

NON-EXEMPT WATER WELL REGISTRATION APPLICATION

Please complete all questions. Please print or type information, or place an "x" in the appropriate space.

Drill New Well: Register an Existing Well: _____ Replace Existing Well: _____ Increase Size of Existing Well: _____
Increase Pump Size of Existing Well: _____ Abandon/Cap/Plug Existing Well: _____ Perform Dye Trace: _____

Well Owner _____ William Marsh Rice University _____ Phone _____ 832-917-2420 _____

Address _____ 6100 Main Street, OGC MS 94, Houston, TX 77005 _____

Fax: _____ **Email:** _____ william.s.irby@rice.edu _____

Drilling Company _____ TBD _____ Phone _____

Address _____

Fax: _____ **Email:** _____

Driller _____ **License#** _____

Well Location: County _____ Waller _____ Well Site Address or Location: _____

Latitude _____ 30.175995 _____ **Longitude** _____ -95.874162 _____

Proposed Water Use: Public Water Supply: Industrial: _____ Recreational: _____ Commercial: _____

Hydraulic Fracturing: _____ Transport Outside of District: _____

Proposed depth: _____ 1320 _____ ft. Aquifer _____ Jasper _____ Date drilling is scheduled to begin _____ TBD _____

Proposed casing size: _____ 20/14 _____ in. Proposed casing depth: _____ 1100 _____ ft. Pump depth: _____ 420 _____ ft. Pump size _____ 150 _____ hp.

Type Pump: Turbine: Submersible: _____ Windmill: _____ Other (specify): _____

Pump fuel or power source: Electricity: Natural Gas: _____ Wind: _____ Other (specify): _____

Pump Bowls: Size _____ # of Stages: _____ TBD _____ Pump Column: Inside Diameter: _____ 8 _____ in. Length: _____ 420 _____ ft.

Pump discharge pipe: Size _____ in. Rated pump horsepower: _____ 150 HP _____ **Pump Discharge:** _____ 900 _____ gpm

Water bearing formation: _____ Jasper Aquifer _____

Estimated Annual Water Production: _____ Acre-Feet or _____ 229,950,000 _____ Gallons

If the water produced from this well will be used in whole or in part on property other than the property where the well is located, **describe the location where the water will be used.** Transportation of water produced and moved to another location may require a District Transportation Permit. See District Rules, Section 10 or contact the District office for information.

_____ Public water supply to serve Waller County Municipal Utility District No. 62 _____

BLUEBONNET GROUNDWATER CONSERVATION DISTRICT

Permit form approved on: _____

By: _____ Zach Holland, General Manger

(Continued) NON-EXEMPT WATER WELL DRILLING PERMIT FORM (Continued)

The following documentation, attachments and fee payments must accompany this form when it is submitted for consideration by the District.

- a. Plat or map showing location of the property and location on property of well for which form is submitted.
- b. If owner and/or operator of a well is different from property owner, provide written documentation from property owner authorizing construction and operation of this well.
- c. All the information and documentation required for the type and class of well for which authorization is requested by Section 8 of the District Rules and that information and documentation required by Rule 8.5.
- d. Forms for non-exempt well authorizations must be accompanied by the information required by Rule 8.5A1:
 - a. 8.5A1(e) – a statement of the projected effect of the proposed withdrawal on the aquifer or aquifer conditions, depletion, subsidence, or effects on existing permit holders or other groundwater users in the District;
 - b. 8.5A1(f) – the applicant’s water conservation plan or a declaration the applicant and subsequent user will comply with the District’s management plan;
 - c. 8.5A1(g)(2) – well construction diagram;
 - d. 8.5A1(g)(3) – a map showing the location of the proposed well or wells, all existing well, hydrologic features, and geologic features located within half (1/2) mile radius of the proposed well or wells site;
 - e. 8.5A1(h) – the applicant’s well closure plan or a declaration the applicant will comply with well plugging guidelines and report closure to the applicable authorities, including the District.
- e. Payment for applicable fees must accompany the form. Additional fees may apply as documented in the District’s adopted Fee Schedule.

Well Development Fee	\$75.00	
Operating Permit Application Fee	\$375.00	
Hydrogeologic Report Fee – applicable if well completed with eight (8) inches or greater inside casing diameter		
	Phase I-a Report (less than 200MG/yr)	Phase I-b Report (> 200MG/yr)
District Prepared Report	\$1,500.00	\$7,500.00
Applicant Prepared/District Review	\$500.00	\$1,500.00

- f. Forms for new non-exempt wells must be accompanied by an Operating Permit Application and, if appropriate, a Transport Permit Application.

I, the undersigned applicant, hereby agree and certify that:

- a. this well will be drilled within 30 feet of the location specified and not elsewhere;
- b. I will furnish the District with a copy of the completed driller’s log, any electric log, the well completion report, and any water quality test report within 60 days of completion of this well and prior to production of water there from (other than such production as may be necessary to the drilling and testing of such well);
- c. in using this well, I will avoid waste, achieve water conservation, protect groundwater quality and the water produced from this well will be for a beneficial use;
- d. I will comply with all District and State well plugging and capping guidelines in effect at the time of well closure;
- e. I agree to abide by the terms of the District Rules, the District Management Plan, and orders of the District Board of Directors currently in effect and as they may be modified, changed, and amended from time to time;
- f. I hereby certify that the information contained herein is true and correct to the best of my knowledge and belief.

Signature: Kelly Fox Date: Aug 21, 2024

Printed Name: Kelly Fox Title: _____

Bluebonnet Groundwater Conservation District

303 E. Washington Ave., P.O. Box 269

Navasota, TX 77868

Phone: 936-825-7303 Fax: 936-825-7331

Email: BGCD@bluebonnetgroundwater.org

BGCD Well ID #: _____

WELL OPERATING PERMIT APPLICATION

Please complete all questions. Please print or type information or place an "x" in the appropriate space.

Drill New Well: Register an Existing Well: _____ Replace Existing Well: _____ Increase Size of Existing Well: _____

Increase Pump Size of Existing Well: _____ Abandon/Cap/Plug Existing Well: _____ Perform Dye Trace: _____

Well Owner _____ William Marsh Rice University _____ Phone _____ 832-917-2420 _____

Address _____ 6100 Main Street, OGC MS 94, Houston, TX 77005 _____

Fax: _____ Email: _____ william.s.irby@rice.edu _____

Drilling Company _____ TBD _____ Phone _____

Address _____

Fax: _____ Email: _____

Driller _____ License# _____

Well Location: County _____ Waller _____ 911 address of well site _____

Latitude _____ 30.175995 _____ Longitude _____ -95.874162 _____

Proposed Water Use: Public Water Supply: Industrial: _____ Recreational: _____ Commercial: _____

Hydraulic Fracturing: _____ Transport Outside of District: _____

Status of well as of application date:

_____ Operating Well (Date drilled _____)

_____ Well Completed but not operating (Date Drilled _____)

Well Development permit attached or awaiting approval

Authorization to produce the following quantity of water annually from this well is: _____ 229,950,000 _____ Gallons

A well operating permit is normally issued for a period of one year (12 months). If a permit for a longer period of time is requested, attach a statement detailing the reasons for a longer permit period and the period of time requested.

If the water produced from this well will be used in whole or in part on property other than the property where the well is located, **describe the location where the water will be used.** Transportation of water produced and moved to another location may require a District Transportation Permit. See District Rules, Section 10 or contact the District office for information.

Public water supply to serve Waller County Municipal Utility District No. 62

BLUEBONNET GROUNDWATER CONSERVATION DISTRICT

Permit application approved on: _____

By: _____ Zach Holland, General Manger

(Continued) WELL OPERATING PERMIT APPLICATION (Continued)

The following documentation, attachments and fee payments must accompany this application when it is submitted for consideration by the District.

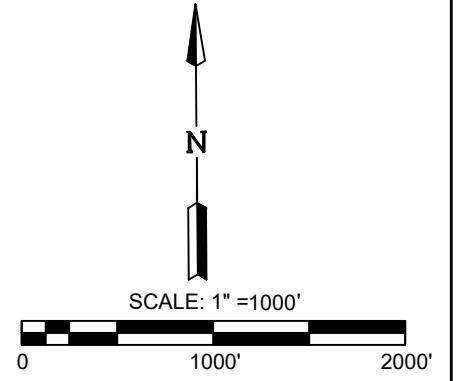
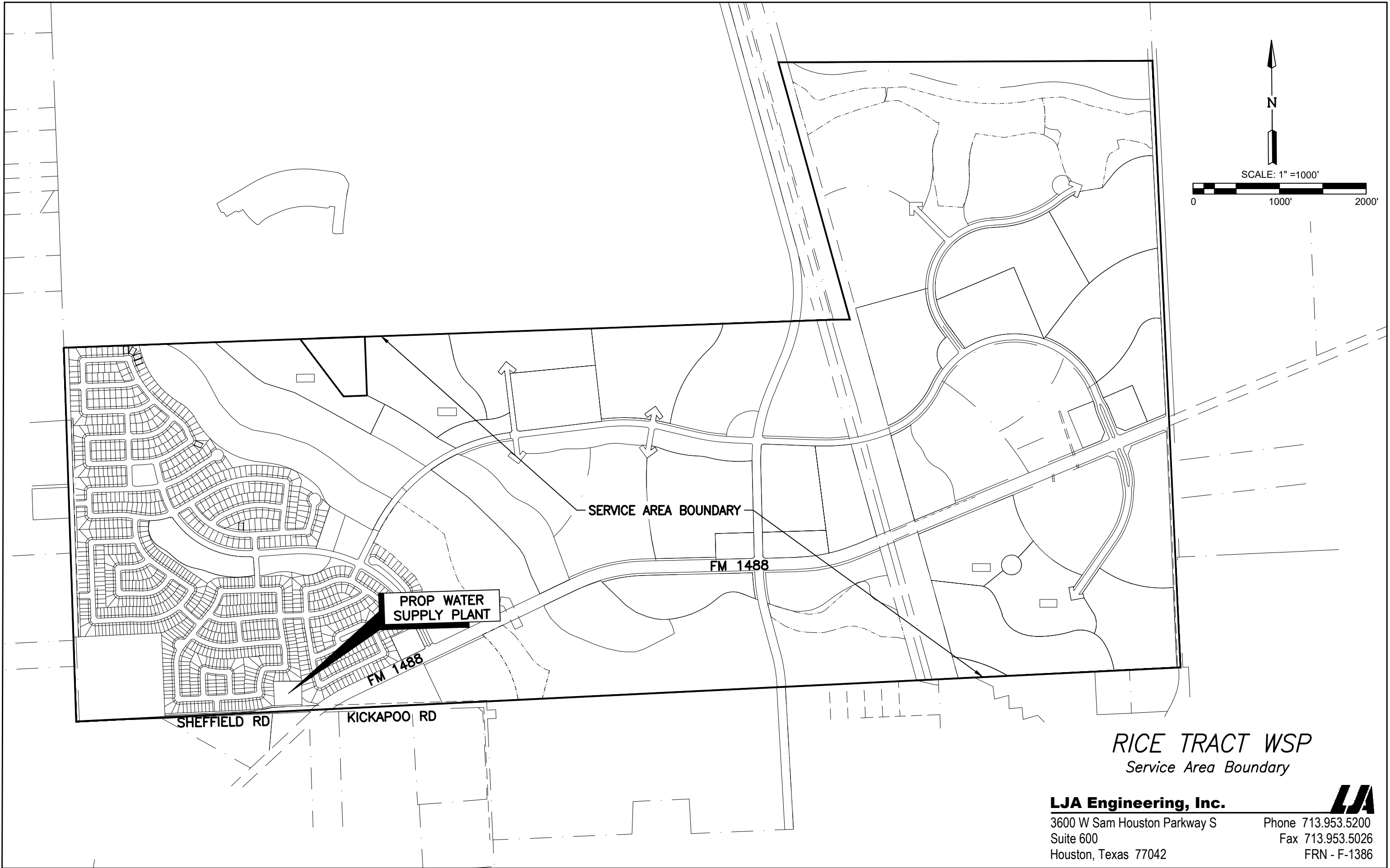
- a. Plat or map showing location of the property and location on property of well for which application is submitted.
- b. If the owner and/or the operator of well is different from the property owner, provide written documentation from the property owner authorizing construction and operation of this well.
- c. All the information and documentation required for the type and class of well for which authorization is requested by Section 8 of the District Rules and in particular that information and documentation required by Rule 8.5.
- d. If this permit application is for a well completed with an inside casing diameter of eight (8) inches or greater, or for any of the conditions enumerated in District Rule 8.5 F, a current hydrogeological report (a report completed within 18 months of the date of this application is considered current) shall be submitted with this application.
- e. Payment for applicable fees must accompany application. For a non-exempt well the appropriate Operating Permit Application Fee (**\$375.00 +\$750.00 if inside casing diameter is eight (8) inches or greater**) must be included.
- f. The applicant's water conservation plan and if any subsequent user of the water is a municipality or entity providing retail water services, the water conservation plan of that municipality or entity shall also be provided. In lieu of a water conservation plan, a declaration that the applicant and/or a subsequent user if any subsequent user is a municipality or entity providing retail water services will comply with the District Management Plan.
- g. The applicant's Drought Contingency Plan and a copy of any subsequent user's Drought Contingency Plan or a declaration that the applicant or a subsequent user will comply with District rules, policies and Board actions in drought conditions.

I, the undersigned applicant, hereby agree and certify that:

- a. in using this well, I will avoid waste, achieve water conservation, protect groundwater quality and the water produced from this well will be for a beneficial use;
- b. I will comply with all District and State well plugging and capping guidelines in effect at the time of well closure;
- c. I agree to abide by the terms of the District Rules, the District Management Plan and orders of the District Board of Directors currently in effect and as they may be modified, changed and amended from time to time;
- d. I hereby certify that the information contained herein is true and correct to the best of my knowledge and belief.

Signature: *Kelly Fox* Date: Aug 21, 2024

Printed Name: Kelly Fox Title: _____



**PROP WATER
SUPPLY PLANT**

SERVICE AREA BOUNDARY

FM 1488

FM 1488

SHEFFIELD RD

KICKAPOO RD

RICE TRACT WSP
Service Area Boundary

LJA Engineering, Inc.



3600 W Sam Houston Parkway S
Suite 600
Houston, Texas 77042

Phone 713.953.5200
Fax 713.953.5026
FRN - F-1386

BLUE BONNET WATER WELL NO. 1

ATTACHMENT 1

JULY 2024

LEGEND

■ WATER WELL LOCATION

CONCENTRIC CIRCLES

□ 10'

□ 50'

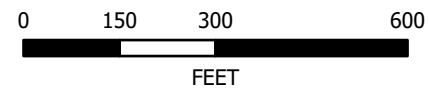
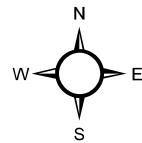
□ 150'

□ 1/4 MILE

■ 150' PROPERTY BOUNDARY
BUFFER

WCAD OWNERSHIP

■ WILLIAM MARSH RICE
UNIVERSITY



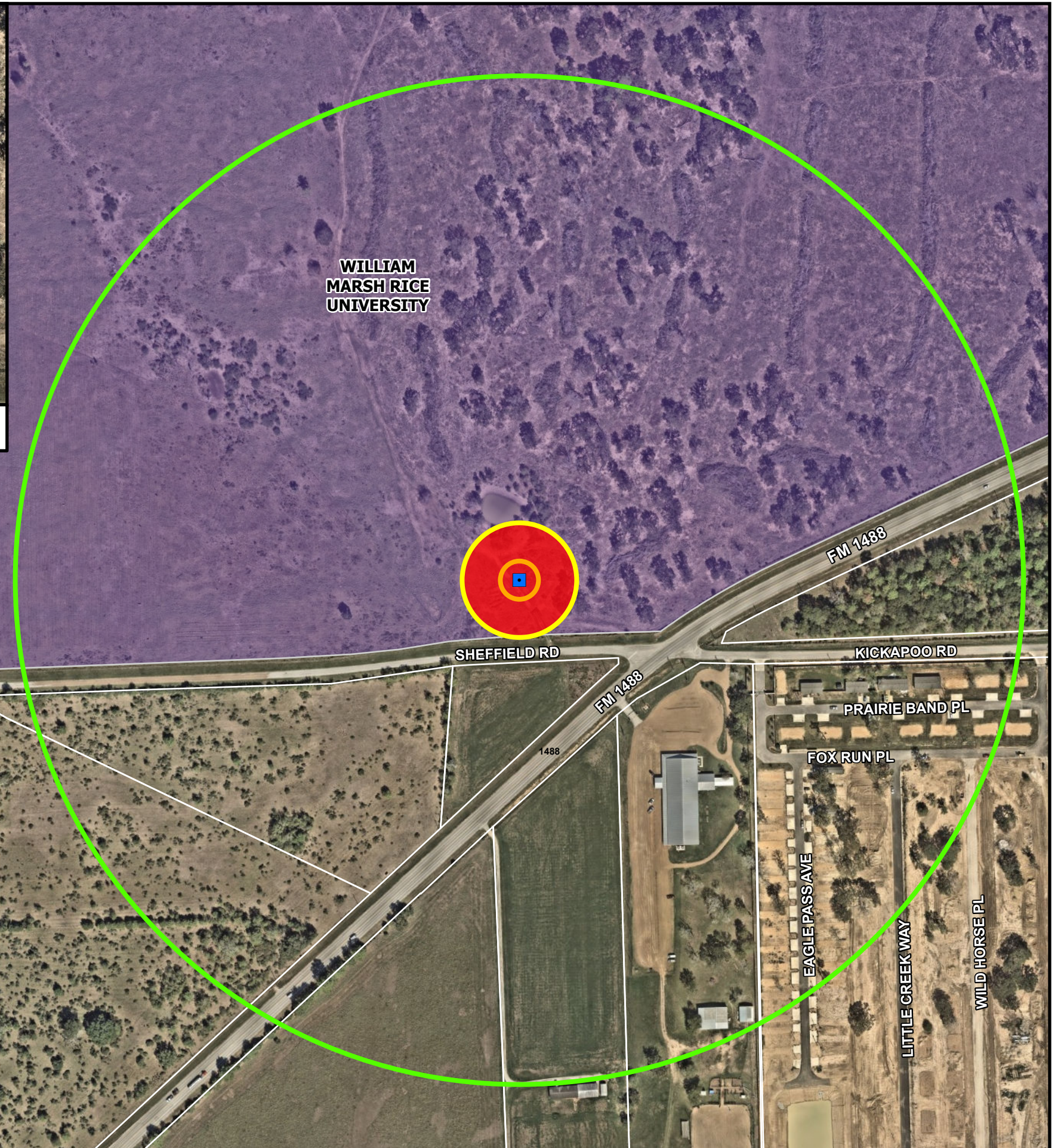
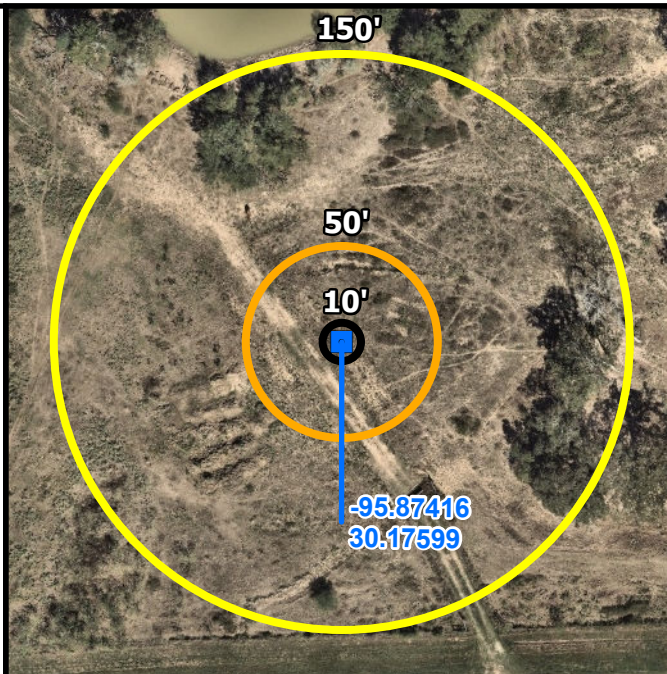
AERIAL PHOTOGRAPHY DATE: NEARMAP OCT 2023

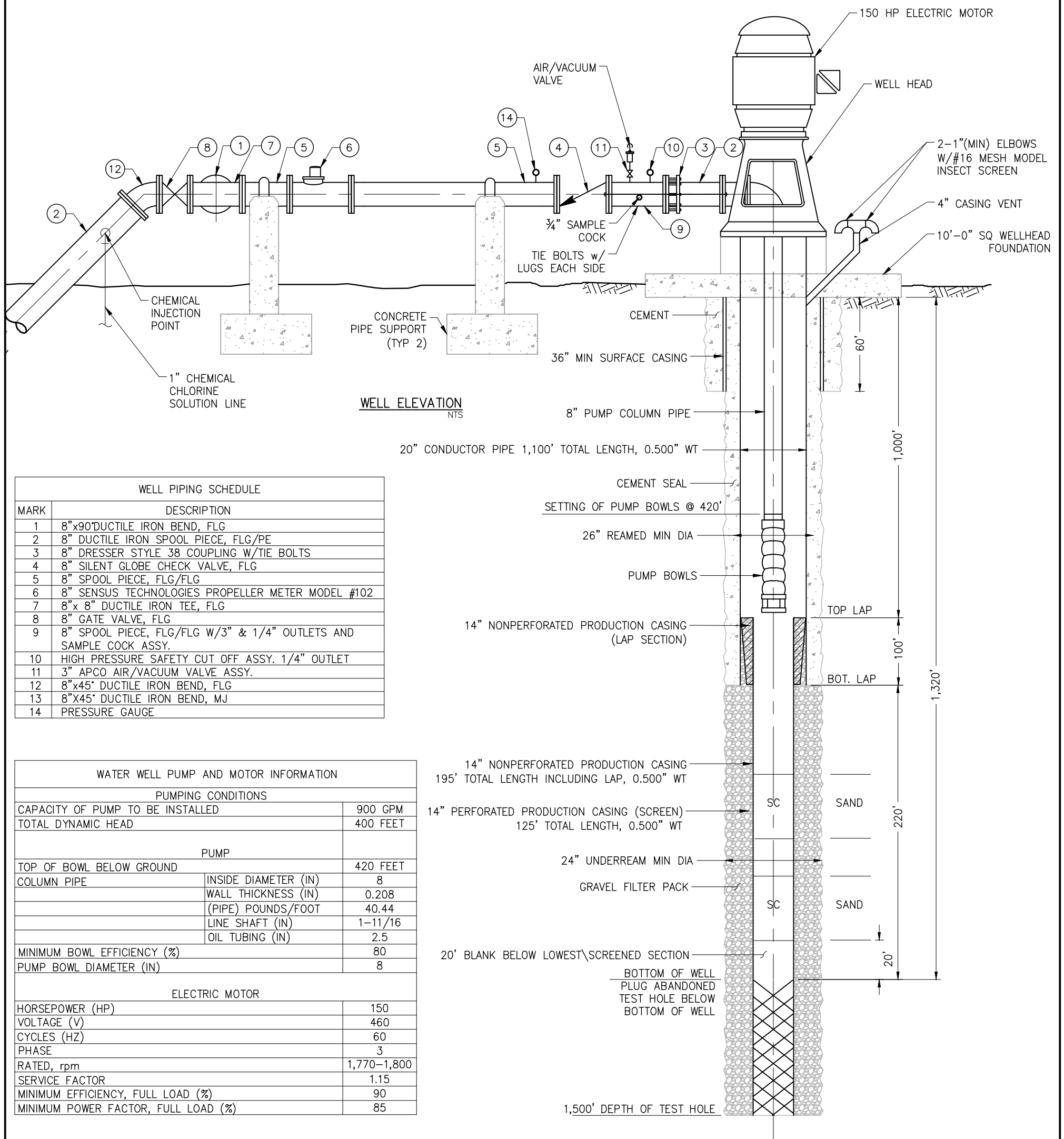
DATA SOURCES: PARCELS - WCAD (OCTOBER 2023)

THIS PRODUCT IS FOR INFORMATIONAL PURPOSES AND
MAY NOT HAVE BEEN PREPARED FOR OR BE SUITABLE
FOR LEGAL, ENGINEERING, OR SURVEYING PURPOSES. IT
DOES NOT REPRESENT AN ON-THE-GROUND SURVEY AND
REPRESENTS ONLY THE APPROXIMATE RELATIVE
LOCATION OF PROPERTY BOUNDARIES.



3600 W Sam Houston Parkway S Suite 600
Houston, Texas 77042
Phone 713.953.5200
LJA.com





WELL ELEVATION
NTS

WELL PIPING SCHEDULE	
MARK	DESCRIPTION
1	8"x90" DUCTILE IRON BEND, FLG
2	8" DUCTILE IRON SPOOL PIECE, FLG/PE
3	8" DRESSER STYLE 38 COUPLING W/TIE BOLTS
4	8" SILENT GLOBE CHECK VALVE, FLG
5	8" SPOOL PIECE, FLG/FLG
6	8" SENSUS TECHNOLOGIES PROPELLER METER MODEL #102
7	8" x 8" DUCTILE IRON TEE, FLG
8	8" GATE VALVE, FLG
9	8" SPOOL PIECE, FLG/FLG W/3" & 1/4" OUTLETS AND SAMPLE COCK ASSY.
10	HIGH PRESSURE SAFETY CUT OFF ASSY. 1/4" OUTLET
11	3" APCO AIR/VACUUM VALVE ASSY.
12	8"x45" DUCTILE IRON BEND, FLG
13	8"x45" DUCTILE IRON BEND, MJ
14	PRESSURE GAUGE

WATER WELL PUMP AND MOTOR INFORMATION	
PUMPING CONDITIONS	
CAPACITY OF PUMP TO BE INSTALLED	900 GPM
TOTAL DYNAMIC HEAD	400 FEET
PUMP	
TOP OF BOWL BELOW GROUND	420 FEET
COLUMN PIPE	INSIDE DIAMETER (IN) 8
	WALL THICKNESS (IN) 0.208
	(PIPE) POUNDS/FOOT 40.44
	LINE SHAFT (IN) 1-11/16
	OIL TUBING (IN) 2.5
MINIMUM BOWL EFFICIENCY (%)	80
PUMP BOWL DIAMETER (IN)	8
ELECTRIC MOTOR	
HORSEPOWER (HP)	150
VOLTAGE (V)	460
CYCLES (HZ)	60
PHASE	3
RATED, rpm	1,770-1,800
SERVICE FACTOR	1.15
MINIMUM EFFICIENCY, FULL LOAD (%)	90
MINIMUM POWER FACTOR, FULL LOAD (%)	85

A 900 GPM (PUMP) WATER WELL DETAIL
NTS

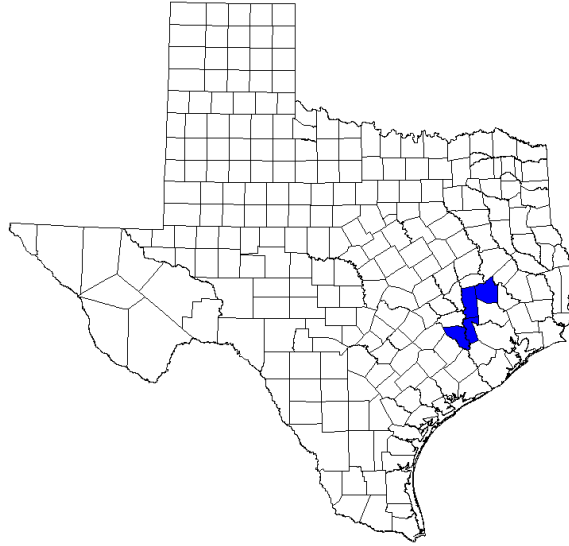
LJA Engineering, Inc.

3600 W. Sam Houston Parkway S.
Suite 600
Houston, Texas 77042

Phone 713.953.5200
Fax 713.953.5026
FRN - F-1386

Final Report

**Phase 1-b Report:
William Marsh Rice University Proposed Well Application
Submitted on August 27, 2024 by LJA Engineering**



Prepared for:
Zach Holland
General Manager
Bluebonnet Groundwater Conservation District
P.O. Box 269
Navasota, TX 77868-0269

Prepared by:
William R. Hutchison, Ph.D., P.E., P.G.
Independent Groundwater Consultant
909 Davy St.
Brenham, TX 77833
512-745-0599
billhutch@texasgw.com

September 9, 2024

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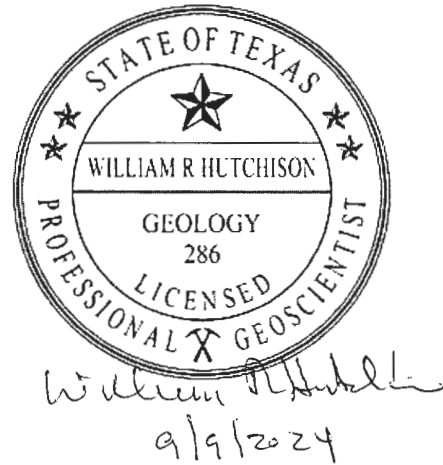
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Professional Engineer and Professional Geoscientist Seals

This report was prepared by William R. Hutchison, Ph.D., P.E., P.G., who is licensed in the State of Texas as follows:

- Professional Engineer (Geological and Civil) No. 96287
- Engineering Firm Registration No. 14526
- Professional Geoscientist (Geology) No. 286



1.0 Introduction

William Marsh Rice University (Rice) has submitted a Non-Exempt Water Well Registration to the Bluebonnet Groundwater Conservation District (BGCD) for a new public water supply well. The proposed well locations and estimated total water production are summarized below:

- Well Location:
 - Latitude: 30.175995
 - Longitude: -95.874162
- Estimated Annual Water Production: 229.95 million gallons.

The rules of BGCD require the applicant to submit Phase I and Phase II hydrogeologic reports for non-exempt wells with an inside diameter casing of eight inches or greater as part of the permit application process. These reports include hydrogeologic information addressing, and specifically related to, the impacts of the proposed well (e.g. area of influence, drawdown, recovery time, and potential for subsidence).

Because the requested permit amount is greater than 200 million gallons per year, a Phase I-b report is required. In general, the Phase I-b report is intended to be a preliminary report that relies on existing regional information and data, and the Phase II report is intended to be a final report that relies on site specific data, information, test results and analyses.

As required in the Guidelines for Submitting Data and Information and the Preparation of Hydrogeologic Reports in Support of Applications for the Permitted Use of Groundwater (dated April 14, 2023), this report contains the Phase I-a tables and the results of a simulation using the Groundwater Availability Model of the area that adds the proposed wells to the most recent run that was used to establish the desired future condition.

All files associated with this report are available for download at the following location:

https://drive.google.com/drive/folders/11OTGxAYni5_ky3tW0KUvf2cU-wErDSts?usp=sharing

2.0 Phase I-a Tables

2.1 Well Locations on HAGM Grid

The latitude and longitude data provided in the application were used to convert the location data to x- and y-coordinates in the GAM coordinate system using Surfer, a commercial gridding program. In addition, registered wells within one mile of the proposed well were identified and their latitude and longitude coordinates were also converted to x- and y-coordinates. All well locations are presented in Figure 1.

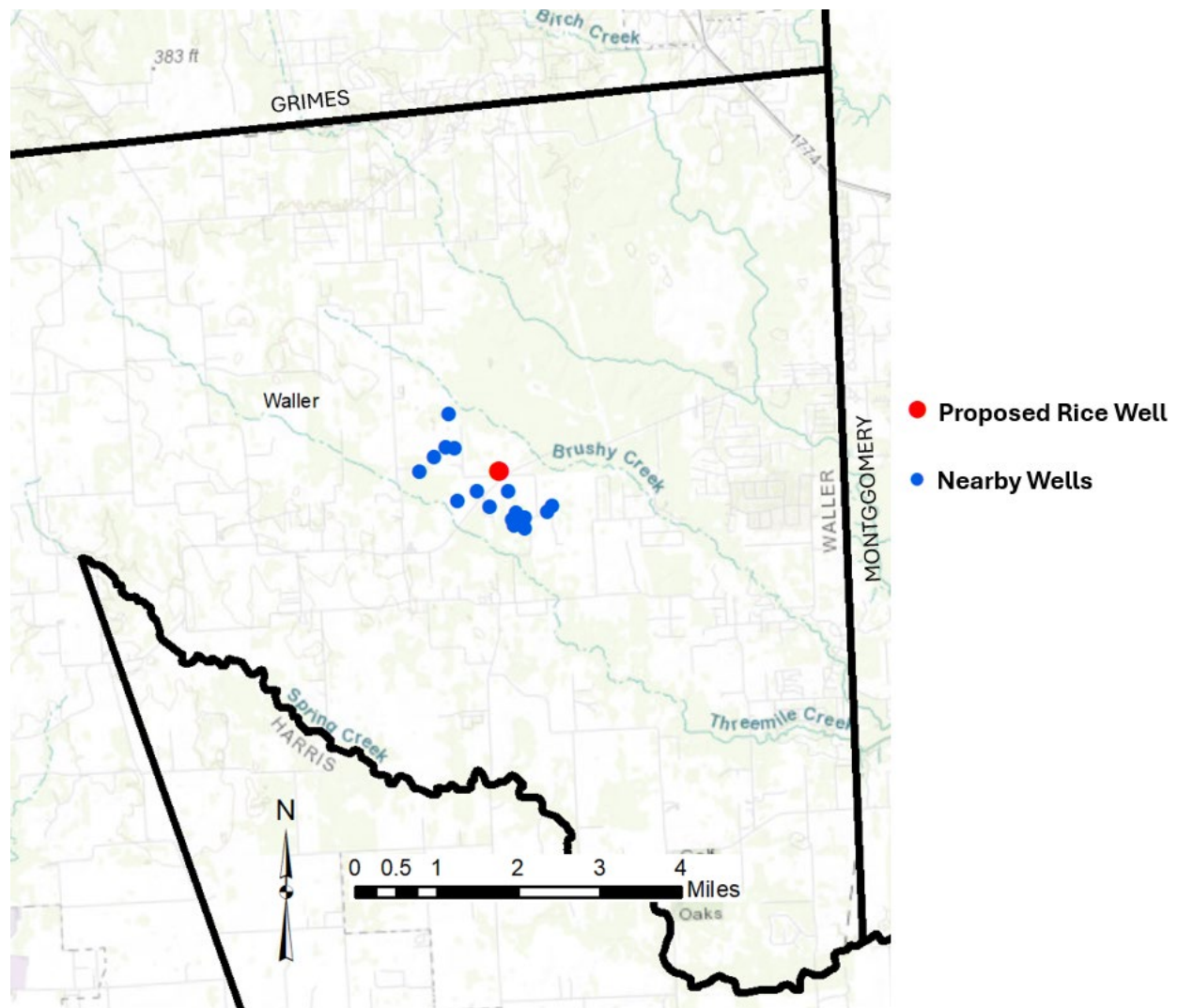


Figure 1. Well Locations

The Fortran program *PointRC.exe* was used to find the HAGM cell for the x- and y-coordinates of the proposed production well and the nearby registered wells. The results are summarized in Table 1.

Table 1. Well Location Coordinates

WellNum	Distance to Rice Well (miles)	Estimated Depth (ft)	Latitude	Longitude	GAMx	GAMy	HAGM Row	HAGM Column
Proposed Well (Rice)	0.00	1320	30.1760	-95.8742	6222174	19317798	33	93
BWLL-5867	0.26	255	30.1725	-95.8725	6222745	19316545	33	93
BWLL-4837	0.36	240	30.1728	-95.8789	6220727	19316572	33	92
BWLL-6385	0.44	255	30.1699	-95.8765	6221520	19315551	33	92
BWLL-4450	0.54	210	30.1686	-95.8711	6223235	19315146	33	92
BWLL-4197	0.60	250	30.1675	-95.8719	6222988	19314730	33	92
BWLL-5561	0.63	247	30.1711	-95.8831	6219437	19315915	33	92
BWLL-4301	0.63	240	30.1806	-95.8833	6219221	19319352	32	92
BWLL-4153	0.63	266	30.1678	-95.8694	6223772	19314862	33	93
BWLL-4353	0.68	255	30.1664	-95.8717	6223090	19314330	33	92
BWLL-4628	0.68	261	30.1667	-95.8703	6223525	19314446	33	92
BWLL-4039	0.73	200	30.1808	-95.8850	6218692	19319432	32	92
BWLL-4718	0.76	214	30.1658	-95.8694	6223799	19314154	33	92
BWLL-4155	0.76	228	30.1686	-95.8647	6225249	19315220	33	93
BWLL-4552	0.76	220	30.1697	-95.8636	6225585	19315638	33	93
BWLL-4692	0.83	205	30.1792	-95.8875	6217927	19318796	32	92
BWLL-4622	0.95	204	30.1867	-95.8842	6218876	19321566	32	93
BWLL-5156	0.98	214	30.1767	-95.8906	6216998	19317850	32	92

2.2 HAGM Grid Parameters

The Excel spreadsheet named *BGCD Parameters.xlsx* contains all the data needed for the review and Phase 1-a calculations. The data for the proposed well were extracted and saved in the Excel file named *Rice Phase I-a Tables.xlsx*. The tab named *gridparam* contains the HAGM grid data and is presented as Table 2. Please note that all model layers for the proposed well location (HAGM Row 33, Column 93) are included.

Table 2. HAGM Grid Parameters for Proposed Rice Well

County Name	Waller	Waller	Waller	Waller
County Code	237	237	237	237
Outcrop Layer	1	1	1	1
Layer	1	2	3	4
Row	33	33	33	33
Column	93	93	93	93
x-coordinate (GAM-ft)	6225217	6225217	6225217	6225217
y-coordinate (GAM-ft)	19317144	19317144	19317144	19317144
Surface Elevation (ft MSL)	267	267	267	267
Cell Top Elevation (ft MSL)	267	180	-658	-929
Cell Bottom Elevation (ft MSL)	180	-658	-929	-1606
Cell Thickness (ft)	87	838	271	677
Clay Thickness (ft)	34	343	95	378
Clay Thickness (% of Cell Thickness)	39.08	40.93	35.20	55.83

2.3 HAGM Aquifer Parameters

The Excel spreadsheet named *BGCD Parameters.xlsx* contains all the data needed for the review and Phase 1-a calculations. The data for the proposed well were extracted and saved in the Excel

file named *Rice Phase I-a Tables.xlsx*. The tab named *HAGMparam* contains the HAGM aquifer parameter data and is presented as Table 3. Please note that all model layers for the proposed well location (HAGM Row 33, Column 93) are included.

Table 3. HAGM Aquifer Parameters for Proposed Rice Well

County Name	Waller	Waller	Waller	Waller
County Code	237	237	237	237
Outcrop Layer	1	1	1	1
Layer	1	2	3	4
Row	33	33	33	33
Column	93	93	93	93
Hydraulic Conductivity (ft/day)	11.92	1.90	0.01	1.88
Transmissivity (gpd/ft)	7,758	11,910	30	9,504
Leakage (1/day)	2.20E-05	6.30E-06	5.16E-09	0.00E+00
Storativity (dimensionless)	1.00E-01	9.00E-04	2.70E-04	2.67E-04
Elastic Storativity (dimensionless)	2.06E-05	7.81E-05	9.20E-07	3.81E-06
Inelastic Storativity (dimensionless)	2.06E-03	7.81E-03	9.20E-05	3.81E-04

2.4 HAGM Results

The Excel spreadsheet named *BGCD Parameters.xlsx* contains all the data needed for the review and Phase 1-a calculations. The data for the proposed well were extracted and saved in the Excel file named *Rice Phase I-a Tables.xlsx*. The tab named *HAGMresults* contains the HAGM results and is presented as Table 4. Please note that all model layers for the proposed well location (HAGM Row 33, Column 93) are included.

Table 4. HAGM Results for Proposed Rice Well

County Name	Waller	Waller	Waller	Waller
County Code	237	237	237	237
Outcrop Layer	1	1	1	1
Layer	1	2	3	4
Row	33	33	33	33
Column	93	93	93	93
Groundwater Elevation in 2009 (ft MSL)	205	196	196	58
Groundwater Elevation in 2080 (ft MSL)	165	155	155	-186
DFC Drawdown (ft)	39	41	42	243
Artesian Head (ft)	-62	16	854	987
Subsidence in 2009 (ft)	0.05	0.05	0.05	0.05
Subsidence in 2080 (ft)	0.27	0.27	0.27	0.27
Subsidence from 2009 to 2080 (ft)	0.22	0.22	0.22	0.22
Cell Pumping in 2009 (AF/yr)	0	50.69	0	0
Cell Pumping in 2080 (AF/yr)	0	38.63	0	0

2.5 Theis Parameters

The Excel spreadsheet named *BGCD Parameters.xlsx* contains all the data needed for the review and Phase 1-a calculations. The data for the proposed well were extracted and saved in the Excel file named *Rice Phase I-a Tables.xlsx*. The tab named *theisparam* contains the Theis parameters and is presented as Table 5. The Theis parameters are associated with the estimation of drawdown using the Theis equation as described below. Please note that only data from the Evangeline (Layer 2) and Jasper (Layer 4) for the proposed well location (HAGM Row 33, Column 93) are included.

Table 5. Theis Parameters for Proposed Rice Well

County Name	Waller	Waller
County Code	237	237
Outcrop Layer	1	1
Layer	2	4
Row	33	33
Column	93	93
Drawdown in Production Well at 100 gpm for 36 hours	16.35	21.67
Drawdown 1/2 mile from Production Well at 100 gpm for 36 hours	0.53	1.29
Drawdown 1/2 miles from Production Well at 100 gpm for 1 year	5.14	7.63
Drawdown-Pumping Ratio for Production Well for 36 hours	0.16345	0.21674
Drawdown-Pumping Ratio for 1/2 mile from Production Well for 36 hours	0.00526	0.01289
Drawdown-Pumping Ratio for 1/2 mile from Production Well for 1 yr	0.05139	0.07629

2.6 Theis Results

Groundwater production data from the permit application were used along with the drawdown-pumping ratios contained in Table 5 to develop three estimates of drawdown:

- Scenario 1: drawdown in the production well after 36 hours of pumping at three times the average annual pumping rate.
- Scenario 2: drawdown in a well ½ mile from the production well after 36 hours of pumping at three times the average annual pumping rate.
- Scenario 3: drawdown in a well ½ mile from the production well after one year of pumping at the average annual pumping rate.

Results of these calculations for the Evangeline Aquifer (Layer 2) are presented in Table 6.

Table 6. Theis Results for Proposed Rice Well

Production Summary	Value
Annual Permit Production Limit (gallons)	229,950,000
Annual Permit Production Limit (acre-feet)	706
Average Pumping Rate (gpm)	438
Average Pumping Rate (cfd)	84225
3X Average Pumping Rate (gpm)	1313
Permit Production Rate (gpm)	900

Japser		
Drawdown Calculations	Drawdown-Pumping Ratios	Calculated Drawdown (ft)
Production Well - 36 hours (3X avg pumping)	0.21674	284.47
1/2 mile from Production Well - 36 hours (3X avg pumping)	0.01289	16.92
1/2 mile from Production Well - one year (avg pumping)	0.07629	33.38

3.0 Phase I-b Results

Phase I-b requirements include the results of a simulation using the HAGM for the area that adds the proposed well to the most current model simulation that was used to establish the desired future condition. The documentation of BGCD implementation of the most recent desired future condition simulation is contained in Hutchison (2021).

As required in the Phase I-b guidelines, this section of the report contains the results of the simulation:

- Drawdown hydrographs
- Subsidence hydrographs
- Summary tables of drawdown and subsidence
- A county-aquifer level groundwater budget that includes a comparison of the HAGM simulation with the proposed well and the groundwater water budget of the desired future condition simulation.

3.1 Drawdown Hydrographs

The proposed production well will be about 1,320 feet in depth. Data from the HAGM suggest that the well would be completed in the Jasper Aquifer. Depths of the nearby wells in Table 1 range between 200 and 266 feet. Data from the HAGM suggest that these wells are completed in the Evangeline Aquifer.

Drawdown hydrographs at the location of the proposed well (Row 33, Column 93) for the Evangeline (the overlying formation) and the Jasper (the production formation) are shown in Figures 2 and 3, respectively. These hydrographs present the predicted drawdown for the DFC run of the HAGM and for the run where the proposed well is added to the DFC run. Figure 4 presents the difference between the two scenarios, or the drawdown that is attributable to the proposed well in both the Evangeline and the Chicot.

HAGM Drawdown (Evangeline)
Layer 2, Row 33, Column 93 (Overlying Formation at Proposed Well Location)

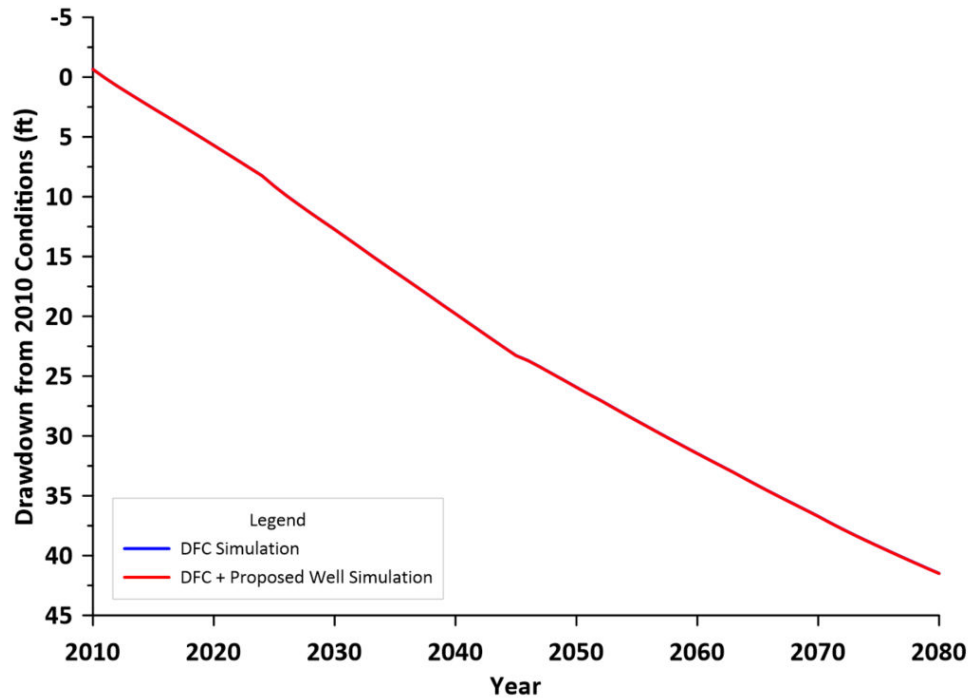


Figure 2. Drawdown Hydrograph for Row 33, Column 93 (Evangeline)

HAGM Drawdown (Jasper)
Layer 4, Row 33, Column 93 (Proposed Well Location)

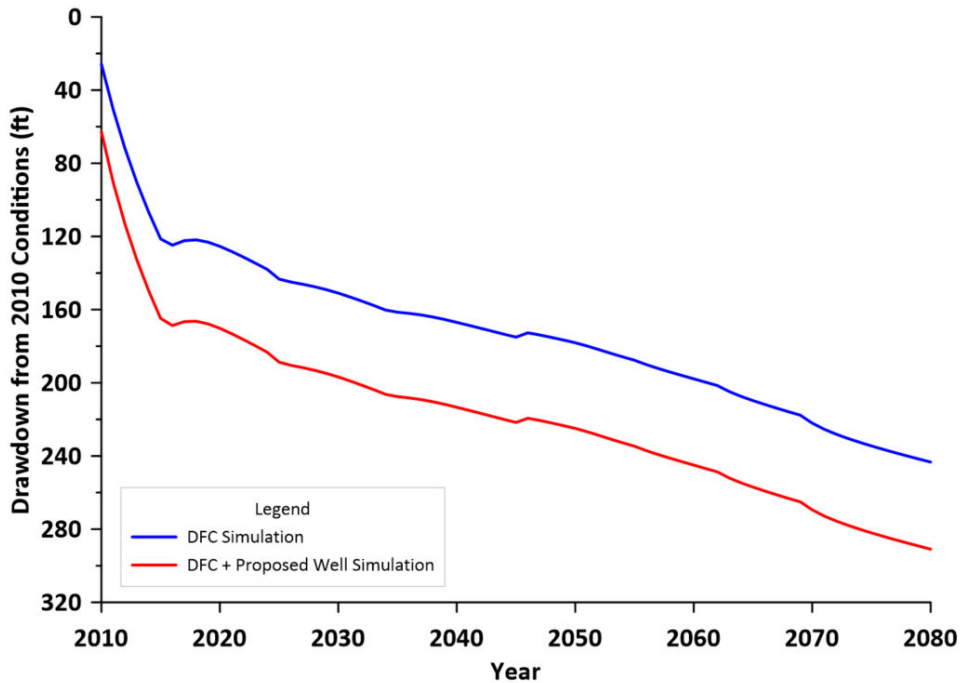


Figure 3. Drawdown Hydrograph for Row 33, Column 93 (Jasper)

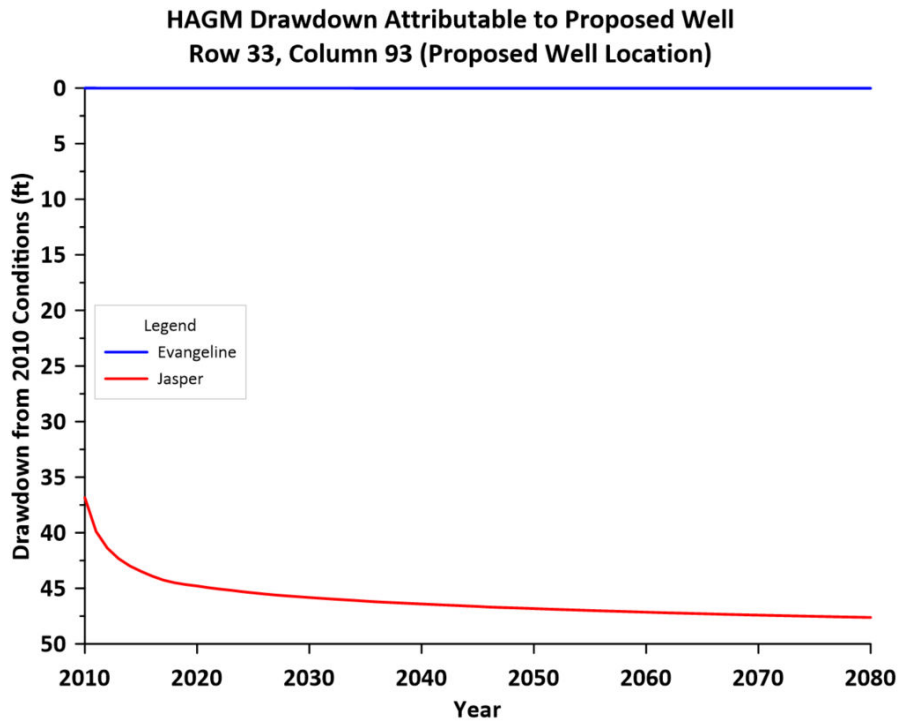


Figure 4. Drawdown Attributable to Proposed Pumping for Row 33, Column 93

3.2 Subsidence Hydrographs

The subsidence hydrograph at the location of the proposed well (Row 33, Column 93) is presented in Figure 5. This hydrograph presents the predicted subsidence for the DFC run of the HAGM and for the run where the proposed well is added to the DFC run. Figure 6 presents the difference between the two scenarios, or the subsidence that is attributable to the proposed well.

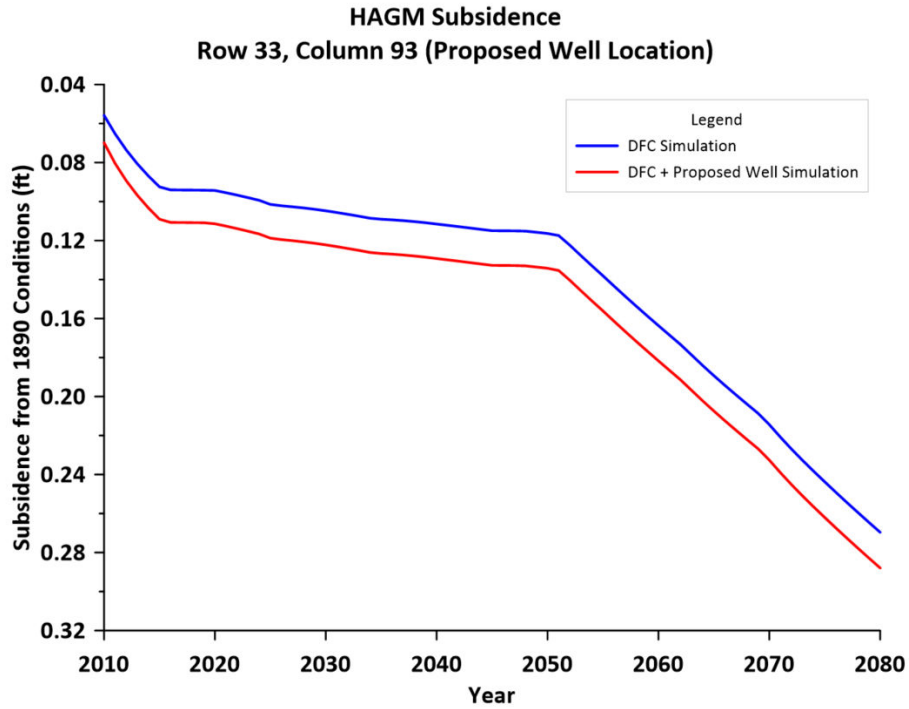


Figure 5. Subsidence Hydrograph for Row 33, Column 93

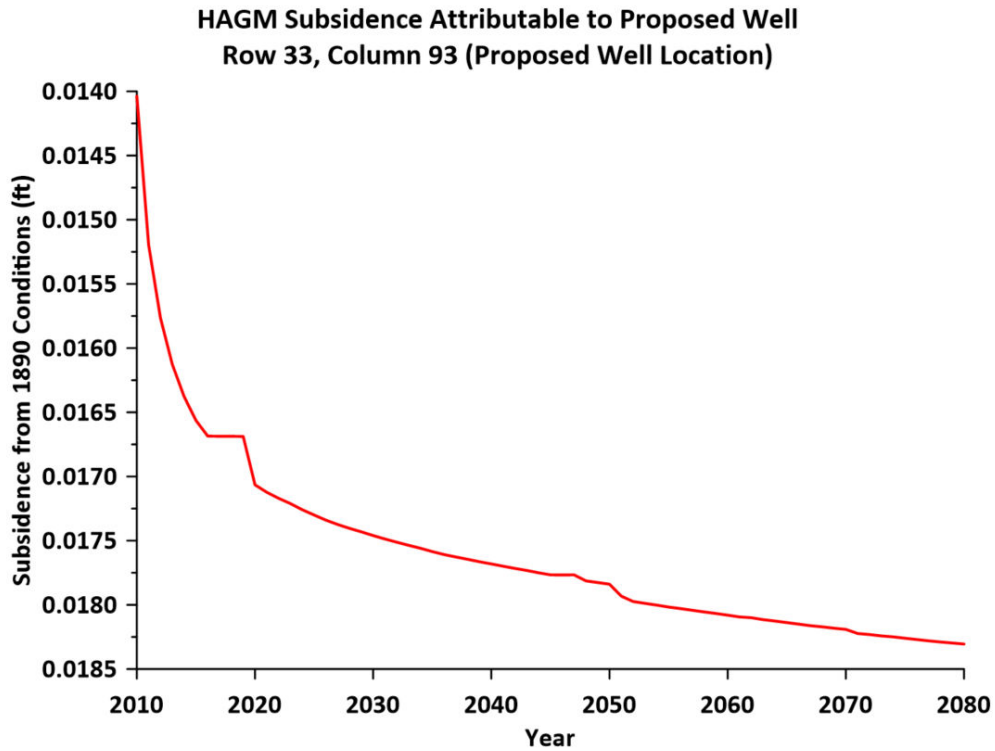


Figure 6. Subsidence Attributable to Proposed Well for Row 33, Column 93

3.3 Tabular Summary of Drawdown and Subsidence

The summary of drawdown and subsidence attributable to the proposed pumping for all well locations is presented in Table 7.

Table 7. Tabular Summary of Drawdown and Subsidence

WellNum	Distance to Rice Well (miles)	Estimated Depth (ft)	HAGM Row	HAGM Column	Drawdown Attributable to Proposed Well (2010 to 2080 - ft)		Subsidence Attributable to Proposed Well (1890 to 2080 - ft)
					Evangeline Aquifer	Jasper Aquifer	
Proposed Well (Rice)	0.00	1320	33	93	0.02	47.62	0.02
BWLL-5867	0.26	255	33	93	0.02	47.62	0.02
BWLL-4837	0.36	240	33	92	0.02	31.83	0.01
BWLL-6385	0.44	255	33	92	0.02	31.83	0.01
BWLL-4450	0.54	210	33	92	0.02	31.83	0.01
BWLL-4197	0.60	250	33	92	0.02	31.83	0.01
BWLL-5561	0.63	247	33	92	0.02	31.83	0.01
BWLL-4301	0.63	240	32	92	0.02	27.32	0.01
BWLL-4153	0.63	266	33	93	0.02	47.62	0.02
BWLL-4353	0.68	255	33	92	0.02	31.83	0.01
BWLL-4628	0.68	261	33	92	0.02	31.83	0.01
BWLL-4039	0.73	200	32	92	0.02	27.32	0.01
BWLL-4718	0.76	214	33	92	0.02	31.83	0.01
BWLL-4155	0.76	228	33	93	0.02	47.62	0.02
BWLL-4552	0.76	220	33	93	0.02	47.62	0.02
BWLL-4692	0.83	205	32	92	0.02	27.32	0.01
BWLL-4622	0.95	204	32	93	0.02	31.83	0.01
BWLL-5156	0.98	214	32	92	0.02	27.32	0.01

3.4 Groundwater Budget Comparison

The summary groundwater budget comparison of the DFC simulation and the simulation where the proposed well is added to the DFC simulation is presented in Table 8 and the analysis of sources of the proposed pumping is presented in Table 9. Please note that about less than 5 percent of the production from the proposed well will come from groundwater storage (including interbed storage), about 30 percent of proposed pumping will come from induced inflow from Grimes County, and about 44 percent will come from captured outflow that would have flowed to Montgomery County.

Table 8. Groundwater Budget Summary

	DFC Run (2010 to 2080)	DFC + Rice Run (2010 to 2080)	Difference (AF/yr)
Inflow			
Recharge and Net Surface Water Inflow (GHB Boundary)	41,382	41,394	11
Interbed Storage	2,956	2,973	17
From Austin County	6,232	6,272	39
From Grimes County	1,816	2,030	214
From Washington County	1,243	1,268	26
Total Inflow	53,629	53,936	307
Outflow			
Pumping	55,495	56,201	706
To Fort Bend County	10,422	10,411	-11
To Harris County	4,157	4,096	-61
To Montgomery County	5,922	5,612	-309
Total Outflow	75,996	76,321	325
Inflow - Outflow	-22,367	-22,385	-18
Model Calculated Storage Change	-22,366	-22,384	-18
Model Error	-1	-1	0

Table 9. Sources of Proposed Pumping

	AF/yr	Percent of Increased Pumping
Pumping Increase	706	100.00
Storage Reduction	18	2.51
Induced Inflow		
Recharge and Net Surface Water Inflow (GHB Boundary)	11	1.61
Interbed Storage (IBS)	17	2.39
From Austin County (Zone 8)	39	5.54
From Grimes County (Zone 93)	214	30.32
From Washington County (Zone 239)	26	3.61
Captured Outflow		
To Fort Bend County (Zone 79)	11	1.56
To Harris County (Zone 101)	61	8.66
To Montgomery County (Zone 170)	309	43.80

4.0 Conclusions and Recommendations

The impacts from this proposed well appear to be modest on the Jasper Aquifer and minimal on the overlying Evangeline Aquifer. The permit application for this well should be approved to proceed to the Phase II activities. Based on the test results and an update of the analyses in this Phase I-b report, this conclusion can be re-evaluated.

5.0 References

Hutchison, W.R., 2021. Implementation of GMA 14 Desired Future Condition Based on Multi-Metric Simulation (70% Available Drawdown, 1 Foot of Subsidence, 30K Pumping Limit, 2016 Pumping Distribution). Final Report to Zach Holland, General Manager of Bluebonnet Groundwater Conservation District, April 27, 2021, 54p.