

Continuance of Permit Hearing
Item #9

NOTICE OF PERMIT HEARING OF THE CLEARWATER UNDERGROUND WATER CONSERVATION DISTRICT

Notice is hereby given that the Board of Directors for the Clearwater Underground Water Conservation District will conduct a hearing on one Application for Permit as described below at 1:30 p.m. on Wednesday, January 11, 2023, in the Clearwater UWCD Board Room located at 700 Kennedy Court, Belton, Texas, in compliance with the Texas Open Meetings Act.

The hearing will be conducted on the following application:

Applicant's File Number/Name	Permit Applicant/Holder and Landowner	Location of Well/Wells	Proposed Annual Groundwater Withdrawal Amount & Purpose of Use
<p>Operating Permit Hearing related to:</p> <p>N3-22-001P Existing Well</p>	<p>Hanks-Cabiness Christian Trust & RREAF Holdings, LLC</p> <p>c/o Stephen Chad Stewart RREAF Holdings, LLC 1909 Woodall Rodgers Fwy Ste 300 Dallas, TX 75201</p> <p>(254) 624-2364</p>	<p>The proposed permitted well is located at:</p> <p>Latitude 30.93497° Longitude -97.53675</p> <p>The proposed annual quantity is not to exceed 19.2 acre-feet or 6,256,339 gallons per year total for landscape irrigation only.</p> <p>The existing well is completed in the Edwards BFZ Aquifer.</p> <p>The existing well is located in the CUWCD Edwards BFZ Management Zone.</p> <p>The well is to be equipped with a maximum 2-inch column pipe with a submersible pump rate not to exceed 50 gallons per minute on the 14.387-acre tract located on the N.E. corner of IH35 and FM 2268 in Salado TX.</p>	<p>Request for an Operating Permit on an existing well,</p> <p>N3-22-001P for an operating permit authorized for commercial landscape irrigation not to exceed 19.2 ac-feet/yr or 6,256,339 gallons per year.</p> <div style="text-align: center; margin-top: 20px;"> <p>RECEIVED FOR POSTING: 2022 DEC 29 A 9:10 SHELLEY COSTON CO. CLK. BELL CO. TX</p> </div>

The Applications for Permit and Permit Amendments, if granted, would authorize the permit holders to operate wells within the Clearwater Underground Water Conservation District according to the terms and conditions set forth in the permit. A person wishing to submit a Contested Case Hearing Request under District Rule 6.10.15(d) who is unable to appear at the hearing on the date and time set forth above must also file a motion for continuance with CUWCD demonstrating good cause for the inability to not appear.

For additional information about this application or the permitting process, or to request information on the legal requirements on what MUST be included for a Contested Case Hearing Request to be valid, please contact CUWCD at 700 Kennedy Court (PO Box 1989) Belton, Texas, 76513, 254-933-0120.

ISSUED this 29th day of December 2022 in Belton, Texas, on the recommendation of the General Manager.

I, the undersigned authority, do hereby certify that the above NOTICE OF PERMIT HEARING of the Board of Directors of the Clearwater Underground Water Conservation District is a true and correct copy of said Notice. I have posted a true and correct copy of said Notice at the District office located in Belton, Texas, and said Notice was posted on December 29, 2022, and remained posted continuously for at least 10 (ten) days immediately preceding the day of said hearing; a true and correct copy of said Notice was furnished to the Bell County Clerk, in which the above-named political subdivision is located.

Dated 12/29/2022

Clearwater Underground Water Conservation District

By: 
Dirk Aaron, General Manager

Request for Continuance
Recieved 4/6/2023 @ 6:01 pm



RREAF HOLDINGS

Stephen Chad Stewart, PE
Partner
RREAF Holdings, LLC

04/06/2023

Dirk Aaron
General Manager
Clearwater Underground Water Conservation District
700 Kennedy Court
Belton, Texas 76513

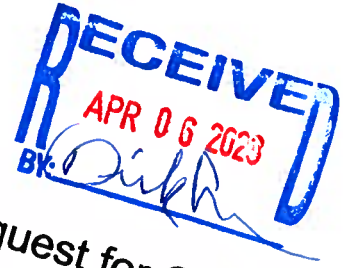
RE: Salado Sanctuary Well Operating Permit

Dear Mr. Aaron,

RREAF Holdings, LLC (RREAF) would like to request a 30-day continuance to the hearing to allow additional time to review data obtained during the pumping test. RREAF would like to determine the viability of reducing the requested water volume while still meeting the irrigation needs.

Sincerely,

Stephen Chad Stewart, PE
Partner
RREAF Holdings, LLC



Request for Continuance
Recieved 4/6/2023 @ 6:01 pm

CUWCD Executive Summary

Follow-Up Staff Report
Application for *Operating* Permit
Continue January 11 Public Hearing
Receive Request for Continuance by Applicant
N3-22-001P



Applicant/Owner: *Sanctuary of Salado
The Hanks-Cabiness Christian Trust
c/o Stephen Chad Stewart, PE , RREAF Holdings LLC
1909 Woodall Rodgers Fwy, STE 300
Dallas, TX 75201*

Location of Well:

Proposed Annual Elements	Proposed Use	Aquifer:	Nearest Existing Wells:
<p>Initial Rate : 50 gpm</p> <p>Column Pipe Size: 2-inch</p> <p>Withdrawal:</p> <p>Proposed annual quantity not to exceed <u>19.2</u> acre-feet/year or <u>6,256,339</u> gallons/year</p>	<p><i>Commercial Landscape use only</i></p>	<p><i>Edwards BFZ</i></p>	<p>Total 35 wells within 1/2 mile of the existing well.</p> <p>Note: All wells within ½ mile appeared to be completed in the <u>Edwards BFZ Aquifer</u></p>

General Information

Mr. Chad Stewart, with RREAF Holdings, LLC (REAFF) submitted an administratively complete application on November 1, 2022. The application went to public hearing on January 11, 2023, and was deemed a Contested Case Hearing with 10 individuals establishing party status thus legal standing to protest the application. The Presiding Officer, with board action, instructed the applicant and staff to conduct the following so that the hearing could be continued at either the March 8th board meeting or at the April 12th board meeting.

The results of the prescribed instructions to the applicant and district staff per Rule 6.9.2(f) have been submitted and in today’s packet. This informs the best available science for the Board before they make their final decision on the permit application of 19.2-acre ft/year from existing well.

The findings and opinions of the District GM and Geoscientist Mike Keester have been prepared for today's continued hearing and will be presented to the Board.

The application stated that they are developing an approximately 14.387-acre tract in Salado, TX at the N.E. corner of I-35 and FM2 268. His documents clearly state the specific area in the proposed (attached) Plat-Landscape Overlay. RREAF, on-behalf of the Hanks-Cabiness Christian Trust, is requesting an Operating Permit for an existing water well (CUWCD Well number N3-22-001P) on the property for commercial landscape irrigation use only for a proposed development known as "Sanctuary of Salado".

In the previous Executive Summary the District highlighted the following:

- 1) The development wishes to utilize groundwater for landscape irrigation only to maintain landscaped areas along the street right of ways, and a trail system that will be accessible for the public.
- 2) The application stated that the landscape scope will utilize plant selections that are drought-resistant species such as native Texas Bermuda grass, and drought-tolerant trees and shrubs.
- 3) The irrigation system is designed for maximum efficiency to encourage water conservation per TCEQ requirements.
- 4) The applicant in their needs assessment for 19.2 ac-ft/year references the option of public water (purchased) and testified that gray water from the Village was not an affordable option..

The prescribed Pumping test was initiated by the applicant and their geoscientist on March 2, 2023. The District Staff meet with all parties and agreed to the test preparation and discharge of the pumping groundwater to the adjacent retention pond. They conducted the test by pumping the well at 50 gpm for more than 48 hours. During the test they monitored the water levels in the pumping well and the observation well (M-22-001P) located approximately 350 feet north of the pumping well.

The full analysis of the pumping test by Mike Keester (attached) illustrated in his scientific assessment of the pumping test, that in accordance with District Rule 6.10.24(c) that the desired permitted amount of 19.2 ac-ft/year "does unreasonably" affect existing groundwater resources, existing permit holders and existing exempt well owners in the prescribed radius of the pumping well. He will testify on April 12th to his findings and opinions.

Following the March 29th meeting with the applicant and his geoscience consultant, the applicant was provided the District's formal assessment by Mike Keester. At that time the applicant was encouraged to present any differing opinions of the scientific results and/or additional science providing an alternative opinion when the Board reconvenes the public hearing, set for April 12, 2023 at 1:30pm. The GM stated by email, his plans are to present these findings on April 12, 2023, but if the applicant and their parties wish for continuance of the hearing for an additional 30-days (May 10, 2023) that the District GM was more than happy to accommodate the request if received by COB on Monday, April 3rd.

At the same time the applicant was notified that they have the option of reducing the amount of desired groundwater in the permit in a manner that again meets the reasonable metric as described in our meeting. The GM did receive a formal request for a continuance on April 6th at approximately 6:00pm. Chad Stewart will testify why he is asking for an additional 30-day continuance to determine the viability of reducing the requested water volume while still meeting the irrigation needs.

In addition, I have also attached the formal opinion of our consultant, Dr. Stephanie Wong, with LRE Water Inc. and a concurring memo from Dr. Joe Yelderma, Department of Geosciences, Baylor University, as it relates to their observations of the spring complex during the pumping test.

On April 12th the Hearing Continuance will be conducted by Mr. Leland Gersbach, Board President.

Item 6 from the January Hearing the General Manager, Applicants and Consultants were asked the following:

Will the proposed use of water unreasonably affect existing groundwater and surface water resources or existing permit holders? (District Rule 9.9.2(e) and 6.9.2(f) for existing wells requiring a non-exempt operating permit.)

The District rules do not impose production limitations other than those determined applicable in the review of the permit request that necessitates further studies be conducted under District Rule 9.9.2(e) and 6.9.2(f) for the purpose of completing the prescribed elements of the Well Completion Report which includes the necessary minimum 24-hour pumping test while monitoring one or more wells was achieved.

The applicant and their representative understand (per their testimony on January 11, 2023) that the proposed permit for production must not cause any unacceptable level of decline in water quality of the aquifer, or as may be necessary to prevent waste and achieve water conservation. The production must minimize as far as practicable the drawdown of the water table or the reduction of artesian pressure, lessen interference between wells.

*In determining the above requirements the applicant testified that the observation well will be **M-22-001P** on their property but the Exempt Well **E-17-067G** owned by Murray and Patsy Lane located at 404 FM 2268 in Salado was not afforded the applicant and their representatives.*

The District GM then met with Mr. & Mrs. Lane at the District Office on Saturday, January 14th, to discuss the District providing continues water level measurements during the pumping test on their private well E-17-067G. They agreed and the District staff installed the device. Unfortunately, the Eno-Scientific devise (670) experienced a static event during the Red Code Storm during the pumping phase. The data logger was damage due to the staff having to use a 110-volt power source. The device was sent to the manufacture in order that the data might be retrieved but the manufacturing company was unable to retrieve the data. The purpose for having two well redundancy was to provide alternative data points should one of the monitoring well devices fail.

*On January 11, 2023, Mike Keester, RW Harden & Associates, reviewed the application, and offered his conclusions with recommendations stating that the proposed permitted amount of 19.2 acre-feet/year **needs further understanding thus the Board required that the well completion report (4-8) of Rule 6.9.2(f) be attained and return to the board for final approval at a later date.***

The District's GM and Protestants expressed concern that the potential impact on Springflow at the Salado springs complex and the impact to the Salado Salamander should be monitored thus hired Dr. Stephanie Wong, LRE water to survey and monitor the spring complex during the pumping phase. Her report and an additional opinion by Dr. Joe Yelderman are attached.

Conclusions and Recommendations:

- 1) District GM recommends that he and the District Consultant, Mike Keester testify to our findings and opinion that the proposed production is unreasonable due to the long-term impact of the proposed production.
- 2) District GM recommends because the applicant wishes an additional 30 day continuance to assess their options, be granted for 30 more days, thus pause and continue the contested hearing on May 10, 2023.
- 3) District GM recommends that the Board take additional testimony from parties who have established party status all parties to the case.
 - a. Chet Sutton bbsconst@embarqmail.com
 - b. Linda Griffith linda@tbc-group.com
 - c. Session Harrell sessionh@saladowsc.com
 - d. Karen Kinnison kvkinnison@gmail.com
 - e. Warren Stevens sparker69@gmail.com
 - f. KD Hill kd@barrowbrewing.com
 - g. Darlene Walsh, Hslaw hslaw@mygrande.net
 - h. Murray Lane mdlane460@gmail.com
 - i. Sara Whitis sgaelw@hotmail.com
 - j. Randy Bloomer, Bloomer Trailers accounting@bloomertrailers.com
- 4) District GM and Keester will state that not all of the following conditions under Rule 6.9.2(f) have been submitted to inform the Board before its final decision, as required by the Board in January.
 - (4) well completion diagram (incomplete)
 - (5) pump curve (completed)
 - (6) pumping test with the prescribed monitor/observation well (completed)
 - (7) water quality (completed by the District)
 - (8) predicted impacts of the proposed production from the well on existing wells completed within the same aquifer that are within ½ mile of the production well. (completed by the District)
- 3) District GM also offers that to the applicant that one or both of the following options have been reviewed as an alternative:
 - Utilizing public water supply from Salado Water Supply or
 - Pursue an alternative groundwater source (Hensell Layer of the Trinity Aquifer) should the pumping test inform all parties that the amount of groundwater requested has a negative impact on existing well owners and/or potential impact on springs which are all down gradient of the existing well.

Attachments are as follows:

Keester PG Technical Summary of the Pumping Test, 03/29/2023
Wong PhD GIT Technical Memorandum Salado Springs Monitoring, 03/17/2023
Yelderman PhD PG Technical Opinion of Salado Springs Monitoring, 03/17/2023

**Mike Keester, P.G.
Technical Summary**

TECHNICAL MEMORANDUM

To: Dirk Aaron, General Manager – Clearwater Underground Water Conservation District
From: Michael R. Keester, PG – R. W. Harden & Associates, Inc.
Date: March 29, 2023
Subject: Aquifer Test Evaluation Summary and Results of Updated Modeling of Projected Production Related to Hanks-Cabiness Christian Trust Well (N3-22-001P) Operating Permit Application

On March 2, 2023 the applicant initiated an aquifer test using their existing well. They conducted the test by pumping the well at 50 gallons per minute for more than 48 hours. During the test they monitored water levels in the pumping well and an observation well (M-22-001P) located approximately 350 feet north of the pumping well. Figure 1 is a hydrograph illustrating the collected water levels at the two wells.

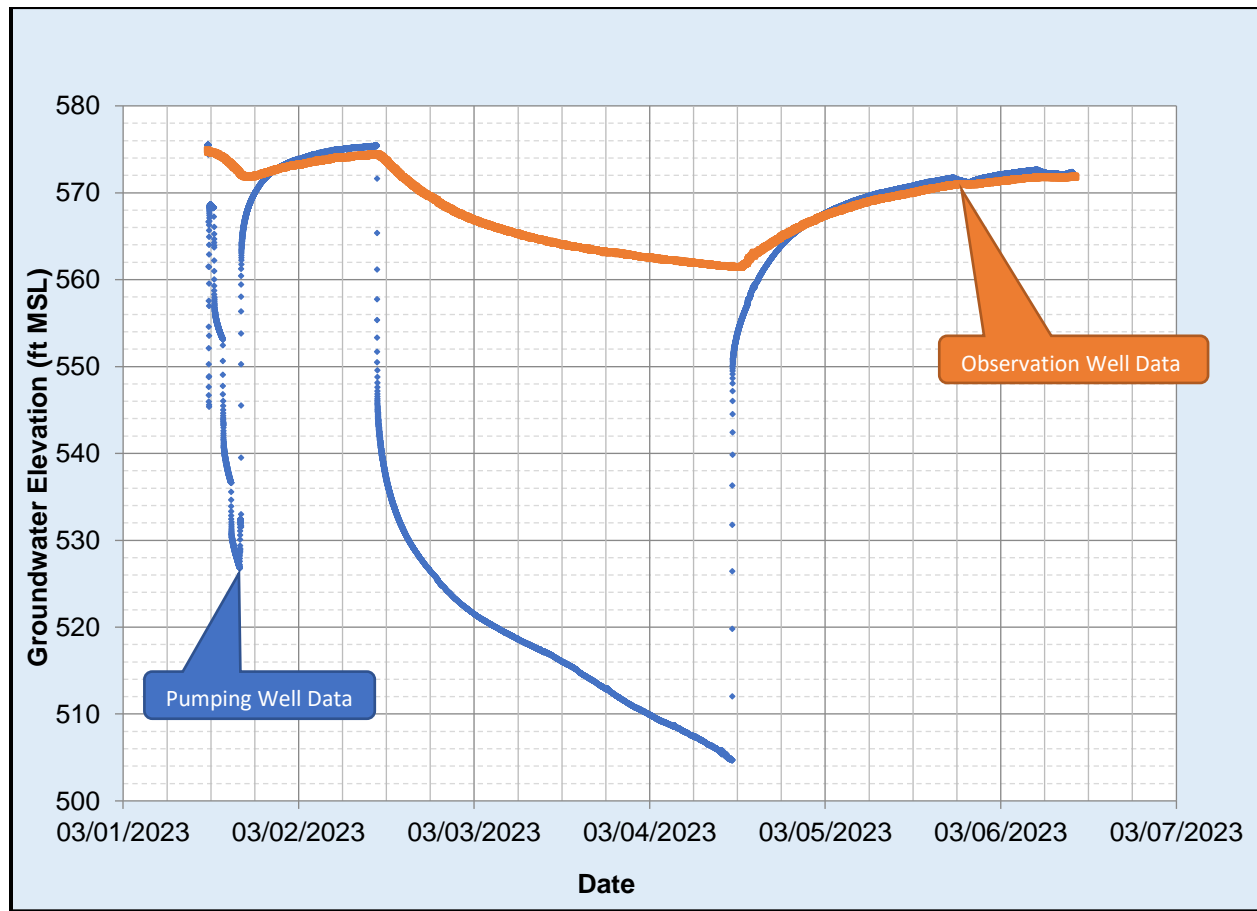


Figure 1. Aquifer test hydrograph.

On Figure 1, declining water level in the two wells between March 2nd and March 4th illustrates the pumping period. The pumping period is immediately followed by the water level recovery period. The data shows an overall decline of 2 to 4 feet in water level from the beginning of the pumping period to the end of the recovery period.

Analysis of the data from the observation well during aquifer test indicates a local aquifer transmissivity of about 1,350 gallons per day per foot (“gpd/ft”) and storage coefficient of 0.00025. Transmissivity values from the pumping well data are lower but may be less representative of aquifer conditions outside of the immediate vicinity of the well. Figure 2 illustrates the trendline match and calculation of aquifer hydraulic parameters from the observation well data.

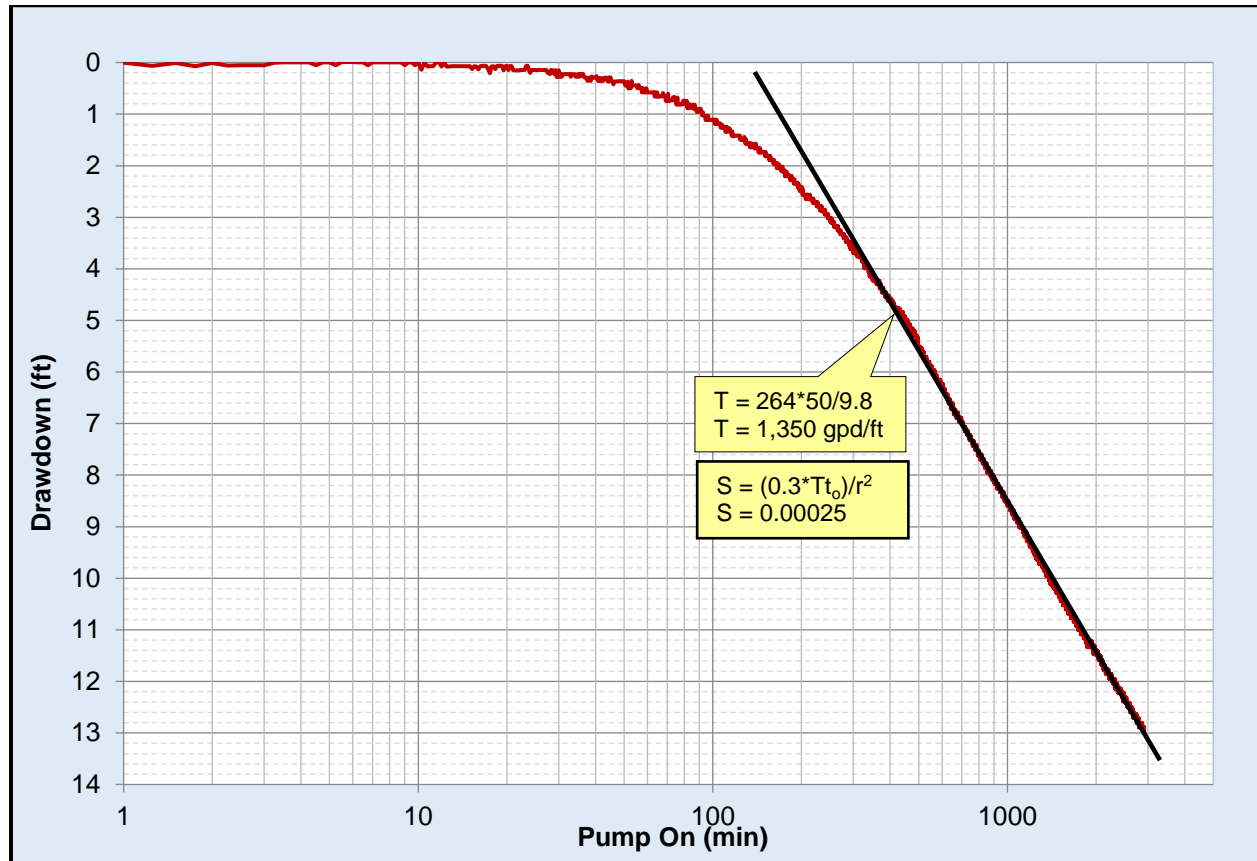


Figure 2. Aquifer test observation well data analysis.

Updated Projected Effect on Existing Wells

We updated the projected effect on existing wells using the same approach as discussed in our December 9, 2022 evaluation except that we used the transmissivity and storage coefficient values derived from the aquifer test. We calculated the potential effects of the proposed production on local water levels in the aquifer using the Theis equation (Theis, 1935), which relates water level decline (that is, drawdown) to the pumping rate of a well and properties of the aquifer. While the equation does not account for aquifer conditions which may affect the calculation of long-term water level declines (for example: aquifer recharge, faulting, or changes in aquifer structure), it does provide a good, reliable, and straightforward method for estimating relatively short-term drawdown in and near a well due to pumping. As the duration of pumping and distance from the well increase, the uncertainty in the calculated drawdown also increases.

Table 1 presents the calculated drawdown based on the proposed annual production rate of 19.2 acre-feet per year from the proposed well. For *1-Day Drawdown*, we applied the proposed instantaneous pumping rate of 50 gallons per minute for a period of 24 hours. For *30-Day Drawdown*, we used an estimated peak monthly demand of 4.52 acre-feet for July as discussed in our December 9, 2022 technical memorandum. For *1-Year Drawdown*, we used the proposed annual production amount. For the 1-Day and 30-Day projected drawdown in the pumping well, we limited the value to 90 feet based on the well completion.

Table 1. Calculated drawdown at N3-22-001P and other nearby wells completed in the Edwards BFZ Aquifer based on an annual production rate of 19.2 acre-feet from the proposed and simulated wells and instantaneous production of 50 gallons per minute.

CUWCD Well ID	Distance from Well (feet)	1-Day Drawdown (feet)	30-Day Drawdown (feet)	1-Year Drawdown (feet)
N3-22-001P (Sanctuary of Salado Well)	—	90 (Max. Value)	90 (Max. Value)	24
E-05-005G	220	17	24	10
E-17-067G	235	16	24	10
M-22-001P (Observation Well)	350	13	21	10
E-02-2275G	578	8	17	8
E-02-2274G	630	7	16	8
E-02-3036G	747	6	15	8
E-18-090GU	749	6	15	8
E-05-004G	1072	4	13	7
E-18-089GU	1076	4	12	7
E-02-3366G	1129	3	12	7
N2-04-014G	1132	3	12	7
E-02-2046G	1178	3	12	7
E-03-407P	1285	3	11	7
E-02-1978G	1391	2	11	7
E-02-3365G	1391	2	11	7
E-19-082GU	1413	2	11	6
E-04-086G	1552	2	10	6
E-05-074G	1671	2	10	6
E-02-3395G	1688	1	10	6
M-08-002G	1812	Negligible	9	6

CUWCD Well ID	Distance from Well (feet)	1-Day Drawdown (feet)	30-Day Drawdown (feet)	1-Year Drawdown (feet)
E-02-1867G	1820	Negligible	9	6
E-11-041P	1821	Negligible	9	6
E-02-863G	1881	Negligible	9	6
N2-02-002G	1957	Negligible	9	6
N2-07-010G	1967	Negligible	9	6
E-02-1889G	2163	Negligible	8	6
E-03-177G	2169	Negligible	8	6
E-02-161G	2210	Negligible	8	6
E-02-215G	2217	Negligible	8	6
E-03-461P	2266	Negligible	8	5
E-02-1602G	2272	Negligible	8	5
E-03-173G	2408	Negligible	7	5
E-02-2110G	2418	Negligible	7	5
N2-02-003G	2474	Negligible	7	5
E-05-069P	2506	Negligible	7	5
E-02-708G	2530	Negligible	7	5
E-02-1890G	2555	Negligible	7	5
N2-02-037G	2596	Negligible	7	5
E-02-100G	2610	Negligible	7	5
E-02-160G	2645	Negligible	7	5
E-02-060G	2725	Negligible	7	5
E-02-313G	2734	Negligible	7	5
E-02-2163G	2759	Negligible	7	5
E-02-1891G	2796	Negligible	6	5
E-02-1982G	2853	Negligible	6	5
E-02-468G	2874	Negligible	6	5
E-17-015G	3016	Negligible	6	5
E-02-3361G	3254	Negligible	6	5
E-02-1612G	3269	Negligible	6	5
E-02-2833P	3307	Negligible	5	5
E-05-006G	3336	Negligible	5	5
E-02-1470G	3363	Negligible	5	5
E-03-176G	3369	Negligible	5	5
E-07-073P	3404	Negligible	5	5
E-03-217G	3408	Negligible	5	5
N2-09-004G	3409	Negligible	5	5
E-02-219G	3437	Negligible	5	5
E-02-046G	3561	Negligible	5	5
E-02-3223G	3589	Negligible	5	4
E-04-002G	3641	Negligible	5	4
N2-02-006G	3695	Negligible	5	4

CUWCD Well ID	Distance from Well (feet)	1-Day Drawdown (feet)	30-Day Drawdown (feet)	1-Year Drawdown (feet)
E-02-597G	3702	Negligible	5	4
E-04-054G	3824	Negligible	5	4
N2-09-002P	3850	Negligible	5	4
E-04-053G	3853	Negligible	5	4
E-02-1538G	3973	Negligible	4	4
E-02-617G	4004	Negligible	4	4
E-05-062G	4040	Negligible	4	4
E-02-841G	4059	Negligible	4	4
E-02-1527G	4079	Negligible	4	4
E-02-1714G	4093	Negligible	4	4
E-02-840G	4106	Negligible	4	4
E-02-839G	4117	Negligible	4	4
E-04-006P	4223	Negligible	4	4
E-13-007P	4261	Negligible	4	4
E-05-096P	4296	Negligible	4	4
E-02-1591G	4340	Negligible	4	4
E-02-3288G	4349	Negligible	4	4
E-03-347G	4368	Negligible	4	4
E-03-174G	4395	Negligible	4	4
E-02-1536G	4416	Negligible	4	4
E-02-3446G	4524	Negligible	4	4
E-16-016P	4534	Negligible	4	4
E-03-456P	4595	Negligible	4	4
E-05-036G	4649	Negligible	4	4
E-02-159G	4714	Negligible	4	4
N2-02-008G	4720	Negligible	4	4
E-02-1535G	4742	Negligible	4	4
E-02-941G	4787	Negligible	4	4
E-02-3453G	4821	Negligible	4	4
E-02-204G	4861	Negligible	3	4
E-02-2661G	4880	Negligible	3	4
E-02-163G	4903	Negligible	3	4
E-02-466G	4938	Negligible	3	4
N2-02-005G	4957	Negligible	3	4
N2-02-010G	4996	Negligible	3	4
E-02-779G	5002	Negligible	3	4
E-02-1191G	5022	Negligible	3	4
E-02-3541G	5074	Negligible	3	4
E-02-3452G	5093	Negligible	3	4
E-02-1696G	5185	Negligible	3	4

Meeting Summary

As discussed during our meeting on March 29, 2023, the projected drawdown is greater than the modeling associated with our December 9, 2022 evaluation. The difference is due to the aquifer parameters from publicly available sources compared to the parameters derived from the aquifer testing. However, for system planning and groundwater management purposes the site-specific testing was necessary to understand the viability of utilizing the well for the desired purpose.

Observed water levels in the pumping well during the aquifer test declined to near the top of the pump within 48 hours of production at 50 gpm. During a peak demand month, the average pumping rate would be about 30 to 35 gpm. At the peak demand month average rate, the observations indicate the aquifer would not be able meet the projected water demand using well N3-22-001P.

Beyond the pumping well, water level decline in neighboring wells is projected to be more the 5 feet after 1 year. In considering a permit application, the District Board must consider whether “the proposed use of water does or does not unreasonably affect existing groundwater and surface water resources or existing permit holders” (Rule 6.10.24(c)). As part of this consideration, the Board reviews the amount of projected drawdown in nearby wells (Table 1) with a value of less than 1 foot being considered negligible.

Geoscientist Seal

The signature and seal appearing on this document was authorized by Michael R. Keester, P.G. on March 29, 2023. R.W. Harden & Associates Texas Board of Professional Geoscientist Firm Registration Number 50033.



Water Quality Assessment During Pumping Test



Every drop counts!

WATER QUALITY ASSESSMENT RESULTS



Created: April 6th 2023, 3:35pm

The Clearwater Underground Water Conservation District (CUWCD or District) provides in-house screening for some of the most common parameters for drinking water. Please note that the CUWCD LAB IS NOT A CERTIFIED LABORATORY. This screening is offered as a convenience to registered well owners in Bell County and is provided for informative purposes only. The District disclaims any liability for this screening and the accuracy of any analysis. The water quality analytical results from different faucets, taken at different times or analyzed by a certified laboratory may be different from CUWCD analysis of water from the same well. Please contact our office if you would like information regarding laboratories that are certified for chemical/microbiological testing of drinking water.

Name: Hanks-Cabiness Christian Trust
Mailing Address: 1101 S Bryant Blvd San Angelo TX 76903
CUWCD Well Number: N3-22-001P

Phone Number:
Email:
Aquifer: Edwards (BFZ)

PARAMETER RESULTS		Test Date:	02/27/2023, 10:00 PM
<u>Coliform Bacteria</u>	Not Tested		
<u>Ecoli</u>	Not Tested		
	Results	Drinking Water Standard *	
<u>Conductivity (µS/cm)</u>	636	none	
<u>**Total Dissolved Solids (mg/L)</u>	310	1,000 mg/L (secondary)	
<u>Salinity (mg/L)</u>	310	500 mg/L (secondary)	
<u>pH</u>	8.33	6.5 - 8.5 (secondary)	
<u>Alkalinity (as CaCO3)</u>	320	none	
<u>Hardness (as CaCO3)</u>	280	none	
<u>Nitrite (as N)(mg/L)</u>	0.003	1 mg/L (primary)	
<u>Nitrate (as N)(mg/L)</u>	0.8	10 mg/L (primary)	
<u>Phosphate (mg/L)</u>	0.3	none	
<u>Sulfate (mg/L)</u>	32	300 mg/L (secondary)	
<u>Fluoride (mg/L)</u>	1.6	4.0 mg/L (primary)	
<u>Comments</u>			

* The concentrations of analytical parameters in milligrams per liter (mg/L) refer to the Drinking Water Standards for public water supply systems established by the United States Environmental Protection Agency (EPA) and Texas Commission on Environmental Quality (TCEQ). Primary standards are the enforceable maximum allowable concentration for each parameter to maintain health. Secondary standards are non-enforceable guidelines for the cosmetic or esthetic quality of drinking water. These standards do not apply to private water wells but are useful in assessing water quality. Details on EPA and TCEQ drinking water standards are available at: <http://www.epa.gov/safewater/mcl.html#mcls> & http://www.tnrcc.state.tx.us/oprd/rules/pdfiib/290_ind.pdf

** The Total Dissolved Solids value reported is calculated from the Conductivity measured in the analysis. This TDS value should be considered as an "apparent" value and may have limited accuracy when compared to values reported by certified laboratories, accuracy range may be + or - 25 percent.



Every drop counts!

WATER QUALITY ASSESSMENT RESULTS



Created: April 6th 2023, 3:17pm

The Clearwater Underground Water Conservation District (CUWCD or District) provides in-house screening for some of the most common parameters for drinking water. Please note that the CUWCD LAB IS NOT A CERTIFIED LABORATORY. This screening is offered as a convenience to registered well owners in Bell County and is provided for informative purposes only. The District disclaims any liability for this screening and the accuracy of any analysis. The water quality analytical results from different faucets, taken at different times or analyzed by a certified laboratory may be different from CUWCD analysis of water from the same well. Please contact our office if you would like information regarding laboratories that are certified for chemical/microbiological testing of drinking water.

Name: Hanks-Cabiness Christian Trust
Mailing Address: 1101 S Bryant Blvd San Angelo TX 76903
CUWCD Well Number: N3-22-001P

Phone Number:
Email:
Aquifer: Edwards (BFZ)

PARAMETER RESULTS		Test Date:	03/10/2023, 9:00 PM
<u>Coliform Bacteria</u>	Not Tested		
<u>Ecoli</u>	Not Tested		
	Results	Drinking Water Standard *	
<u>Conductivity (µS/cm)</u>	642	none	
<u>**Total Dissolved Solids (mg/L)</u>	312	1,000 mg/L (secondary)	
<u>Salinity (mg/L)</u>	310	500 mg/L (secondary)	
<u>pH</u>	8.32	6.5 - 8.5 (secondary)	
<u>Alkalinity (as CaCO3)</u>	340	none	
<u>Hardness (as CaCO3)</u>	300	none	
<u>Nitrite (as N)(mg/L)</u>	0.002	1 mg/L (primary)	
<u>Nitrate (as N)(mg/L)</u>	0.9	10 mg/L (primary)	
<u>Phosphate (mg/L)</u>	0.32	none	
<u>Sulfate (mg/L)</u>	29	300 mg/L (secondary)	
<u>Fluoride (mg/L)</u>	1.65	4.0 mg/L (primary)	
<u>Comments</u>			

* The concentrations of analytical parameters in milligrams per liter (mg/L) refer to the Drinking Water Standards for public water supply systems established by the United States Environmental Protection Agency (EPA) and Texas Commission on Environmental Quality (TCEQ). Primary standards are the enforceable maximum allowable concentration for each parameter to maintain health. Secondary standards are non-enforceable guidelines for the cosmetic or esthetic quality of drinking water. These standards do not apply to private water wells but are useful in assessing water quality. Details on EPA and TCEQ drinking water standards are available at: <http://www.epa.gov/safewater/mcl.html#mcls> & http://www.tnrcc.state.tx.us/oprd/rules/pdflib/290_ind.pdf

** The Total Dissolved Solids value reported is calculated from the Conductivity measured in the analysis. This TDS value should be considered as an "apparent" value and may have limited accuracy when compared to values reported by certified laboratories, accuracy range may be + or - 25 percent.

LRE Springs Assessment
Stephanie Wong, PhD



Technical Memorandum

To: Mr. Dirk Aaron, General Manager, Clearwater Underground Water Conservation District

From: Stephanie S. Wong, PhD, GIT

Reviewed By: Jordan Furnans, PhD, PE, PG; Joe C. Yelderian Jr., PhD, PG

Copy to: Mr. Mike Keester, PG – RW Harden & Assoc., Inc.

Date: March 17, 2023

Project: Sanctuary Pumping Test Observation

Subject: Salado Springs Monitoring

SUMMARY

Over the period of Thursday March 2 to Saturday March 4, 2023, LRE collected field chemistry measurements at the outlets of Salado Springs in downtown Salado, Bell County. The measurements coincided with a constant rate pumping test conducted at the Sanctuary Development (RREAF Holdings), approximately 0.65 mi south-southwest of Salado Springs (Figure 1) by Gamblin Engineering Group, LLC. Since the pumping well is completed in the Edwards BFZ Aquifer and located upgradient from the springs, Clearwater Underground Conservation District (CUWCD) was concerned with possible impacts to the springs. Therefore, LRE documented the springs through field observations and field chemistry measurements over the course of the pumping test, and compared these data with pumping test results and conceptual knowledge of the groundwater system to evaluate if impacts at Salado Springs from the Sanctuary pumping test were observed.

TIMING OF PUMPING TEST, SPRING MEASUREMENTS, AND RAIN

The timing for the start and end of pumping for the constant rate test as well as pumping rate measurements are presented in Table 1. LRE conducted four (4) rounds of spring measurements on Thursday morning before the start of the pumping period, Thursday afternoon, Friday afternoon, and Saturday morning before the end of the pumping period (Tables 2 and A1).

Table 1. Key times for Sanctuary pumping test.

Date	Time	Description
R, March 2, 2023	10:43	Pump start
R, March 2, 2023	10:48	Pumping rate: 51 gpm
R, March 2, 2023	11:18	Pumping rate: 51 gpm
R, March 2, 2023	15:46	Pumping rate: 50 gpm
F, March 3, 2023	13:00	Pumping rate: 50 gpm
Sa, March 4, 2023	11:15	Pumping rate: 50 gpm
Sa, March 4, 2023	11:17	Pump stop

Table 2. Start times for Salado Springs measurements. Sampling times for each spring are presented in Table A1.

Date	Start Time
Th, March 2, 2023	9:14
Th, March 2, 2023	16:14
F, March 3, 2023	17:07
Sa, March 4, 2023	10:08

The area experienced several rain events prior to and during the pumping period. Per Texas Mesonet station TWB62 two miles south of the pumping well, 0.1 inch of rain fell on February 22, 0.19 inch of rain fell on March 1, and 0.91 inch of rain fell on March 2 after the start of the pumping period. Weather conditions are summarized in Table 3.

Table 3. Weather conditions during the pumping period, recorded at Texas Mesonet station Station ID TWB62 (Station Name - TxDOT Southbound Rest Area Salado [TWDB]).

Date	Temperature Min (°F)	Temperature Max (°F)	Precipitation (in)
W, March 1, 2023	68.81	80.89	0.19
R, March 2, 2023	45.03	78.12	0.91
F, March 3, 2023	42.34	67.84	0
Sa, March 4, 2023	43.43	79.00	0

SPRING OBSERVATIONS AND MEASUREMENTS

Flow conditions at Salado Springs appeared to be at low-to-normal levels, and did not appear to change over the pumping period of the Sanctuary test. The spring pools and spring runs at Big Boiling, Doc Benedict, and Anderson Springs were full and flowing towards Salado Creek (Figure A1). Groundwater discharge from Critchfield Spring was pooled, and there was not sufficient discharge to flow into the spring run (Figure A1d, e). Groundwater discharge from Side Spring was measurable, but appeared low.

LRE collected readings for specific conductance (SC), pH, and temperature at each spring over the pumping period (Figure 2, Table A1). The SC and pH data show a generally consistent pattern between all the springs, where the Thursday afternoon values are lower than the initial readings on Thursday morning, and Saturday values approach the Thursday morning values. The first SC value at Doc Benedict was anomalously low. It was difficult for the water probe to stabilize to get a reading at this time, possibly due to turbulent discharge from the spring outlet and how the probe was positioned. Overall, temperature data were very consistent between springs and throughout the pumping period. Temperature values at Critchfield Spring were not consistent with other springs; the ponding of water in the spring pool indicated that discharge from the spring and water circulation was low, resulting in water temperatures that more closely resembled the ambient air temperature.

SUMMARY AND ASSESSMENT OF SPRING CONDITION OVER TEST PUMPING PERIOD

The objective of collecting field chemistry at Salado Springs on March 2-4, 2023 was to provide CUWCD with documentation of spring conditions and an assessment of possible impacts during the pumping period of the Sanctuary constant rate pumping test.

Field observations suggested that springflows were at low-to-normal levels, and did not visibly change over the pumping period. SC and pH values decreased in the Thursday afternoon and Friday samples, then returned to values similar to Thursday morning values. The return to pre-pumping values before the end of the pumping period suggests that a dilution of groundwater by rain was observed at Salado Springs, as rain typically has a lower SC and is more acidic. A consistent pattern in the data for all of the springs also suggests that Salado Springs is responding to a system change such as rain providing areal recharge. In contrast, a response to pumping may produce flow and chemistry responses at different times, since the springs are at different radial distances from the pumping well.

Interpretation of possible impacts by the Sanctuary test pumping on Salado Springs was complicated by the occurrence of rain before and during the pumping period. While the field observations and chemistry do not indicate a spring impact from pumping, it cannot be ruled out. In addition to rain providing additional recharge to the springs and diluting the groundwater chemistry, the duration of the pumping period may not have been sufficient to impact springflows. Using the standard Theis equation corrected for unsaturated zone application, the expected drawdown from this constant rate test would amount to 0.25 ft at the spring locations (0.65 miles) after 36-hours, if the springs were wells. This estimation utilizes hydraulic properties calculated by Gamblin Engineering Group, LLC using the pumping test data: a transmissivity of 170 ft²/day, a storativity of 0.0001643, a saturated thickness of 65 ft, and a 50 gpm pumping rate. The impact on the springs would translate to decreased flow rates as opposed to drawdown.

Sanctuary Pumping Test Spring Observations

March 17, 2023

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We sincerely appreciate the opportunity to serve CUWCD in our specialty. Please let us know if you have any questions.

Sincerely,

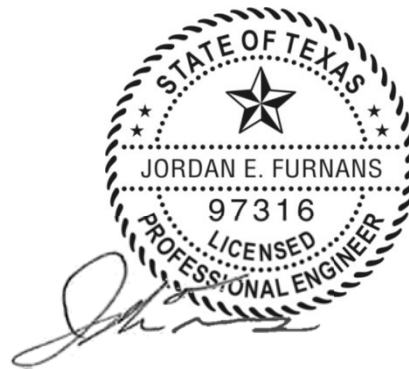
LRE WATER



Stephanie S. Wong, PhD, GIT
Staff Hydrogeologist II



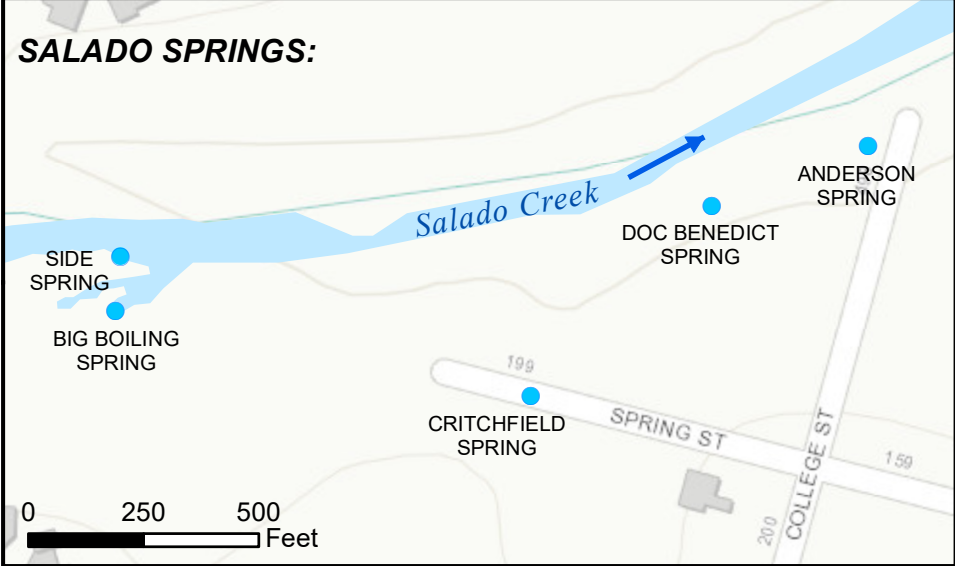
Jordan Furnans, PhD, PE, PG
Vice President – TX Operations



The seal appearing on this document was authorized by Dr. Jordan Furnans, P.E. 97316 on March 17, 2023.
LRE Water, LLC TBPELS Firm No. 14368.

FIGURES

SALADO SPRINGS:



Prepared By:
LRE Water, LLC - Texas Office
Round Rock, Texas
TBPELS Firm #14368



Sanctuary Pumping Test

- Pumping well
- Observation well

- Salado Springs Outlets
- Sinkhole
- Stagecoach Inn Well



FIGURE 1. LOCATION MAP, SANCTUARY PUMPING TEST AND SALADO SPRINGS

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CLEARWATER UNDERGROUND WATER CONSERVATION DISTRICT

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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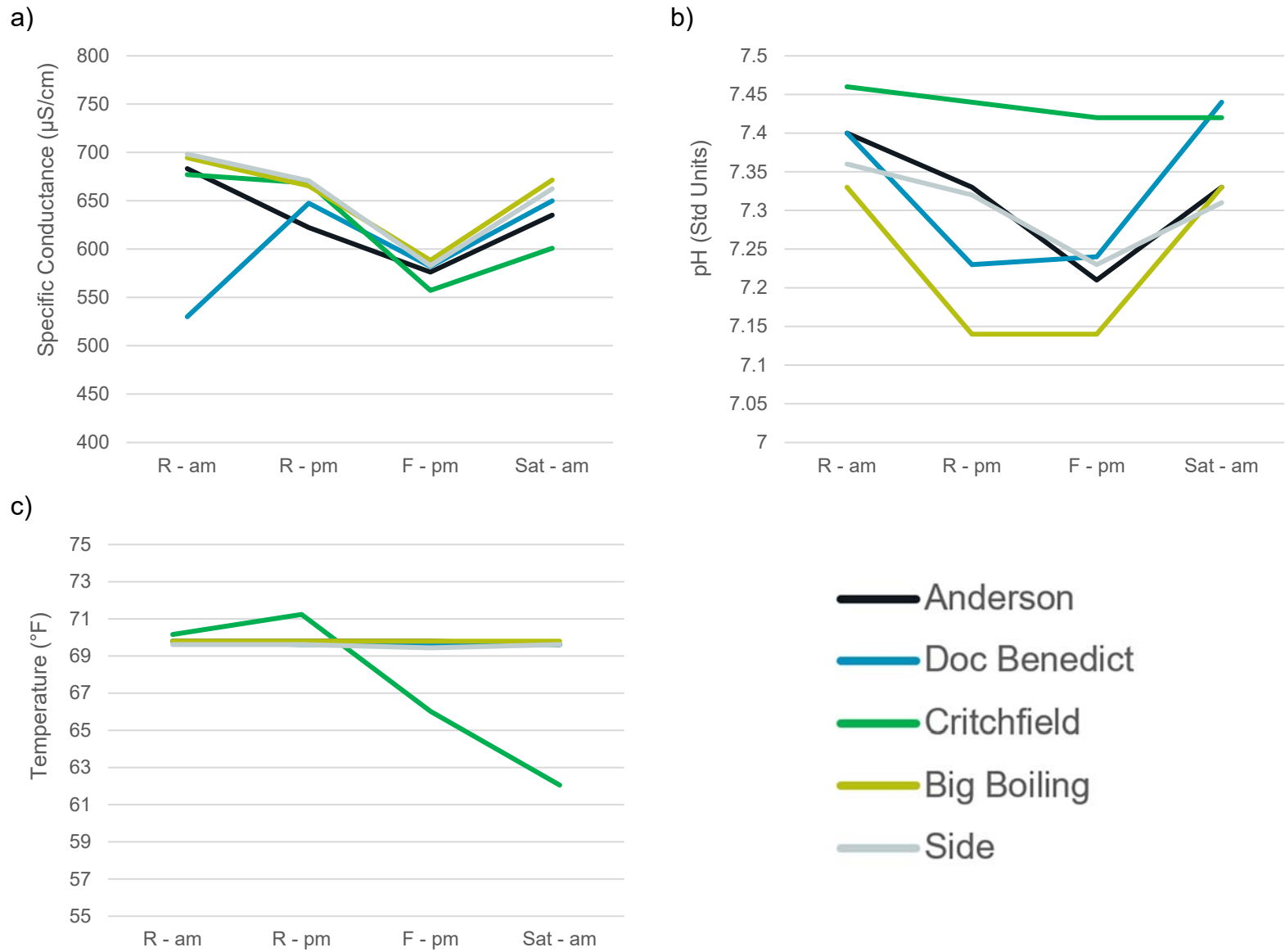


Figure 2. Timeseries plots of sampled field chemistry at Salado Springs.

APPENDIX A
FIELD OBSERVATIONS AND MEASUREMENTS



Figure A1. Visual documentation of Salado Springs outlets over the pumping period. Flow conditions appeared normal and the spring runs and pools were full for (a) Big Boiling Spring, (b) Doc Benedict Spring, and (c) Anderson Spring. Groundwater was pooled at Critchfield Spring (d) and no flow was observed in the spring run (e). Groundwater flow was observed at Side Spring but at low levels (f). Groundwater flow directions are indicated by the black arrows in (a), (b), (c), and (f).

Table A1. Field chemistry data at Salado Springs over the course of the Sanctuary pumping test.

Site	Date	Sample*	Anderson Spring	Doc Benedict Spring	Critchfield Spring	Big Boiling Spring	Side Spring
Sample Time (hh:mm)	3/2/2023	R - am	9:14	9:23	9:35	9:46	9:50
	3/2/2023	R - am	16:14	16:26	16:36	16:45	16:52
	3/3/2023	F - pm	17:07	17:20	17:32	17:42	17:41
	3/4/2023	Sa - am	10:08	10:19	10:28	10:40	10:36
SC (μS/cm)	3/2/2023	R - am	683.3	530	677.1	694.6	698.3
	3/2/2023	R - am	622.2	647.5	668.3	665.3	670.6
	3/3/2023	F - pm	576.3	582	557.3	588.4	582.9
	3/4/2023	Sa - am	635.1	650	600.8	671.5	662.4
pH (Standard Units)	3/2/2023	R - am	7.4	7.4	7.46	7.33	7.36
	3/2/2023	R - am	7.33	7.23	7.44	7.14	7.32
	3/3/2023	F - pm	7.21	7.24	7.42	7.14	7.23
	3/4/2023	Sa - am	7.33	7.44	7.42	7.33	7.31
T (°F)	3/2/2023	R - am	69.8	69.8	70.16	69.8	69.62
	3/2/2023	R - am	69.8	69.62	71.24	69.8	69.62
	3/3/2023	F - pm	69.8	69.62	66.02	69.8	69.44
	3/4/2023	Sa - am	69.62	69.62	62.06	69.8	69.62

* Thursday morning measurements were collected with field assistance from Dr. Joe C. Yelderan, Jr. from Baylor University.

Springs Assessment
Joe Yelderman, PhD, P.G.

Potential impacts from the pumping test on spring flow and chemistry, Salado Texas

Joe C. Yelderman Jr., Ph.D., P.G.
Department of Geosciences, Baylor University
March 17, 2023

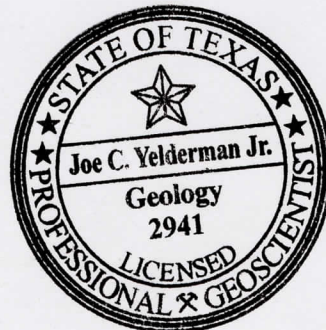
Field chemistry (specific conductance, pH, and temperature) was sampled at Salado Springs in downtown Salado from Thursday March 2 through Saturday March 4, during the pumping period of the constant rate pumping test conducted at the Sanctuary development (Figure 1).

There was a decrease in Specific Conductance (SpC) in all the spring samples from Thursday morning before the pumping test until Friday afternoon (Figure 2). Then there was an increase in SpC approaching pre-test conditions for all the spring samples between Friday afternoon and Saturday morning. If the pumping caused drawdown that pulled potentially lower SpC stream water into the springs it could have diluted the groundwater and decreased the SpC samples. However, it is highly unlikely that the decrease in SpC would have been detected at Critchfield Spring because of its distance from the stream (when considering head differential or gradient reversal and flow times). It is also unlikely that Big Boiling Spring would have been affected to the magnitude observed because its discharge is so great reversed flow could not occur. The decreases in SpC are more likely the result of the precipitation that occurred during the test. Per the Salado Mesonet station (Station TWB62), 0.19 inch of precipitation occurred on Wednesday March 1 and 0.91 inch of precipitation occurred on Thursday March 2, after the start of the pumping test. The pH of the spring water also changed in a similar pattern to the SpC, and only Critchfield Spring showed a change in Temperature (Figure 2). Critchfield Spring was pooled but not flowing and this may have allowed the rain to affect the temperature.

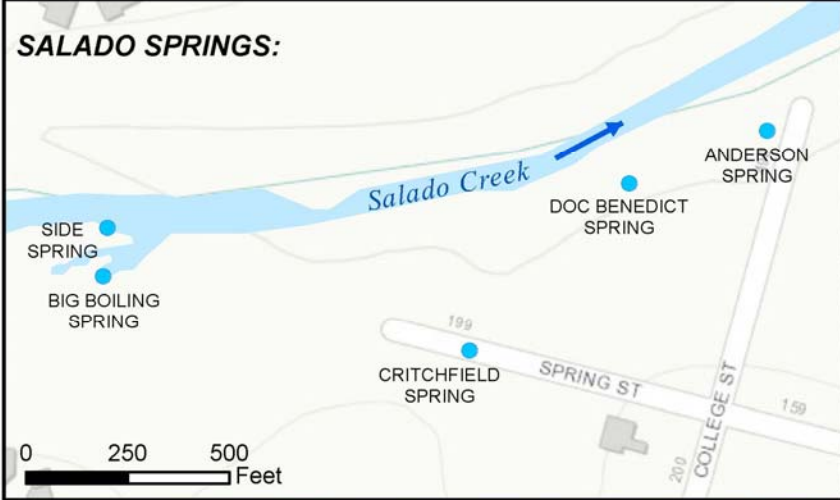
The fact that all the springs were affected similarly would favor the effect of rain rather than reversed gradient from the cone of depression caused by the pumping. (If the Salado Stream Gage shows an increase in the flow rate because of the rain, this would also make it impossible to assess any spring "flow" effects on the springs from the pumping). Therefore because of the rain effects, potential impacts from the pumping test on the spring chemistry is not possible.

None of these observations say anything about potential long-term impacts from increased pumping up-gradient from the springs. That potential impact would need long term monitoring. Although the Salado stream gage which is located downstream of the springs may be able to see an effect on flow of the entire spring system, if impacts to individual springs are desired, individual spring flows will need to be measured over time.


Joe C. Yelderman Jr. Ph.D., P.G.



FIGURES



Prepared By:
 LRE Water, LLC - Texas Office
 Round Rock, Texas
 TBPELS Firm #14368

Sanctuary Pumping Test

- Salado Springs Outlets
- Sinkhole
- Pumping well
- Stagecoach Inn Well
- Observation well

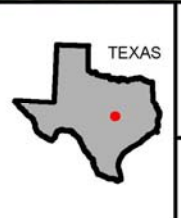


FIGURE 1.
LOCATION MAP,
SANCTUARY PUMPING TEST
AND SALADO SPRINGS

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 CLEARWATER UNDERGROUND WATER
 CONSERVATION DISTRICT

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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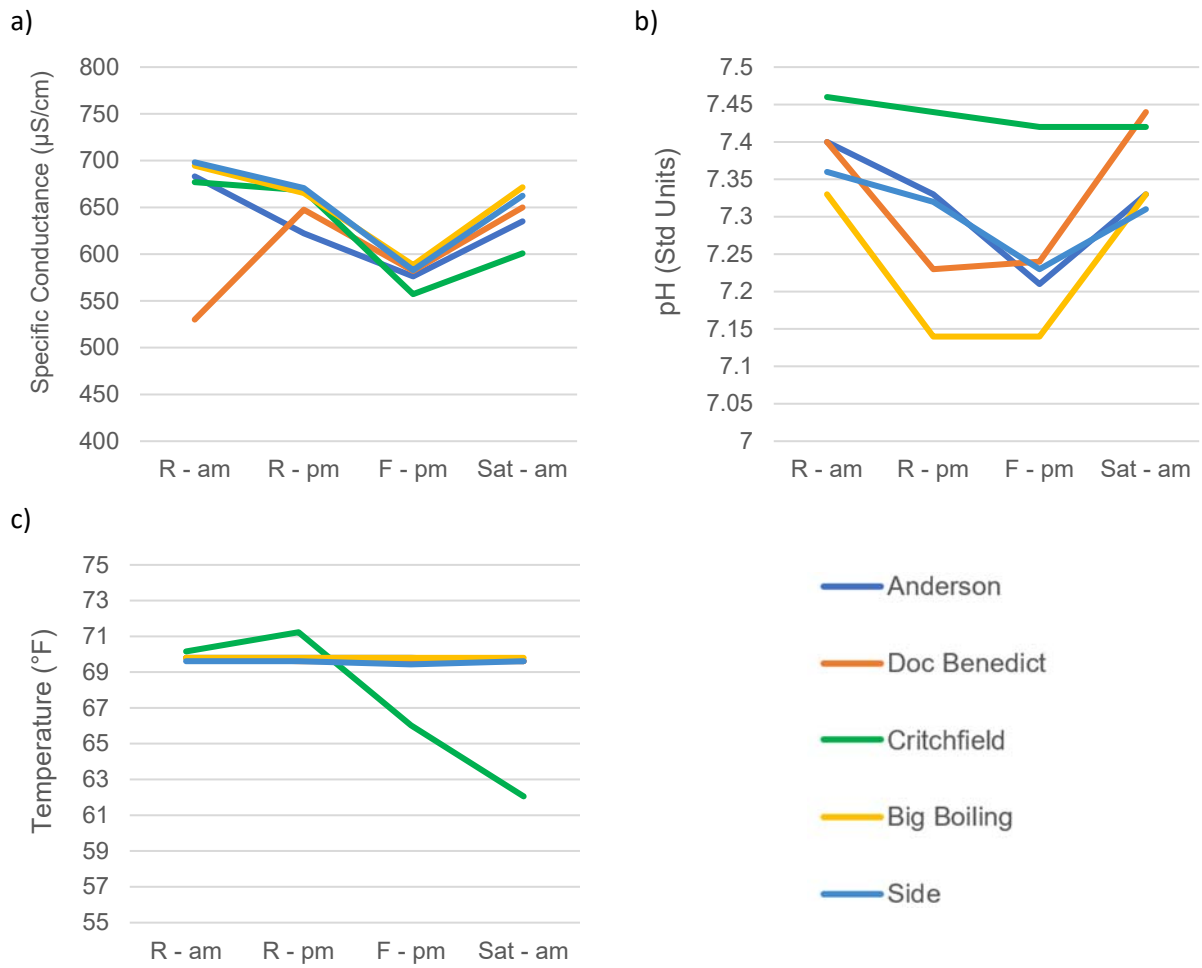


Figure 2. Timeseries plots of sampled field chemistry at Salado Springs (figure provided by LRE Water).