



GW-1 & GW-2 and related aspects of Statewide Rules 13, 14, 9, 46, 99 & 100

Rick Behal, P.G.
August 2020



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- Who is the GAU
- What does the GAU do
- Water classification
- The Application (Form GW-1)
- Attachments
- Capitan Reef
- Surface Casing Estimator

Who We Are



- Oil & Gas Division
 - Technical Permitting
 - Groundwater Advisory Unit (GAU)
 - Injection Permitting and Support
 - Environmental Permits and Support
 - Engineering Unit

What We Do (1 of 2)



- Groundwater Determinations:
 - SWR 13: Set and cement sufficient surface casing to protect all usable quality water strata (BUQW)
 - New Drills, Injection, Re-entry, Recompletion, P&A, H-15, O&G Water Supply (W-1 if deeper than BUQW)
- Geologic Isolation (H-1, W-14)
 - No injection is allowed in Underground Source of Drinking Water (USDW)*
 - Depth of confining clay or shale below BUQW/USDW

What We Do (2 of 2)



- Cathodic Protection and Microseismic wells
 - CP (SWR 99) and MS (SWR 100)
 - Required if depth is >30 feet
 - W-1 required if CP/MS well exceeds protection depth
 - Submit well schematic of CP/MS well with W-1
 - GW-1 for CP/MS wells cannot be used for other purposes
- Special Projects
 - Capitan Reef (BEG)
 - BRACS/ASR – Texas Water Development Board (TWDB)

Water Classification



- Superior Quality Water (SQW) \leq 1,000 ppm
 - Good tasting drinking water
- The Base of Usable Quality Water (BUQW) \leq 3,000 ppm
 - Protection depth as define by SWR 13
- Underground Source of Drinking Water (USDW) \leq 10,000 ppm
 - No injection allowed in the USDW*
 - * Aquifer Exemption or EPA concurrence

Water Board Letters



- Why do we call them Water Board Letters?
- Texas Board of Water Engineers established 1913
- 1950 Order required operators to obtain a TBWE letter

RAILROAD COMMISSION OF TEXAS
OIL AND GAS DIVISION.

OIL AND GAS DOCKET NOS. 108,
120, 123, 124, 125, 126, 128,
129, 132, and 146

#20- 19, 629

IN RE: CONSERVATION AND PREVENTION
OF WASTE OF CRUDE PETROLEUM
AND NATURAL GAS IN THE
STATE OF TEXAS

Austin, Texas
November 14, 1950

SPECIAL ORDER
AMENDING STATEWIDE RULE 12(a), DIVISION ONE
OF OIL AND GAS CIRCULAR 16-B, DATED MAY 15, 1934
AS AMENDED FEBRUARY 19, 1937, AND JUNE 25, 1942 .

WHEREAS, After notice for the time and in the manner required by law, the Railroad Commission of Texas held hearings at various times in Austin, Texas, including the hearings held October 19 and November 14, 1950, for the purpose of determining whether or not Statewide Rule 12(a), adopted and promulgated in Oil and Gas Circular 16-B, dated May 15, 1934, as amended February 19, 1937, and June 25, 1942, should be further amended; and

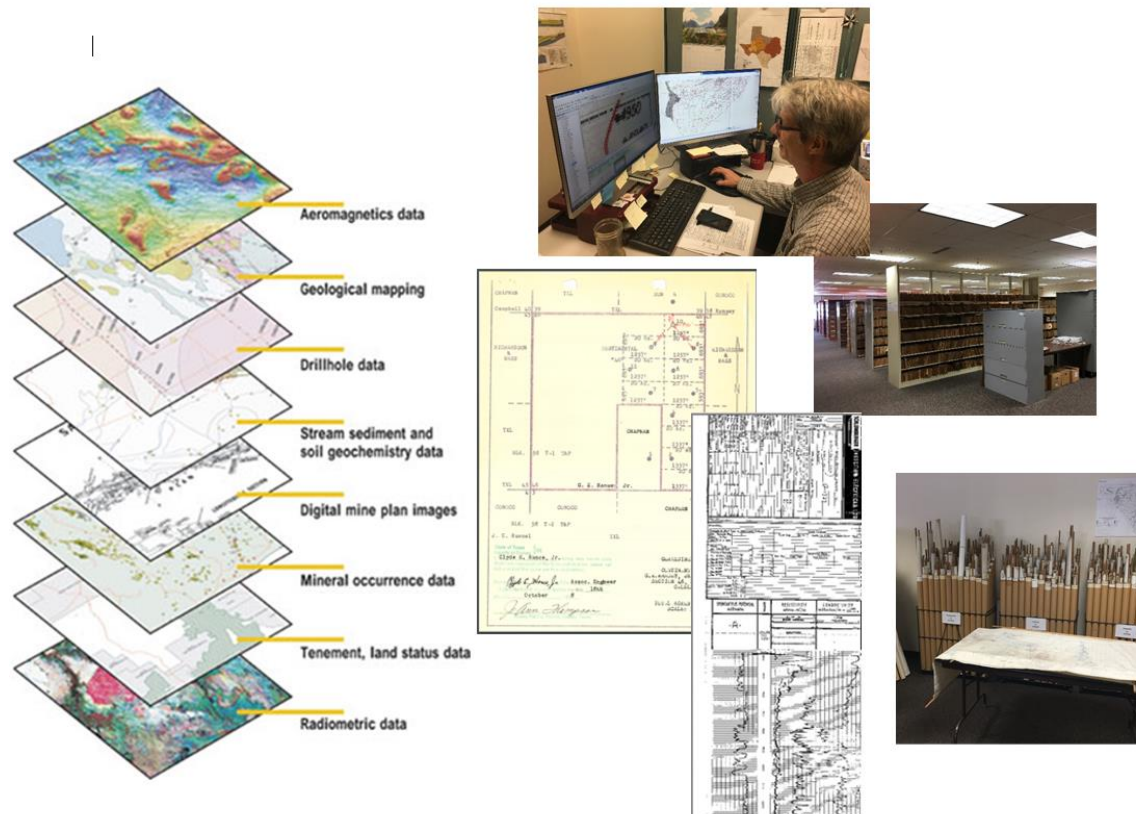
WHEREAS, From evidence adduced at the hearings held on October 19 and November 14, 1950, the Commission is of the opinion and finds that said Statewide Rule 12(a), as amended, should be further amended.

GAU Tools and Techniques (1 of 2)



The GAU uses Geographical Information System (GIS)

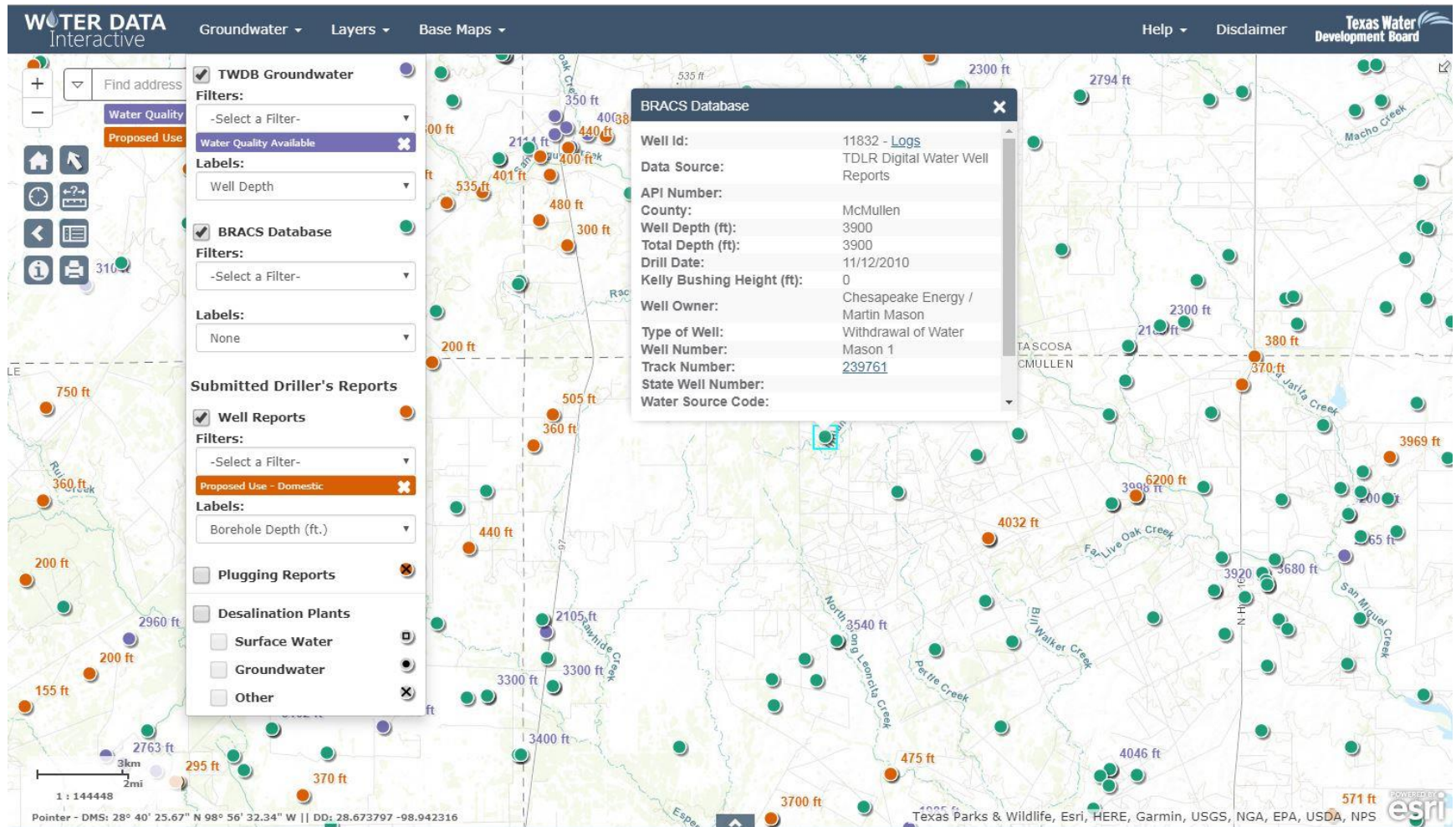
- Operator Provided Information
- Other Government and NGO Web Resources
- Legacy Cloth Maps and Well Files



GAU Tools and Techniques (2 of 2)



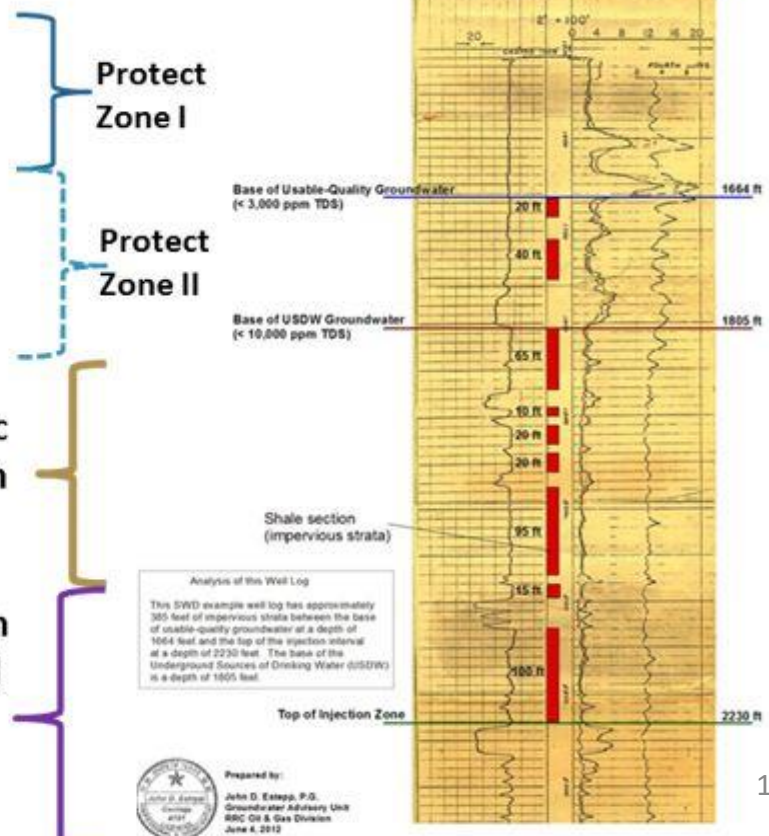
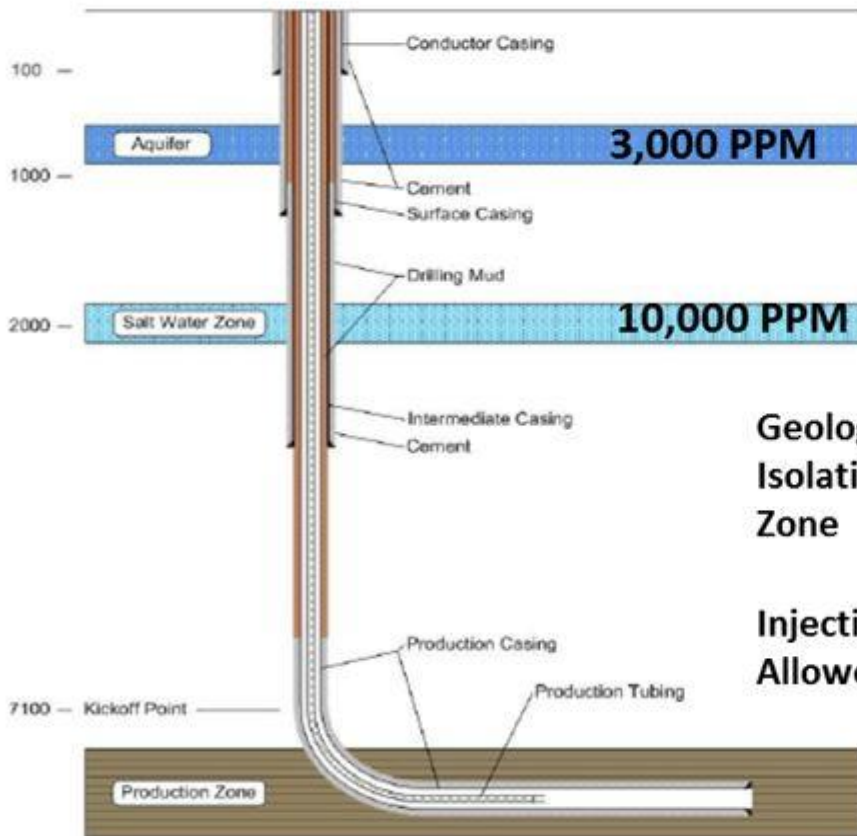
- Texas Water Development Board – Water Data Interactive



How do we Protect?



- Provide Depths for Surface Casing, Cementing, and Plugging
- Locate Geologic Isolation For Injection Wells (H-1, W-14)
 - Depth of confining clay or shale below USDW is required 250' Below BUQW with 100' contiguous confinement



Prepared by:
 John D. Estep, P.G.
 Groundwater Advisory Unit
 RRC Oil & Gas Division
 June 4, 2012

Casing and Cement (1 of 2)



- SWR 13 requires that surface casing protect groundwater as stated in Groundwater Advisory Unit (GAU) letter (Form GW-2)
 - Surface Casing
 - Protects usable-quality water from drilling/completion process
 - Extra protection against leaks during production
 - Cement
 - Prevents annular migration of fluids
 - Prevents corrosion of casing
 - Isolates formation

Casing and Cement (2 of 2)



- Three layers of protection: surface casing, production casing and tubing

- Surface casing

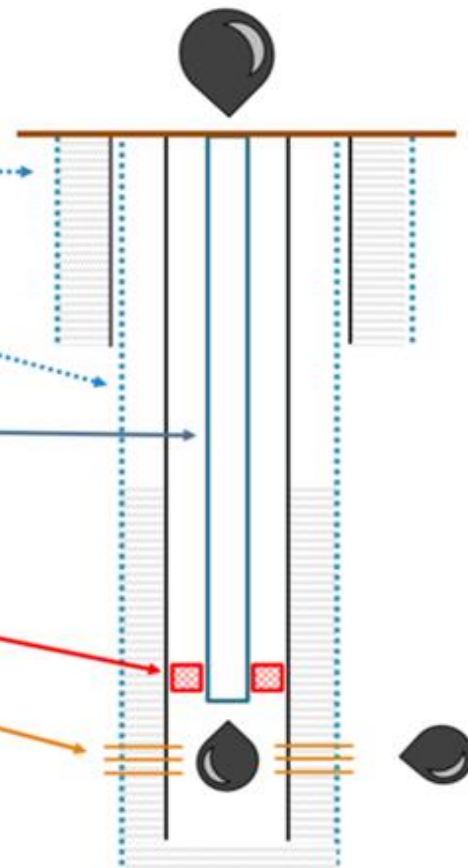
- Production casing

- Cement 

- Tubing

- Packer

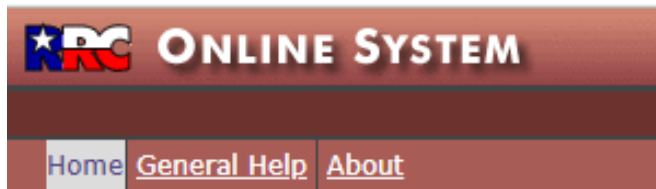
- Perforations



Application (Form GW-1)



- Requests for Groundwater Determinations can be made one of two ways
 - Use the RRC On-Line System
 - Download a PDF form on the GAU Website
 - Email the completed GW-1 form to gau@rrc.texas.gov
 - Send the completed GW-1 form through regular mail



Welcome to the RRC Online System

Main Application

- [Account Administration](#)
- [Drilling Permits \(W-1\)](#)
- [Completions](#)
- [Groundwater \(GW-1\)](#)
- [Digital Well Log Submission](#)

Home / Oil & Gas / Applications and Permits

Groundwater Advisory Unit (GAU)

NOTICE: As part of the RRC Texas Oilfield Relief Initiative, the GAU has identified areas with consistent groundwater protection depths in the following fourteen (14) North Central Texas counties: Archer, Baylor, Callahan, Foard, Haskell, Jones, Knox, Shackelford, Stephens, Taylor, Throckmorton, Wichita, Wilbarger, and Young. Go to our [North Central Texas Area page](#) for more information.

GAU provides Groundwater Protection Determinations for surface casing, underground injection and other underground activities.

If you are an oil or gas operator in Texas, the Railroad Commission of Texas may require you to obtain a Groundwater Protection Determination, which states the base of usable-quality groundwater and additional isolation zones that should be protected for a well or multiple wells within a specified area.

Groundwater Protection Determination Request (Form GW-1)

To request a Groundwater Protection Determination, submit the following documents:

1. A Form GW-1, which can be completed in two different ways:
 - By online filing (RRC Online System)
 - Google Chrome 37.0+ is recommended. Other browsers cause known technical issues.
 - JavaScript must be enabled.
 - Pop-up blocking software must be disabled.
 - Using the [Interactive PDF](#)
2. A scaled map showing the well location and surrounding survey lines;
3. A copy of the electric log, if you are plugging, re-entering an existing well, or converting to a water well (Form-P13, [Application of Landowner to Condition an Abandoned Well for Fresh Water Production](#)); and
4. Application fee (Expedited fee, optional)

For detailed information regarding the Form GW-1 on the Online System refer to the [Groundwater Application Users Guide](#). The online Groundwater Application will only allow oil and gas operators who have registered with the Railroad Commission of Texas by filing an annual Organization Report (Form P-6). If you are not a registered P-S operator, you will be required to submit the Form GW-1 using the [Interactive PDF](#) format version. For instructions on filing the Form GW-1 by PDF go to the [Instructions for Completing Form GW-1 \(PDF\)](#) page.

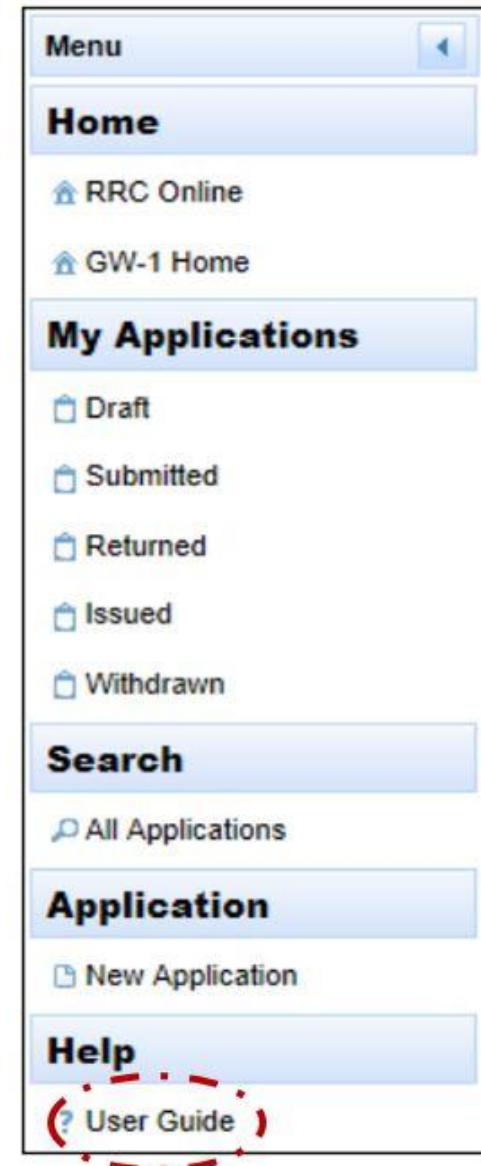
Groundwater Advisory Unit (GAU) Links

- [GAU Home Page](#)
- [Payments](#)
- [Oil & Gas Waste Disposal Wells Application](#)
- [Seismic Survey Application](#)
- [Instructions for Completing the Form GW-1 \(PDF\)](#)
- [How the RRC Protects Groundwater](#)
- [North Central Texas Area](#)
- [Researching Groundwater Protection Determinations and Data](#)

Menu and User Guide



- My Applications (Status)
 - Check application status
 - “Draft” means not submitted
- Search for previous filings
- New Application
- User Guide



Reason for Filing



- Important for H-1 and W-14 because determination will include the USDW necessary for UIC permit application

Railroad Commission of Texas User: Rick Bohal [Log Out](#)

Groundwater Application : GW-1

Filing Information

Effective 02/01/2016, an Application Fee with Surcharge totaling \$250 will be payable on initial submission of this application.

Reason for Filing API Number DP Number

Areal Extent Radius Distance Expedite

Previous GAU No. for this well Regular Register NO. Expedite Register NO.

Rig On Location

Operator Information

Are you filing for P5 Operator?

[Search Operator](#)

Operator Name Operator Number Address1

Address2 City State

Zip Code

Well Identification

[Disclaimer](#) | [RRC Online](#) | [RRC Home](#) | [Release : 2.2.1](#) | [Contact](#)

Areal Extent



- Areal Extent
 - May request Radius, Section, Abstract, Lease...
 - Provide additional information in “Remarks”
(ex: specify well API numbers to be included)
 - Extent depends on hydrogeology & topography

Groundwater Application : GW-1

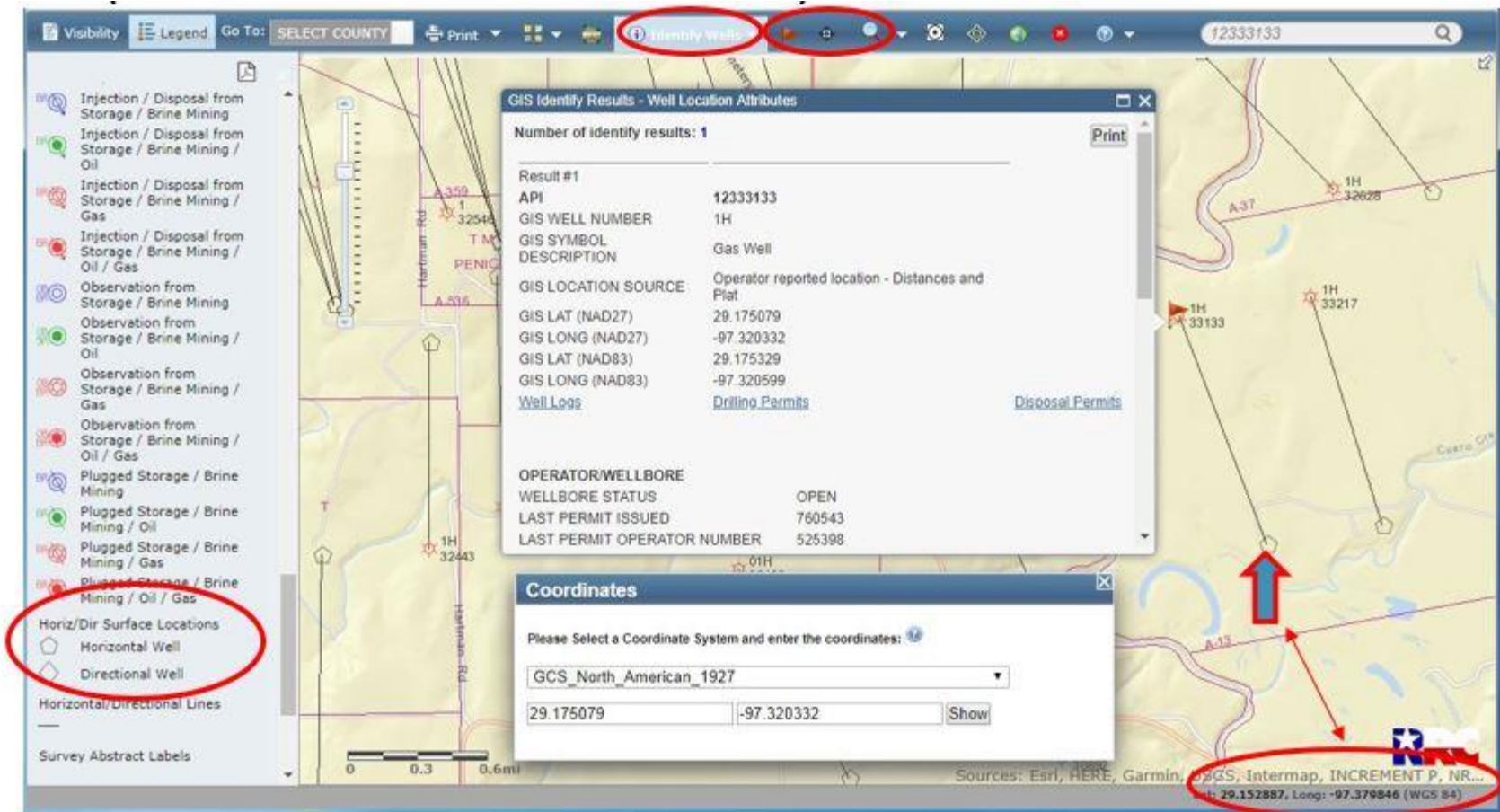
Filing Information

If Reason for Filing is 'New Drill', data fields will be prepopulated if available from an entered API Number/DP Number. Data will not be prepopulated for any other Reason for Filing. Effective 02/01/2016, an Application Fee with Surcharge totaling \$250 will be payable on initial submission of this application.

Reason for Filing *	Choose	API Number	42- 000-00000	DP Number	Number
Areal Extent *	Radius	Radius Distance	200	Expedite	<input type="checkbox"/> Expedite Fee with Surcharge is \$187.50
Previous GAU No. for this well		Rig On Location	<input type="checkbox"/>	Filed Hardcopy	<input checked="" type="checkbox"/>

Location Information

- GPS coordinates for surface location
- GIS tools for identifying wells and plotting coordinates
- Coordinates and survey calls consistent with other RRC filings (RRC GIS, W-1, H-1, W-14, etc.)



The screenshot displays a GIS application interface with a map of a well field. The 'Identify Well' button in the top toolbar is circled in red. A legend on the left side has the 'Horiz/Dir Surface Locations' section circled in red, showing symbols for Horizontal Well and Directional Well. A 'GIS Identify Results - Well Location Attributes' window is open, displaying the following data:

Number of identify results: 1	
Result #1	
API	12333133
GIS WELL NUMBER	1H
GIS SYMBOL DESCRIPTION	Gas Well
GIS LOCATION SOURCE	Operator reported location - Distances and Plat
GIS LAT (NAD27)	29.175079
GIS LONG (NAD27)	-97.320332
GIS LAT (NAD83)	29.175329
GIS LONG (NAD83)	-97.320599
Well Logs	Drilling Permits
Disposal Permits	
OPERATOR/WELLBORE	
WELLBORE STATUS	OPEN
LAST PERMIT ISSUED	760543
LAST PERMIT OPERATOR NUMBER	525398

Below the attributes window, a 'Coordinates' window is open, showing the following information:

Please Select a Coordinate System and enter the coordinates:

GCS_North_American_1927

29.175079 -97.320332 Show

At the bottom of the map, a red arrow points to a well symbol, and another red arrow points to a coordinate pair: 29.152887, Long: -97.379846 (WGS 84), which is circled in red. The RRC logo is also visible in the bottom right corner of the map area.

RRC GIS Public Viewer



- GAU webpage links - Using the RRC Public GIS



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Home / Oil & Gas / Applications and Permits / Groundwater Advisory Unit /

Using the RRC Public GIS Viewer

Navigating

You may instantly zoom to the location of an existing or permitted well by entering the eight digit API number into the search bar and clicking the search icon (magnifying glass). The map will zoom centered on the well, and the well will be highlighted in cyan (light blue).



You can instantly zoom to any location for which you have GPS coordinates. To do so, click on the "Coordinates" tool, shown below, select the correct coordinate system, and enter the appropriate coordinate values.



Groundwater Advisory Unit (GAU) Links

- GAU Home Page
- Payments
- North Central Texas Letter Exemptions
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- Researching Groundwater Protection Determinations and Data

Creating a Scaled Map



- GAU webpage links – Creating a Scaled Map
- A map is required with all application



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Creating a Scaled Map

Requirements

At a minimum for a GW-1 application, the scaled map for a well should include:

- The surface location of the well – Please highlight the well or indicate in some way to make it easy to see relative to other wells on the map
- Two survey lines (of the section, abstract, league, etc.) to which the reference line measurements from the well are made

Though not required, we prefer a professional map to also include: North arrow, scale bar, lease lines, survey lines that are distinctive from lease lines, survey name and abstract number, measured distances of the well from survey lines, GPS coordinates of the surface hole location, lease name and well number, API number if available, operator information, county name, and ground elevation of the surface hole location.

Example of a Basic Map



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- [Researching Groundwater Protection Determinations and Data](#)



Attachments for H-1 and W-14



- Additional info is required for H-1 & W-14
 - H-1: Include the Form H-1A
 - W-14: Include Form W-14 and a representative well log
- GAU issues “no harm” letter for W-14 in addition to the GW-2 Determination

Log Submission



- Four ways to submit well logs
 - Attach to application (Form GW-1)
 - Digital Well Log Submission*
 - Refer to log already available via RRC GIS*
 - email or USPS mail in the hardcopy*
(* Note in GW-1 Remarks)

Upload Files

I certify that at this time I cannot submit all well logs in LAS format.

Choose Primary Well Log Type*
Select One Primary Well Log Type

Choose Secondary Well Log Type(s)
Acoustic/Sonic
Cement Bond
Density
Drillers

Comments
125 characters remaining.

+ Choose Tiff
+ Choose LAS

IMPORTANT: Please select a primary well log. For SWR 16 compliance, the primary well log should match the log header associated with the Completion (G-1/W-2) filed for this well.

Select One Primary File	File Name	File Size	File Type	Primary Well Log Type	Secondary Well Log Type	Comments	Upload status
No results found for search.							

Payment (1 of 2)



- Hit the “Next” button at the bottom of the page to accept the terms and pay.
- If “Save” – Return via Menu/My Applications/Draft

Upload Files -

IMPORTANT: Click Upload to upload the selected attachments

Choose File Type* + Choose ↑ Upload ↻ Cancel

File Name	File Size	File Type	Upload status
No results found for search.			

(1 of 1) << < > >> 10 ▼

Additional Information -

Total Vertical Depth* Elevation*

Formation at Total Vertical Depth Remarks

250 characters remaining.

Payment (2 of 2)



- Check the “Accept” box then the “Payment” button.
- Remember to return to the application after payment confirmation to submit. Otherwise GW-1 remains in “Draft” status (not submitted)

A screenshot of the Railroad Commission of Texas online application system. The page title is "Groundwater Application : GW-1". The main content area shows a "View Application" button at the top. Below it, there are three steps: Step 1: Read the statement in the box below and click the Accept box to digitally sign the application. Step 2: Click the Payment box to pay fees. Payment is made at initial submission. No fees will be charged for resubmission. Step 3: Once the payment is complete, select the RETURN button at the bottom of the page to go back to the submit application screen. A red arrow points to the word "RETURN" in Step 3. Below the steps is a declaration box with the text: "I declare under penalties prescribed in Texas Natural Resources Code Section 91.143, that I am authorized to make this report, that this report was prepared by me or under my supervision and direction, and that the data and facts stated therein are true, correct, and complete, to the best of my knowledge." At the bottom of the page, there are three buttons: "Accept", "Payment", and "Cancel". The "Accept" and "Payment" buttons are circled in red.

Payment Confirmation



- “Print Confirmation” here (now or never!)
- Click on “Return” to go back and finalize submitting the GW-1

Payment Portal:

1 Select Quantity 2 Contact Information 3 Verify Information 4 Pay Fee 5 Confirmation

GAO No: 191641

Name	MATTHEW ACOCK
Company Name	ACOCK OPERATING LIMITED
Phone Number	(214) 828-2853
Email	Lashonda.Hicks@rrc.state.tx.gov

Fee Description	Amount	Quantity	Total
GAU - Surface Casing	\$ 250.00	1	\$ 250.00
SSC Fee			\$ 250.00
Taxes/gov Price			\$ 250.00

Payment Information	
Payment Amount	\$250.00
Date and Time	05/08/2018 09:13:01 AM
Trace Number	4898A0021FF287C
Authorization Code	TEST1123
Register Number	95183


Use the Print Confirmation button below to create a printable receipt and confirm your payment.

[Print Confirmation](#) [Return](#)

Application Status



- If an application is returned, “Edit and Resubmit” to make changes to the application and resubmit.

 **Railroad Commission of Texas** User: Laura Adams

Groundwater Application : GW-1

Application Count : 1 **My Applications**

Showing 1-1 out of 1 applications

	GAU Number	Date Submitted	Application Status	Submitter Name	Operator Name	County	Lease Name	Well Number	Expedite	Ver
Actions	191720	05-23-2018	Admin Returned	Laura Adams	ELEON OPERATORS, LLC	CLAY	JONES	1H	N	1

Showing 1-1 out of 1 applications

Actions

- Edit and Resubmit
- View PDF
- Withdraw
- View Return Email

Summary



- Filing online helps expedite
- No Special Characters (!@#\$%^&*) or Spaces
- Chrome Browser recommended
- Map/plat – Info consistent with GW-1/W-1
- More data favors the desired outcome
- Shout out for more data (shallow log data)
- Confidentiality
- Rig on Location!!! Call Us...

Special Projects

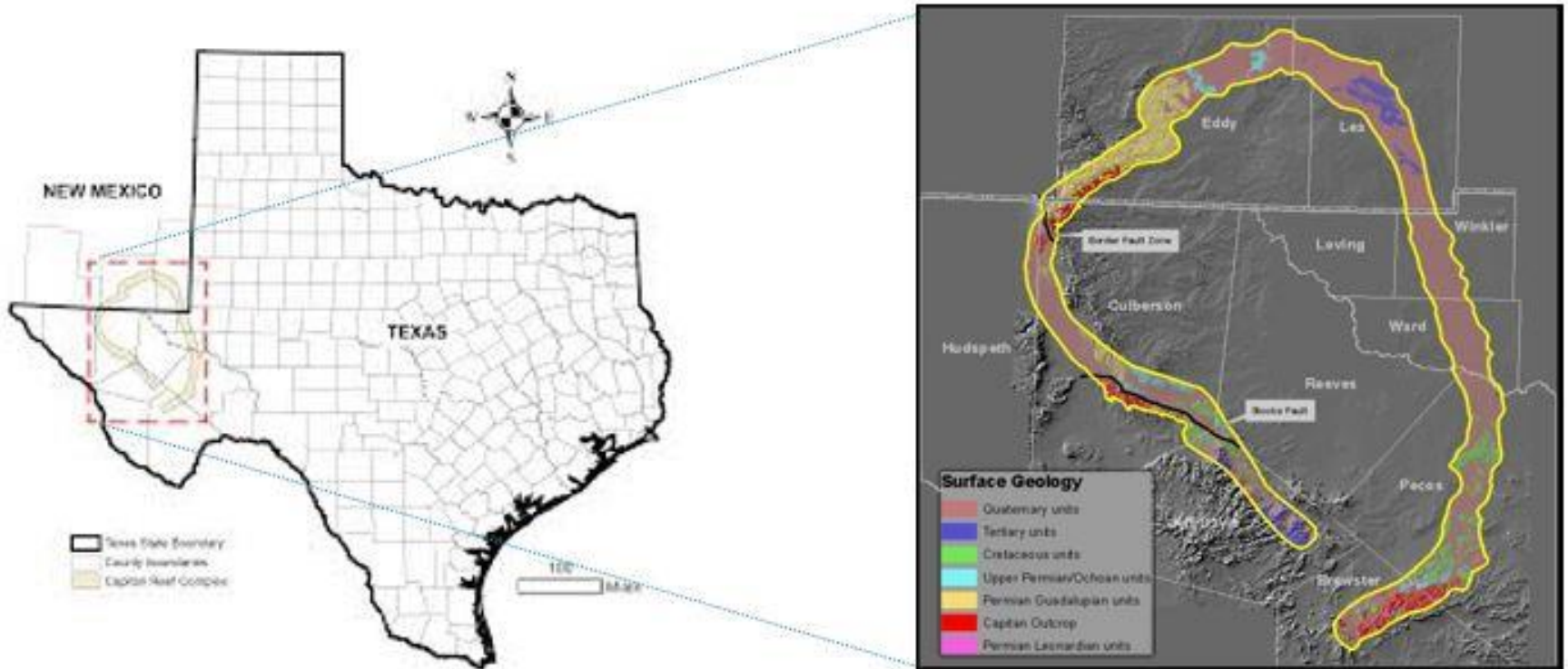


Capitan Reef

Capitan Reef (1 of 3)



- Located in West Texas Permian Basin and South East New Mexico
- Present in Brewster, Culberson, Jeff Davis, Pecos, Ward, and Winkler Counties



Capitan Reef (2 of 3)



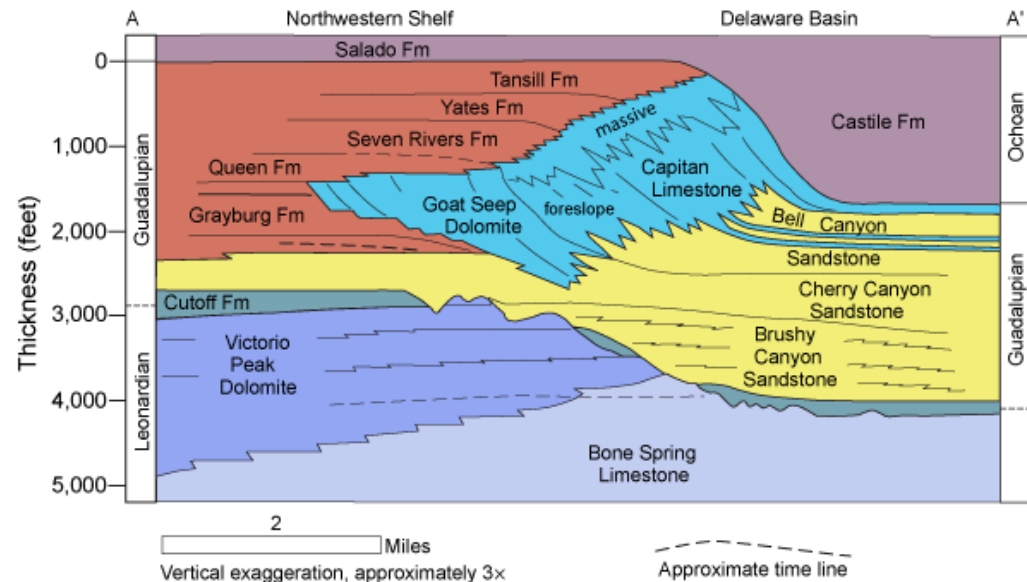
- The Reef contains fresh water but no oil
 - Important Hydrogeologic formation of the Permian Basin
 - Classified by the TWDB as a Minor Aquifer of Texas



Capitan Reef (3 of 3)



- Request logs (shallow data only) to help locate reef
- Capitan Reef added to SWR 13 Geologic Formation List to be reported on Completions Reports (Forms G-1/W-2)



Modified from King, 1948; Hayes, 1964; Tyrrell, 1969; Pray, 1988

Surface Casing Estimator (1 of 4)



- SCE provides operator with an estimate of casing depths
- Prepared in cooperation with the RRC and BEG

Surface Casing Estimator

This web site provides operators with an estimate of casing depths to assist in obtaining the [Groundwater Protection Determination Letter \(pdf\)](#).

All estimates derived from this Web site must be verified by the RRC Groundwater Advisory Unit Team and final recommendations will be provided in the Groundwater Protection Determination Letter.

Railroad Commission of Texas regulations require that anyone drilling for oil and gas or reentering an existing oil and gas well must have a plan for the well design that is approved by the RRC. Part of the plan must include use of surface casing and cement to protect fresh water (generally a salinity of less than 1000 mg/l TDS) and useable quality water (generally a salinity of less than 3000 mg/l TDS). Surface casing also helps protect the well from caving in and blowing out.

The well operator must have a letter from the RRC Groundwater Advisory unit, which is then provided to the RRC, which outlines where fresh and usable-quality water is located. The RRC uses the recommendations in the Groundwater Protection Determination Letter for designing well requirements.

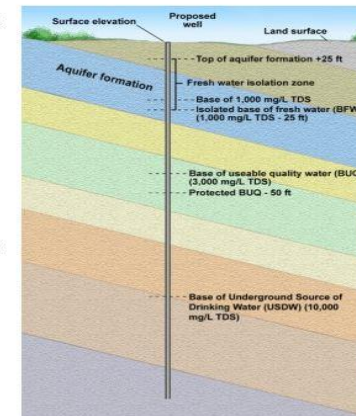
For a full explanation of the procedures and available resources for obtaining the Groundwater Protection Determination Letter, please visit the [RRC Groundwater Advisory Unit page](#) that includes sample application forms, surface casing rules, expedited application procedures, and contact information.

To acquire surface casing information, click the map below:

[Go to the Surface Casing Estimator >](#)



CLICK THIS MAP



This site is prepared in cooperation with the Railroad Commission of Texas and was financed through funds from the Railroad Commission of Texas and the Texas Commission on Environmental Quality.

Effective September 1, 2011, the Surface Casing Estimator project is coordinated through the RRC Groundwater Advisory Unit. Prior to September 1, 2011, the Surface Casing Estimator project was coordinated through the Texas Commission on Environmental Quality.

Surface Casing Estimator (2 of 4)



RRC Surface Casing Estimator

RRC Surface Casing Estimator

- Logged Well
- Oil or Gas Well
- Urban Areas
- Surveys
- County Boundaries
- Alert Areas

RRC Surface Casing Estimator

County Boundaries

Casing Data Available

Alert Areas:

- Alert
- Aquifer/Drilling Hazard
- Gas Storage
- Salt Dome

Map showing Surface Casing Estimator results with various alert areas highlighted in yellow, blue, red, and green. Labels on the map include: "Western Gasfield", "Gas Storage Unit", "Koch and High Depth", "Eastwick Area", and "Permit Required".

SCE via GAU quick links

Groundwater Advisory Unit (GAU) Links

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SCE link: <https://coastal.beg.utexas.edu/surfacecasing/#/>

Earthstar Geographics | Esri, HERE, Garmin

Powered by Esri

Surface Casing Estimator (3 of 4)



Casing Query Result

[Copy link to these results](#)

Well Casing Information

Longitude: -98.01303
 Latitude: 28.99374
 Ground Elevation: 341 ft.
 Aquifer (at BUQ): Carrizo and Wilcox
 Top of Carrizo Isolation Interval: 3080' Depth (2739' Below MSL)
 Bottom of fresh water isolation zone: N/A
 Protected base of usable quality water: 4190' Depth (3849' Below MSL)
 Base of USDW: 5713' Depth (5372' Below MSL)
 The top of the Carrizo isolation interval is at 3080 feet (2739 feet Below MSL).

The base of usable quality water is estimated to occur at a depth of 4190

Logged Well

Q-Number: Q-62

View Q-Log

DATE	TIME	DEPTH	TEMP	RESISTIVITY	LOG	REMARKS
11-27-81	11:17	67	72.8	82		
11-27-81	11:25	100	10.0	100		
11-27-81	11:35	115	11.5	115		
11-27-81	11:45	130	13.0	130		
11-27-81	11:55	145	14.5	145		
11-27-81	12:05	160	16.0	160		
11-27-81	12:15	175	17.5	175		
11-27-81	12:25	190	19.0	190		
11-27-81	12:35	205	20.5	205		
11-27-81	12:45	220	22.0	220		
11-27-81	12:55	235	23.5	235		
11-27-81	13:05	250	25.0	250		
11-27-81	13:15	265	26.5	265		
11-27-81	13:25	280	28.0	280		
11-27-81	13:35	295	29.5	295		
11-27-81	13:45	310	31.0	310		
11-27-81	13:55	325	32.5	325		
11-27-81	14:05	340	34.0	340		
11-27-81	14:15	355	35.5	355		
11-27-81	14:25	370	37.0	370		
11-27-81	14:35	385	38.5	385		
11-27-81	14:45	400	40.0	400		
11-27-81	14:55	415	41.5	415		
11-27-81	15:05	430	43.0	430		
11-27-81	15:15	445	44.5	445		
11-27-81	15:25	460	46.0	460		
11-27-81	15:35	475	47.5	475		
11-27-81	15:45	490	49.0	490		
11-27-81	15:55	505	50.5	505		
11-27-81	16:05	520	52.0	520		
11-27-81	16:15	535	53.5	535		
11-27-81	16:25	550	55.0	550		
11-27-81	16:35	565	56.5	565		
11-27-81	16:45	580	58.0	580		
11-27-81	16:55	595	59.5	595		
11-27-81	17:05	610	61.0	610		
11-27-81	17:15	625	62.5	625		
11-27-81	17:25	640	64.0	640		
11-27-81	17:35	655	65.5	655		
11-27-81	17:45	670	67.0	670		
11-27-81	17:55	685	68.5	685		
11-27-81	18:05	700	70.0	700		
11-27-81	18:15	715	71.5	715		
11-27-81	18:25	730	73.0	730		
11-27-81	18:35	745	74.5	745		
11-27-81	18:45	760	76.0	760		
11-27-81	18:55	775	77.5	775		
11-27-81	19:05	790	79.0	790		
11-27-81	19:15	805	80.5	805		
11-27-81	19:25	820	82.0	820		
11-27-81	19:35	835	83.5	835		
11-27-81	19:45	850	85.0	850		
11-27-81	19:55	865	86.5	865		
11-27-81	20:05	880	88.0	880		
11-27-81	20:15	895	89.5	895		
11-27-81	20:25	910	91.0	910		
11-27-81	20:35	925	92.5	925		
11-27-81	20:45	940	94.0	940		
11-27-81	20:55	955	95.5	955		
11-27-81	21:05	970	97.0	970		
11-27-81	21:15	985	98.5	985		
11-27-81	21:25	1000	100.0	1000		

STANDARD WELL LOGGING COMPANY
 COUNTY: KARNES
 FIELD: MILLCAT
 LOCATION: RAYMOND MUSQUIZ SIMS
 COMPANY: STANDARD OIL COMPANY OF TEXAS
 WELL: 104 PACE #1
 FIELD NO: 257-02637
 COUNTY: KARNES
 STATE: TEXAS

Surface Casing Estimator (4 of 4)



RRC Surface Casing Estimator

▼ RRC Surface Casing Estimator

- Logged Well
- Oil or Gas Well
- Urban Areas
- Surveys
- County Boundaries
- Alert Areas

RRC Surface Casing Estimator

Logged Well



Oil or Gas Well



Surveys



County Boundaries



Casing Data Available

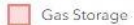
Alert Areas



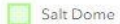
Alert



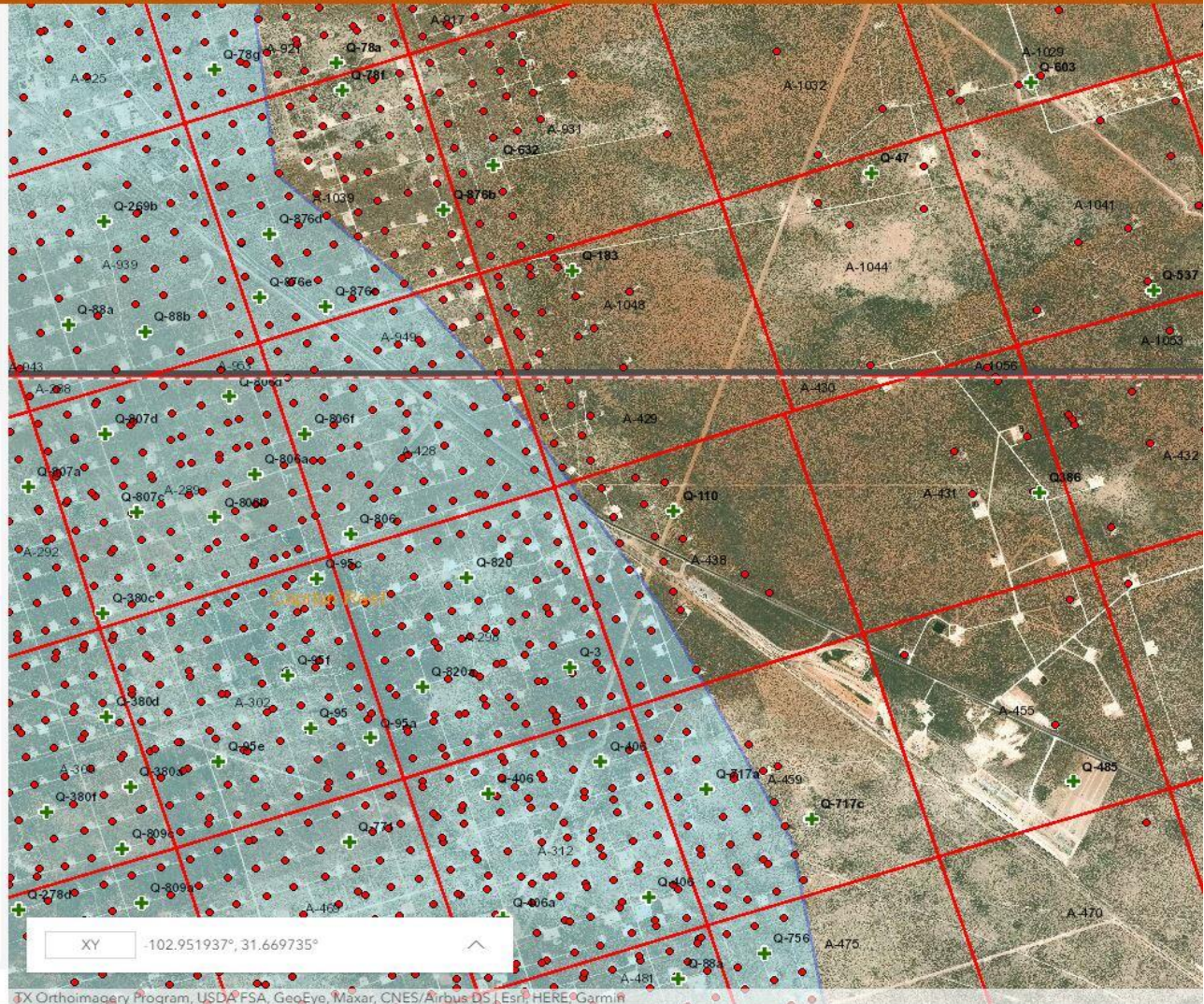
Aquifer/Drilling Hazard



Gas Storage



Salt Dome



XY -102.951937°, 31.669735°

GAU Contact Info



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Hank Zhao, PhD, PG	463-3313
Royce Massey, GIT	462-7017
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Questions ?



Questions?