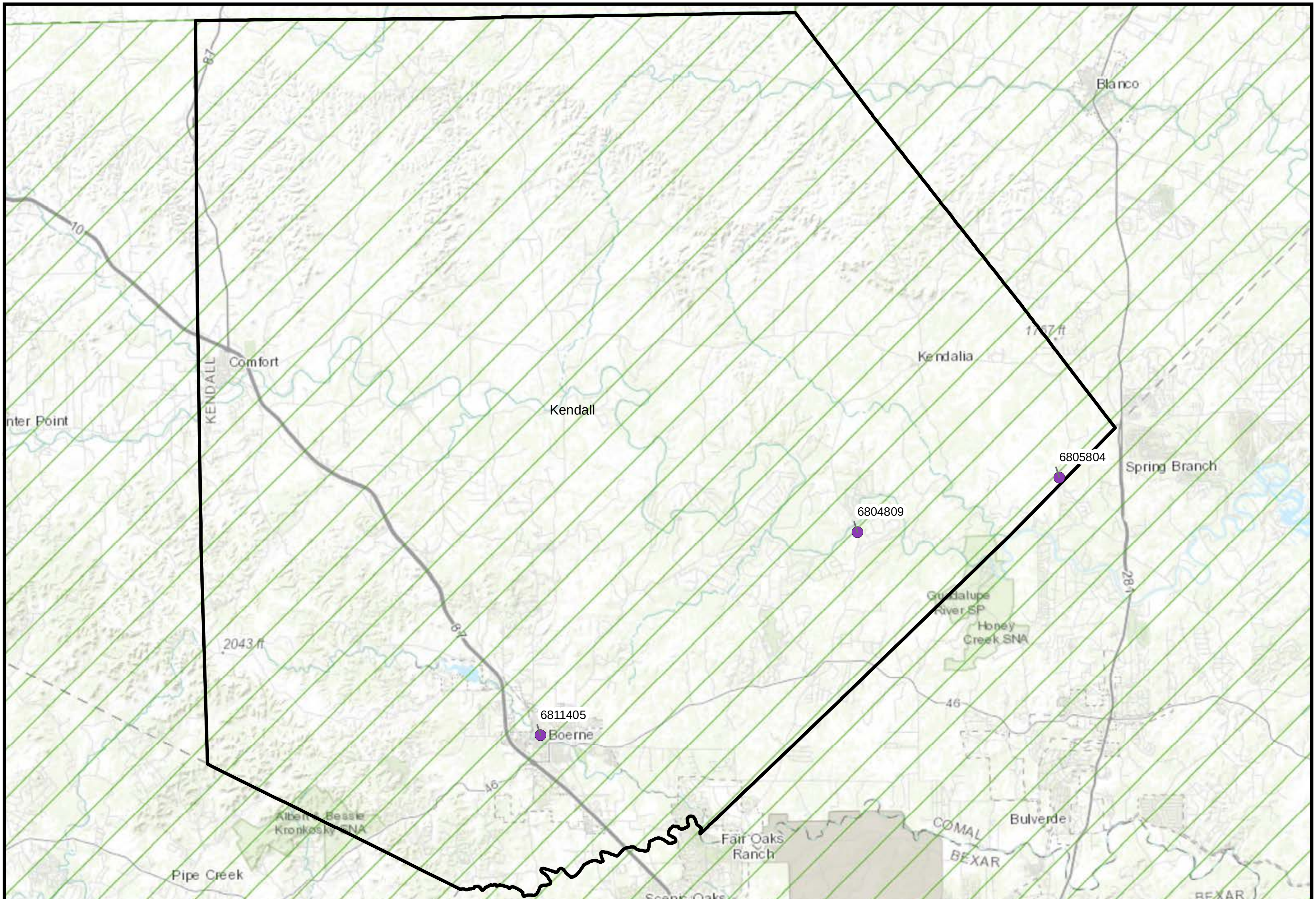


Aquifer

218GLRSU - Glen Rose Limestone, Upper Member

GMA 9

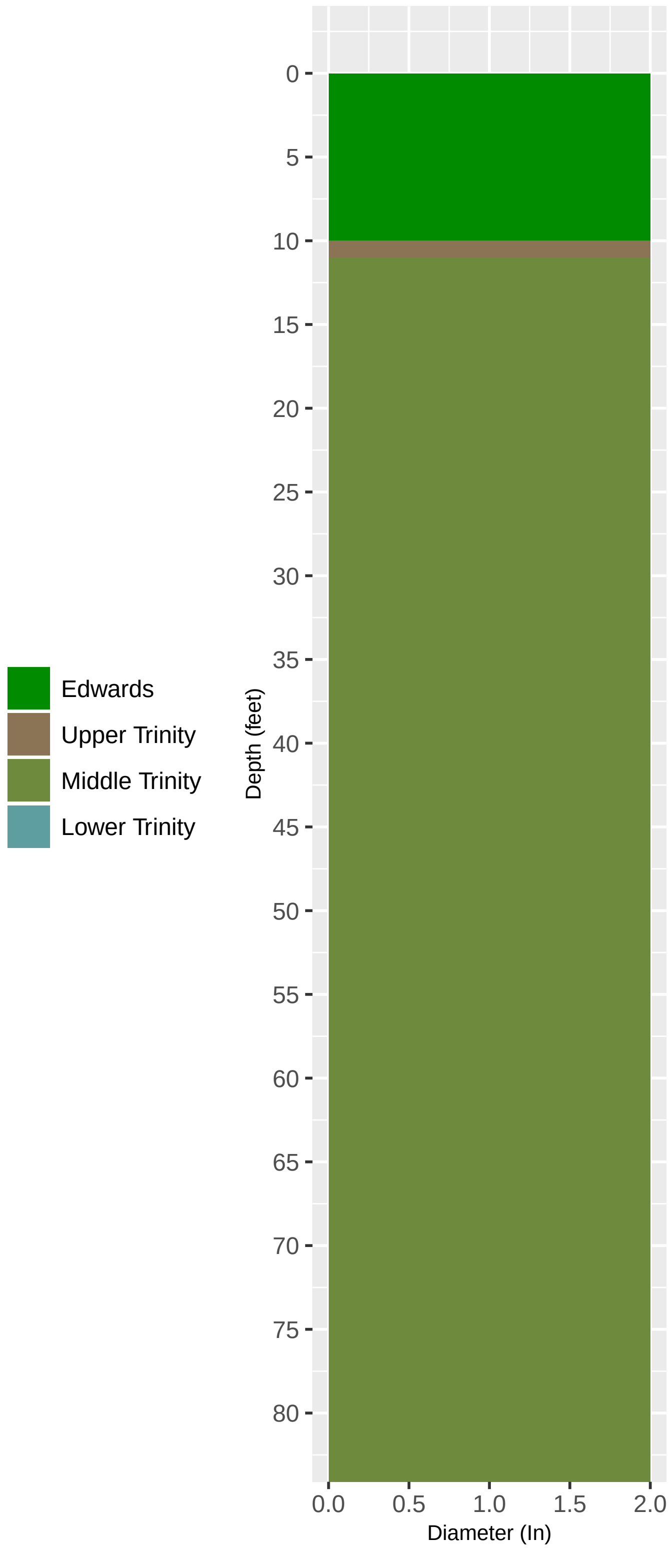
N

0 1 2 4

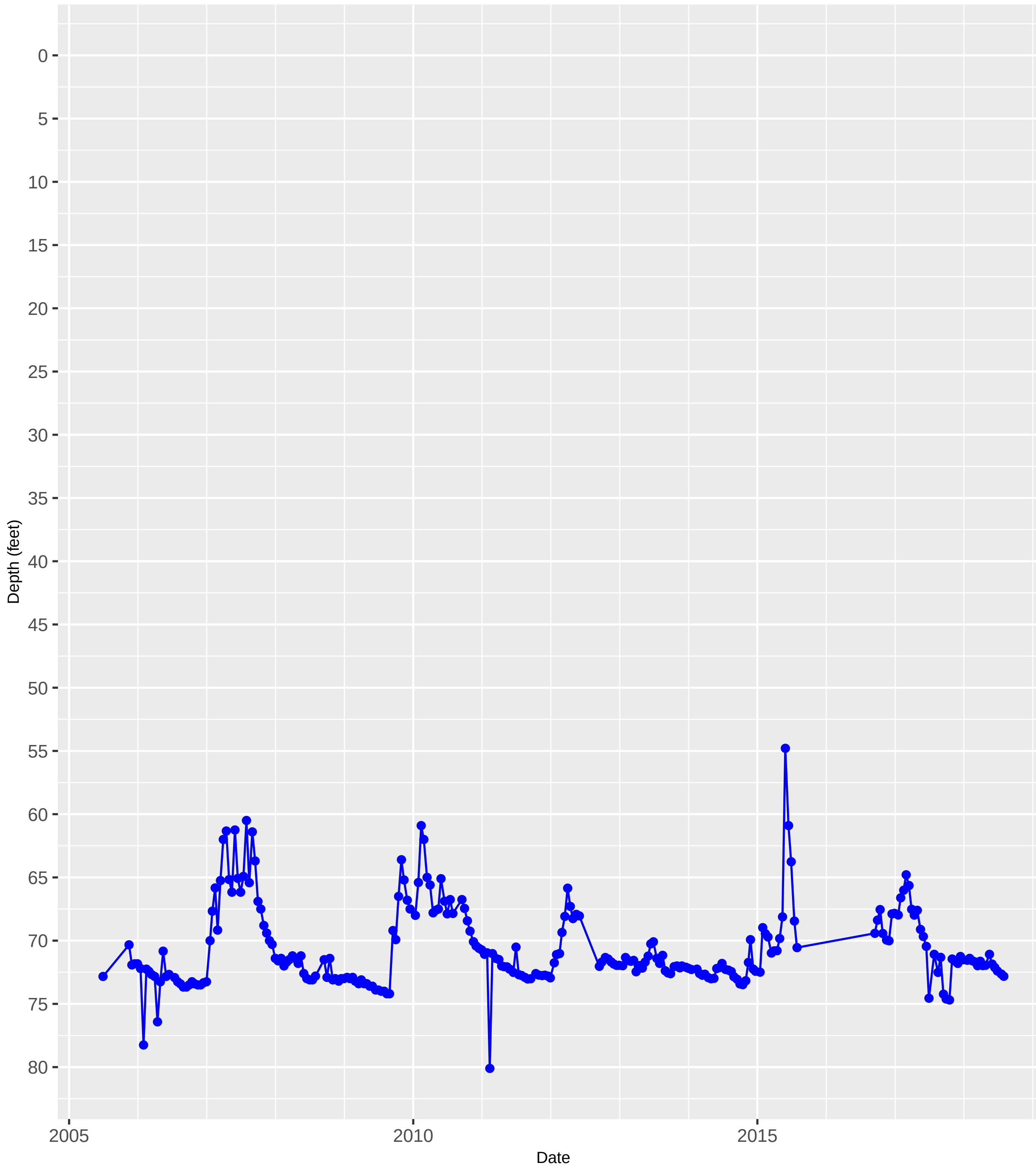
Miles

Map of Hydrograph Well Locations in Kendall County
218GLRSU
Glen Rose Limestone, Upper Member

Casing Diagram



6804809 Hydrograph in 218GLRSU − Glen Rose Limestone, Upper Member located in Kendall County



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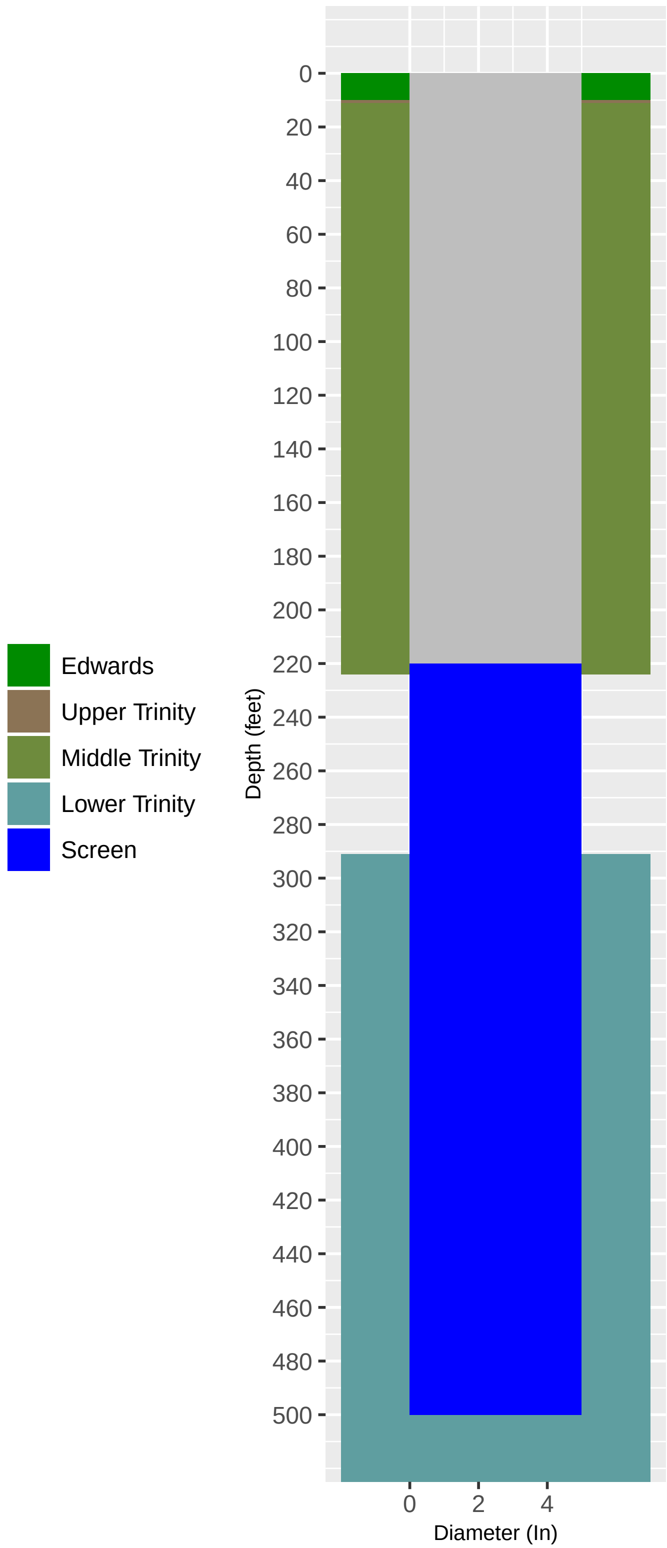
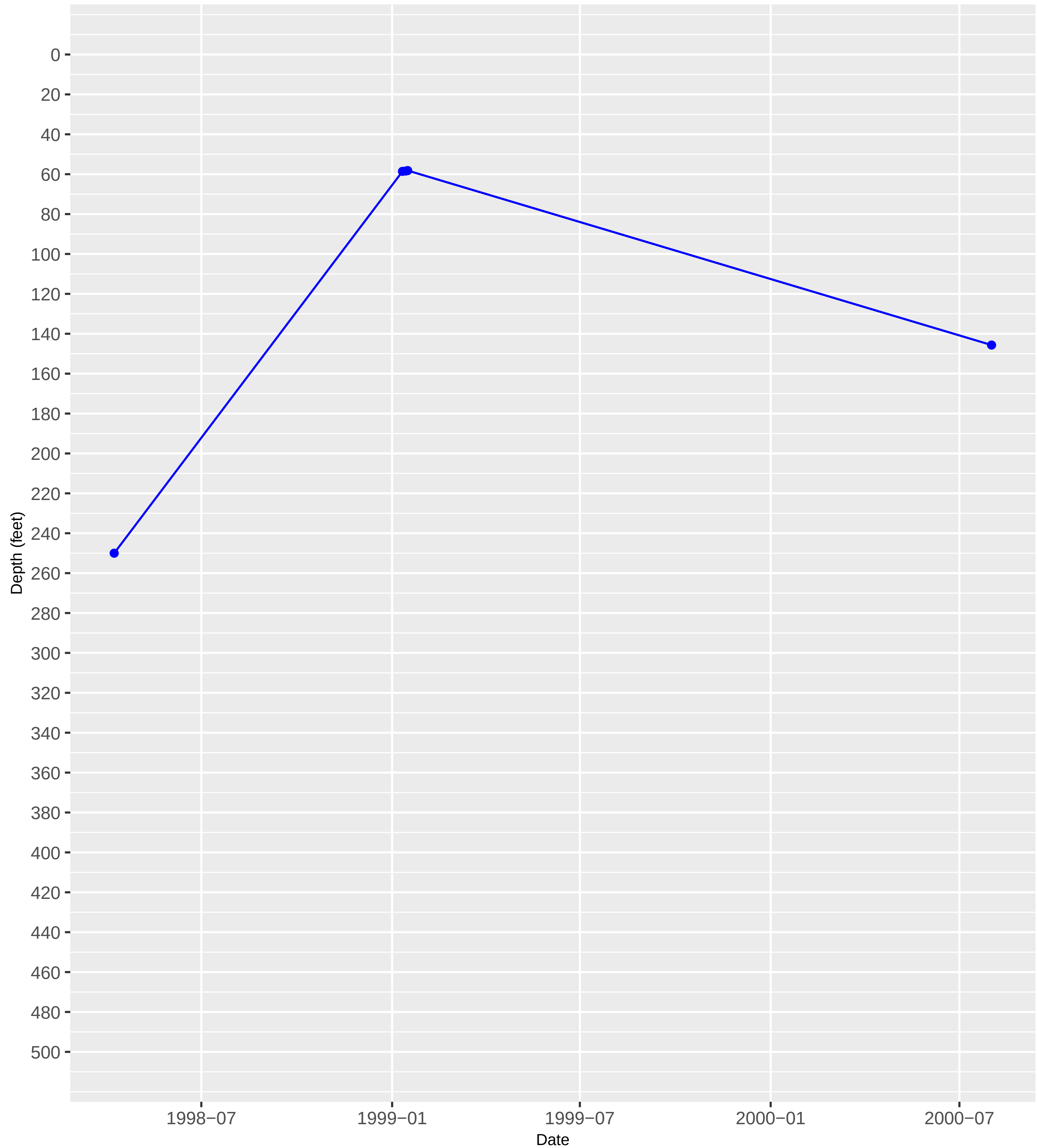
Casing Diagram



6805804 Hydrograph in 218GLRSU − Glen Rose Limestone, Upper Member located in Kendall County



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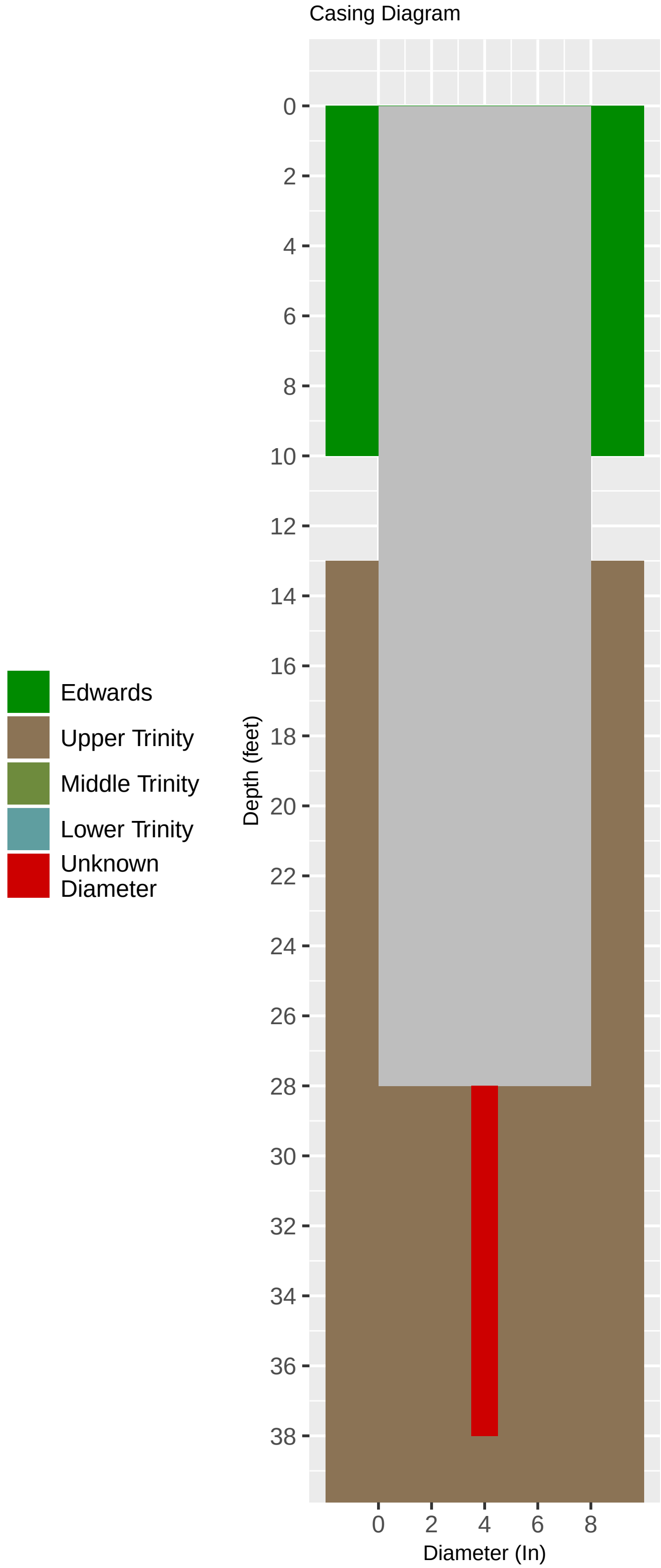

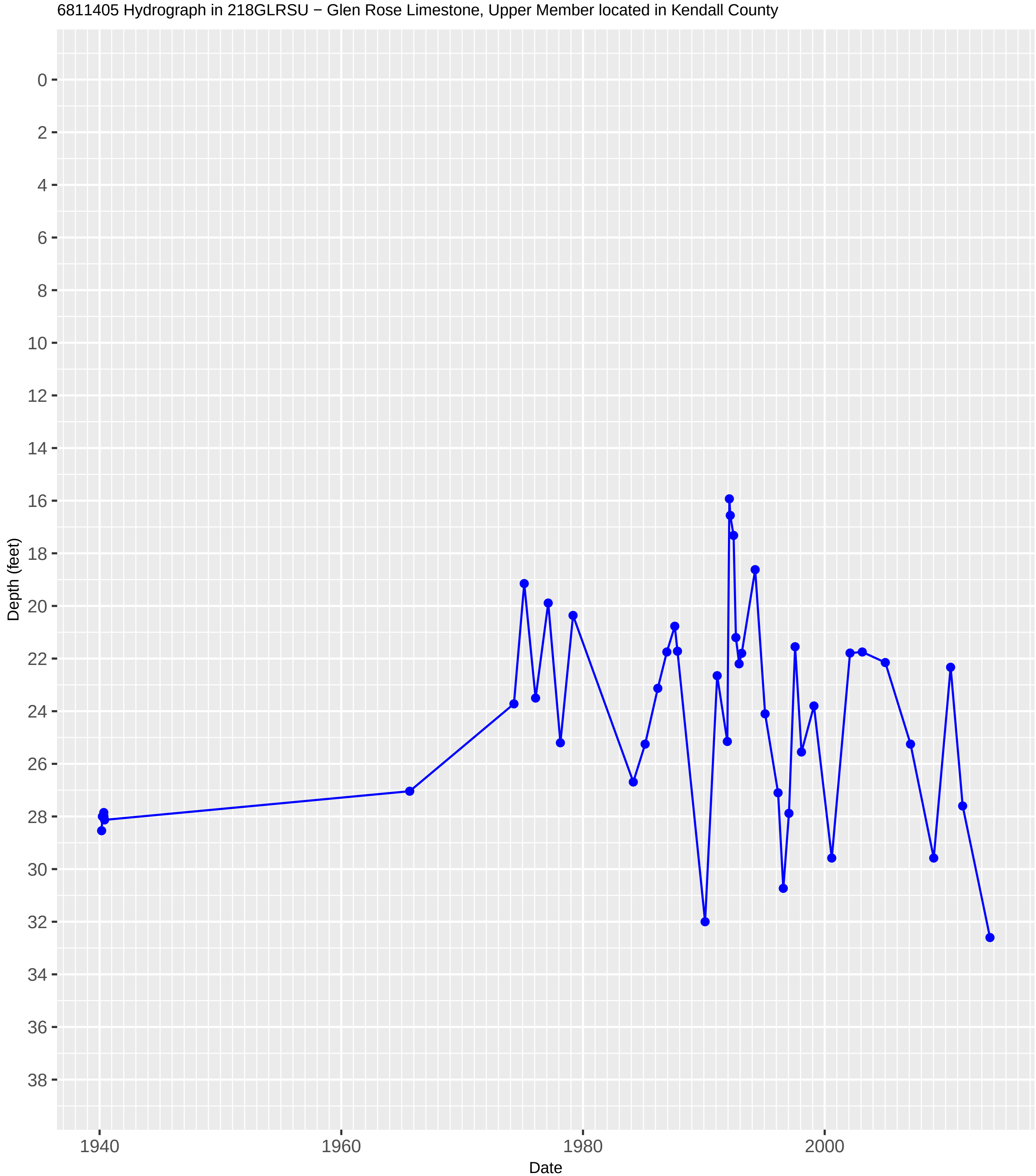

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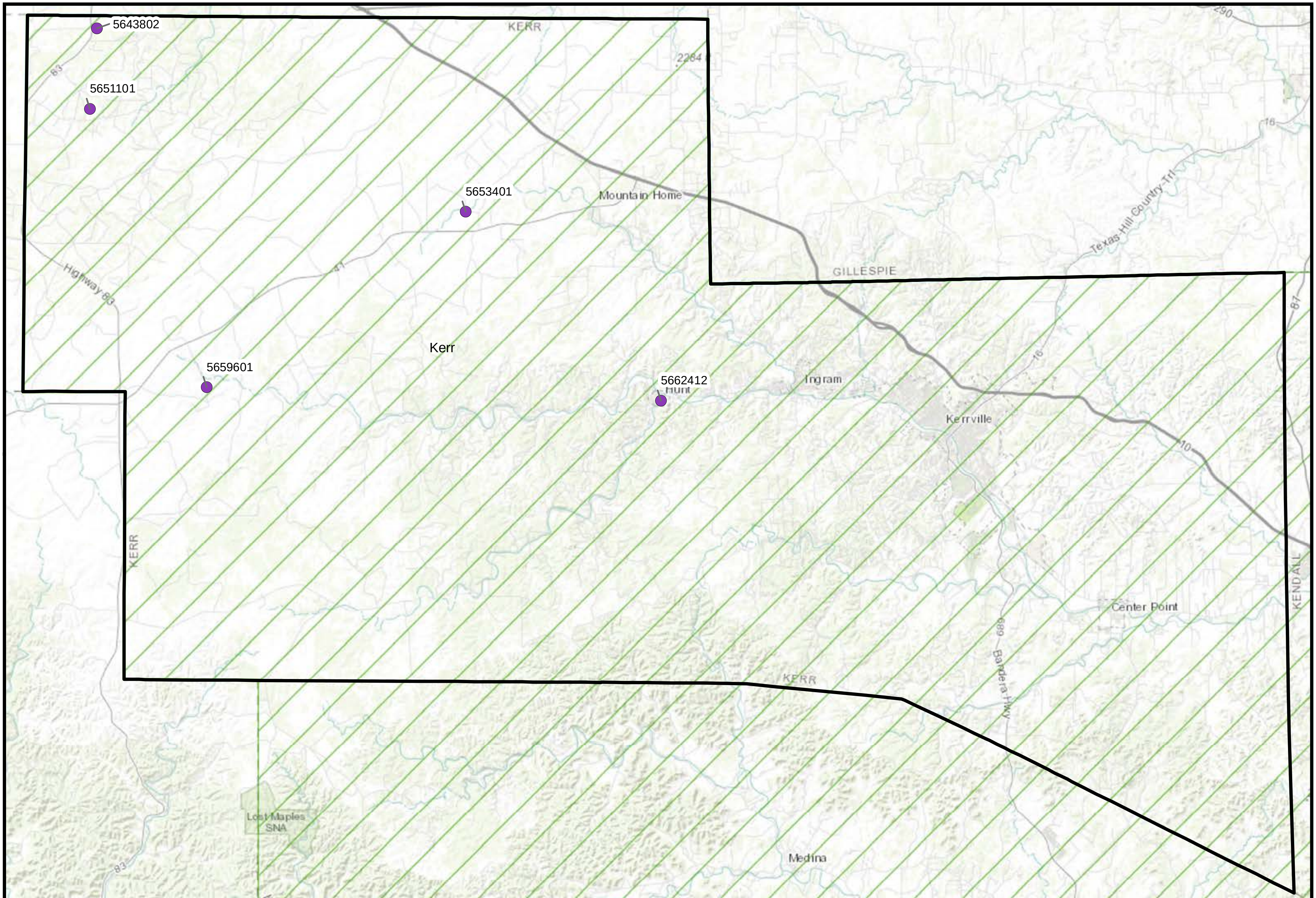


Aquifer

218GLRSU - Glen Rose Limestone, Upper Member

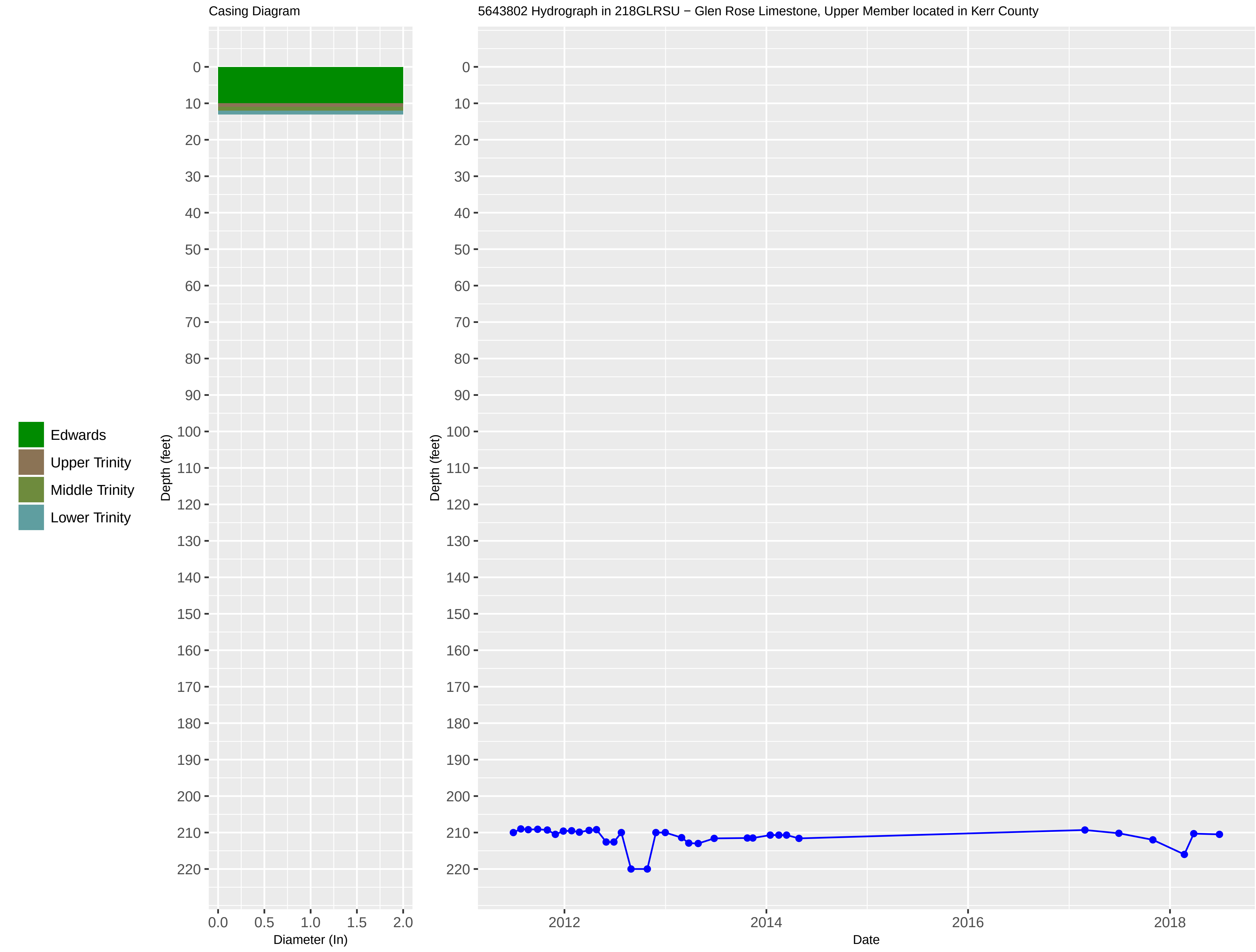
GMA 9

N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Kerr County
218GLRSU
Glen Rose Limestone, Upper Member



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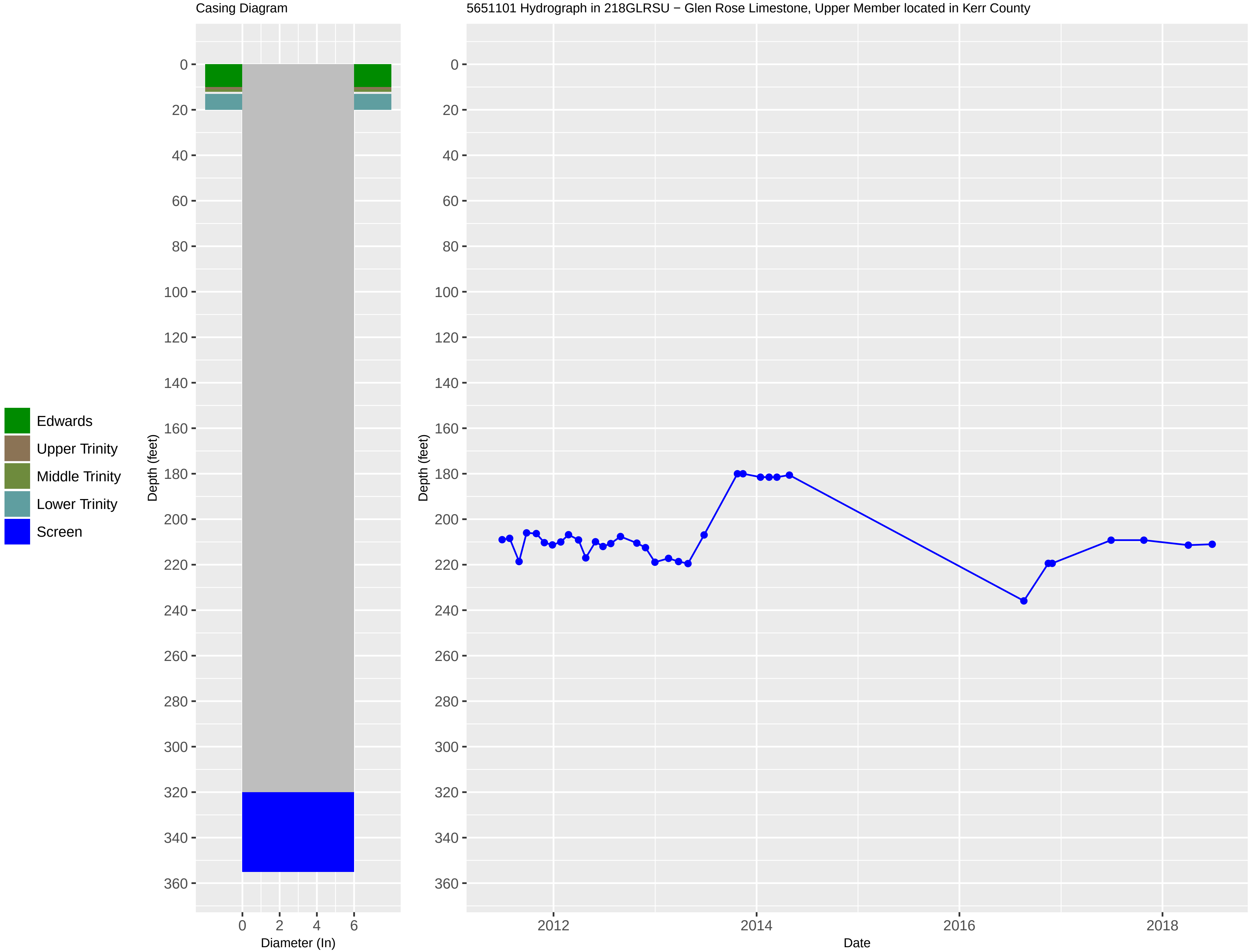

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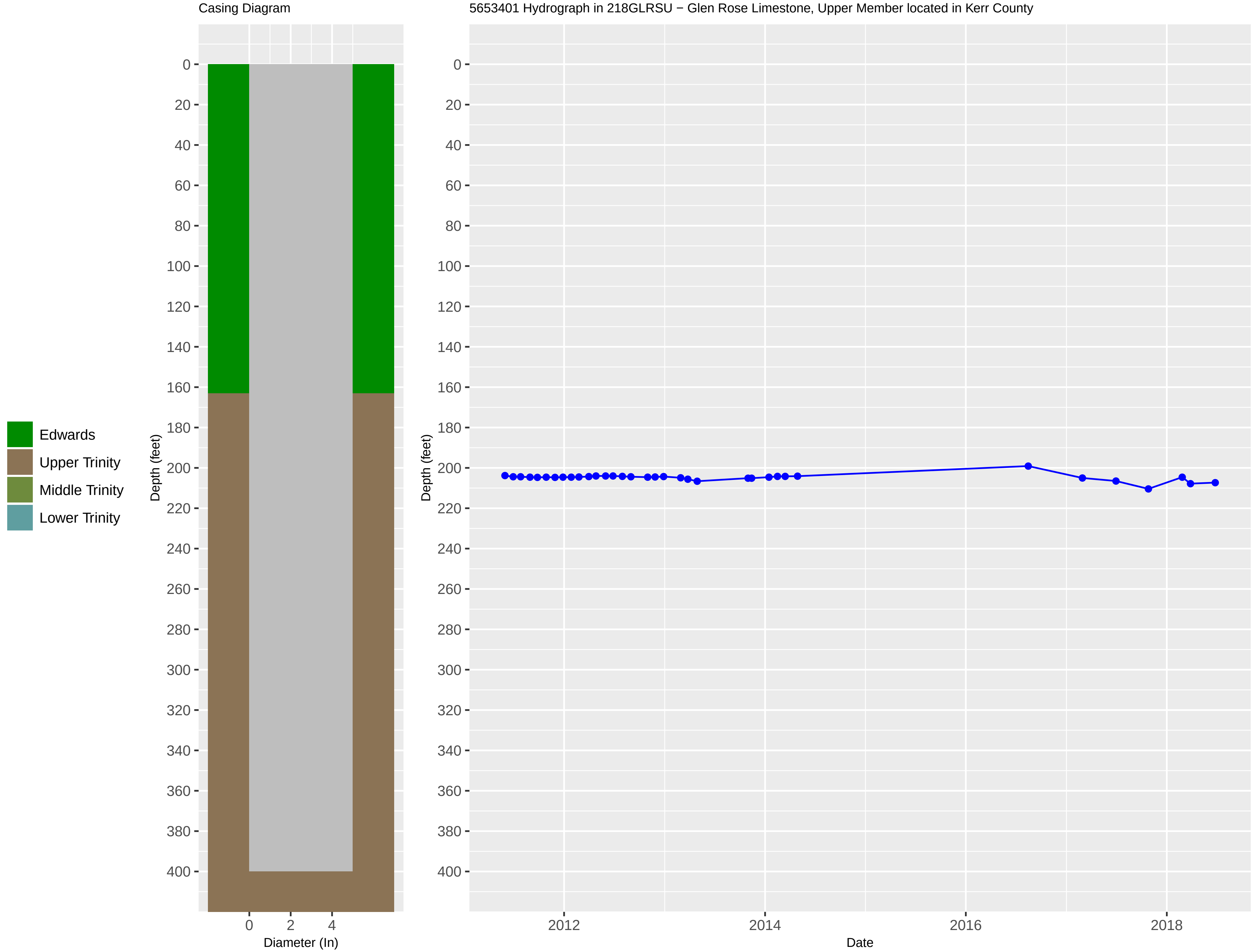

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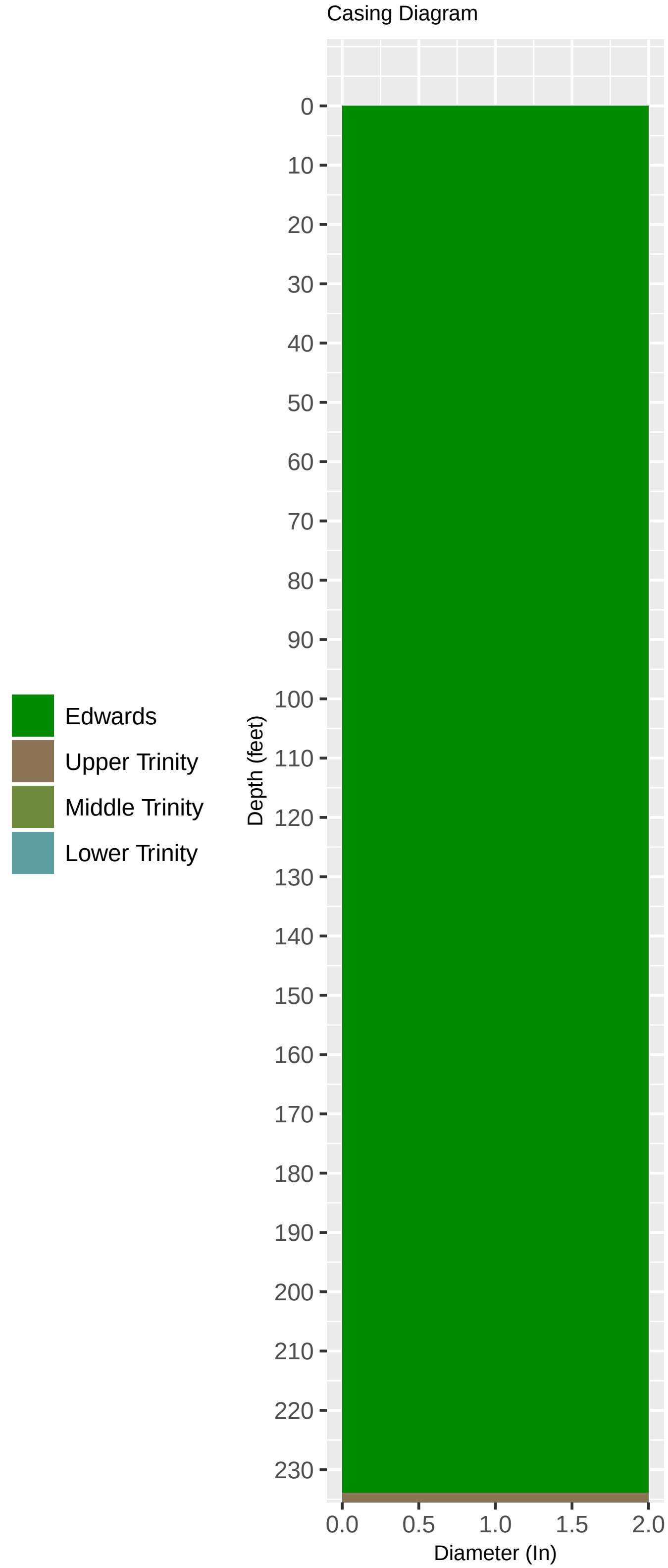

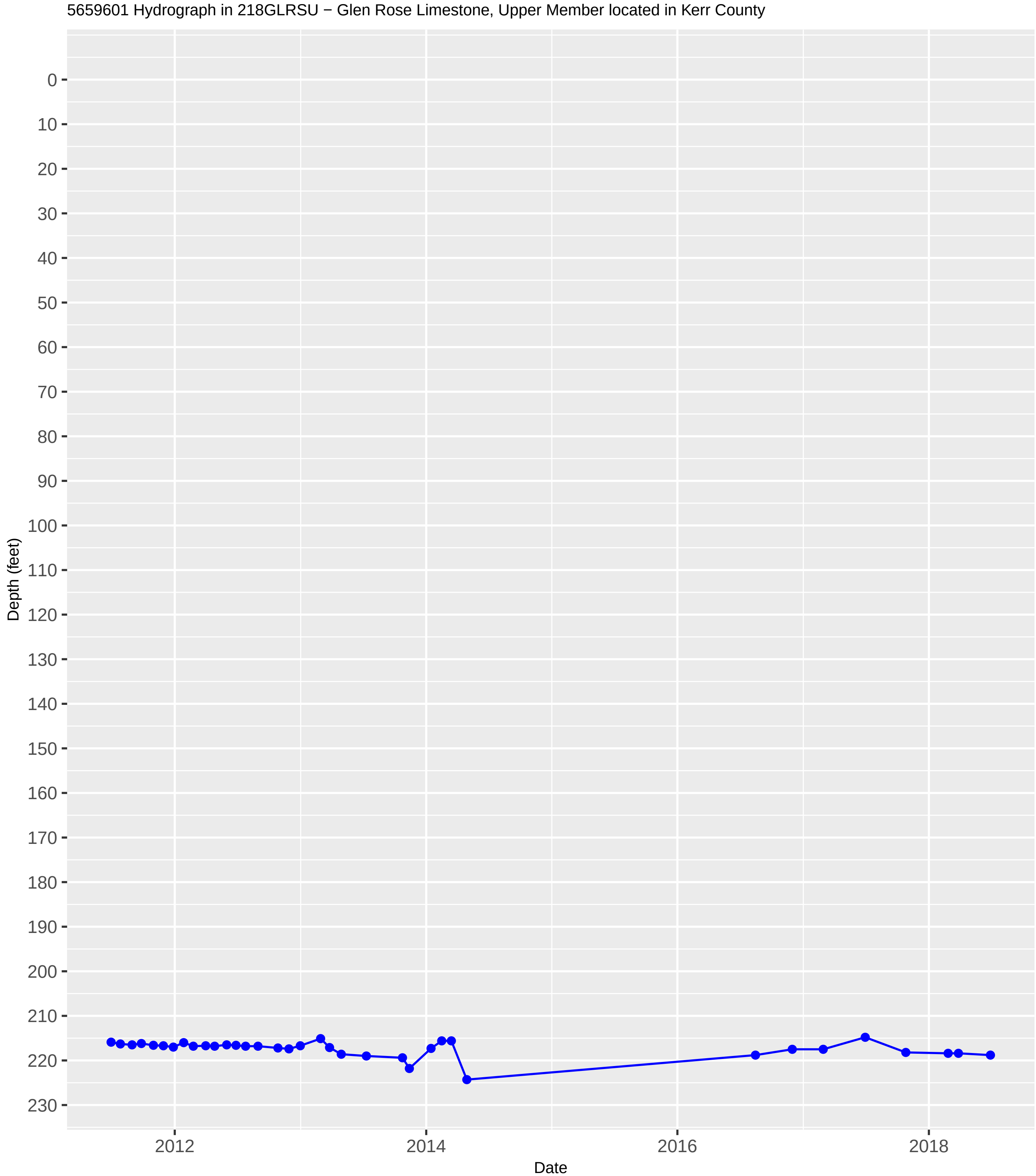

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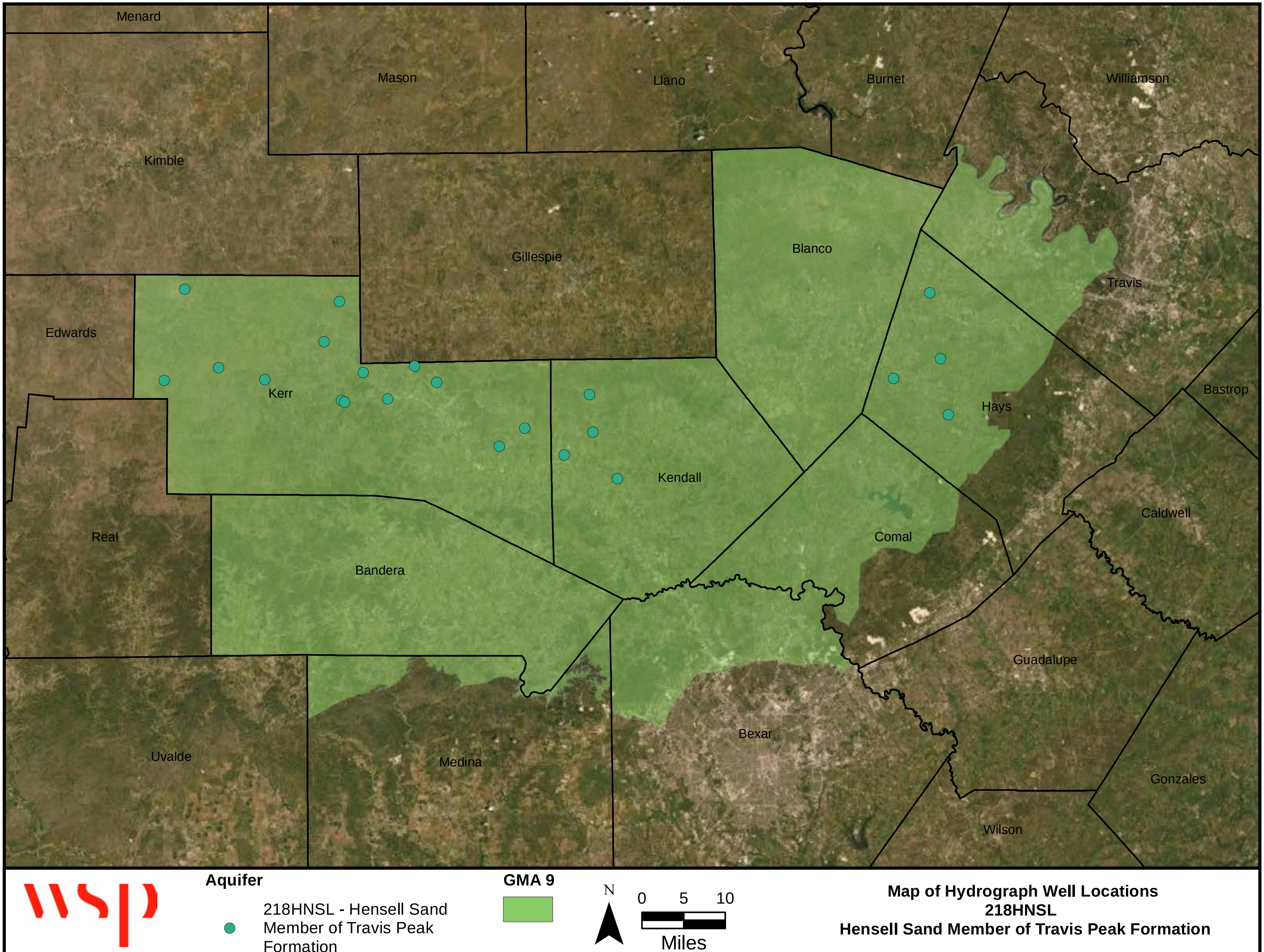
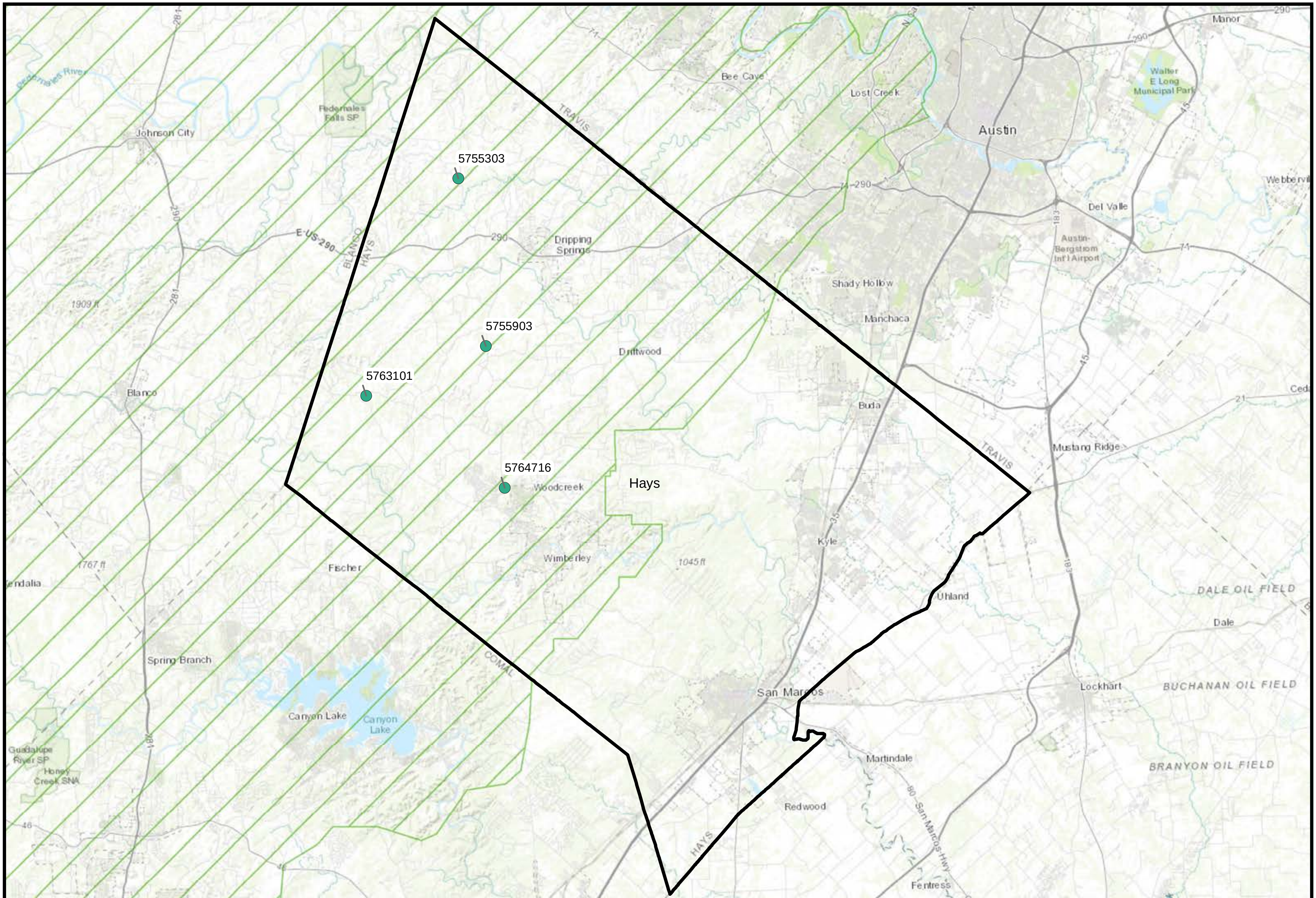


Map of Hydrograph Well Locations
218HNSL
Hensell Sand Member of Travis Peak Formation



Aquifer

218HNSL - Hensell Sand Member of Travis Peak Formation

GMA 9

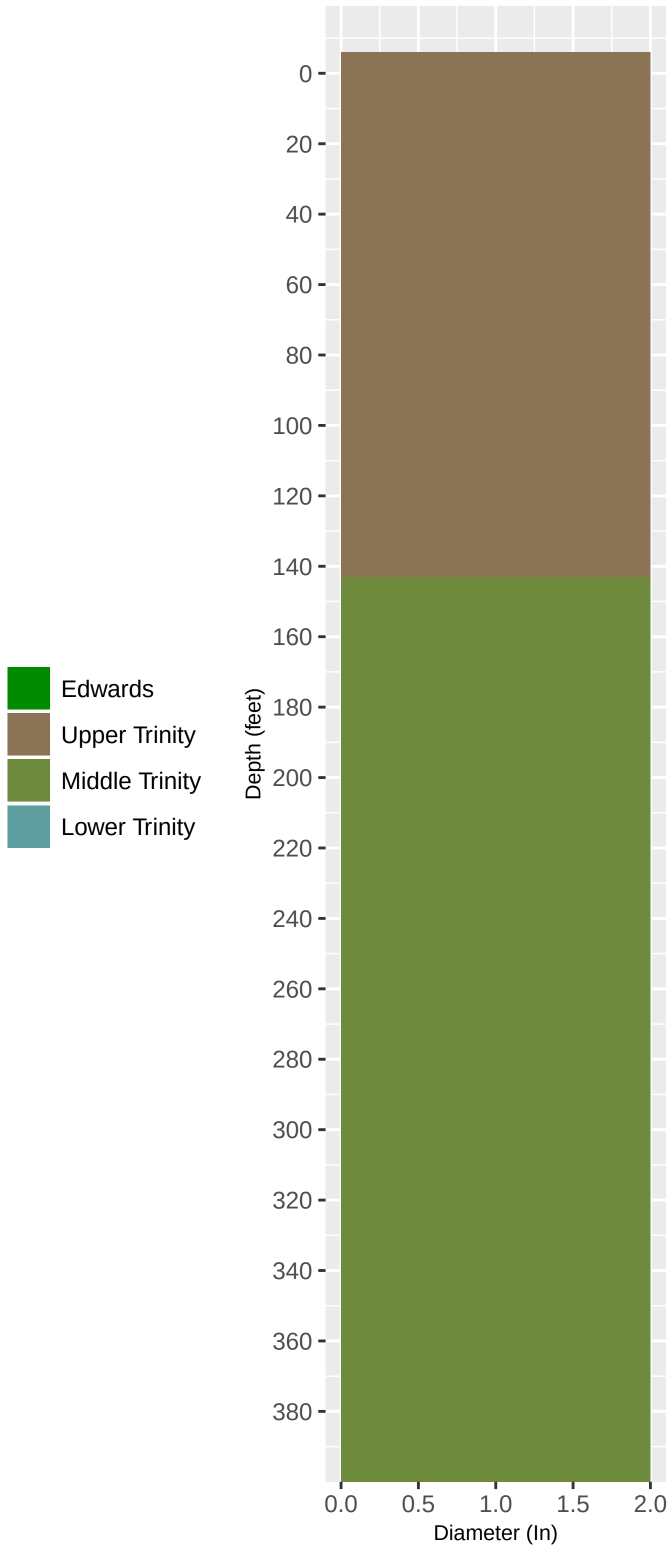
N

0 1 2 4 6

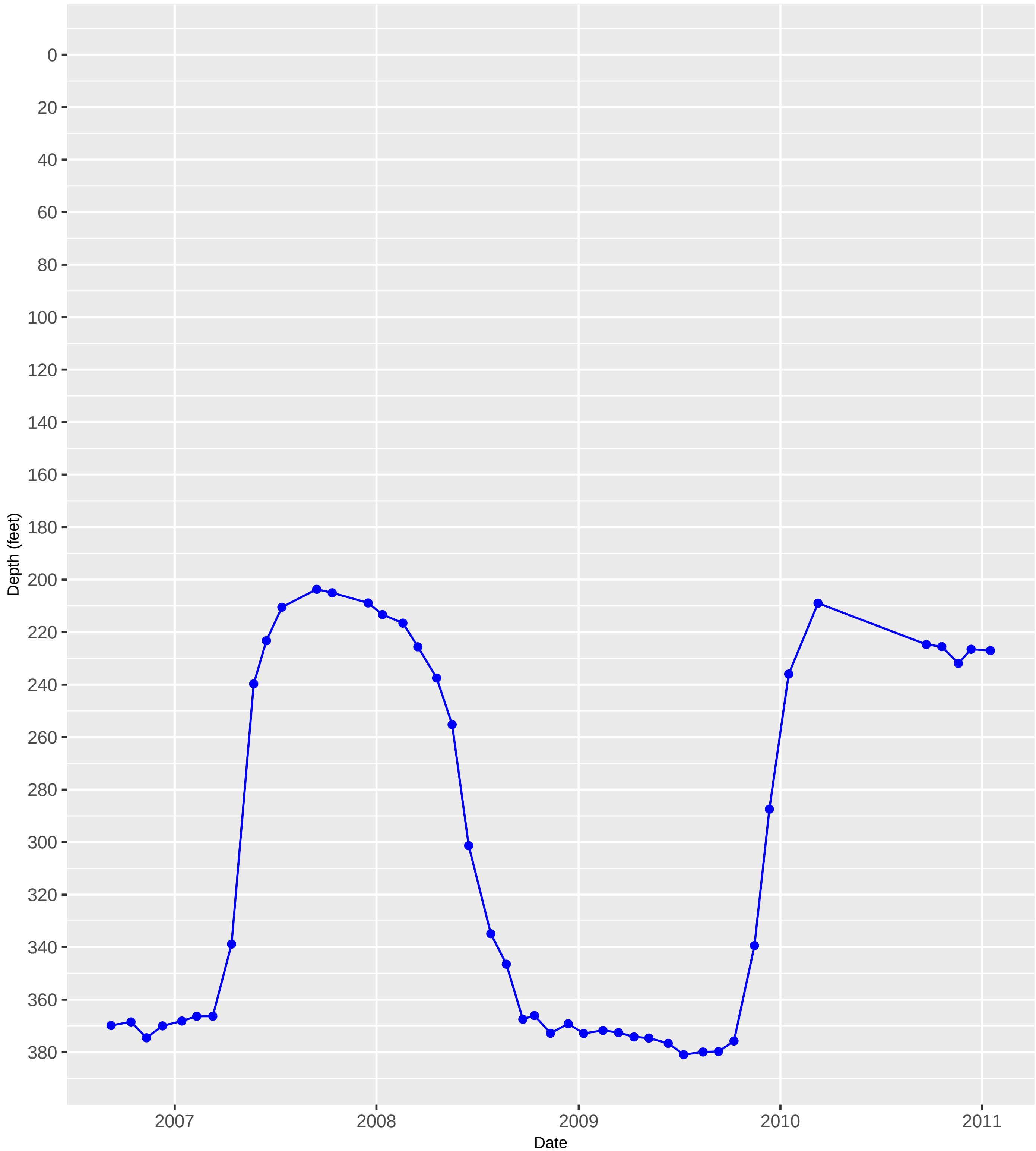
Miles

Map of Hydrograph Well Locations in Hays County
218HNSL
Hensell Sand Member of Travis Peak Formation

Casing Diagram



5755303 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Hays County



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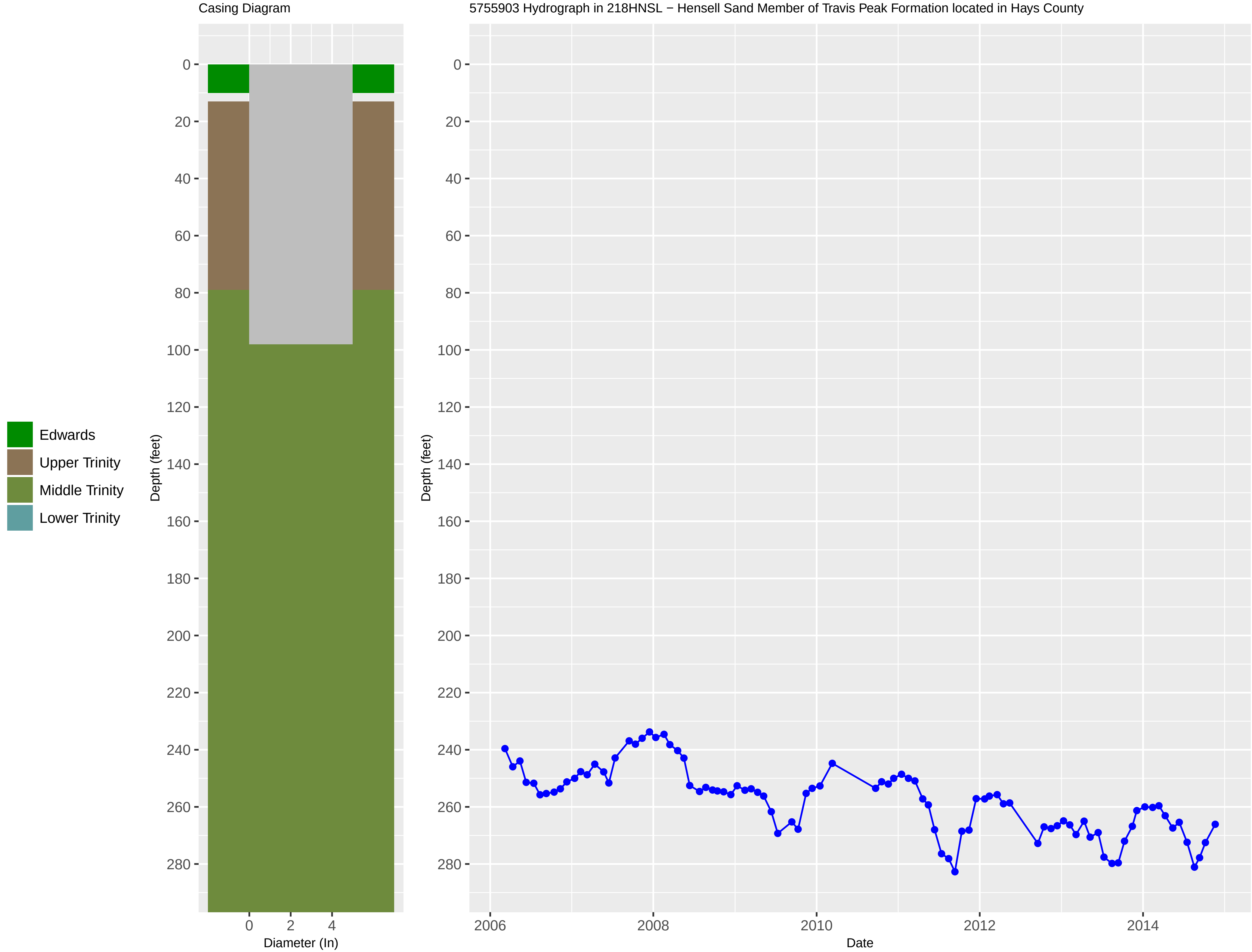

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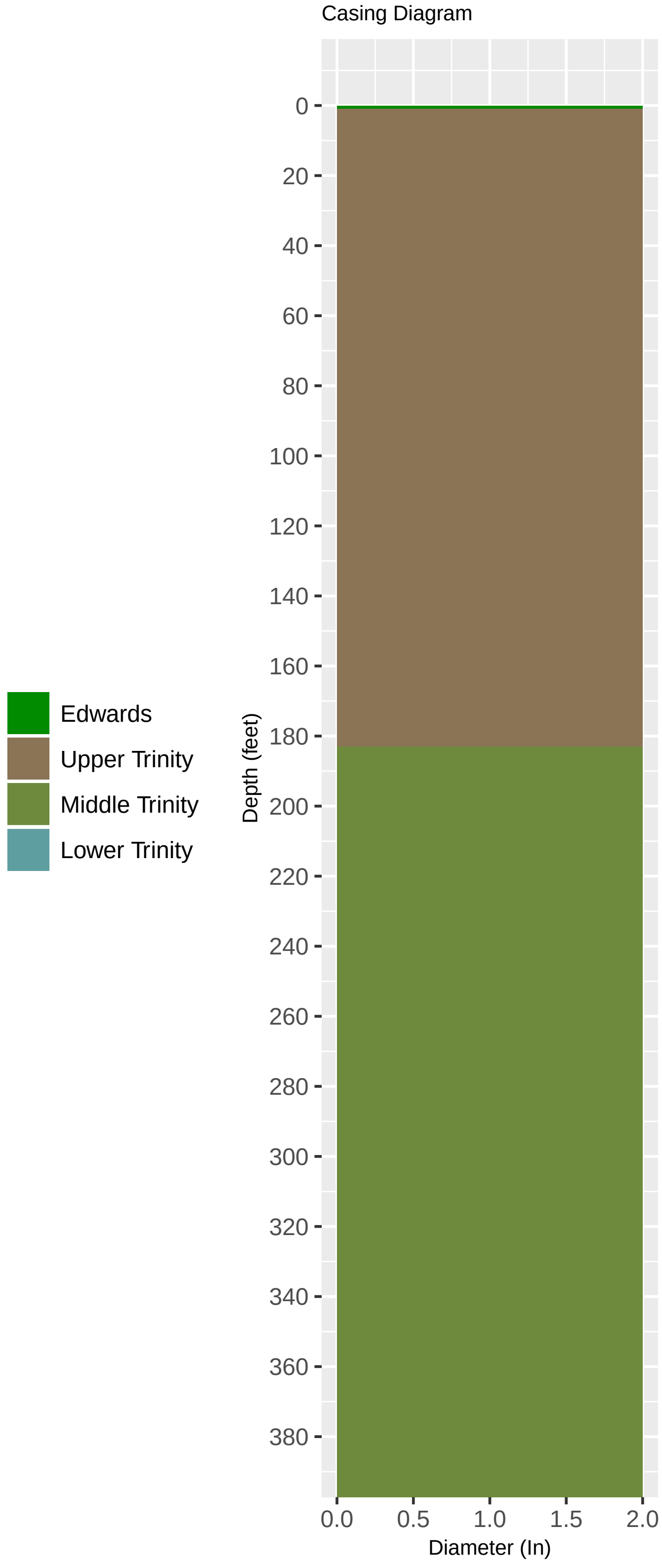

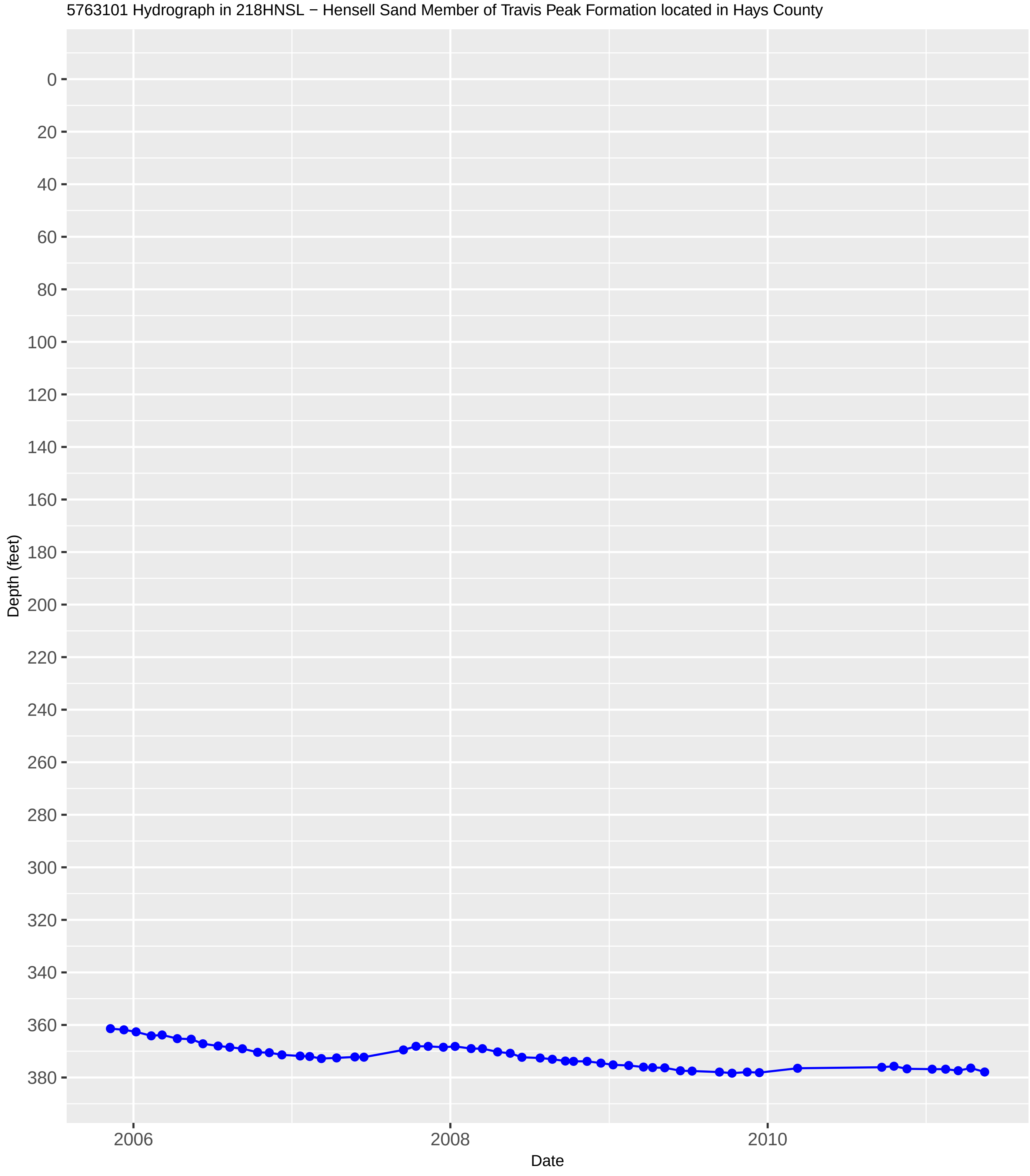

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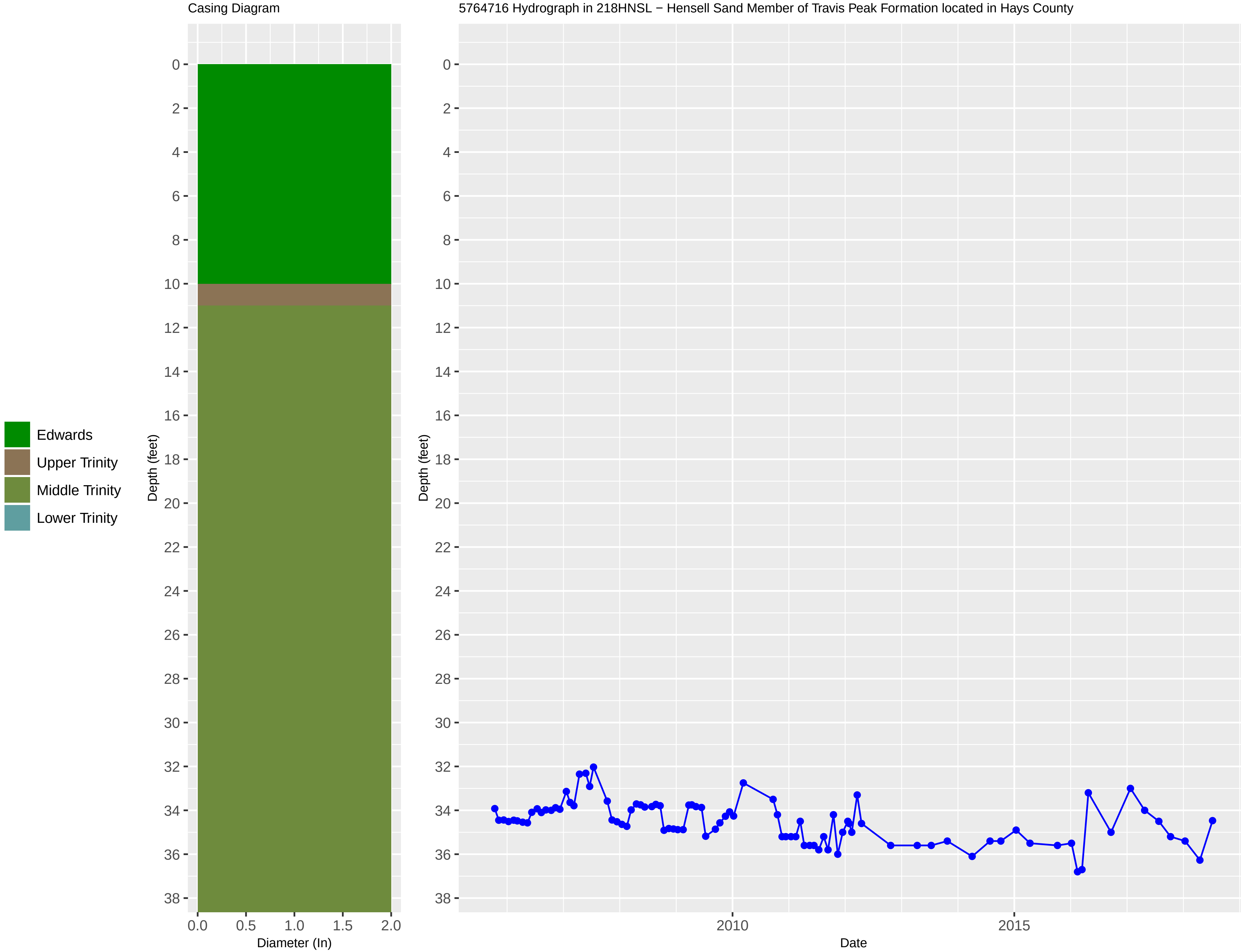

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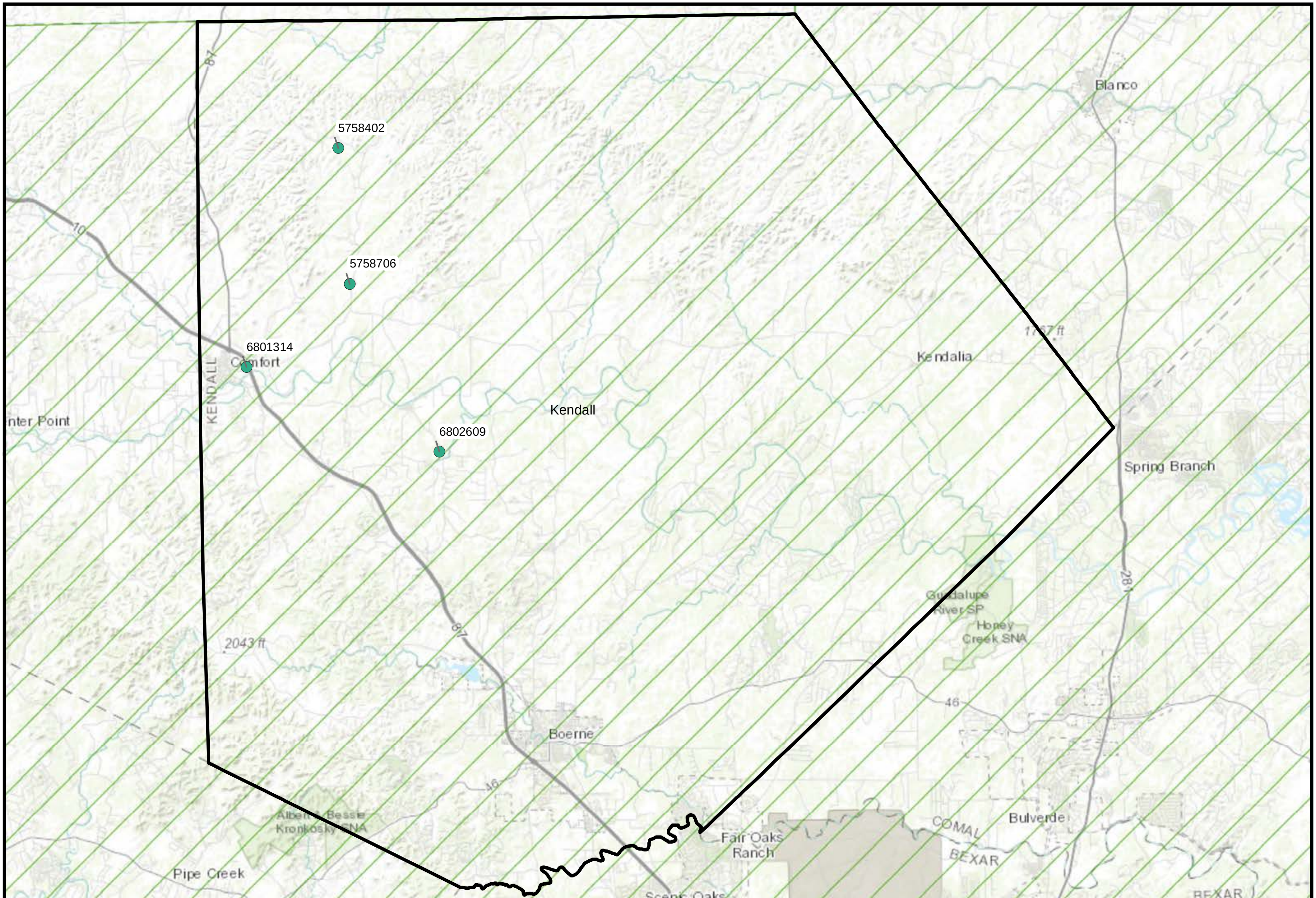


Aquifer

218HNSL - Hensell Sand Member of Travis Peak Formation

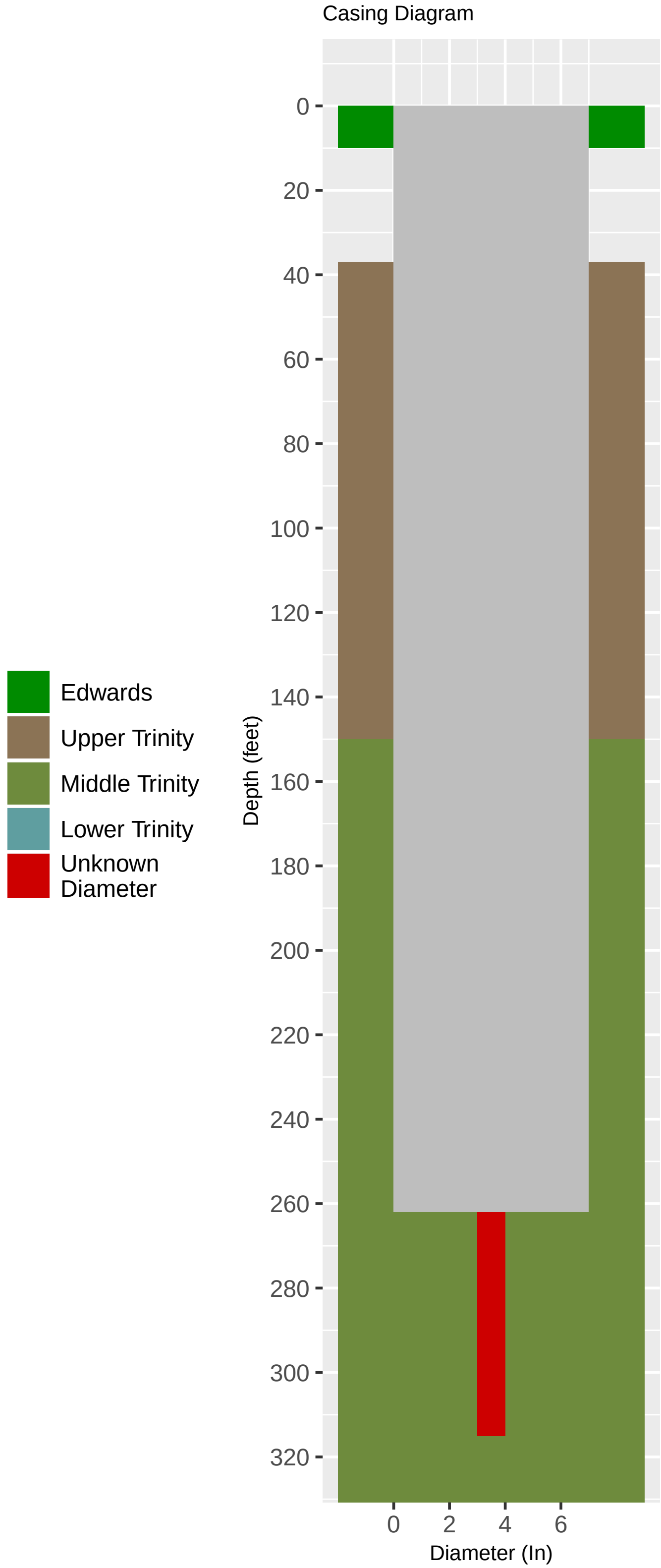
GMA 9

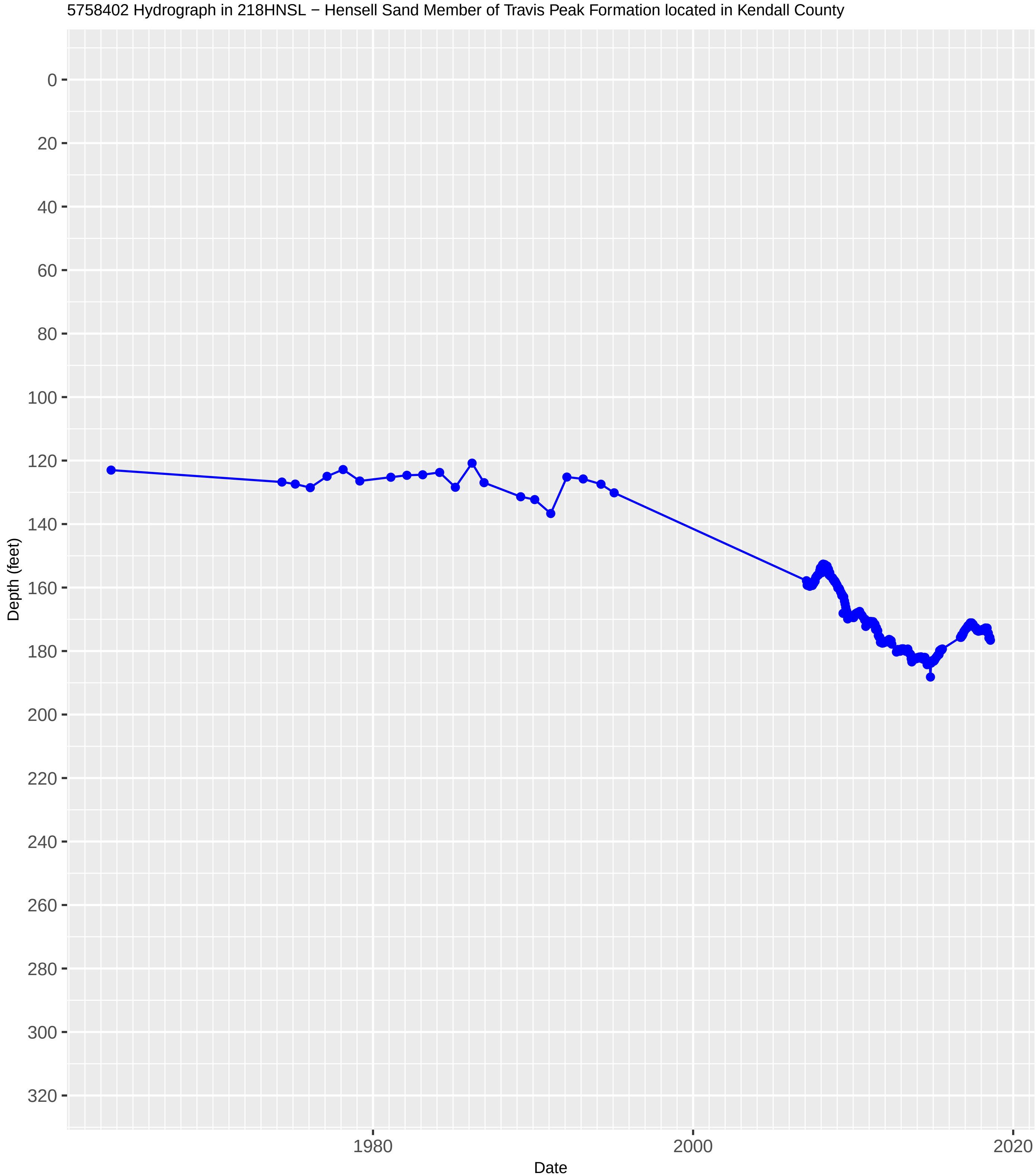
N

0 1 2 4

Miles

Map of Hydrograph Well Locations in Kendall County
218HNSL
Hensell Sand Member of Travis Peak Formation





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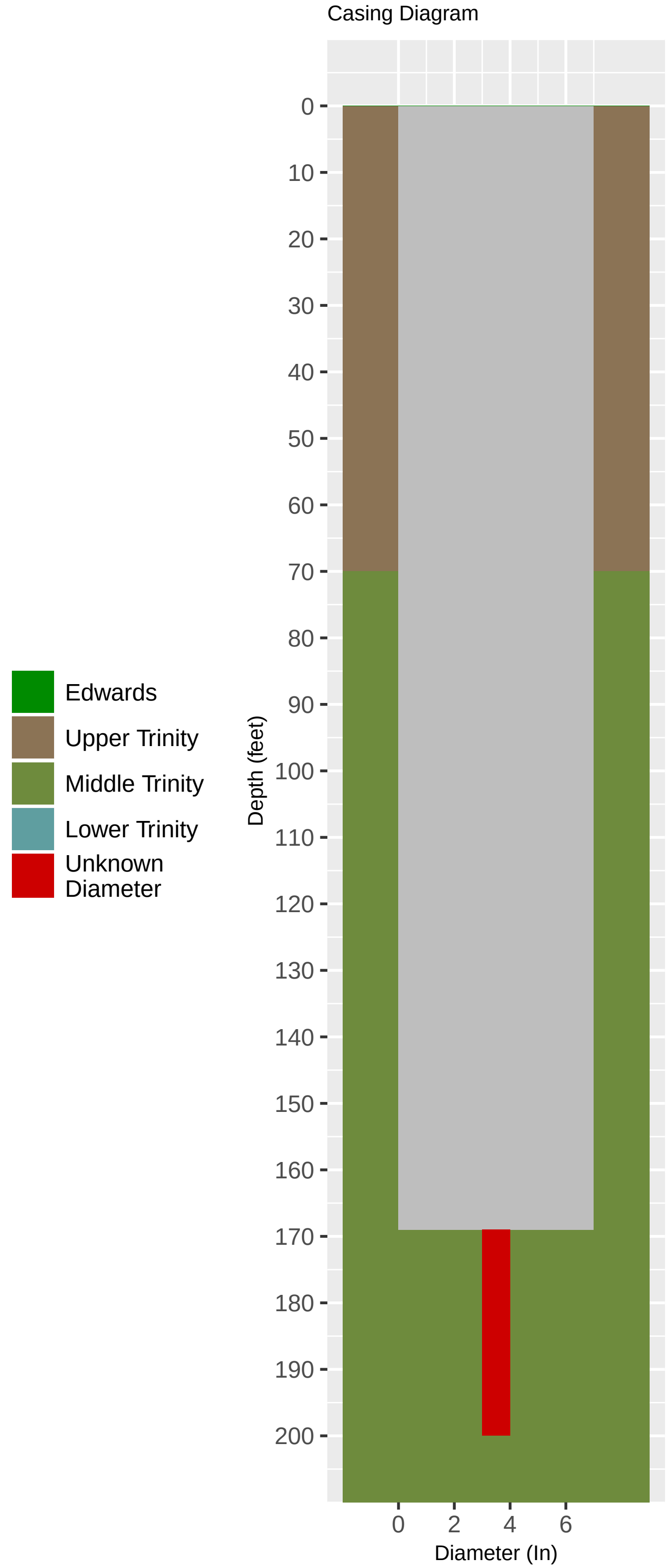

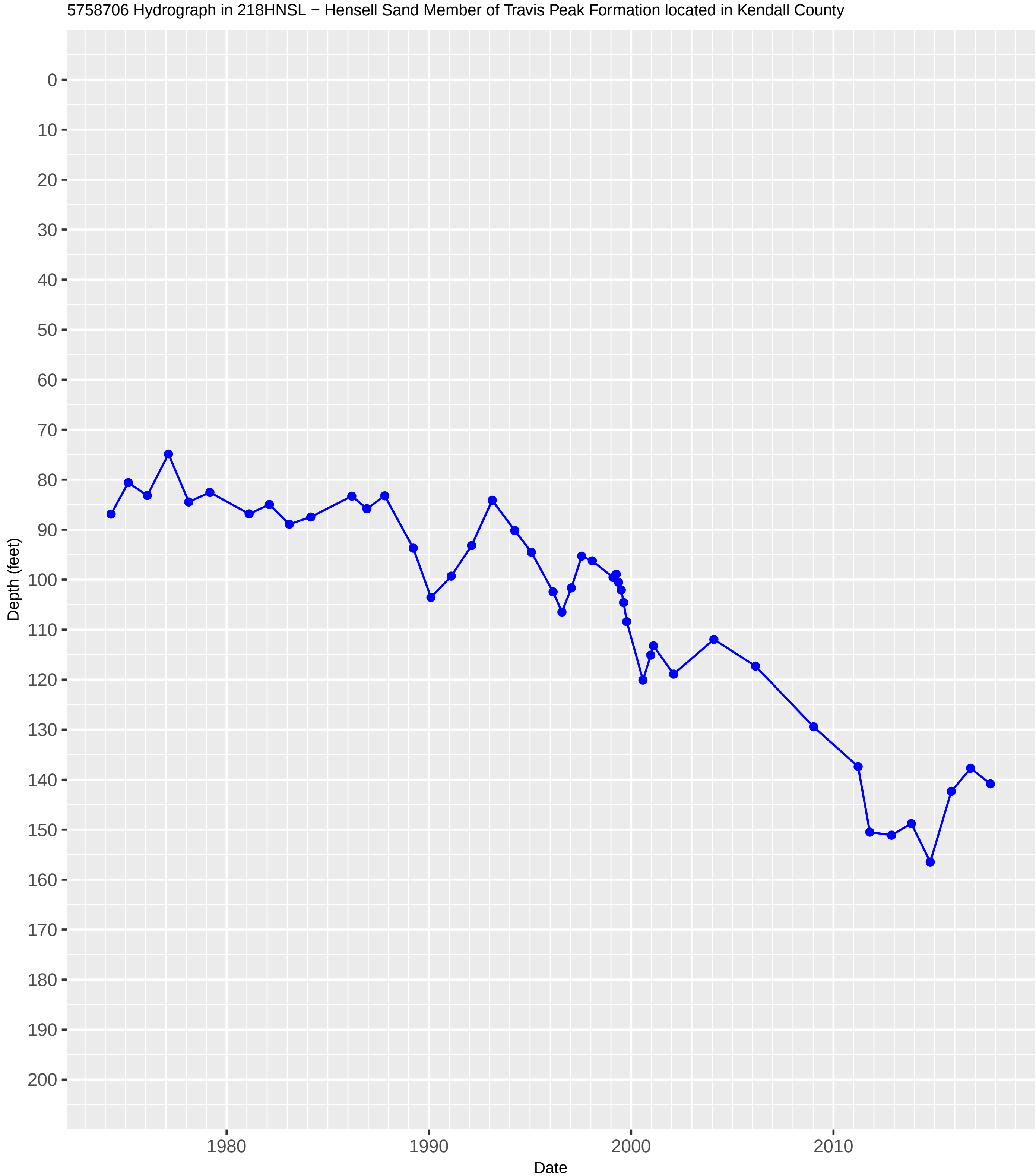

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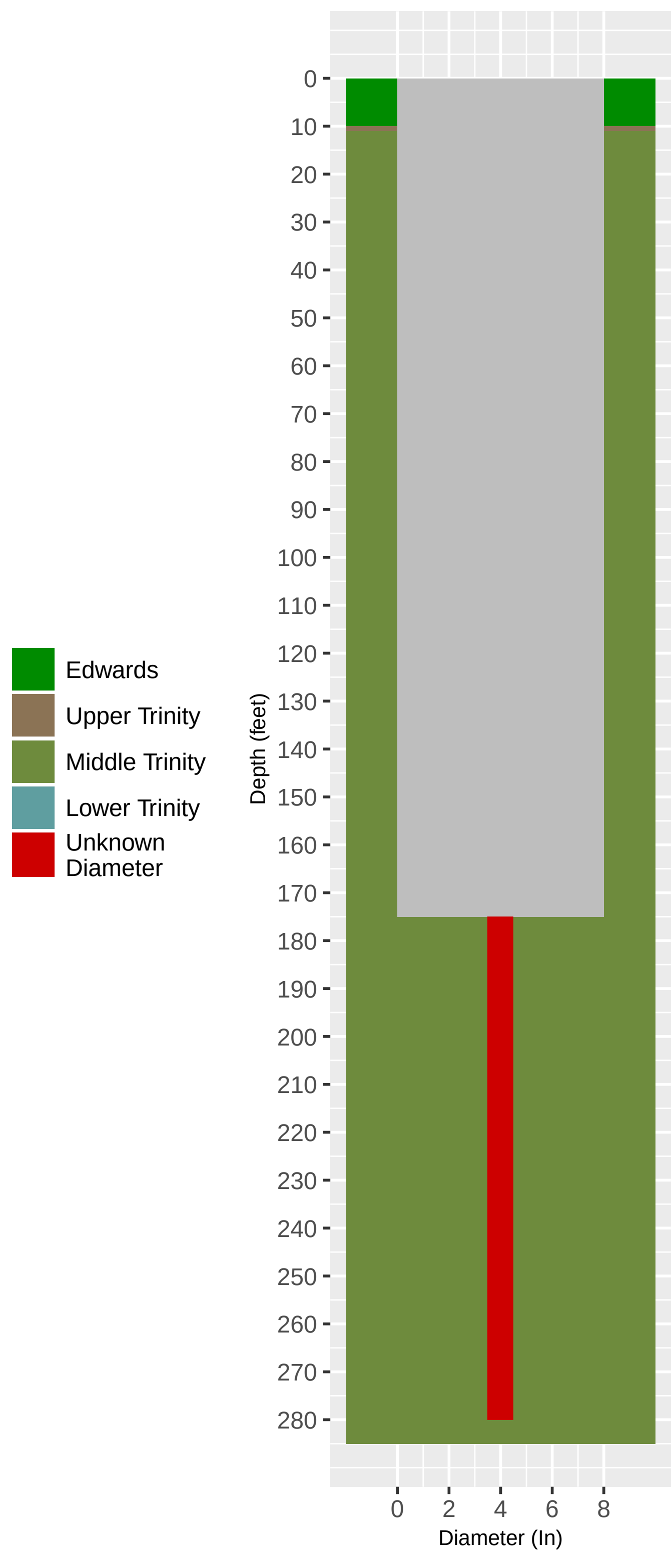
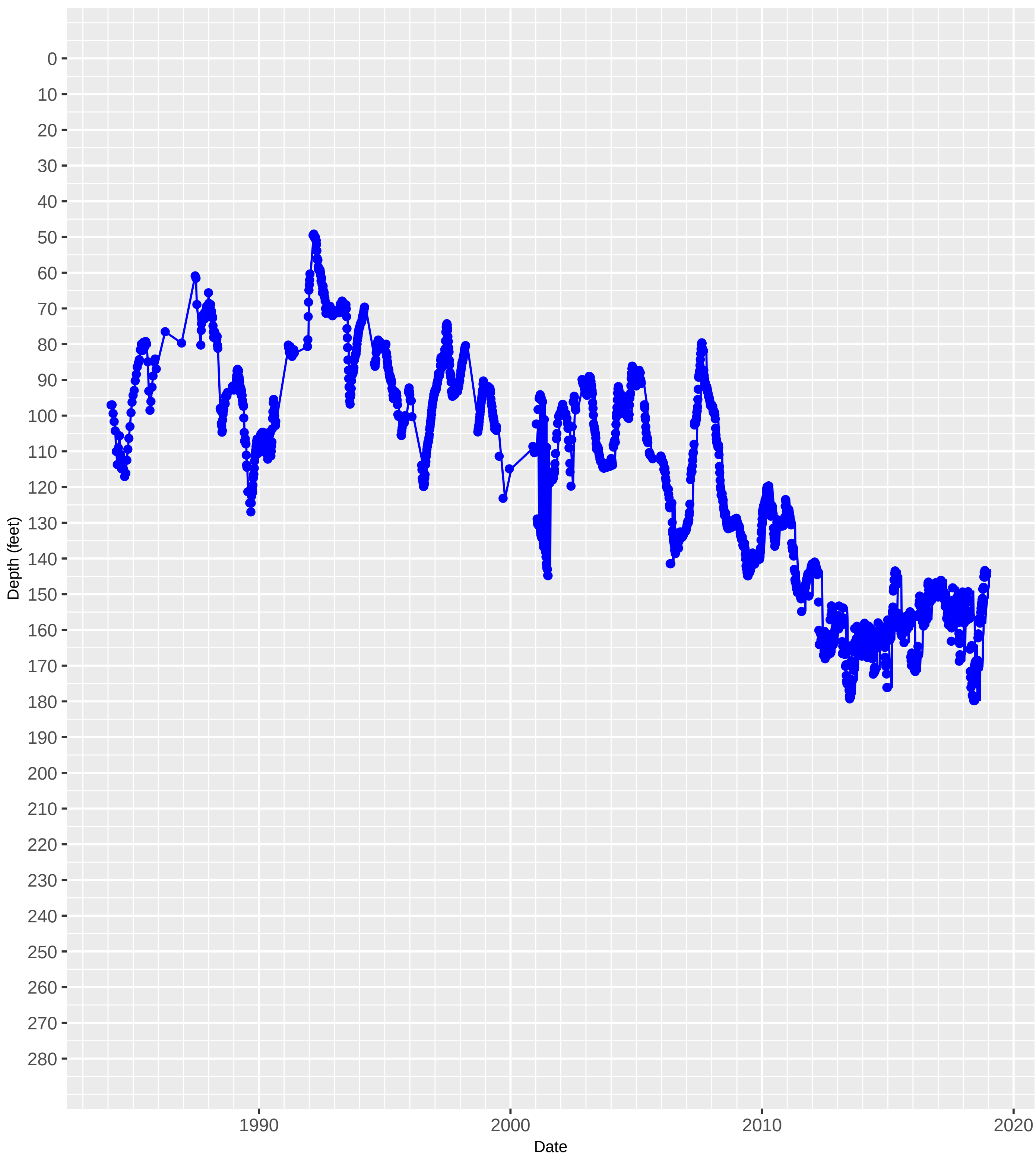
Casing Diagram

6801314 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Kendall County





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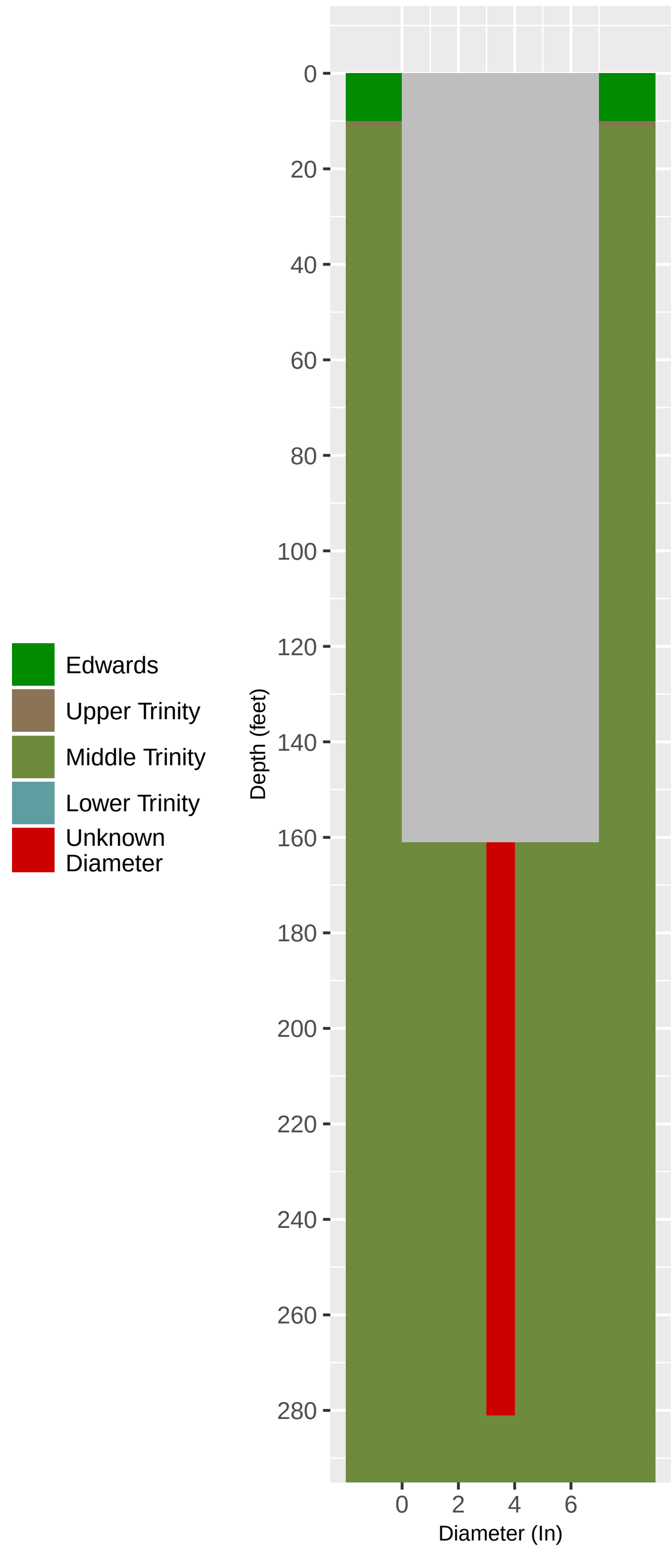
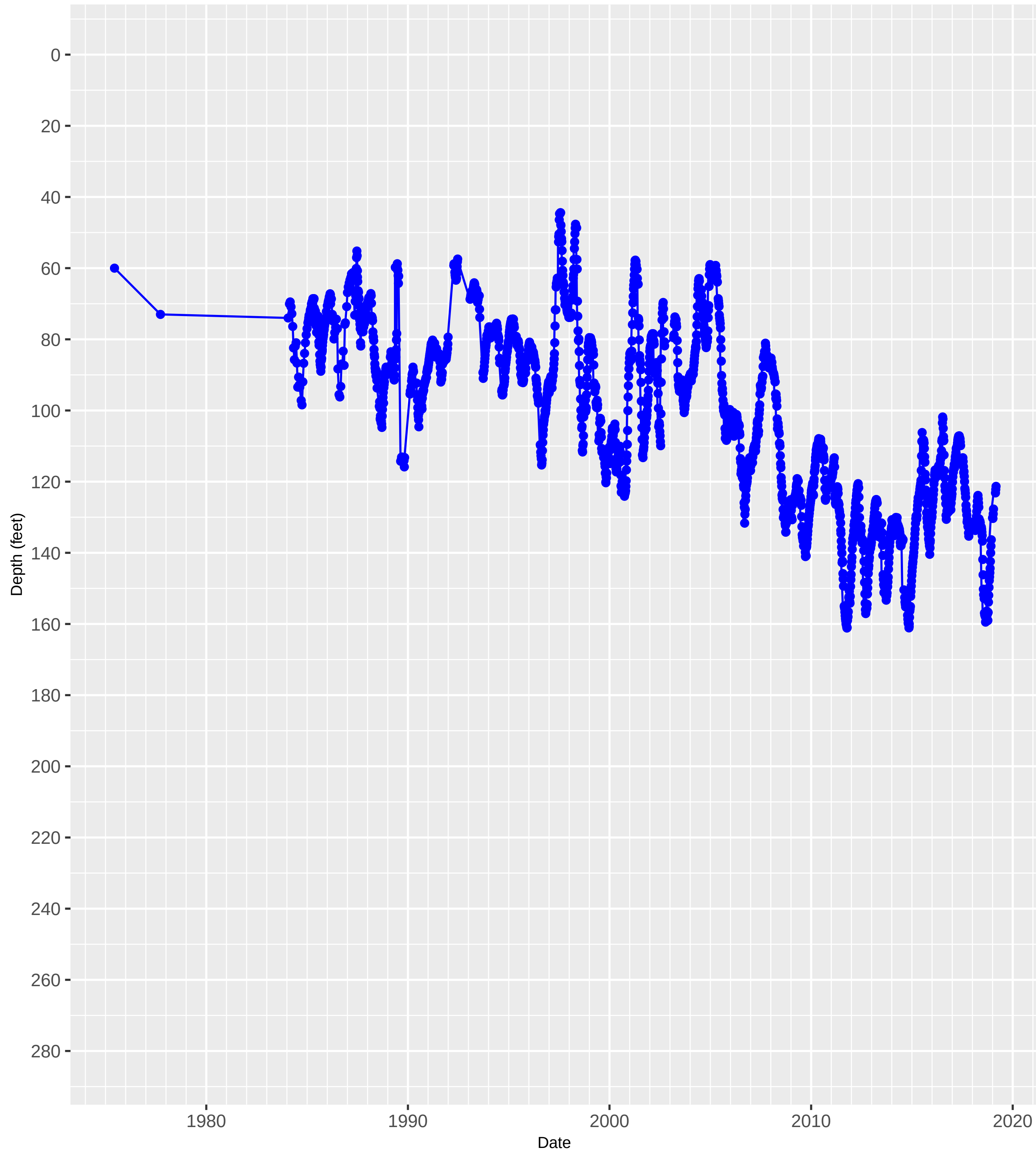
Casing Diagram



6802609 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Kendall County



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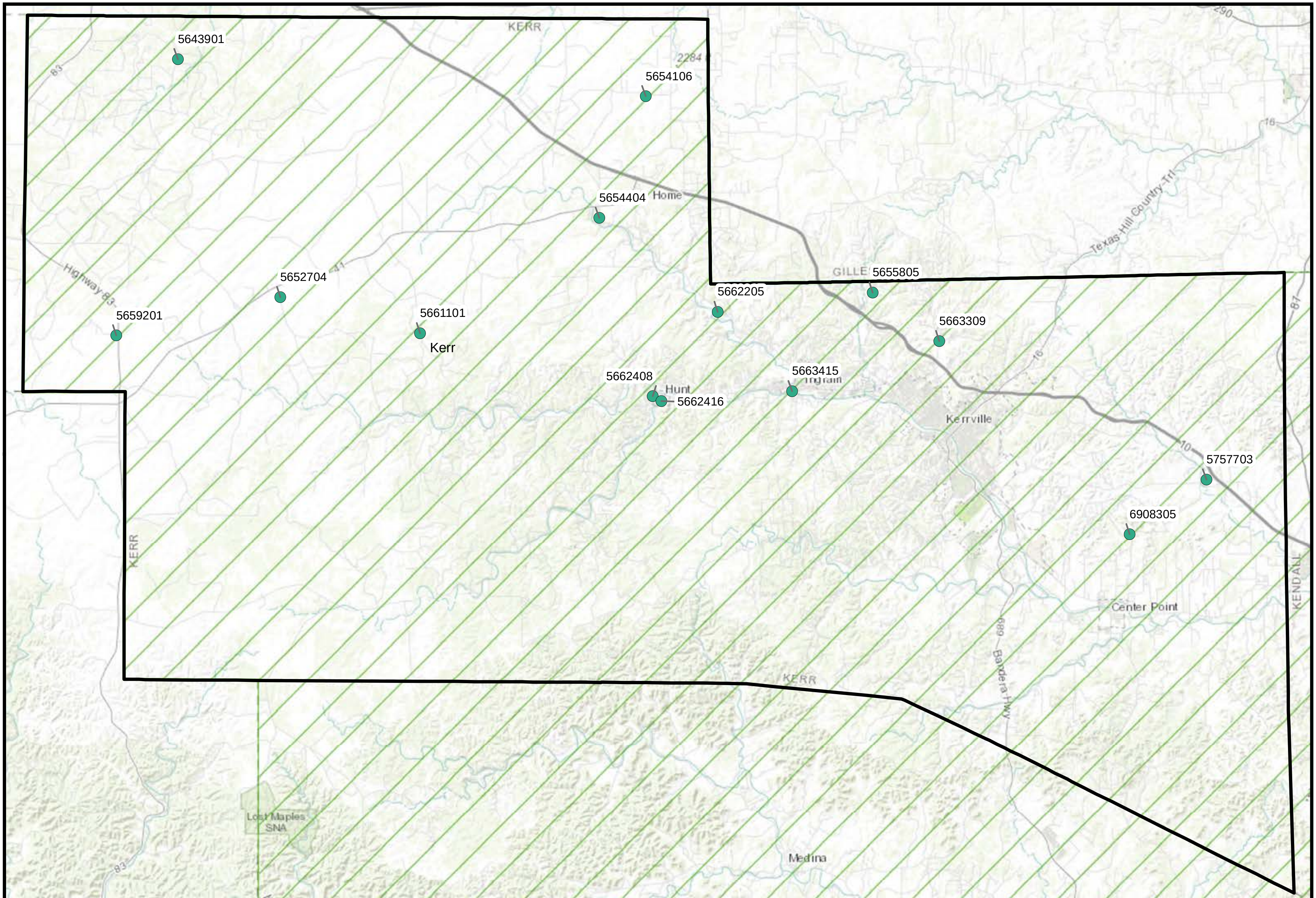

Aquifer

218HNSL - Hensell Sand Member of Travis Peak Formation

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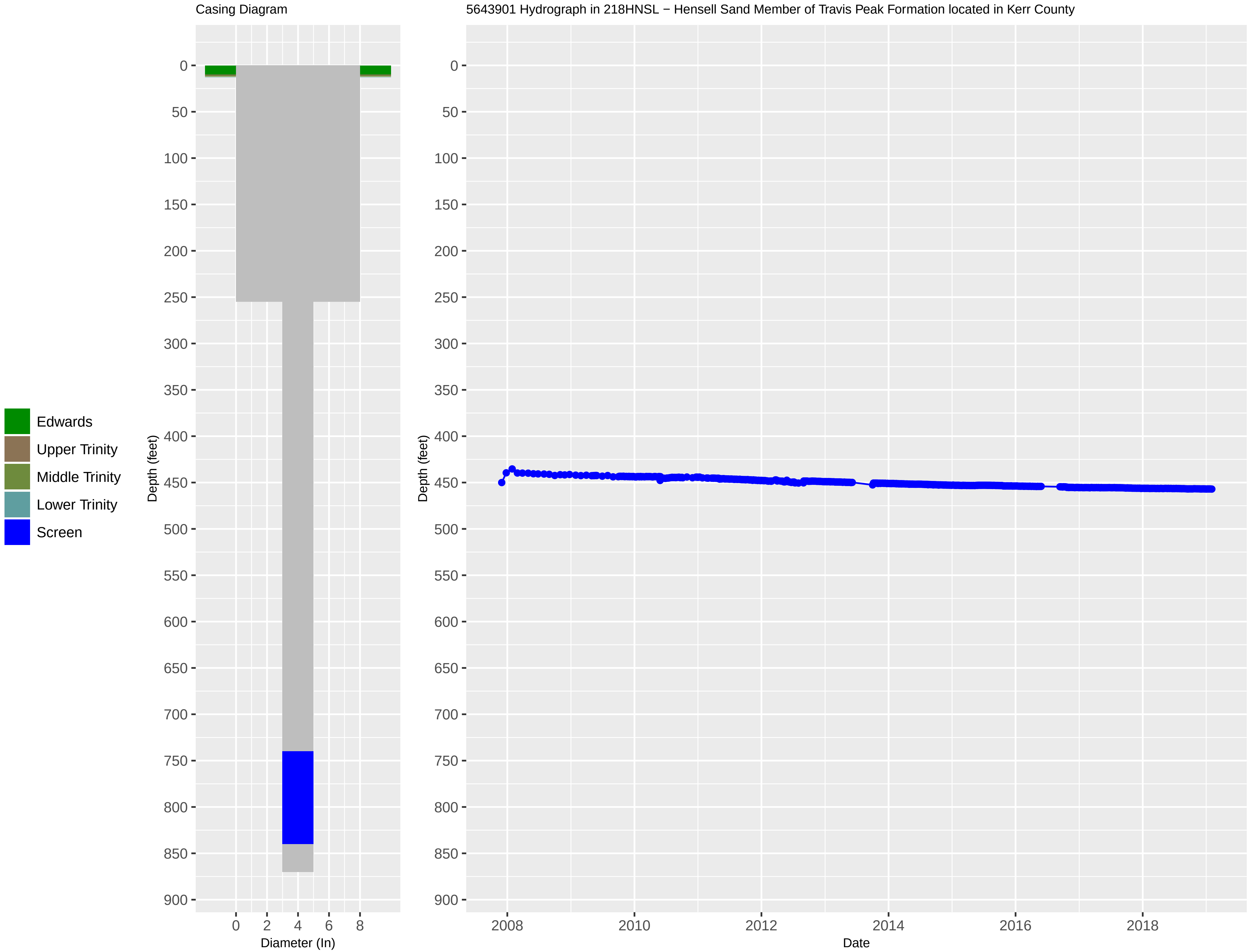
Map of Hydrograph Well Locations in Kerr County
218HNSL
Hensell Sand Member of Travis Peak Formation



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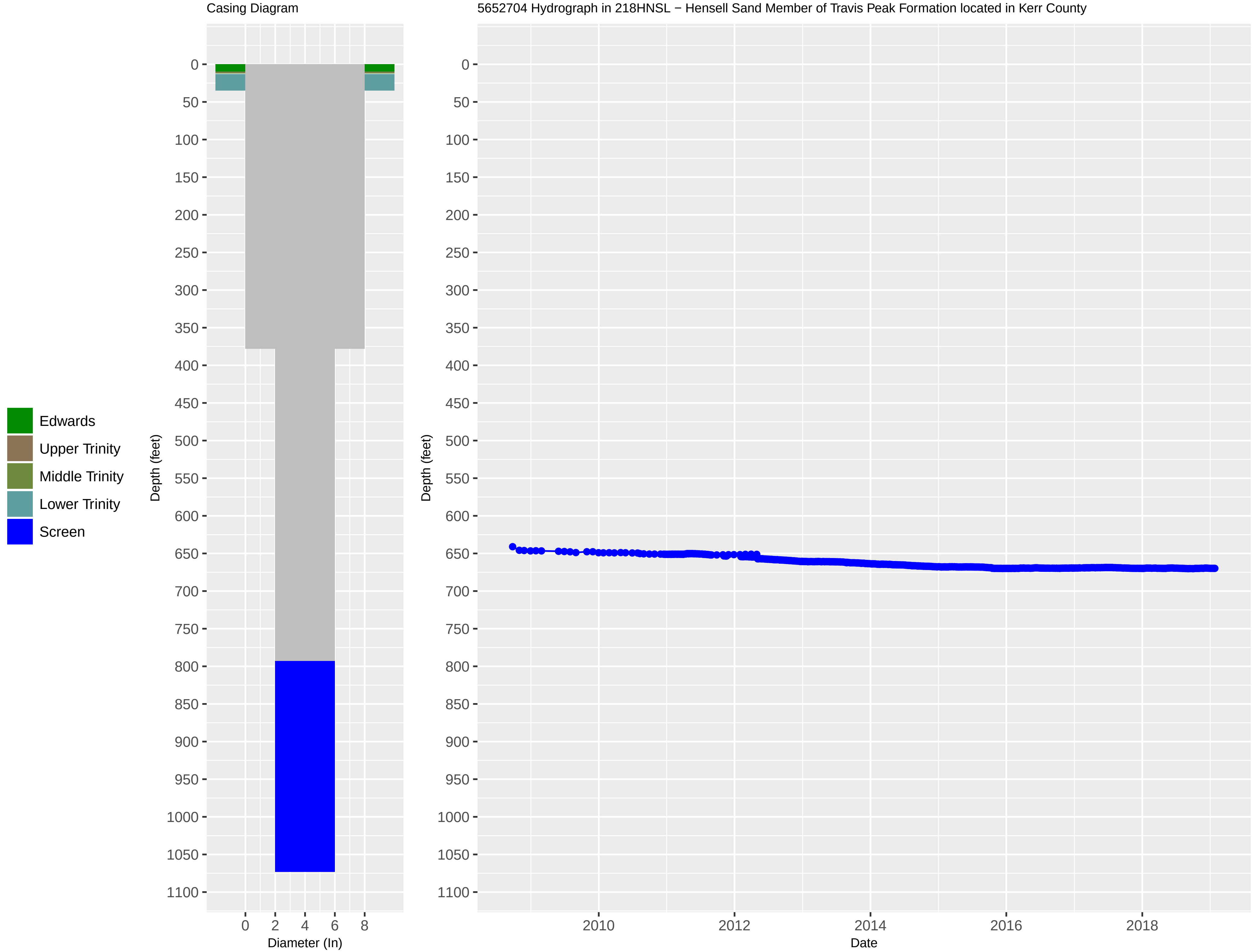

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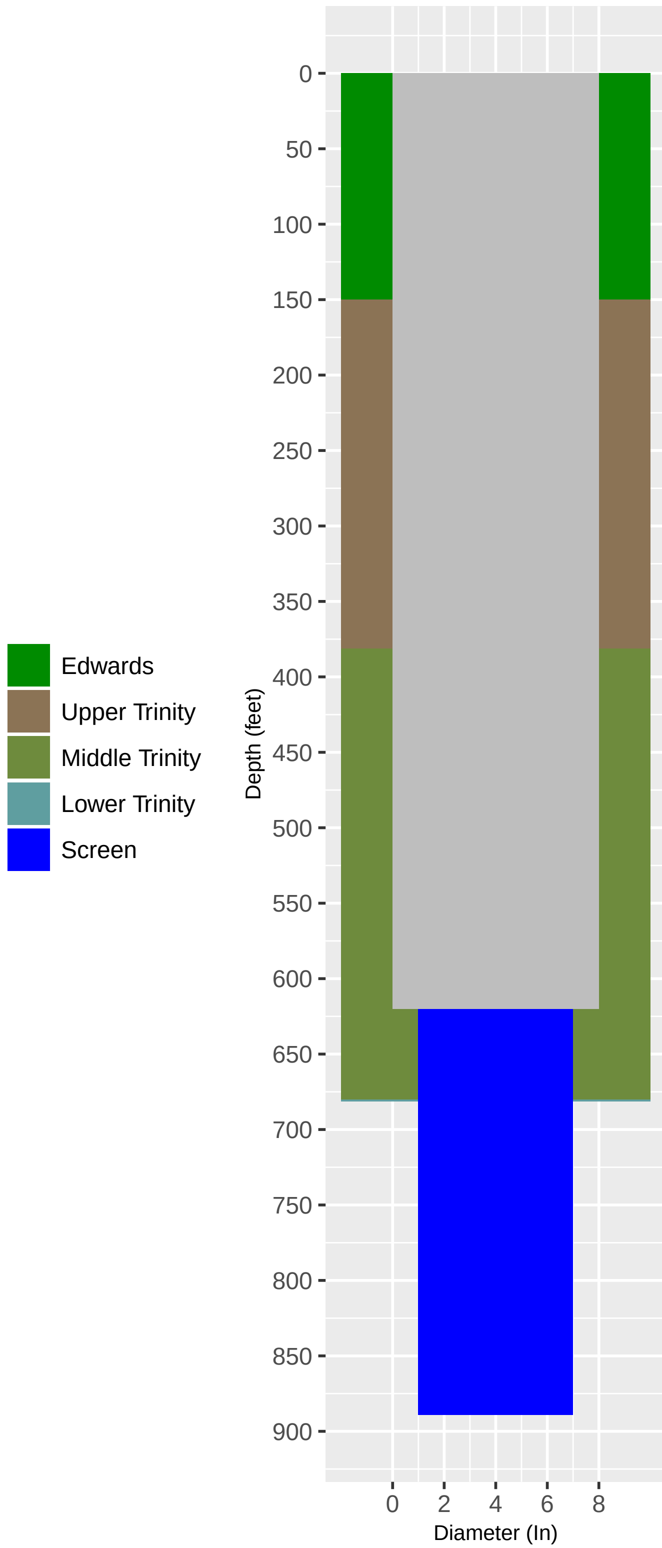
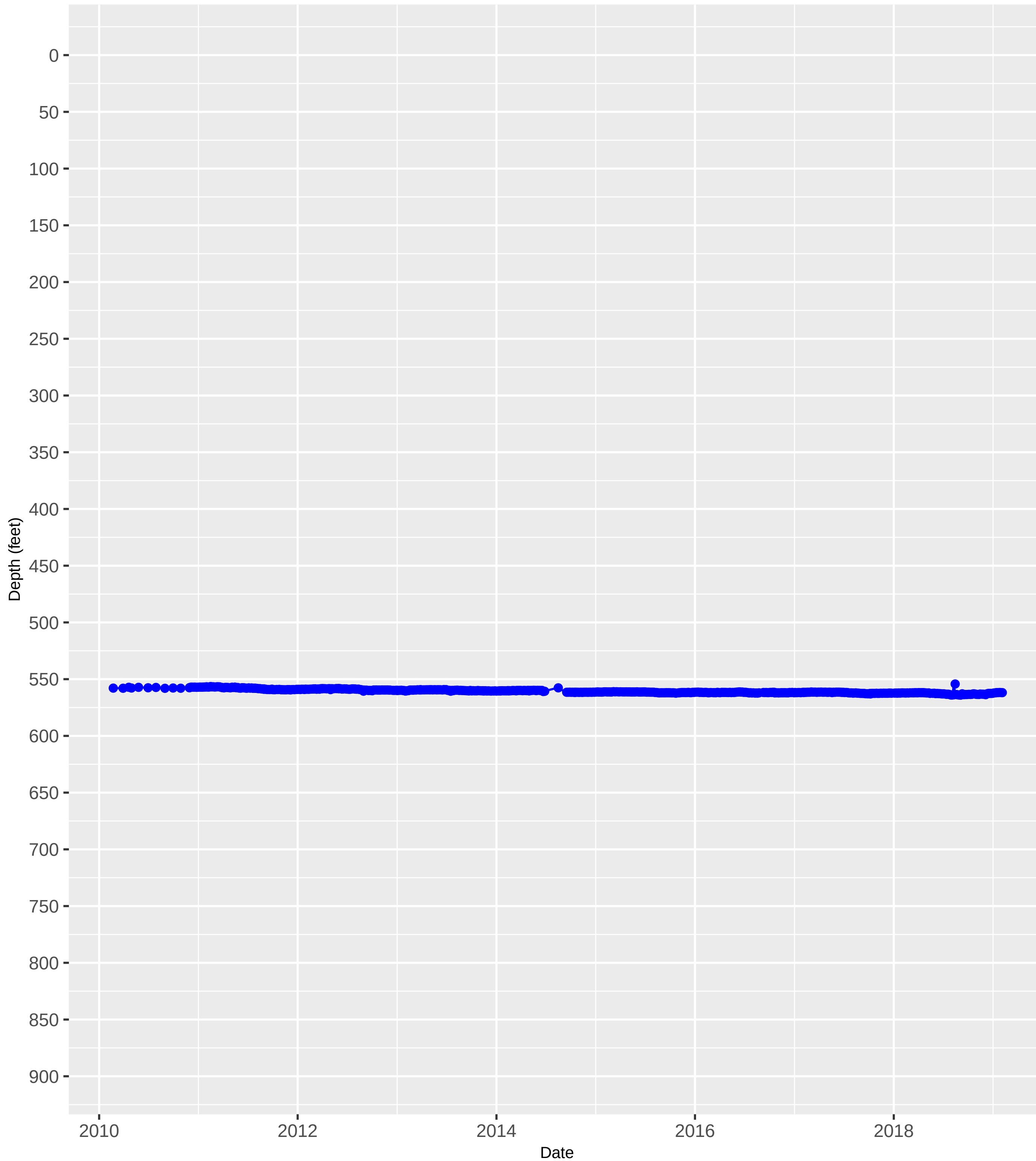
Casing Diagram



5654106 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Kerr County



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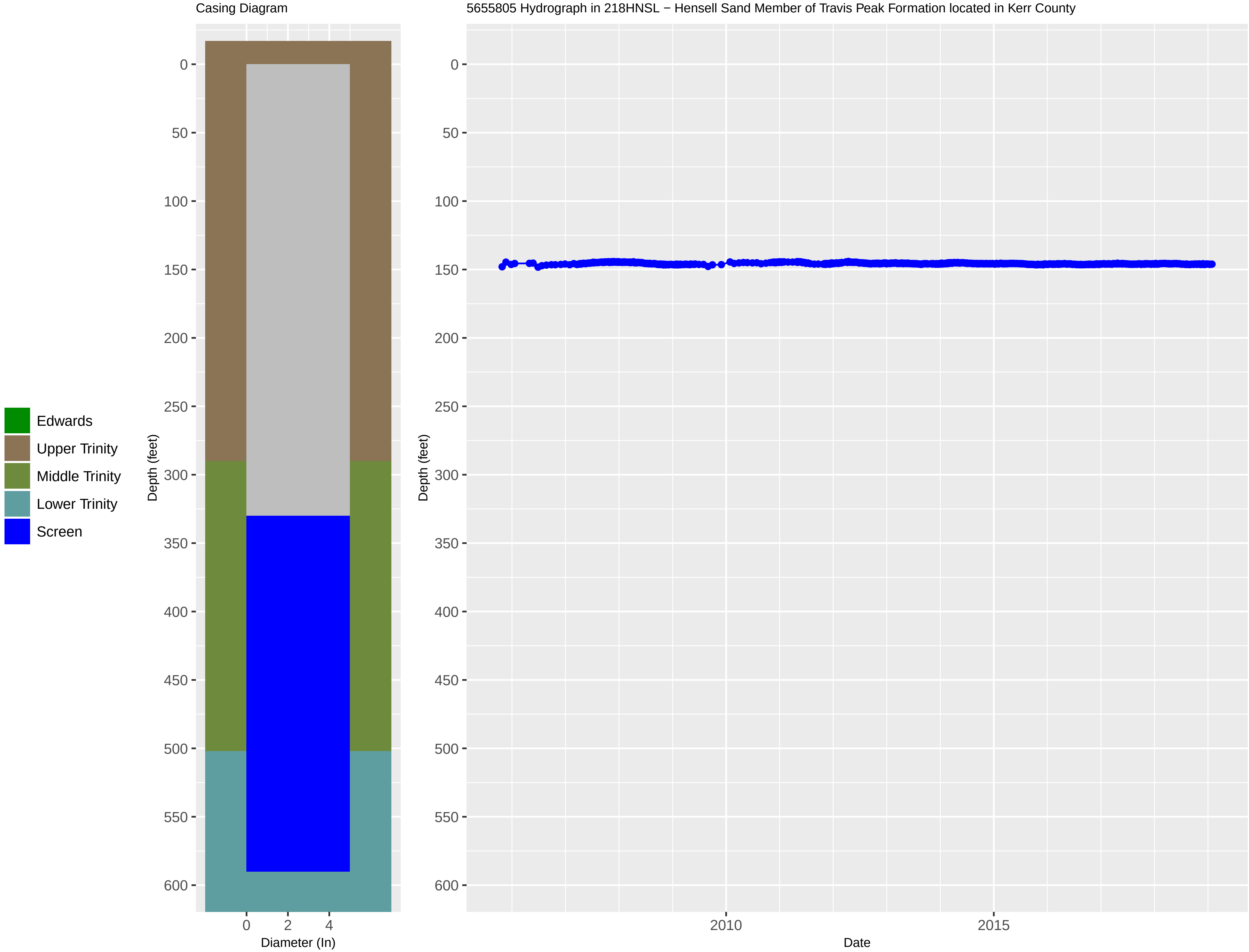

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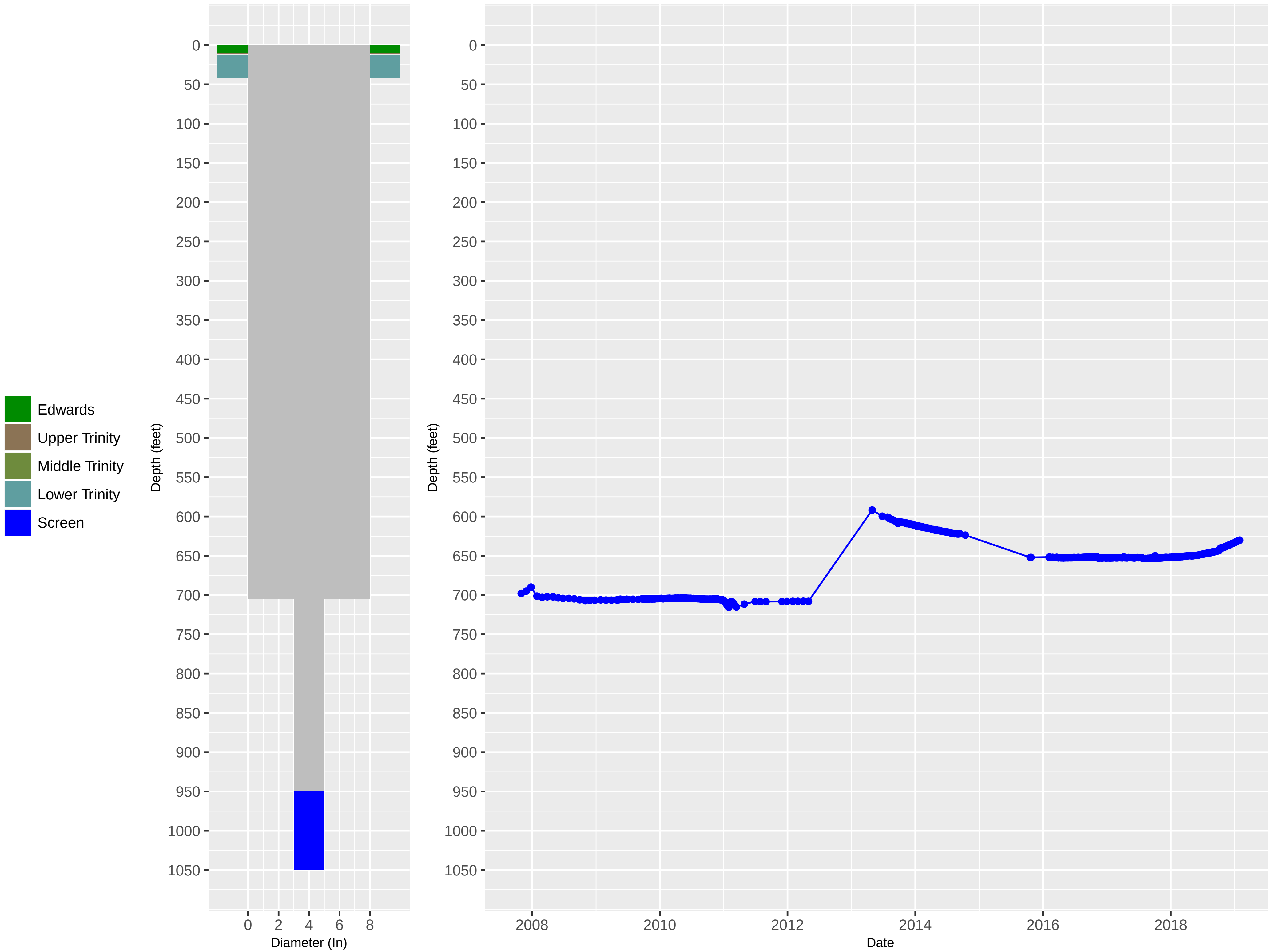
Casing Diagram

5659201 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Kerr County



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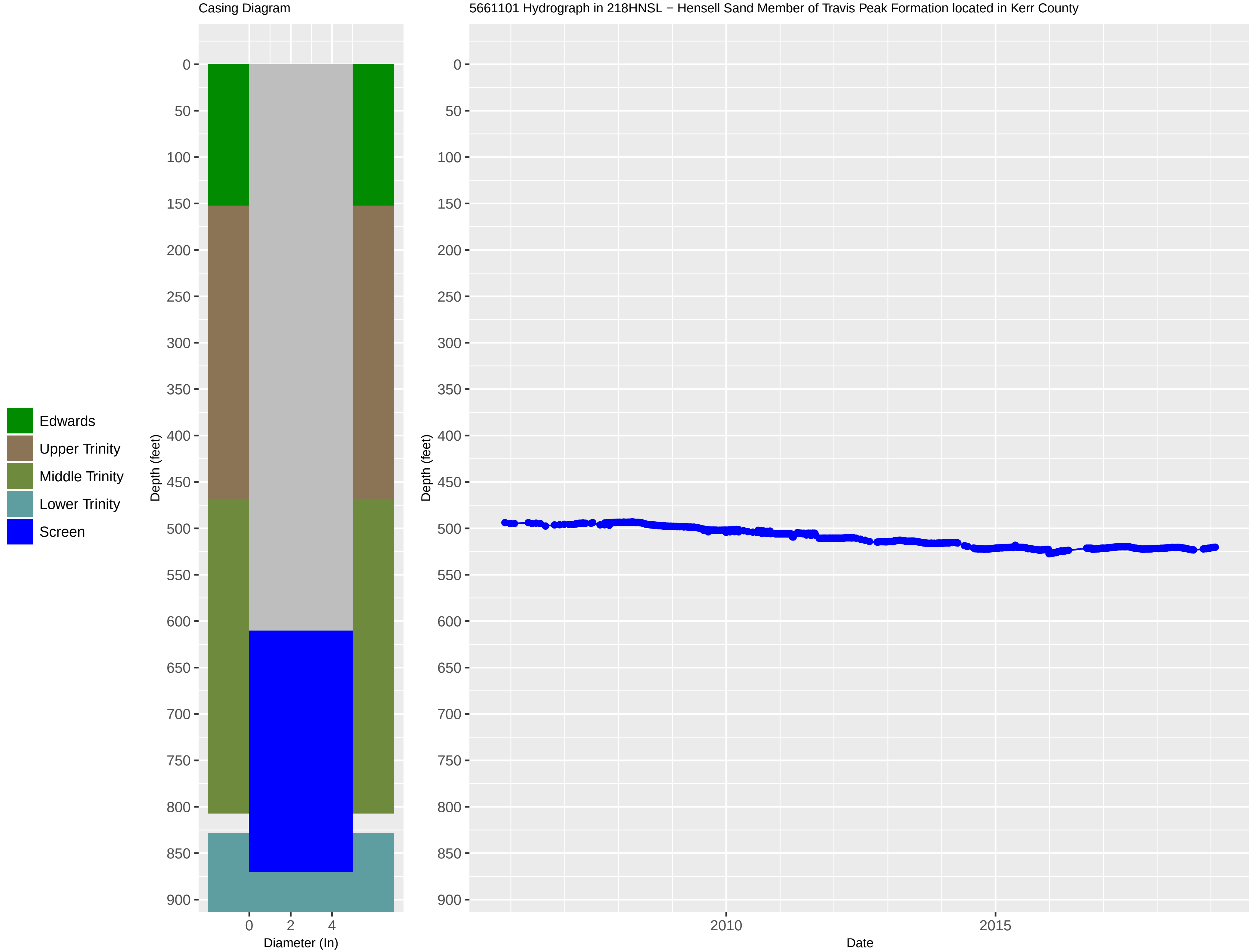

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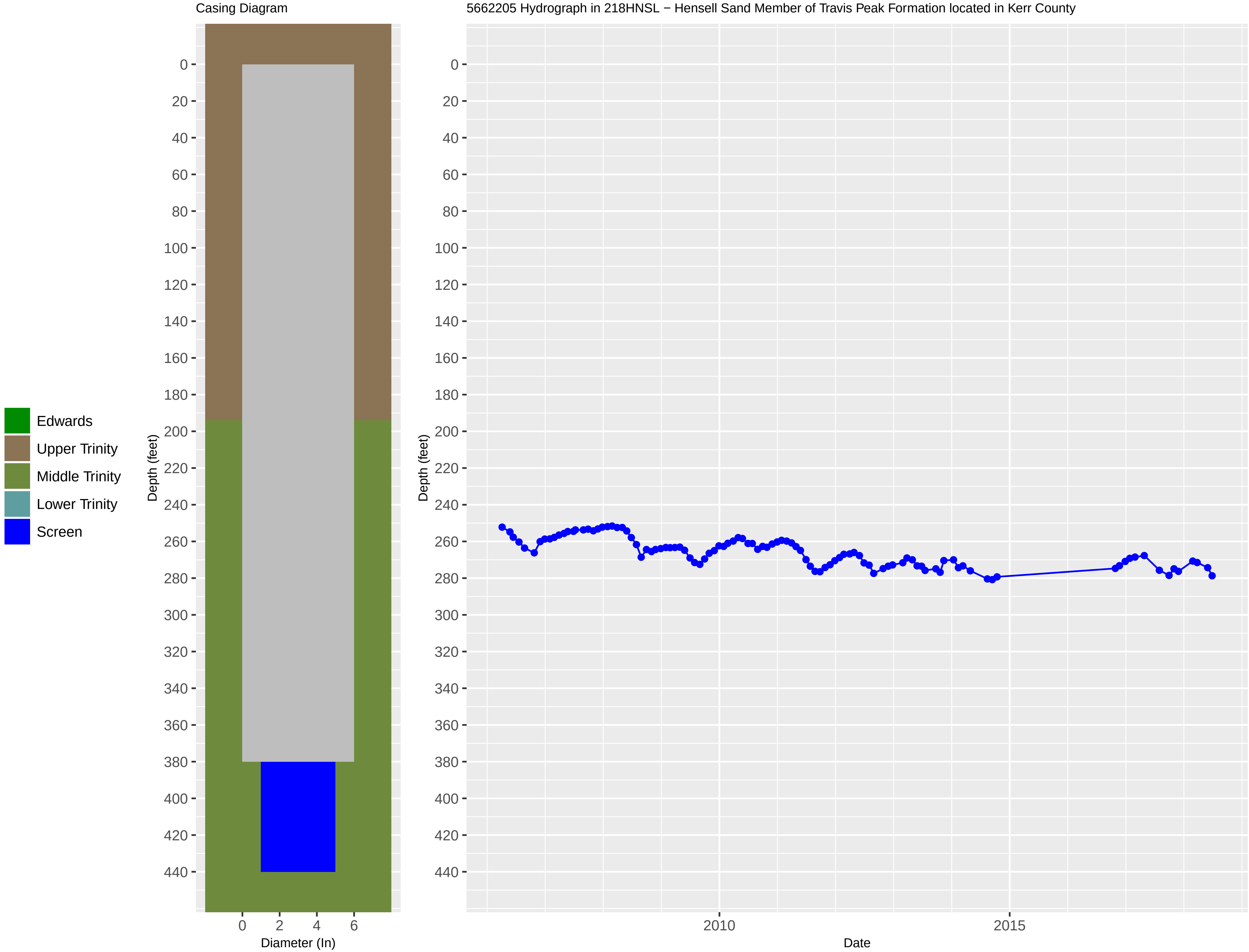

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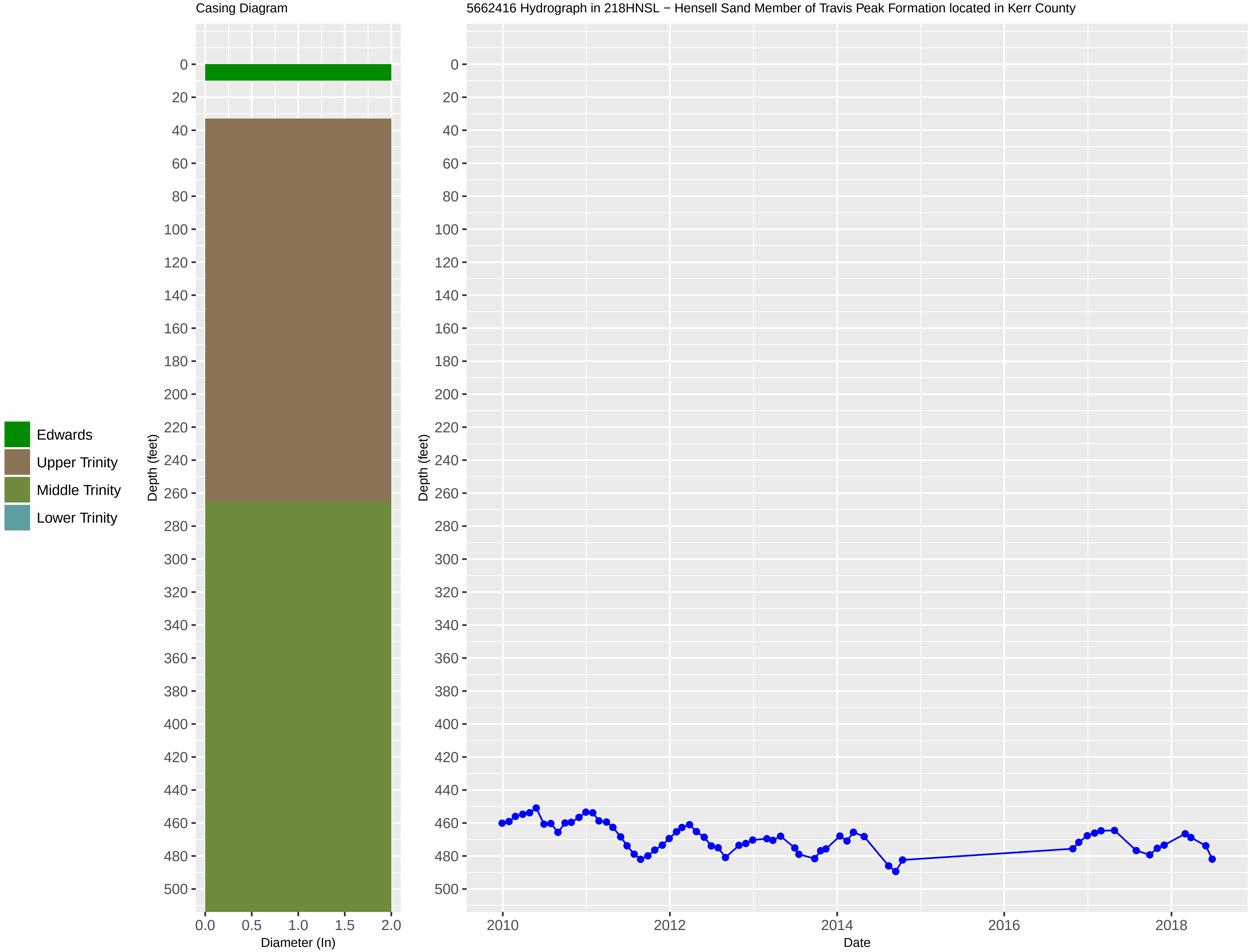

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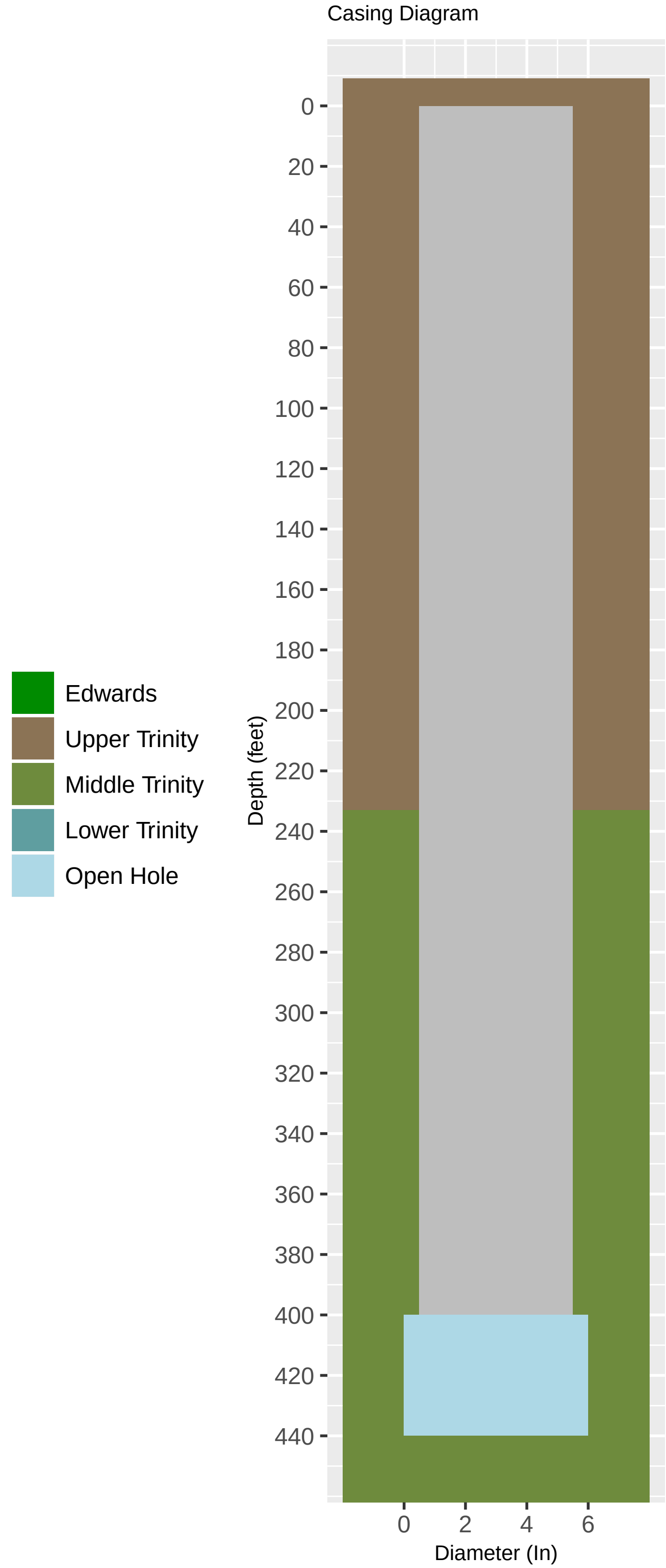

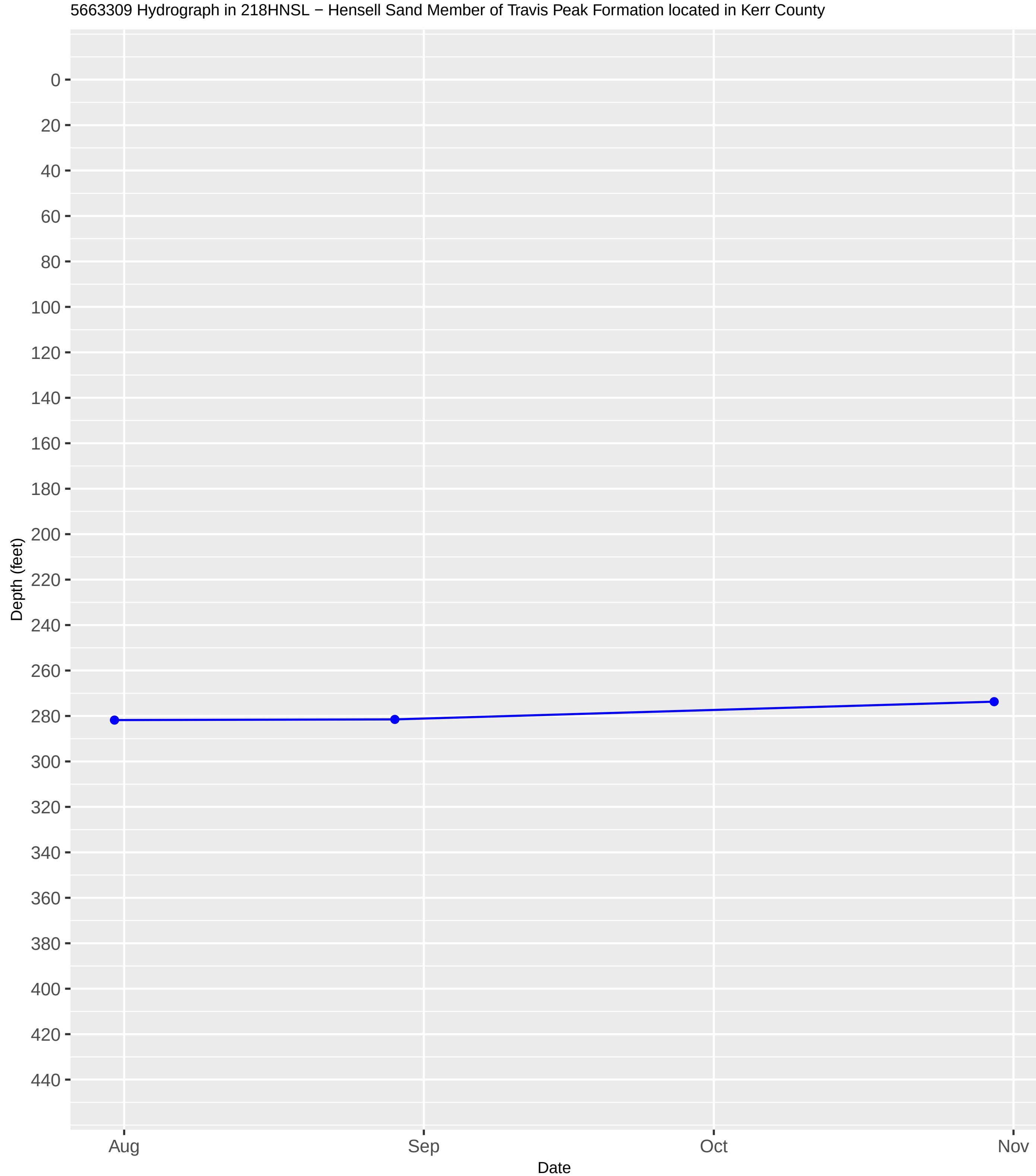

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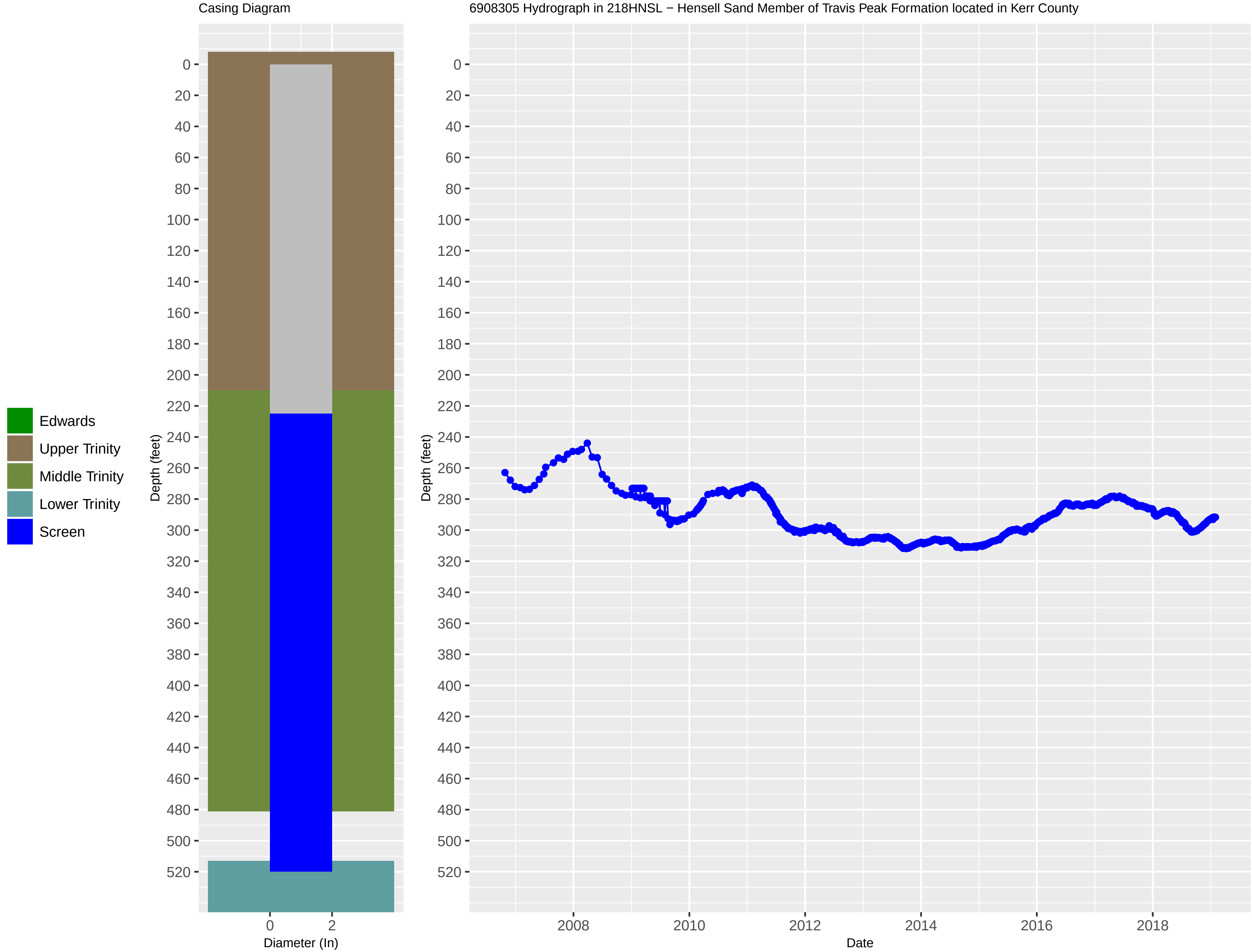

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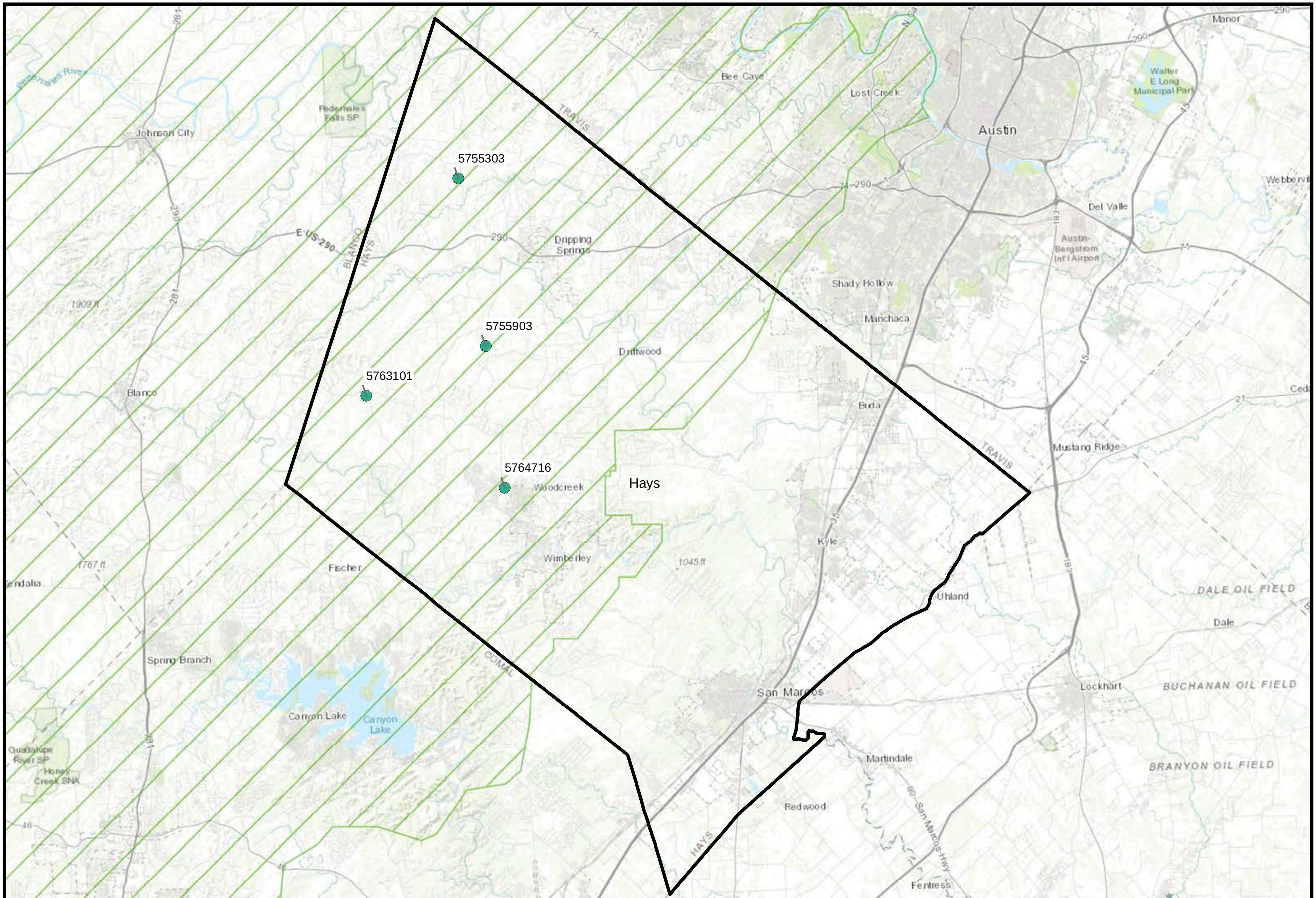

Aquifer

218HNSL - Hensell Sand Member of Travis Peak Formation

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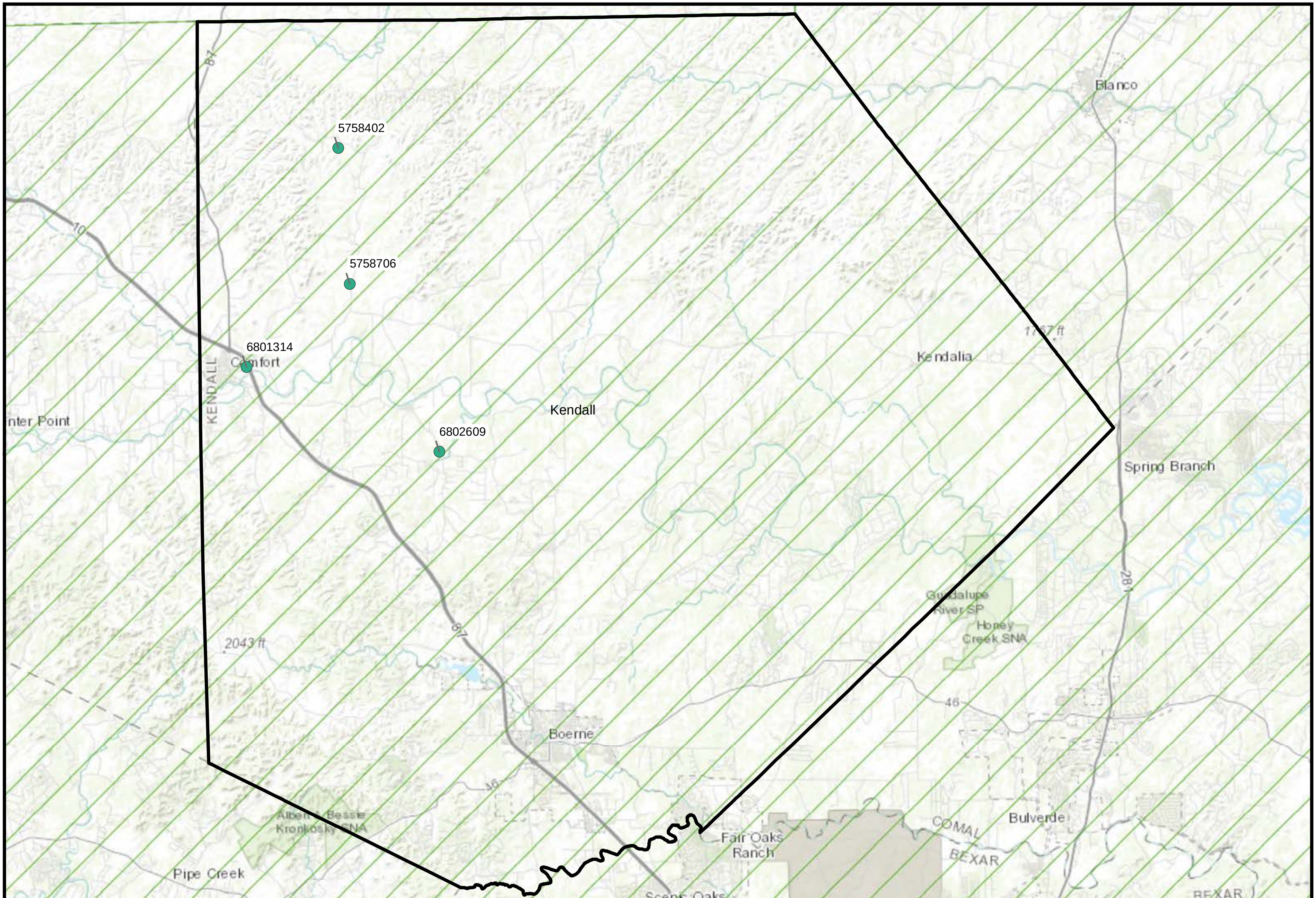
Miles

Map of Hydrograph Well Locations in Hays County
218HNSL
Hensell Sand Member of Travis Peak Formation



Aquifer

218HNSL - Hensell Sand Member of Travis Peak Formation

GMA 9

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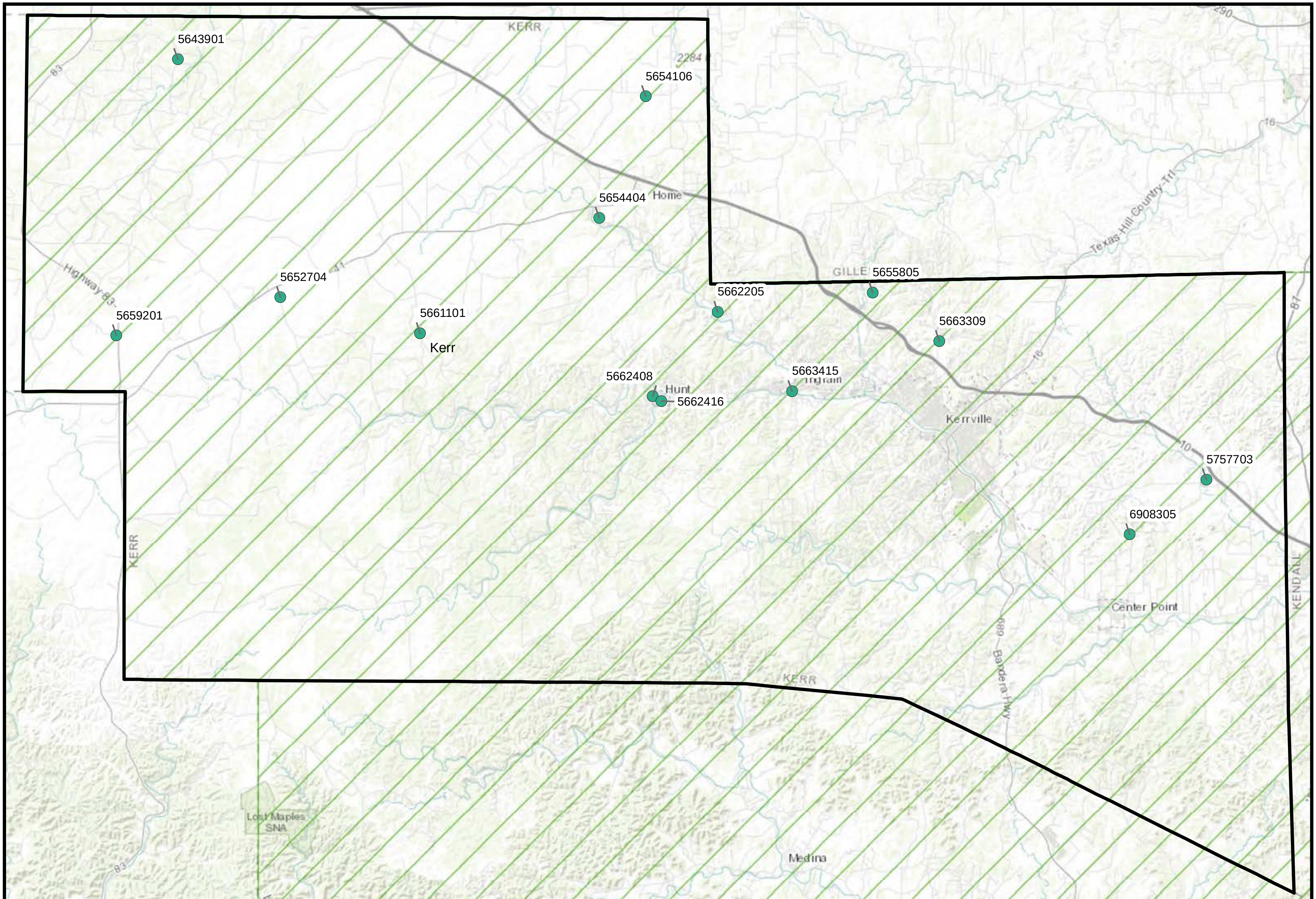
Miles

Map of Hydrograph Well Locations in Kendall County
218HNSL
Hensell Sand Member of Travis Peak Formation



Aquifer

218HNSL - Hensell Sand Member of Travis Peak Formation

GMA 9

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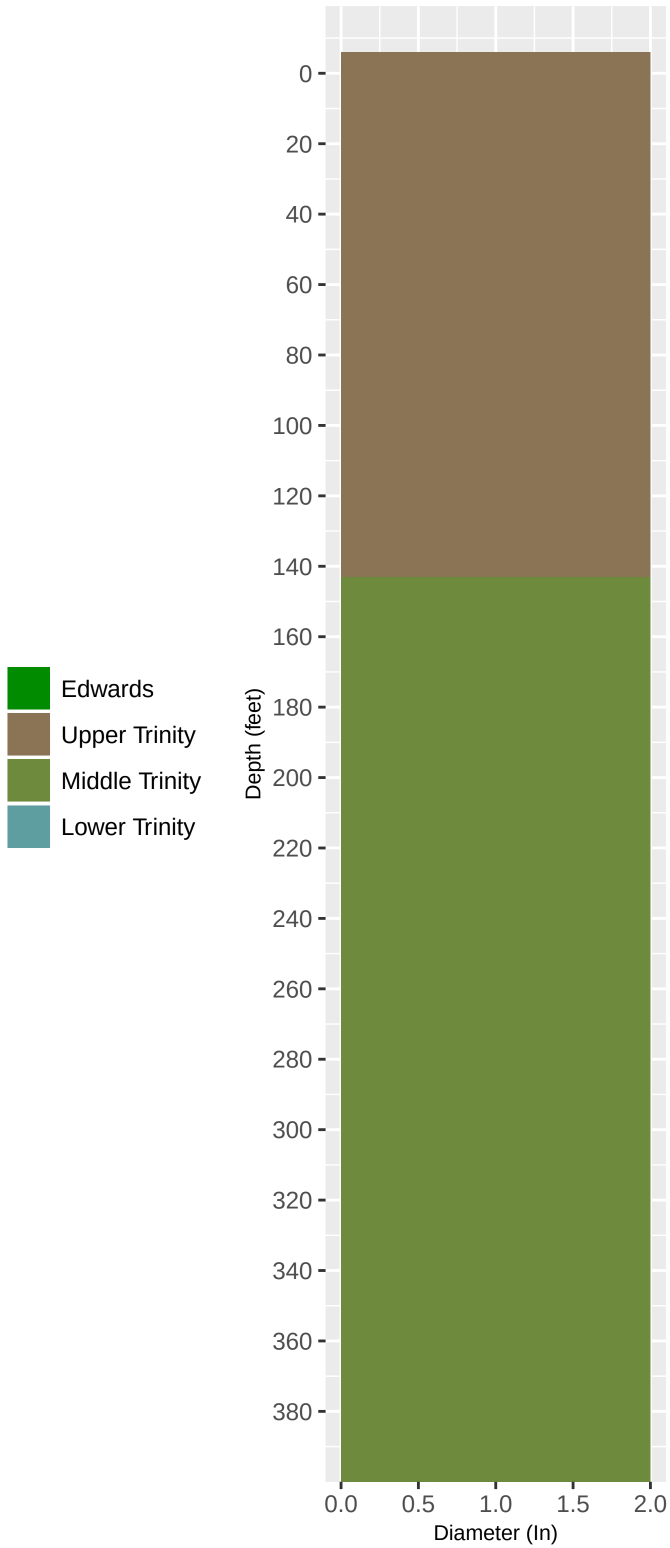
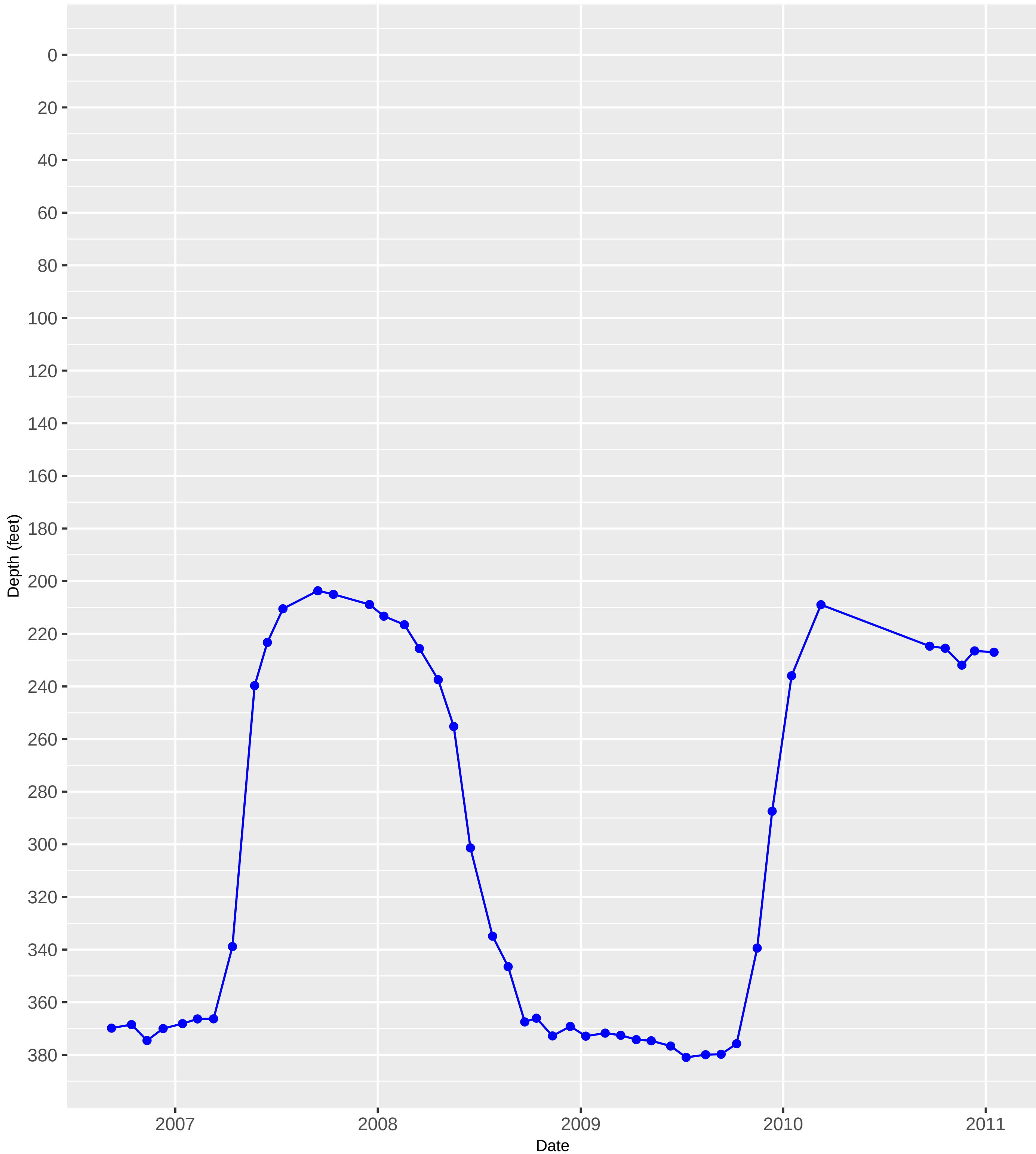
Miles

Map of Hydrograph Well Locations in Kerr County
218HNSL
Hensell Sand Member of Travis Peak Formation

Casing Diagram



5755303 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Hays County



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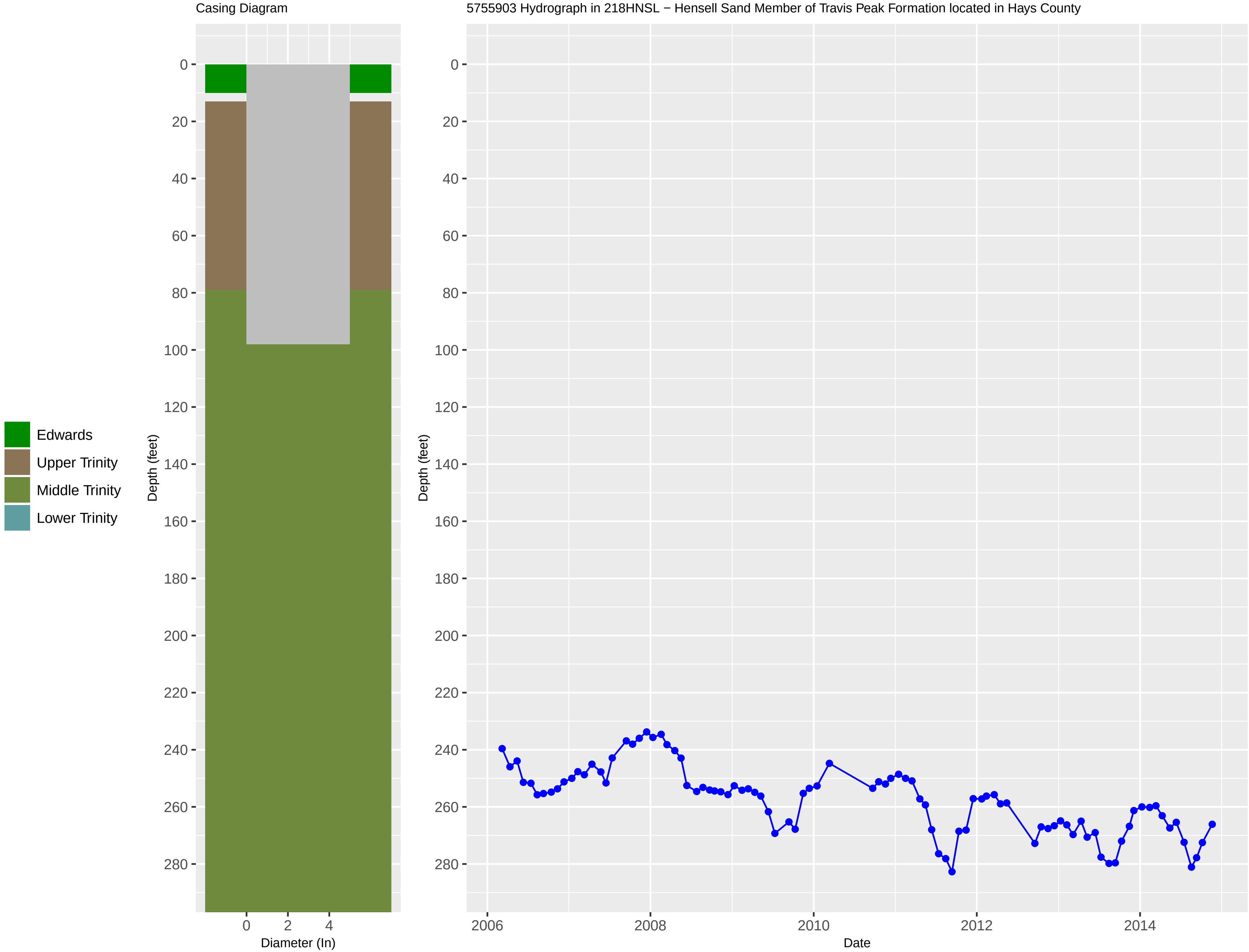

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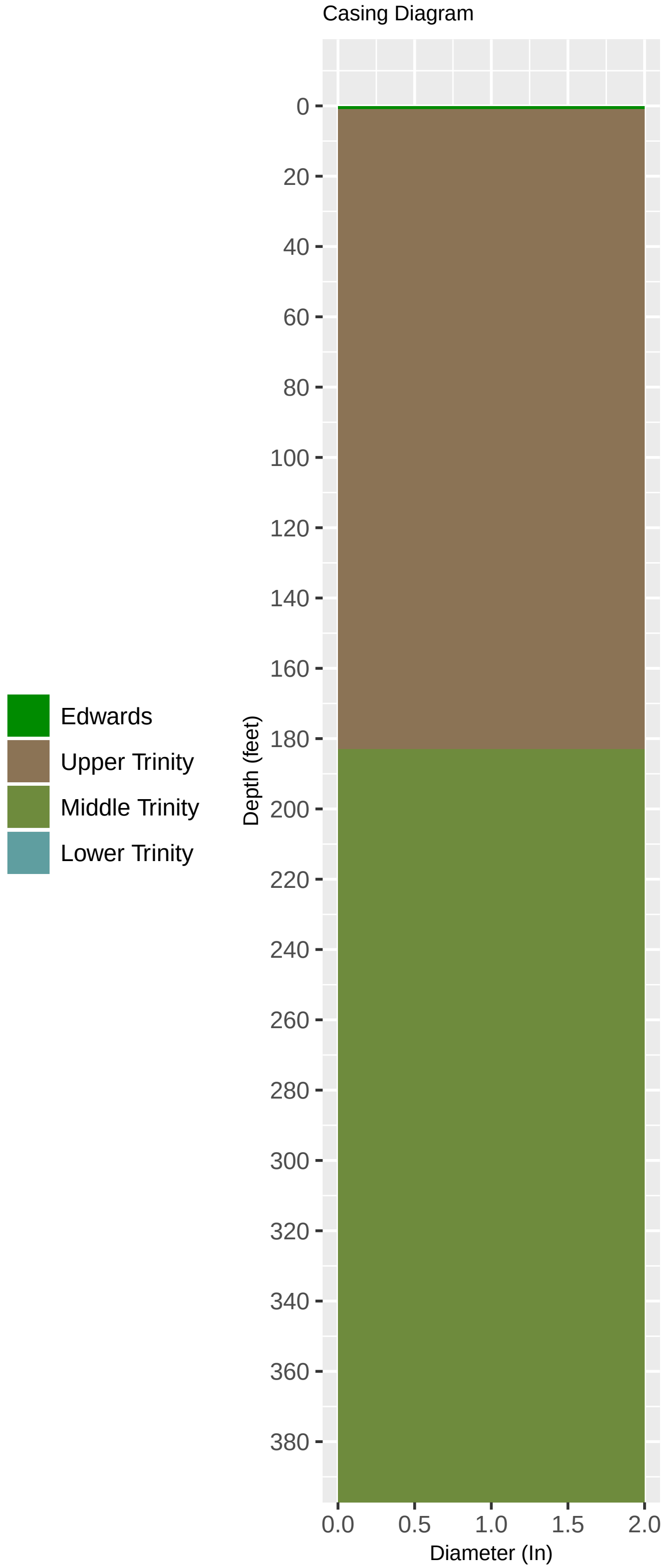

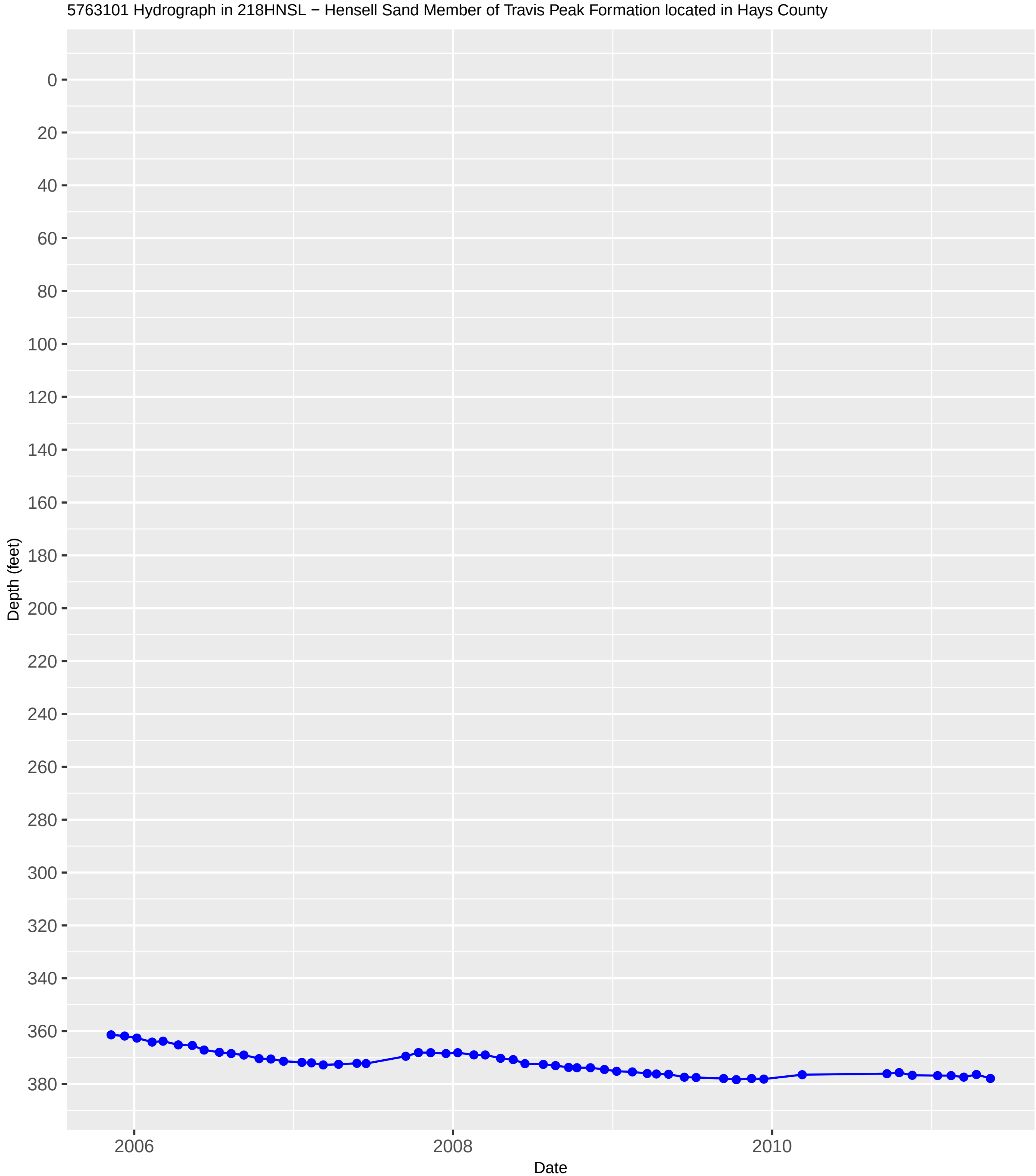

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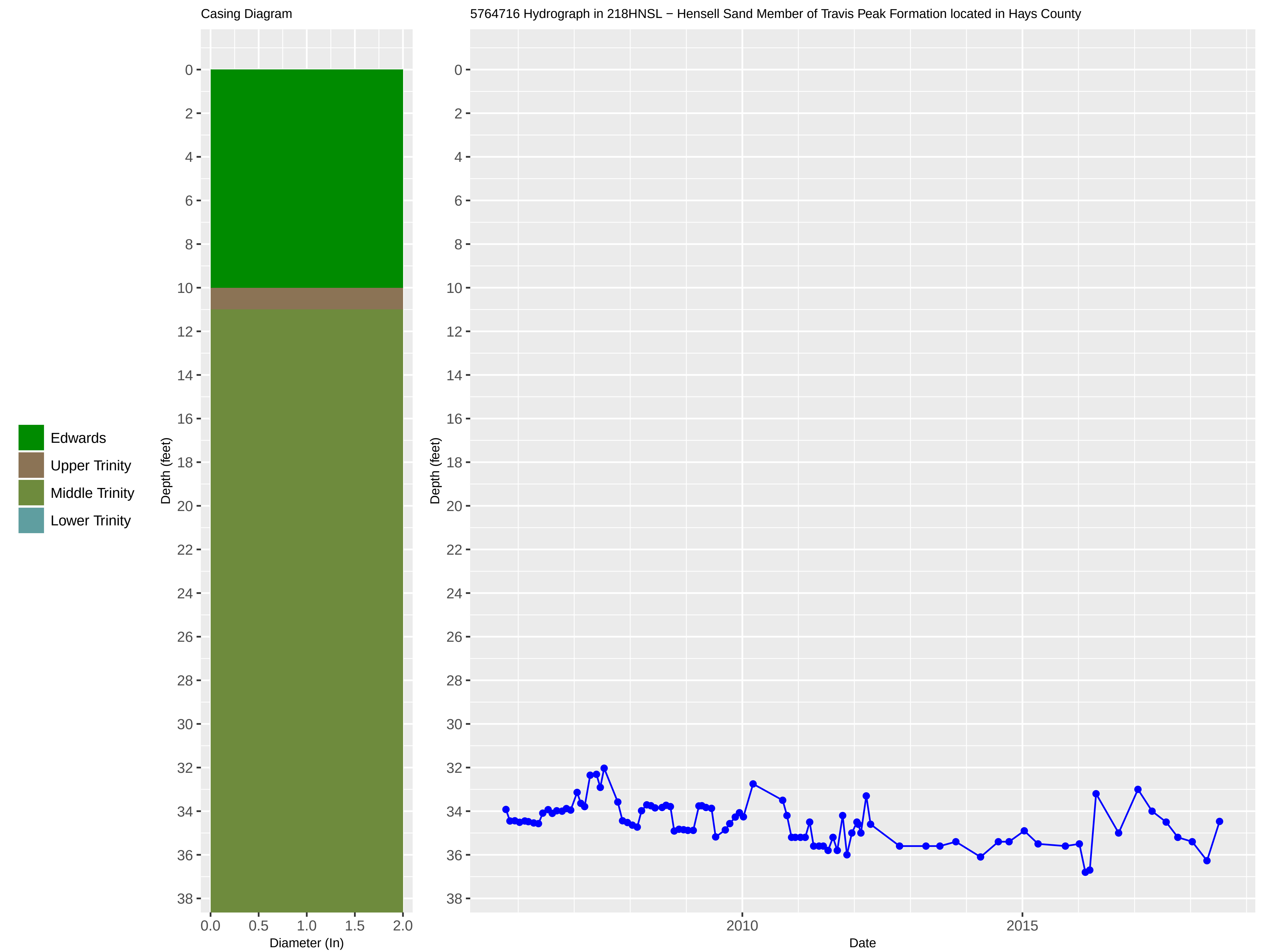

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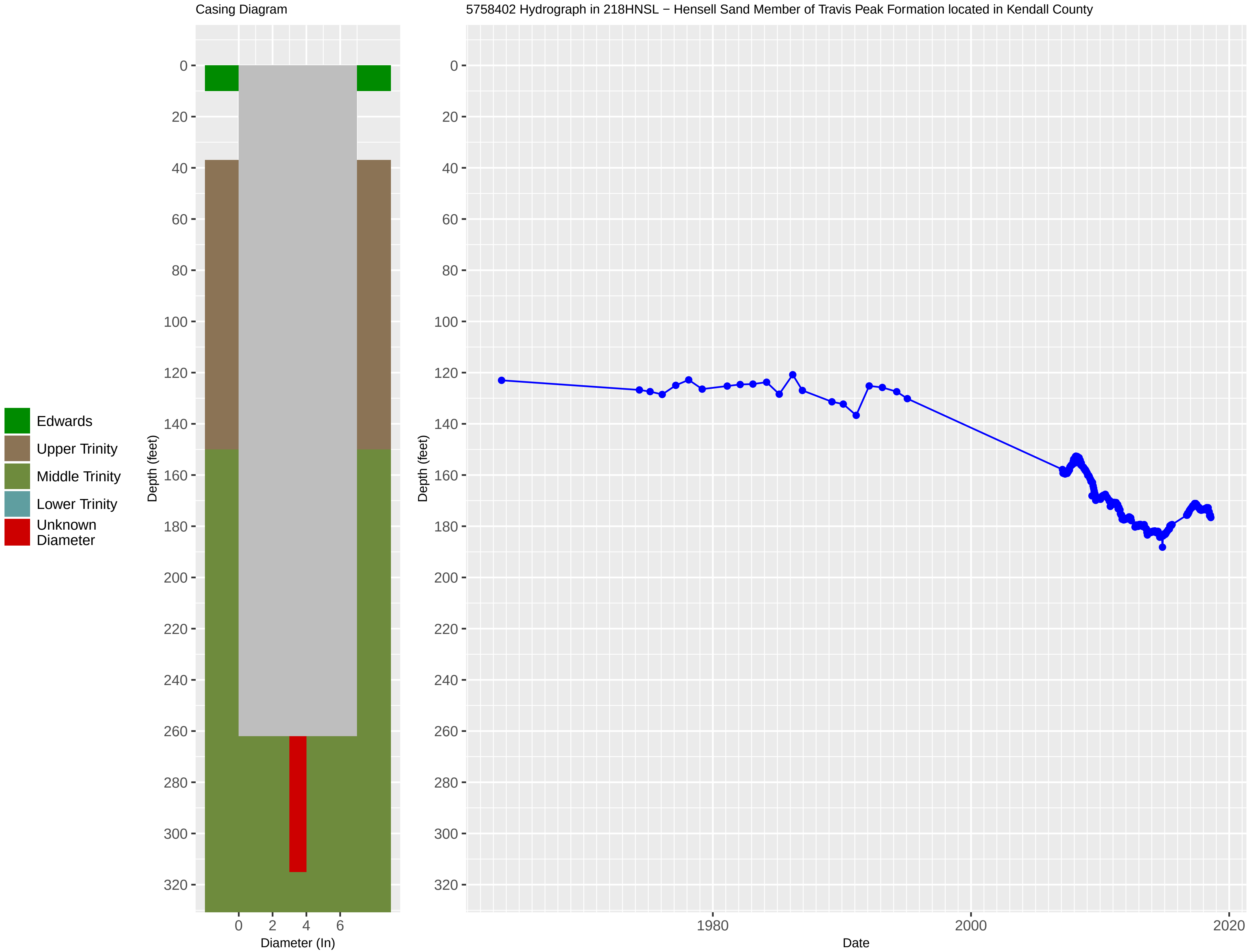

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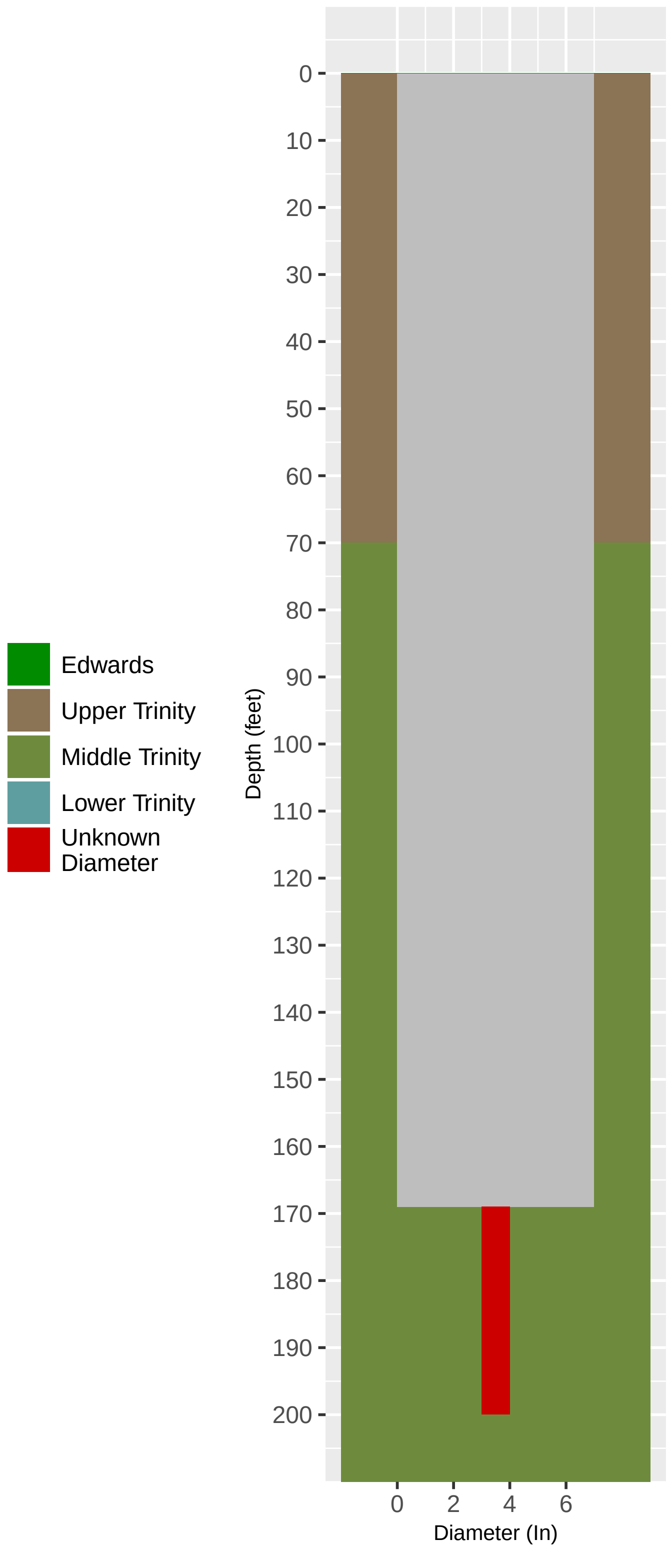
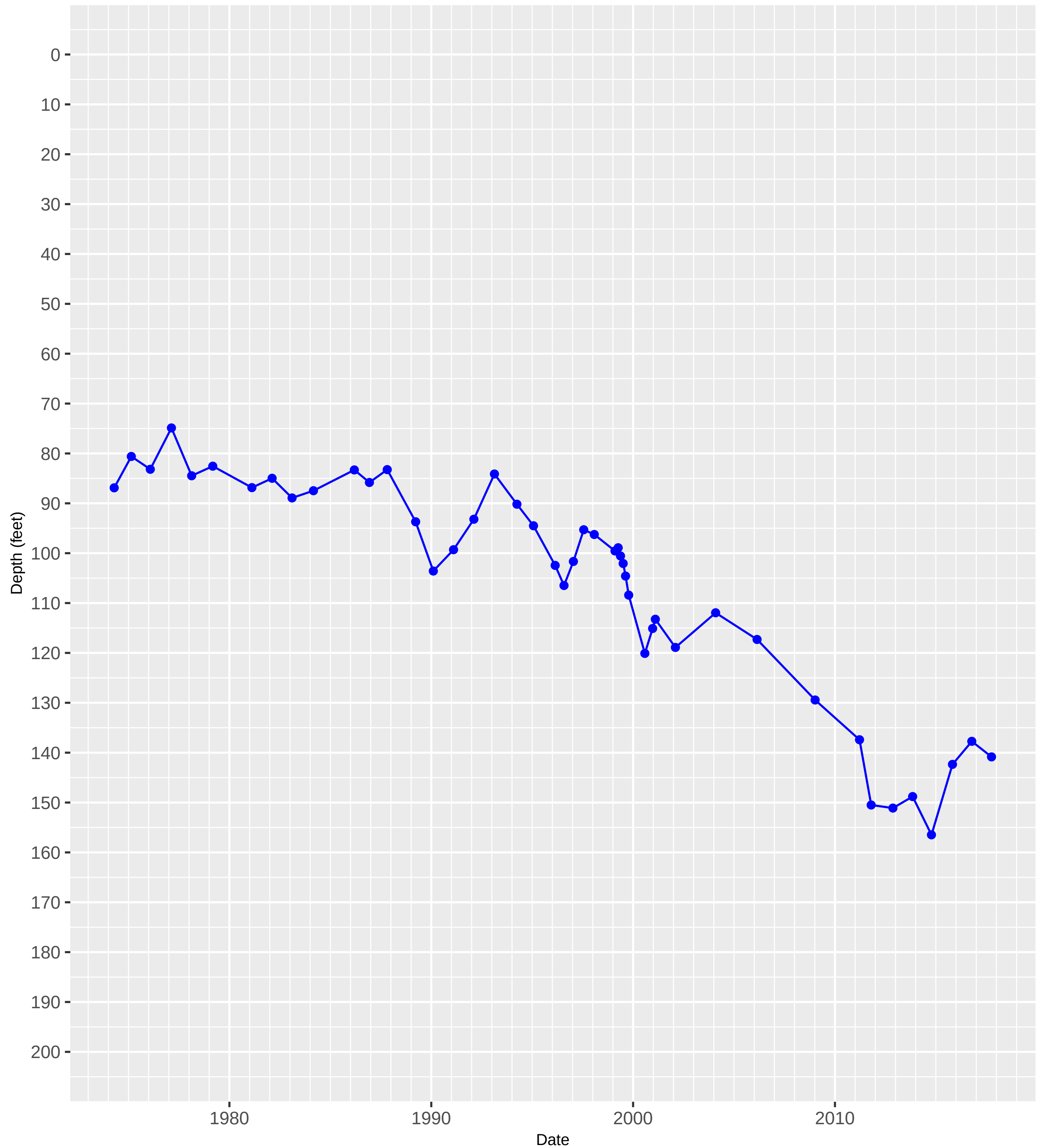
Casing Diagram



5758706 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Kendall County



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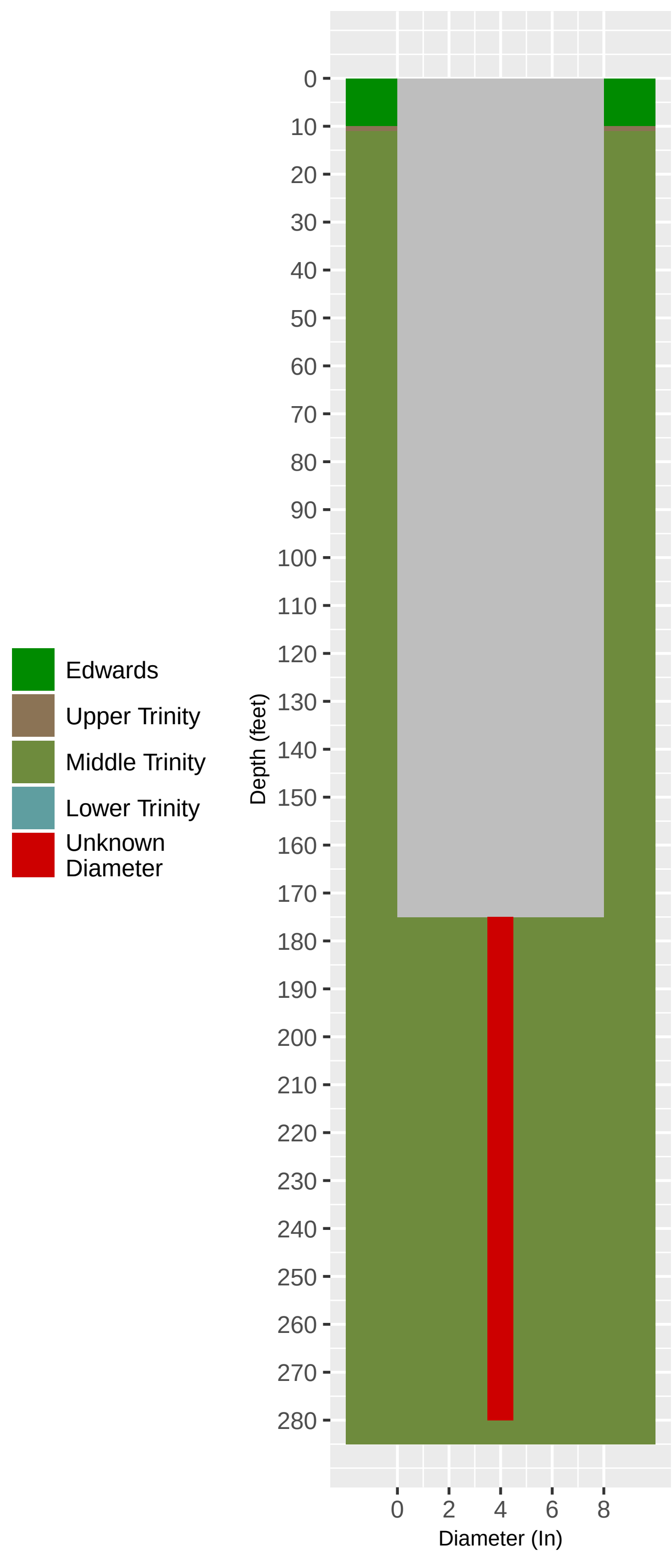
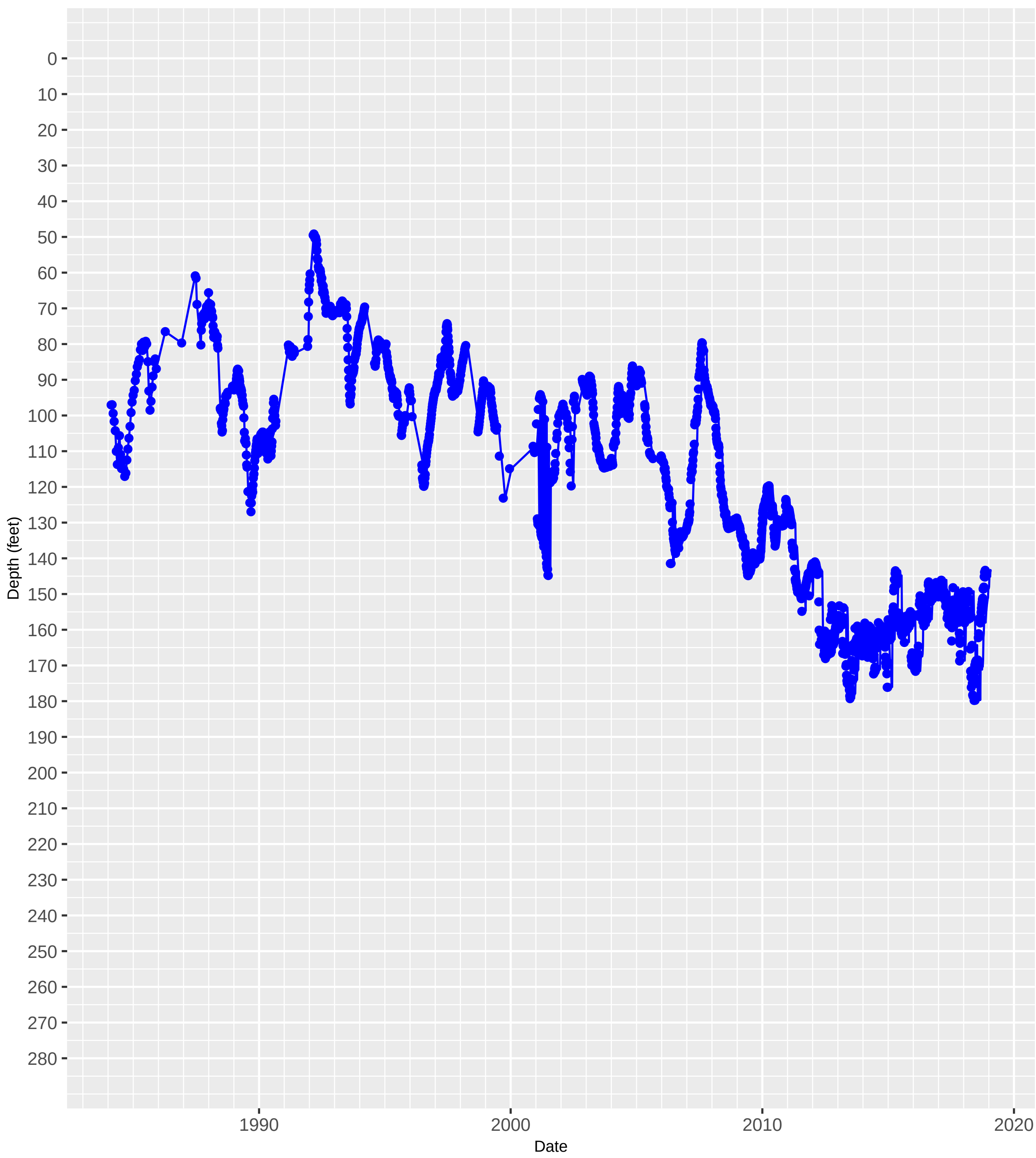
Casing Diagram



6801314 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Kendall County



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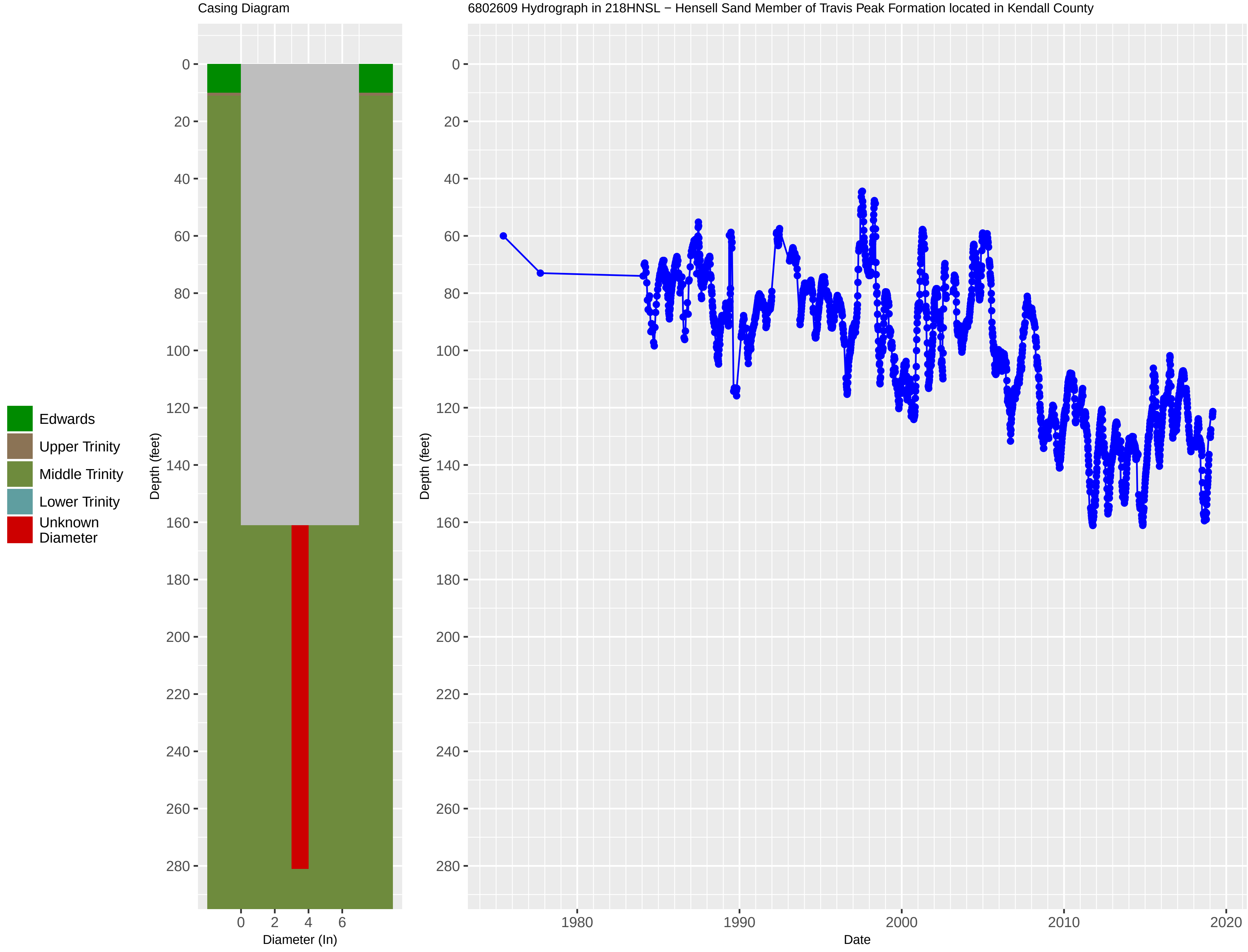

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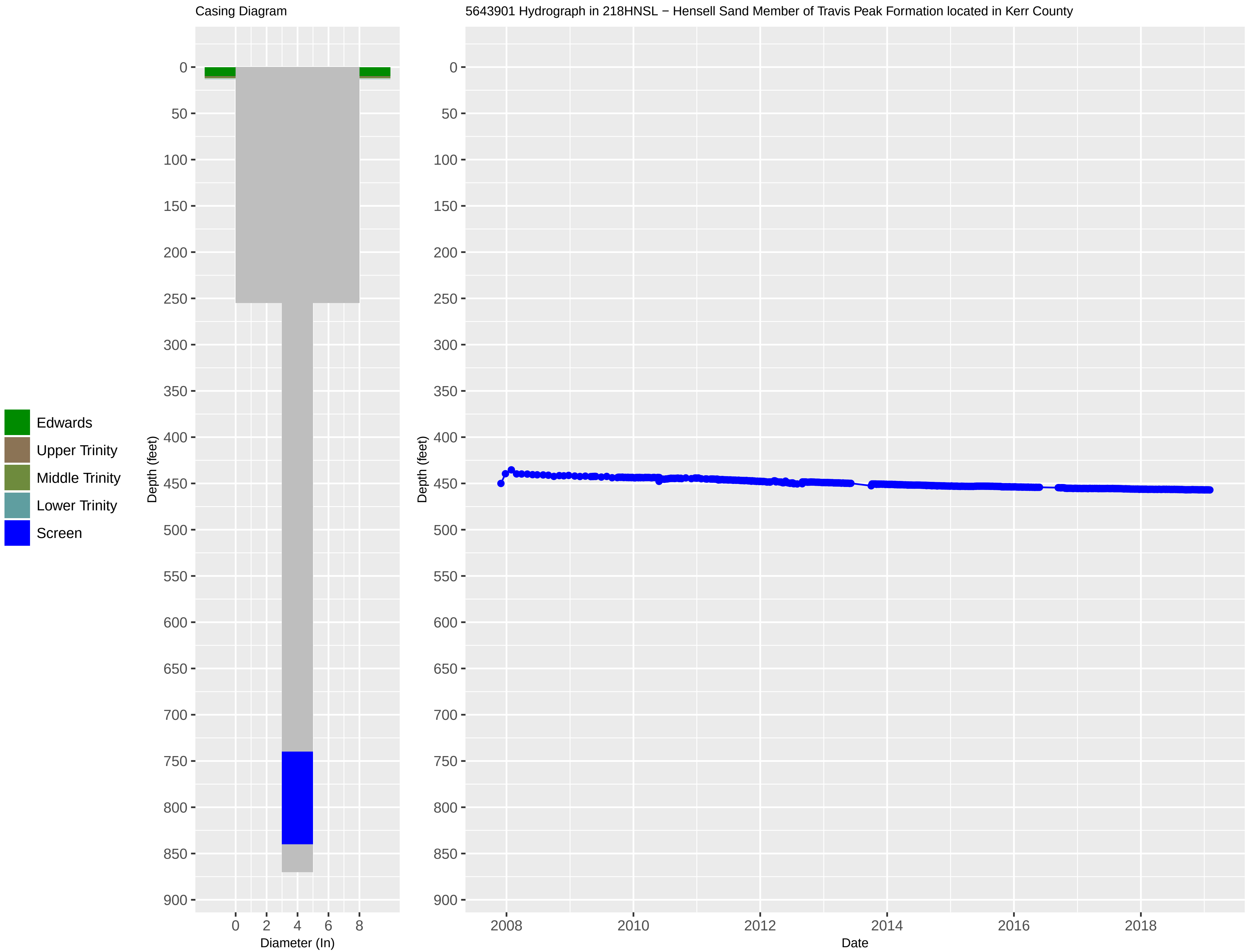

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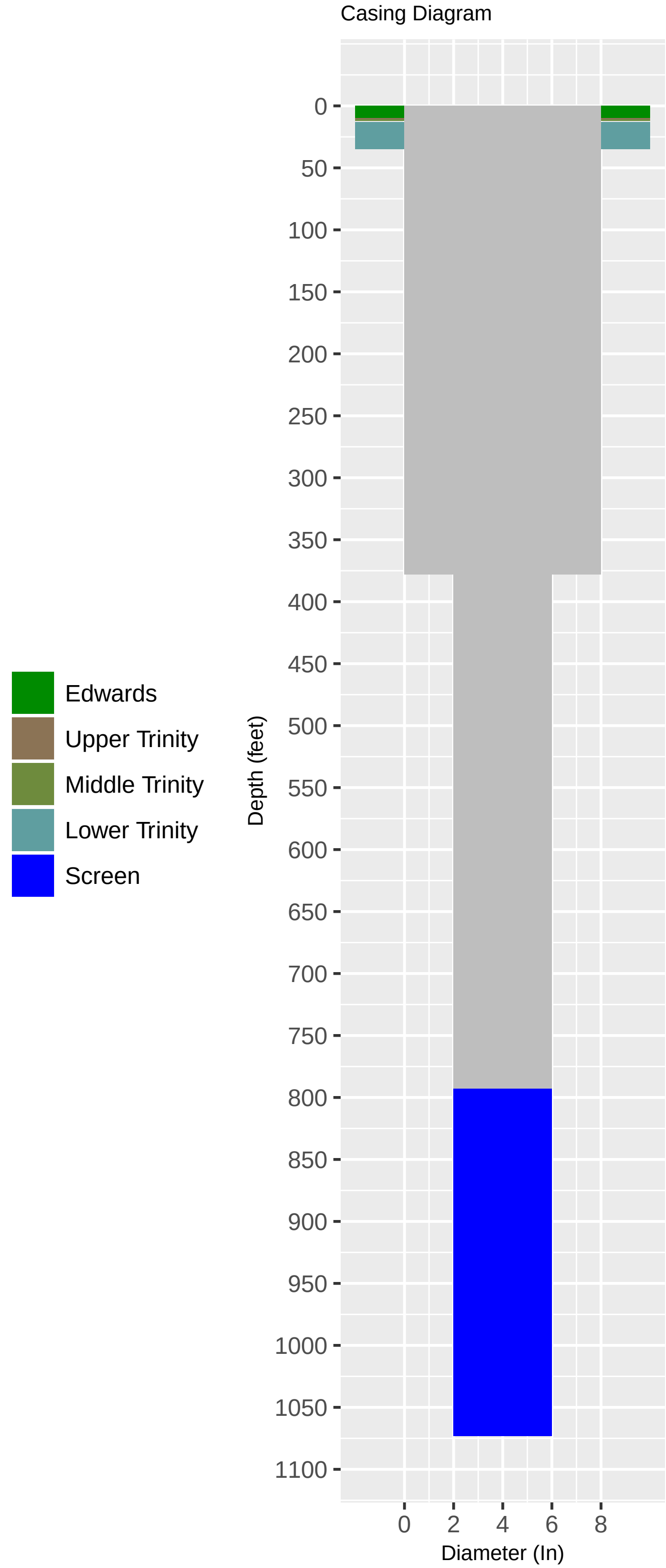

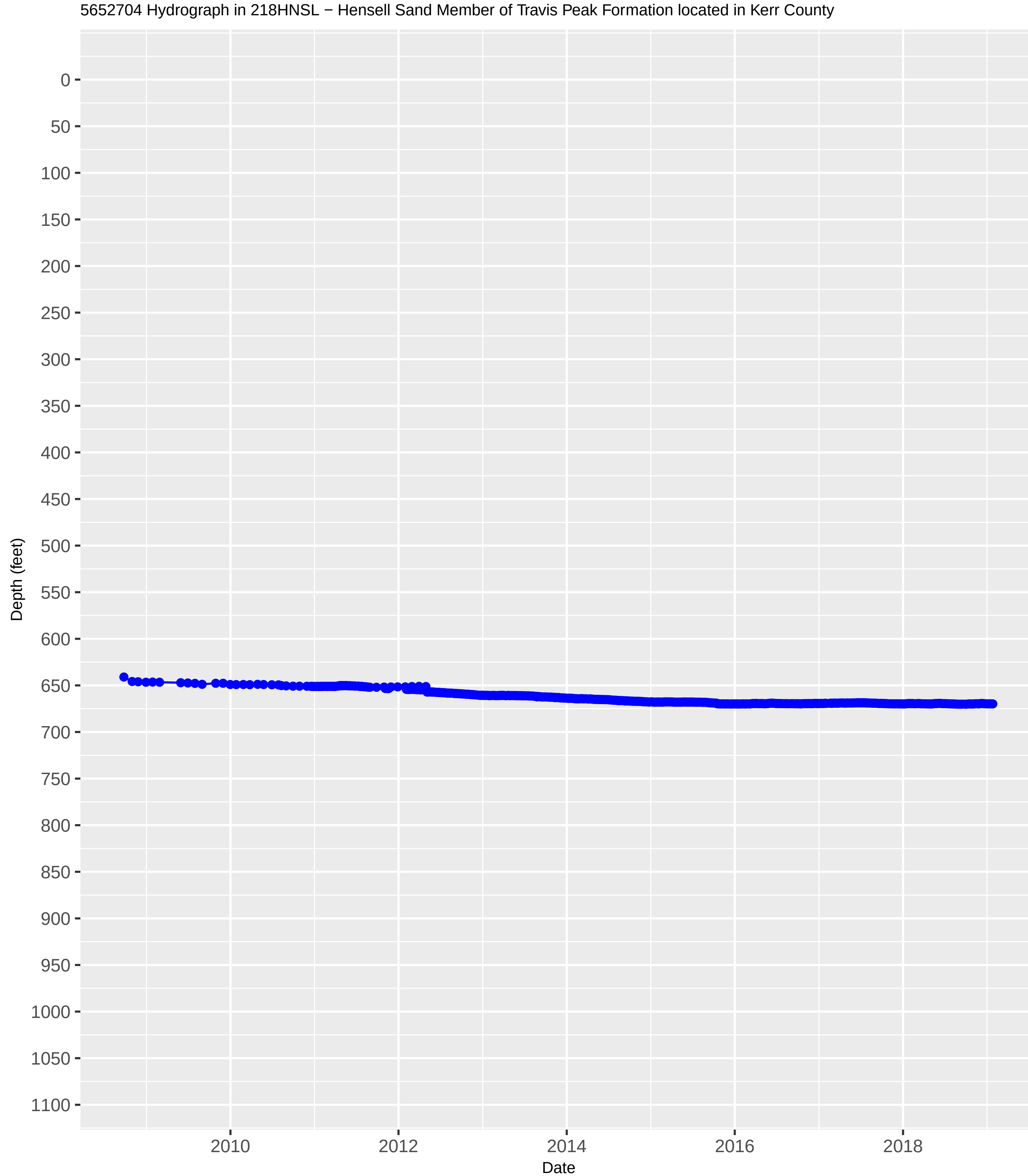

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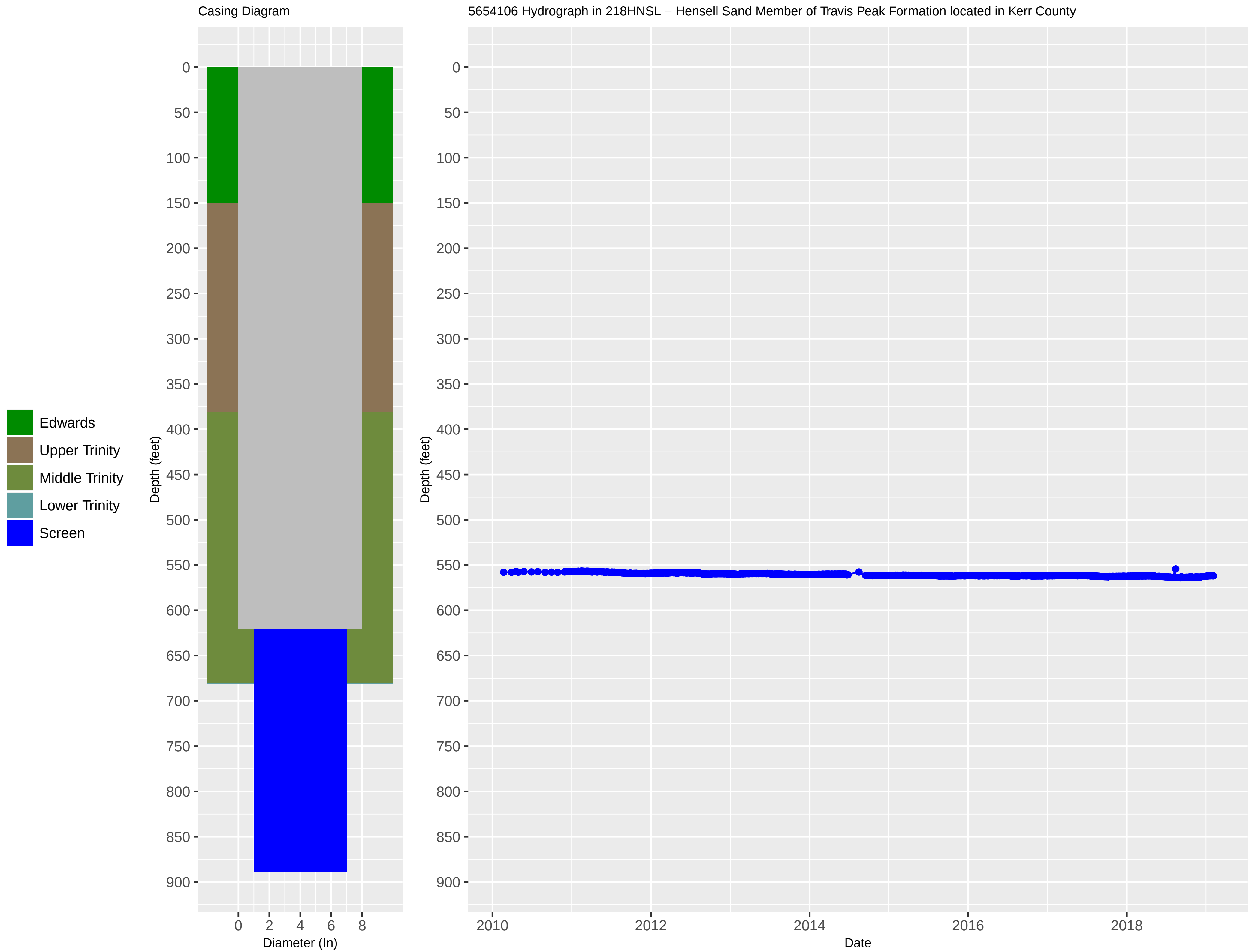

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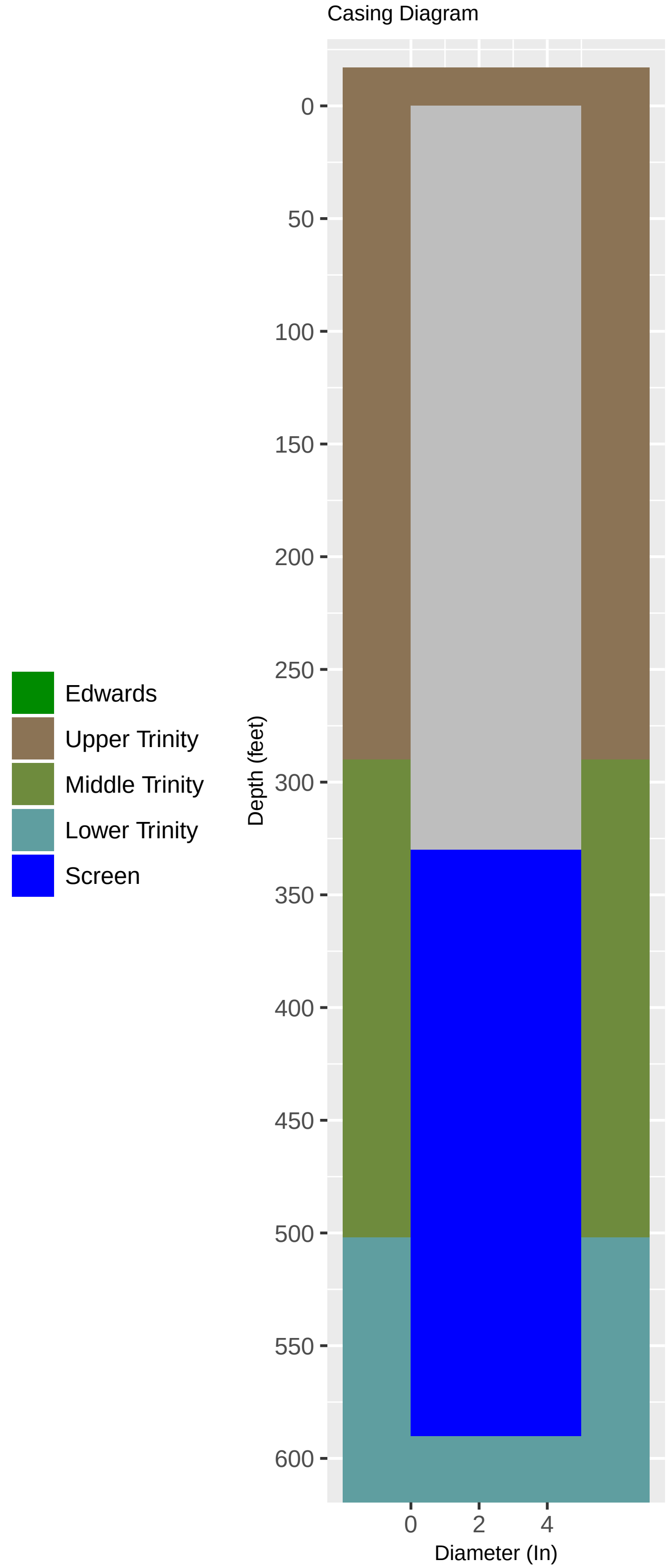

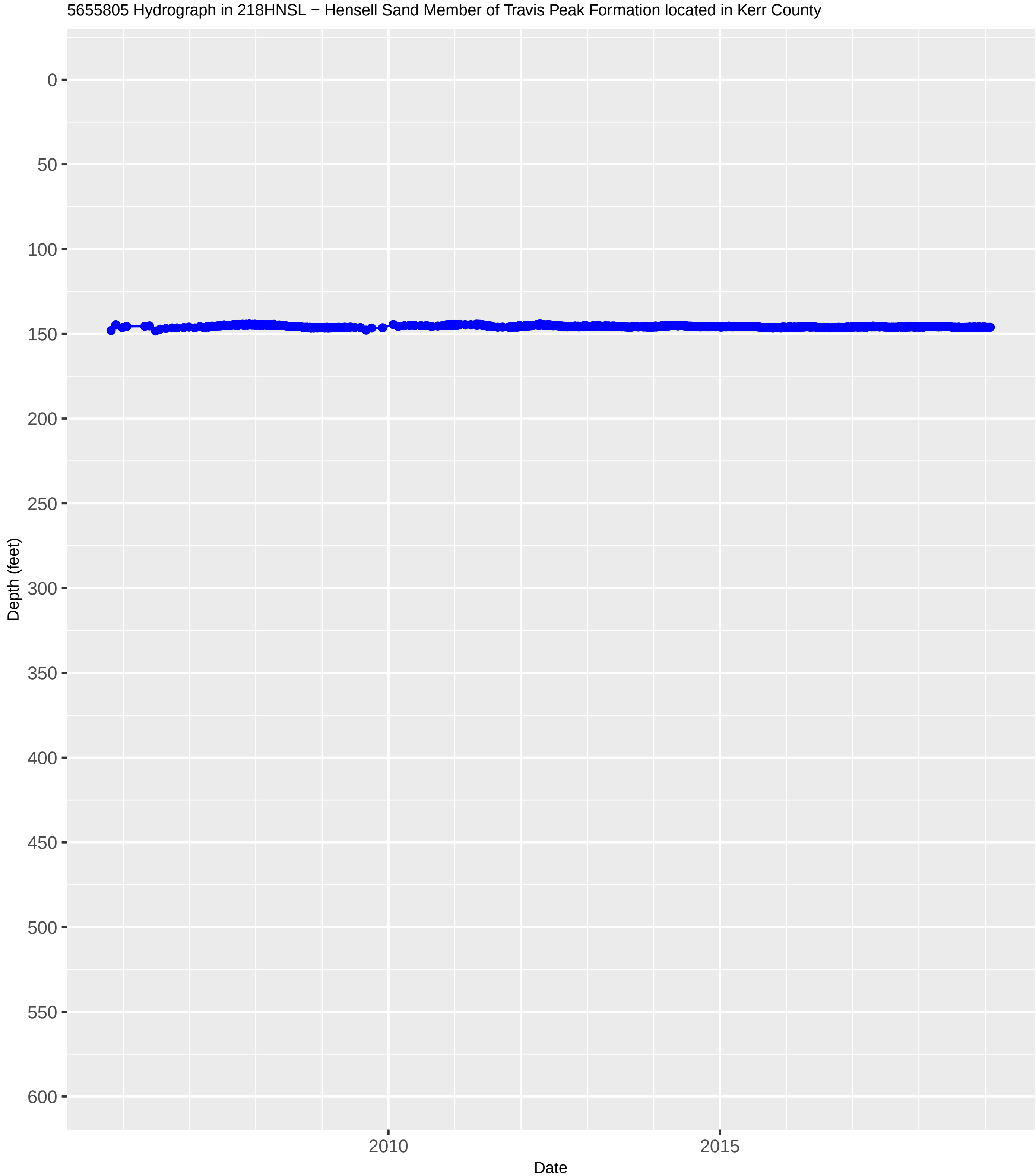

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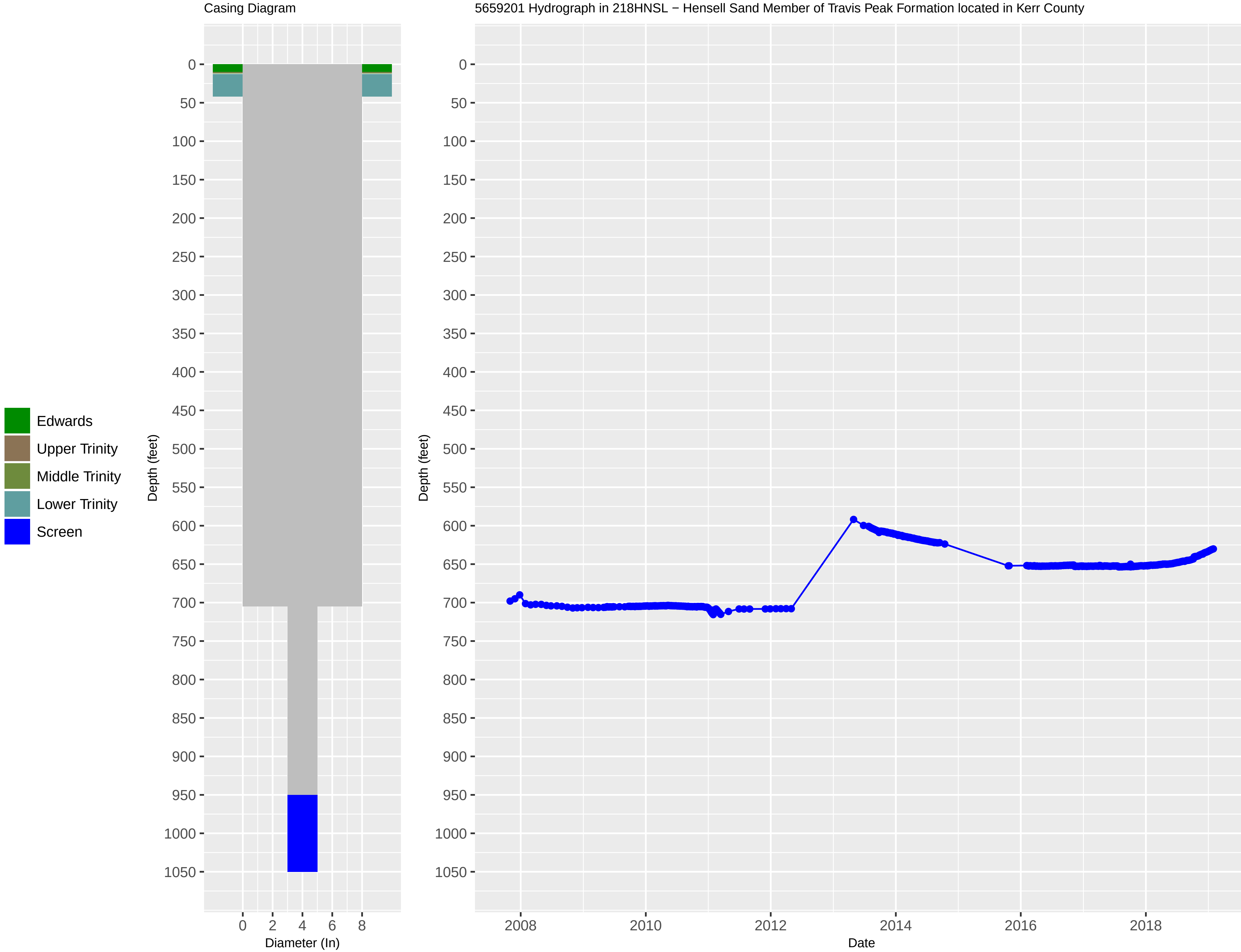

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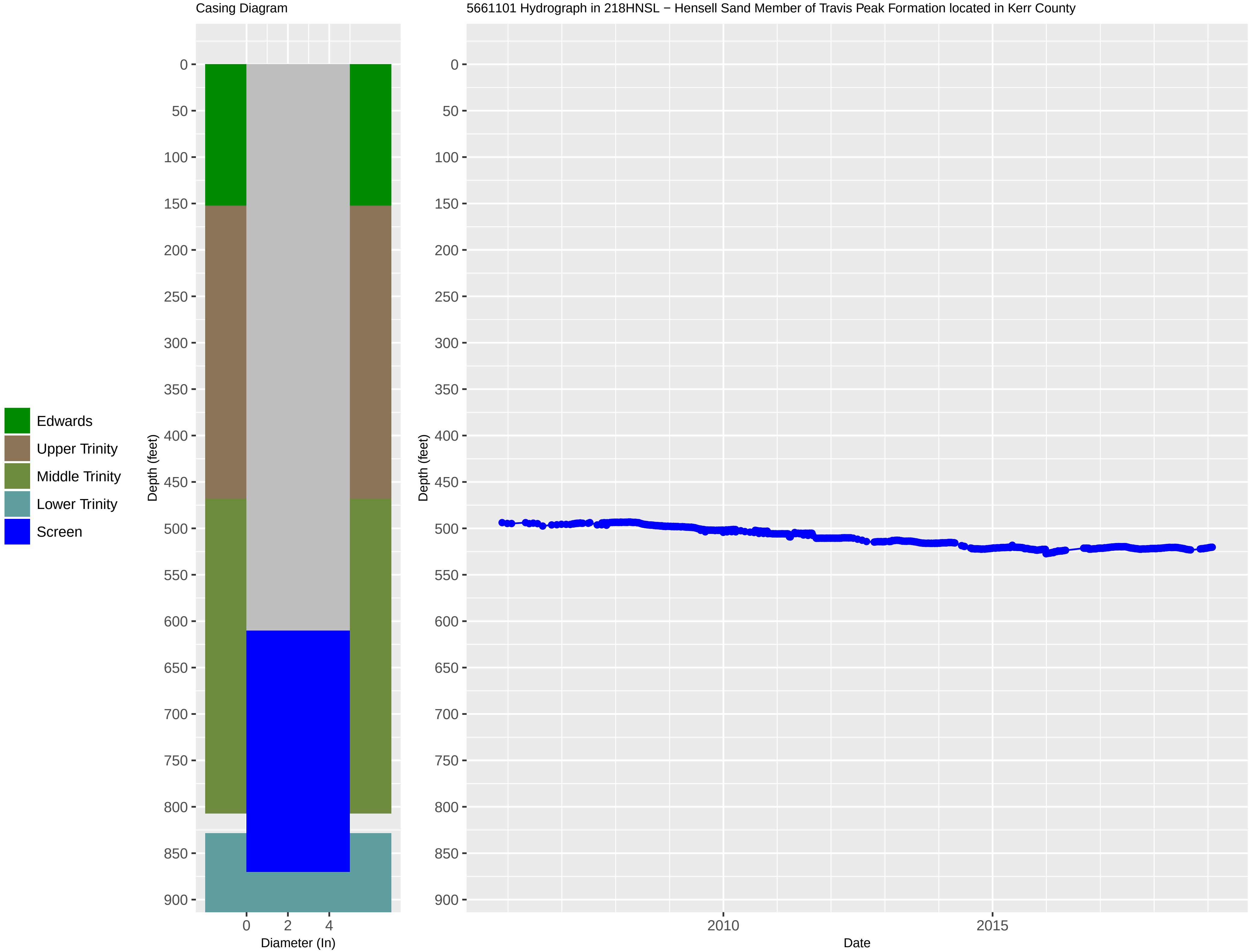

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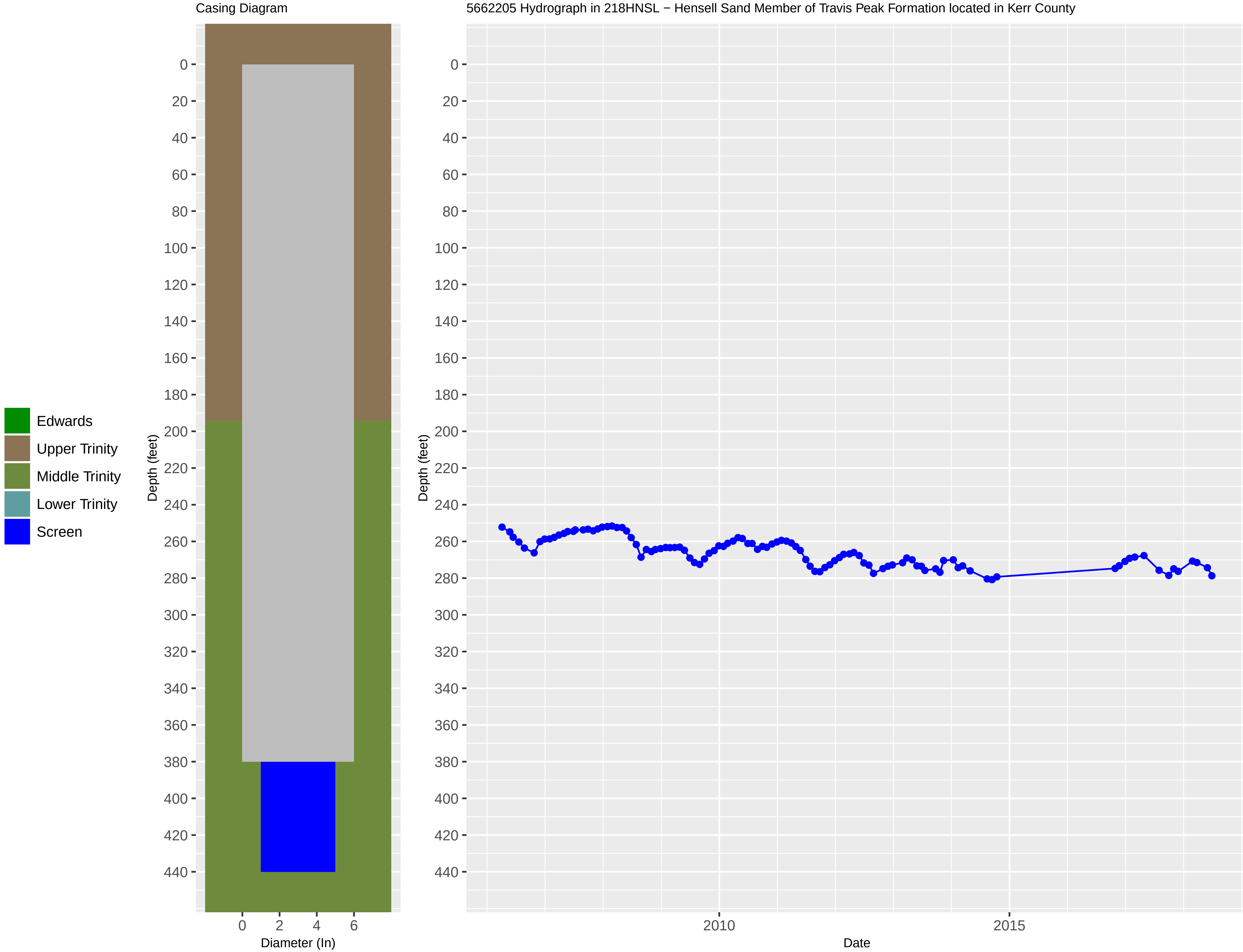

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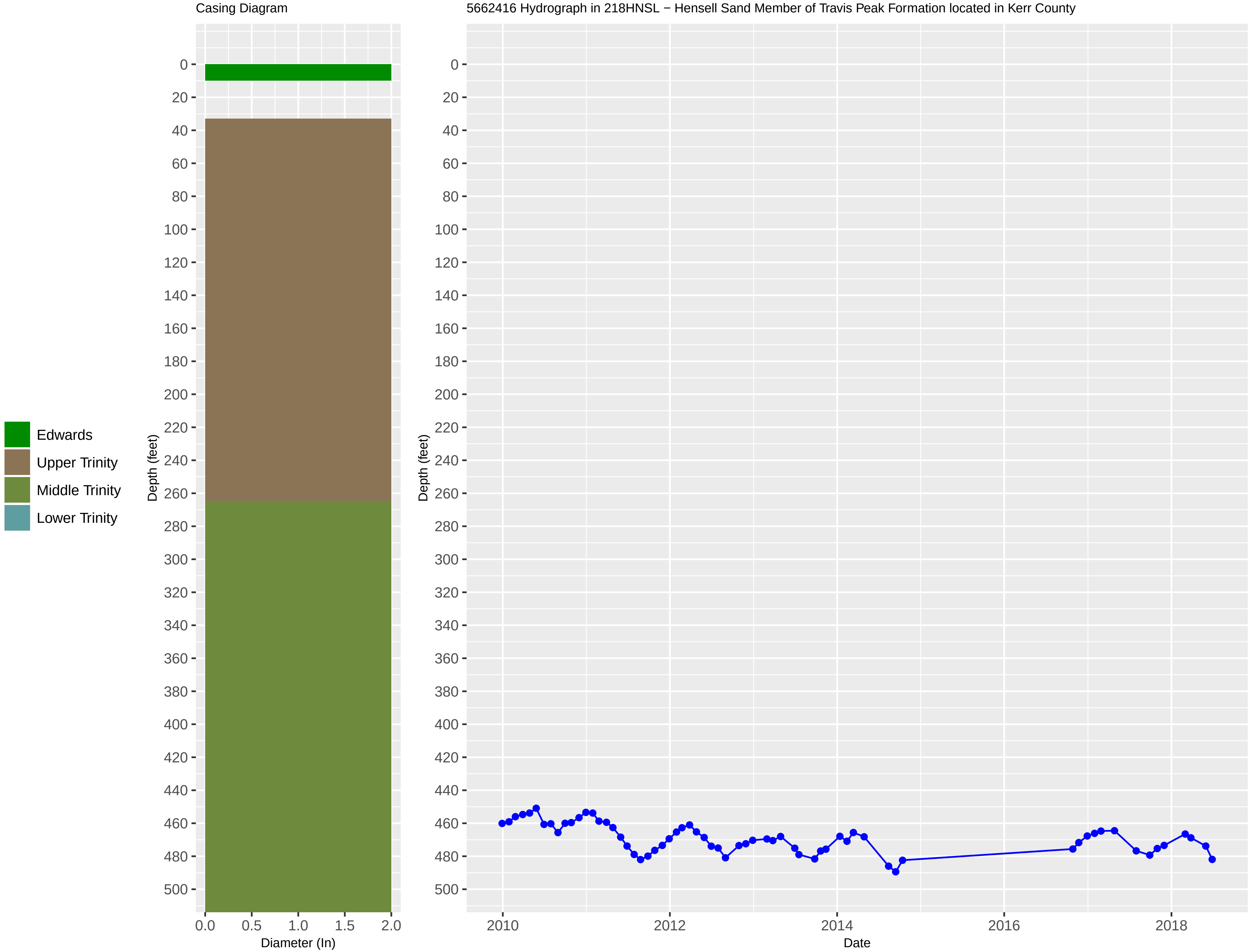

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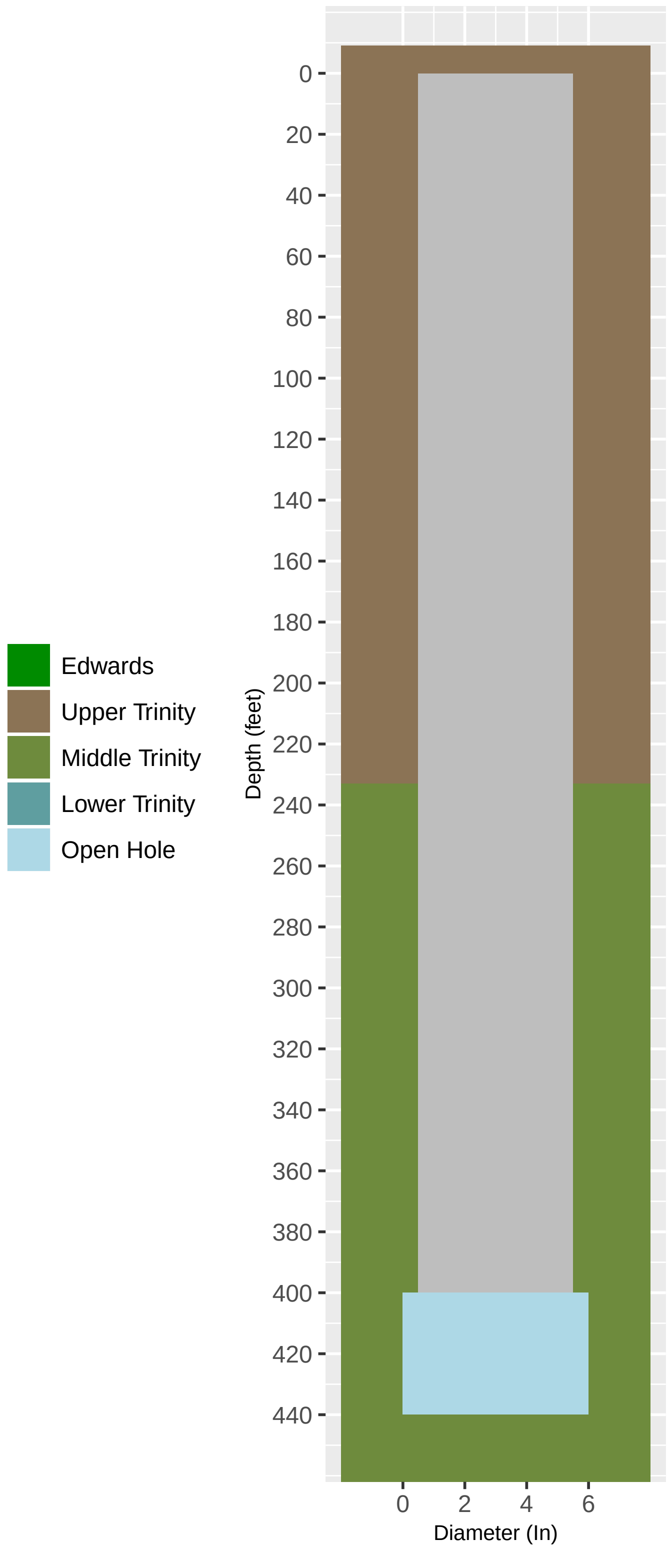
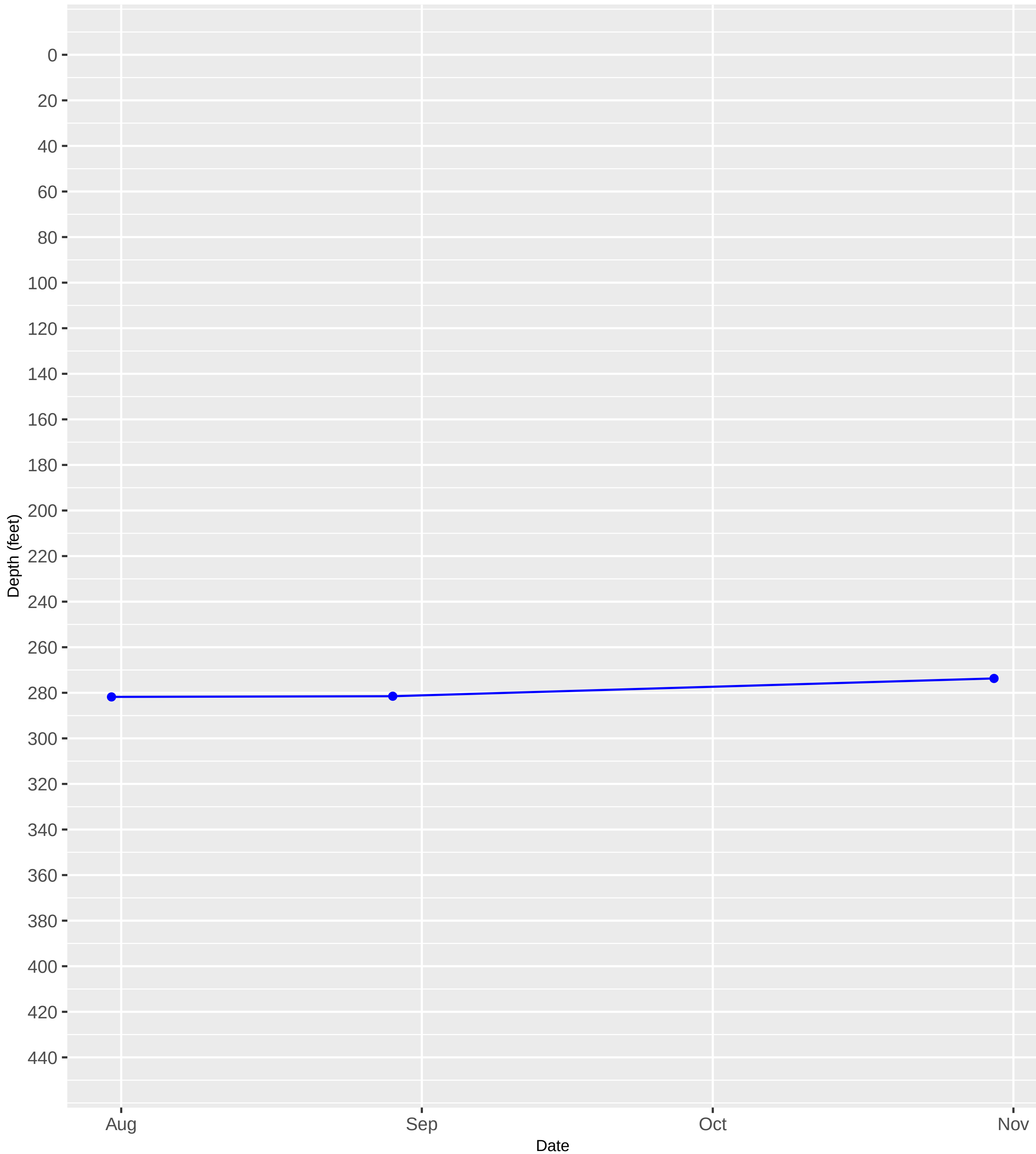
Casing Diagram



5663309 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Kerr County



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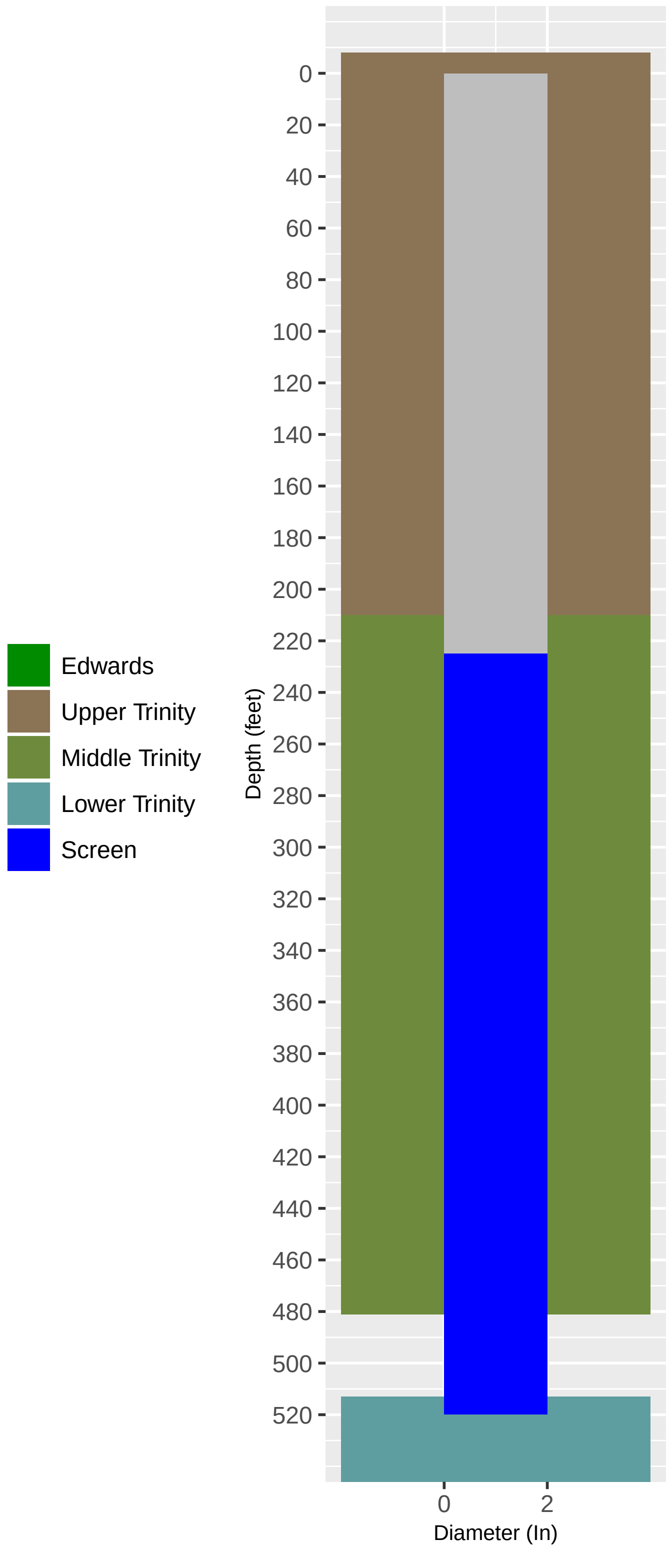
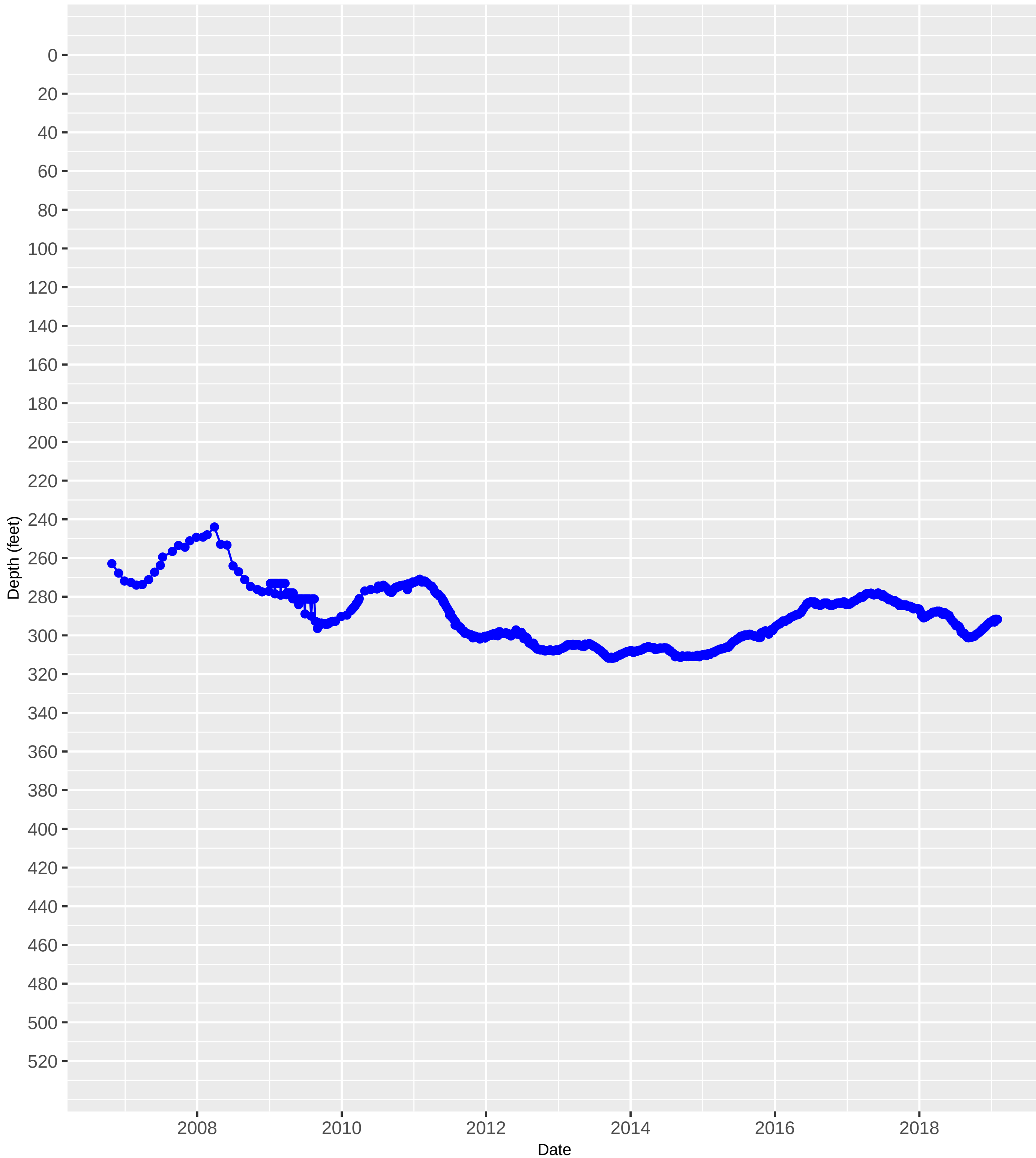
Casing Diagram



6908305 Hydrograph in 218HNSL − Hensell Sand Member of Travis Peak Formation located in Kerr County



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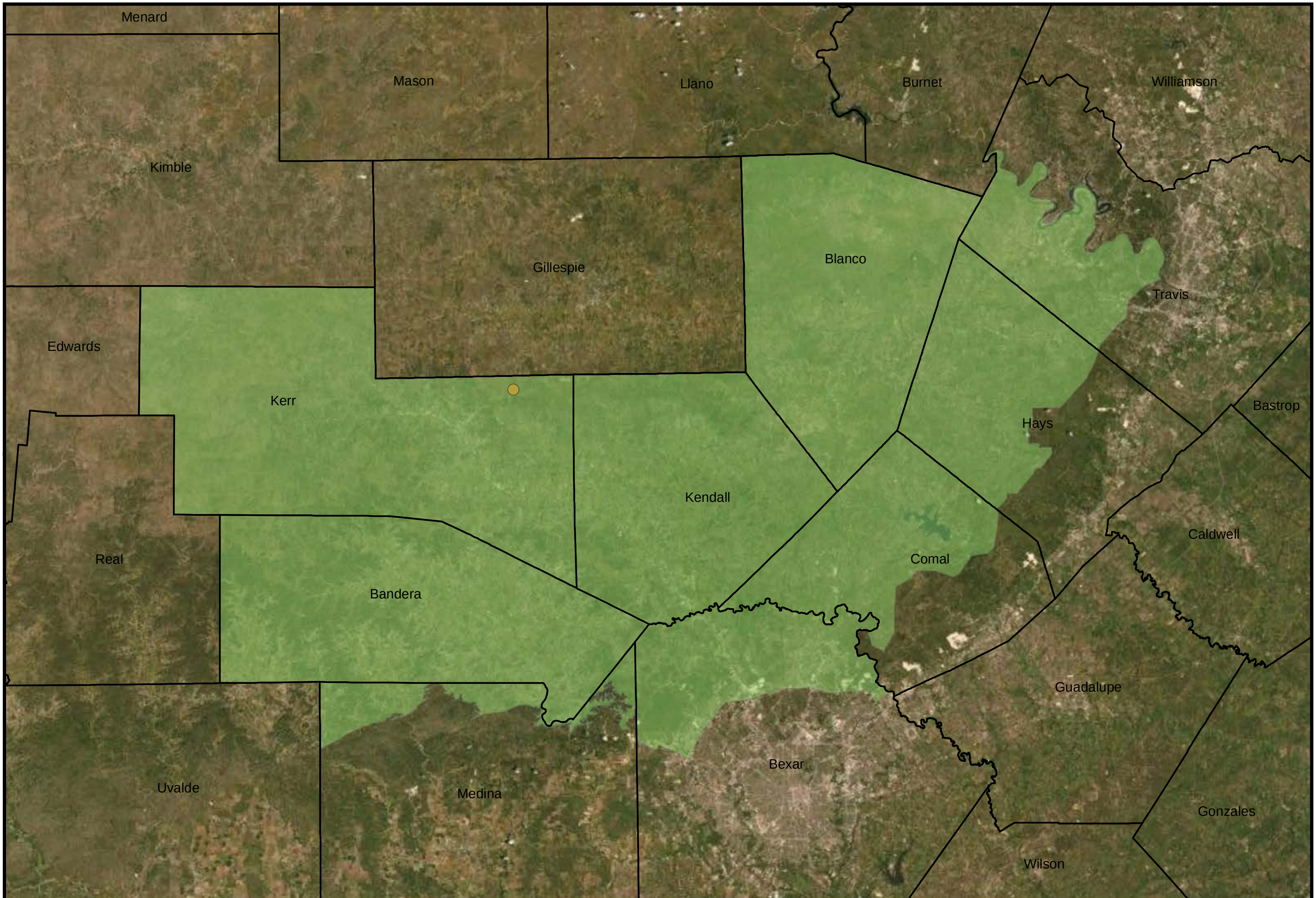

Aquifer

218TSEB - Trinity (Hensell Sand) and Ellenburger Group

GMA 9

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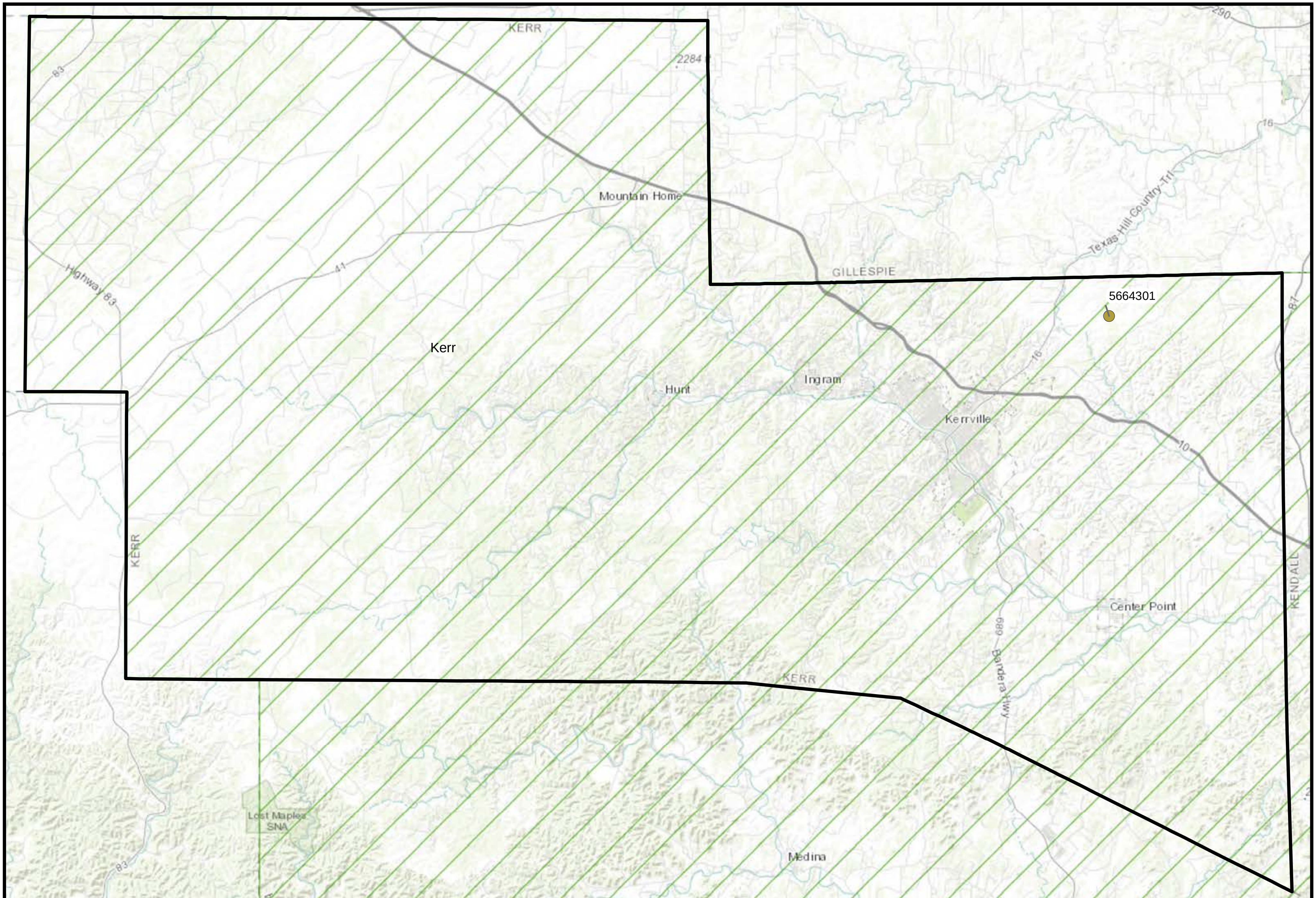
Miles

Map of Hydrograph Well Locations
218TSEB
Trinity (Hensell Sand) and Ellenburger Group



Aquifer

218TSEB - Trinity (Hensell Sand) and Ellenburger Group

GMA 9

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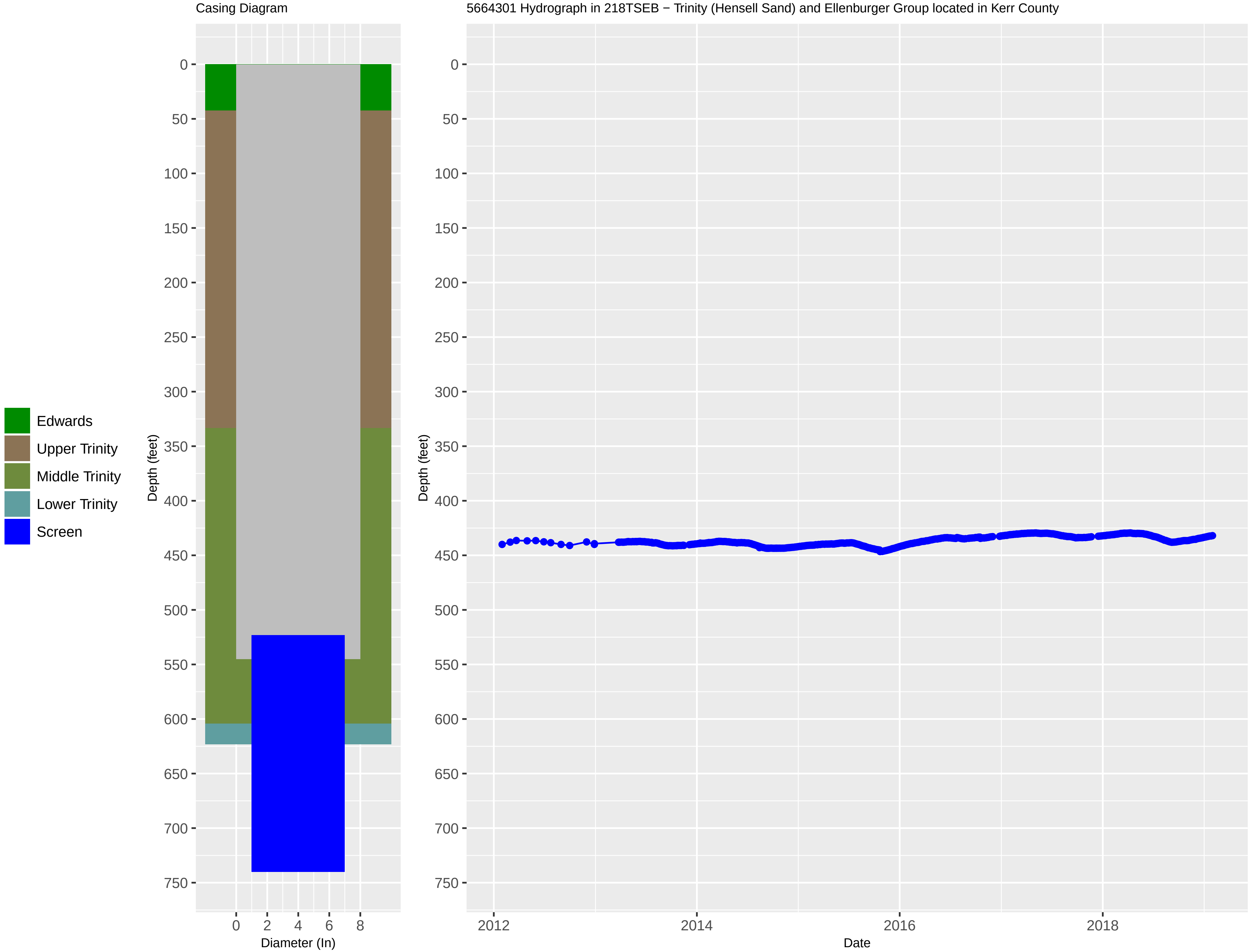
Miles

Map of Hydrograph Well Locations in Kerr County
218TSEB
Trinity (Hensell Sand) and Ellenburger Group



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Appendix G
Water Level Data Analysis Methodology Presentations

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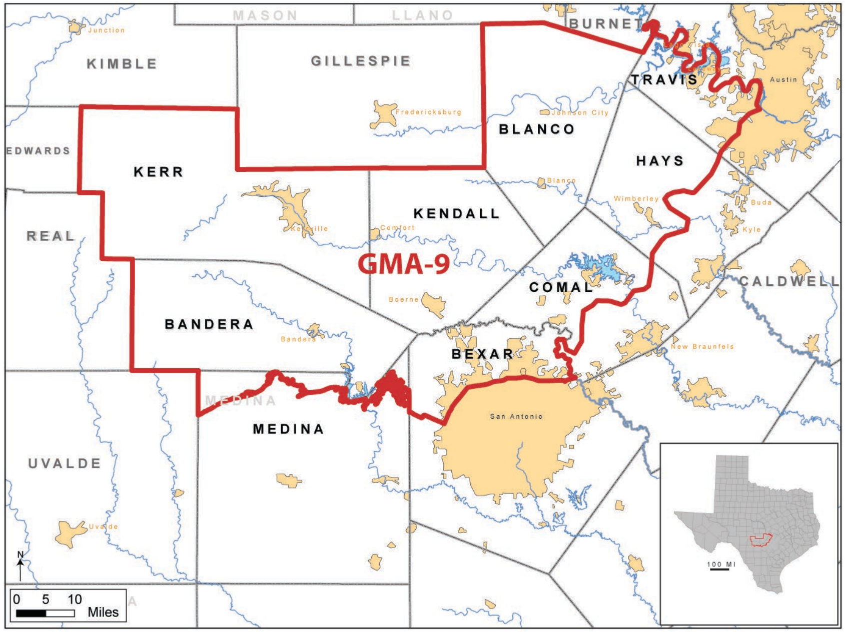
Desired Future Conditions



- DFCs could be considered a consensus yield
  - Not necessarily sustainable!

- Regional consensus planning objective or goal for the next 50 years

Trinity Hill Country DFC

- allow for an increase in average drawdown of ~**30 feet** through 2060 consistent with scenario 6 in TWDB Draft GAM Task 10-005

Pumping and Avg Drawdown of Water Levels in GMA-9

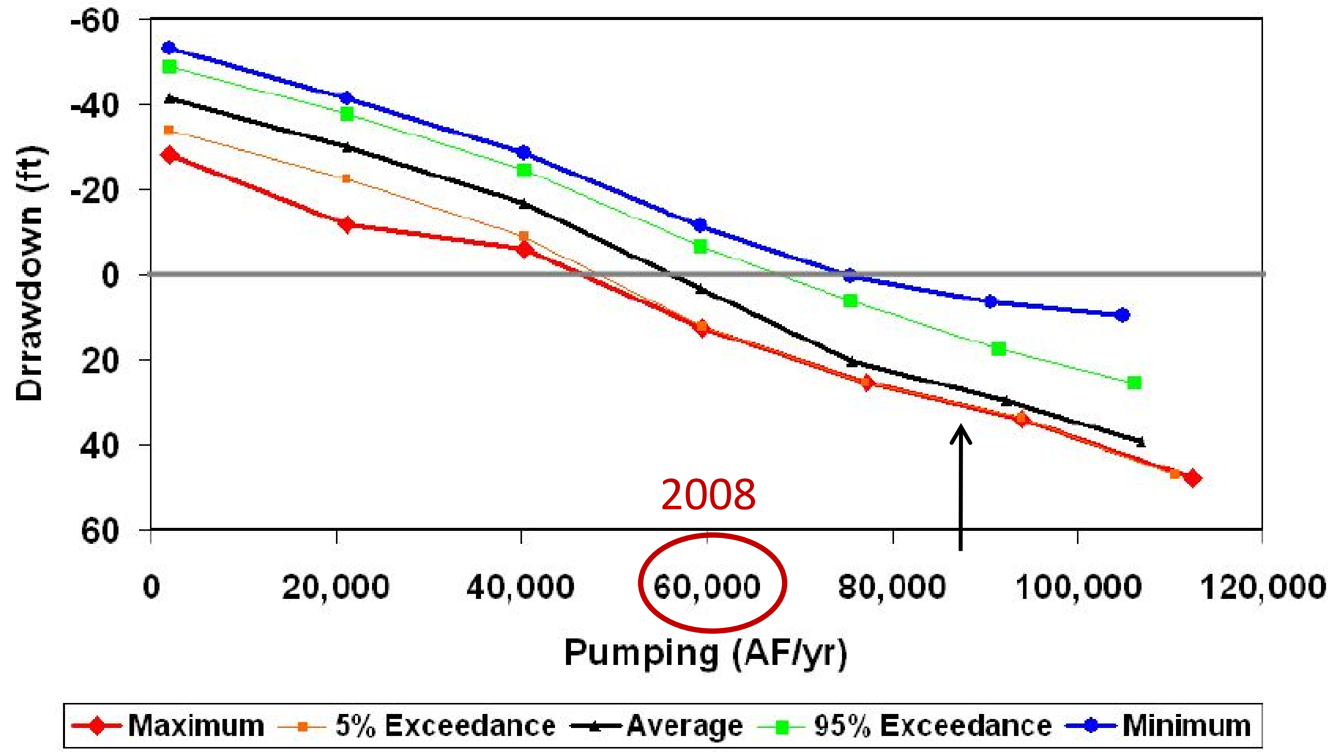


Figure 3. Pumping versus overall Trinity Aquifer drawdown after 50 years for all scenarios for Groundwater Management Area 9

From Hutchison, 2010

Fundamental DFC Problem

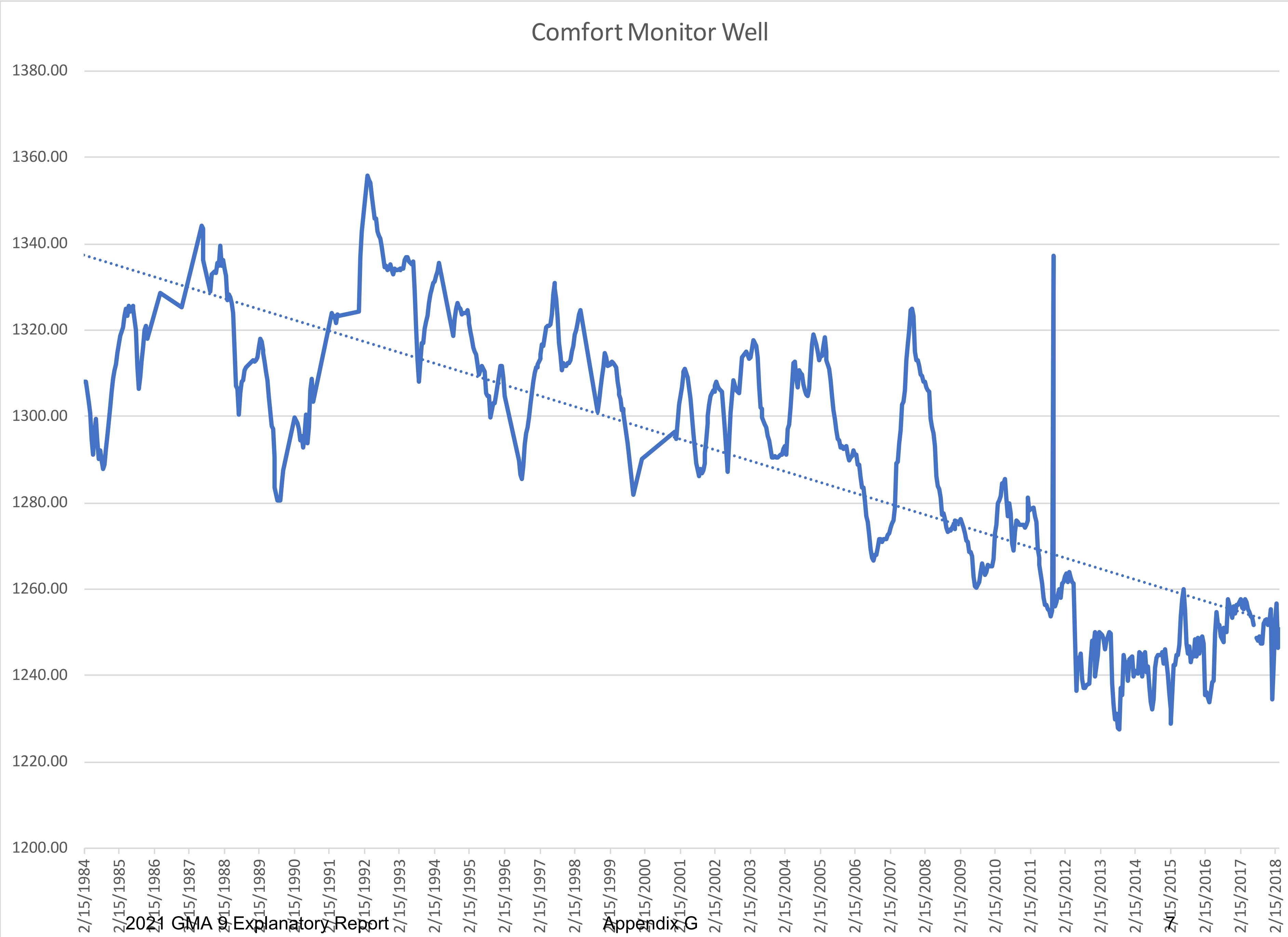
- No guidance as to the method or approach for measuring the DFC “compliance” over time

Meeting Purpose

- Discuss consistent simple, and representative approach(es) to monitoring the DFC for GMA 9.
- Discuss potential revisions to the DFC for future planning cycles.
- Discuss data or study needs.
- Other…

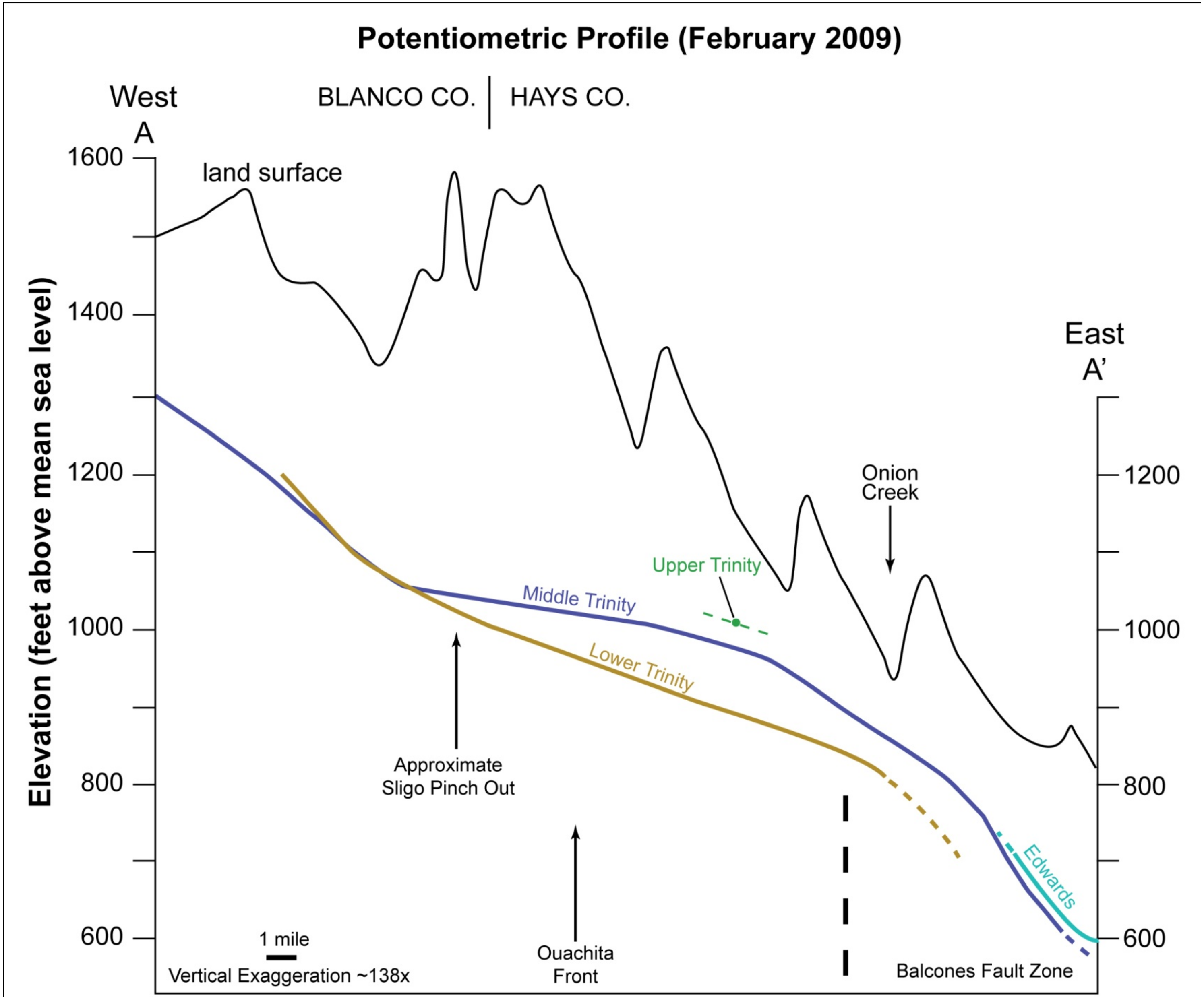
Examples for discussion purposes

Comfort (CCGCD) and Henly (HTGCD)
monitor wells


Comfort Monitor Well
1380.00
1360.00
1340.00
1320.00
1300.00
1280.00
1260.00
1240.00
1220.00
1200.00
2/15/1984
2/15/1985
2/15/1986
2/15/1987
2/15/1988
2/15/1989
2/15/1990
2/15/1991
2/15/1992
2/15/1993
2/15/1994
2/15/1995
2/15/1996
2/15/1997
2/15/1998
2/15/1999
2/15/2000
2/15/2001
2/15/2002
2/15/2003
2/15/2004
2/15/2005
2/15/2006
2/15/2007
2/15/2008
2/15/2009
2/15/2010
2/15/2011
2/15/2012
2/15/2013
2/15/2014
2/15/2015
2/15/2016
2/15/2017
2/15/2018

Monitoring Considerations (1)

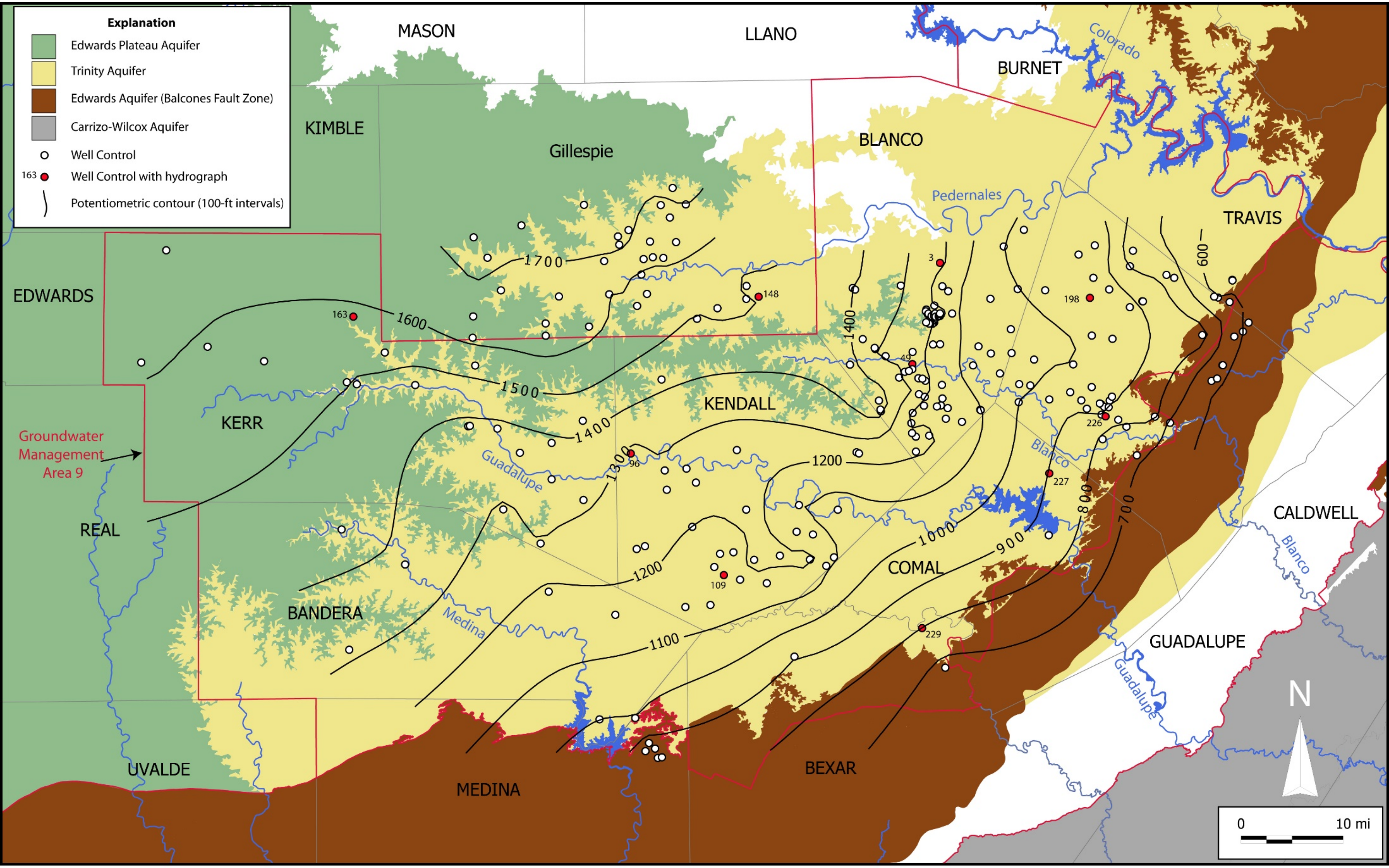
- **What aquifer(s) do we monitor?**
  - **Trinity Undifferentiated**
    - Upper Trinity (not relevant?)
    - **Middle Trinity**
    - Lower Trinity



From Wierman et al., 2010

Monitoring Considerations (2)

- **How many wells are representative of the aquifer for a given GCD?**
    - Data sources (GCDs, TWDB, etc)
    - Well completions and representativeness
    - Frequency of data collection
    - Interference vs depletion



Basemap data provided by the Texas Water Development Board: Major Aquifers of Texas, Major Rivers, and Groundwater Management Areas.

Potentiometric Map of the Middle Trinity Aquifer, Texas Hill Country
March 2009

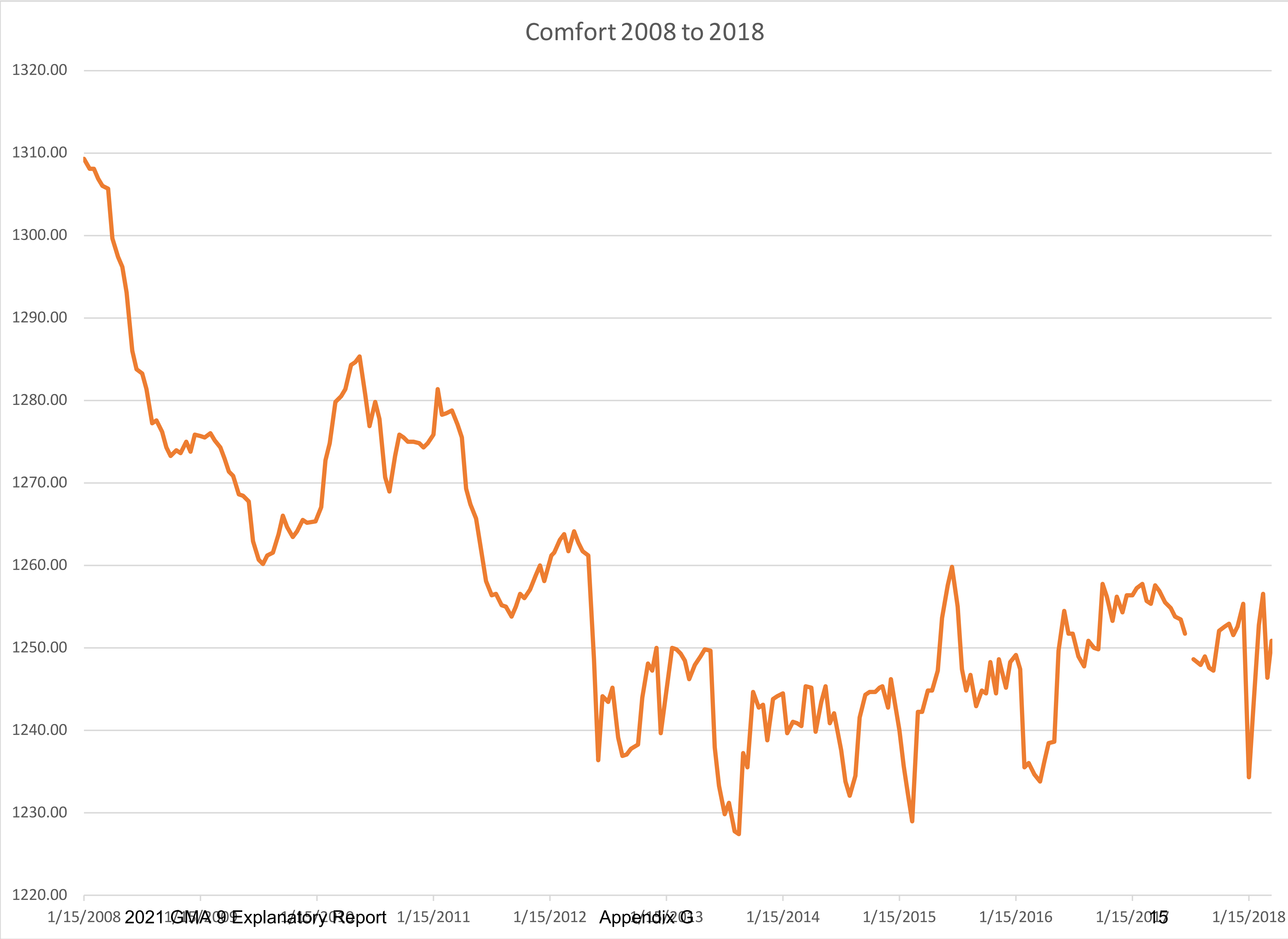
Monitoring Considerations (3)

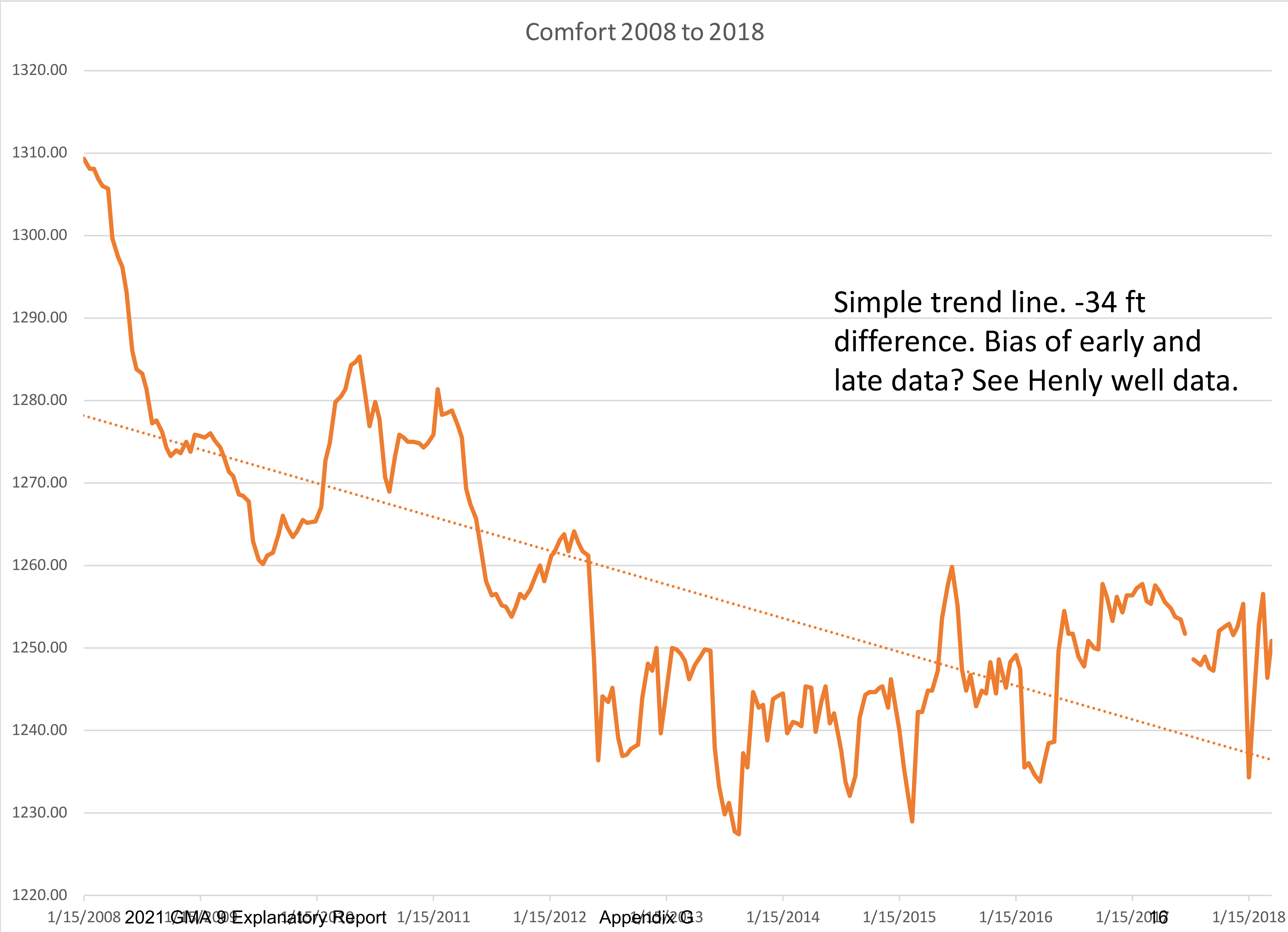
- **What is the benchmark to measure from?**
  - *"…all drawdown results are expressed as drawdown from **2008** initial conditions at the end of the simulation (50 years)." (Hutchison, 2010b, GAM Task 10-005)*
  - *Mean 2008 water level elevation for each well used as benchmark?*

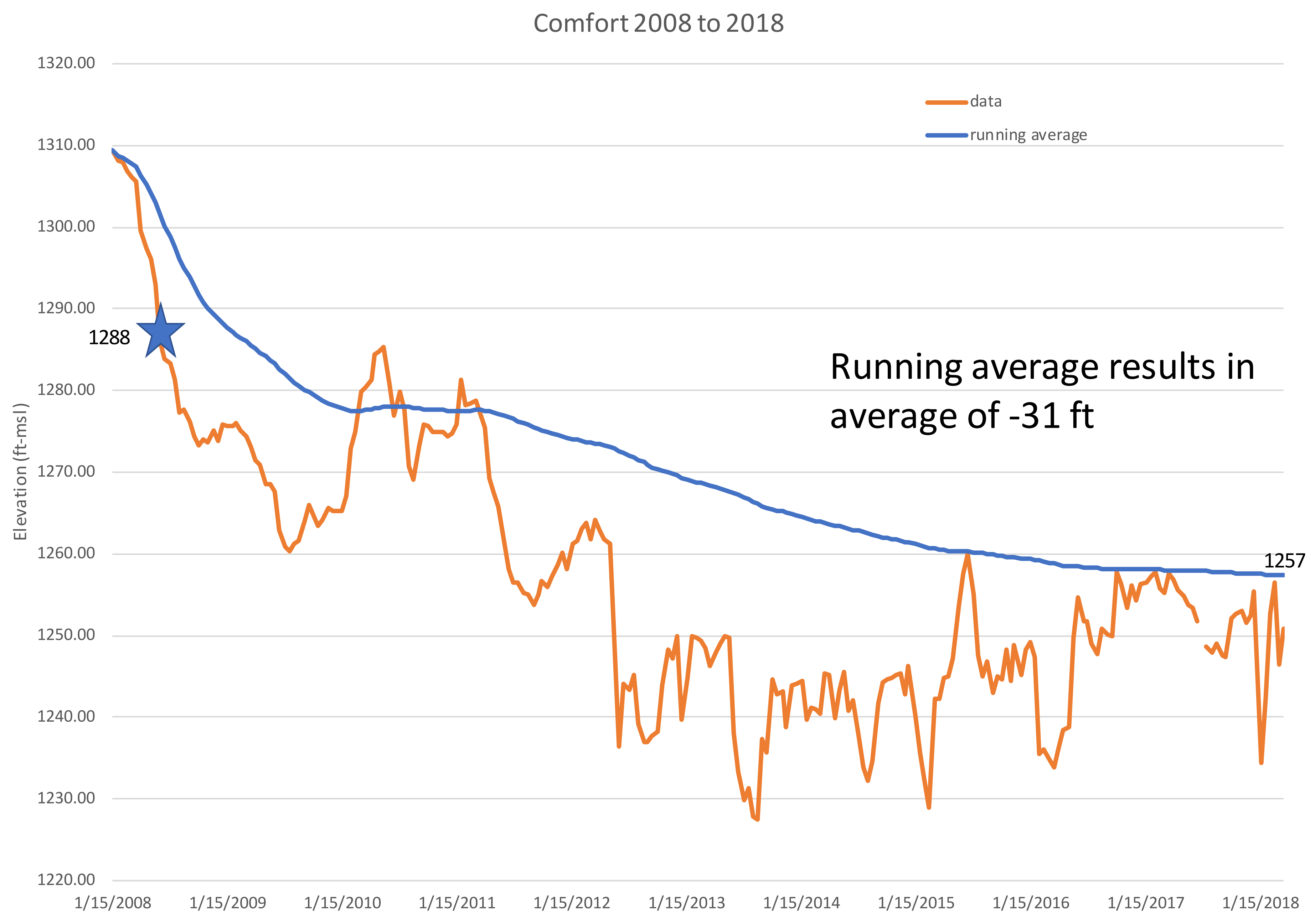

Comfort Water Levels 2008
1320.00
1310.00
1300.00
1290.00
1280.00
1270.00
1260.00
1250.00
2008 average = 1288 ft-msl
2008 median = 1283 ft-msl
1/15/2008
2/15/2008
3/15/2008
4/15/2008
5/15/2008
6/15/2008
7/15/2008
8/15/2008
9/15/2008
10/15/2008
11/15/2008
12/15/2008
Series1

Monitoring Considerations (4)

- **What do we compare the 2008 water level to?**
  - Calculate the difference from (average) 2008 level to the running average for each monitor well (June-08 through May 2012)?
  - Trend line?
  - Annual average?
- **Spatially weight and interpolate using Surfer®**


Comfort 2008 to 2018
1320.00
1310.00
1300.00
1290.00
1280.00
1270.00
1260.00
1250.00
1240.00
1230.00
1220.00
1/15/2008
1/15/2011
1/15/2012
1/15/2014
1/15/2015
1/15/2016
1/15/2018

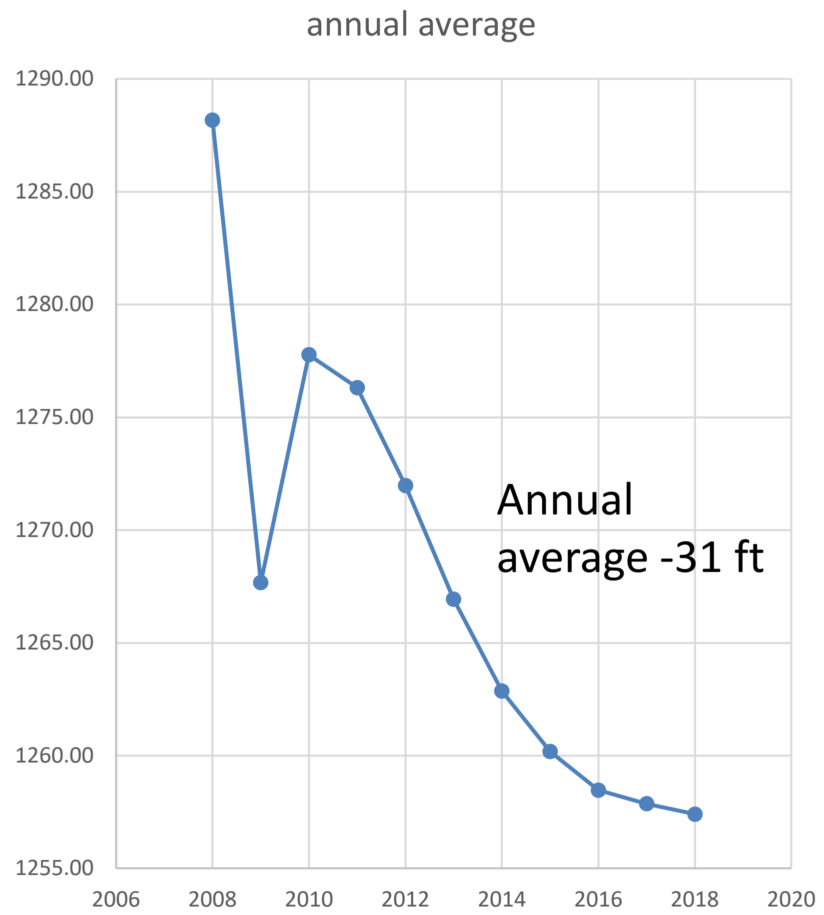

Comfort 2008 to 2018
1320.00
1310.00
1300.00
1290.00
1280.00
1270.00
1260.00
1250.00
1240.00
1230.00
1220.00
1/15/2008
1/15/2009
1/15/2010
1/15/2011
1/15/2012
1/15/2013
1/15/2014
1/15/2015
1/15/2016
1/15/2017
1/15/2018
Simple trend line. -34 ft difference. Bias of early and late data? See Henly well data.


Comfort 2008 to 2018
data
running average
Elevation (ft-msl)
1320.00
1310.00
1300.00
1290.00
1280.00
1270.00
1260.00
1250.00
1240.00
1230.00
1220.00
1/15/2008
1/15/2009
1/15/2010
1/15/2011
1/15/2012
1/15/2013
1/15/2014
1/15/2015
1/15/2016
1/15/2017
1/15/2018
1288
1257
Running average results in average of -31 ft

Annual Average (Comfort)

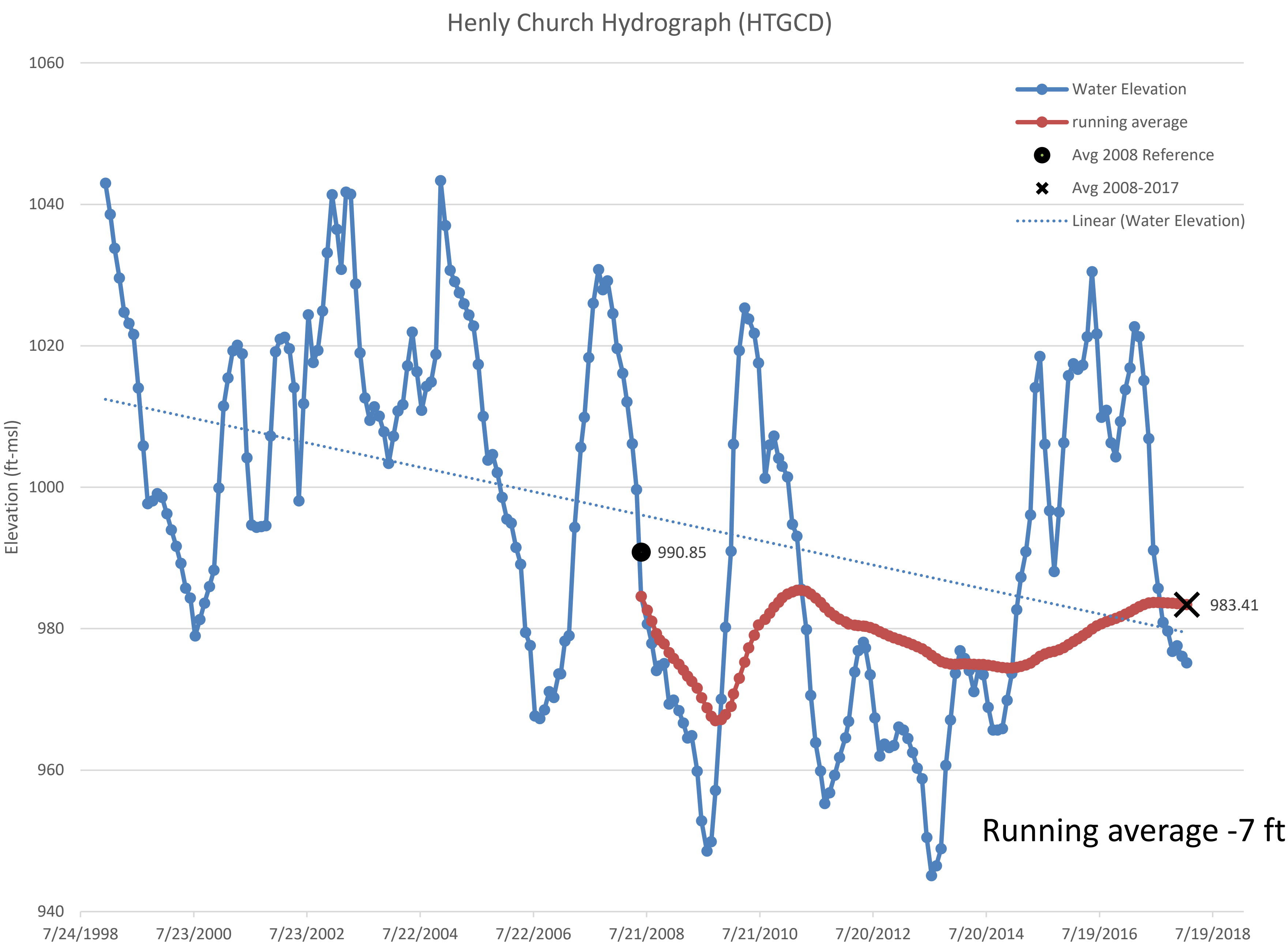
year	annual average
2008	1288.17
2009	1267.68
2010	1277.77
2011	1276.32
2012	1271.98
2013	1266.93
2014	1262.86
2015	1260.18
2016	1258.47
2017	1257.87
*2018	*1257.41*

**only through March 2018*

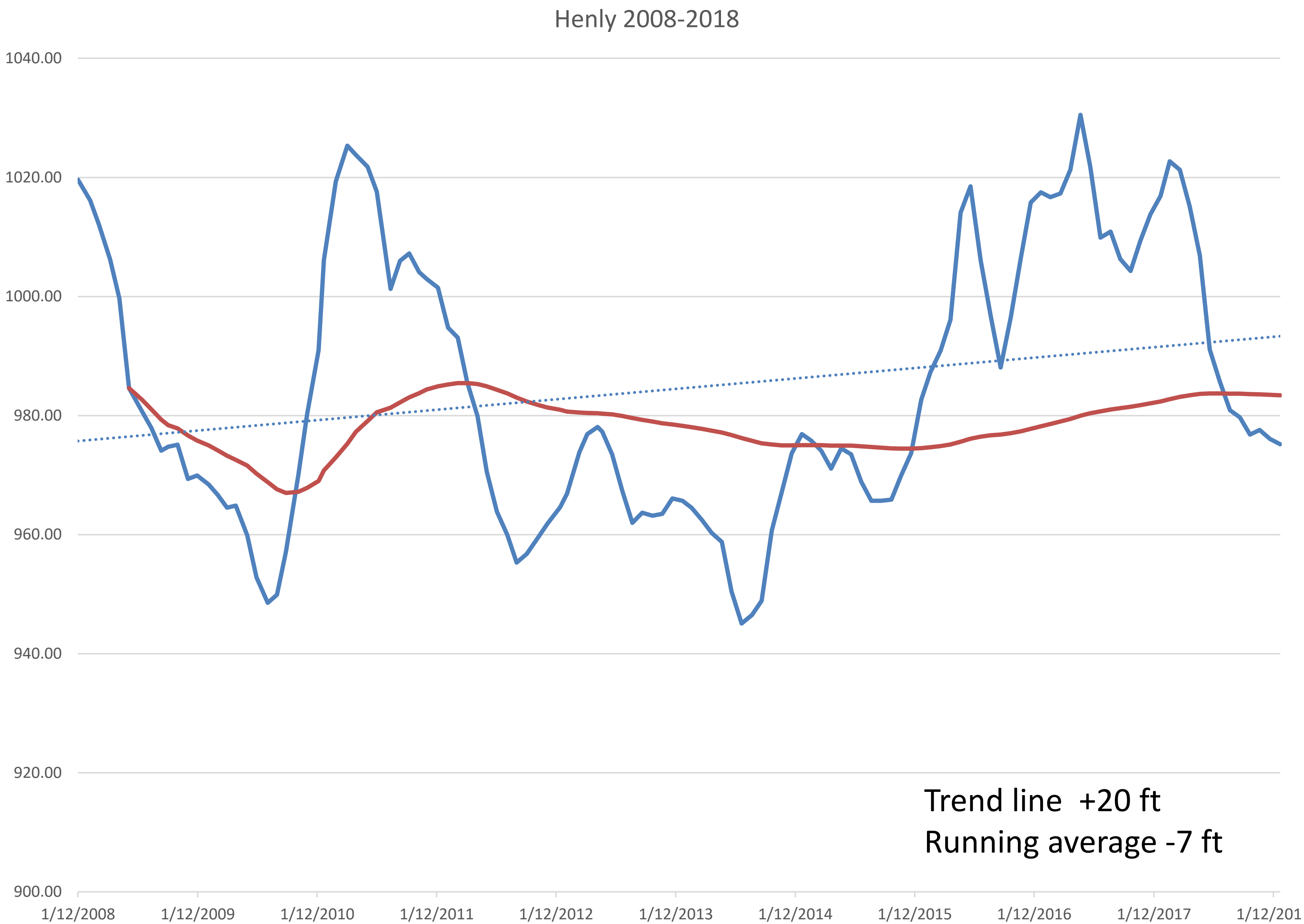


A more dynamic well…

Henly



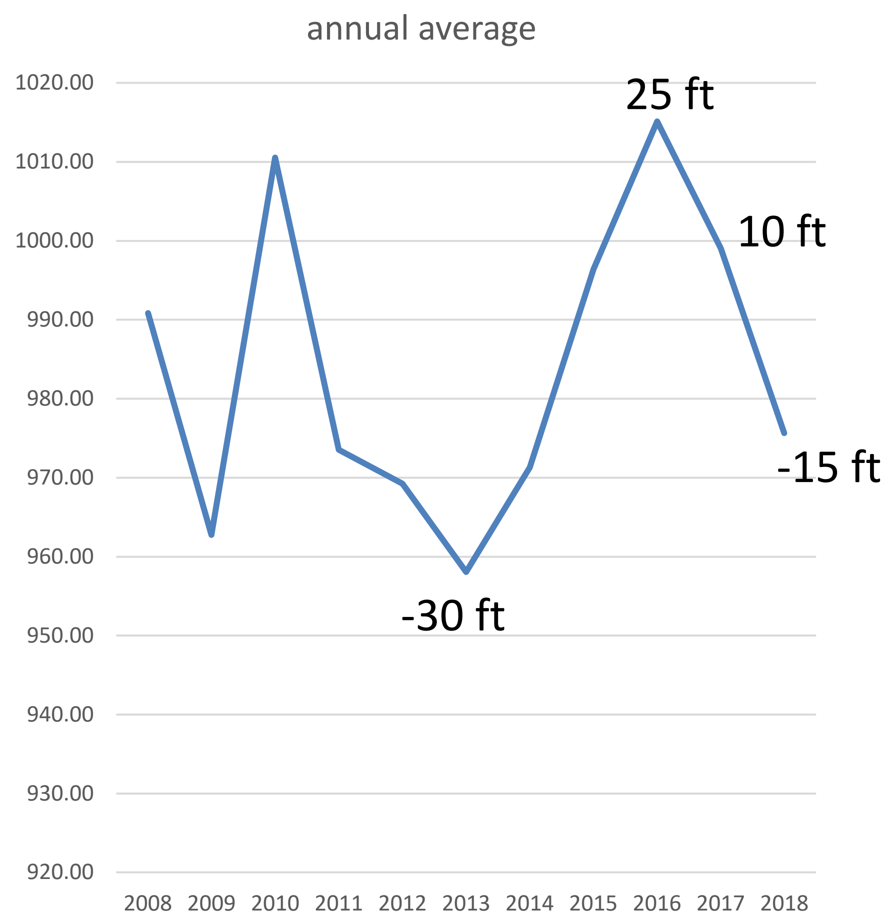
Henly Church Hydrograph (HTGCD)
Water Elevation
running average
Avg 2008 Reference
Avg 2008-2017
Linear (Water Elevation)
Elevation (ft-msl)
1060
1040
1020
1000
980
960
940
990.85
983.41
Running average -7 ft
7/24/1998
7/23/2000
7/23/2002
7/22/2004
7/22/2006
7/21/2008
7/21/2010
7/20/2012
7/20/2014
7/19/2016
7/19/2018


Henly 2008-2018
1040.00
1020.00
1000.00
980.00
960.00
940.00
920.00
900.00
1/12/2008
1/12/2009
1/12/2010
1/12/2011
1/12/2012
1/12/2013
1/12/2014
1/12/2015
1/12/2016
1/12/2017
1/12/201
Trend line +20 ft
Running average -7 ft

Annual Average (Henly)

Year	**average**
2008	990.85
2009	962.75
2010	1010.54
2011	973.53
2012	969.24
2013	958.05
2014	971.30
2015	996.41
2016	1015.12
2017	999.03
*2018	975.64

**only through February 2018*



Monitoring Considerations (5)

- **Spatially weight and interpolate using Surfer®**

County/GCD	***Grid Average***	***Avg. from wells***	***No. wells***	***Comment***
GMA-9	-10.5	-8.1	75	
Bandera (BCRAGCD)	-8.5	-6.6	16	
Bexar (TGRGCD)	-20.7	-13.6	4	
Blanco (BPGCD)	-1.2	-0.2	6	No aquifer in northwestern Blanco
Comal GCD	-11.6	-21.7	1	one well only
Hays (HTGCD)	-1.8	-0.6	13	
Kendall (CCGCD)	-10.4	-10.4	26	
Kerr (HGCD)	-15.8	-7.0	4	
Western Travis (No confirmed GCD)	-3.0	ND	ND	No well data in grid
Hays and Travis (BSEACD)		-9.5	3	Mostly outside GMA 9
Gillespie (HCUWCD)		-7.0	4	Outside of GMA 9

Averaging Wells vs Gridding?