



Montrachet Groundwater Availability Certification Study

Attention:

Donnie Siratt

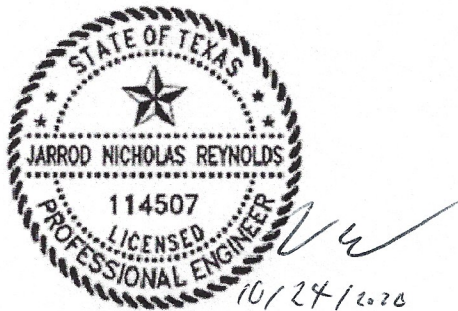
Siratt Partners

10/24/2020

Compiled by:

Triple Z Engineering LLC, Jarrod Reynolds

TBPE: 18750 Certificate no: 114507



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1.0 CONTACT INFORMATION

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Siratt Partners

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Core Management LLC

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2.0 OVERVIEW

Property Details	Property is in the City of Fort Worth, Texas – Extra Territorial Jurisdiction (ETJ)
Property District	Property location is in the Northern Trinity Groundwater Conservation District
Project Scope	<p>Immediate:</p> <p>To provide a ground water assessment for siting of water wells within the specified locations of the Montrachet subdivision in Fort Worth, Texas. The proposed wells will be subject to the rules and regulations outlined by the Texas Commission on Environmental Quality (TCEQ) and the Northern Trinity Groundwater Conservation District; these will be the basis upon which the report is constructed. The report is compiled with the latest, and best known, data. TCEQ Certification for platting, stamped by a Professional Engineer, will be provided.</p> <p>Prospective:</p> <p>To provide landowners with stratigraphic and location mapping as it pertains to purchased lots. Landowner(s) will receive applicable Northern Trinity Groundwater Conservation District permits. Landowner(s) will be provided with general well-design schematic for their property and water well drilling consultation, including collaboration with driller if needed.</p> <p>Details of both immediate and prospective deliverables outlined in Section 4: Assessment Specifications.</p>
Project Cost	<p>Immediate: \$14,000.00 USD + Cost of water testing if applicable</p> <p>Prospective: \$1,500.00 USD Per Well</p>
Payment Terms	<p>Immediate: Net 30 days of report submission</p> <p>Prospective: Full payment upon documentation completion (per well)</p>

3.0 ASSESSMENT

Disclaimer

This report is outlined using the TCEQ Groundwater Availability Certification for Platting §§ 230.1-230.11. All information contained here within is based upon the best data available at the time of the report. Data is taken from multiple sources and subject to updates and errors in the state reporting process. Estimation of usage is taken from the latest demographic data available to the area and does not necessarily reflect future scenarios.

3.1 ASSESSMENT SPECIFICATIONS

Property Details / Mapping	Associated site-specific maps
Demand Estimate	Residential demand estimates
Water Quality	Location specific data and analysis
Water Availability	Aquifer details and drawdown calculations

3.2 EXECUTIVE SUMMARY

The planned development will use ground water withdrawn from wells as the source for home supply in the lots identified by the developer.

This report will meet the requirements of the §TAC 30 230.1 – 230.11 groundwater availability certification checklist for a platted subdivision, provided by the TCEQ. The water withdrawal will be from one of two aquifers underlying the area; the Paluxy and the Trinity. The Paluxy is the shallower and more economical aquifer. The Trinity will be the higher producing zone. Both aquifers are accessible for homeowners in the development. Northern Trinity Groundwater Conservation District (NTGCD) has jurisdiction over the area. All water wells must be drilled and completed in accordance with the NTGCD requirements.

Montrachet is located at the approximate intersection of Interstate 20 and Loop 820, southwest of Fort Worth. It totals 185 lots. The lots will be served from the City of Fort Worth with the exception of those that are higher in elevation than 820 feet mean sea level (MSL). These lots, totaling 21, will be served by an onsite water well and Fort Worth sewer services. In these 21 lots no water distribution or treatment facilities will be installed. It is understood each property owner will be responsible for their own installation, connection, and maintenance of their respective water wells. No notification of surrounding Certificate for Convenience and Necessity (CCN) is required due to independent ownership for installation of the water wells.

Name of Proposed Subdivision	Montrachet
Property Owners Name(s)	Montserrat Hills, LLC
Address	6000 Western Place II, Suite 456, Fort Worth, Texas 76107
Phone	817-377-8827
Fax	817-732-0595
Plat Applicants Name	Montserrat Properties, LLC
Address	6000 Western Place II, Suite 110, Fort Worth, Texas 76107
Phone	817-377-8827
Fax	817-732-0595
Tract Description	An addition to City of Fort Worth, Tarrant County, Texas – being 253.64 acres of land. Situated in the J.F Elliot Survey, Abstract No. 493, John Bursey Survey, Abstract No. 128, and Nancy Casteel Survey, Survey No. 349. Fort Worth (E.T.J.), Tarrant County, Texas
Parcel	Tax Assessor Parcel Number(s). H V LUDIE PARTNERSHIP LTD D207134955 D.R.T.C.T. PARCEL 4W 52.582 AC
Firm Information	Core Management, LLC DBA Triple Z Engineering, LLC TBPE Firm # 18759
Engineer Information	Name: Jarrod Reynolds Address: 9501 Rocky Branch Hwy, Lipan, Tx 76462 Phone: 817-597-5858 Fax: N/A Certificate Number: TBPE License # 114507

3.3 GEOLOGICAL DATA

Underlying the development is the Cretaceous formation. It extends from the surface to the base of what is referred to the Trinity Sand. The immediately accessible sand is the Paluxy aquifer. It is recommended that the homeowners utilize this sand as it is the most economical for the individual homeowner. The Paluxy exhibits elastic storage which means in nominal cases the pump can be set at the aquifer surface or above. This provides a better operating well less prone to failure. It should be noted that if a driller encounters a non-artesian configuration to consult the engineer before well completion. It should be noted that if a well spacing issue should arise that the verticle offset clause in the NTGCD can allow the Trinity to be utilized instead of the Paluxy. No Woodbine is available in this area.

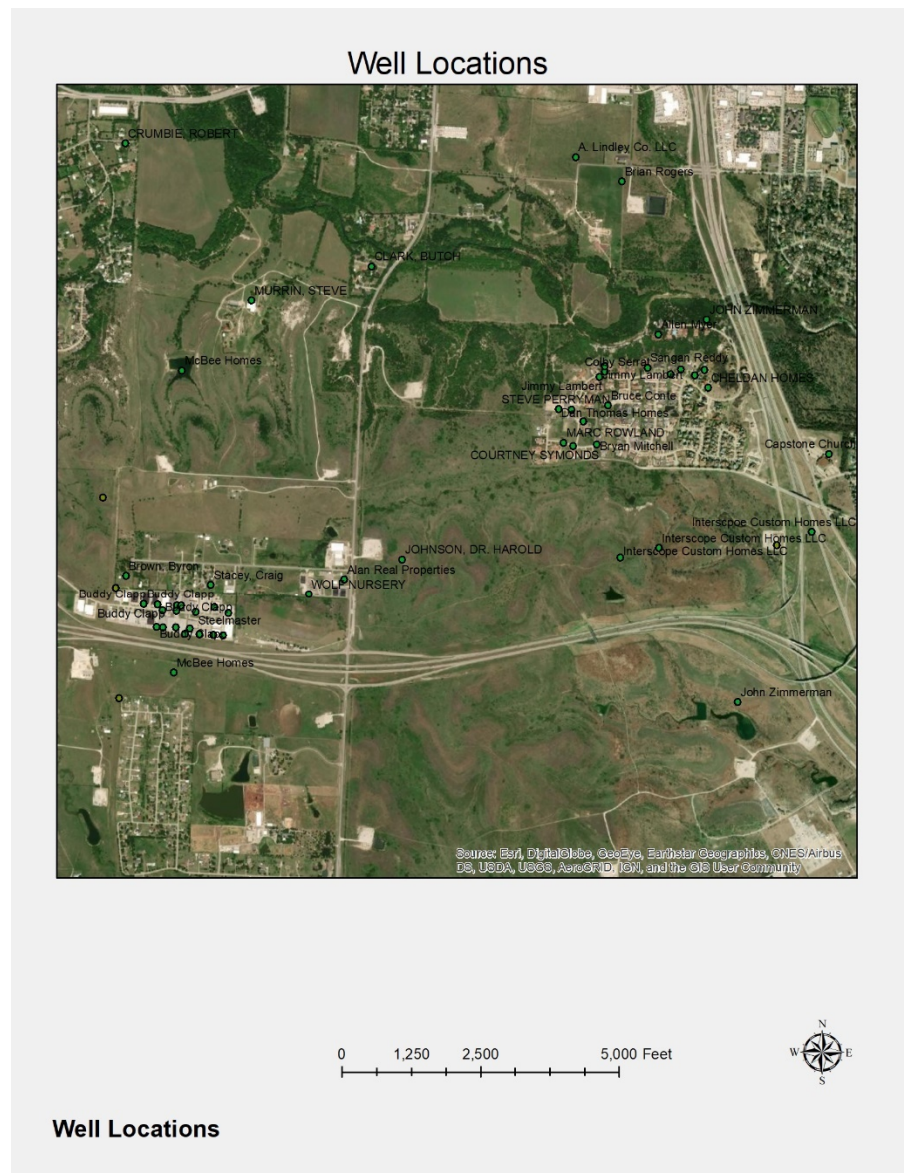
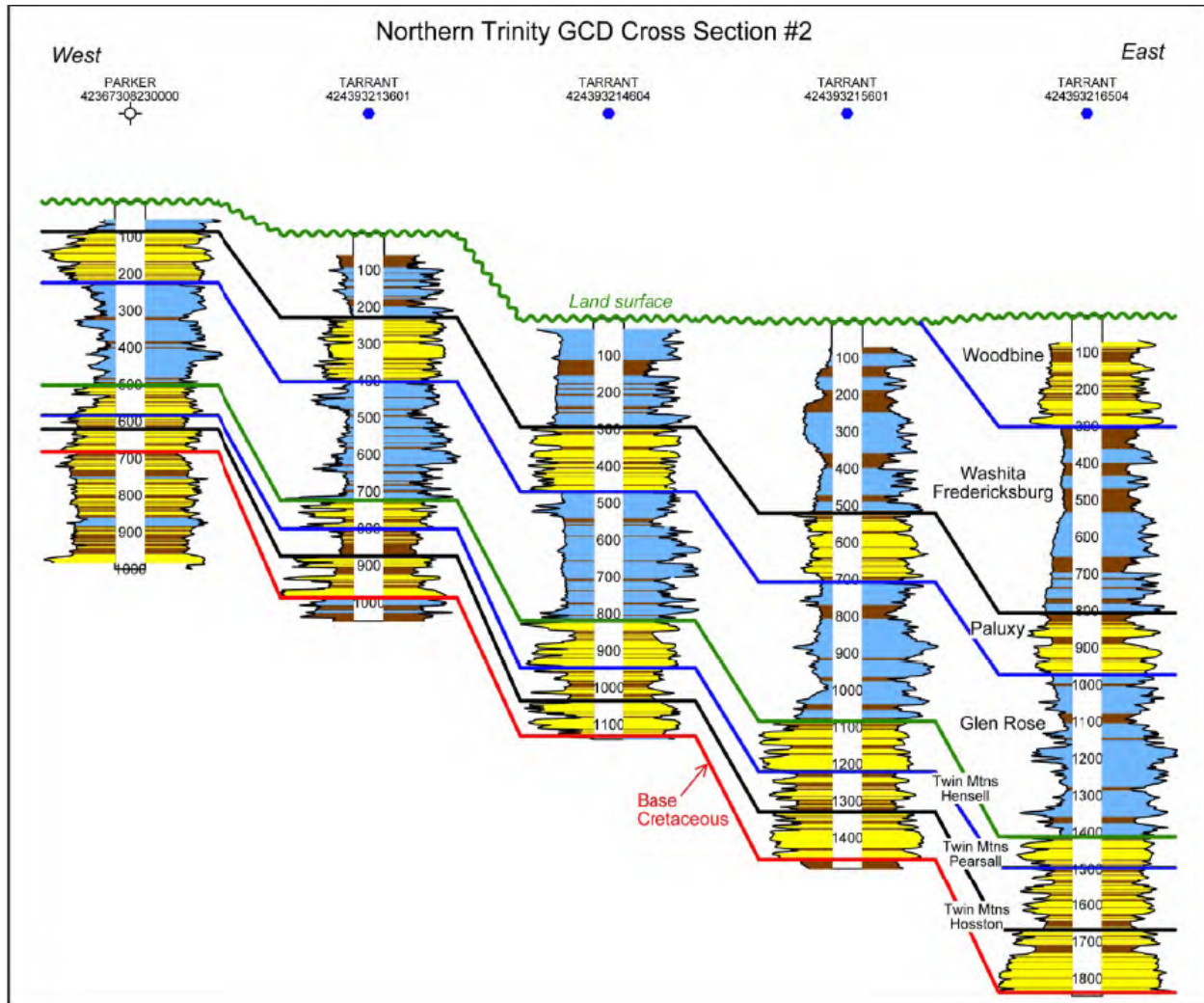


Figure 1: The above image demonstrates existing wells in in the area (BUFF_DIST = measurement in feet)



Source: TWDB GMA 8 GAM

Figure 2: Demonstration of Northern GCD Aquifers and their associated footages by depth

Located below the Paluxy aquifer is the Twin Mountains formation. As shown in Figure 2, the Twin Mountains consist of the Hensell, Pearsall, and the Hosston. Typically, the Pearsall is distinguished by a tighter limey signature. Because the separation in the Twin Mountain formation is so small, they are colloquially known, in combination, as the Trinity. For the purposes of this report, all three formations will be shown and calculated together for simplicity and referred to as such.

We utilized the drilling logs of the six wells in closest proximity to the Montrachet wells to predict aquifer depths and consistent surface (see Figure 3). These 6 wells comprise both gas and water wells. The Silver Saddle well is a Paluxy well, and the others are gas / Trinity wells, but data is extrapolated for Paluxy and Trinity aquifer depth.

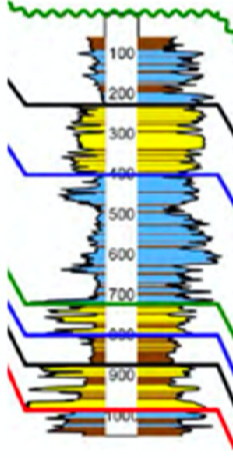
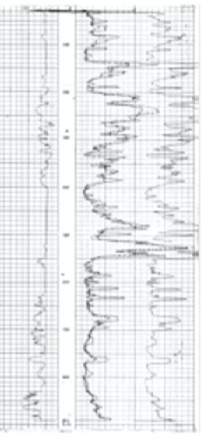
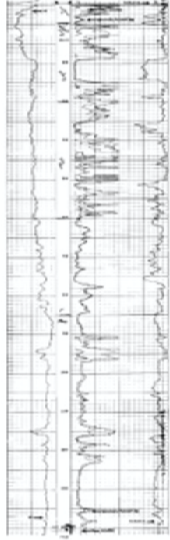
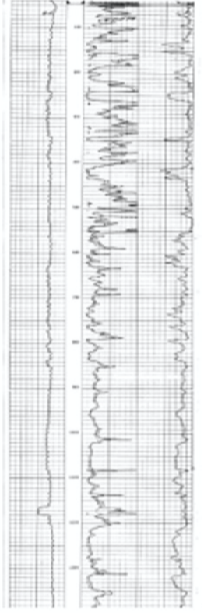
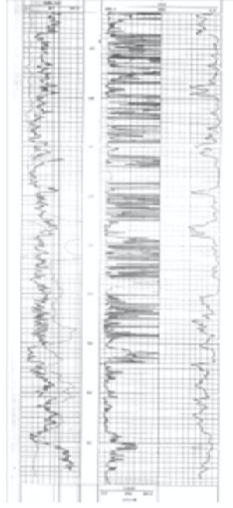
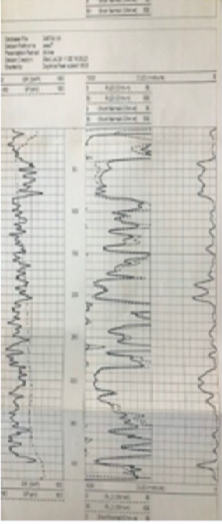
Well name	Jack Wilson	White Settlement	Johnson #2	<u>Murran #1</u>	<u>Markum Ranch</u>	Silver Saddle
Latitude	32.995012	32.743453	32.699825	32.700781	32.690824	32.696311
Longitude	-97.413202	-97.456933	-97.474212	-97.51375	-97.512318	-97.512789
Well Logs						

Figure 3: The well names, corresponding longitude / latitude and well logs for the 6 reference wells are depicted above.

3.4 DEMAND ESTIMATE

The projected demands of the subdivision are based upon the City of Fort Worth average usage of 157 gallons per day (gpd).

The average household size, according to the US census data, is 2.67 persons per household (PPHH), used for calculations.

$$\text{Average Usage} = 157 \text{ gpd} \times 2.67 \text{ pphh} = 420 \text{ gallons per day per household}$$

3.5 RULES AND REGULATIONS

The subdivision is under the jurisdiction of NTGCD. All wells drilled in each of the 14 lots will be considered exempt *so long as the following requirements are met*. The following is an excerpt from NTGCD Rules effective December 17, 2018 – amended May 20, 2020:

SECTION 2. APPLICABILITY OF REGULATORY REQUIREMENTS; EXEMPTIONS

RULE 2.1 WELLS EXEMPT FROM WATER USE FEE PAYMENT, METERING, REPORTING, AND PERMITTING REQUIREMENTS

(a) The requirements of these Rules relating to the permits issued under Section 5, payment of water use fees under Section 6, the requirement to install and maintain a meter under Section 7, and the requirement to report to the District the amount of water produced from a well under Section 3 do not apply to the following types of wells:

- 1) All wells, existing or new, of any size or capacity that are used solely for domestic use, livestock use, poultry use, or agricultural irrigation use (use of groundwater for any purpose associated with a golf course is not agricultural irrigation use);
- 2) An existing well or new well that is not a public water supply well and: i) does not have the capacity, as equipped, to produce more than 17.36 gallons per minute, except as provided by Subsection (b) of this rule; and ii) is used in whole or in part for any purpose of use other than solely for domestic, livestock, poultry, or agricultural irrigation use; or
- 3) Leachate wells and monitoring wells. Wells that qualify for this exemption pursuant to this subsection are still subject to the reporting requirements in District Rule 3.8 and metering requirements of District Rule 7.1 for the purposes of verifying the exemption claimed under this subsection. Any monitoring well that produces over 5,000 gallons per year loses its exempt status under this subsection and is otherwise subject to District Rule 2.2.
- 4) The owners of a closed loop geothermal wells must provide written notice of the existence of such a well to all owners of registered wells located within 200 feet of the closed loop geothermal well. Any well that produces groundwater for use associated with a golf course must comply with Sections 5, 6, and 7 of the District's rules.

All other wells are subject to rule 2.2

RULE 2.2 WELLS SUBJECT TO WATER USE FEE PAYMENT, METERING, REPORTING, AND PERMITTING REQUIREMENTS

(a) All wells not described as exempt under Rule 2.1 are subject to the permitting, water use fee payment, metering, reporting, and other requirements of these Rules, except as provided under Rule 2.3. Such wells include all public water supply wells and all wells or well systems with a capacity, as equipped, to produce more than 17.36 gallons per minute that are used in whole or in part for any purpose of use other than solely for domestic use, livestock use, poultry use, or agricultural irrigation use. Wells equipped to produce groundwater for golf course use must comply with this Section.

(b) Any well that is subject to fee payment under this rule and that provides water for both exempt purposes and purposes not exempt under Rule 2.1 or Rule 2.3 shall pay the water use fee rate established by the District for all water produced from the well, unless the owner or operator can demonstrate through convincing evidence to the satisfaction of the District that a system is or will be in place so as to assure an accurate accounting of water for each purpose of use. Subject to the District's discretion, a well owner or operator that can demonstrate an accurate accounting of water produced for each purpose of use shall only be subject to the water use fee payment and reporting requirements of these Rules for water produced from the well for nonexempt purposes of use.

Well Registration is required with the district citing rule 3.2

(a) The following wells must be registered with the District:

- 1) all new wells, including new wells exempt under Rules 2.1 or 2.3; and
- 2) all existing wells that are not exempt under Rule 2.1.

(b) A person seeking to register a well shall provide the District with the following information in the registration application on a form provided by the District:

- 1) the name and mailing address of the registrant and the owner of the property, if different from the registrant, on which the well is or will be located;
 - 2) if the registrant is other than the owner of the property, documentation establishing the applicable authority to file the application for well registration, to serve as the registrant in lieu of the property owner, and to construct and operate a well for the proposed use;
 - 3) a statement of the nature and purpose of the existing or proposed use of water from the well;
 - 4) the location or proposed location of the well, identified as a specific point measured by latitudinal and longitudinal coordinates;
 - 5) the location or proposed location of the use of water from the well, if used or proposed to be used at a location other than the location of the well;
 - 6) the production capacity or proposed production capacity of the well, as equipped, in gallons per minute;
 - 7) a water well closure plan or a declaration that the applicant will comply with well plugging guidelines and report closure to the District;
 - 8) a statement that the water withdrawn from the well will be put to beneficial use at all times;
- and

9) any other information deemed necessary by the Board.

(c) The timely filing of an application for registration shall provide the owner of a well described under Subsection (a)(2) with evidence that a well existed before December 17, 2018, for purposes of grandfathering the well from the requirement to comply with any well location or spacing requirements of the District and any other entitlements that existing wells may receive under these Rules or under permanent rules adopted by the District. A well that is required to be registered under this Rule and that is not exempt under Rule 2.1 shall not be operated, without first complying with the metering provisions set forth under Section 7.

(d) Once a registration is complete, which for new wells also includes receipt by the District of the well report required by Rule 3.7 and the well registration fee, the registration shall be perpetual in nature, subject to being amended or transferred and subject to enforcement for violations of these Rules.

RULE 3.3 REGISTRATION OF NEW WELLS OR ALTERATIONS TO EXISTING WELLS REQUIRED PRIOR TO DRILLING OR ALTERATION

(a) An owner or well driller, or any other person legally authorized to act on their behalf, must submit and obtain approval of a registration application and submit a well registration fee under Rule 6.3 and a well report deposit under Rule 6.6 with the District before any new well, except leachate wells or monitoring wells, may be drilled, equipped, or completed, or before an existing well may be substantially altered with respect to size or capacity.

(b) A registrant for a new well has 120 days from the date of approval of its application for well registration to drill and complete the new well, and must file the well report with the District within 60 days of completion. However, if the well is for a public water system, the registrant shall have 240 days to drill and complete the new well from the date of approval of its application for well registration, in order to allow time for TCEQ approval(s), and must file the well report within 60 days of well completion. Such a public water system registrant may apply for one extension of an additional 240 days or may resubmit an identical well registration without the need to pay an additional well registration fee.

(c) If the well report is timely submitted to the District, the District shall return the well report deposit to the owner or well driller. In the event that the well report required under this rule and Rule 3.5 is not filed within the deadlines set forth under Subsection (b) of this rule, the driller or owner shall forfeit the well report deposit and shall be subject to enforcement by the District for violation of this rule.

(d) Notwithstanding any other rule to the contrary, the owner and driller of a new well are jointly responsible for ensuring that a well registration required by this section is timely filed with the District and contains only information that is true and accurate. Each will be subject to enforcement action if a registration required by this section is not timely filed by either, or by any other person legally authorized to act on the behalf of either. (use of groundwater for any purpose associated with a golf course is not agricultural irrigation use);

1) An existing well or new well that is not a public water supply well and: iii) does not have the capacity, as equipped, to produce more than 17.36 gallons per minute, except as provided by Subsection (b) of this rule; and iv) is used in whole or in part for any purpose of use other than solely for domestic, livestock, poultry, or agricultural irrigation use; or exempt well are not subject to the spacing requirement.

Rule 4.1 and 4.2 are included for reference:

RULE 4.2 SPACING AND LOCATION OF NEW WELLS

(a) To minimize as far as practicable the drawdown of the water table and the reduction of artesian pressure, to prevent interference between water wells, to prevent degradation of water quality, and to prevent waste, all new wells drilled within the boundaries of the District after December 17, 2018 must comply with the spacing and location requirements as follows:

- 1) All water wells must comply with the regulations set forth under the Texas Water Well Drillers and Pump Installers Administrative Rules, Title 16, Part 4, Chapter 76, Texas Administrative Code, unless a written variance is granted by the Texas Department of Licensing and Regulation and a copy of the variance is forwarded to the District by the applicant or registrant, and must be drilled and located in compliance with applicable rules and regulations of other political subdivisions.
- 2) All water wells must comply with the following minimum spacing requirements:

Maximum Production Capacity (gallons per minute)	Minimum Spacing from Registered Wells
< 20	200
20-39	600
40-59	1000
60-79	1400
80-99	1800

* Vertical Spacing: If the screened interval of the proposed well is separated vertically by more than fifty (50) feet from the screened interval of a registered well, that registered well is not considered when evaluating compliance with horizontal well spacing requirements.

(b) After authorization to drill a new well has been granted by the District, the well may only be drilled at a location that is within ten (10) yards (30 feet) of the location specified in the registration.

(c) Replacement wells must be actually drilled and completed so that they are located no more than 50 feet from the well being replaced, unless otherwise authorized by Rule 3.10(d).

(d) Compliance with the spacing and location requirements of these rules does not necessarily authorize a person to drill a well at a specified location in the District. Agencies or other political subdivisions of the State of Texas that are located in whole or in part within the boundaries of the District may impose additional requirements related to the drilling or completion of water wells.

(e) The owner and driller of a well are jointly responsible for ensuring that the well is drilled at a location that strictly complies with the location requirements of Subsection (b). If the board determines that a well is drilled at a location that does not strictly comply with the location requirements of Subsection (b), the Board may, in addition to taking all other appropriate enforcement action, require the well to be permanently closed or authorize the institution of legal action to enjoin any continued drilling activity or the operation of the well.

(f) Exception to Spacing Requirements. A well that is to be drilled or operated solely for domestic use, livestock use, poultry use or agricultural irrigation use overlying a tract of land regardless of tract size that is to be either drilled, equipped, or completed so that the well is incapable of producing more than 17.36 gallons per minute of groundwater and that:

- 1) the tract of land was part of an original application for development; a planned development of real property; or an approved plat prior to December 17, 2018; and
- 2) the tract of land is not further configured or subdivided into smaller tracts of land after December 17, 2018 and prior to the drilling, completion, or equipping of the well, unless required by a change in city or county requirements.

All metering and reporting requirements are not applicable to wells exempt under rule 2.1. The NTGCD rules can be found in their entirety at www.ntgcd.com.

3.6 WATER QUALITY

Water samples were obtained from two representative water wells in proximity to Montrachet, both in the Paluxy aquifer. One was the unnamed well at the end of Palencia Court in Montserrat, and the other in the Silver Saddle subdivision. Water chemistry meets the State of Texas drinking water standards. The only analyte that had any exceedance was iron in the Silver Saddle well exceeding the secondary constituent of 0.3. However, it is noted that the well is new and there is residual material from the drilling process; no other issues with iron have been anecdotally reported in the area. The well in Montserrat showed no exceedances and showed to provide acceptable drinking water for household use.

Analyte Name	Units	Montserrat Results (mg/L)	Silver Saddle Results(mg/L)	Maximum Contaminate Level(mg/L)
Metals				
Aluminum ND ug/L	mg/L	ND	0.186	0.2
Arsenic	mg/L	ND	ND	0.01
Calcium	mg/L	52.1	59	N/A
Calcium, Total as CaCO3	mg/L	N/A	147	N/A
Copper	mg/L	ND	ND	1
Iron	mg/L	ND	0.426	0.3
Lead	mg/L	ND	ND	0.015
Manganese	mg/L	ND	0.0404	0.05
Sodium	mg/L	56.1	35	N/A
Zinc	mg/L	ND	0.609	5
Alkalinity				
Alkalinity, Hydroxide (CaCO3)	mg/L	ND	ND	N/A
Alkalinity, Phenolphthalein	mg/L	ND	ND	N/A
Alkalinity, Total as CaCO3	mg/L	130	252	N/A
Alkalinity, Bicarbonate (CaCO3)	mg/L	130	ND	N/A
Alkalinity, Carbonate (CaCO3)	mg/L	ND	ND	N/A
TDS				
Total Dissolved Solids	mg/L	359	316	1000
4500H+ pH, Electrometric				
pH	Std. Units	7(@25C)	7.7 (@18C)	N/A
300.0 IC Anions				
Nitrate as N	mg/L	ND	ND	10
Nitrite as N	mg/L	ND	ND	1
300.0 IC Anions 28 Days				
Chloride	mg/L	ND	8.87	N/A
Fluoride	mg/L	ND	0.161	2
Sulfate	mg/L	99.4	36.8	300

Figure 4: Water Quality test results for the two sampled wells (received week beginning 9/15).

3.7 WATER AVAILABILITY

Water availability is well established in the area. Underlying the study area are 3 major aquifers, the shallower being the Paluxy.

In the study area, typical penetration depths for the top of the Paluxy are approximately 200 - 300 ft. Typical well depths at the bottom of the Paluxy are on average about 350 ft below ground level. The Paluxy wells are capable of producing more than the maximum 17.36 gallons per minute (GPM) required for exempt domestic use.

In the test well the water surface reaches equilibrium at approximately 590 feet msl. There will be slight variations in piezometric surface of the aquifer. The provided Google Earth file (.kml) will allow the existing wells to be visualized individually for depths. Please refer to the ‘Supplemental Information’ Google Earth for static levels in existing wells.

3.71 PUMP TESTING

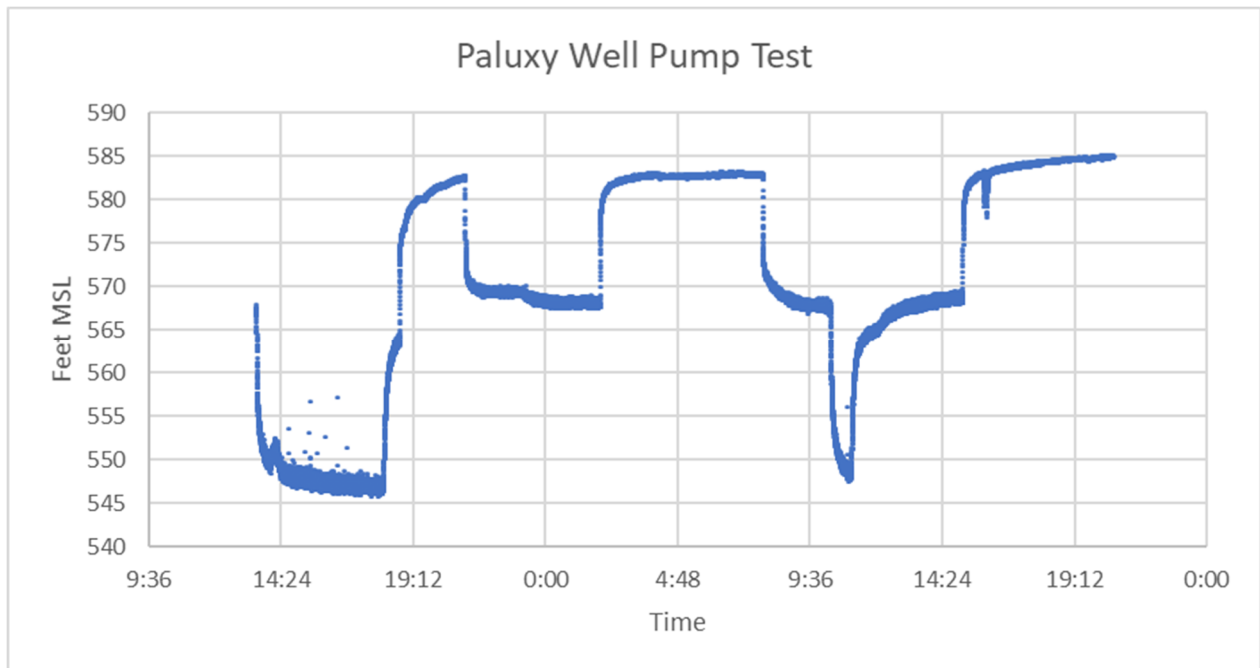


Figure 5: Pump test data acquired from the Silver Saddle well.

The pump test was conducted on simultaneous producing wells placed 18 feet apart. This is characterized by the dualling logarithmic drawdown curves that exhibit the superimposition with one another. This data was acquired, and simulations run with different parameters until the aquifer properties were retroductively determined from the pump test. Starting points were interpolated from maps provided by the TWDB GMA 8 GAM. Values were adjusted from the starting values to fit the pump test. The new values were then inputted, and the simulations run.

The test makes several assumptions. This is a Theis drawdown calculation which is a theoretical drawdown between two wells. There are a host of assumptions associated with this calculation. However, the drawdowns will be adequate in the theoretical wells assuming isolation boundary conditions. The simulations do not consider the superposition of multiple wells in a well field which would require a field study. The amounts are assumed because water use is intermittent. Average usage is extrapolated through the day to simulate what a constant withdrawal would be based upon that daily usage. In this instance, 420 gallons per day or .29 gpm are used for estimations. A drawdown for 17 gpm, or the maximum exempt withdrawal, is also provided.

3.72 DRAWDOWN CALCULATIONS

Paluxy pump test Scenario 1:

This scenario is based upon the 200 ft spacing that is the minimum required for the NTGCD rules. Values are obtained by calibration from the Paluxy pump test shown above. The constant usage of .29 gpm is used to represent 420 gallons per day. This would be the long-term effect on a well at the edge of a 200 foot minimum spacing requirement.

INPUTS:

Constant pumping rate (Q): 0.000646 cfs
 Aquifer transmissivity (T): 350 ft²/day or 0.004051 ft²/second

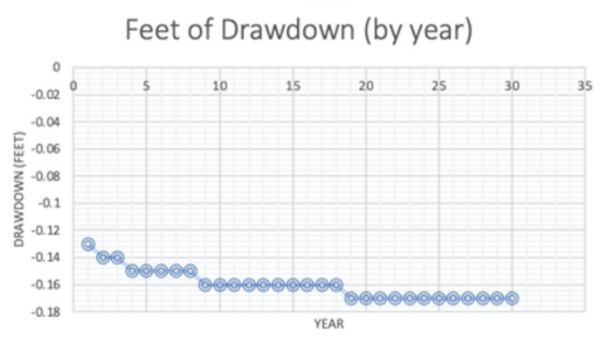
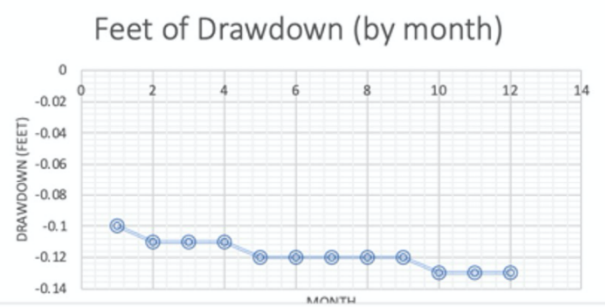
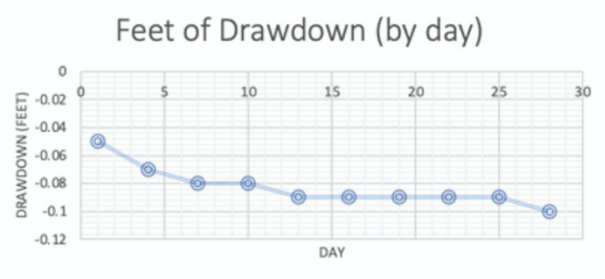
Time since pumping began (t): 1 days
 Radial distance from well (r): 200.00 feet
 Aquifer storativity (S): .0003
 Q is the constant pumping rate (L³/T; ft³/day or m³/day)

h is hydraulic head (L; ft or m)
 ho is hydraulic head before pumping started (L; ft or m)

ho-h is the drawdown (L; ft or m)
 T is aquifer transmissivity (L²/T; ft²/day or m²/day)
 t is time since pumping began (T; days)
 r is radial distance from the pumping well (L; ft or m)
 S is aquifer storativity (dimensionless)
 b is aquifer thickness (L; ft or m)

u: 0.008571
 W(u) series: 4.19067396196911

Drawdown (ho-h) at day 1: 0.05 ft using series calculation of W(u) to u⁶



Paluxy pump test Scenario 2:

This scenario would be based upon the maximum allowable usage (17.5 gpm) 24 hours a day, with spacing at a minimum of 200 ft.

INPUTS:

Constant pumping rate (Q): 0.037876 cfs
 Aquifer transmissivity (T): 350 ft²/day or 0.004051 ft²/second
 Time since pumping began (t): 1 days
 Radial distance from well (r): 200.00 feet
 Aquifer storativity (S): .0003

Q is the constant pumping rate (L³/T; ft³/day or m³/day)
 h is hydraulic head (L; ft or m)

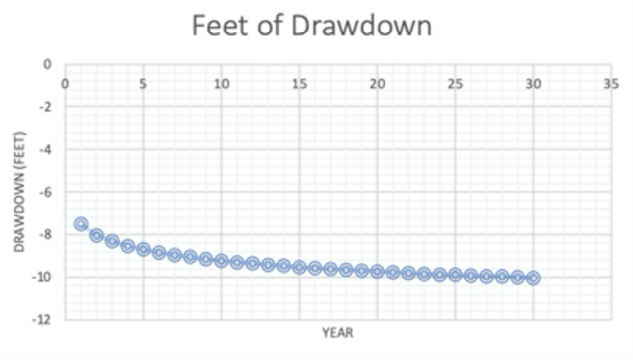
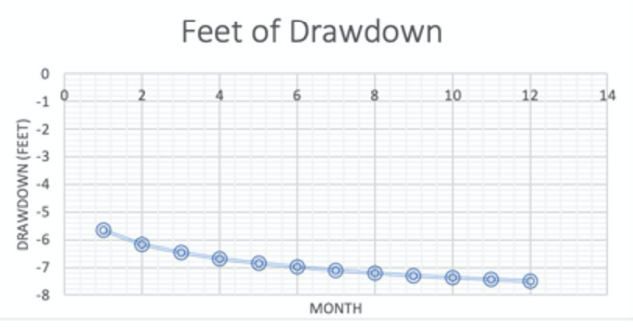
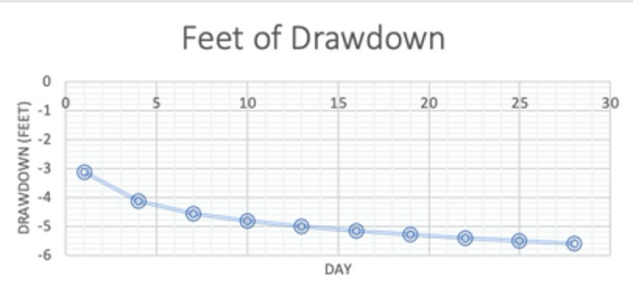
h₀ is hydraulic head before pumping started (L; ft or m)
 h₀-h is the drawdown (L; ft or m)

T is aquifer transmissivity (L²/T; ft²/day or m²/day)
 t is time since pumping began (T; days)
 r is radial distance from the pumping well (L; ft or m)
 S is aquifer storativity (dimensionless)
 b is aquifer thickness (L; ft or m)

u: 0.008571

W(u) series: 4.19067396196911

Drawdown (h₀-h) at day 1: 3.12 ft using series calculation of W(u) to u₆



Paluxy pump test Scenario 3:

Scenario 3 assumes a 1000 ft spacing with a daily usage of 420 gallons per day. This would most likely be the impact on any commercial well which would typically have a 1000 ft spacing depending on production.

INPUTS:

Constant pumping rate (Q): 0.000657 cfs
 Aquifer transmissivity (T): 350 ft²/day or 0.004051 ft²/second

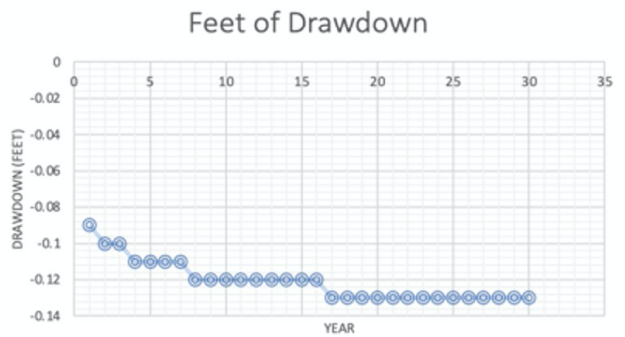
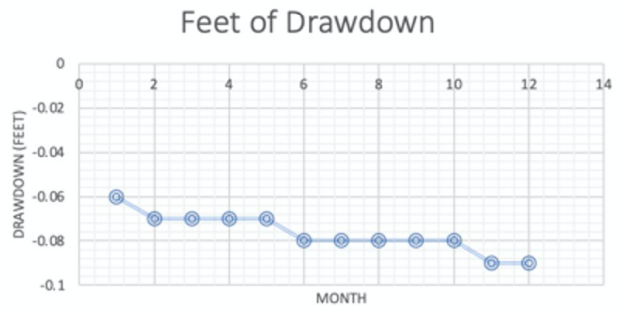
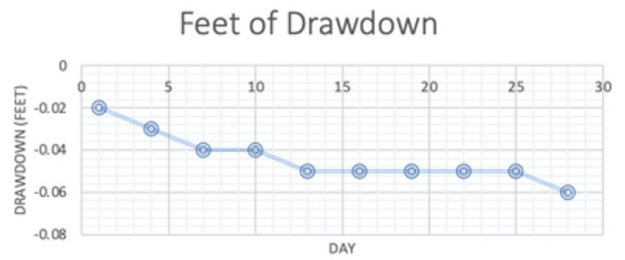
Time since pumping began (t): 1 days
 Radial distance from well (r): 1,000.00 feet
 Aquifer storativity (S): .0003
 Q is the constant pumping rate (L³/T; ft³/day or m³/day)

h is hydraulic head (L; ft or m)
 ho is hydraulic head before pumping started (L; ft or m)

ho-h is the drawdown (L; ft or m)
 T is aquifer transmissivity (L²/T; ft²/day or m²/day)
 t is time since pumping began (T; days)
 r is radial distance from the pumping well (L; ft or m)
 S is aquifer storativity (dimensionless)
 b is aquifer thickness (L; ft or m)
 u: 0.214286

W(u) series: 1.16657657774437

Drawdown (ho-h) at day 1: 0.02 ft using series calculation of W(u) to u6



The Trinity pump test lack data for any calibration. Typical transmissivity and storativity values were taken from the GMA 8 GAM. These values are interpolated estimated aquifer parameters and used as the simulation parameters.

Trinity Drawdown Scenario 1

This scenario assumes the same parameters as Paluxy Pump Test Simulation 1. Usage is equal to 420 gpm. Spacing is the minimum 200 feet.

INPUTS:

Constant pumping rate (Q): 0.000657 cfs
 Aquifer transmissivity (T): 500 ft²/day or 0.005787 ft²/second

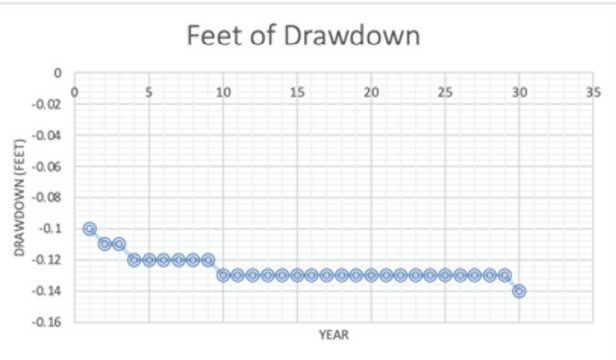
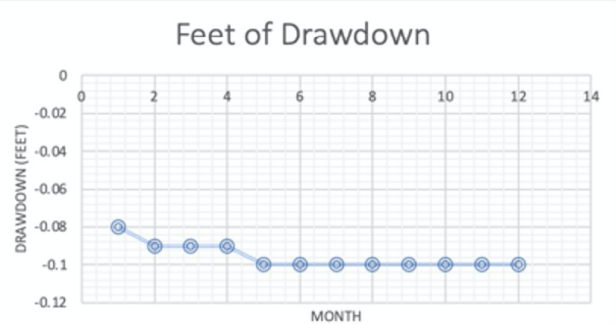
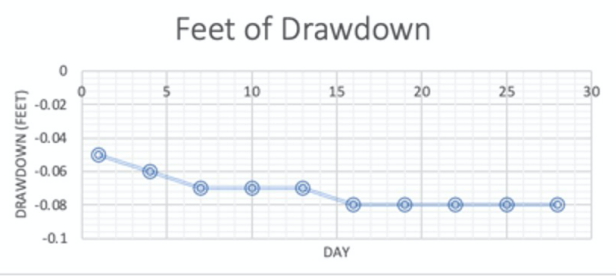
Time since pumping began (t): 1 days
 Radial distance from well (r): 200.00 feet
 Aquifer storativity (S): .0001
 Q is the constant pumping rate (L³/T; ft³/day or m³/day)

h is hydraulic head (L; ft or m)
 ho is hydraulic head before pumping started (L; ft or m)

ho-h is the drawdown (L; ft or m)
 T is aquifer transmissivity (L²/T; ft²/day or m²/day)
 t is time since pumping began (T; days)
 r is radial distance from the pumping well (L; ft or m)
 S is aquifer storativity (dimensionless)
 b is aquifer thickness (L; ft or m)

u: 0.002000
 W(u) series: 5.63940709886647

Drawdown (ho-h) at day 1: 0.05 ft using series calculation of W(u) to u6



Trinity Drawdown Scenario 2

This scenario assumes a 24 hour per day pumping of the maximum allowed exempt amount of 17.5 gpm. The spacing is set to the minimum 200 feet allowance.

INPUTS:

Constant pumping rate (Q): 0.037876 cfs
 Aquifer transmissivity (T): 500 ft²/day or 0.005787 ft²/second

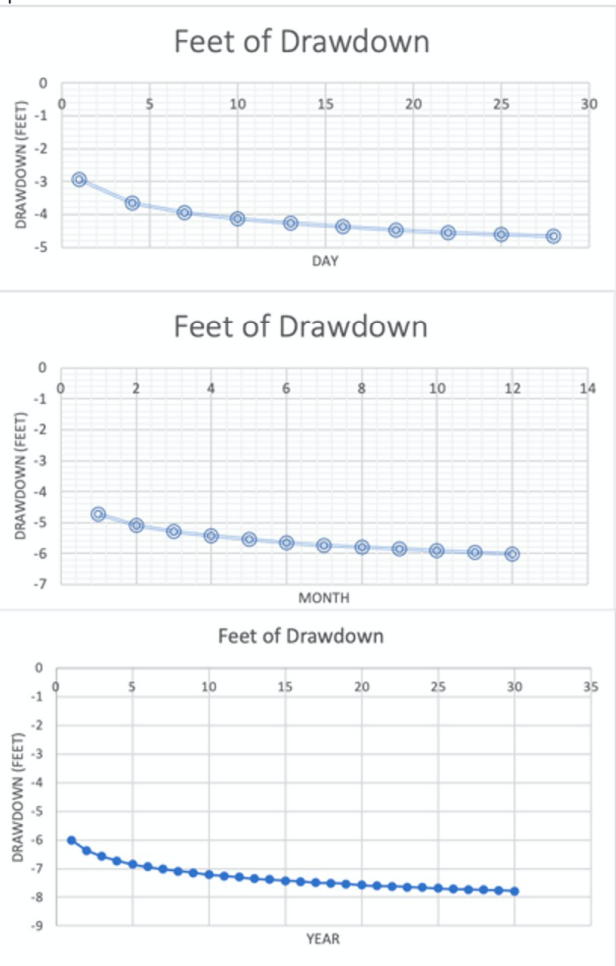
Time since pumping began (t): 1 days
 Radial distance from well (r): 200.00 feet
 Aquifer storativity (S): .0001
 Q is the constant pumping rate (L3/T; ft3/day or m3/day)

h is hydraulic head (L; ft or m)
 ho is hydraulic head before pumping started (L; ft or m)

ho-h is the drawdown (L; ft or m)
 T is aquifer transmissivity (L2/T; ft2/day or m2/day)
 t is time since pumping began (T; days)
 r is radial distance from the pumping well (L; ft or m)
 S is aquifer storativity (dimensionless)
 b is aquifer thickness (L; ft or m)

u: 0.002000
 W(u) series: 5.63940709886647

Drawdown (ho-h) at day 1: 2.94 ft using series calculation of W(u) to u6



It is determined that minimal impacts will be observed in the well field. Strong aquifer characteristic coupled with minimal high demand usage shows small, insignificant impact to the aquifer. No significant long-term temporal impacts are observed on any scenarios simulating actual use. Should full usage, meaning 17.5 gpm for 24hours a day, ever be needed then a well field study would be recommended. However, low usages predict minimal impacts. It should be noted that infinite boundary conditions are assumed. Only the wells considered are simulated. Aquifer piezometric surfaces fluctuate. With population growth in the area it is to be assumed that aquifer levels will decline with extended periods of time. To mitigate risk, it is strongly recommended that each well drilled penetrate the full depth of its respective aquifer.

Refer to the geological supplement for well spacing scenarios. Careful consideration of well placement for all lots need to be simulated before each well is drilled. Each well is required a minimal spacing of 200 feet from another well and 50 feet from the property line. If grouting is used the well can be offset by 5 feet. However, this is not recommended, has no precedent set with NTGCD, and has a reasonably high probability of being contested.

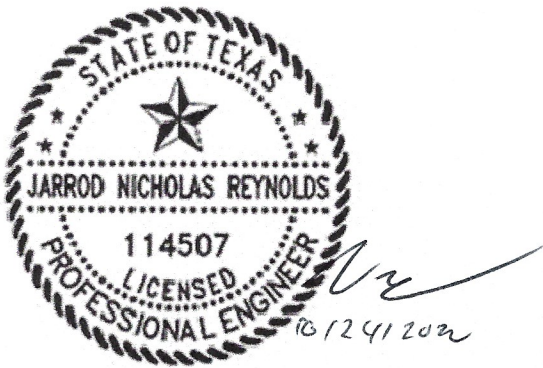
4.0 SIGNATURE / STAMP

PRINTED NAME:

Jarrold Reynolds P.E.

SIGNATURE:

[Handwritten signature]



COMPANY: Triple Z Engineering, LLC F-18750

DATE: 10/24/2020