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APPLICATION OF AN AREA-OF-REVIEW (AOR) CONCEPT TO THE
EAST TEXAS FIELD AND OTHER SELECTED TEXAS OILFIELDS

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ABSTRACT

The Underground Injection Control (UIC) regulations of the U.S. Environmental Protection Agency (EPA) require an Area-of-Review (AOR) study for newly drilled or converted Class II injection wells. In Texas, the UIC program is administered by the Texas Railroad Commission.

A Federal Advisory Committee (FAC) formed by the EPA recommended, in 1992, that exceptions to the AOR requirement should be allowed for wells in those areas where a variance has been granted because there is sufficiently low risk of upward fluid migration from the injection zone into an underground source of drinking water.

The FAC listed conditions that could be considered in determining whether to grant a variance. The University of Missouri-Rolla (UMR), under contract with the American Petroleum Institute, then expanded the FAC AOR variance conditions into an AOR variance methodology.

A Department of Energy (DOE) grant to UMR, for which this is the final report, provided for study of the application of the AOR variance methodology to the East Texas field and to other selected Texas oilfields. A final report on the East Texas field portion of the DOE project was submitted by UMR to DOE in 1995. This current final report describes the results of UMR's study of AOR variance opportunities in the Texas Gulf Coast Frio Formation oil producing trend.

In the course of this study, AOR variance opportunities were examined for 73 oilfields in nine Texas Gulf Coast counties. It is believed that the combination of well construction and abandonment characteristics plus the presence of sloughing and squeezing shales and porous and permeable sand sink zones provide for the possibility of AOR variances in 57 of the 73 study fields. The remaining 16 fields are ones where the oil accumulations occur in conjunction with shallow salt domes and where geologic conditions are probably too complex to allow field-wide AOR variances. The successful study results can probably be extended to at least 78 additional oilfields in 17 other Frio Formation producing trend counties.

1.0 EXECUTIVE SUMMARY

1.1 Background

The Underground Injection Control Regulations promulgated in 1980, under the Safe Drinking Water Act of 1974, require Area-of- Review (AOR) studies be conducted as part of the permitting process for newly drilled or converted Class II injection wells. Existing Class II injection wells operating at the time regulations became effective were excluded from the AOR requirement.

The Area of Review (AOR) is the area surrounding an injection well or wells defined by either the radial distance within which pressure in the injection zone may cause migration of the injection and/or formation fluid into an underground source of drinking water (USDW) or defined by a fixed radius of not less than one-fourth mile. In the method where injection pressure is used to define the AOR radial distance, the AOR is also known as the "zone of endangering influence."

Underground Injection Control (UIC) Program requirements are enforced by the states, where the state has applied for and received primacy from the Environmental Protection Agency (EPA) under Section 1425 of the Safe Drinking Water Act. In Texas, the UIC program is administered by the Texas Railroad Commission (TRRC).

In January 1988, the EPA initiated a Mid-Course Evaluation (MCE) of the adequacy of its regulations for Class II injection wells and, in August 1989, published a report of its findings. As a result of the MCE, EPA's Office of Drinking Water identified areas of concern to be further studied. Among the areas of concern was the need to further evaluate AOR requirements.

In April 1991, the agency proposed and did form a Federal Advisory Committee (FAC) whose charge was to make recommendations to EPA regarding the Class II injection well program. The Committee examined data and information gathered by the EPA during the MCE of the Class II program and, in subsequent studies, identified regulatory gaps and made recommendations for program changes where they were appropriate.

With respect to the AOR requirement, the FAC reached consensus that an exception to this requirement should be allowed for those wells located in areas that have been granted a variance by the Program Director based upon criteria presented in an approved variance plan. Variances could be granted where there is sufficiently low risk of upward fluid migration from the injection zone into underground sources of drinking water.

The Final Document of the FAC lists conditions that could be considered by a Director in determining whether to grant a variance. A variance could be granted based on information indicating any of the following conditions:

- the absence of USDWs,
- the reservoir is underpressured relative to the USDW,
- local geological conditions preclude upward fluid movement that could endanger USDWs, and/or
- other compelling evidence.

The University of Missouri-Rolla (UMR), under contract with the American Petroleum Institute (API), expanded the FAC AOR variance recommendation into an AOR variance methodology that was subsequently revised and adopted by the Underground Injection Practices Foundation of the Ground Water Protection Council.

Five general methods (Figure 2.1) are available for obtaining variance from well-by-well AORs, these are:

1. Variance Based on Absence of USDW
2. Variance Based on Lack of Intersection
3. Variance Based on Negative Flow Potential
4. Variance Based on Mitigating Geological Factors
5. Variance Based on Well Construction and Abandonment Methods

These methods can be used in any order, singly or in combination, to provide variance for some or all wells. Wells not excluded by variance would be subject to conventional AORs.

It is believed that all five of the methods can be applied over large geographic areas but the four methods based upon geologic and hydrologic criteria are most easily visualized as "global" methods. The fifth method requires evaluation of the manner by which the wells in the area under consideration were completed and abandoned.

As part of UMR's contract research for API, the AOR variance methodology was tested by application to the San Juan Basin of New Mexico and the Permian Basin of Texas.

1.2 Purpose and Scope of DOE Grant

In the two API sponsored AOR variance studies, the principal data resources were public ones. The first one-year (5/94-5/95) phase of the DOE grant to UMR was for AOR variance study of the East Texas field, where it was anticipated that non-public data would be required, as was the case. Furthermore, it was believed that if an AOR variance could be obtained for the East Texas field, it would be of significant economic benefit to the field's operators, many of which are smaller independent producing companies.

Phase II of this DOE sponsored grant study was for AOR variance study of other Texas counties to be selected in consultation with the TRRC. The purpose of this phase of the grant was to further test and develop the AOR methodology by application to a previously unstudied area or petroleum province in Texas.

1.2.1 East Texas Field Study

The East Texas oil field is located in the extreme eastern part of Texas and comprises approximately 131,000 acres. The field was discovered in 1930 and is the largest oil field in the conterminous United States in the number of wells and volume of oil produced.

Because of pressure declines in the reservoir, the field has been undergoing water injection for pressure maintenance since 1938. As of 1995, a total of 104 Class II salt-water disposal wells, operated by the East Texas Salt Water Disposal Company (SWDC), were returning all produced salt water to the Woodbine sand producing reservoir.

At the suggestion of various East Texas field operators, and with the agreement and encouragement of the SWDC and the TRRC, UMR proposed to DOE a study of AOR variance opportunities for the East Texas field. A Steering Committee recommended that UMR study the variance method based upon the lack of sufficient petroleum reservoir pressure to cause flow into the lowermost USDW. A 1995 report documents the results of UMR's investigation of this variance option.

1.2.2 Selection of the Texas Gulf Coast Area for Study

In consultation with the TRRC, the Texas Gulf Coast area was selected because:

1. It has geologic characteristics quite different from any previously studied area and is large and generally geologically similar throughout.
2. There is substantial petroleum production from the area.
3. The Class II injection wells in the area are disposal wells, rather than enhanced recovery wells because the petroleum reservoirs are generally not amenable to waterflooding. Thus, the study would require an approach different than in any previous study.

In selecting the Gulf Coast area for study, it was generally understood that the area would include a band from the coastline inland, probably for several counties, and extending southwest from the Louisiana border to the Mexican border. No more exact definition of the study was adopted because it was expected that such definition would come from the study itself. It was agreed that the study would begin with centrally located Refugio County and would then expand, as appropriate, to additional counties.

1.3 The Texas Gulf Coast Study

Selection of the Texas Gulf Coast for study was made in consultation with the TRRC and approved by DOE in late 1994. Some preliminary work began in late 1994 and early 1995. After May, 1995, most grant work was focused on this Phase II effort.

In considering the study, the following concepts were used as starting points.

1. If a variance methodology or methodologies should be found to be applicable, the methodology or methodologies should apply over a large geographic area because of the relatively similar geology that is found throughout much of the Texas Gulf Coast.

2. Groundwater aquifers exist throughout most of the Gulf Coast and the petroleum producing reservoirs are generally either overpressured or normally pressured so that extensive variances based on lack of USDWs or on reservoir underpressuring would be unlikely.
3. Class II wells in the area would probably be disposal wells, rather than waterflood wells. They might or might not be located within oil field boundaries.
4. Based upon experience in the Permian Basin it could be assumed that all wells would be constructed according to TRRC regulations and rules that are protective of usable groundwater and that wells plugged and abandoned after 1967 would probably be abandoned under TRRC regulations and rules that are protective of usable groundwater.
5. Because of the age of some Gulf Coast fields, it was believed likely that some wells, abandoned prior to 1967, would be identified for which TRRC records of abandonment would be incomplete or missing. It was expected that it would be difficult or even impossible to determine if such wells had been abandoned according to TRRC regulations and rules.
6. It was believed likely that sloughing and squeezing shale intervals and permeable sand sink zones would most likely be present to provide mitigating geological circumstances throughout the Gulf Coast. If present, such shales and sand could seal the wellbores and divert upward flowing formation water in the wellbores of any abandoned wells that might be unplugged or improperly plugged, thus providing protection to usable groundwater.

Study of area-wide topics such as geology and hydrogeology was carried out for the entire Gulf Coast simultaneously. Study of individual oil fields began with Refugio County, as a pilot effort, and was then expanded to the other eight counties, including, Brazoria, Chambers, Hardin, Jackson, Nueces, San Patricio, Starr and Victoria.

1.3.1 Geology and Hydrogeology of the Texas Gulf Coast

1.3.1.1 General Geology

The Texas Gulf Coast geologic province consists of Mesozoic and Cenozoic, mostly clastic, sedimentary rocks that dip gently (average of about 1°) to the southeast towards the Gulf of Mexico. The nine counties are within a band about 30 to 80 miles wide, containing oilfields with dominantly Frio Formation oil production, that roughly parallels the Texas coastline from Louisiana to Mexico (Figure 2.2). In the subsurface and also paralleling the coastline through the nine county area are a series of major down-to-the-southeast fault zones of which the most important are the Vicksburg and Frio fault trends (Figure 3.1).

As shown in Figure 3.2, this area contains two embayments, the Houston Embayment centered near Houston, Texas, and the Rio Grande Embayment which occurs to the north of the Rio Grande River in south Texas. Parts of both embayments are underlain by salt, and salt domes are present in parts (but not all) of both embayments. Located between the two embayments is a rather poorly defined high area known as the San Marcos Arch.

Oilfields in the central and southern six counties (from northeast to southwest: Jackson, Victoria, Refugio, San Patricio, Nueces and Starr Counties--in the San Marcos Arch and Rio Grande Embayment area) are all associated with major down-to-the-southeast growth fault systems, the largest being the Vicksburg and Frio fault trends (Figure 3.1).

Although major growth faults may penetrate to the land surface in some areas, and although stratigraphic sections are often thin on the upthrown side of the faults, the faults do not seem to significantly affect the thickness of major sloughing and squeezing shale sequences. That is, the AOR procedure described herein is not significantly affected by major growth faults, and the AOR procedure may be used on either side of the Vicksburg or Frio fault trends as long as shale sections are present.

The northern three study counties (from northeast to southwest: Hardin, Chambers and Brazoria) are located in the Houston Embayment or Houston salt basin, and most oilfields in these and adjacent counties are related to salt domes. Shallow domes occur at less than 4,000 feet in the subsurface, intermediate domes occur between 4,000 feet to 10,000 feet, and deep domes are below 10,000 feet.

Although all salt domes are structurally and stratigraphically complicated, intermediate and deep seated domes do not significantly alter the overlying stratigraphic section to the point of disqualification of the AOR procedure described in this report. Shallow salt domes are domes that often bring stratigraphic and structural disturbances to within several hundred feet of the land surface. Shallow domes are a particular problem for the AOR procedure because they bring hydrocarbon traps almost to the surface of the land. Because of these complications, the AOR procedure described herein probably cannot be used field-wide for oilfields associated with shallow salt domes.

Table 3.2 shows the generalized stratigraphic nomenclature for the Texas Gulf Coast. Table 3.2 also identifies major hydrogeologic units (aquifers and confining layers) as well as significant hydrocarbon producing horizons.

All of the Tertiary age stratigraphic units listed in Table 3.2 are composed principally of clastic material ranging from sand size to clay size. While the sandy units are generally referred to as sandstones and the clayey units are often referred to as shales, the deposits are all very poorly consolidated and poorly cemented. In the strictest sense, the term "shale" is reserved for mudrocks that have fissility. Most of the mudrocks in the study area do not have well developed fissility and should probably be called mudstone rather than shale. In the report, the terms shale and mudstone are used interchangeably for what should probably, in the strictest sense, be called mudstone.

The overall stratigraphy of the Texas Gulf Coast is complicated. Although the stratigraphy within one field or county is typically fairly uniform in the sense that major sand units, such as Frio, or shale units, such as the Anahuac, are present in varying thicknesses throughout the field or county, significant differences occur between counties along depositional strike as well as updip and downdip.

Virtually all of the sand sequences have high porosity and permeability and, thus, the potential to make excellent petroleum reservoirs or groundwater aquifers. The shallow Miocene and Pliocene age horizons (Oakville, Lagarto and Goliad Formations) are typically non-marine fluvial and lagoonal sand and mudstone sediments through the study area. Thick sand sequences in the Miocene and Pliocene are, in some cases, minor gas reservoirs and, otherwise, are groundwater aquifers or make excellent sink zones for upward moving fluids.

Virtually all of the Miocene and Pliocene shales and mudstones are considered to have potential as good sloughing and squeezing zones. The shales and mudstones are poorly consolidated and many are known to contain swelling clays such as montmorillonite and bentonite.

1.3.1.2 Mitigating Geological Circumstances

Mitigating geological circumstances that can prevent upward movement fluids to an aquifer include:

- A. Sloughing and squeezing shales or mudstones that, in an uncased wellbore, will slough into or squeeze off vertical permeability, and
- B. An intervening low pressure or normally pressured, high permeability zone (known as a sink zone) that would divert upward flow of fluids into that zone.

Environmentally, shales or mudstones of the Gulf Coast consist of three main types, marine, bay or lagoonal, and non-marine sediments that occur as overbank deposits in fluvial sequences and interdistributary areas on delta plains.

Bay, lagoonal and other non-marine mudstones tend to be thin and discontinuous laterally, though collectively they can combine to form important confining or sloughing and squeezing units.

From youngest to oldest, important Oligocene-Pliocene stratigraphic units that contain important sloughing and squeezing shales and confining units include:

- Pliocene Willis Formation
- Miocene Goliad Formation
- Miocene Lagarto Formation
- Miocene Oakville Formation
- Oligocene Anahuac Formation
- Oligocene Vicksburg Formation

In the fields in this study, only the post-Anahuac formations are of importance.

Within the study area, Miocene age stratigraphic units, including the Oakville and Lagarto Formations of the Fleming Group and the Goliad Formation, have a total thickness of about 2,700 to 5,000 feet of non-marine fluvial and lagoonal sediments comprised of sand (<20 to 70%) and mudstone (30 to >80%). While we were not able to distinguish stratigraphic boundaries in our log studies, we believe that the shale (mudstone) units identified on the borehole logs of Appendix 2 are within the Oakville-Goliad Miocene sequence. These potentially sloughing and squeezing shale (mudstone) units are described to contain montmorillonite and bentonite clays that would be expected to

enhance their sloughing and squeezing properties.

Sink zones are high permeability zones that are either normally pressured or underpressured. The Gulf Coast has many normally pressured shallow sandstones that are individually or collectively very thick. Any thick sandstone sequence that is normally pressured or underpressured can act as a sink zone for diversion of upward flowing fluids.

1.3.1.3 Hydrogeology

Table 3.2 identifies major aquifers and confining units relative to major oil and gas producing horizons in the Texas Gulf Coast. The Texas Gulf Coast is divided by Ryder and Ardis¹⁷ into two major aquifer systems, the older *coastal uplands* aquifer system, and the younger *coastal lowlands* aquifer system. The two systems are separated by the Vicksburg-Jackson confining layer at the Eocene-Oligocene boundary. The uplands aquifer occurs entirely to the northwest of the area of this study, and only the lowlands aquifer is pertinent to this study. The lowlands aquifer is divided here into four permeable zones and two confining units as follows:

- Pleistocene Chicot Aquifer
- Pliocene Evangeline (Goliad) Aquifer
- Miocene Burkeville (Largarto) Confining unit
- Miocene Jasper (Oakville) Aquifer
- Miocene Catahoula (Anahuac) Confining unit, (only in the subsurface), and the
- Miocene Jasper (Frio) Aquifer (present only in the subsurface).

The stratigraphy of the aquifers and the confining units is multilayered and complex, and different authors subdivide the lowlands aquifer differently. All of the units dip gently to the southeast as well as thicken to the southeast. Aquifers are recharged from the northwest where they either intersect the land surface or are in communication with aquifers that intersect the surface. In general, the aquifers all contain fresh water at shallow depths near their surface exposures to the northwest, and salinities increase to the southeast as the aquifers descend into the subsurface. Sandstones that are well flushed by fresh water can contain potable water to depths as great as 3,000 feet. More typically, water becomes brackish in the 2000-foot depth range and saline in the 4000-foot depth range.

The deepest aquifer that contains water with less than 3,000 mg/l of dissolved solids within any significant part of the study area is the Evangeline aquifer. The Chicot aquifer is the principal fresh water bearing unit within the study area and even it has water with greater than 3,000 mg/l of dissolved solids in some parts of the area, particularly the extreme southern counties of Cameron, Willacy, Hidalgo and Kenedy; but also in the most coastal portions of some other counties that immediately border the Gulf of Mexico.

1.4 Texas Railroad Commission Regulations and AOR Variance Implications

The Texas Railroad Commission (TRRC) is the governing body which regulates well operations in the State of Texas. The Commission was formed on April 3, 1891, but the Oil and Gas Division was not created until 1919. Presently, the Commission is sub-divided into geographical districts. The districts which cover the Gulf Coast study area include Districts 2, 3 and 4.

Since inception, the TRRC has issued a number of orders or rules regarding the manner in which wells were to be completed and abandoned. It is important to understand the evolution of these rules, and the level of compliance with these rules as fields were developed. This is because fields whose discovery and development post dates well construction and abandonment rules describing adequate protection to overlying USDWs may qualify for an AOR variance.

One variance approach is the demonstration, using a representative sample of wells, that construction and abandonment practices provide adequate groundwater protection. Another approach is demonstration that field discovery and development occurred after promulgation of well construction and abandonment standards that provide adequate groundwater protection.

In the Permian Basin study the approach that was used was a combination of the approaches suggested above in that populations of active and abandoned wells were evaluated for selected age groups. Briefly, the Permian Basin study showed that active wells in all age groups are constructed so that they are protective of usable quality water (UQW) and that wells abandoned after 1982 and probably those abandoned during 1967-1982 are protective of UQWs. It was found, however, that

abandonment information on some pre-1967 abandoned wells was lacking so that evaluation of that age group of abandoned wells was more difficult.

Based upon the Permian Basin study results, it was decided, in this Gulf Coast study, that it was unnecessary to evaluate active wells or wells abandoned after 1982, since it was believed that these wells would be protective of usable quality groundwater. Samples of wells abandoned during 1967-1982 and wells abandoned prior to 1967 were identified for evaluation in a pilot study in Refugio County and the results from Refugio County were then used to guide further study of pre-67 abandoned wells in eight other Gulf Coast counties.

1.5 Texas Gulf Coast Abandoned Well Studies

1.5.1 Databases for Study

A representative sample of wells was randomly drawn for review from each of the fields with active injection operations in the nine selected Texas Gulf Coast counties. Identification of well populations was performed using publicly available information obtained from the Texas Railroad Commission (TRRC) and commercial information obtained from Petroleum Information Corporation (PI).

The TRRC publishes several oil and gas field databases. The principal databases used in this study included the "Oil and Gas Well Bore System" (OGWBS), the "Oil and Gas Field Information" (OGFI), the "Oil and Gas P-4 Information" (OGP4I), the "Mapping Information Management System" (MIMS), and the Underground Injection Control (UIC) database.

Data were obtained from PI for all pre-67 abandoned wells in PI's master database for Refugio County and wells in the predetermined fields were selected for analysis. A total of 134 wells existed in this database, and a listing of them was sent to Banks Information Solutions (Banks) of Austin, Texas, for a search of the TRRC files for all file information, but particularly for the Form 4 abandonment forms.

1.5.1.2 Selection of Fields and Wells in Other Counties

On completion of the Refugio County pilot study, the following eight Texas Gulf Coast counties were also evaluated: Brazoria, Chambers, Hardin, Jackson, Nueces, San Patricio, Starr, and Victoria (Figure 2.2). The fields to be studied were identified from the TRRC UIC database. As documented in a previous report, and confirmed in the Refugio County study, minimal information for pre-67 abandoned wells is contained in the TRRC OGWS database. The single source for identification of pre-67 abandoned wells in Gulf Coast counties was the PI database.

Using the TRRC UIC database, the field selection criteria employed in Refugio County was applied to the additional eight Gulf Coast counties (i.e., all fields having a minimum of 5 active secondary recovery or disposal injection wells will be evaluated). This analysis resulted in 72 additional fields available for analysis in the eight counties in the Gulf Coast region. A breakdown of fields by county is shown below.

<u>County</u>	<u>Number of Fields</u>
Brazoria	15
Chambers	8
Hardin	7
Jackson	10
Nueces	7
San Patricio	7
Starr	9
Victoria	11
Subtotal	74
Less White Point East Field (located in 2 counties)	-1
Less McFaddin Field (located in 2 counties)	-1
TOTAL	72

Comparing the well data from the UIC database with the PI database, some fields were eliminated as they had no pre-67 abandoned wells. This resulted in 66 fields remaining available for analysis.

The 66 selected fields contained 3249 pre-67 abandoned wells. Of these 3249 wells, only 2562 had locational data which allowed mapping. Employing a 10% oversampling on an individual field basis (i.e., the 10% sample size was always rounded-up for each field), resulted in a sample of 359 wells, a list of which was sent to Banks for a search of the TRRC files for additional information. Well samples

were drawn using the random number generator selection method described in the Permian Basin report. A per county well count of the samples selected is shown below:

<u>County</u>	<u>Number of Wells in 10% Sample</u>
Brazoria	92
Chambers	34
Hardin	73
Jackson	23
Nueces	48
San Patricio	29
Starr	39
Victoria	21
TOTAL	359

1.5.2 TRRC File Searches

Plugging data existed for only the post-66 wells in the TRRC database. All pre-67 wells in the TRRC database and all wells in the PI database contained no plugging information. As a result, plugging information was obtained using a manual search of the TRRC records. All available well information (e.g., field, API well number, construction information) was sent to Banks in Austin, Texas, where a manual search was performed to locate all file forms and, particularly, the Form 4 (Plugging Form).

1.5.3 Conclusions From Abandoned Well Studies

A sample of 138 wells believed to be abandoned during 1967-1982 was selected for study from nine oilfields in Refugio County. TRRC Forms 4 or W-3 were found for all of the 112 wells that were determined to actually be post-67 abandonments. Based on this Refugio County result, it is concluded that, as was expected, wells abandoned during and after 1967 are protective of usable groundwater and this age class of abandoned wells was not studied in the other eight Gulf Coast study counties.

In the Refugio County pilot study, the TRRC files were searched for data for all 134 wells contained in a Refugio County database created by PI to contain possible pre-67 abandonments. The file search results showed that 15 wells were not pre-67 abandonments. Of the remaining 119 wells, Forms 4 were found for 100 wells but were not found for 19 wells. Because the status and mechanical

condition of these 19 wells was not determined, they are considered to be of possible concern in that they could be wells that, if in an AOR, would need corrective action to meet UIC requirements.

Because of the results of the Refugio County pilot study, examination of pre-67 abandoned wells was extended to eight additional Gulf Coast counties. Including Refugio County, a total of 493 wells was selected for analysis as possible pre-67 abandoned wells in the nine counties. Fifty (50) of the original 493 wells were determined to not be pre-67 abandonments. Of the remaining 443 possible pre-67 abandonments, Forms 4 were found for 362 wells but no abandonment data were found in the TRRC files for 81 of the wells. Those 81 wells are of possible concern in that their status and mechanical condition are unknown and they might, if in an AOR, require corrective action to meet UIC requirements.

It is believed, based on the Texas Permian Basin study and this study, that the only wells that would be likely to raise any TRRC concerns in AOR studies in the Texas Gulf Coast area will be in the pre-67 abandoned well population. The results described above show that TRRC file data are lacking for some percentage of that group of wells, about 18% in this study. Thus, well construction and abandonment characteristics of the majority of all wells would be such that AOR variances could be considered for Gulf Coast injection wells but a population of pre-67 abandoned wells exists that could preclude such variances. The next section describes the existence of mitigating geological circumstances that could ameliorate concerns about those pre-67 abandoned wells the status and mechanical condition of which are uncertain.

1.6 Mitigating Geological Circumstances

A possible basis for AOR variance is the availability of geologic conditions that preclude upward fluid movement through a pathway, such as an unplugged or inadequately plugged abandoned well.

1.6.1 Sloughing and Squeezing Shales

Some shales and some other types of sedimentary rocks exhibit a tendency to slough or cave into a borehole, thus acting as a naturally occurring plug. In other cases the shales expand and squeeze the borehole shut. Both effects can also occur behind the casing of a cased borehole to fill or close the

behind-casing annulus.

Such shales or mudstones occur throughout the Texas Gulf Coast, interbedded with sands, from the ground surface to very great depths below the surface. More specifically, they are ubiquitously present in the depth interval of from a few hundred feet below the ground surface to about 4,000 feet which is the interval where they would be needed to close off any open boreholes between the base of the deepest usable quality groundwater and the top of the shallowest injection zone. While this general shale presence is well known, it must be demonstrated that the locations and amounts of shale are present in individual oilfields to satisfy criteria for those characteristics.

1.6.1.1 Specific Availability in Study Fields

To test the availability of sloughing and squeezing shales* for AOR purposes in specific individual oilfields, criteria for their location and thickness must first be established. In consultation with the TRRC, two thickness criteria were established.

1. A cumulative thickness of 250 feet.
2. A continuous thickness in one shale unit of 100 feet.

In addition to these two criteria, in analyzing borehole geophysical logs, only shale units of > 20 feet in thickness were counted toward the cumulative 250 feet and sandstone units of > 10 feet in thickness were counted as breaks when cumulating the 250 feet of thickness and in locating the 100 feet of continuous shale.

To determine where in the vertical geologic column the shale units needed to be, the TRRC UIC computer data base was analyzed to show the deepest permitted base of usable quality groundwater in each analyzed oilfield.

After establishing the deepest base of usable quality groundwater in each oilfield, well logs were used to establish the presence and location of the 250 feet cumulative and 100 feet continuous shale intervals in the fields.

**Throughout this section, the term shale is used whereas, as discussed in Sections 1.3.1 and 3.2, these deposits are probably Miocene-Pliocene age fluvial and lagoonal mudstones.*

Because a single log was selected for each oilfield, there is no assurance that the detailed location of the shale intervals in the borehole as interpreted from that log are representative of the entire field. However, the occurrence of shale intervals that meet the established criteria of 250 feet cumulative thickness and 100 feet continuous thickness in every oilfield and in every usable log studied is considered to be compelling evidence that such shale is present throughout the Gulf Coast study area, within the stratigraphic interval of interest.

No log interpretation was done for oilfields that had been identified as shallow piercement dome oilfields. These fields were excluded because their geology was considered to be too complex to allow any generalization of the presence and location of sloughing or squeezing shale intervals throughout the field. Such fields are probably not amenable, on a field-wide basis, to AOR variance based on geologic conditions.

1.6.1.2 Evidence of Effectiveness

The principal evidence for the effectiveness of Texas Gulf Coast shales in closing an open borehole comes from a 1991 study conducted by the E.I. du Pont de Nemours Company at a site near Orangefield, Orange County, Texas. The study was conducted to show that, in the study area, an open borehole will be naturally sealed by squeezing shales within a very short period of time. In the DuPont study, closure of the test borehole within one week was demonstrated to occur.

The shale section that was the subject of the DuPont test was the same Miocene age Fleming Group that is of interest in this study. The interval that caused the borehole closure during the DuPont test was at a depth of from 2838 feet to 2926 feet (88 feet) or roughly the same depth range and minimum continuous thickness of shale being suggested for borehole closure purposes in this study.

1.6.2 Sink Zones

Porous and permeable formations that are underpressured or normally pressured provide sink zones that can divert upward flowing fluids before the fluids can reach a UQW. The sands that are interbedded with squeezing shales, on an approximate one-to-one average basis in the study area, are normally pressured and constitute such sink zones. No detailed analysis of these zones is given because

they are universally present and are considered to provide secondary protection, with the squeezing and sloughing shales being the more important source of protection for usable quality groundwater in pre-67 abandoned wells for which abandonment information is not available.

1.7 Extension of Study Results Within the Frio Formation Producing Trend

It is believed that the study results that have been previously described can probably be extended to all oilfields producing from the Frio Formation and deeper formations within the Frio producing trend that is shown in Figure 2.2. To facilitate this process, the UIC database for counties, other than the nine study counties, was searched for fields with five or more active permitted injection wells. There are at least 78 additional fields in the 17 counties that were searched that contain 5 or more active UIC permitted injection wells.

1.8 AOR Variance Recommendation

Based upon the study results that have been described, it is recommended that field-by-field AOR variances be considered for oilfields within the area of the Texas Gulf Coast Frio Formation producing trend as shown in Figure 2.2. The basis for a variance for a particular field would be demonstration of the presence of prerequisite amounts of cumulative and continuous shale between the deepest base of usable quality groundwater and the injection zone to be permitted. The procedures for such demonstration have been developed and presented herein and have been successfully applied to 57 fields in eight counties. There are at least 78 additional fields in 17 other Frio producing trend counties to which the recommended procedures may apply.

2.0 INTRODUCTION

2.1 Background

2.1.1 The Area-of-Review Requirement

The Underground Injection Control Regulations¹ promulgated in 1980, under the Safe Drinking Water Act of 1974, require Area-of- Review (AOR) studies be conducted as part of the permitting process for newly drilled or converted Class II injection wells². Existing Class II injection wells operating at the time regulations became effective were excluded from the AOR requirement.

2.1.1.1 Definition of the AOR

The Area of Review (AOR) is the area surrounding an injection well or wells defined by either the radial distance within which pressure in the injection zone may cause migration of the injection and/or formation fluid into an underground source of drinking water (USDW) or defined by a fixed radius of not less than one-fourth mile. In the method where injection pressure is used to define the AOR radial distance, the AOR is also known as the "zone of endangering influence."

2.1.1.2 Information Required for an AOR

Underground Injection Control (UIC) Program requirements are enforced by the states, where the state has applied for and received primacy from the Environmental Protection Agency (EPA) under Section 1425 of the Safe Drinking Water Act. In Texas, the UIC program is administered by the Texas Railroad Commission (TRRC).

In conjunction with a TRRC application for a UIC injection or disposal well permit, applicants are required to submit a map showing the location and depth of all wells of public record within the AOR. For those wells which penetrate the top of the injection or disposal zone, the applicant must attach a tabulation of the wells showing the dates the wells were drilled and the status of the wells and to identify any abandoned well that is indicated to be unplugged or improperly plugged.

2.1.2 The AOR Variance Concept

In January 1988, the EPA initiated a Mid-Course Evaluation (MCE) of the adequacy of its regulations for Class II injection wells and, in August 1989, published a report of its findings. As a

result of the MCE, EPA's Office of Drinking Water identified areas of concern to be further studied. Among the areas of concern was the need to further evaluate AOR requirements.

In April 1991, the agency proposed and did form a Federal Advisory Committee (FAC) whose charge was to make recommendations to EPA regarding the Class II injection well program. The Committee examined data and information gathered by the EPA during the MCE of the Class II program and, in subsequent studies, identified regulatory gaps and made recommendations for program changes where they were appropriate.

The FAC held its first formal meeting on June 11-12, 1991 during which the Committee approved its charter and identified issues to be addressed, including AOR requirements. The FAC met for a seventh and final time in January 1992. A March 23, 1992, draft Final Document (see Reference 3 or 4) was prepared summarizing the recommendations of the FAC. Those recommendations received formal endorsement by the organizations and individuals represented on the Committee in August, 1992.

With respect to the AOR requirement, the FAC reached consensus that an exception to this requirement should be allowed for those wells located in areas that have been granted a variance by the Program Director based upon criteria presented in an approved variance plan. Variances could be granted where there is sufficiently low risk of upward fluid migration from the injection zone into underground sources of drinking water.

The Final Document lists conditions that could be considered by a Director in determining whether to grant a variance. A variance could be granted based on information indicating any of the following conditions:

- the absence of USDWs,
- the reservoir is underpressured relative to the USDW,
- local geological conditions preclude upward fluid movement that could endanger USDWs, and/or
- other compelling evidence.

As is discussed below, the University of Missouri-Rolla (UMR), under contract with the American Petroleum Institute (API), expanded the FAC AOR variance recommendation into an AOR variance methodology^{3,4} that was subsequently revised and adopted by the Underground Injection Practices

Foundation of the Ground Water Protection Council⁵.

2.1.3 AOR Variance Methodology

The following discussion describes a methodology^{3,4,5} developed for identifying a producing basin, trend, region or field or a portion of such areas which would be eligible for variance from AOR requirements. Five general methods (Figure 2.1) are proposed for obtaining variance from well-by-well AORs. These methods can be used in any order, singly or in combination, to provide variance for some or all wells. Wells not excluded by variance would be subject to conventional AORs.

It is believed that all five of the methods can be applied over large geographic areas but the four methods based upon geologic and hydrologic criteria are most easily visualized as "global" methods. The fifth method requires evaluation of the manner by which the wells in the area under consideration were completed and abandoned.

2.1.3.1 Variance Based on Absence of USDW

In some oil and gas producing areas, there are no USDWs. Any appropriate studies may be used to document this and to justify the granting of a variance from the AOR requirement. Further, "exempted aquifers" by regulatory definition are not USDWs⁶ even though ground water total dissolved solids are less than 10,000 mg/l. States have exempted numerous aquifers since inception of the UIC program. Other aquifers may meet the criteria for exemption and operators may petition to have these aquifers exempted⁷.

2.1.3.2 Variance Based on Lack of Intersection

"No Intersection" refers to the situation where a USDW exists and overlies a zone with Class II injection operations, but none of the wells adjacent to the injection well are drilled to the depth of the injection zone.

2.1.3.3 Variance Based on Negative Flow Potential

The FAC recommendations provide for the possibility of variance from the AOR process where the petroleum reservoir is underpressured relative to the USDW.

Flow potential information is generally available as measured water level (potentiometric head) data

from wells completed in USDWs and as petroleum reservoir pressure data from oil and gas wells. References 3, 5, and 8 provide detailed discussion of the procedures for conversion of petroleum reservoir pressure data to potentiometric head data for comparison with USDW potentiometric head data. The procedures call for subtraction of USDW heads from petroleum reservoir heads to obtain a residual value. Areas with negative residual heads would be ones in which a variance based upon lack of flow potential would be possible.

2.1.3.4 Variance Based on Mitigating Geological Factors

The FAC variance criteria include the availability of local geologic conditions that preclude upward fluid movement that could endanger USDWs. Such mitigating geological factors include sloughing, squeezing and sink zones.

A sloughing formation refers to any geological horizon which is highly incompetent and tends to fall or cave into the wellbore, bridge off, and form a solid barrier to flow. A squeezing formation is one with strata that flow plastically under the overburden stress to close an uncased borehole or to close the casing-formation annulus in a cased well. Examples of sloughing and squeezing formations include unconsolidated shales, consolidated bentonitic shales, salt and anhydrite.

A sink or thief zone refers to a geological horizon which has a flow potential less than the overlying USDWs and the petroleum reservoir which contains injection operations. Sink zones, as used here, are intermediate formations (located between an injection zone and a USDW) which act to divert the fluids flowing up the wellbore. A sink zone can also be a normally-pressured formation that is so permeable and thick that it diverts virtually all upward flowing fluid⁹.

2.1.3.5 Variance Based on Well Construction and Abandonment Methods

Well construction and abandonment methods can also be considered as a factor for an AOR variance. This is because the manner in which a well is constructed or abandoned may preclude fluid migration, even if a positive hydraulic flow potential does exist. States which have oil and gas production have historically set forth standards for well construction and abandonment. These standards detail the correct use or placement of casing, cement, bridge plugs, and other mechanical barriers in a wellbore.

2.1.3.5.1 Alternative Variance Approaches

On the basis of the historic sequence of development of construction and abandonment laws, regulations and practices, it is believed logical that well construction/abandonment based variances should be available through several different approaches, which are: 1. Field discovery and development occurs after promulgation of well construction and abandonment standards that provide adequate USDW protection. 2. Sufficient AORs exist and provide statistical evidence that all wells protect the USDWs. 3. A representative sample of wells is found to provide adequate protection to USDWs when the wells are evaluated with respect to flow barriers and plugs.

2.1.3.6 Variance Based on Other Compelling Evidence

While the authors and the many others that have participated in guiding and reviewing their work have attempted to identify as many bases for qualifying an area for variance as possible, there may be other opportunities that have been overlooked. In developing a variance plan, the states and EPA regions should remain flexible and not limit the information that will be considered in determining whether to grant a variance. This flexibility is needed to ensure variances can be obtained in all areas where injection wells pose sufficiently low risk to USDWs.

2.1.4 Previous Studies

As part of UMR's contract research for API, the AOR variance methodology was tested by application to the San Juan Basin of New Mexico^{10,11} and the Permian Basin of Texas¹².

2.1.4.1 San Juan Basin

The first area to which UMR applied the AOR variance methodology described above was the San Juan Basin of New Mexico. The results of that study are described in a final report¹⁰ to the API and in a summary paper¹¹.

The San Juan Basin is a nearly circular basin in the Four Corners region of New Mexico. Most of the basin is located in New Mexico, although the outer margins are located in Colorado, Utah and Arizona.

Oilfields with injection operations were identified and located throughout the basin. There were 24 oilfields with active injection operations in the San Juan Basin. No single variance criterion applied to

all fields in the basin. There are, however, criteria that apply widely throughout the basin. These include: 1. Development of the field post-dates the establishment of regulations or rules that provide for adequate USDW protection. 2. Examination of a sample population of wells establishes that wells are constructed and abandoned so that they provide adequate USDW protection. 3. Sloughing and/or squeezing zones are present that may preclude upward fluid movement through an open wellbore or behind casing.

At least two variance criteria were found to apply to all 24 fields and are believed to provide good possibilities for variances for 20 fields and some possibilities for the remaining four.

2.1.4.2 Permian Basin of Texas

The AOR variance methodology has been applied to the Permian Basin, Texas, in order to determine the level of protection which producing and abandoned wells provide to USDWs throughout the basin¹².

The Permian Basin refers to an area in West Texas and New Mexico that is one of the most prolific oil producing areas of the world. A statistically valid sample of producing wells and plugged and abandoned wells was studied in 78 injection fields in eleven counties to determine the extent to which the construction and abandonment characteristics of these wells are protective of USDWs.

Examination of the well records for selected producing wells has shown that Permian Basin producing wells are constructed so that they are protective of USDWs.

With the exception of wells for which no records could be located, all abandoned wells examined in the Permian Basin study had plugging forms which showed notification to and approval by the TRRC. Based on the examination of records of abandoned wells in the Permian Basin study, it was determined that wells abandoned during and after 1967 have adequate and appropriately placed cement plugs to provide USDW protection. All but a few pre-1967 wells examined had TRRC plugging forms available. Examination of those abandonment records indicated that nearly all wells with records have adequate and appropriately placed cement plugs and are protective of USDWs. A few did not have cement plugs; however, in those wells, casing, behind casing cement, mud laden fluid and other features provide USDW protection. Comparison of the wells without TRRC plugging forms with other nearby wells

showed that those few wells lacking abandonment records probably do provide USDW protection.

On the basis of the findings of this study, it is believed that the 78 injection fields should qualify for AOR variances based upon well construction and abandonment characteristics. By extension, other fields in these counties and in adjoining counties should also merit consideration for variances.

2.2 Purpose and Scope of DOE Grant

In the two API sponsored AOR variance studies described above, the principal data resources were public ones. The first one-year (5/94-5/95) phase of the DOE grant to UMR was for AOR variance study of the East Texas field, where it was anticipated that non-public data would be required, as was the case. Furthermore, it was believed that if an AOR variance could be obtained for the East Texas field, it would be of significant economic benefit to the field's operators, many of which are smaller independent producers.

Phase II of this DOE sponsored grant study was for AOR variance study of other Texas counties to be selected in consultation with the TRRC. The purpose of this phase of the grant was to further test and develop the AOR methodology by application to a previously unstudied area or petroleum province in Texas.

2.2.1 East Texas Field Study

The purpose of this sub-section is to provide a brief review of the results of the Phase I, East Texas field study as part of this final grant report.

The East Texas oil field is located in the extreme eastern part of Texas and comprises approximately 131,000 acres. The field was discovered in 1930 and is the largest oil field in the conterminous United States in the number of wells and volume of oil produced.

Because of pressure declines in the reservoir, the field has been undergoing water injection for pressure maintenance since 1938. As of 1995, a total of 104 Class II salt-water disposal wells, operated by the East Texas Salt Water Disposal Company (SWDC), were returning all produced salt water to the Woodbine sand producing reservoir.

At the suggestion of various East Texas field operators, and with the agreement and encouragement

of the SWDC and the TRRC, UMR proposed to DOE a study of AOR variance opportunities for the East Texas field. A Steering Committee recommended that UMR study the variance method based upon the lack of sufficient petroleum reservoir pressure to cause flow into the lowermost USDW. A 1995 report documents the results of UMR's investigation of this variance option¹³.

2.2.2 Selection of the Texas Gulf Coast Area for Study

In consultation with the TRRC, the Texas Gulf Coast area was selected because:

1. It has geologic characteristics quite different from any previously studied area and is large and generally geologically similar throughout.
2. There is substantial petroleum production from the area.
3. The Class II injection wells in the area are disposal wells, rather than enhanced recovery wells because the petroleum reservoirs are generally not amenable to waterflooding. Thus, the study would require an approach different than in any previous study.

In selecting the Gulf Coast area for study, it was generally understood that the area would include a band from the coastline inland, probably for several counties, and extending southwest from the Louisiana border to the Mexican border. No more exact definition of the study was adopted because it was expected that such definition would come from the study itself. It was agreed that the study would begin with centrally located Refugio County and would then expand, as appropriate, to additional counties. Figure 2.2 shows the location of Refugio County and the eight other counties subsequently selected for study. It also shows the general area of Texas Gulf Coast Frio Formation oil production that was, ultimately, defined as the area to which the results of this study should apply. Figures 2.3-2.9 show the locations of the oilfields studied within the Frio Formation oil producing trend.

The remainder of this report provides the details of the Texas Gulf Coast AOR variance study and the results of that study.

3.0 RESULTS AND DISCUSSION

3.1 The Texas Gulf Coast Study

Selection of the Texas Gulf Coast for study was made in consultation with the TRRC and approved by DOE in late 1994. Some preliminary work began in late 1994 and early 1995. After May, 1995, most grant work was focused on this Phase II effort.

In considering the study, the following concepts were used as starting points.

1. If a variance methodology or methodologies should be found to be applicable, the methodology or methodologies should apply over a large geographic area because of the relatively similar geology that is found throughout much of the Texas Gulf Coast.
2. Groundwater aquifers exist throughout most of the Gulf Coast and the petroleum producing reservoirs are generally either overpressured or normally pressured so that extensive variances based on lack of USDWs or on reservoir underpressuring would be unlikely.
3. Class II wells in the area would probably be disposal wells, rather than waterflood wells. They might or might not be located within oil field boundaries.
4. Based upon experience in the Permian Basin¹² it could be assumed that all wells would be constructed according to TRRC regulations and rules that are protective of usable groundwater and that wells plugged and abandoned after 1966 would probably be abandoned under TRRC regulations and rules that are protective of usable groundwater.
5. Because of the age of some Gulf Coast fields, it was believed likely that some wells, abandoned prior to 1967, would be identified for which TRRC records of abandonment would be incomplete or missing. It was expected that it would be difficult or even impossible to determine if such wells had been abandoned according to TRRC regulations and rules.
6. It was believed likely that sloughing and squeezing shale intervals and permeable sand sink zones would most likely be present to provide mitigating geological circumstances throughout the Gulf Coast. If present, such shales and sand could seal the wellbores and divert upward flowing formation water in the wellbores of any abandoned wells that might be unplugged or improperly plugged, thus providing protection to usable groundwater.

Study of area-wide topics such as geology and hydrogeology was carried out for the entire Gulf Coast simultaneously and will be reported that way. Study of individual oil fields began with Refugio County, as a pilot effort, and discussion of the field-by-field well-based results will focus first on Refugio County and then be expanded to the other eight counties, including, Brazoria, Chambers, Hardin, Jackson, Nueces, San Patricio, Starr and Victoria (Figure 2.2-2.9).

3.2 Geology and Hydrogeology of the Texas Gulf Coast

3.2.1 General Geology

The UMR AOR analysis procedure has been performed on 73 fields having injection operations in nine Texas Gulf Coast counties. From northeast to southwest the counties are Hardin, Chambers, Brazoria, Jackson, Victoria, Refugio, San Patricio, Nueces and Starr Counties (Figure 2.2). The following is a discussion of the structural geology and stratigraphy of the Texas Gulf Coast and their relevance to the petroleum geology and hydrogeology of the area.

3.2.2 Structural Geology

3.2.2.1 General Structure

The Texas Gulf Coast geologic province consists of Mesozoic and Cenozoic, mostly clastic, sedimentary strata that dip gently (average of about 1°) to the southeast towards the Gulf of Mexico. The nine counties are within a band about 30 to 80 miles wide, containing oilfields with dominantly Frio Formation oil production, that roughly parallels the Texas coastline from Louisiana to Mexico (Figure 2.2). In the subsurface and also paralleling the coastline through the nine county area is a series of major down-to-the-southeast listric-normal (growth) fault zones of which the most important are the Vicksburg and Frio fault trends (Figure 3.1).

As shown in Figure 3.2, this area contains two structural geologic embayments, the Houston Embayment centered near Houston, Texas, and the Rio Grande Embayment which occurs to the north of the Rio Grande River in south Texas. Parts of both embayments are underlain by deeply buried Louann salt of Jurassic age, and salt domes are present in parts (but not all) of both embayments. Located between the two embayments is a rather poorly defined high area known as the San Marcos Arch.

3.2.2.2 Growth Faults

Oilfields in the central and southern six counties (from northeast to southwest: Jackson, Victoria, Refugio, San Patricio, Nueces and Starr Counties--in the San Marcos Arch and Rio Grande Embayment area) are all associated with major down-to-the-southeast growth fault systems, the largest being the Vicksburg and Frio fault trends (Figure 3.1). Most oilfields through this part of Texas occur in rollover

anticlines on the downthrown side (Gulf side) of the growth faults (Figure 3.3 & 3.4). The crests (axes) of the anticlines parallel the fault trends and typically occur from three to five miles to the southeast of the faults themselves. Oil and gas are not trapped against faults themselves, but rather in rollover anticline associated with the faults. Many of the anticlines are cut by spur and antithetic faults that may or may not act as seals for hydrocarbons.

Although major growth faults may penetrate to the land surface in some areas, and although pre-Miocene Tertiary age stratigraphic sections are often thin on the upthrown side of the faults, the faults do not seem to significantly affect the thickness or lithology of Miocene and Pliocene age strata. Thus, the AOR procedure described herein, which depends on the presence of Miocene and Pliocene age shales and mudstones, is not significantly affected by major growth faults, and the AOR procedure may be used on either side of the Vicksburg or Frio fault trends.

3.2.2.3 Salt basins and salt domes

The northern three study counties (from northeast to southwest: Hardin, Chambers and Brazoria) are located in the Houston Embayment or Houston salt basin, and most oilfields in these and adjacent counties are related to salt domes. Salt domes in these counties are classified by Halbouty¹⁴ into three types based on depth to the top of the dome. Shallow domes occur at less than 4,000 feet in the subsurface, intermediate domes occur between 4,000 feet to 10,000 feet, and deep domes are below 10,000 feet (Table 3.1 & Figure 3.5).

Although sedimentary strata associated with all salt domes have structural and stratigraphic complications, strata overlying the intermediate and deep seated domes of the study are do not seem to be disturbed to the point of disqualification of the AOR procedure described in this report. For this reason, intermediate and deep seated domes will be discussed together in this report.

Shallow salt domes are domes that often bring stratigraphic and structural disturbances to within several hundred feet of the land surface. In some cases mounds or hills can be observed on the land surface above such domes. Shallow domes are a particular problem for the AOR procedure because hydrocarbons commonly occur at extremely shallow depths near such domes. In some of the fields

analyzed, some oil and gas reservoirs occur at depths shallower than the stated base of usable quality water. Because of these complications, the AOR procedure described herein probably cannot be used field-wide for oilfields associated with shallow salt domes.

3.2.3 Stratigraphy

3.2.3.1 General Stratigraphy

Table 3.2 shows the generalized stratigraphic nomenclature for the Texas Gulf Coast. Table 3.2 also identifies major hydrogeologic units (aquifers and confining layers) as well as significant hydrocarbon producing horizons. Hydrogeologic data in this table are summarized from Ryder and Ardis¹⁷ and oilfield information is primarily from Galloway¹⁶.

All of the Tertiary age stratigraphic units listed in Table 3.2 are composed principally of clastic material ranging from sand size to clay size. While the sandy units are generally referred to as sandstones and the clayey units are often referred to as shales, the deposits are all very poorly consolidated and poorly cemented. In the strictest sense, the term "shale" is reserved for mudrocks that have fissility. Most of the mudrocks in the study area do not have well developed fissility and should probably be called mudstone rather than shale. However, for several of the marine mudstone units of the Gulf Coast, such as the Anahuac, the term shale has been used extensively in the literature. In this report, the terms shale and mudstone are used interchangeably for what should probably, in the strictest sense, be called mudstone.

The overall stratigraphy of the Texas Gulf Coast is complicated. Although the stratigraphy within one field or county is typically fairly uniform in the sense that major sand units, such as the Frio, or shale units, such as the Anahuac, are present in varying thicknesses throughout the field or county, significant differences occur between counties along depositional strike as well as updip and downdip. Figure 3.6 illustrates the lateral variation in sedimentary facies for the Oligocene Frio Formation, the principal oil and gas producing horizon for the Gulf Coast. Delta systems are concentrated in the Houston and Rio Grande Embayment areas, while bay and lagoonal muds, as well as strandline sands are concentrated along the San Marcos arch area, between the two embayments. Updip (to the northwest of the study

area) non-marine fluvial systems dominate during Frio time, and downdip (to the southeast of the study area) marine muds are deposited on the continental shelf and slope.

Although Figure 3.6 illustrates facies patterns for the Oligocene Frio Formation only, the overall sedimentary facies distribution for all Tertiary rocks is similar, except that all facies are transposed landward on transgression and seaward on regression. At any one location, high sea level stands are marked by marine shales, and low sea level stands are marked by non-marine, typically fluvial and lagoonal sand and mud sediments. As the overall Tertiary sequence of the Gulf coast is regressive, the principal environment of deposition for the Miocene Oakville, Lagarto and Goliad Formations is non-marine, principally fluvial and lagoonal, in the nine counties of this study.

Virtually all of the sand sequences have high porosity and permeability and, thus, the potential to make excellent petroleum reservoirs or groundwater aquifers. On the downthrown side of major growth faults, the pre-Miocene Tertiary age sequences tend to be both sandier and thicker, as these areas were topographic lows (or depocenters) as the faults grew through time. Many barrier island and delta front sandstone sequences in the Paleocene, Eocene and Oligocene (major oil producing horizons) become thousands of feet thicker on the downthrown side of the Vicksburg and Frio faults. Thick sand sequences in the Miocene and Pliocene are, in some cases, minor gas reservoirs and, otherwise, are groundwater aquifers or make excellent sink zones for upward moving fluids.

Virtually all of the Miocene and Pliocene shales and mudstones are considered to have potential as good sloughing and squeezing zones. The shales and mudstones are poorly consolidated and many are known to contain swelling clays such as montmorillonite and bentonite^{20,21}.

In summary, the overall stratigraphy of the Gulf Coast is complicated. Throughout the study area, the deep oil and gas producing horizons are marked by strandline sand sequences that are unusually thick on the downthrown side of major growth faults. As the overall Gulf Coast sequence is regressive, the shallow Miocene and Pliocene age horizons are typically non-marine fluvial and lagoonal sand and mudstone sediments through the study area.

3.2.3.2 Petroleum Reservoirs

Because so many wells have been drilled in this area, and because the data from these wells are public information, the stratigraphy and depositional systems associated with hydrocarbon reservoirs of this area have been worked out in great detail. Galloway¹⁶ has done an excellent job of illustrating the structure, stratigraphy and depositional systems of south and south central Texas.

Hydrocarbons are trapped in a number of different types of traps in the Texas Gulf Coastal areas. The most significant traps can be outlined as follows:

- I. Structural traps
 - A. Rollover anticline on the downthrown side of growth faults.
 - B. True fault traps associated growth faults.
 - C. Salt domes: Many different types of traps including:
 - 1. Anticline over top (supra dome anticline)
 - 2. True fault traps over the top.
 - 3. Cap rock.
 - 4. Flank traps, either against salt or shale sheath.
 - 5. True fault traps on the flanks.
 - D. Other types of anticlines, such as "turtlebacks" caused by salt evacuation between salt domes.
- II. Stratigraphic traps
 - A. Fluvial and distributary channels.
 - B. Updip pinchout of sand (such as barrier island sands).
 - C. Unconformities, especially on the flanks of salt domes.

As shown in Table 3.2, the vast majority of Texas Gulf Coast oil production is from Yegua, Jackson, Vicksburg and Frio sands associated with growth faults (trap type I.A, above). The largest single producer is the Oligocene Frio Formation where it becomes sandy and very thick on the downthrown side of the Vicksburg fault (Figures 3.3 & 3.4).

Significant amounts of oil and gas occur in several types of traps over the tops of salt domes (Trap types I.C.1,2,or 3, above) but the largest volume of hydrocarbons associated with salt domes occurs on the flanks of the domes (trap type I.C.4, above).

3.2.3.3 Shallow Strata

Figures 3.7 and 3.8 are percent sandstone maps for the Miocene Lagarto and Goliad Formations, and Figures 3.9 and 3.10 show northwest-southeast (dip) cross sections for these same formations as well as the Miocene Oakville Formation. These formations contain the sloughing and squeezing mudstone

sequences and sandstone sink zones in the study area. From Figures 3.9 and 3.10 it can be seen that, through the study area, these formations were deposited primarily in either fluvial or lagoonal settings. To the southeast and downdip of the study area, the formations were deposited in mixed strand plain, delta and, eventually, marine environments.

In Figures 3.7 and 3.8, fluvial facies can be identified by elongate concentrations of sand that are oriented generally perpendicular to the modern shoreline. These concentrations of sand are fluvial channel complexes that are composed of as much as 70 percent sandstone at a very few locations. Between the channel complexes are sand-poor areas that were deposited in flood plain or overbank environments of the fluvial systems. The flood plain areas typically contain less than 40 percent sand and commonly less than 20 percent sand. The lagoonal areas are also sand poor and commonly contain less than 20 percent sand. The significance of these maps and cross sections is that, throughout the study area, the shallow sequence typically contains at least 50 percent and never less than 30 percent mudstone.

From Figures 3.9 and 3.10, it can be observed that the shallow formations generally thicken to the southeast towards the Gulf of Mexico through the study area. The Oakville Formation ranges in thickness from 800 to 1400 feet, the Lagarto ranges from 1000 to 2400 feet thick, and the Goliad ranges from 1000 to 1400 feet thick. Collectively they range in thickness from 2700 to 5000 feet thick. Through the study area and to the southeast (downdip) of the study area, Figures 3.9 and 3.10 show that the shallow formations become thicker on the downthrown side of some, but not all, of the growth faults. The effect of growth faults on the thickness and lithology of the shallow section is considered to be not significant through the study area. Updip of the study area, sandstones are recharged by fresh water where the formations are exposed at the surface.

Also shown in Figures 3.9 and 3.10 are the electric log responses through these formations. Particularly well shown is the log response to an upward decrease in ground water salinity in the sandstones of the study area (onshore logs). From deep to shallow, note that there is a general decrease in SP response as well as an increase in electrical resistivity. At a depth of approximately 2,000 feet, a transition zone occurs where both the SP and resistivity curves are suppressed. Although sand/shale

ratios can be difficult to determine through this interval, detailed analyses of electric logs (Appendix 2) and correlation from other areas indicate that sand/shale ratios are no different through this interval than through the rest of the Miocene-Pliocene section.

Henke²⁰, in an evaluation of uranium deposits of the Beaumont Quadrangle, describes the Oligocene, Miocene and Pliocene section as having bentonites and bentonitic sandstones throughout. The bentonites are derived from reworked Cretaceous sediments as well as volcanic ashes that were deposited during major volcanic eruptions that occurred throughout Late Tertiary time in northern and western Mexico, and to a lesser extent, in west Texas. Anderson²¹ reports sodium montmorillonites throughout the Oligocene and Miocene section of San Jacinto County, Texas. Bentonites and montmorillonites are well known for their swelling properties.

In conclusion, although sand content can be as high as 70 percent in some parts of the study area, significant total thicknesses of shale (mudstone) were found to be present throughout the Gulf Coast in the Miocene-Pliocene sequence. In addition, many of the mudstones are known to contain bentonite and sodium montmorillonite, both of which are clays that are well known for their swelling properties.

3.2.4 Oilfields

3.2.4.1 General Discussion

As shown in Tables 3.2 and 3.3, the vast majority of Texas Gulf Coast oil production is from Frio, Yegua, Jackson and Vicksburg clastic sedimentary rocks associated with major growth faults or with salt domes. As already mentioned, far and away the largest production is from the Oligocene Frio Formation, particularly from the barrier island-strand plain facies downthrown to the Vicksburg fault.

3.2.4.2 Central Gulf Fields

The oilfields in the central Gulf counties (from northeast to southwest: Jackson, Victoria, Refugio, San Patricio, and Nueces Counties) are typified by the Tom O'Connor field of Refugio County (Figure 3.11).

The Tom O'Connor field was discovered in 1934. It produces from a number of different sandstones in the Upper Tertiary section with the majority of the production coming from the Oligocene Frio

Formation (Figure 3.12). Figure 3.13 shows that Tom O'Connor and other similar fields are located in rollover anticlines downthrown to the Vicksburg fault where barrier island and strandline sand sections are greatly expanded.

The barrier island and strandline sands of the Frio trend are well known for their spectacular reservoir rocks. For the 46 Frio reservoirs in the trend, in-place reserves are estimated at over 4.2 billion barrels (Galloway¹⁶). Cumulative production has already exceeded three billion barrels and the overall recovery efficiency for the trend is estimated at 53 percent with some fields estimated at over 60 percent. The Tom O'Connor field alone has produced over 575 million barrels and has an ultimate recovery estimated at over 800 million barrels (Galloway¹⁶).

Virtually all of the fields in the central five counties have production from the Frio Formations, and most have lesser production from the Yegua, Jackson and/or Vicksburg Formations. In addition, all of the studied fields in these counties have shallow shale zones that have the potential to act as squeezing or sloughing zones.

3.2.4.3 Houston Salt Basin Fields

The Houston salt basin is typified by three types of fields. One is rollover on a growth fault similar to that described for the Central Gulf fields. The second is shallow, piercement salt dome fields, that is, fields that are associated with salt domes that penetrate to very close to the land surface, and the third is in association with intermediate to deep seated salt domes.

3.2.4.3.1 Shallow piercement salt-dome fields

Shallow piercement fields include Bryan Mound, Damon Mound, Hoskins Mound, Nash Dome, and West Columbia fields of Brazoria County, Barbers Hill, High Island and Moss Bluff fields of Chambers County, and Arriola, Batson, Saratoga and Sour Lake fields of Hardin County (Tables 3.1 and 3.3). The Sour Lake field is typical of the shallow, piercement type of salt dome. The top of salt in the Sour Lake field occurs at about 1,800 feet and the cap rock comes to within 660 feet of the surface. Production occurs in three types of traps: (1) flank production, (2) supra dome production, and (3) cap rock production. In the Sour Lake field and throughout most fields of the Gulf Coast, the majority of the

production is from the flanks (Figure 3.14).

Flank Production: Traps on the flanks of salt domes are typically numerous, complex and of many different types. The most typical traps occur where reservoir rocks are truncated against salt itself, but other types of traps include true fault traps, reservoir pinch outs, and traps against unconformities (see the Yegua in Figure 3.14).

Supra dome production: As they push upwards most salt domes produce anticlines in the sedimentary rocks above them, and supra dome production is from these overlying anticlines. Typically, supra dome anticlines are highly faulted, and many fault traps are also typical of the supra dome location (Figure 3.14).

Cap rock production: Cap rocks are typically composed of limestone and insoluble residues that accumulate in a complex chemical environment at the very tops of most salt domes. Cap rocks are noted throughout the Gulf for containing free sulfur and sulfide minerals that are thought to have formed by complex chemical reduction of sulfur from anhydrite (CaSO_4) by heterotrophic bacteria. In the process the bacteria metabolize hydrocarbons and produce "inorganic" (meaning no fossils) CaCO_3 , limestones that are typically very dense and highly fractured.

In addition to being chemically complicated, cap rocks are often structurally complicated as well. One author described the cap rock of one field as being similar to a pane of glass that has been shattered by being thrown on the floor. Faults are everywhere and some salt domes have hundreds of wells into cap rock reservoirs where each well is thought to be in a separate fault block.

The Sour Lake field (Figure 3.14) illustrates why the AOR procedure described in this report does not apply to shallow piercement domes. They are structurally and stratigraphically very complicated, and the hydrogeology is equally complex. Above such domes there is typically a complex interplay of fresh water derived from shallow aquifers with salt water derived from dissolution of salt from the salt dome. Salt brines derived from the salt dome can occur in close proximity to fresh water near a salt dome. Oil and gas reservoirs in the cap rock and supra dome areas commonly occur at elevations that are higher than fresh water zones on the flanks of the dome. Major shale sections that could act as sloughing or

squeezing zones as well as major reservoir rocks that could act as sink zones are commonly faulted out or pinched out near the crest of such domes. Shallow, piercement salt domes are so complicated and variable that it is dangerous to make all-encompassing rules or generalizations about them.

3.2.4.3.2 Intermediate and Deep Seated Salt Dome Fields

Intermediate and deep seated domes include Danbury, Hastings, and Manvel fields of Brazoria County, and Anahuac, Fig Ridge, Lost Lake and Oyster Bayou fields of Chambers County.

The majority of the production from intermediate and deep seated domes is from supra dome anticlines. Such anticlines are typically large and highly faulted as exemplified by the Anahuac field (Figure 3.15).

Intermediate and deep seated salt domes have many of the structural and stratigraphic complications associated with shallow domes, but the shallow hydrogeology of intermediate and deep domes is not generally affected by these complications. That is, shallow faulting and some thinning of sediments certainly occurs over such domes, but these complications are not great enough at shallow depths to significantly affect important sloughing and squeezing shales, confining layers, or sink zones.

3.2.4.4 Rio Grande Embayment Fields

Production from salt dome related fields does occur in parts of the Rio Grande Embayment, but not in counties of this study. Rio Grande Embayment fields included in this report occur in Starr County and the southern part of Nueces County (Figure 3.2), and all fields are associated with fluvial and deltaic sandstones along the Vicksburg fault zone. These fields include all the fields in Starr County plus Agua Dulce and Richard King of Nueces County.

Upper Frio sands are typically fluvial, while lower sands are deltaic distributary channel sands that are draped over growth fault anticlines. Many channels are stacked on top of each other creating individual fields that commonly have from 20 to 40 stacked reservoirs. Many of the reservoirs are compartmentalized by mud-filled channel plugs.

3.2.5 Mitigating Geological Circumstances

Mitigating geological circumstances that can prevent upward movement of fluids to an aquifer include:

- A. Sloughing and squeezing shales or mudstones that, in an uncased wellbore, will slough into or squeeze off vertical permeability, and
- B. An intervening low pressure or normally pressured, high permeability zone (known as a sink zone) that would divert upward flow of fluids into that zone.

3.2.5.1 Sloughing and Squeezing Shales

Environmentally, shales or mudstones of the Gulf Coast consist of three main types, marine, bay or lagoonal, and non-marine sediments that occur as overbank deposits in fluvial sequences and interdistributary areas on delta plains. Marine shales, such as the Anahuac (Table 3.2), tend to be thick and continuous over large areas, though they thin and pinch out updip. Where they are present, they form important confining units both for shallow aquifers and for deeper trapping of hydrocarbons and overpressures. The Anahuac is one of the most important seals for hydrocarbons and overpressures in the Gulf Coast. Most oil and gas reservoirs above the Anahuac in the Gulf Coast are normally pressured, whereas those deeper than the Anahuac are commonly overpressured.

Bay, lagoonal and other non-marine mudstones tend to be thin and discontinuous laterally, though collectively they can combine to form important confining or sloughing and squeezing units.

From youngest to oldest, important Oligocene-Pliocene stratigraphic units that contain important sloughing and squeezing shales and confining units include:

- Pliocene Willis Formation
- Miocene Goliad Formation
- Miocene Lagarto Formation
- Miocene Oakville Formation
- Oligocene Anahuac Formation
- Oligocene Vicksburg Formation

In the fields in this study, only the post-Anahuac shales are of importance.

As has been described in Sections 3.2.3.1 and 3.2.3.3, within the study area, Miocene age stratigraphic units, including the Oakville and Lagarto Formations of the Fleming Group and the Goliad Formation, have a total thickness of about 2,700 to 5,000 feet of non-marine fluvial and lagoonal sediments comprised of sand (<20 to 70%) and mudstone (30 to >80%). While we were not able to

distinguish stratigraphic boundaries in our log studies, we believe that the shale (mudstone) units identified on the borehole logs of Appendix 2 are within the Oakville-Goliad Miocene sequence as shown in Figures 3.9 and 3.10. These potentially sloughing and squeezing shale (mudstone) units are described to contain montmorillonite and bentonite clays^{20,21} that would be expected to enhance their sloughing and squeezing properties.

3.2.5.2 Sink Zones

Sink zones are high permeability zones that are either normally pressured or underpressured. In the Gulf Coast, significant underpressures are believed to always be associated with artificial depletion of a reservoir. An oil or gas reservoir that has been depleted or partially depleted or an aquifer that has been severely drawn down by pumping can act as a sink zone. The Gulf Coast also has many normally pressured shallow sandstones that are individually or collectively very thick. Any thick sandstone sequence that is normally pressured or underpressured can act as a sink zone for diversion of upward flowing fluids.

3.2.6 Hydrogeology

Table 3.2 identifies major aquifers and confining units relative to major oil and gas producing horizons in the Texas Gulf Coast. The Texas Gulf Coast is divided by Ryder and Ardis¹⁷ into two major aquifer systems, the older *coastal uplands* aquifer system, and the younger *coastal lowlands* aquifer system. The two systems are separated by the Vicksburg-Jackson confining layer at the Eocene-Oligocene boundary. The uplands aquifer occurs entirely to the northwest of this study, and only the lowlands aquifer is pertinent to this study. The lowlands aquifer is divided here into four permeable zones and two confining units as follows:

- Pleistocene Chicot Aquifer
- Miocene Evangeline (Goliad) Aquifer
- Miocene Burkeville (Lagarto) Confining unit
- Miocene Jasper (Oakville) Aquifer
- Miocene Catahoula (Anahuac) Confining unit, (only in the subsurface), and the
- Miocene Jasper (Frio) Aquifer (present only in the subsurface).

The stratigraphy of the aquifers and the confining units is multilayered and complex, and different authors subdivide the lowlands aquifer differently. All of the units dip gently to the southeast as well as

thicken to the southeast. Aquifers are recharged from the northwest where they either intersect the land surface or are in communication with aquifers that intersect the surface. In general, the aquifers all contain fresh water at shallow depths near their surface exposures to the northwest, and salinities increase to the southeast as the aquifers descend into the subsurface. Sandstones that are well flushed by fresh water can contain potable water to depths as great as 3,000 feet. More typically, water becomes brackish in the 2000-foot depth range and saline in the 4000-foot depth range (Figures 3.9 and 3.10 and logs of Appendix 2).

Within the Frio Formation producing trend that is of interest in this study, the Frio portion of the Jasper aquifer occurs at depths below 4,000 feet and contains only saline water. Ryder and Ardis¹⁷, in their Figure 21, show the Frio and equivalent interval to contain water with greater than 10,000 mg/l of dissolved solids throughout the study area of this report. The deepest aquifer that contains water with less than 3,000 mg/l of dissolved solids within any significant part of the study area is the Evangeline aquifer (Figure 19 of Ryder and Ardis¹⁷). The Chicot aquifer is the principal fresh water bearing unit within the study area and even it has water with greater than 3,000 mg/l of dissolved solids in some parts of the area, particularly the extreme southern counties of Cameron, Willacy, Hidalgo and Kenedy; but also in the most coastal portions of some other counties that immediately border the Gulf of Mexico (Figure 17 of Ryder and Ardis¹⁷).

3.3 Texas Railroad Commission Regulations and AOR Variance Implications

The Texas Railroad Commission (TRRC) is the governing body which regulates well operations in the State of Texas. The Commission was formed on April 3, 1891, but the Oil and Gas Division was not created until 1919. Presently, the Commission is sub-divided into geographical districts. The districts which cover the Gulf Coast study area include Districts 2, 3 and 4.

Since inception, the TRRC has issued a number of orders or rules regarding the manner in which wells were to be completed and abandoned. It is important to understand the evolution of these rules, and the level of compliance with these rules as fields were developed. This is because fields whose discovery and development post dates well construction and abandonment rules describing adequate

protection to overlying USDWs may qualify for an AOR variance^{3,4,5}.

The TRRC well construction and abandonment rules for Texas were researched and summarized by Mr. Dwight Smith²². This work, in addition to discussions with Mr. Jerry Mullican of the Texas RRC, forms the basis of comments made herein.

3.3.1 Well Construction

The earliest record of statewide rules regarding oil well construction are those of 1919. At that time, the well construction was meant to conserve and contain fresh water, oil and gas in their respective strata. However, the requirements of these early rules were written in a general manner. For example, there is a requirement that "no well shall be drilled through or below any oil, gas or water stratum without sealing off such stratum or the contents thereof, after passing through the sand, either by the mud-laden fluid process or by casing and packers, regardless of volume or thickness of sand." Specific requirements, such as running surface casing below fresh water sand or cementing casing in place, evolved at a later time.

The first comprehensive rules regarding wellbore casing and cementing were enacted in 1931 and later in 1943 (Figures 3.16 and 3.17). A surface casing string was required to be run and to be cemented from the shoe to surface. Production casing, where run, was required to be cemented to a point at least 600 feet above the shoe. Casing was expected to pass a bailing test for quality of the seal, and all oil, water and gas strata were required to be properly sealed off. These rules remained essentially unchanged until 1950.

In 1950 changes were included in the surface casing rule to allow an exception to the length of surface casing required if multi-stage cementing of the production string was envisaged (Figure 3.18). This exception was based on special request or application to the TRRC. Two years later, casing program exceptions were defined within statewide Rule 12, the principal casing and cementing rule. Rule 12 also required flowing wells to be completed with a string of tubing at this time.

In 1956 an order was issued requiring that disposal wells be cased and cemented. The order allowed the TRRC to handle disposal well permits administratively rather than requiring a public hearing.

Rule 12 remained the principal well construction rule until 1963, when the provisions outlined in Rule 12 were reissued as Rule 13 (Figure 3.19). The casing and cementing requirements defined in Rule 13 are similar to those initially required in 1931, although exceptions are outlined for shorter surface strings and multi-stage cementing of the production string.

Only minor changes occurred to Rule 13 from 1963 to 1982. Certain reports and forms for cementing were required in 1970. In 1971 the TRRC was given the power to grant exceptions to casing programs administratively.

Definitions of "stand under pressure", "zone of critical cement", "protection depth" and "productive horizon" were added to Rule 13 in 1983, and the title of the Rule was expanded to include both casing and cementing (Figure 3.20). Surface casing requirements were relaxed somewhat in that wells less than 1000 feet deep were not required to have surface casing provided that the production string was cemented back to surface. Intermediate strings were required to be cemented at least 600 feet above the intermediate casing shoe.

The last revision to Rule 13 was in 1991, but recent revisions have been minor modifications in language or more detailed requirements for offshore wells. The fundamental construction requirements for onshore wells described under Rule 13 have not changed appreciably since 1981.

3.3.2 Well Abandonment

The initial plugging rule, Rule 10, was issued in an order dated July 26, 1919. This rule defined the manner of plugging as "all dry or abandoned wells must be plugged by confining all oil, gas or water to the strata in which they occur by the use of mud laden fluid filling well to the top as directed by the Commission, or by some other method approved by the Commission. In case of cable tool drilling, in addition to mud laden fluid, cement and plugs may be used, and shall be used when so directed." This original plugging rule remained essentially unchanged until the 1930s, although a separate article was published in 1925 describing similar abandonment methods for plugging active wells.

In 1934 detailed abandonment requirements were specified regarding the manner in which wells were to be plugged (Figures 3.21, 3.22, 3.23 and 3.24). Dry or abandoned wells were to be plugged

within a period of 20 days after drilling or production operations cease. Rule 10 defined methods of abandonment for producing wells, specifying cementing requirements for production casing, screens or perforated liners. Wells completed as non-producers could still be plugged with mud-laden fluid if there were no exposed commercial water zones or high pressure gas formations. The regulation also stated that "after the producing formation has been protected, the hole shall be filled from the top of the cement plug to the surface with 10 ppg mud unless high pressure gas strata or water strata need additional protection."

Rule 10 remained essentially unchanged until 1967. However, in 1957 Rule 15 was added. This rule described surface casing to be left in place at abandonment. Specifically, fresh water sands were to be protected with cemented casing and such casing should not be removed from the well at abandonment. Exceptions to this rule applied only if a short string of surface casing was set and cemented with the intention of using a multi-stage tool below fresh water sands, or if it was intended to cement the entire long or intermediate string of casing from casing set to the surface. If the well was a dry hole, the short string of surface casing had to be cemented in its entirety, and the deepest fresh water zone had to be protected by a cement plug covering the deepest water zone and at least 50 feet above and below the zone.

In 1966, specific and detailed descriptions were added to the plugging rule. These regulations were included as statewide Rule 14 (Figures 3.25, 3.26, 3.27, and 3.28). A 100 foot cement plug was required immediately above perforated zones, but the District advisor was granted authority to approve the use of bridge plugs with 20 feet of cement. Perforated screens or liners were to be retrieved when possible, or cemented back to a point at least 100 feet above the top of the liner. If production casing was removed from the well, a 100 foot cement plug was required across the shoe of the surface casing. In addition, if the surface casing was insufficient to protect fresh water horizons and they were exposed when production casing was removed from the well or as a result of production casing not being run, then a cement plug was required. This plug was to extend 50 feet above and 50 feet below the fresh water zone.

Rule 14 also required a 10 foot surface plug and additional cement spacer plugs to adequately cover and contain any high pressure gas or water sands. Mud laden fluid of at least 9.5 ppg was required to be placed in all portions of the well not filled with cement. All plugs were to be placed by the circulation method while the hole was in a static condition.

Rule 14 was amended in 1969 to allow a landowner to file an application to condition an abandoned well located on his land for fresh water production operations. The regulations specifically stated that, by doing so, the landowner assumed responsibility for ultimately plugging the well.

During the 1970s there were memoranda regarding permissible shut-in periods. These memoranda led to the extension of Rule 14 in 1975, to include specific language regarding temporary abandonments.

In 1983, comprehensive language was added to the plugging rule and some modifications were specified (Figures 3.29, 3.30, 3.31, 3.32 and 3.33). Operators were required to use only cementers approved by the director of field operations. (The regulation detailed how cementing companies, service companies or operators could become qualified as approved cementers.) A 10% excess cement volume based on depth was required for cement plugs, and all plugs except the surface plug were required to be 100 feet. The operator or cementer was required to tag the plugs to verify their placement. In addition, stricter requirements were added for cementing surface, intermediate and production casing, e.g. squeeze operations are defined for the first time.

Rule 14 has not changed substantially since 1983. Most of the memoranda issued in the 1980s address issues regarding financial security, financial assurances for time extensions for plugging a well, and designations of the responsible party for plugging a particular well. More specific language was added to Rule 14 in 1986 and 1988, but there were only minor changes to the manner in which wells were to be plugged. In 1987, plug back operations and zone abandonments were included in Rule 14, but the procedures outlined were similar to plugging methods described historically. Finally, in 1990 the Commission issued a detailed policy with respect to appropriate actions in cases where wells had been orphaned or improperly plugged.

3.3.3 Determination of Dates of Adequate Well Construction and Abandonment

In order to identify a time, or a period of time in which well construction and abandonment regulations provided adequate protection to overlying usable quality groundwater (UQW), it is first necessary to define what constitutes a (minimum) adequate level of protection for UQWs.

During 1980, the Environmental Protection Agency adopted regulations under the Safe Drinking Water Act which defined Underground Sources of Drinking Water (USDWs) and their required level of protection. These regulations required protection of waters with salinities of less than 10,000 mg/l. Since enactment of the Federal regulations, the State of Texas has required surface casing protection of usable quality groundwater (UQW) with salinities of 3,000 mg/l or less. Aquifers with salinities ranging between 3000 mg/l and 10,000 mg/l are protected from injected fluids.

From a review of the Texas State regulations it is apparent that the well construction regulations since 1931 require some protection of UQWs since the regulations specify water, oil and gas be confined and protected in their respective stratum. Rule 16 (1934) specifically states that "no well shall be drilled through or below any oil, gas or water stratum without sealing off such stratum or the contents thereof, after passing through the sand, either by the mud-laden fluid process or by casing and packers, regardless of volume or thickness of sand." The intent of this rule was to have casing, or casing and cement covering the fresh water aquifers. This is reflected in Rule 12, also issued in 1934:

"Any well drilled in any field or area shall be required to set and cement a sufficient amount of surface casing to properly protect fresh water sands which are or may be a source of water supply for that area or field. Cementing shall be by pump and plug method and sufficient cement shall be used to fill the annular space back of the casing to the surface of the ground or to the bottom of the cellar. ..."

The abandonment regulations enacted in 1934 also required some protection of fresh water aquifers in abandoned wells. At that time, Rule 10 required a well to be plugged back with cement to a point at least 50 ft above the shoe of the producing string (Figure 3.21). For wells where the producing string was not cemented, the entire producing formation was to be plugged off with cement before the casing seat was broken. In wells completed with screen or perforated liners (Figure 3.22), if it was impractical to remove the screen or perforated liner, then the well was to be cemented back to a point at least 10 feet

above the top of the liner. However, wells completed as non-producers (Figure 3.23) which did not encounter any commercial water sands or high pressure gas sands could be abandoned with mud laden fluid and, therefore, would not have a cement plug present.

Rule 10 also specified that when high pressure gas strata or water strata need additional protection, the Deputy Supervisor shall protect such strata or horizon by cementing from a point ten feet below said formation to a point ten feet above said formation.

Although the well construction and abandonment rules of the mid-1930s required protection of fresh water, these rules cannot be considered as a benchmark for adequate protection to UQWs, as defined today. It is likely that the fresh water aquifers of concern in the 1930s may have been considerably less saline than those presently defined as UQWs. Hence, waters which qualify as UQWs by current standards may not necessarily have been adequately protected by the early regulation.

Another concern regarding early regulations is that the method of determining minimum casing points is not specified. Rule 12 of 1934 requires "a sufficient amount of surface casing to properly protect fresh water sands which are or may be a source of water supply for that area or field", but does not describe how casing points will be determined or what parties will be responsible for such decisions. This issue was not clarified until 1950, when Rule 12 was amended to include the following language:

"An operator shall, before drilling and setting casing in his first well in a field or area, contact the Board of Water Engineers and obtain a letter from this agency stating where the fresh water sands are found in the area of field in question and must set the amount of surface casing required by the Board of Water Engineers to protect all fresh water sands."

At present, casing depths are set for a field or an area by the surface casing unit of the Texas Natural Resource Conservation Commission (TNRCC). UQWs are protected on a well-by-well basis as specified by the TNRCC.

The lack of specificity in the early regulations was improved through subsequent changes in their form and language. However, these changes occurred over a long period of time, i.e. 1934 to 1980. For this reason, and also due to the lack of a formal definition of usable quality water, it was not possible to identify a specific year (or period of time) in the regulations in which wells could uncategorically be considered to provide adequate protection to present day UQWs. For this reason, the TRRC was queried

regarding the time, or times, when it was felt that active and abandoned wells were required to provide adequate protection to UQWs.

In a 1993 telephone conversation, Mr. Jerry Mullican of the TRRC indicated that wells completed and abandoned prior to 1967 may or may not provide adequate groundwater protection, and those wells should be examined. Wells completed and abandoned from 1967 through 1982 should exhibit a high level of groundwater protection and good compliance with the regulations, but should receive sufficient study to confirm their condition. Further, he indicated that wells completed and abandoned since 1983 would provide adequate protection and, therefore, one should not need to study those wells.

Mr. Mullican's age categorization of wells appeared reasonable when compared to the historical progression of the well construction and abandonment regulations. For example, the level of specificity in the well plugging rule increases sharply in 1967, and again in 1983. The well construction rule has significant changes in 1950, 1957, and 1963, and then again in 1981 and 1983. Hence, it was decided, in the Permian Basin study, to adopt and test the time period categorization of wells (pre-1967; 1967-1982; post-1982) for sampling well populations. Results of the Permian Basin study supported the use of the age classification and it was adopted for further testing and subsequent use in this study as well.

3.3.4 AOR Variance Implications

As discussed in Section 2.1.3.5 well construction and abandonment methods can be considered as a factor for an AOR variance. One variance approach that is suggested is the demonstration, using a representative sample of wells, that construction and abandonment practices provide adequate groundwater protection. Another suggested approach is demonstration that field discovery and development occurred after promulgation of well construction and abandonment standards that provide adequate groundwater protection.

In the Permian Basin study¹² the approach that was used was a combination of the approaches suggested above in that populations of active and abandoned wells were evaluated for the age groups suggested in Section 3.3.3. Briefly, the Permian Basin study showed that active wells in all age groups

are constructed so that they are protective of UQW and that wells abandoned after 1982 and probably those abandoned during 1967-1982 are protective of UQWs. It was found, however, that abandonment information on some pre-1967 abandoned wells was lacking so that evaluation of that age group of abandoned wells was more difficult.

Based upon the Permian Basin study results¹², it was decided, in this Gulf Coast study, that it was unnecessary to evaluate active wells or wells abandoned after 1982, since it was believed that these wells would be protective of usable quality groundwater. As will be discussed later, samples of wells abandoned during 1967-1982 and wells abandoned prior to 1967 were identified for evaluation in a pilot study in Refugio County and the results from Refugio County were then used to guide further study of pre-67 abandoned wells in eight other Gulf Coast counties.

3.4 Texas Gulf Coast Abandoned Well Studies

The following discussion details results of the abandoned well studies performed on the principal class II injection fields in nine Texas Gulf Coast counties.

3.4.1 Data Bases for Study

A representative sample of wells was selected for review from each of the fields in the Texas Gulf Coast counties selected with active injection operations. Identification of well populations was performed using publicly available information obtained from the Texas Railroad Commission (TRRC) and commercial information obtained from Petroleum Information Corporation (PI).

3.4.1.1 Texas Railroad Commission Databases

The TRRC publishes several oil and gas field databases. The principal databases used in this study included the "Oil and Gas Well Bore System" (OGWBS), the "Oil and Gas Field Information" (OGFI), the "Oil and Gas P-4 Information" (OGP4I), the "Mapping Information Management System" (MIMS), and the Underground Injection Control (UIC) database.

Some wellbore construction and abandonment information is contained in the OGWBS database; however, this database was found to be of limited use primarily because the OGWBS was developed after 1976 and, as a consequence, does not contain substantial information on older wells. Older wells

had to be identified with databases from PI and records for these wells obtained manually from TRRC files as discussed herein.

Another difficulty encountered in the OGWBS was that a field name was not associated with the wells. To solve this problem, a method of matching data from multiple databases was devised to provide the necessary information. Figure 3.34 depicts the databases and the matching technique employed to locate wells within Class II injection fields. Well data are available by county in the OGWBS, but as stated previously, wells are not directly referenced to fields in this database. In order to obtain field groupings of wells, the 5-digit field number must be extracted from the OGFI database using the lease number for a particular well available from the OGWBS. The lease number is matched with lease numbers in the OGP4I database which yields an associated field number. Finally, the field number is matched with the OGFI database which results in a field name.

The databases involved in these comparisons are quite large and would require a large storage mainframe or network computer system for analysis using the complete databases. Various sorting routines were employed to download data from a large mainframe computer and reduce the original large databases into county-wide and ultimately field-wide databases which were compatible with personal computing systems. Compression routines were used to create portability.

A record location is available in the OGWBS which indicates the reservoirs for the well. In principal, this record could be employed to sort wells by reservoir; however, this information was seldom complete for individual reservoirs which precluded sorting wells in a given field by reservoirs.

Locational information in the OGWBS was not useful in computer-plotting the wells. As a result, the API well number from the OGWBS was matched with the MIMS database to create field maps. Only wells with MIMS locations were studied. The well type was also obtained from both the OGWBS and the MIMS databases; frequently, the well type in the MIMS database did not agree with the OGWBS.

Once the wells in the selected Class II injection fields were located, they were further classified and categorized by age as suggested by the TRRC. The groupings consisted of:

1. Wells with no dates indicated
2. Wells drilled, completed or plugged prior to 1/1/67
3. Wells drilled, completed or plugged between 1/1/67 and 1/1/83
4. Wells drilled, completed or plugged on or after 1/1/83.

For each of the age categories shown, well counts are reported for the total number of wells available in the database, number of wells with locations, number of plugged wells, number of injection wells, and number of producing wells. These well counts are summarized in Table 3.4 for selected Refugio County fields.

It is important to recognize that the date reported in the OGWS represents either drilling, completion, or plugging dates. The TRRC has not routinely updated the OGWS for wellbore re-entry and, as a result, the dates associated with wells in the OGWS generally reflect the status of the well at the time the data were entered. Logically, the last date should be the plugging date for a P&A well; however, if this information was lacking or incomplete, the completion and drilling dates were selected, respectively. In the research, the latest date available was employed in the initial well age classification, but manual searches of TRRC data resulted in an age re-classification of many wells owing to either additional wellbore completion/plugging information not originally in the OGWS or to the determining of dates that were lacking in the OGWS.

The UIC database contains data for fields with active and historical injection operations, including the number and types of UIC permitted injection wells in each field. This database was first used to identify fields with significant Class II injection operations in the Gulf Coast region.

Injection well data from the UIC database were also used to determine a maximum depth to the base of usable quality water (UQW) and the minimum depth of permitted injection for the fields investigated.

3.4.1.2 *Petroleum Information (PI) Databases*

A commercial database was purchased from Petroleum Information Corporation (PI) to supplement the OGWS for pre-1967 abandoned wells. PI data were obtained for the nine counties studied in the Gulf Coast region. Useful information obtained from the PI database included the API well number, well locational data consisting of latitude, longitude, lease and field names, spud and completion dates,

total depth, and some well construction details which were usually limited to casing size and depth. An abandonment date was also included in this database, but it was usually blank.

All of the pre-67 abandoned wells had to be located with respect to the active injection fields. This step was important because it was necessary to determine which wells were within field boundaries. Wells located in Refugio County which existed in both the MIMS and PI databases were combined by comparing the two databases with a computer program. As was the case with TRRC databases, extraction routines were constructed to obtain the necessary well data as commercial routines were either unavailable or inadequate.

Unfortunately, the PI databases contain only well construction data and do not contain any abandonment information. This limitation required that a manual search of TRRC well records would need to be performed on every well studied.

3.4.2. Selection of Fields and Abandoned Wells for Study

Oil fields with 5 or more active secondary recovery or disposal injection wells were considered to be fields with significant Class II injection operations and wells located within these fields were included in the study. Fields which met this criteria were identified using the TRRC UIC database. This database lists wells with present or past UIC permits and, where located in a field, gives the field name.

3.4.2.1 Refugio County Pilot Study

Refugio County (Figure 2.2) has a total of 5832 wells in the TRRC OGWS. Data from the TRRC UIC database indicated that very few fields have secondary recovery injectors, so the combination of disposal wells (both those injecting into the producing zone and those injecting into non-producing zones) plus secondary recovery injection wells was evaluated. All fields having a total of 5 or more injectors of the combination indicated were evaluated. This consisted of 9 fields as shown in Figure 2.3: Bonnie View, Greta, Lake Pasture, La Rosa, McFaddin, Mary Ellen O'Connor, New Refugio, Old Refugio, and Tom O'Connor.

All wells in the TRRC OGWS database were sorted into the four chronological groups as previously explained: No Date, pre-1967, 1967-82, post-1982.

3.4.2.1.2 Post-1966 Wells

Since Refugio County was to be used as the pilot study for the remaining Gulf Coast counties, all plugged wells in the 1967-82 era that had sufficient data available from the TRRC databases were identified for analysis; this data set contained 53 wells. An additional 85 wells were selected using manual searches resulting in a total of 138 wells to be analyzed. As explained in section 3.4.2.1.3, the additional 85 wells were originally selected as either Wells with No Dates or pre-67 wells, but searches of the TRRC files by Banks Information Solutions (Banks) of Austin, Texas, indicated all were either not plugged or were post-66 abandoned wells. A large number of wells had all data available except cement records; these wells were analyzed assuming no cement was employed. No additional data search was employed for 1967-82 plugged wells.

3.4.2.1.3 Pre-1967 Wells

All plugged wells with No Dates and with pre-1967 dates were reviewed for analyzable data. Data were found to be insufficient in every case, so these wells were sent to Banks Information Solutions for searches of TRRC files for additional data. A list of 85 plugged wells from the TRRC OGWBS database was sent to Banks where all of the wells were determined to be not plugged or to be post-66 abandonments. These 85 wells were included in the post-66 well analysis. Based on these results, the TRRC OGWBS was determined not to be appropriate for identification of pre-67 wells.

Data were obtained from PI for all pre-67 abandoned wells in PI's master database for Refugio County and wells in the predetermined fields were selected for analysis. A total of 134 wells existed in this database, and a listing of them was sent to Banks for a search of the TRRC files for all file information, but particularly for the Form 4 abandonment forms. The results of this search are given in Section 3.4.5.1.2.

3.4.2.2 Selection of Fields and Wells in Other Counties

On completion of the Refugio County pilot study, the following eight Texas Gulf Coast counties were also evaluated: Brazoria, Chambers, Hardin, Jackson, Nueces, San Patricio, Starr, and Victoria (Figure 2.2). The fields to be studied were identified from the TRRC UIC database. As documented in a

previous report, and confirmed in the Refugio County study, minimal information for pre-67 abandoned wells is contained in the TRRC OGWS database. The single source for identification of pre-67 abandoned wells in Gulf Coast counties was the PI database.

3.4.2.2.1 Fields

Using the TRRC UIC database, the field selection criteria employed in Refugio County was applied to the additional eight Gulf Coast counties (i.e., all fields having a minimum of 5 active secondary recovery or disposal injection wells will be evaluated). This analysis resulted in 72 additional fields available for analysis in the eight counties in the Gulf Coast region. A breakdown of fields by county is shown below.

<u>County</u>	<u>Number of Fields</u>
Brazoria	15
Chambers	8
Hardin	7
Jackson	10
Nueces	7
San Patricio	7
Starr	9
Victoria	<u>11</u>
Subtotal	74
Less White Point East Field (located in 2 counties)	-1
Less McFaddin Field (located in 2 counties)	<u>-1</u>
TOTAL	72

Comparing the well data from the UIC database with the PI database, some fields were eliminated as they had no pre-67 abandoned wells. This resulted in 66 fields remaining available for analysis. The fields and their locations are identified in Figures 2.4 through 2.9.

3.4.2.2.2 Pre-1967 Wells

The 66 selected fields contained 3249 pre-67 abandoned wells as shown in Table 3.5. Of these 3249 wells, only 2562 had locational data which allowed mapping. Employing a 10% oversampling on an individual field basis (i.e., the 10% sample size was always rounded-up for each field), resulted in a sample of 359 wells, a list of which was sent to Banks for a search of the TRRC files for additional information. Well samples were drawn using the random number generator selection method described in the Permian Basin report¹². A per county well count of the samples selected is shown below:

<u>County</u>	<u>Number of Wells in 10% Sample</u>
Brazoria	92
Chambers	34
Hardin	73
Jackson	23
Nueces	48
San Patricio	29
Starr	39
Victoria	21
TOTAL	359

3.4.3 TRRC File Searches

Plugging data existed for only the post-66 wells in the TRRC database. All pre-67 wells in the TRRC database and all wells in the PI database contained no plugging information. As a result, plugging information was obtained using a manual search of the TRRC records. All available well information (e.g., field, API well number, construction information) was sent to Banks Information Solutions in Austin, Texas, where a manual search was performed to locate all file forms and, particularly, the Form 4 (Plugging Form).

3.4.4 Generation of Scout Tickets and Wellbore Drawings

Previous work^{10,11,12} demonstrated that it is both necessary and advantageous to prepare wellbore schematics of the wells under consideration in order to accurately assess the flow barriers present in each well. Depending on availability, one can use several different sources of information for preparing the wellbore schematics; for example, commercial databases or company well records. The Texas Gulf Coast study utilizes the OGWS database for abandoned wells dated 1967-82, and both the OGWS and PI databases supplemented with manual records searches of the TRRC records for pre-1967 wells.

An access program was created to search and extract data from the OGWS database. This program was used to obtain well counts for each field and to prepare a well report (scout ticket) summarizing the drilling, completion and abandonment data for the sampled well populations. Figure 3.35 shows an example scout ticket generated from the PI database. When available, construction and abandonment data from the scout tickets were used to prepare wellbore drawings for wells investigated in this study.

A separate access program was also written to obtain scout ticket data from the PI databases. As discussed, this database contained only construction data. Abandonment data for the PI wells had to be

obtained by manual searches of the TRRC well records. The types of data which are available from the TRRC are summarized in Table 3.6.

Figures 3.36, 3.37 and 3.38 depict typical well data obtained from the TRRC. The data obtained include applications to drill, deepen, or plug back (Figure 3.36), reports indicating intention to plug (Figure 3.37), and final plugging records (Figure 3.38). These reports are TRRC forms and there are two generations of each form. For example, the final plugging record is now Form W-3, but evolved from Form 4.

Figures 3.36, 3.37 and 3.38 are representative of the data received for the studied wells. Form 2's were received for some of the wells studied, but were not necessarily available for all wells. Form 2A was available on most of the wells researched by Banks or the TRRC. Form 4's were received on most, but not all wells researched. The plugging information recorded on Form 4 was generally adequate, but some records did not provide details regarding the cement plugs used at abandonment.

Scout ticket and other well data retrieved were used to prepare wellbore schematics for each sampled well included in the study. Figures 3.39 through 3.43 depict typical wellbore drawings prepared in the Texas Gulf Coast study. Casing depths, casing cementing information, mechanical barriers, cement plugs and the depths of fresh water and active injection were shown as available.

Each of the wells with sufficient data was evaluated with the Automated Borehole Evaluation program (ABE). This program is discussed in detail in the AOR Variance Methodology report.^{3,4,5} Briefly, the program counts casing and cement flow barriers which are present between the Class II injection zone and the overlying base of usable quality groundwater. The program assigns a numerical value for both a through pipe (TP) and behind pipe (BP) flowpath. Wells for which no abandonment data were found were evaluated in the presence of squeezing and sloughing shales (when applicable) to determine the potential flow path and the number of barriers to flow from the injection zone to the base of the UQW. The most conservative ABE values for each well studied are shown in Table 3.30. Some specific examples of this analysis are discussed in Section 3.5.1.4.

3.4.5 Analysis of Well Data

The following analysis of the well data generated during this study focuses first on Refugio County, since that county was selected for pilot study and the Refugio County results then guided the remaining work.

In Refugio County, wells abandoned between 1967 and 1982 (post-66 wells) and wells abandoned prior to 1967 (pre-67 wells) were studied. In the other eight counties, because of the Refugio County results, only pre-67 abandoned wells were studied.

3.4.5.1 Refugio County

3.4.5.1.1 Post-66 Wells

As discussed in Section 3.4.2.1.2, 138 wells believed to have been abandoned during 1967-1982 were selected for study from the TTRRC OGWBS. A list of these wells was provided to Banks Information Solutions (Banks) of Austin, Texas, which searched files of the TRRC for all available well forms and data, particularly the well abandonment Forms 4 or W-3. According to the TRRC, if such forms are on file, a well is considered to have been properly abandoned so that it is protective of usable quality groundwater.

Table 3.7 lists the 138 wells that were selected and studied in nine Refugio County oilfields and Table 3.8 summarizes data from Table 3.7. After TRRC file searches by Banks, it was determined that, of the 138 wells, 112 were actually post-66 abandoned wells while 26 of the wells were in some other status category, including current producer, current disposal well, shut-in or temporarily abandoned. A few of the post-66 abandoned wells were abandoned after 1982.

Table 3.8 shows that a Form 4 or W-3 was found for all 112 post-66 Refugio County abandoned wells. This result is consistent with UMR's Texas Permian Basin study¹² in which post-66 abandoned wells in that area were found to be protective of usable quality groundwater.

Because Forms 4 or W-3 were found for all of the sample of post-66 abandoned wells in Refugio County, abandoned wells in that age category were not studied in other Texas Gulf Coast counties.

3.4.5.1.2 Pre-67 Wells

The process of selection and data acquisition for pre-67 Refugio County wells is given in Section 3.4.2.1.3. In all, as shown in summary Table 3.9, 134 wells were selected for detailed study from the PI data base of pre-67 abandoned wells. After search of the TRRC files by Banks, it could be determined that 7 of the 134 wells were not actually abandoned and that 8 wells were post-66 abandonments.

Of the remaining 119 wells still considered to be possible pre-67 abandonments, Forms 4 were found for 100 wells but none were found for 19 wells. Table 3.10 provides details on all 134 wells, and, particularly, under the comments section, provides information on what forms were found in the TRRC files for the 19 wells that are shown by the PI data base to be pre-67 abandonments but for which no abandonment forms were located. These wells are considered to be of possible concern in that their status and condition are unknown and they might, if in an AOR, need corrective action to meet UIC requirements.

Because the 19 wells that were identified as possibly being of concern represent a significant percent (19/119 or 16%) of the total pre-67 abandoned wells in the nine Refugio County fields that were studied, the pre-67 abandoned well analysis was extended to eight selected other Gulf Coast counties to test the Refugio County results.

3.4.5.2 All Counties

Table 3.11 summarizes the data for all PI data base wells studied in Refugio and the eight other selected counties. These wells represent the total sample of 493 wells that were originally selected for study as possible pre-67 abandoned wells. Tables 3.12-3.19 summarize the well data by county for all counties but Refugio County, the data for which are shown in Table 3.9. Table 3.10 lists the individual well data for all counties but Refugio. The Refugio County individual well data are given in Table 3.10.

Summary Table 3.11 shows that, of the 493 wells originally thought to be possible pre-67 abandoned wells, 16 were found to not be abandoned and 34 were abandoned after 1966. Of the remaining 443 wells still considered to be possible pre-67 abandonments, Forms 4 were found for 362 wells but none were found for 81 wells.

Tables 3.10 (Refugio County) and Table 3.20 provide the details on all 443 wells and, particularly under the comments section, provide information on what was found in the TRRC files for the 81 wells that are shown by the PI data base to be pre-67 abandonments but for which no abandonment forms were located. These wells could be considered to be of possible concern in that their status and condition are unknown and they could be wells that, if in an AOR, would require corrective action in order to meet UIC requirements. The 81 wells of possible concern represent 18% (81/443) of the total pre-67 abandoned wells studied in the 73 fields in the nine study counties. This is remarkably consistent with the 16% wells of concern in the Refugio County pilot study.

3.4.6 Conclusions From Abandoned Well Studies

As discussed in Section 3.3, a previous study of the Texas Permian Basin¹² showed that abandoned wells in that area could be considered in three age groups, pre-1967, 1967-1982 and post-1982. In the Permian Basin study it was found that data were available to demonstrate that wells abandoned during and after 1967 were protective of usable quality groundwater. In the case of pre-1967 abandoned wells, abandonment data could not be found for some wells, which made demonstration of the adequacy of abandonment of wells in that age group more difficult.

As a result of the Permian Basin study results, it was decided that post-82 abandoned wells did not require examination in this Gulf Coast study but that the 1967-1982 and pre-1967 abandoned wells should be studied in a Refugio County pilot study.

A sample of 138 wells believed to be abandoned during 1967-1982 was selected for study from nine oilfields in Refugio County. TRRC Forms 4 or W-3 were found for all of the 112 wells that were determined to actually be post-66 abandonments. Based on this Refugio County result, it is concluded that, as was expected, wells abandoned during and after 1967 are protective of usable groundwater and this age class of abandoned wells was not studied in the other eight Gulf Coast study counties.

In the Refugio County pilot study, the TRRC files were searched for data for all 134 wells contained in a Refugio County data base created by PI to contain possible pre-67 abandonments. The file search results, which are summarized in Table 3.9, showed that 15 wells were not pre-67 abandonments. Of the

remaining 119 wells, Forms 4 were found for 100 wells but were not found for 19 wells. Because the status and mechanical condition of these 19 wells was not determined they are considered to be of possible concern in that they could be wells that, if in an AOR, would need corrective action to meet UIC requirements.

Because of the results of the Refugio County pilot study, examination of pre-67 abandoned wells was extended to eight additional Gulf Coast counties (Figure 2.2). Including Refugio County, a total of 493 wells was selected for analysis as possible pre-67 abandoned wells in the nine counties. Table 3.11 summarizes the pre-67 abandoned well study results for the combined nine counties. Table 3.11 shows that 50 of the original 493 wells were determined to not be pre-67 abandonments. Of the remaining 443 possible pre-67 abandonments, Forms 4 were found for 362 wells but no abandonment data were found in the TRRC files for 81 of the wells. Those 81 wells are of possible concern in that their status and mechanical condition are unknown and they might, if in an AOR, require corrective action to meet UIC requirements.

It is believed, based on the Texas Permian Basin study and this study, that the only wells that would be likely to raise any TRRC concerns in AOR studies in the Texas Gulf Coast area will be in the pre-67 abandoned well population. The results described above show that TRRC file data are lacking for some percentage of that group of wells, about 18% in this study. Thus, well construction and abandonment characteristics of the majority of all wells would be such that AOR variances could be considered for Gulf Coast injection wells but a population of pre-67 abandoned wells exists that could preclude such variances. The next section (Section 3.5) describes the existence of mitigating geological circumstances that could ameliorate concerns about those pre-67 abandoned wells the status and mechanical condition of which are uncertain.

3.5 Mitigating Geological Circumstances

As discussed in Section 2.1.3.4, a possible basis for AOR variance is the availability of geologic conditions that preclude upward fluid movement through a pathway, such as an unplugged or inadequately plugged abandoned well. Section 3.1 discusses the geology and hydrogeology of the Texas

Gulf Coast and, within that section, sub-Section 3.2.5 points out the general availability of both sloughing and squeezing shales* for closure of boreholes and normally pressured sands to act as sinks for any upward flowing formation water.

3.5.1 Sloughing and Squeezing Shales

Some shales and some other types of sedimentary rocks exhibit a tendency to slough or cave into a borehole, thus acting as a naturally occurring plug. In other cases the shales expand and squeeze the borehole shut. Both effects can also occur behind the casing of a cased borehole to fill or close the behind-casing annulus.

3.5.1.1 General Availability in Study Area

Sub-Section 3.2.5.1 discusses the general availability of sloughing and squeezing shales in the Gulf Coast study area. Such shales occur throughout the Texas Gulf coast, interbedded with sands, from the ground surface to very great depths below the surface. More specifically, they are ubiquitously present in the depth interval of from a few hundred feet below the ground surface to about 4,000 feet which is the interval where they would be needed to close off any open boreholes between the base of the deepest usable quality water (UQW) and the top of the shallowest injection zone. While this general shale presence is well known, it must be demonstrated that the locations and amounts of shale are present in individual oilfields to satisfy criteria for those characteristics.

3.5.1.2 Specific Availability in Study Fields

To test the availability of sloughing and squeezing shales for AOR purposes in specific individual oilfields, criteria for their location and thickness must first be established. In consultation with the TRRC, two thickness criteria were established.

1. A cumulative thickness of 250 feet.
2. A continuous thickness in one shale unit of 100 feet.

**Throughout this section, the term shale is used whereas, as discussed in Sections 1.3.1 and 3.2, these deposits are probably Miocene-Pliocene age fluvial and lagoonal mudstones.*

In addition to these two criteria, in analyzing borehole geophysical logs, only shale units of >20 feet in thickness were counted toward the cumulative 250 feet and sandstone units of >10 feet in thickness were counted as breaks when cumulating the 250 feet of thickness and in locating the 100 feet of continuous shale.

To determine where in the vertical geologic column the shale units needed to be, the TRRC UIC computer data base was analyzed to show the deepest permitted base of usable quality groundwater in each analyzed oilfield. These data are contained in the computer printouts in Appendix 1. For example, in the Tom O'Connor oilfield in Refugio County, the deepest base of UQW is 1500 feet. This value which comes from the Refugio County printout in Appendix 1 is shown in data Column 1 of Tables 3.21-3.29, which summarize these and other data items for all study oilfields, as extracted from Appendix 1 and from analysis of the well logs in Appendix 2.

After establishing the deepest base of UQW in each oilfield, the well logs shown in Appendix 2 were used to establish the presence and location of the 250 feet cumulative and 100 feet continuous shale intervals in the fields.

The logs in Appendix 2 were obtained from Cambe Geological Services, Houston, Texas. The logs were selected to begin at depths above the deepest base of UQW, if possible. They were also selected to have a suite of electric logs that could be interpreted to distinguish the shale/sand strata in the depth interval of interest.

After preliminary investigation of available logs in the Cambe log library, it was decided to use only a single log that could be found to meet or nearly meet these criteria. This was because such logs proved to be scarce and because it was found that the necessary shales were present in every usable log that was examined. The principal problems of log selection were:

1. Very few, in some fields no, usable logs could be found that extend upward to the base of deepest UQW.
2. Because of the age of fields and for other reasons, the logs that are available often do not have the desirable combinations of good-quality electric logs necessary for the shale/sand interpretation in the transition zone from fresh to saline water.

Because a single log was selected for each oilfield, there is no assurance that the detailed location of the shale intervals in the borehole as interpreted from that log are representative of the entire field. However, the occurrence of shale intervals that meet the established criteria of 250 feet cumulative thickness and 100 feet continuous thickness in every oilfield and in every usable log studied is considered to be compelling evidence that such shale is present throughout the Gulf Coast study area within the stratigraphic interval of interest.

As shown in Tables 3.21, 3.22 and 3.23, no log interpretation was done for oilfields that had been identified as shallow piercement dome oilfields these fields were excluded because their geology was considered to be too complex, as discussed in Section 3.2.4.3.1, to allow any generalization of the presence and location of sloughing or squeezing shale intervals throughout the field. Such fields are probably not amenable, on a field-wide basis, to AOR variance based on geologic conditions.

In addition to the deepest base of usable quality groundwater, which appears in Column 1 of Tables 3.21 - 3.29, these tables show:

- Column 2 - The shallowest permitted top of injection for any UIC database well in the field.
- Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.
- Column 4 - The base of the shale isolation section from the field log in Appendix 2.
- Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.
- Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

The data in Table 3.26 will be interpreted for Refugio County to exemplify their significance and application. For Refugio County, Table 3.26 shows that the deepest base of usable quality groundwater ranges from a minimum depth of 1200 feet in two fields to a maximum of 1650 feet in the Greta field. This is a rather uniform maximum depth throughout the county. Within the individual fields the range throughout the field is also not great. For example, in the Tom O'Connor field, the field data sheets in Appendix 1 show the Base UQW ranging from a minimum depth of 1200 feet to the maximum depth shown in Table 3.26 of 1500 feet. The maximum depths of Table 3.26, Column 1, were selected to represent the most conservative known depth from which to begin the analysis of the logs in Appendix 2.

The Column 2 and Column 3 values in Table 3.26 are shown to indicate the shallowest depth at which the TRRC database shows injection to have been permitted for any well in the database (Column 2) and the shallowest depth at which any active UIC database well is permitted to inject (Column 3). These values help to put into perspective the depth of the base of the shale isolation interval in Column 4. For example, in the Tom O'Connor field, the base of the shale isolation interval is at a depth of 2080 feet. Since no injection is currently permitted above a depth of 2950 feet, it would pose no restriction on current actual practice if a variance stipulation for that field was that injection must be below a depth of, for example, 2500 feet. Even if a depth of 3000 feet were selected as the minimum for injection it would be largely consistent with current practice in that only one active injection well in the UIC database is shown to be permitted to inject at a depth of less than 3000 feet.

The logic in suggesting that a minimum depth for injection in an AOR variance scenario be greater than the base of the shale isolation intervals shown in Tables 3.21 - 3.29, Column 4, is that, as previously discussed, the shale isolation interval location is based on a single well log from each field and some variation in the location of that interval will occur throughout the field.

Column 5 of Table 3.26 gives the total thickness of stratigraphic interval that was needed to obtain the 250 feet cumulative and 100 feet continuous shale intervals required to meet the criteria discussed earlier in this section. Column 6 of Table 3.26 gives the Column 5 value divided by the actual thickness of shale within the total interval. The resulting ratio is an indication of the amount of shale v. the total interval. For example, in the Tom O'Connor field the ratio of Column 6, Table 3.26 is 2.32. This means that, within the overall 580 feet interval, there is slightly more sand than shale (1.32 feet of sand for each 1.0 feet of shale). However, for all of Refugio County, based on the results of one well in each of nine fields, the average ratio is very close to 2, showing an approximately equal occurrence of sand and shale. The significance of this is that, if the total isolation interval in Refugio County fields were, for example, to be arbitrarily doubled, this should also approximately double the amount of shale present to provide borehole closure. This is also true, on average, for all of the counties studied, as a group.

In the specific case of the Tom O'Connor field, if the base of the shale isolation interval were to be extended to a depth of 3000 feet, as previously discussed, this should result in an approximate total cumulative shale thickness of 500 feet, twice the minimum criterion of 250 feet $[(3000 - \text{Column 1}) \times (2) = 500]$. This process is suggested as a conservative means of compensating for the lack of field-wide studies of shale occurrence while, at the same time, imposing no undue restriction on actual injection practice. Obviously, the general concept will need to be applied thoughtfully, field-by-field, using the type of data presented in Table 3.26.

3.5.1.3 Evidence of Effectiveness

Early evidence of the presence of the presence of sloughing and squeezing shales and their effectiveness for borehole closure in the Texas Gulf Coast was reported by Frost²⁵ who summarized information available to him in 1938 concerning the problem of drilling through "heaving" shales in that geologic province. Frost²⁵ avoided defining a "heaving" shale but reported that; "In the work of certain companies, if a formation could be drilled through finally it was not reported as a heaving shale, but if the company was forced to stop drilling operations because of shale heaving in the hole, it was reported that the hole was abandoned due to heaving shale." It would seem that this extreme squeezing or "heaving" behavior is far beyond that required for closure of an abandoned borehole that needs only to be closed off over an extended period of time.

The "heaving" shale intervals and trends reported on by Frost²⁵ included shales of the Miocene age Largeto (Fleming) Formation. Details of the heaving shale occurrences in individual fields were described in 1938 Gulf Coast field summaries by Leyendecker²⁶. Those field summaries showed that the "heaving" shale intervals were generally at depths below 3000 feet. This is possibly because the extremely rapid borehole closure that was considered "heaving" required overburden pressures that are present below 3000 feet. It would be expected that such shales would also close-off an open borehole at shallower depths, but more slowly.

The principal evidence for the effectiveness of Texas Gulf Coast shales in closing an open borehole comes from a 1991 study conducted by the E.I. du Pont de Nemours Company (Appendix 3) at a site near

Orangefield, Orange County, Texas. The study was conducted to show that, in the study area, an open borehole will be naturally sealed by squeezing shales within a very short period of time. In the DuPont study, closure of the test borehole within one week was demonstrated to occur.

The shale section that was the subject of the DuPont test was the same Miocene age Fleming Group that is of interest in this study. The interval that caused the borehole closure during the DuPont test was at a depth of from 2838 feet to 2926 feet (88 feet) or roughly the same depth range and minimum continuous thickness of shale being suggested for borehole closure purposes in this study.

3.5.1.4 Examples of Concept in Selected Wells

Figures 3.39 - 3.43 depict typical wellbores for pre-67 Gulf Coast wells for which abandonment data were not found. Thus, they are wellbores for which the availability of properly located sloughing and squeezing shales, combined with the only known wellbore features, could be the basis for AOR variance consideration.

Figure 3.39 is the wellbore schematic drawing of a typical dry hole, where surface casing was set but with no production casing. For this well, no casing cement data were reported, so no cement is shown. The surface casing was set at a depth of 800 feet, above the deepest base of usable quality groundwater (UQW) at a depth of 1500 feet. Thus, based on the available information the wellbore contains no barriers to prevent flow from the shallowest reported top of active injection (Table 3.26) to the deepest UQW base.

The Tom O'Connor field well log in Appendix 2 is the source for the squeezing shale interval depicted in Figure 3.39. As discussed earlier in Section 3.5.1.2, there are probably several hundred more feet of shale available between the base of the shale isolation interval shown in Figure 3.39 and the top of the shallowest active injection zone in the field.

The potential flow path and the number of barriers to flow from the injection zone to the UQW base can be evaluated visually, or the Automated Borehole Evaluation (ABE) program^{3,4,5} can be used. The results of this evaluation are shown in Table 3.30, where wells are listed by field for all counties, including Refugio County, and for each field in increasing API number. For the M.F. Lambert well, API

#391-01350, the table shows that the available path is "TP" or through pipe (or through borehole) and that there is one barrier, which is a section of squeezing shale, that forms a plug. In the absence of the squeezing shale, there would be no firm basis for evaluating this well or others like it, since its status and wellbore condition are not completely known.

Figure 3.40 depicts an example very much like the first one except that casing cement was reported and is shown. However, since the surface casing is above the deepest UQW base. The casing and the cement provide no protection to the deepest UQW. The barrier evaluation scenario would be the same as for the first wellbore. That result is given in Table 3.30 which shows one TP barrier and one plug.

Figure 3.41 shows a borehole where surface casing does cover the deepest base of UQW and where cement data are available. In this case, Table 3.27 shows that there are three TP barriers (surface casing, surface casing cement and squeezing shale) and one plug (squeezing shale). There is one behind pipe or "BP" barrier (casing cement).

The example of Figure 3.42 is for a borehole with both surface casing and production casing. No cement data were found and, therefore, no behind-casing cement is shown for either casing string. Flow paths could be present from the shallowest injection zone either behind the production casing or through the borehole inside the production casing. The squeezing shale provides one BP barrier and the casing provides one TP barrier (Table 3.30).

In the example of Figure 3.43, both surface and production casing are present and cement data were available for both casing strings. Because of the production casing cement, the only available flowpath from the shallowest injection zone to the deepest base of UQW is behind casing. The squeezing shale interval provides one BP barrier and the TP analysis is not applicable, since there is no TP flowpath (Table 3.30).

3.5.1.5. Overall Probable Effectiveness in Study Area

Specific examples of the availability and basis for effectiveness of squeezing and sloughing shales are given in the previous section. Table 3.30 shows that squeezing shale flow barriers are considered to exist in all fields except for fields that are known or believed to be shallow or shallow-intermediate

piercement salt dome fields. Those shallow to shallow-intermediate salt domes that were not identified to be variance candidates can be distinguished in Table 3.21, 3.22, and 3.23 by the “na” or not applicable comment shown in the base of shale isolation interval column (Column 4). This “na” comment applies to seven fields in Brazoria County, three fields in Chambers County, and all six fields in Hardin County. All of the remaining fields ($73-16=57$) are believed to have the prerequisite squeezing shales. Such shales should also be present in all other non-salt dome fields or deep salt dome fields in other Gulf Coast counties within the Frio production trend identified in Section 3.2.

3.5.2 Sink Zones

Porous and permeable formations that are underpressured or normally pressured provide sink zones that can divert upward flowing fluids before the fluids can reach a UQW. The sands that are interbedded with squeezing shales, on an approximate one-to-one average basis in the study area, are normally pressured and constitute such sink zones. No detailed analysis of these zones is given because they are universally present and are considered to provide secondary protection, with the squeezing and sloughing shales being the more important source of protection for usable quality groundwater in pre-67 abandoned wells for which abandonment information is not available.

3.6 Extension of Study Results Within the Frio Formation Producing Trend

It is believed that the study results that have been previously described can probably be extended to all oilfields producing from the Frio Formation and deeper formations within the Frio producing trend that is shown in Figure 2.2. To facilitate this process, the UIC database for counties, other than the nine study counties, was searched for fields with five or more active permitted injection wells. The results of this search are contained in Appendix 4. As shown in Appendix 4, there are at least 78 additional fields in the 17 counties that were searched that contain 5 or more active UIC permitted injection wells.

3.7 AOR Variance Recommendation

Based upon the study results that have been described, it is recommended that field-by-field AOR variances be considered for oilfields within the area of the Texas Gulf Coast Frio Formation producing trend as shown in Figure 2.2. The basis for a variance for a particular field would be demonstration of

the presence of prerequisite amounts of cumulative and continuous shale between the deepest base of usable quality groundwater and the injection zone to be permitted. The procedures for such demonstration have been developed and presented herein and have been successfully applied to 57 fields in eight counties. There are at least 78 additional fields in 17 other Frio producing trend counties to which the recommended procedures may apply.

4.0 CONCLUSION

A study has been conducted of 73 oilfields in 9 counties of the Texas Gulf Coast Frio Formation producing trend to evaluate the area of review variance opportunities for new injection wells in that oil producing trend.

During the study TRRC abandonment forms were found for all wells studied that were abandoned during and after 1967. Based on this result and the results of a previous Permian Basin study, well construction and abandonment characteristics of the majority of all wells are such that AOR variances could be considered for Gulf Coast injection wells. However, abandonment data were not found for 18% of pre-67 abandoned wells. These wells, for which abandonment data were not located, are of possible concern in that their status and mechanical condition are unknown and they might, if in an AOR, require corrective action to meet UIC requirements.

To deal with the wells for which abandonment data were not found, the mitigating geological circumstances of sloughing and squeezing shales for borehole closure and of normally pressured sands to act as sinks for any upward flowing formation water were investigated.

Minimum criteria of 250 ft of cumulative shale and 100 ft of continuous shale were established. The necessary amount of shale and nearly equal average amounts of sand were found to be present below the base of the deepest usable quality groundwater and above the top of most permitted injection zones in 57 of the 73 injection fields that were investigated. The remaining 16 fields are shallow to shallow-intermediate depth salt dome fields for which this AOR variance procedure can probably not be applied field-wide.

It is concluded that field-by-field AOR variances can be considered for the Texas Gulf Coast Frio Formation producing trend based upon a combination of well construction and abandonment characteristics and the presence of mitigating geological circumstances. The study methods that produced this conclusion can probably be extended to at least an additional 78 fields in 17 other counties.

5.0 REFERENCES

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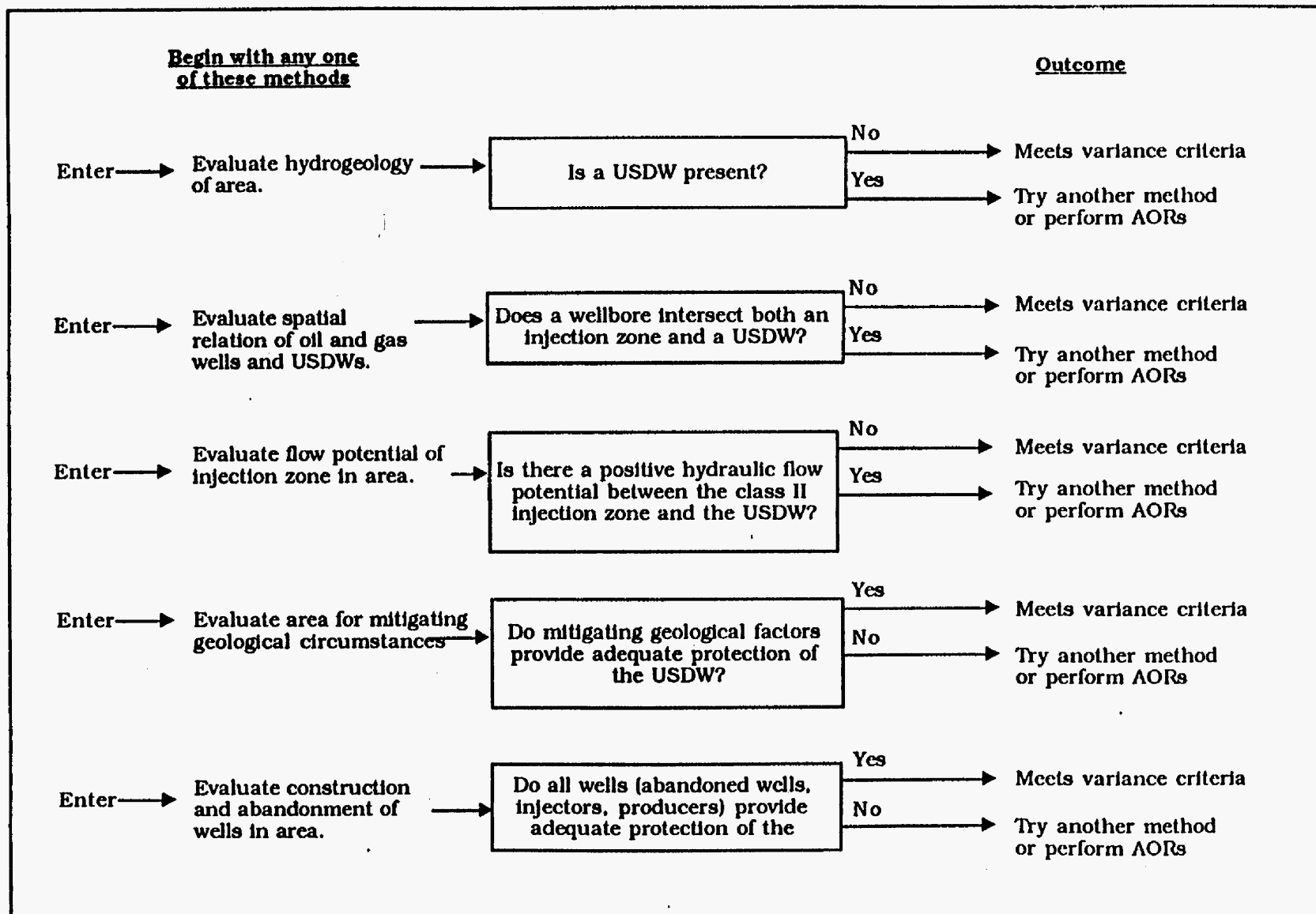


Figure 2.1: Five general methods are available for obtaining variance from revised EPA Area of Review requirements. These methods can be used in any order, singly or in combination, to exclude some or all wells from the AOR process. Wells not excluded by variance would be subject to well-by-well AORs.

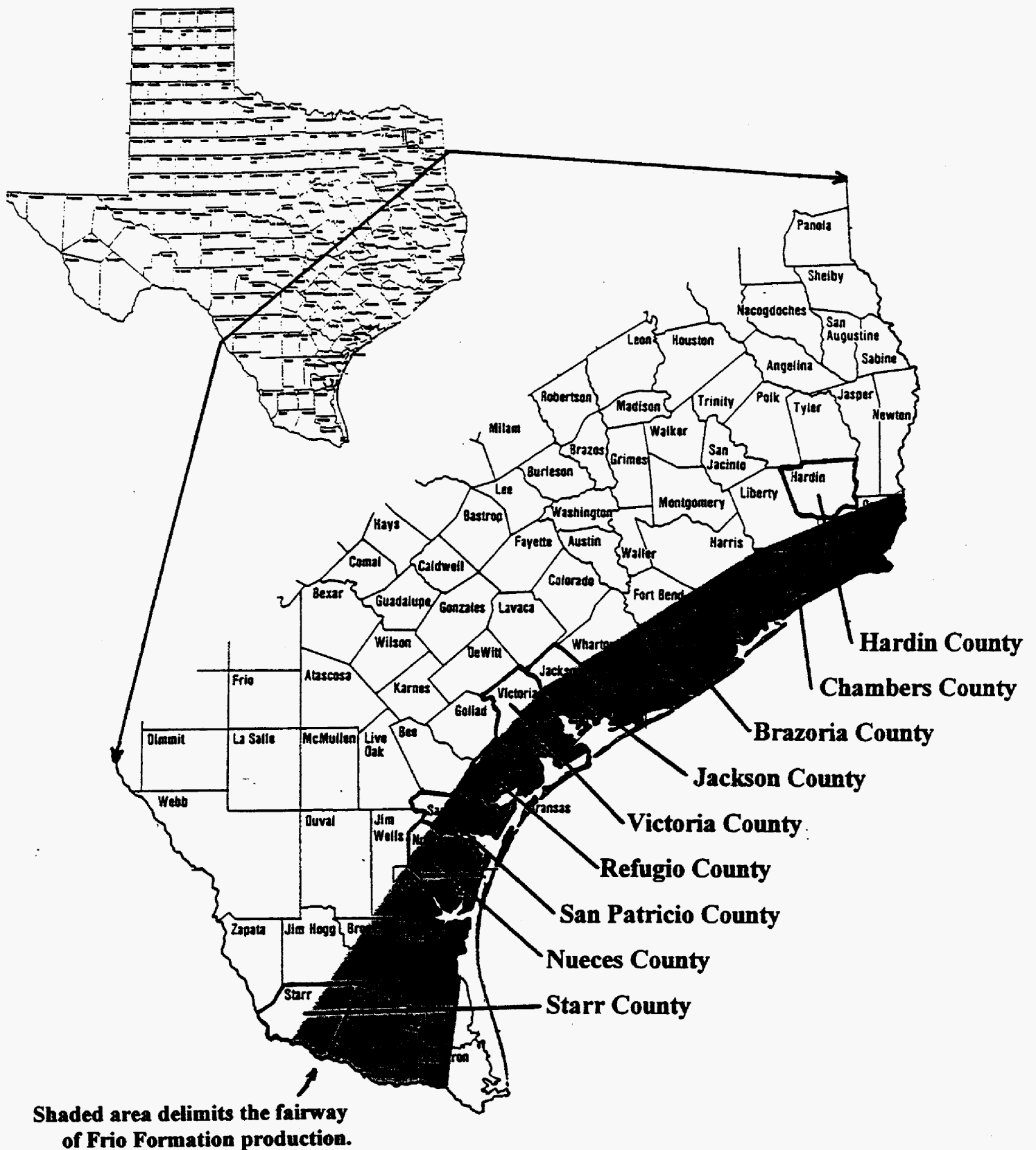
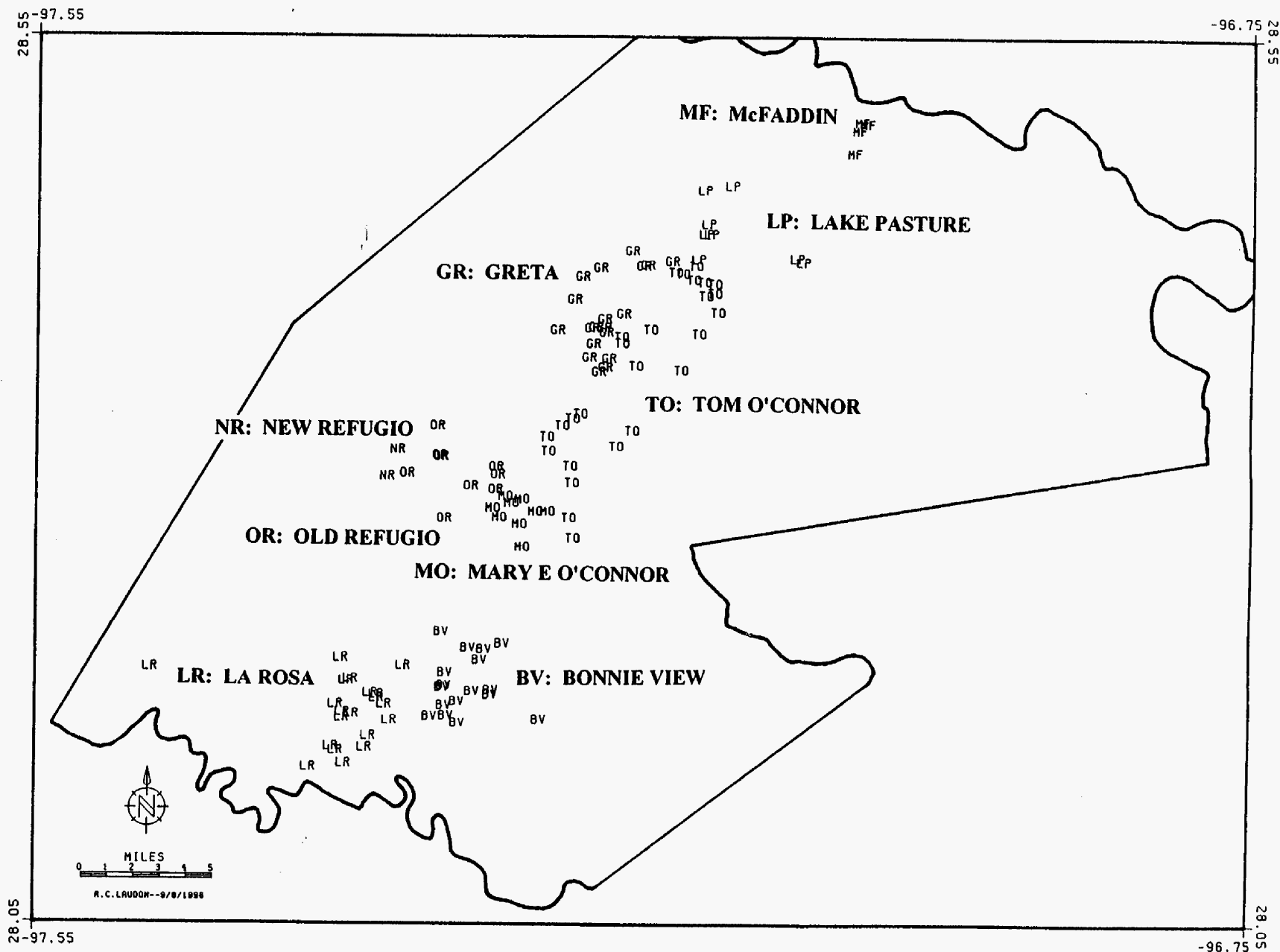


Figure 2.2: Map showing Texas Gulf Coast Frio Formation producing trend and nine counties of this study.



**Figure 2.3: Map of Refugio County with locations of pre-67 abandoned wells.
Data from Petroleum Information database.**

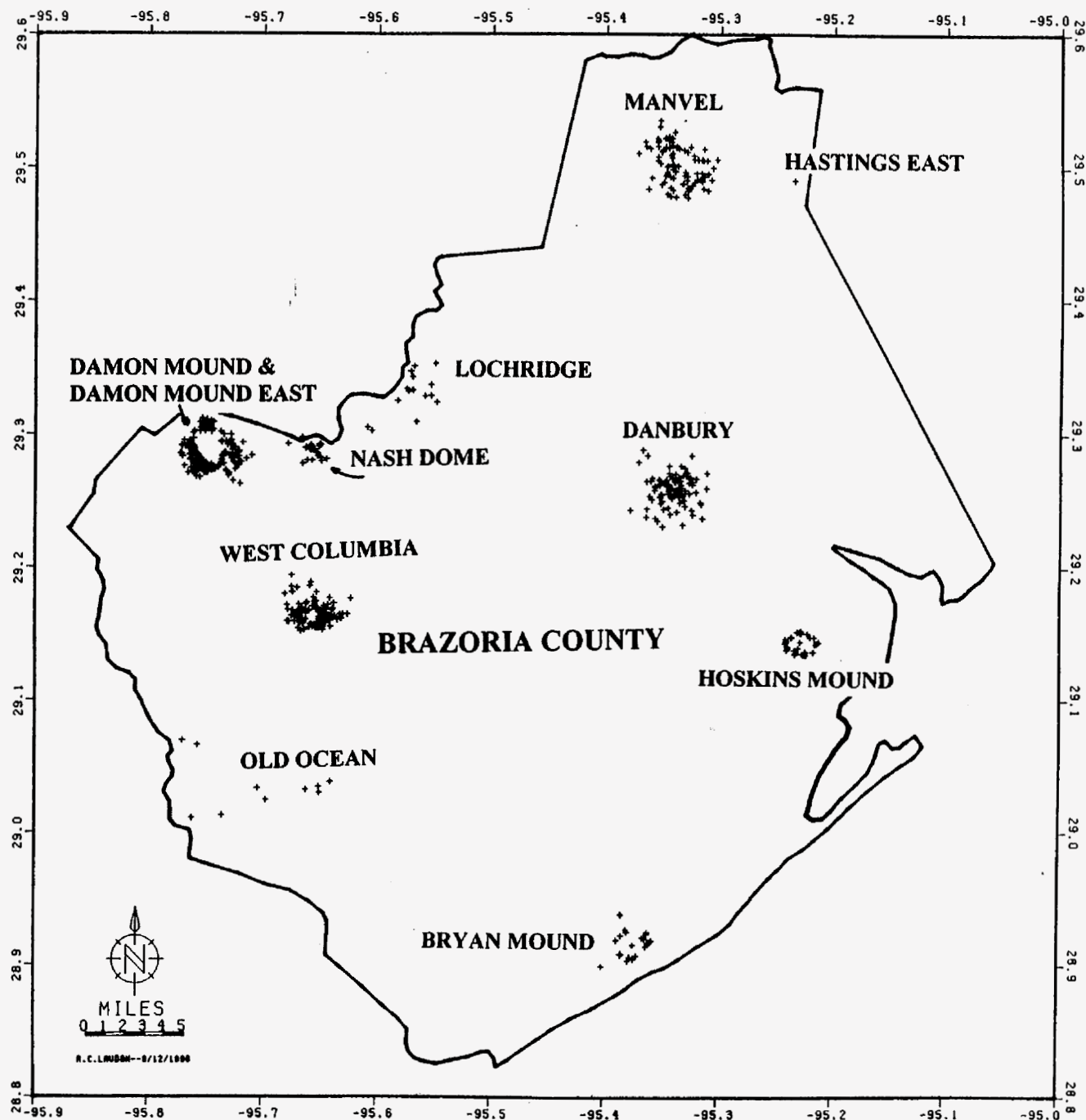


Figure 2.4: Map of Brazoria County showing abandoned well locations for fields included in this study. Data from Petroleum Information database.

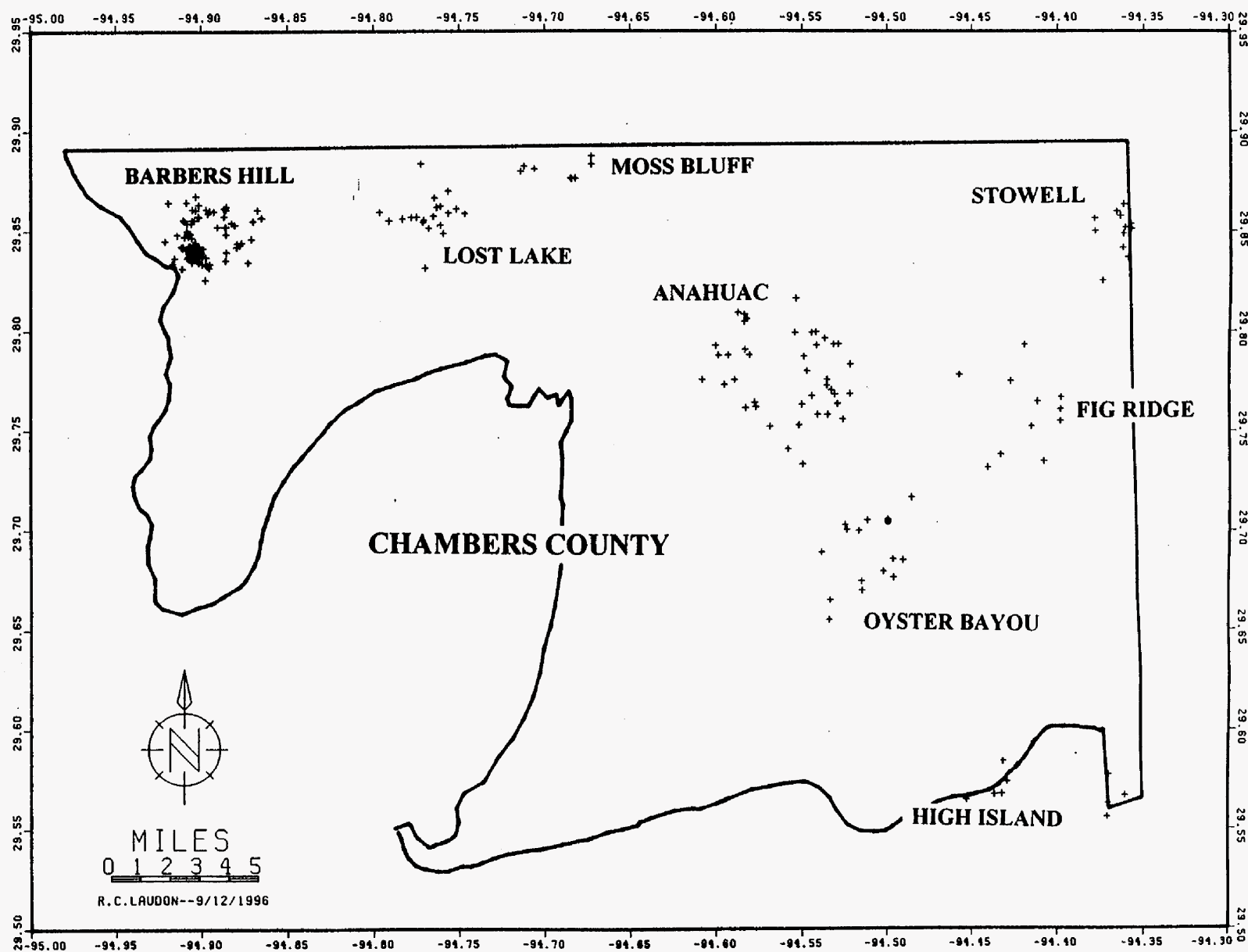


Figure 2.5: Map of Chambers County showing abandoned well locations for fields included in this study. Data from Petroleum Information database.

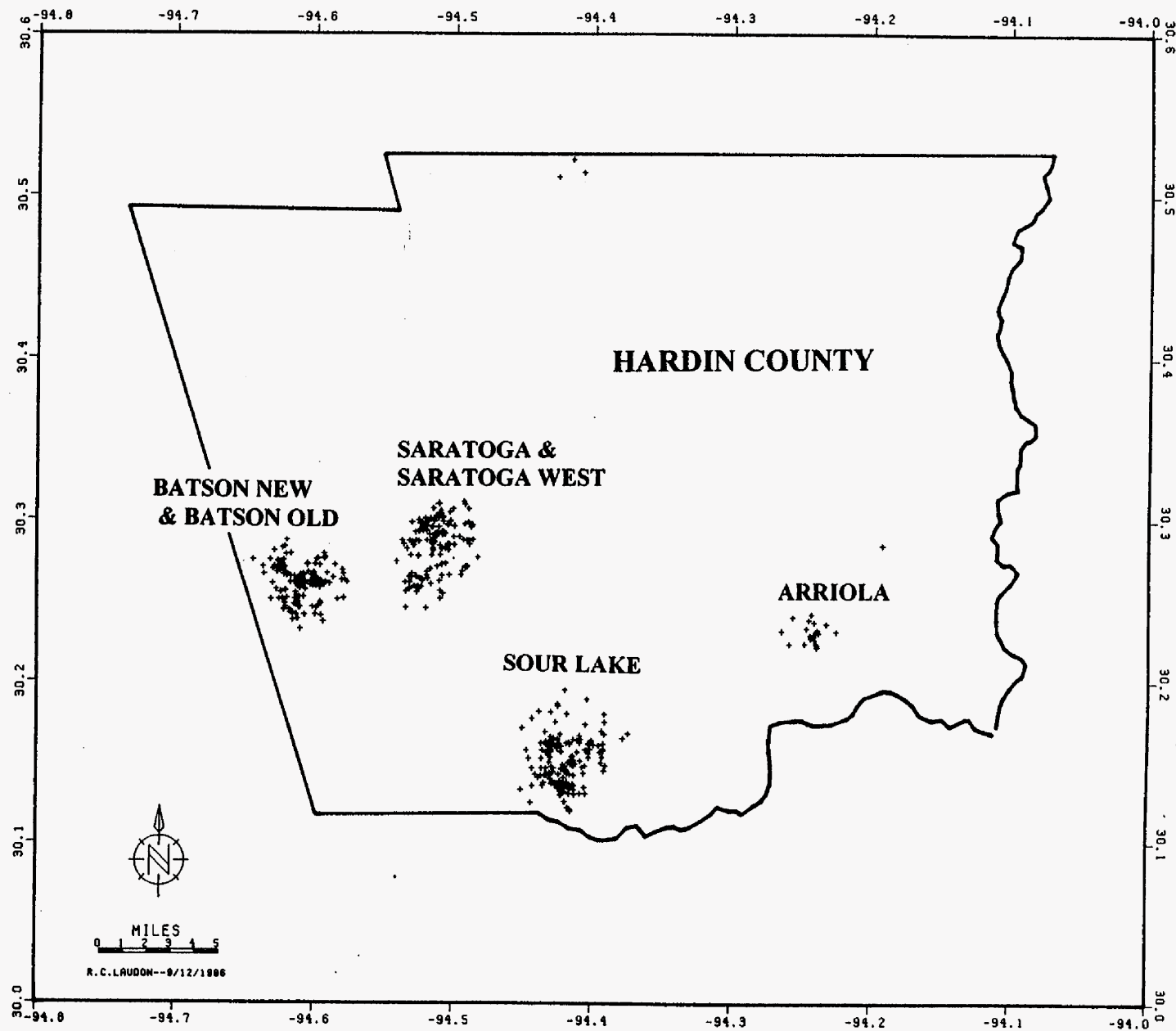


Figure 2.6: Map of Hardin County showing abandoned well locations for fields included in this study. Data from Petroleum Information database.

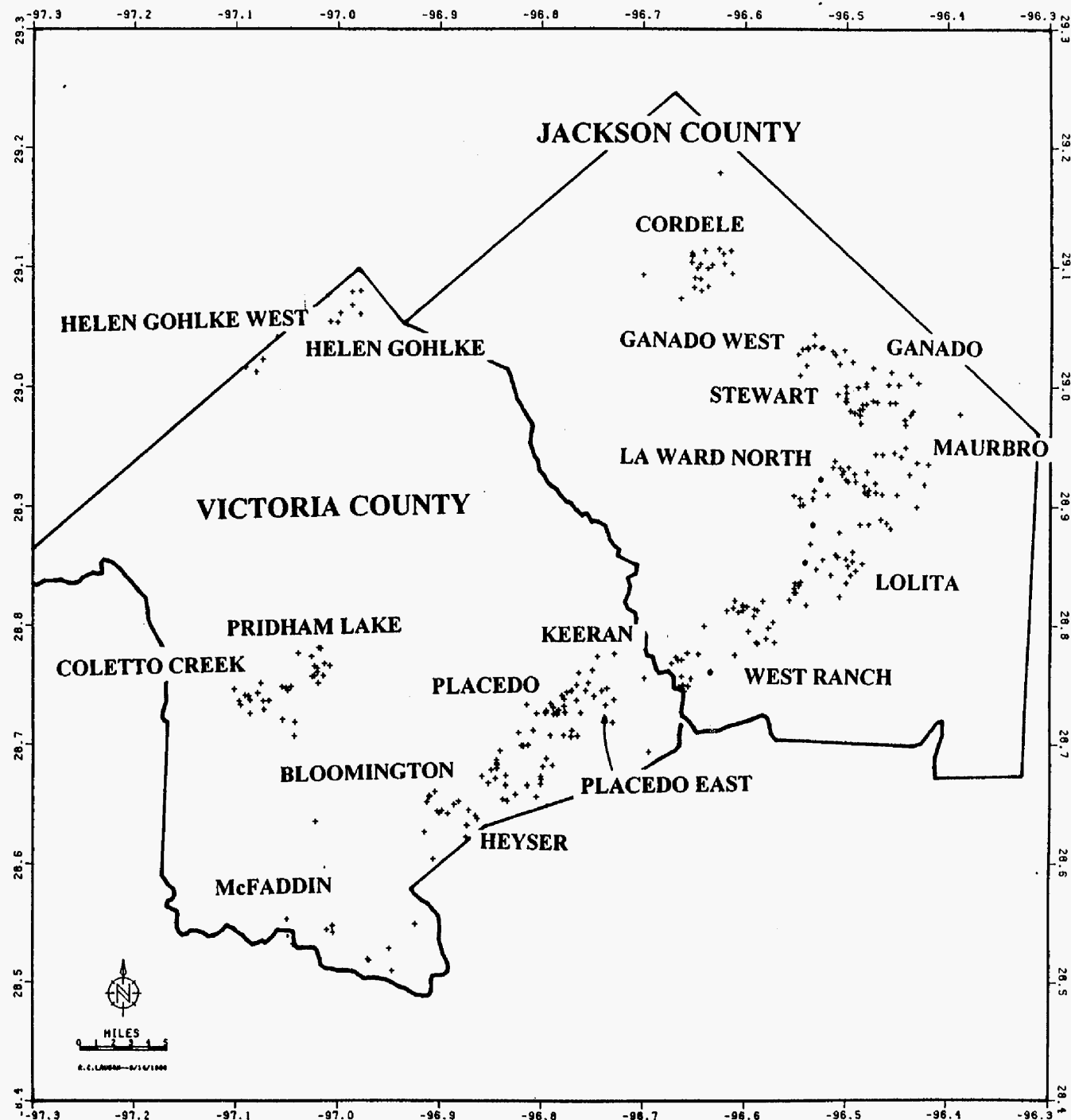


Figure 2.7: Map of Jackson and Victoria Counties showing abandoned well locations for fields included in this study. Data from Petroleum Information database.

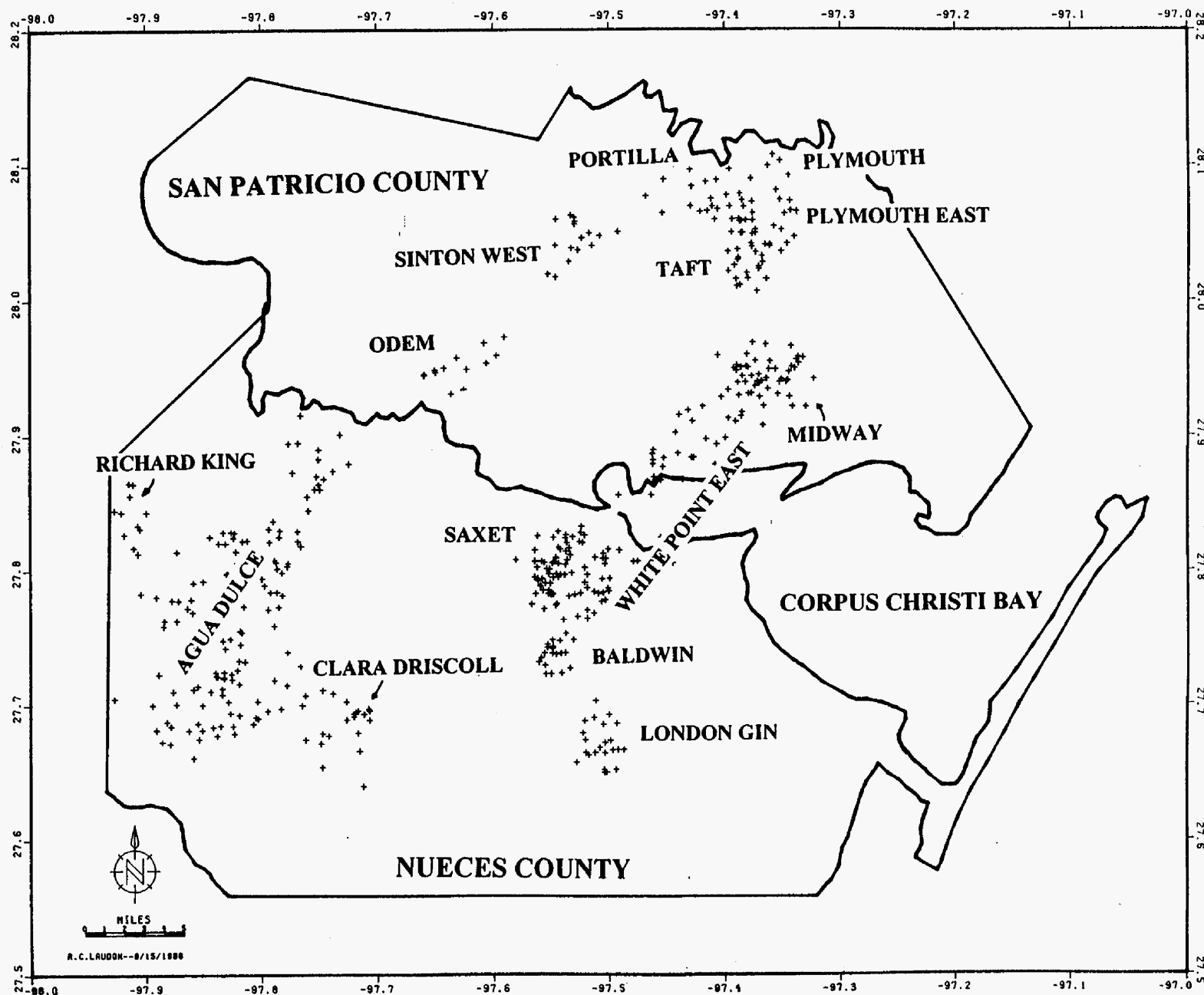


Figure 2.8: Map of Nueces and San Patricio Counties showing abandoned well locations for fields included in this study. Data from Petroleum Information database.

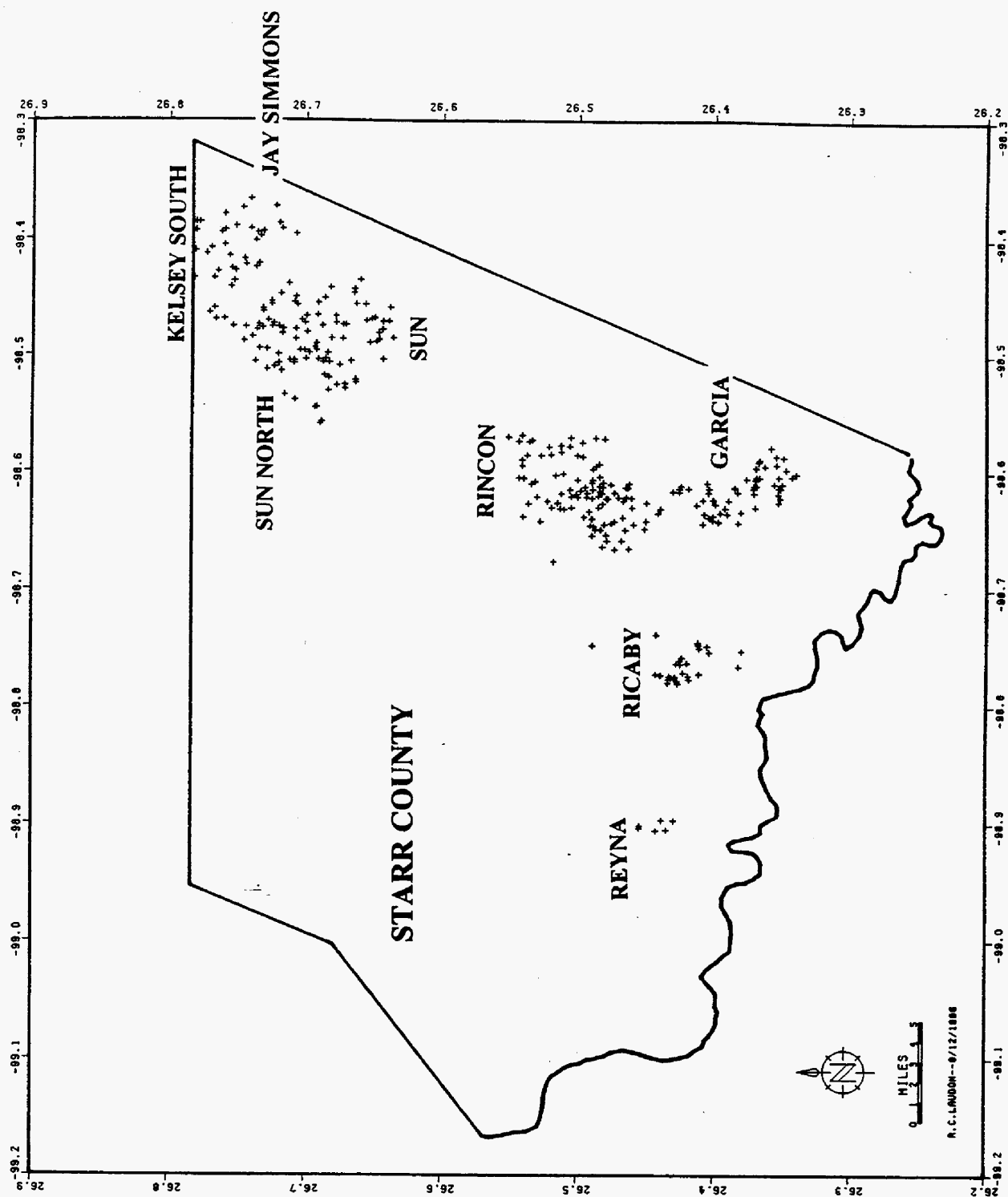


Figure 2.9: Map of Starr County showing abandoned well locations for fields included in this study. Data from Petroleum Information database.

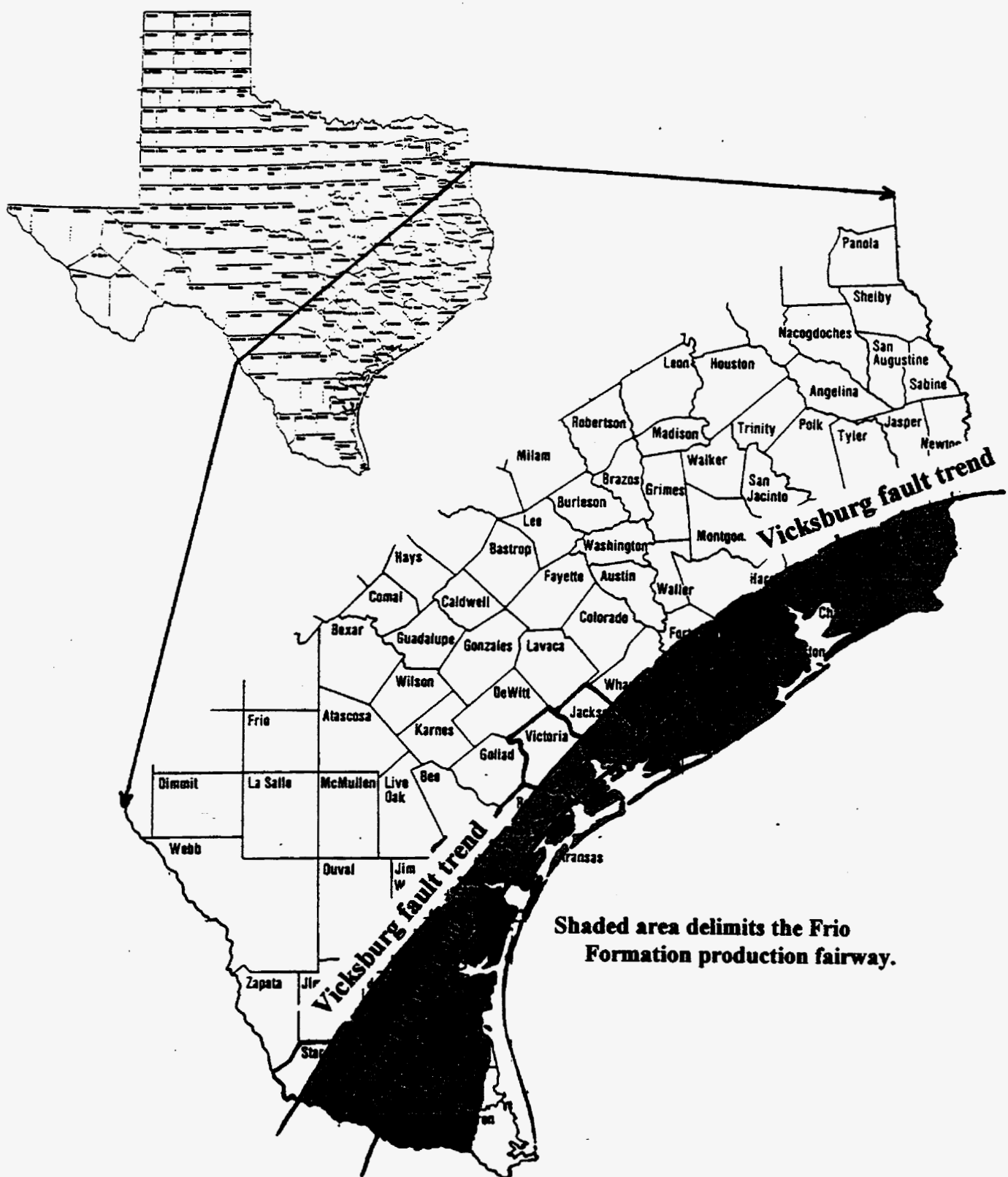


Figure 3.1: Map showing Texas Gulf Coast Frio Formation producing trend and Vicksburg and Frio fault trends.

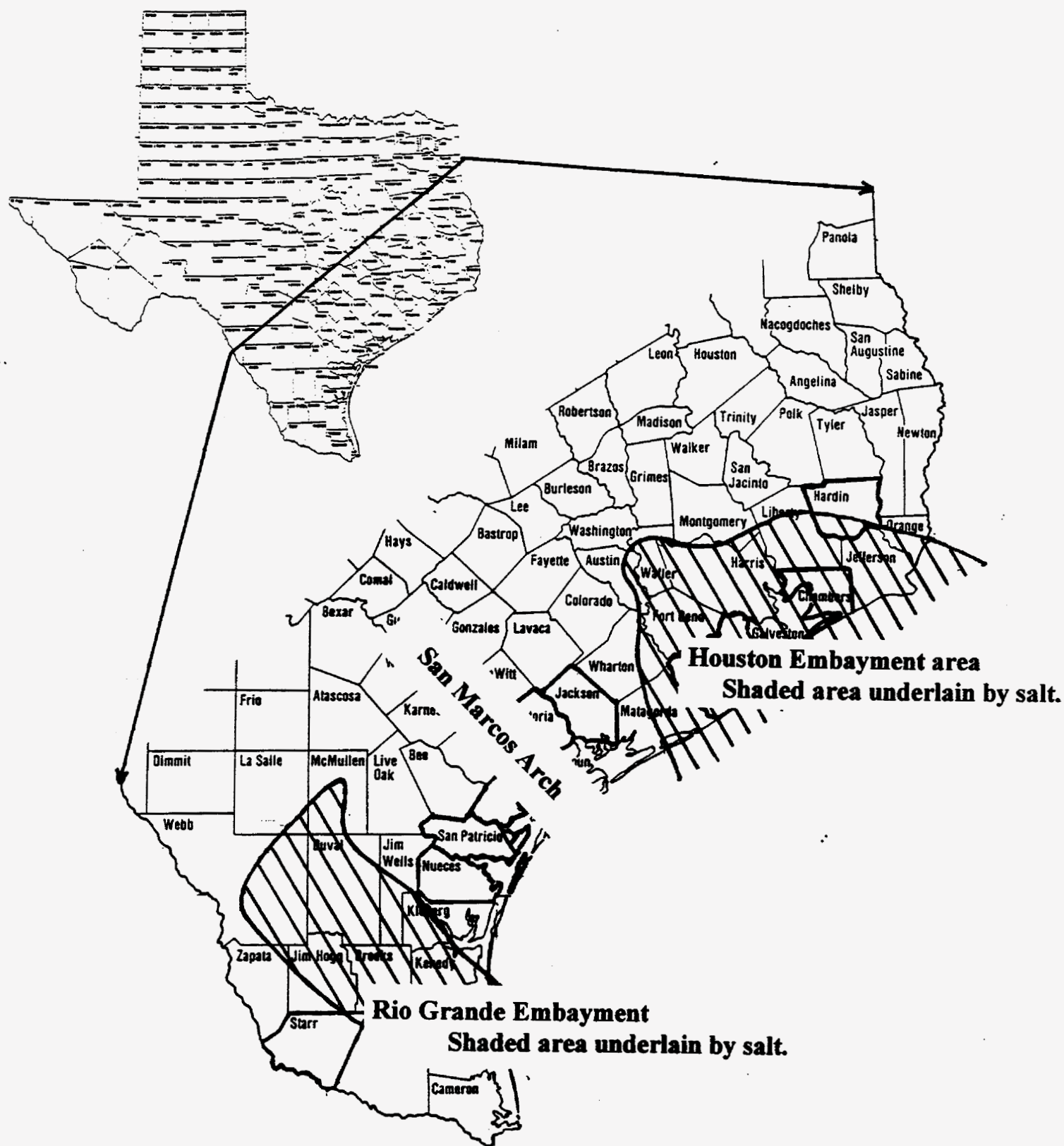


Figure 3.2: Map showing three major structural elements of the Texas Gulf Coast.

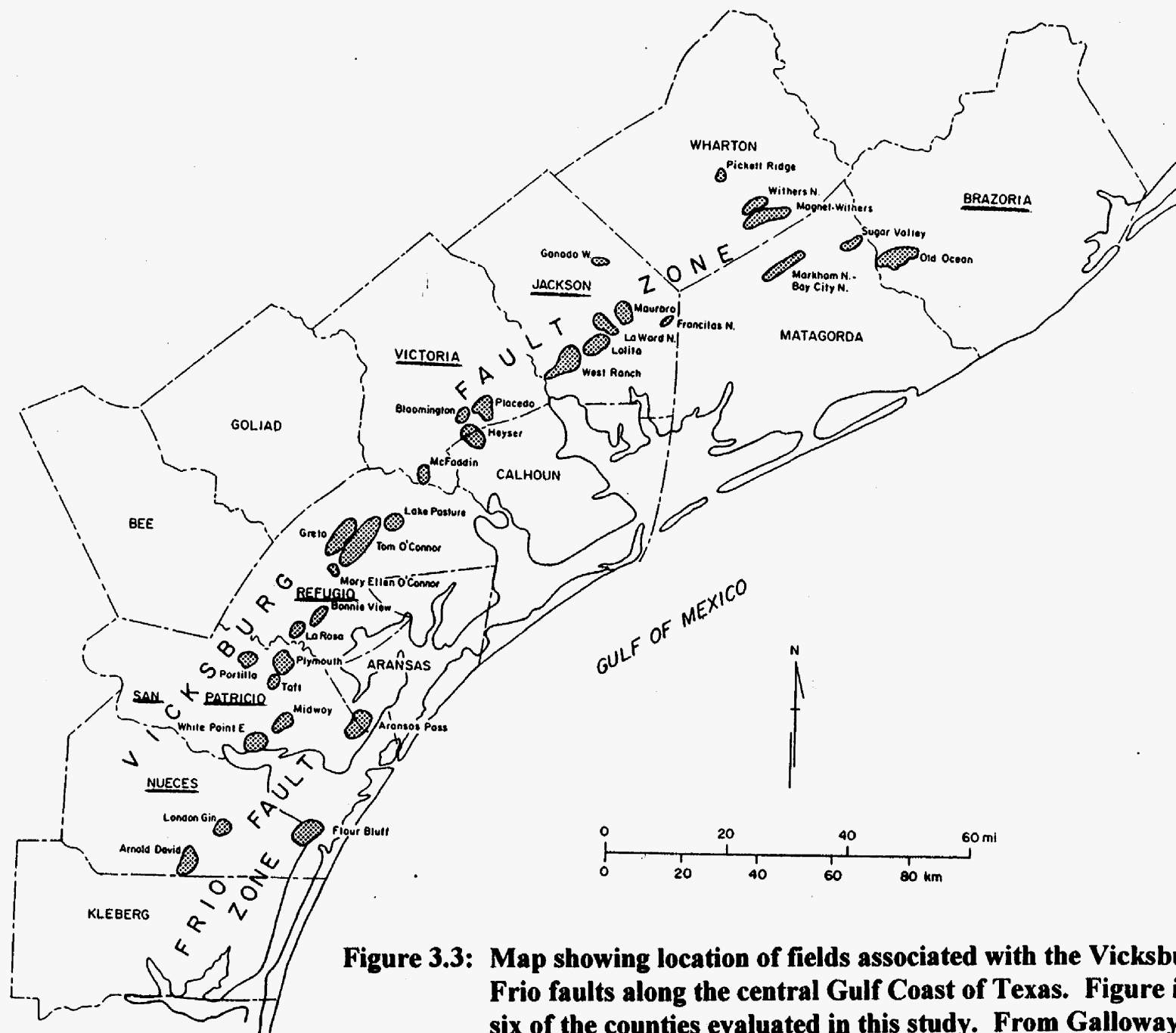


Figure 3.3: Map showing location of fields associated with the Vicksburg and Frio faults along the central Gulf Coast of Texas. Figure includes six of the counties evaluated in this study. From Galloway¹⁶.

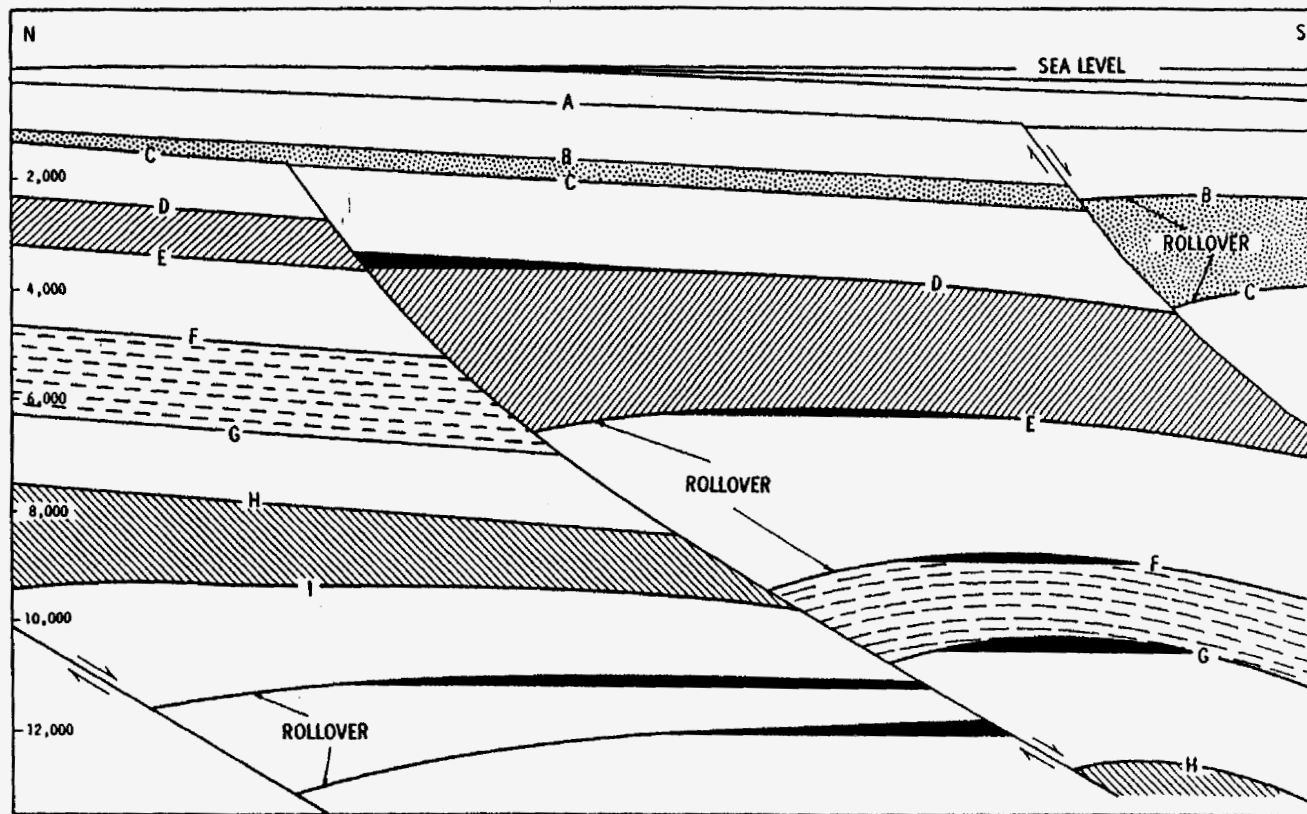


Figure 3.4: Schematic cross section through a typical Gulf Coast growth fault. Note the rollover anticline (reverse drag) and the increase in stratigraphic thickness on the downthrown side of the fault. From Landes¹⁵.

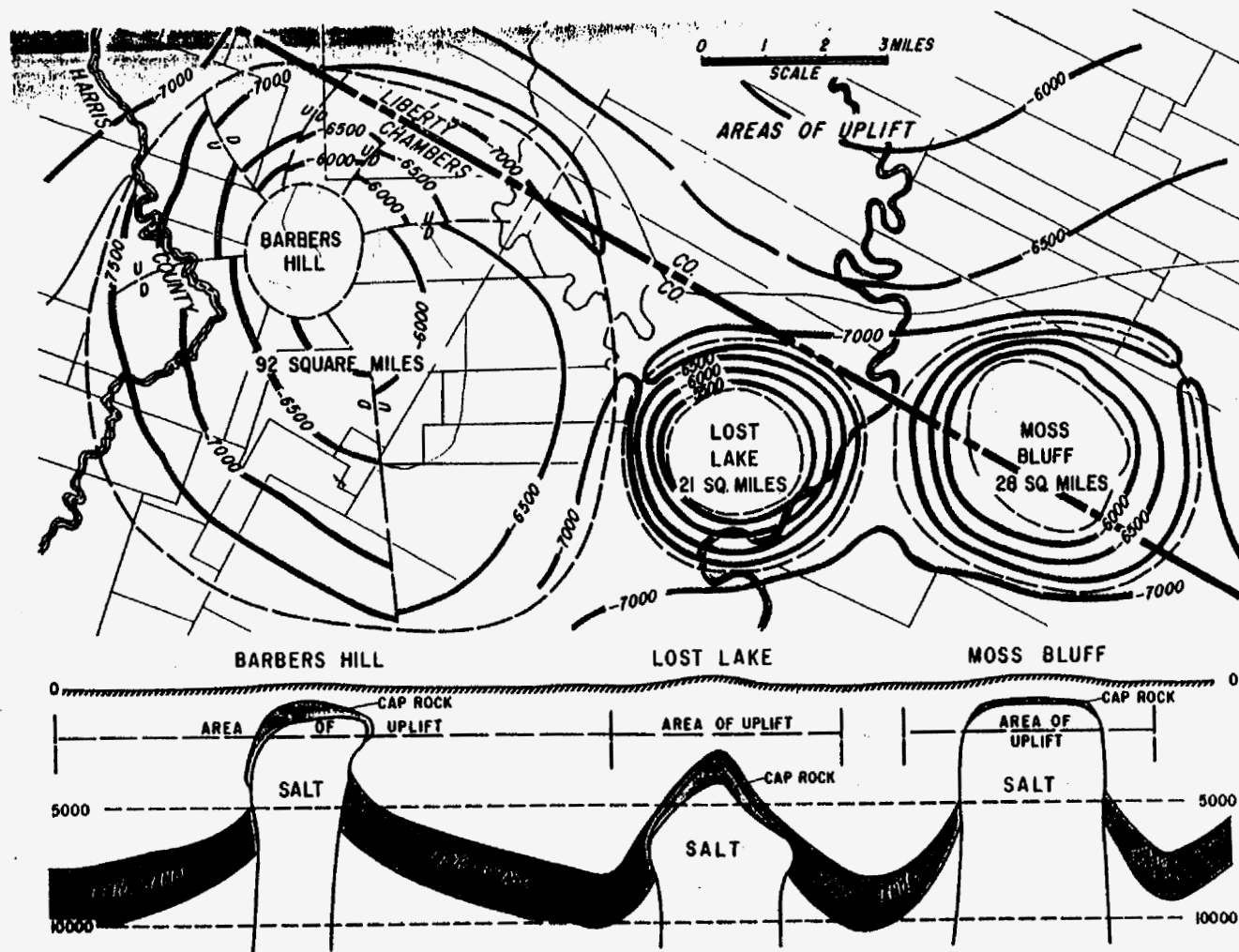


Figure 3.5: Structure contour map and cross section through Barbers Hill, Lost Lake and Moss Bluff salt domes, Chambers and Liberty Counties, Texas. From Halbouty¹⁴.

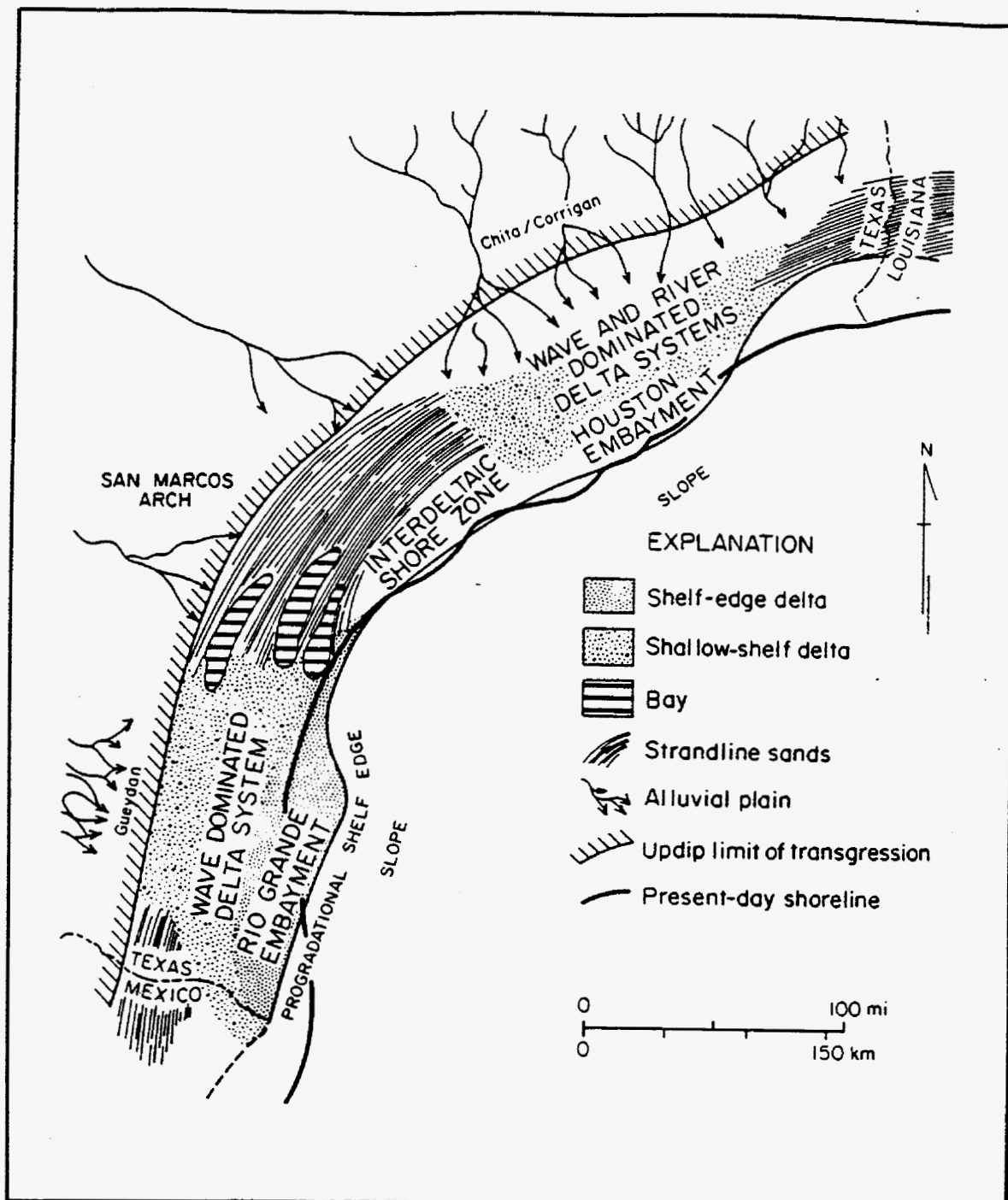


Figure 3.6: Paleogeography of the Oligocene Frio Formation showing fluvial and delta systems in the Houston and Rio Grande Embayments, and barrier island/strand plain systems along the San Marcos arch. From Galloway¹⁶.

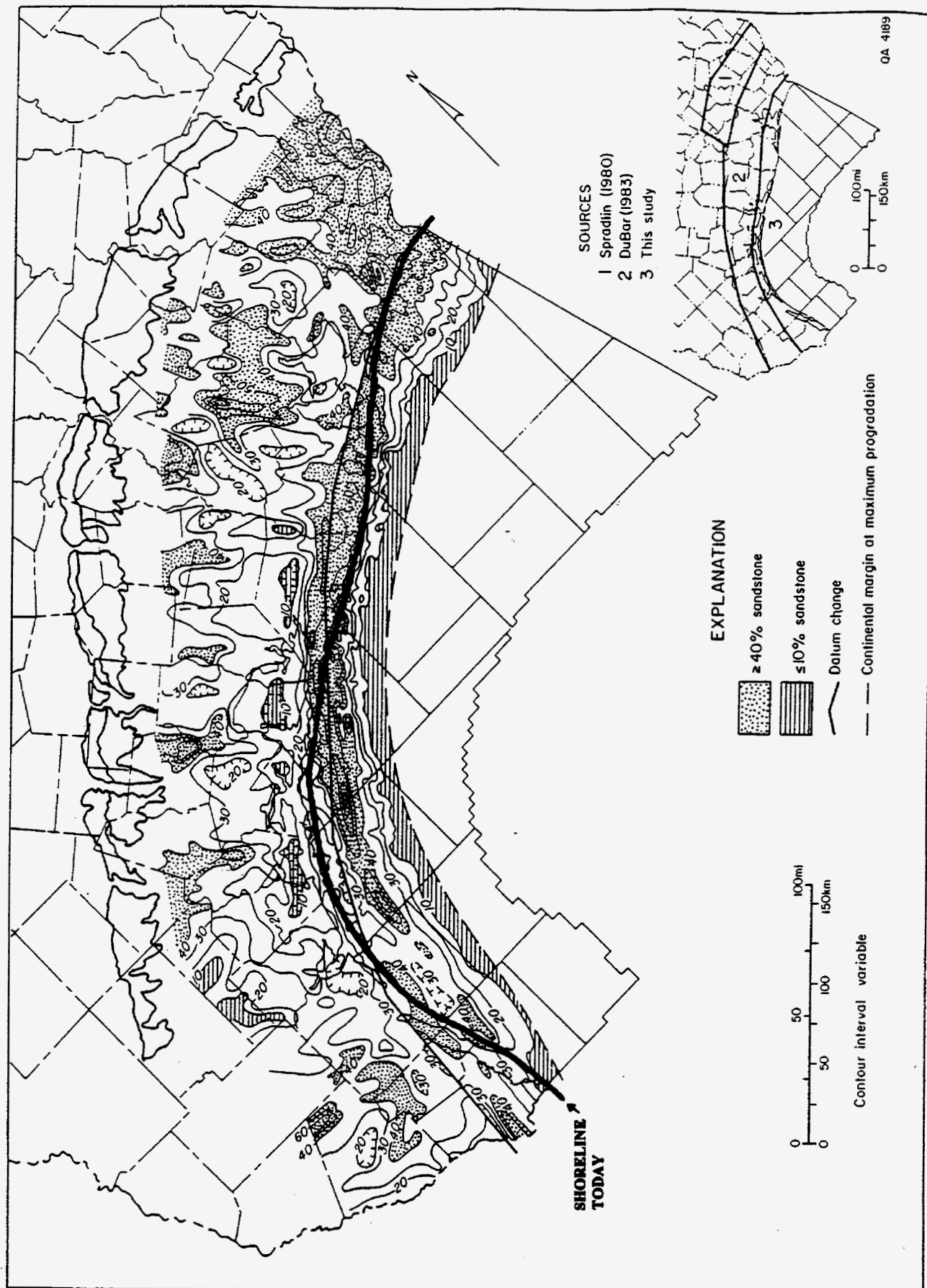


Figure 3.7: Percent-sandstone map of the Lagarto Formation of the Lower Miocene Fleming Group. Note that the maximum onshore sandstone percentage is approximately 70 percent with an average of approximately 30 percent. Figure Modified from Galloway²³.

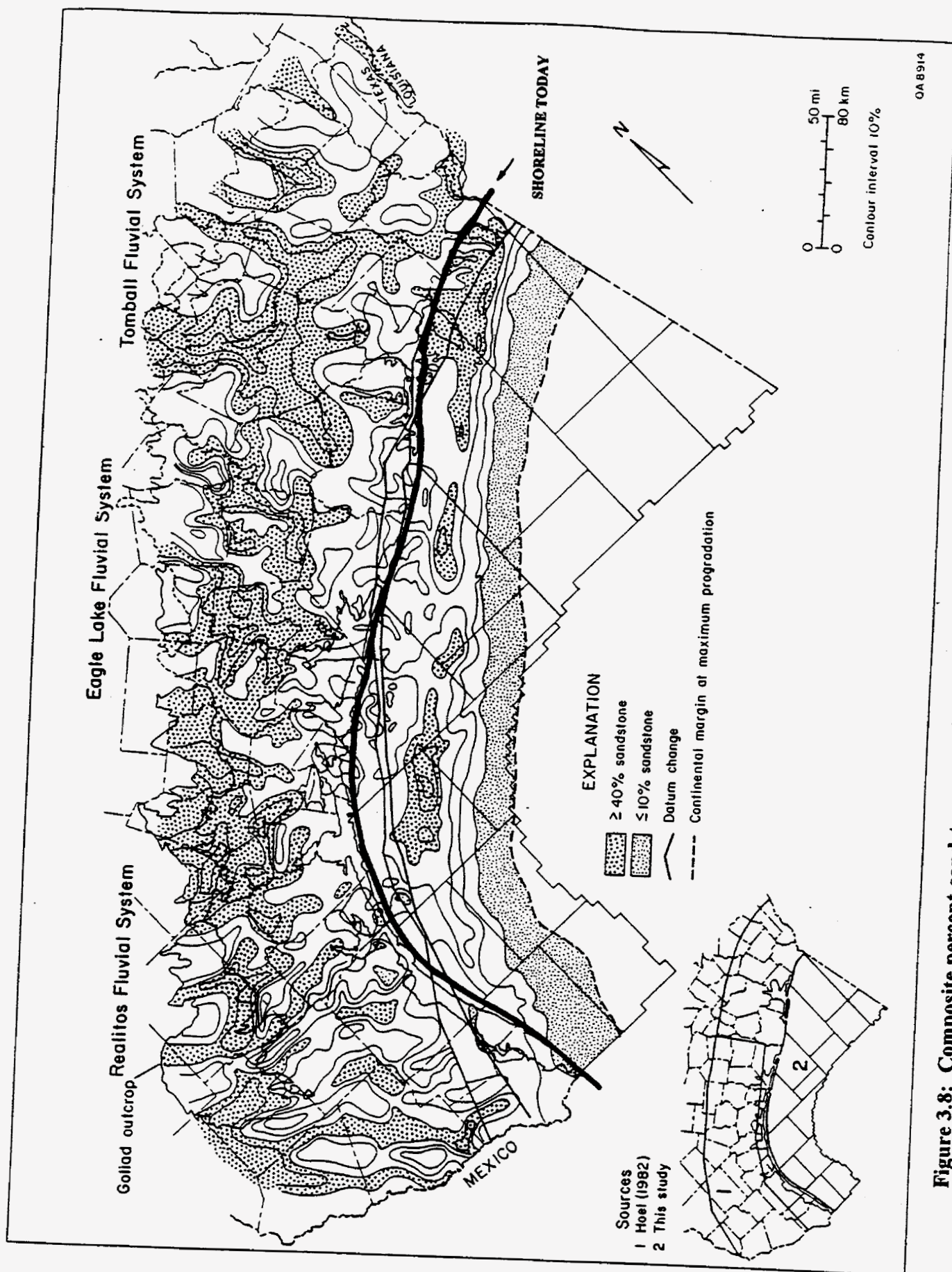


Figure 3.8: Composite percent-sandstone map of the middle-upper Miocene Goliad Formation. Note that the maximum onshore sandstone percentage is approximately 70 percent with an average of approximately 40 percent. Figure modified from Morton²⁴.

NORTHWEST

SOUTHEAST

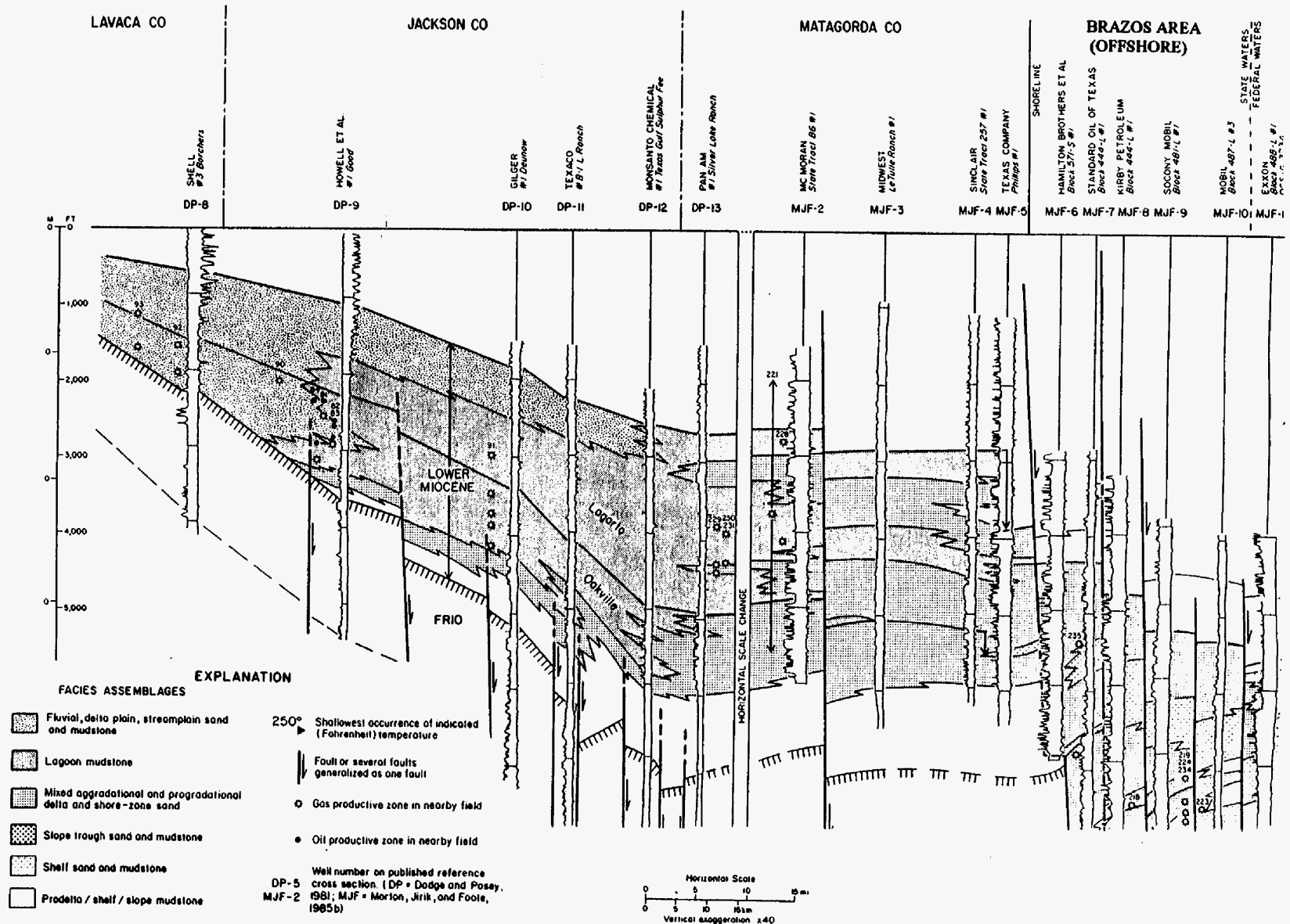


Figure 3.9: Northwest-southeast cross section through the central Gulf Coast (Jackson County of this report) showing facies assemblages for the Oakville and Lagarto Formations of the Lower Miocene Fleming Group. From northwest to southeast, note the complex interfingering of sandy fluvial facies with muddy lagoonal facies with sandy delta and shoreface facies. Also note the salinity transition on the SP-Resistivity logs on the two northwesterly logs. Figure modified from Galloway²³.

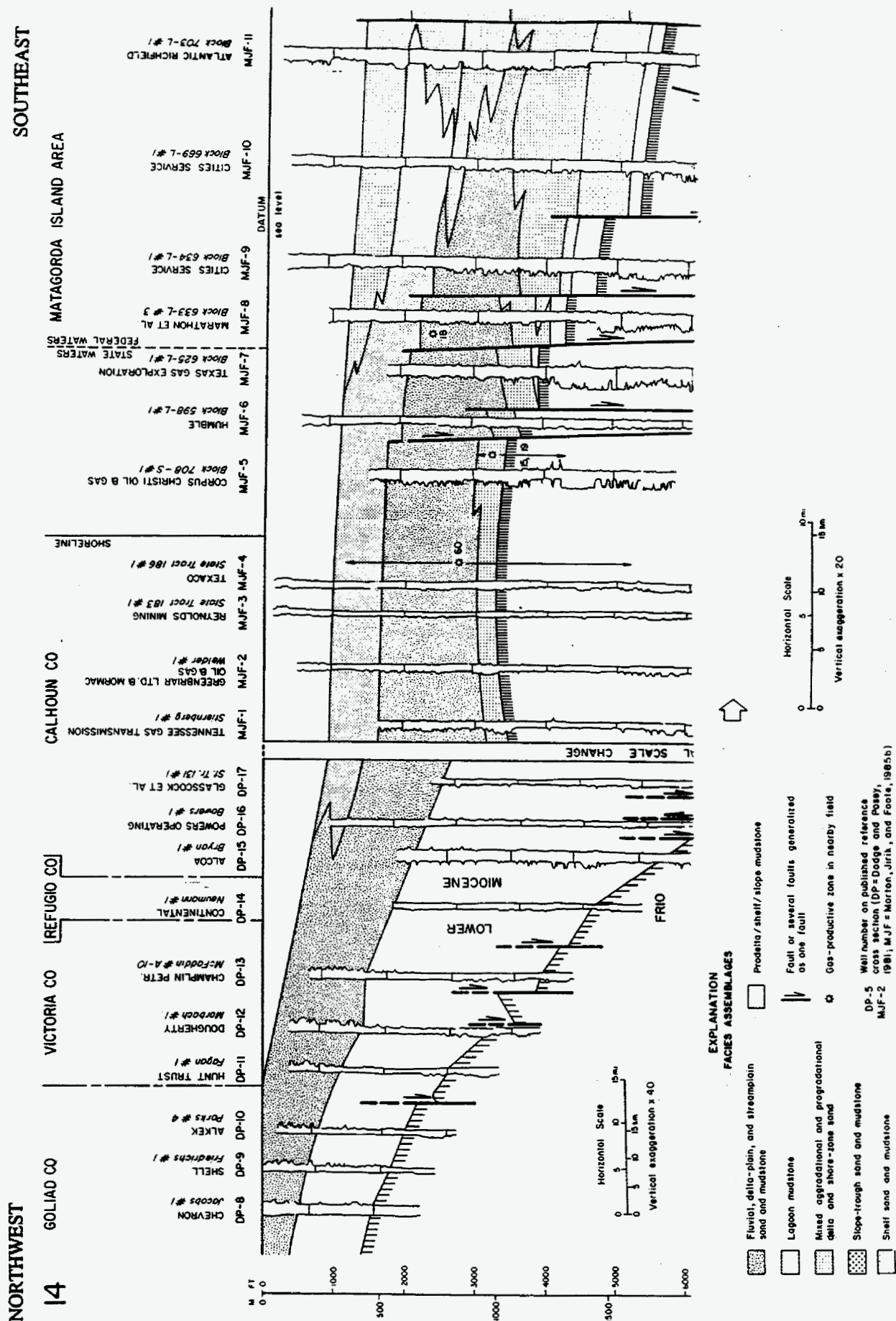


Figure 3.10: Northwest-southeast cross section through the central Gulf Coast (Victoria and Refugio Counties of this report) showing facies assemblages for the Upper Miocene Goliad Formation. Note the downdip pinchout of sandy fluvial facies into muddy lagoonal and offshore facies. Figure modified from Morton²⁴.

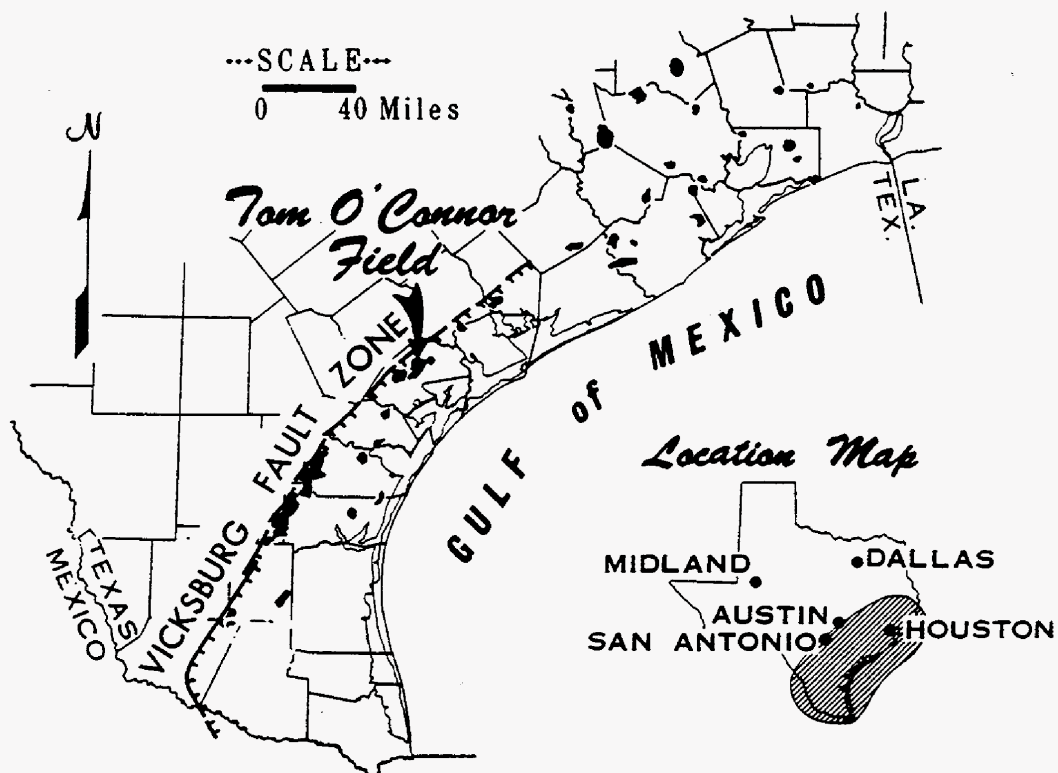


Figure 3.11: Location of the Tom O'Connor field and other fields along the Vicksburg fault. From Mills¹⁹.

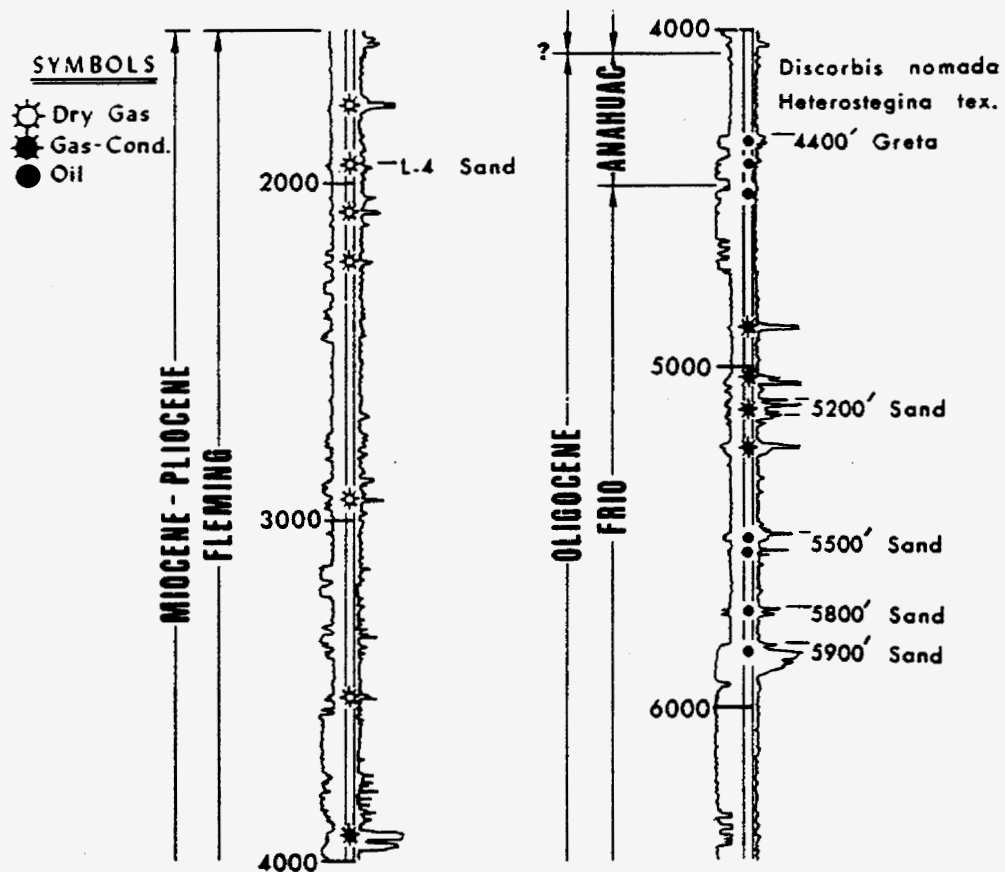


Figure 3.12: Type log for the Tom O'Connor field showing multiple Frio, Anahuac and Fleming production horizons. From Mills¹⁹.

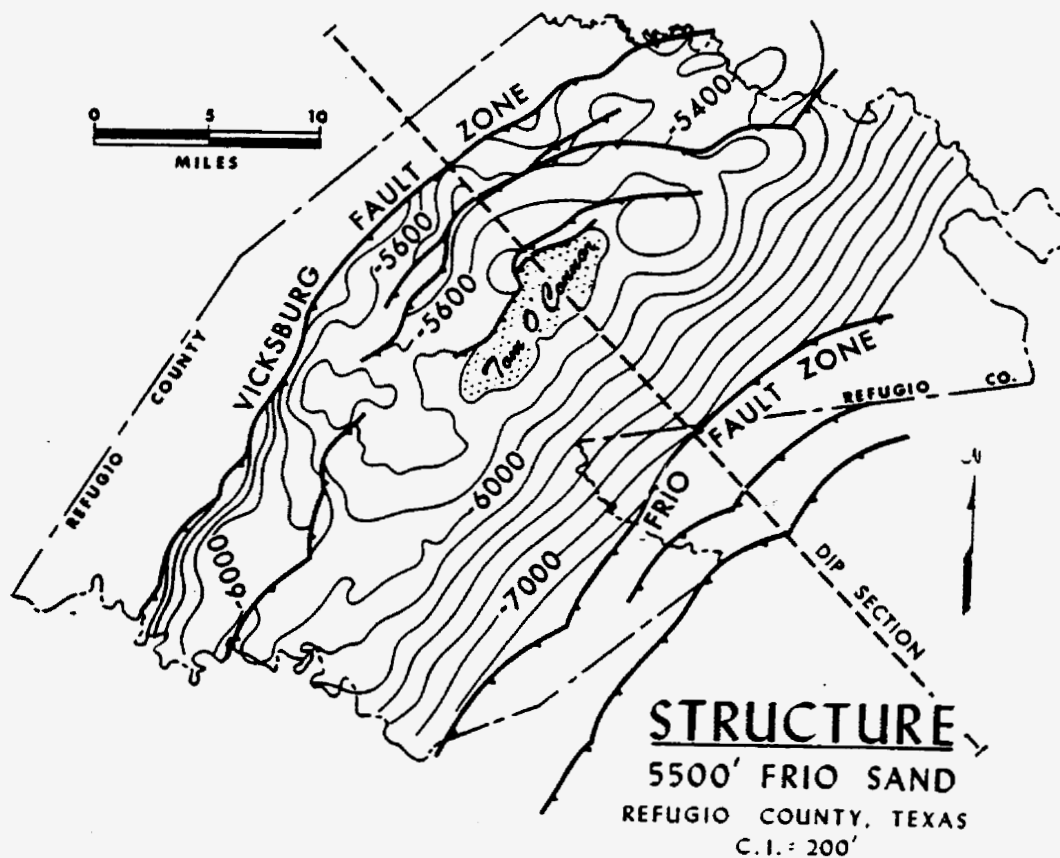


Figure 3.13: Structure contour map on the top of the 5500' Frio Sand of the Tom O'Connor field showing rollover anticline location relative to faults. From Mills¹⁹.

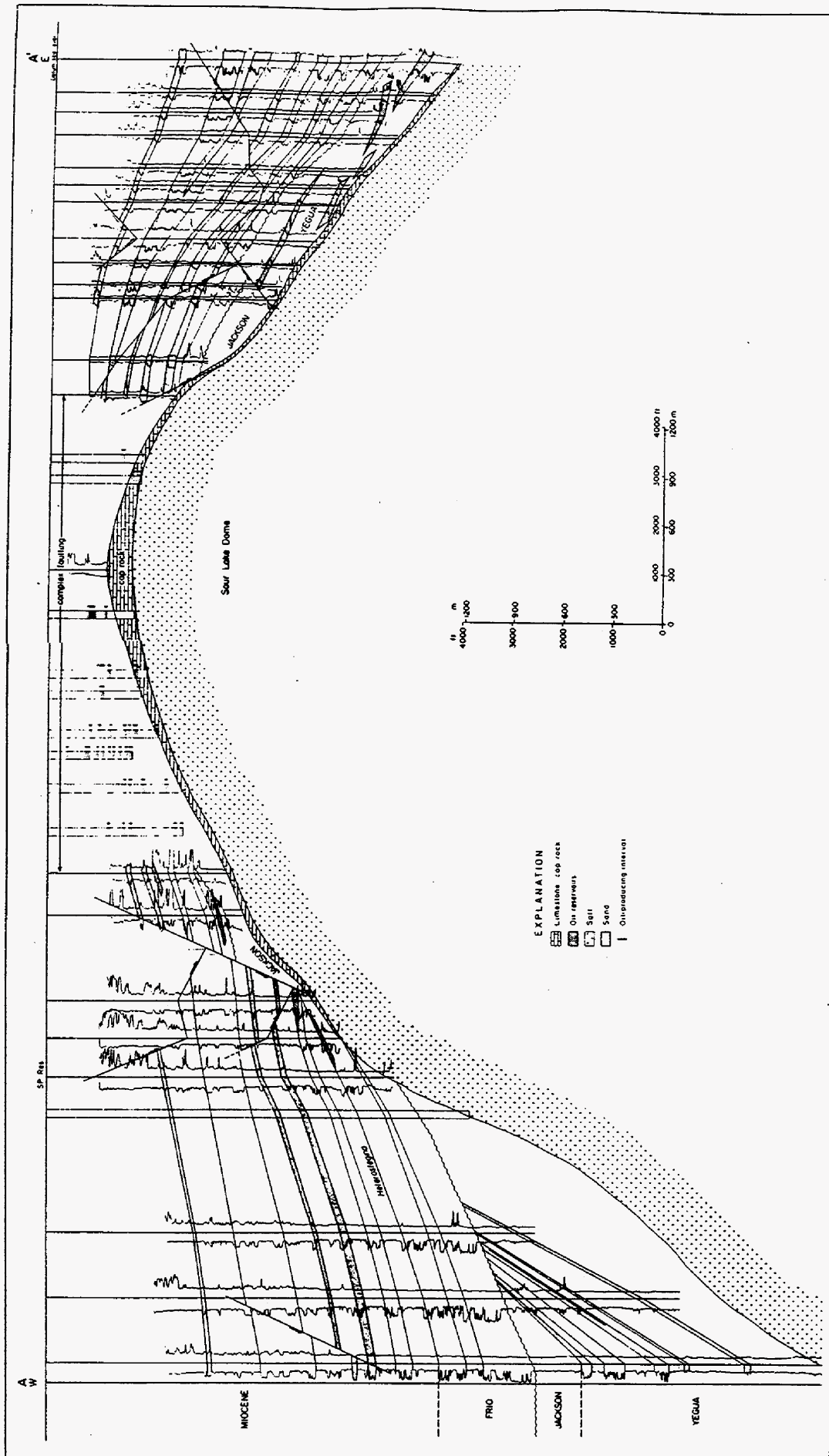


Figure 3.14: East-west cross section through the Sour Lake field, a shallow piercement dome, in Hardin County, Texas. Note complex faulting in the supra dome area, minor production from the cap rock, and complexities of major reservoirs on the flanks. From Galloway¹⁶.

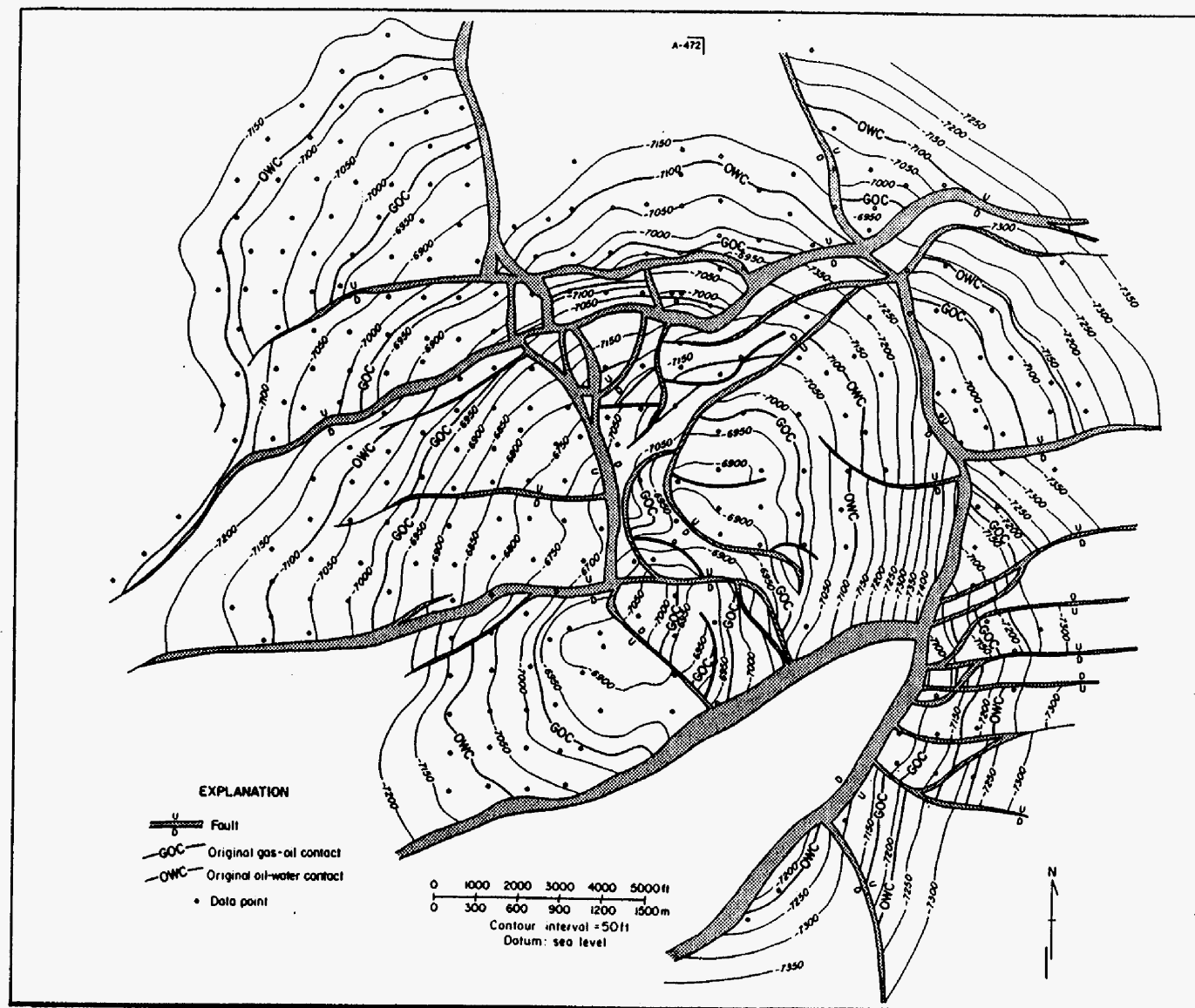


Figure 3.15: Structure contour map on the top of the Frio 4 sand, Anahuac field, Chambers County, Texas showing complex faulting typical of supra domal areas on a deep seated salt dome. From Galloway¹⁶.

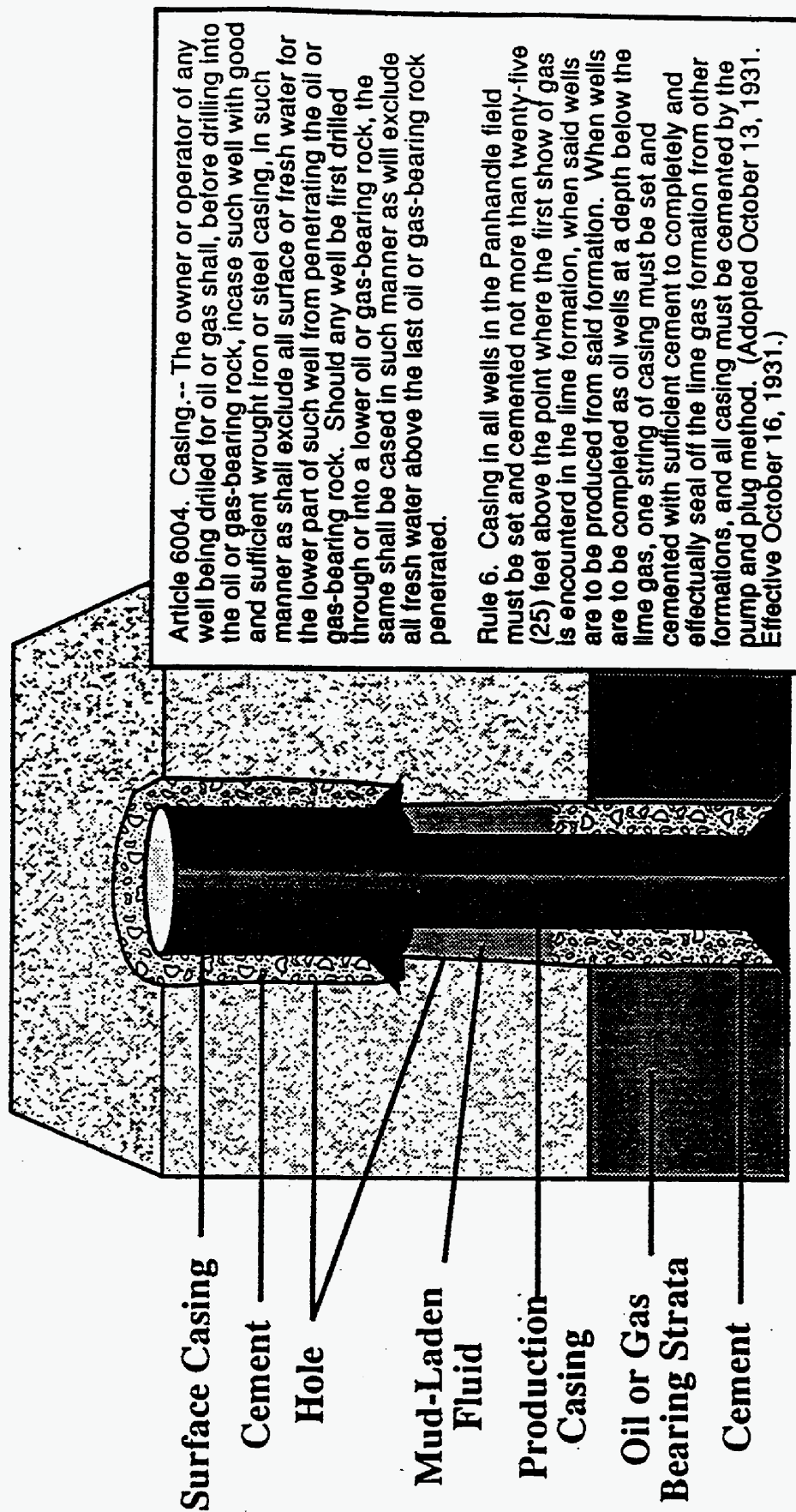
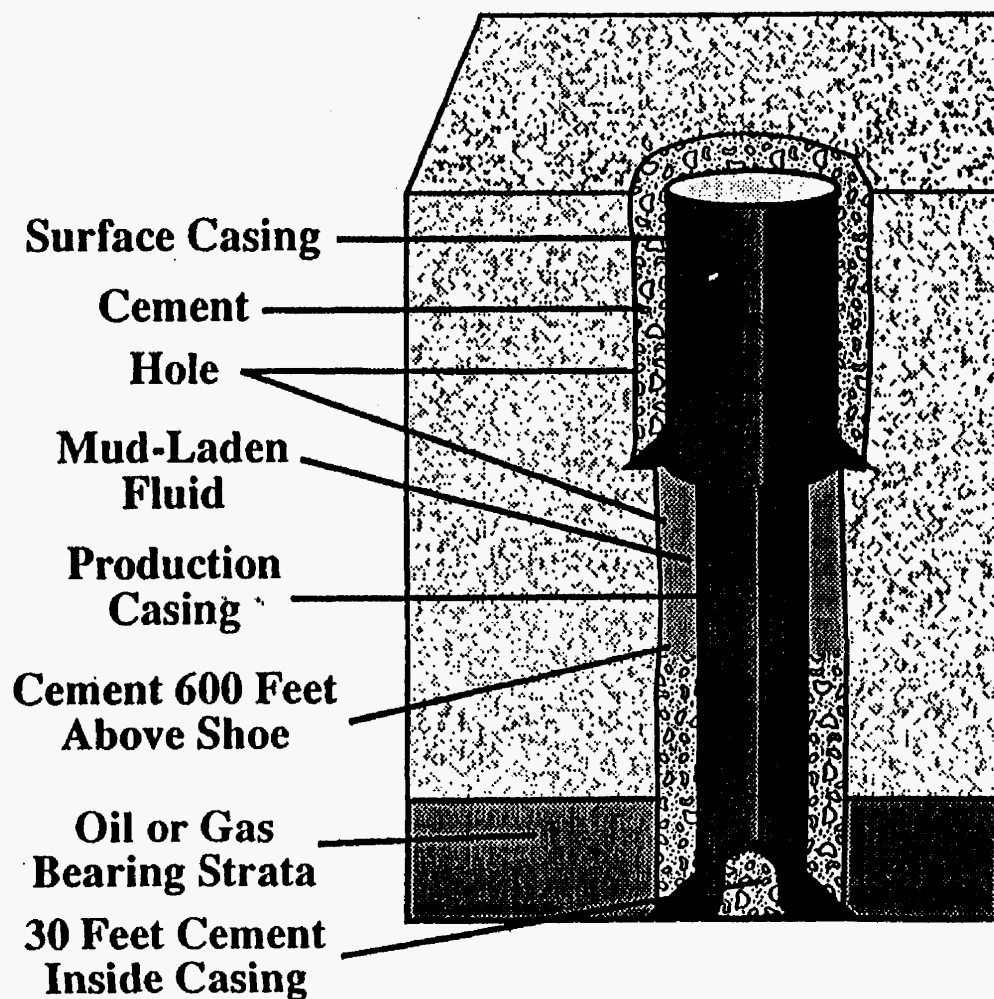


Figure 3.16: 1932 Casing and Cementing Rules and Regulations²²



Rule 12 Order No. 20-5513, Effective October 20, 1943.--In any well drilled in any field or area the production string of casing shall be cemented by the pump and plug method, or another method approved by the Commission, with sufficient cement to fill the calculated annular space back of the casing to a point at least six hundred (600) feet above the shoe. Where three thousand (3000) feet or more of pipe is set for the producing or protecting string, a minimum of thirty (30) feet of cement shall be left inside the pipe. Before drilling the cement plug in the producing string of casing of any well, the casing shall be tested at a pressure in pounds per square inch calculated by multiplying the length of the producing string by two-tenths (.2) with the maximum test pressure required, unless otherwise ordered by the Commission, not to exceed fifteen hundred (1500) pounds per square inch. If at the end of thirty (30) minutes pressure shows a drop of ten (10%) percent, or more, of the above required test pressure, the casing shall be condemned. After corrective operation the casing shall again be tested in the same manner. Bailing test may be used by reducing the fluid level in the hole to a point at least midway between the calculated top and bottom of the cement columns on the outside of the string being tested.

Figure 3.17: 1934 & 1943 Casing and Cementing Rules and Regulations²²

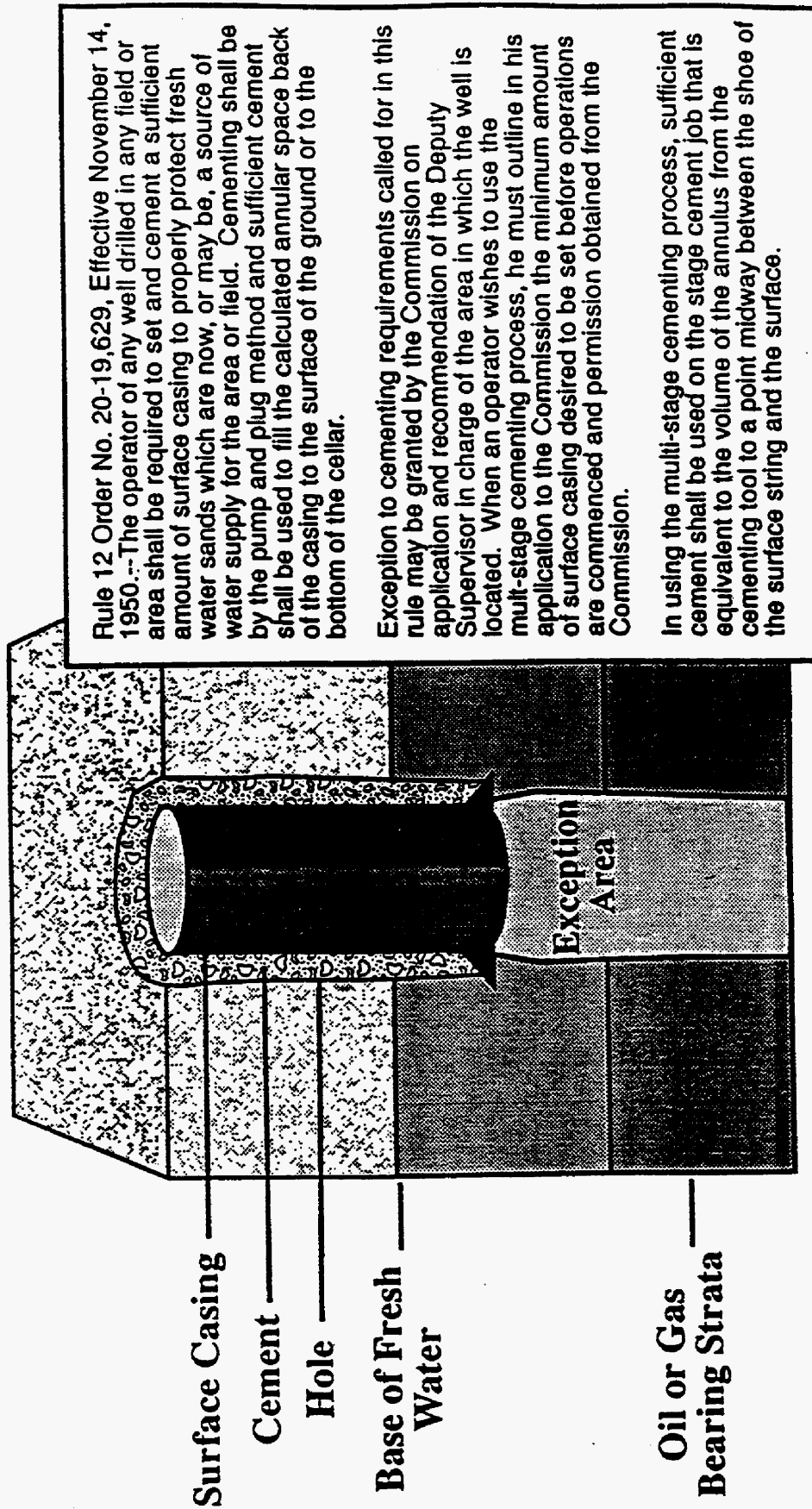
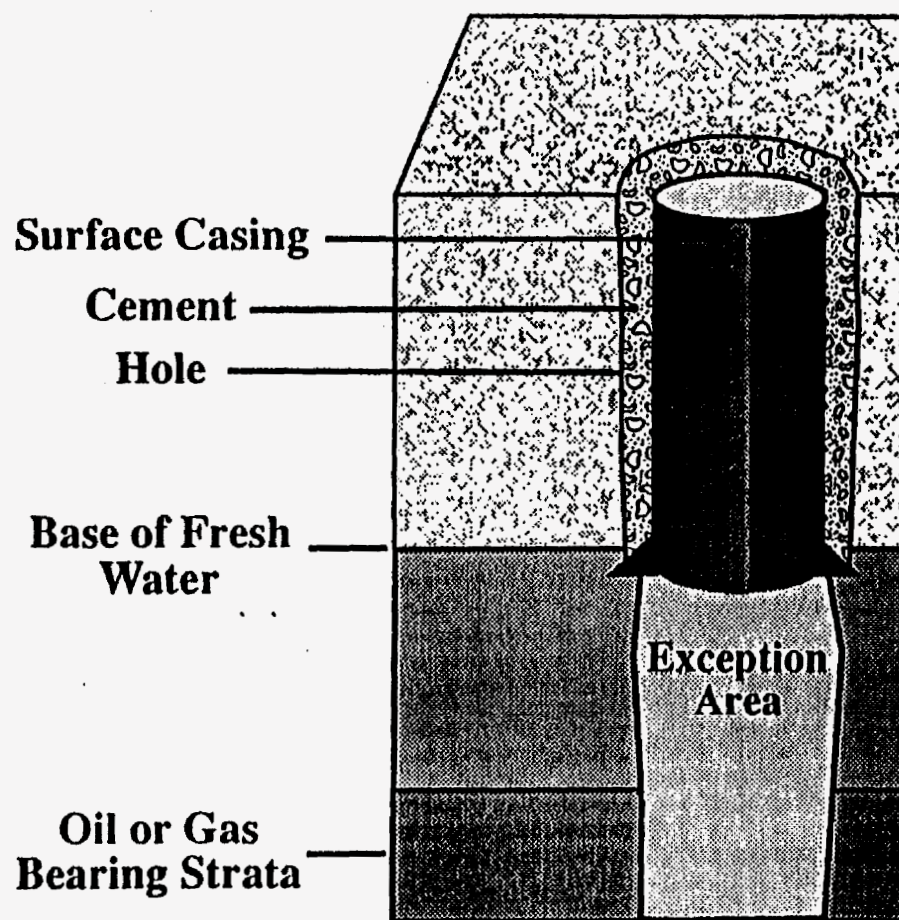


Figure 3.18: 1950 Casing and Cementing Rules and Regulations²²



Rule 13. The operator of any well drilled in any field or area shall be required to set and cement a sufficient amount of surface casing to properly protect fresh water sands which are now, or may be, a source of water supply for the area or field. Cementing shall be by the pump and plug method and sufficient cement shall be used to fill the calculated annular space back of the casing to the surface of the ground or to the bottom of the cellar.

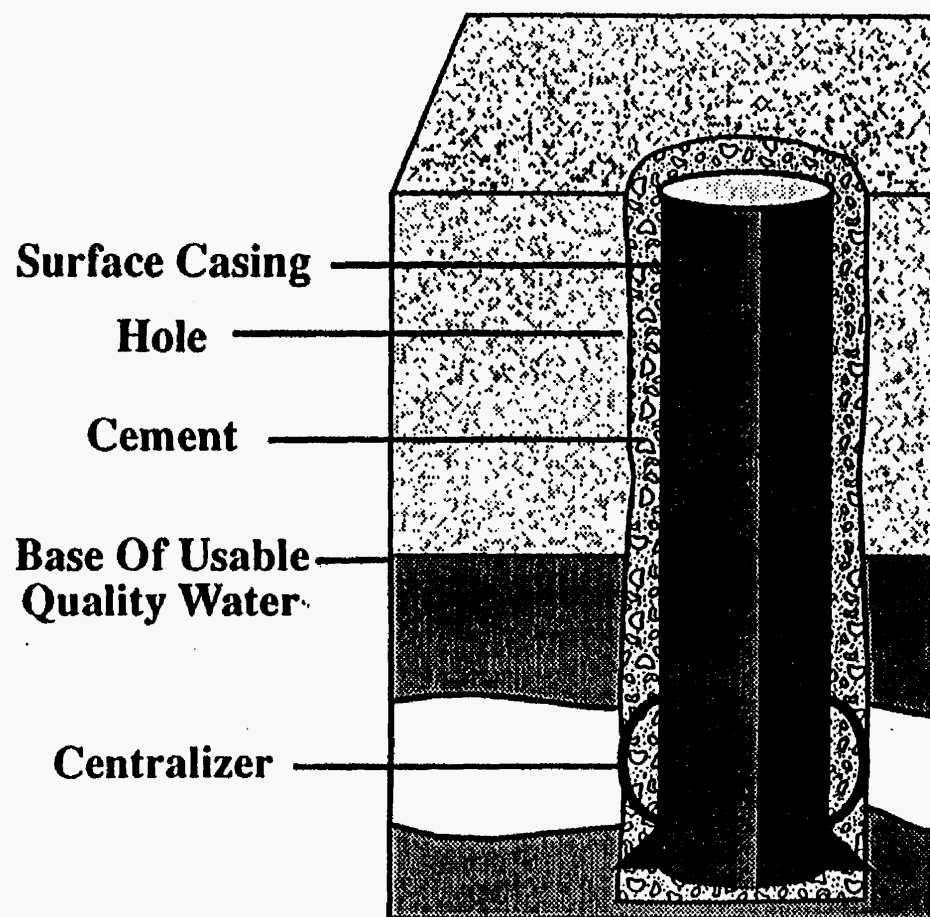
A. Exception to cementing requirements called for in this rule may be granted by the Commission on application. An operator shall, before drilling and setting casing in his first well in a field or area, obtain from the Texas Water Development Board a letter stating where the fresh water sands are found in the area or field in question. Such operator must set the surface casing to the depth recommended by the Texas Water Development Board to protect all fresh water sands.

B. When an operator wishes to use the multistage process, he must outline in his application to the Commission the minimum amount of surface casing desired to be set before operations are commenced, and permission must be obtained from the Commission. After the operation is completed, he must then file with the Commission an affidavit (Form X-105) made by the cementing company's representative showing where the stage cement tool was set and the number of sacks of cement used in the operation.

C. In using the multi-stage cementing process, sufficient cement shall be used on the stage cement job that is equivalent to the volume of the annulus from the cementing tool to a point midway between the shoe of the surface string and the surface.

This authority will not be granted in fields where the special rules require the setting of a specific amount of casing for reasons other than the protection of fresh water sands; an exception to this provision may be granted after due notice and hearing, wherein the multistage process is shown to be feasible.

Figure 3.19: 1963 Casing and Cementing Rules and Regulations²²



Rule 13. Surface Casing.--Set and cement sufficient surface casing to protect all usable-quality water strata, as defined by the Texas Department of Water Resources. Where no field rules are in effect, an operator shall obtain a letter from the Texas Department of Water Resources stating the protection depth. Surface casing shall not be set deeper than 200 feet below the specified depth without prior approval from the Commission.

Any well drilled to at total depth of 1000 feet or less below the ground surface may be drilled without setting surface casing provided no shallow gas sands or abnormally high pressures exist, and provided that production casing is cemented from the shoe to the ground surface by the pump and plug method.

Cementing shall be by the pump and plug method, sufficient cement shall be used to fill the annular space outside the casing from the shoe to the ground surface or to the bottom of the cellar. If cement does not circulate to ground surface the operator shall obtain the approval of the district director for the procedures to be used.

Cement Quality.--Surface casing must be allowed to stand under pressure until the cement has reached a compressive strength of at least 500 psi in the zone of critical cement before drilling plug or initiating a test. The cement mixture in the zone of critical cement shall have a 72 hour compressive strength of at least 1200 psi.

If volume extenders are used above the critical cement to cement the casing, the cement must have a compressive strength of no less than 100 psi at the time of drill out nor less than 250 psi 24 hours after being placed.

API free water separation shall average no more than six milliliters per 250 milliliters of cement tested in accordance with the current API RP 10B.

Surface casing shall be centralized at the shoe, above and below a stage collar or diverting tool, if run, and through usable-quality water zones. A centralizer shall be placed every fourth joint from the cement shoe to the ground surface or to the bottom of the cellar.

Figure 3.20: 1983 Casing and Cementing Rules and Regulations²²

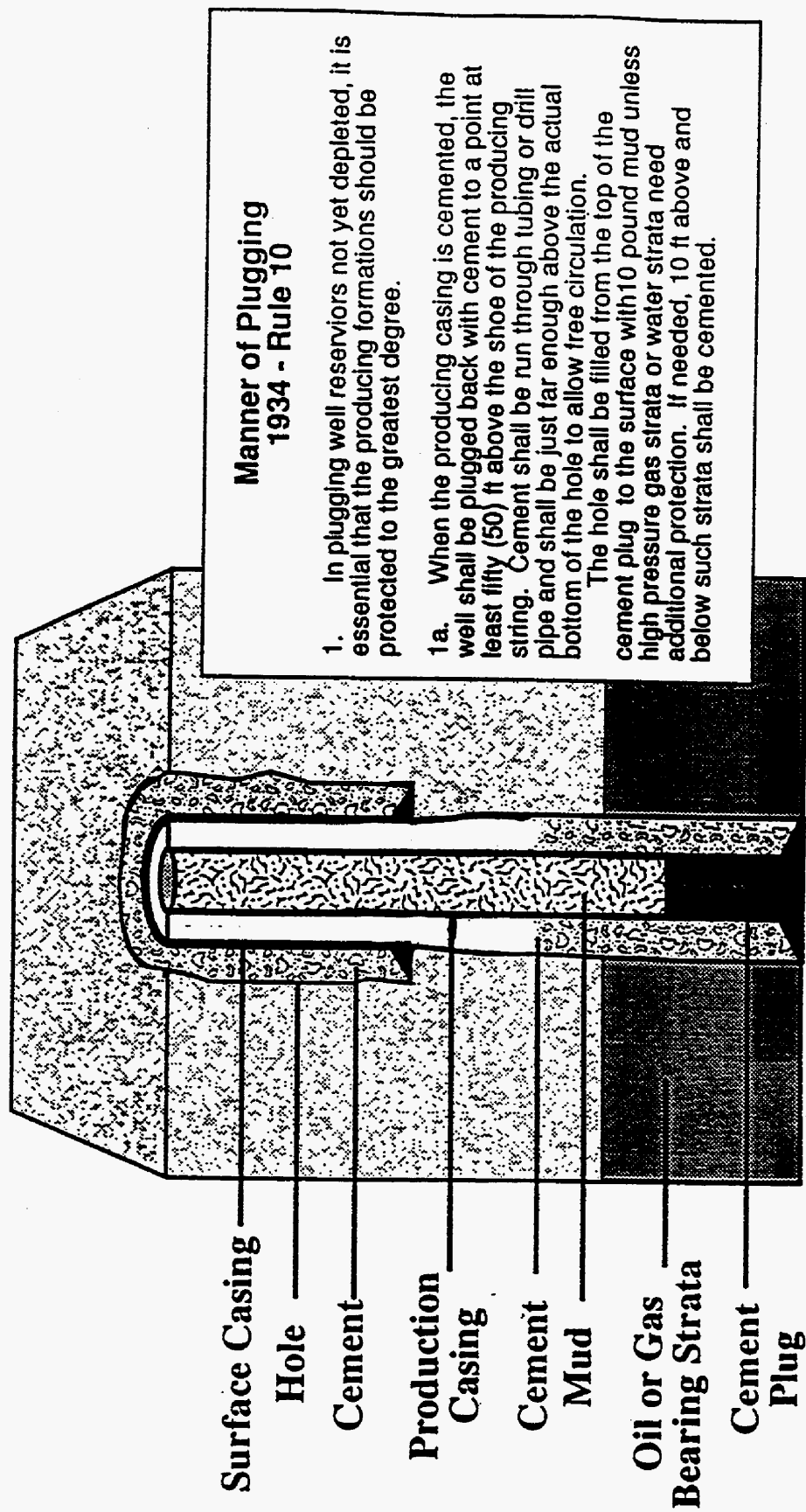
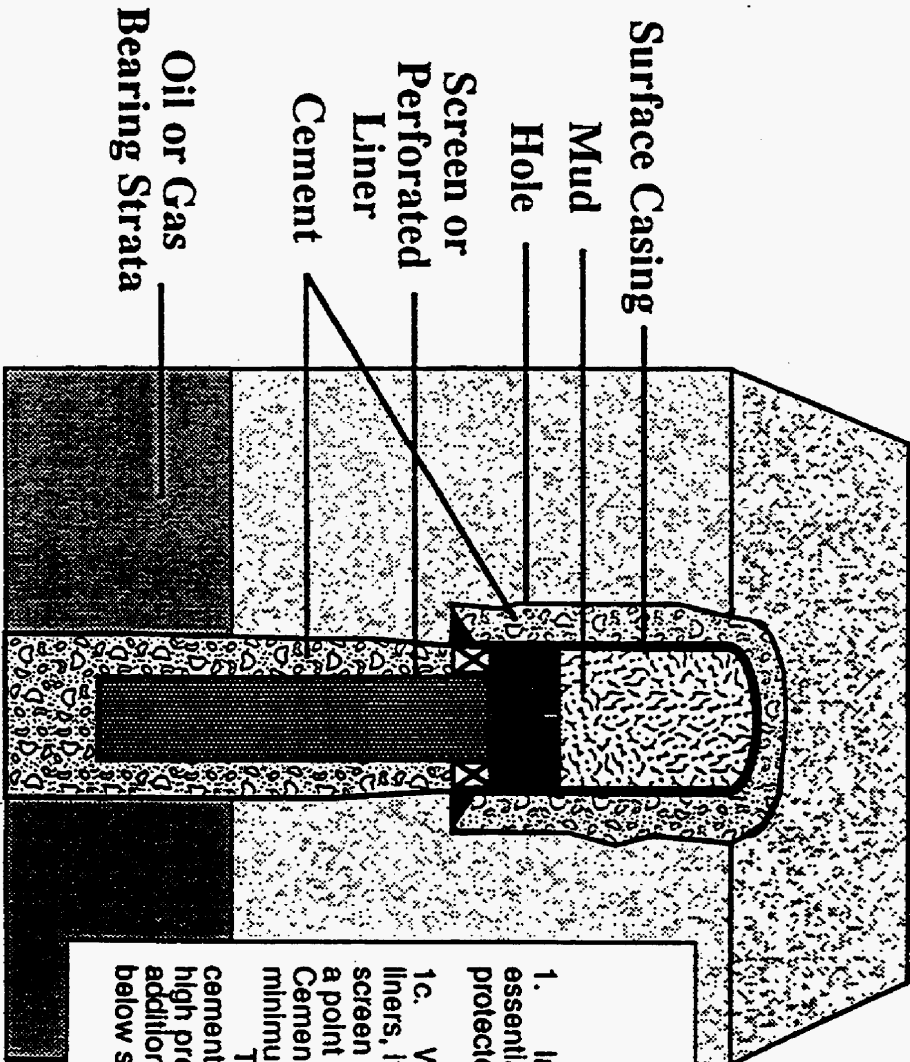


Figure 3.21: 1934 Well Abandonment Regulations - Well Plugging Rule 10²²



Manner of Plugging 1934 - Rule 10

1. In plugging well reservoirs not yet depleted, it is essential that the producing formations should be protected to the greatest degree.

1c. Wells completed with screen or perforated liners, if impractical for the operator to remove the screen or perforated liner, shall be cemented back to a point at least ten (10) ft above the top of the liner. Cement shall be allowed to stand under pressure a minimum of sixteen (16) hours.

The hole shall be filled from the top of the cement plug to the surface with 10 pound mud unless high pressure gas strata or water strata need additional protection. If needed, 10 ft above and below such strata shall be cemented.

Figure 3.22: 1934 Well Abandonment Regulations - Well Plugging Rule 10²²

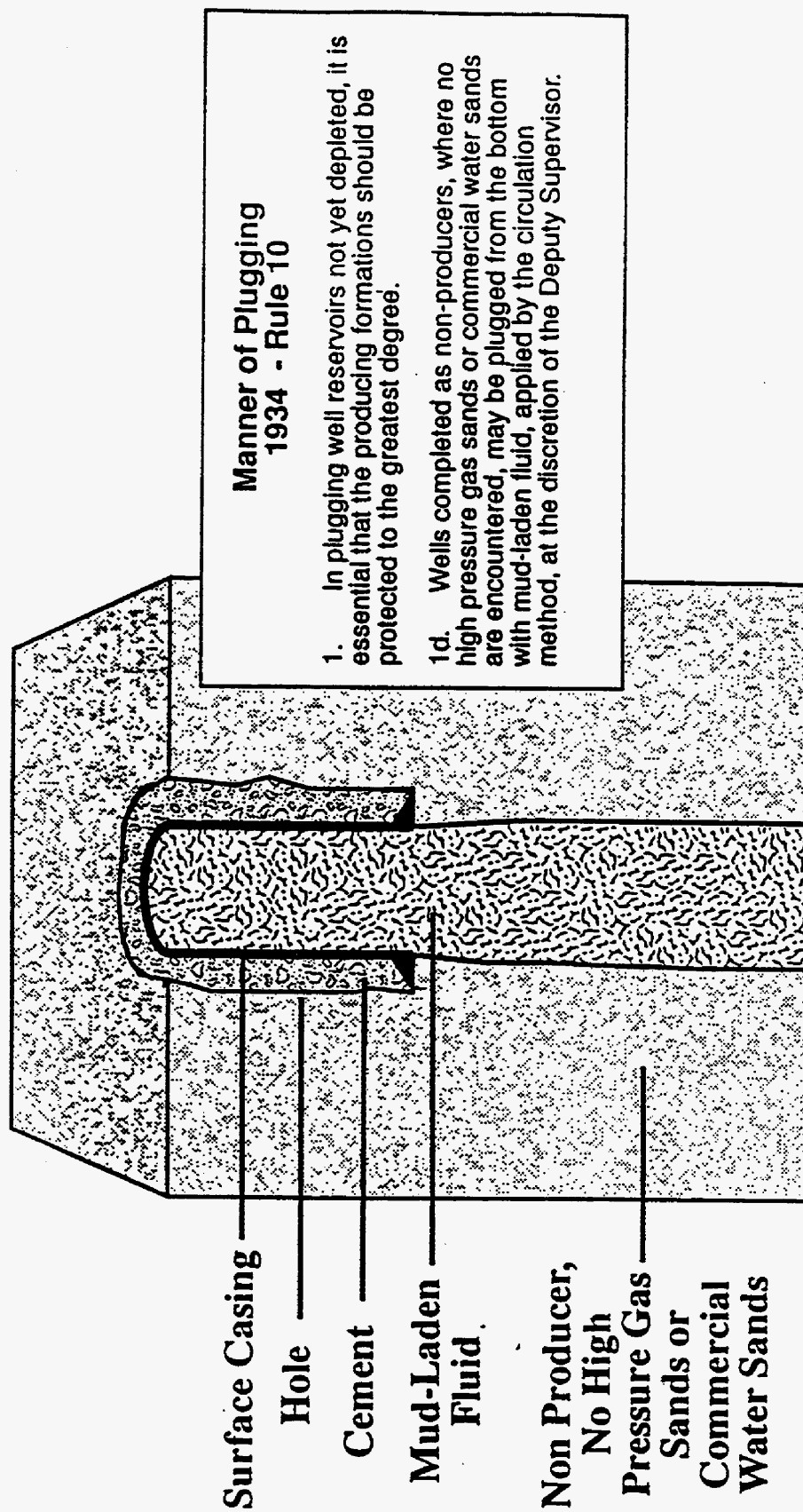


Figure 3.23: 1934 Well Abandonment Regulations - Well Plugging Rule 10²²

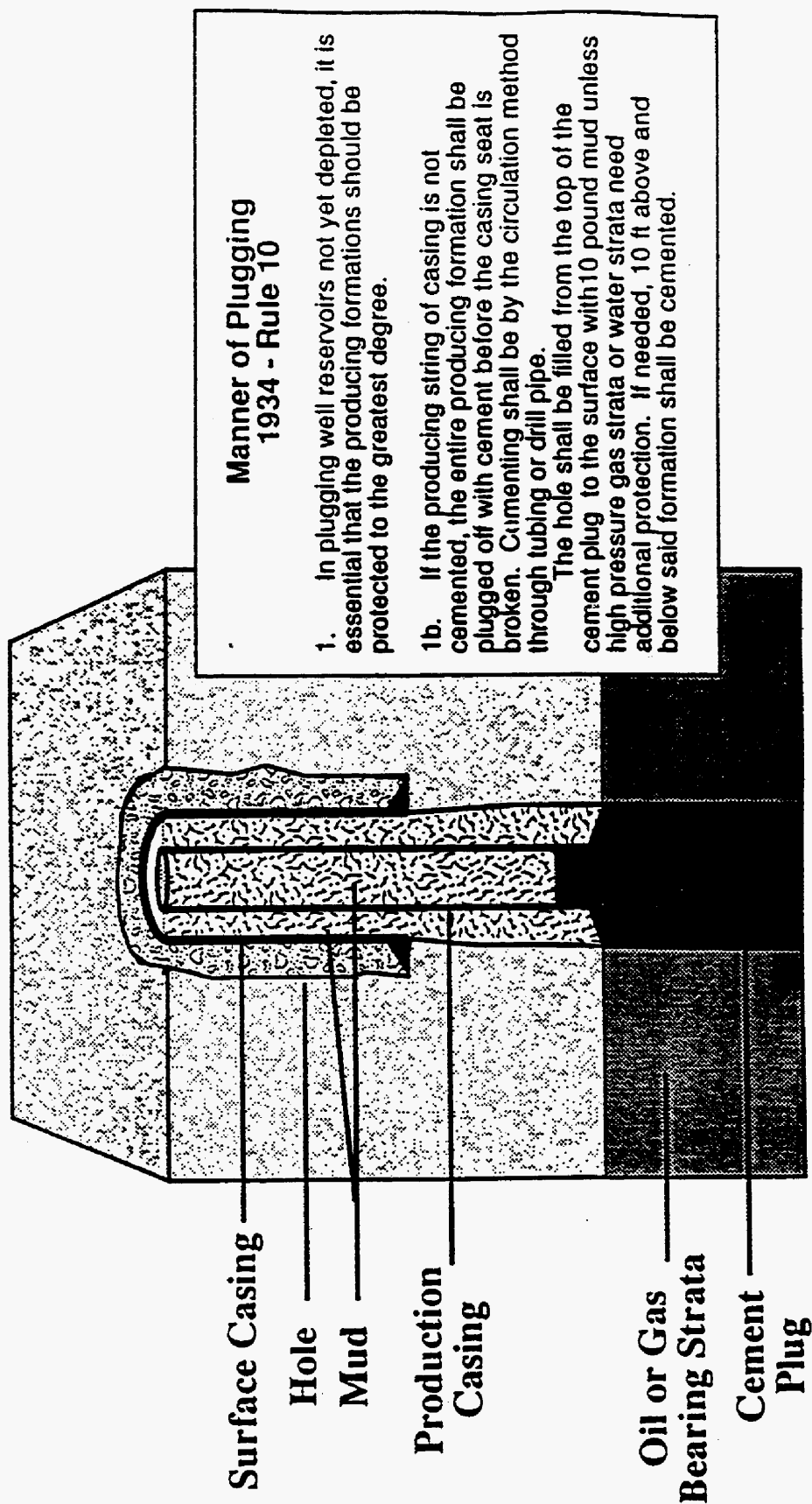


Figure 3.24: 1934 Well Abandonment Regulations - Well Plugging Rule 10²²

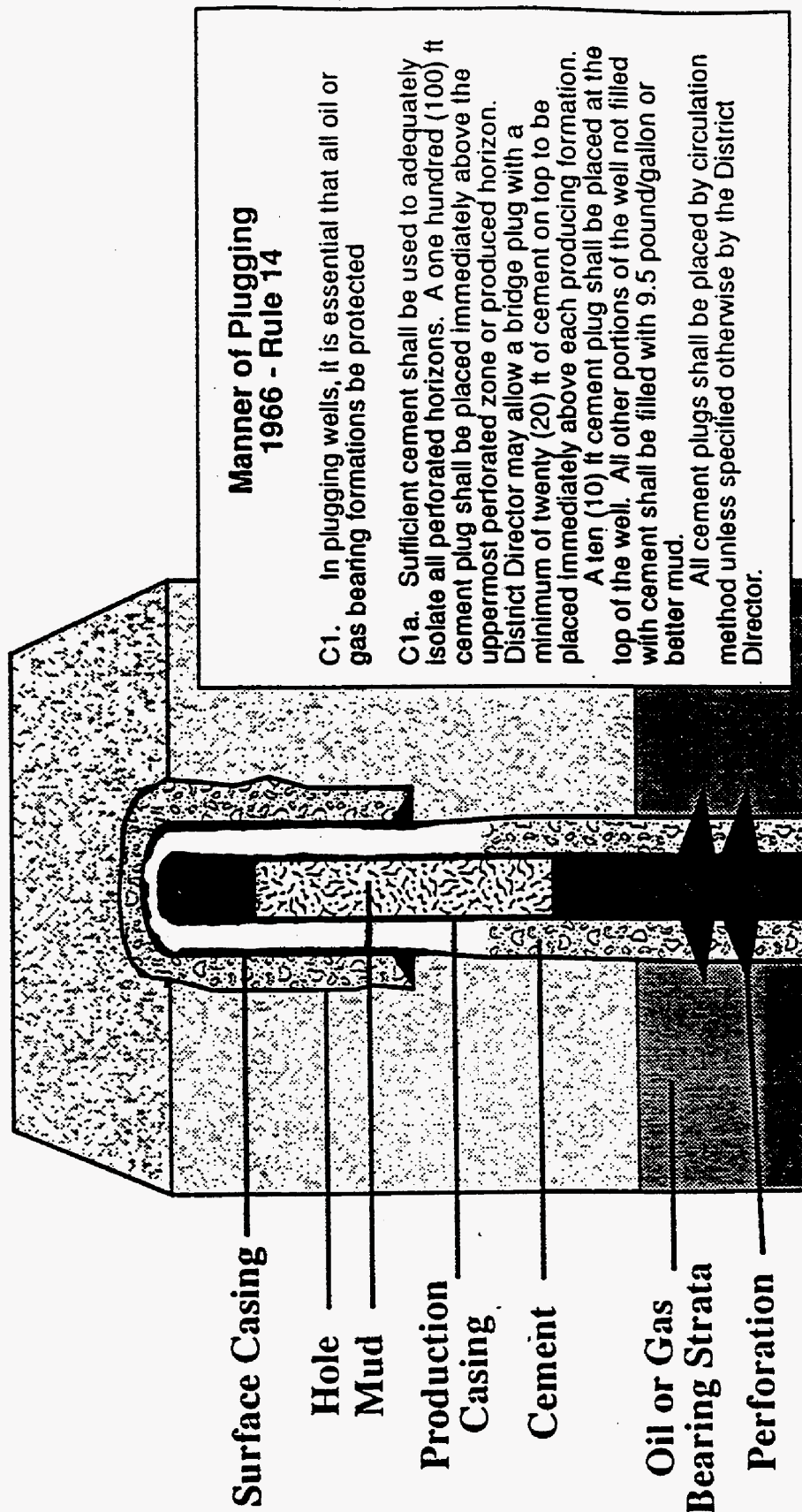


Figure 3.25: 1966 Well Abandonment Regulations - Well Plugging Rule 14²²

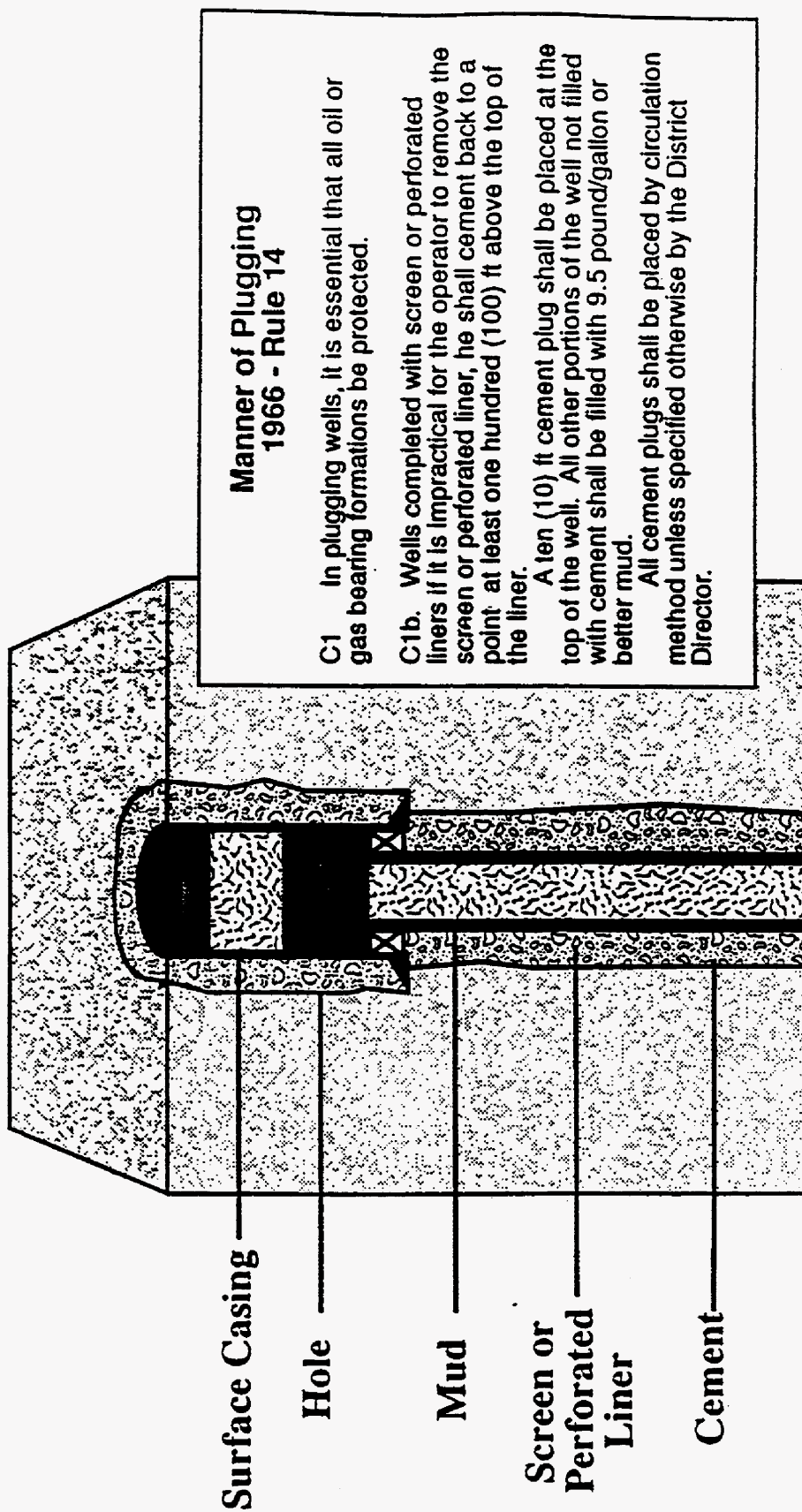


Figure 3.26: 1966 Well Abandonment Regulations - Well Plugging Rule 14²²

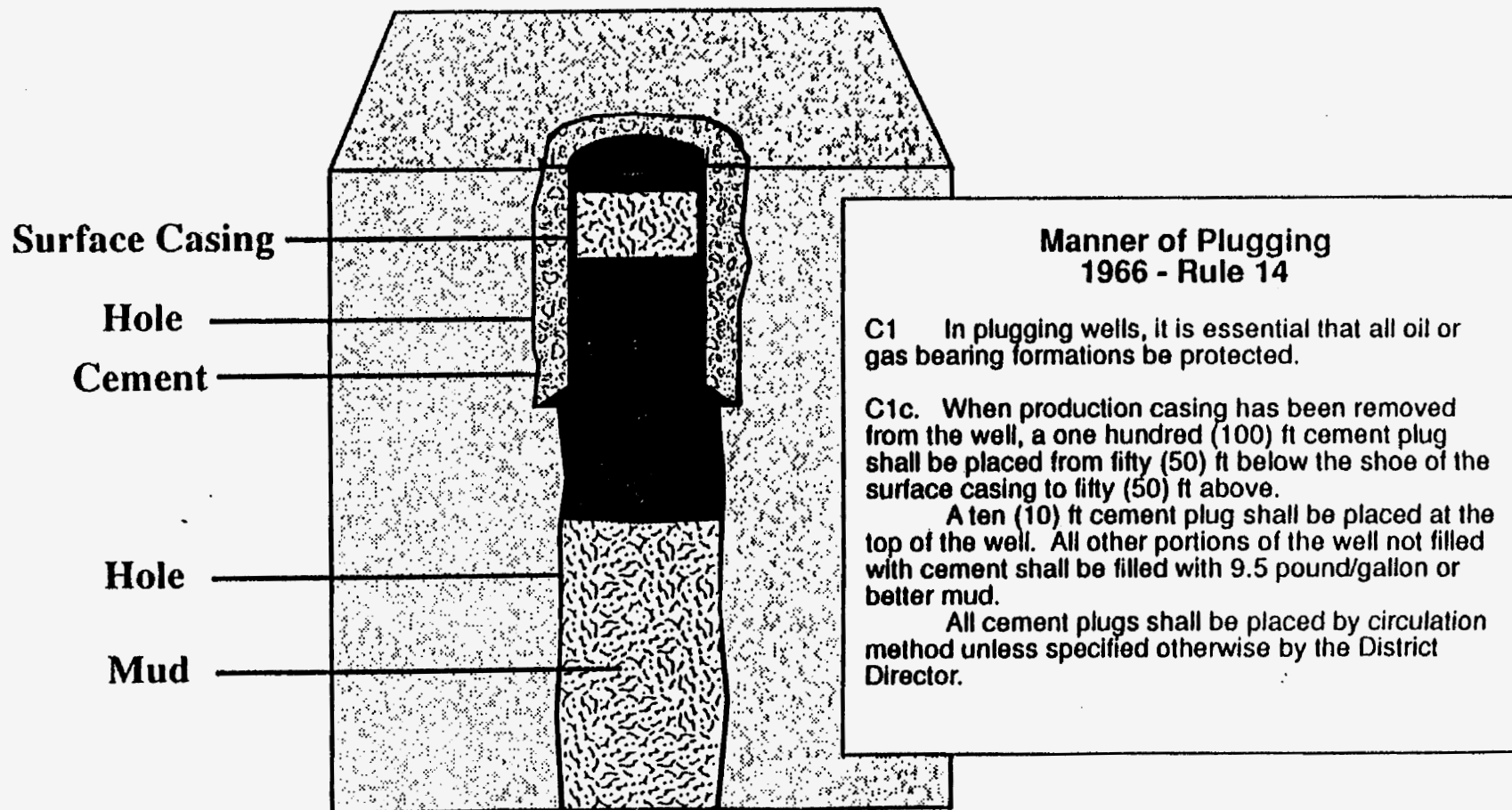


Figure 3.27: 1966 Well Abandonment Regulations - Well Plugging Rule 14²²

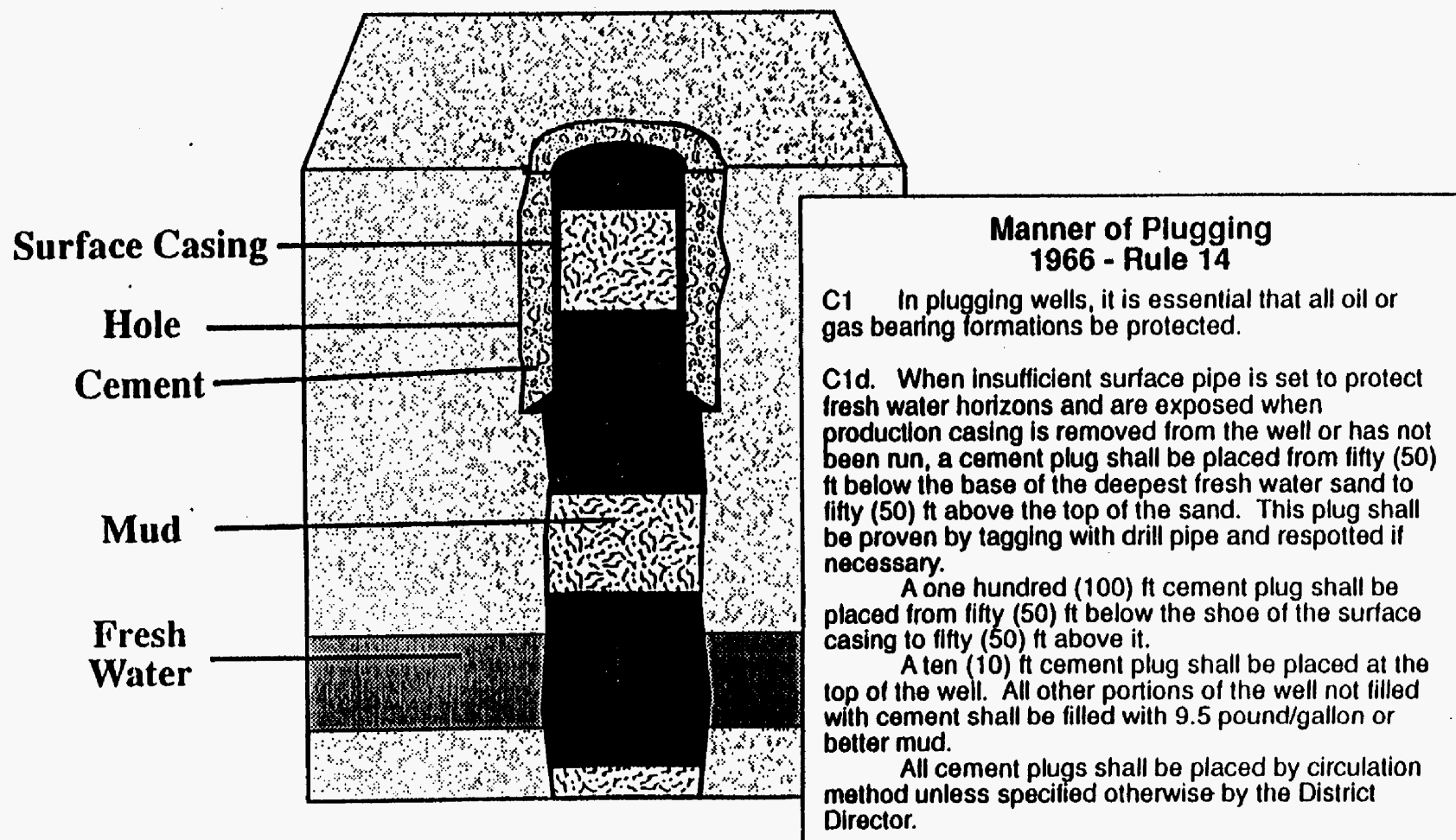


Figure 3.28: 1966 Well Abandonment Regulations - Well Plugging Rule 14²²

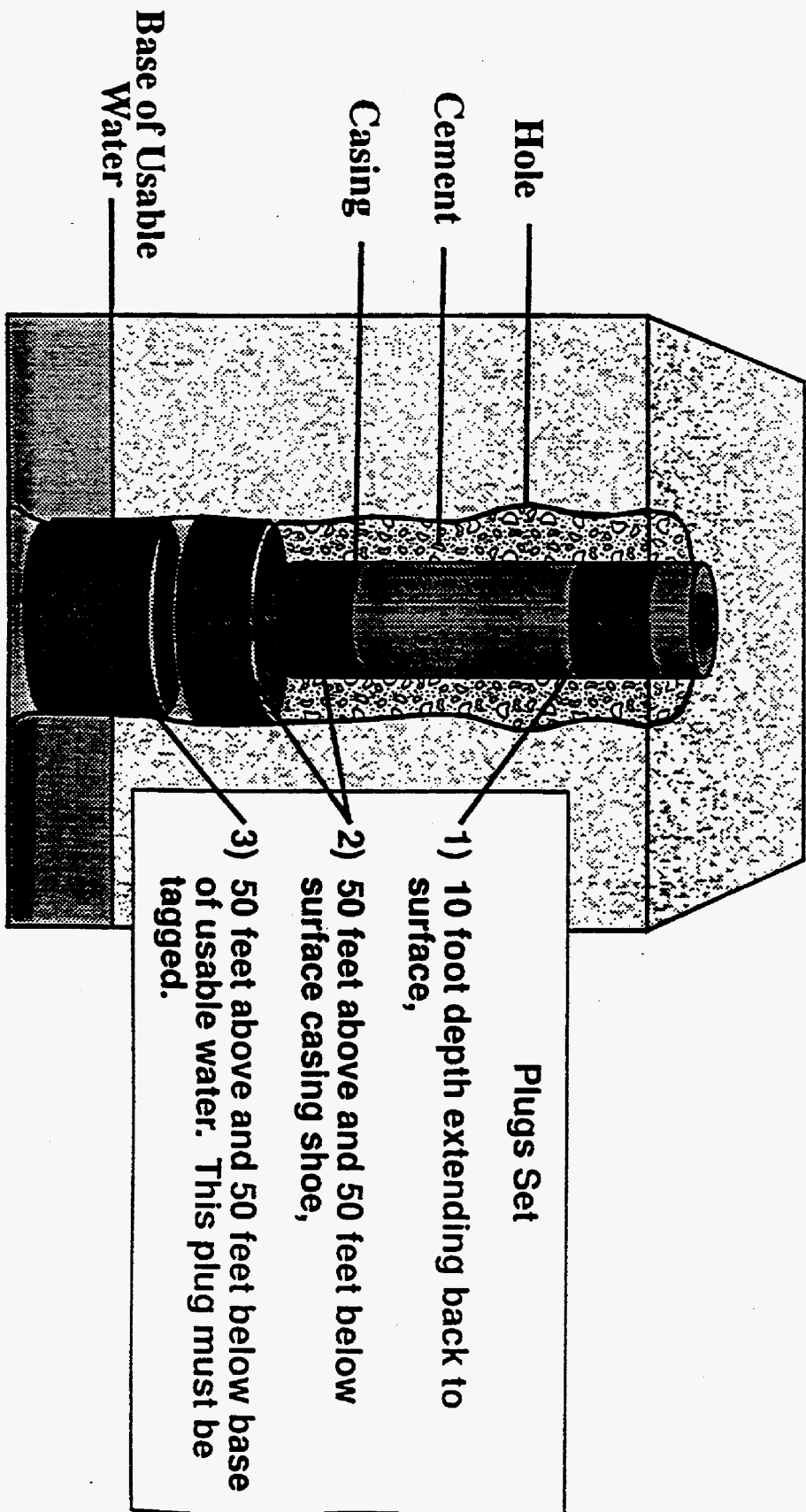
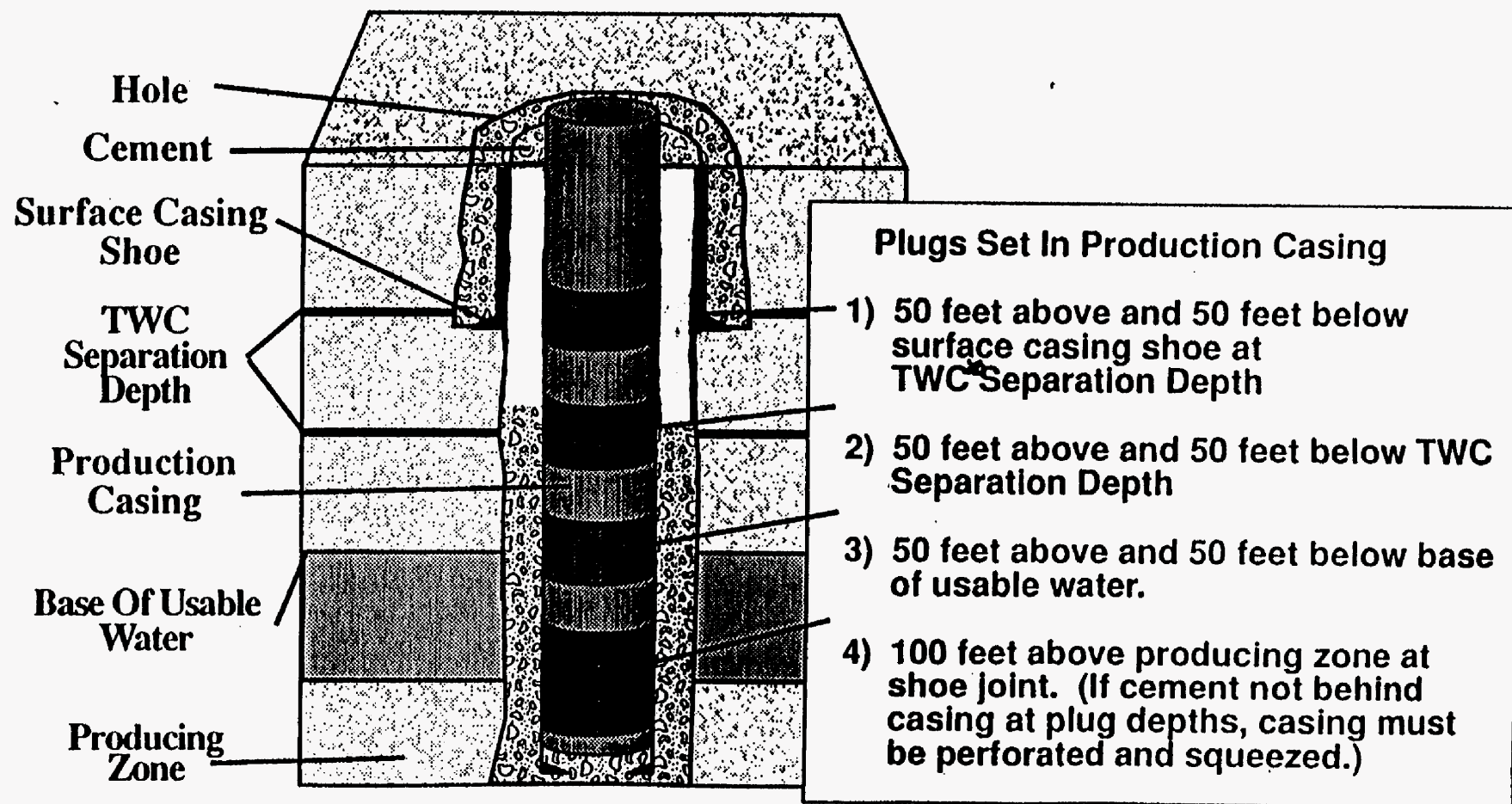


Figure 3.29: 1983 Well Abandonment Regulations²²



* TWC is the Texas Water Commission

Figure 3.30: 1983 Well Abandonment Regulations²²

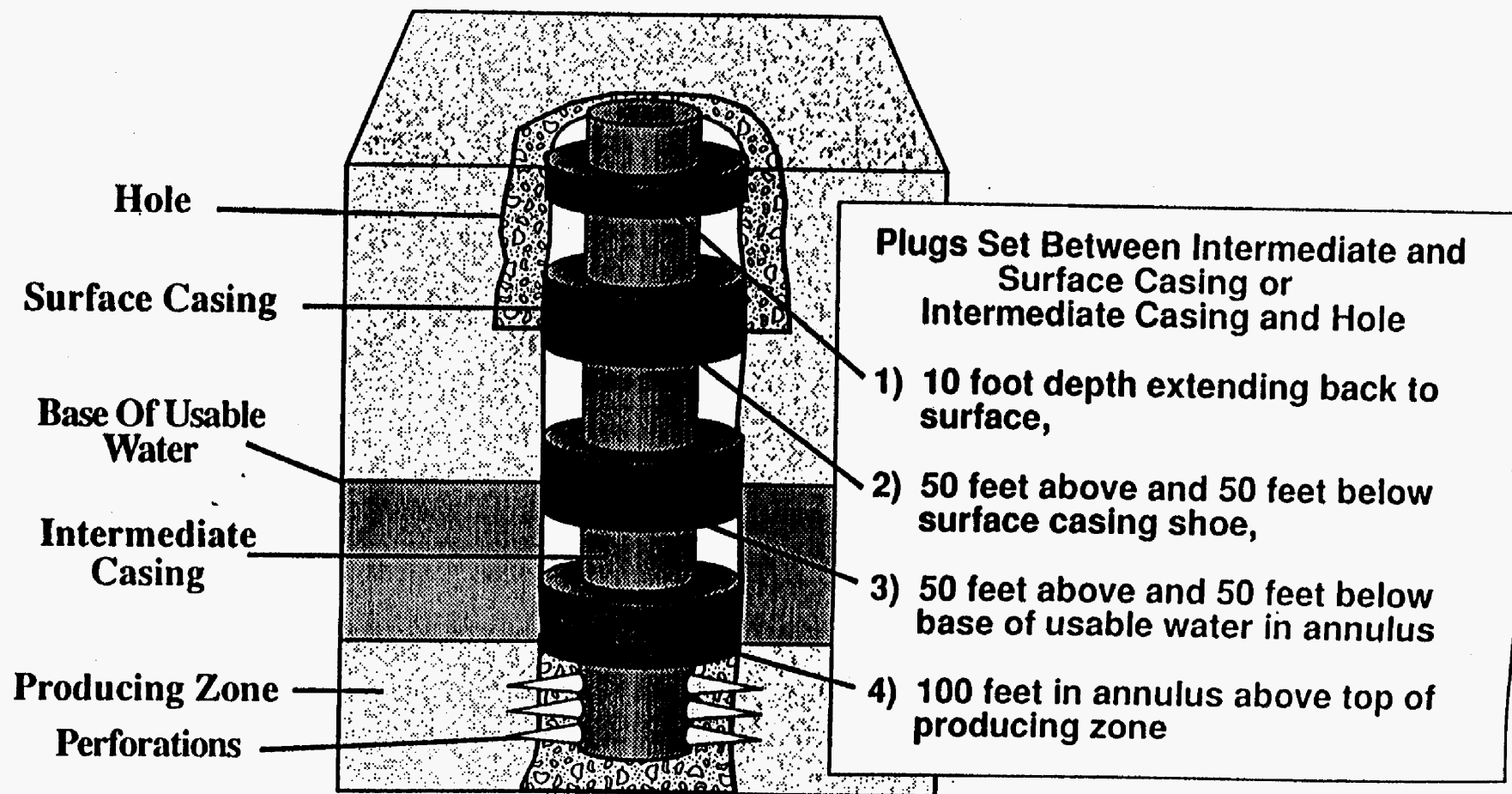


Figure 3.31: 1983 Well Abandonment Regulations²²

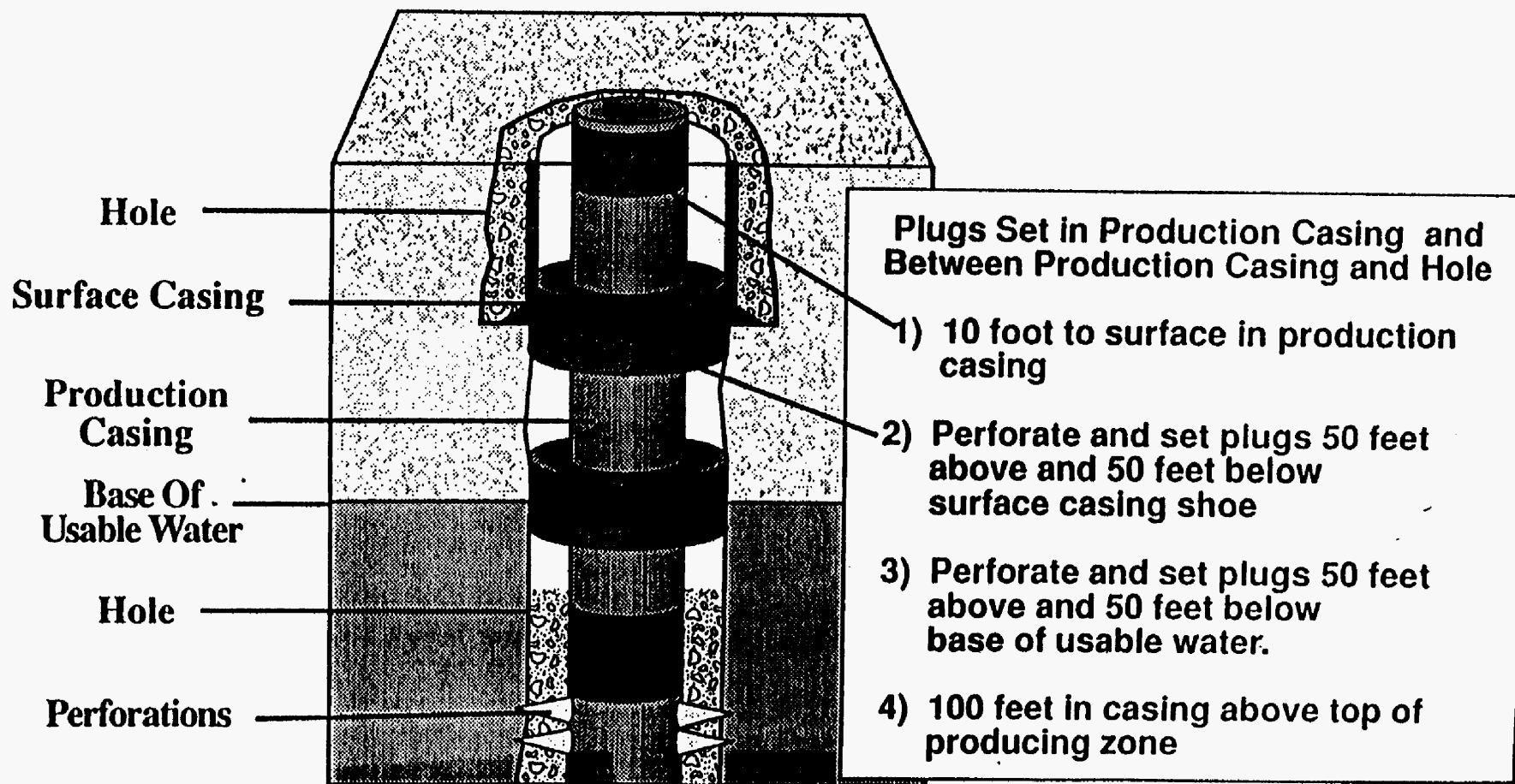


Figure 3.32: 1983 Well Abandonment Regulations²²

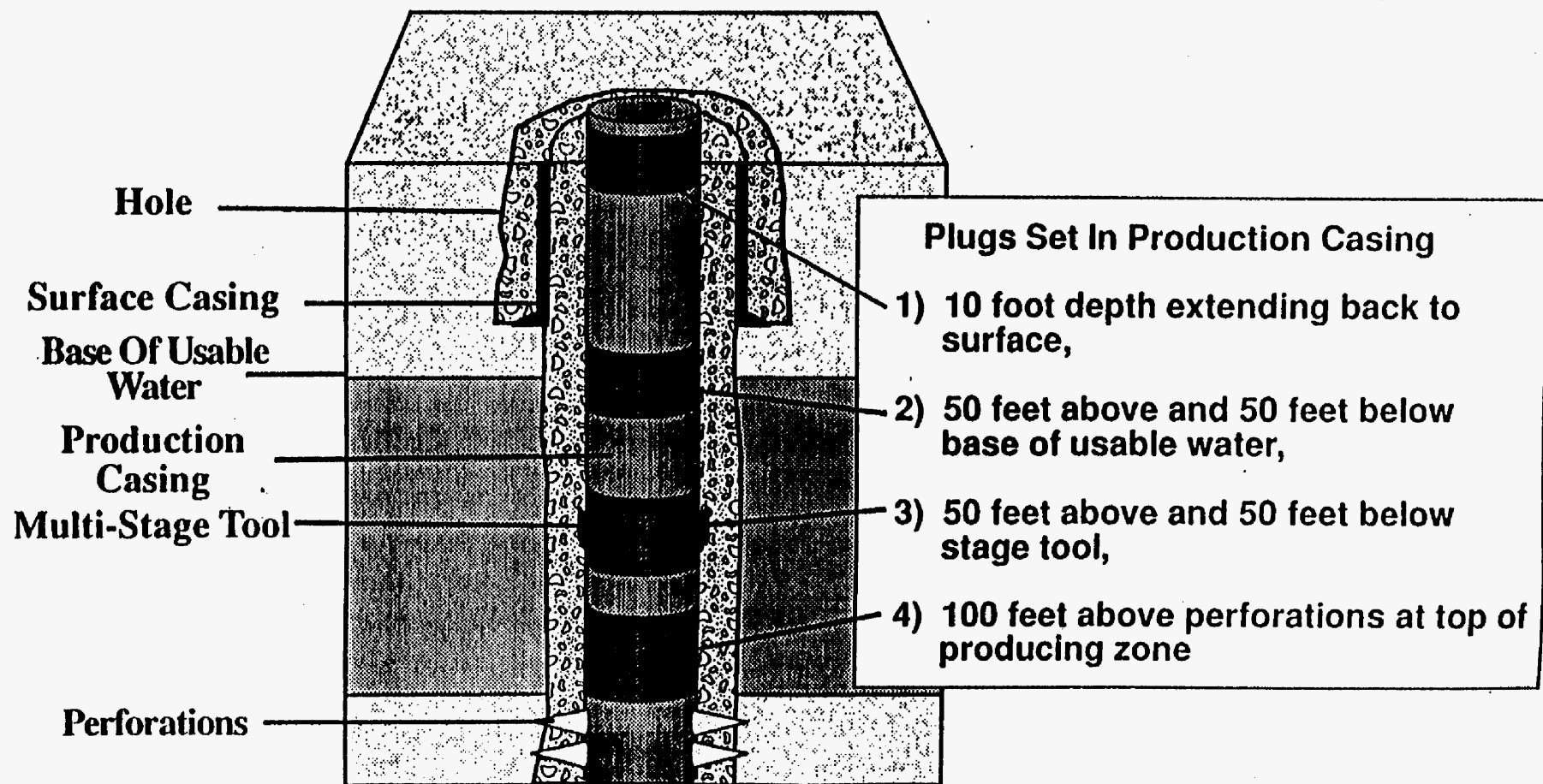


Figure 3.33: 1983 Well Abandonment Regulations²²

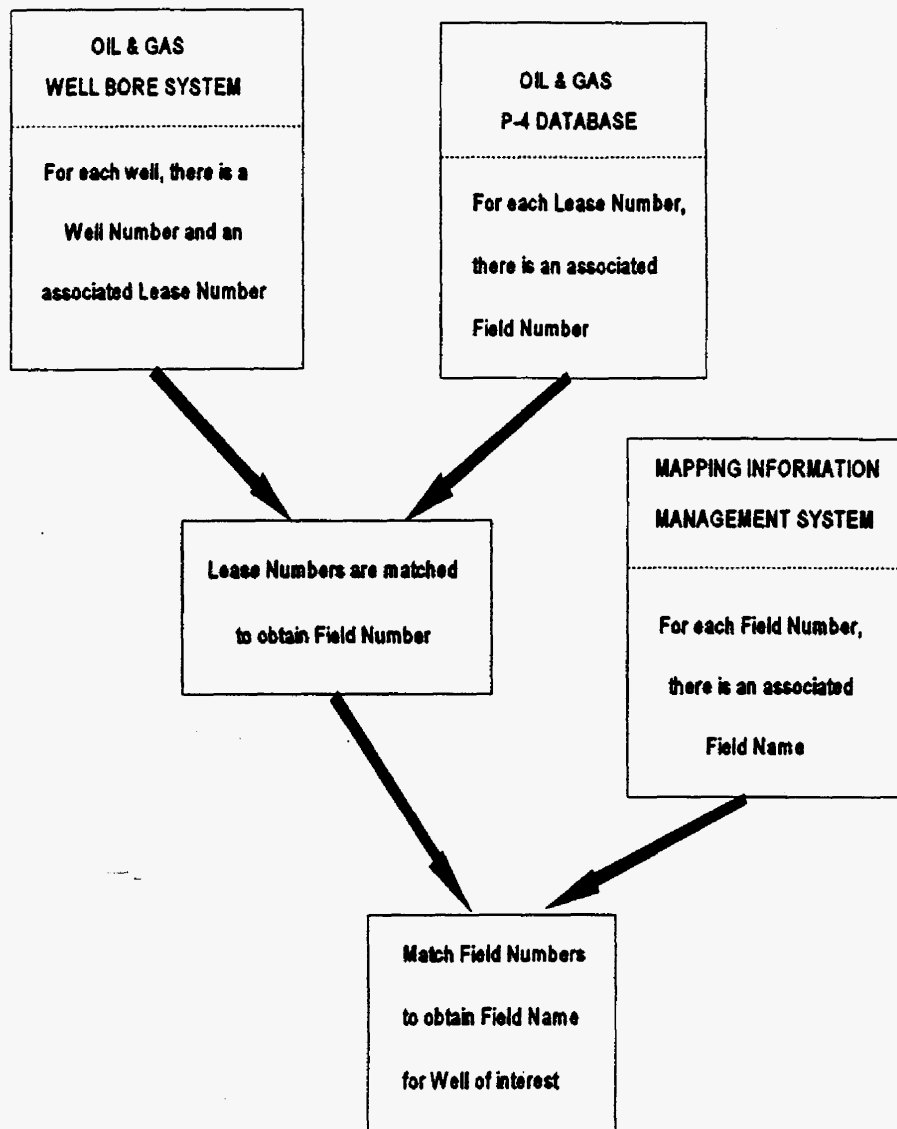


Figure 3.34
Field Matching Technique for TRRC Databases

UMR Well Review Project		Date :	6/ 7/1995
SCOUT Program - Version:95.157			
Data from Petroleum Information			
County = 39	API # = 39-		765
DRY HOLE			
Formation @ TD: 653VKBG	Prod. Formation:		
Well Status: D&A-OG	Total Depth = 7509		
Spud Date = 3/28/63	Completion Date = 5/27/63		
Latitude = 29.49098	Longitude = 95.23517		
ABANDONED WELL			
N-S Loc.: 2210 FS	E-W Loc.: 3350 FW		
Footage Ref.: SURVEY LN	Township:		
Block: 000	Section: SEC002		
Survey Name: W T HUGHES		Lease: GILBERT SNEED	
Operator: PAN AM			
Field: HASTINGS E			
Casing Data:			
Size: 10 3/4	Depth: 2017	Sacks Cmt.:	0
Size: 5 1/2	Depth: 7312	Sacks Cmt.:	0

Figure 3.35: Example of UMR Scout Program printout for data from PI abandoned well database.

Please refer to File No. _____ **RAILROAD COMMISSION OF TEXAS**
OIL AND GAS DIVISION

APPLICATION TO DRILL, DEEPEN OR PLUG BACK

IS THIS AN APPLICATION TO DRILL, DEEPEN OR PLUG BACK.....Drill.....?

FILE IN DUPLICATE WITH DEPUTY SUPERVISOR OF DISTRICT IN WHICH WELL IS LOCATED

<p>READ CAREFULLY AND COMPLY FULLY</p>	<p>Date... <u>April 12</u> 19 <u>61</u> ..</p>
<p>In order that it may be ascertained whether or not the proposed location covered by this notice conforms to the applicable spacing regulations set down by the Railroad Commission, there are two important footages that must be shown: that is, THE NEAREST DISTANCE OF PROPOSED LOCATION FROM LEASE OR PROPERTY LINE AND DISTANCE OF PROPOSED LOCATION FROM THE NEAREST WELL ON THE SAME LEASE. Do not begin drilling operations on any location prior to filing Form 1 and until permit granted by the Commission has been received and waiting clause period has terminated.</p>	<p>Name of company or operator Name..... <u>Glen Humphrey, Jr.</u> Address..... <u>P.O. Box 91</u> City..... <u>Beaverville, Texas</u></p>
<p>For the purpose of this determination, track on the east side hereof a most accurate sketch made to scale of this lease, block, or lot location, showing the proposed site for this location with reference to the nearest lease lines. Also show the nearest well on the same lease of this location and the distance from the proposed location to these wells. In addition to the foregoing, best boundary designations must be shown for the producing well on the lease and shall include boundary and boundaries for the location herein applied for. Showing the acreage to be assigned this well to the lease and addresses of adjoining lease or property owners and designate all property by lease and county name. You may attach a blue print showing the location, if you so desire.</p>	<p>Description of face or leader Name of lease..... <u>Marberry</u> Number of acres..... <u>162</u> Number of sections..... <u>1</u> Survey..... <u>Nicholas Sagan A-25</u> Elevation..... <u>254</u> feet (above sea level) Section No..... Located in..... <u>McMaddin</u> field (if different state above)</p>
<p>DO NOT CONFUSE SURVEY LINES WITH LEASE LINES. IF THE SKETCH ON BLUE PRINT SHOWS ONLY A SECTION, BLOCK, OR LOT OUT OF YOUR LEASE, DESIGNATE SAME AS BEING ONLY THAT PART OF THE LEASE.</p>	<p>County..... <u>Refugio</u> Nearest post office or town..... <u>West</u> Nearest post office or town..... <u>Tivoli</u> Nearest post office or town..... <u>Rotary</u></p>
<p>When the area of the tract is in parcels, use scale of one inch equaling 100 feet; if less than 3 acres use scale of one inch equaling 100 feet. DESIGNATE SCALE TO WHICH PLAT OR SURVEY IS MADE. ALSO DESIGNATE NORTHERLY DIRECTION ON THE SURVEY OR PLAT.</p>	<p>Date work will start drilling..... <u>Immediately</u> Depth to which you propose to drill..... <u>2500</u> feet. Date work will start deepening.....</p>
<p>STILL IN DUBIO IN THE SPACES RESERVED FOR THIS PURPOSE THE FOOTAGES ASKED FOR:</p>	<p>IF LEASE PURCHASED UNDER ONE OF OUR LEASES, FROM WHOM PURCHASED? <u>RECEIVED</u></p>
<p>Nearest distance from proposed location to property or lease line..... <u>300</u> feet.</p>	<p>APR 12 1961</p>
<p>Distance from proposed location to nearest drilling completed, or applied for well on the lease..... <u>7</u> feet.</p>	<p>Address..... <u>Beaverville, Texas</u></p>
<p><i>Repetitor provided this well is in same lease</i></p>	<p>REFUGIO, TEXAS</p>
<p>Is the acreage on which this well is to be located presently assigned to another well in any reservoir for which this permit is requested? <u>No</u></p>	<p><i>in the same reservoir as any other well closer than 95 feet to this same lease</i></p>
<p>NOTICE: Before sending in this form be sure that you have given all information requested. Much unnecessary correspondence can be thus be avoided.</p>	<p><i>DRILL SECTION AND MAKE AFFIDAVIT ON REVENUE BOOK</i></p>
<p>This well to be drilled under farm-out agreement from Cox and Hamon whereby they retain all production and rights below 2500 feet. Glen Humphrey, Jr. has shallow rights down to 2500 feet. This well will not be completed in any sand that is presently completed and capable of production in the Cox and Hamon No. 1 Marberry.</p>	<p><i>282</i></p>

Figure 3.36: Example of Form 1 from TRRC files.

FILE No. _____

DRAW SKETCH IN SPACE BELOW OR FILE CERTIFIED LEASE PLAT
(Be sure that all required locations, footages, distances, and scales are given.)

NORTH

VICTORIA COUNTY
REFUGIO RIVER
COUNTY

SUNRAY
Harberry - 20 acres

Cox & Hanson - Rights below 2500'

Glen Humphrey, Jr. - Rights above 2500'

Harberry 160 ac

Colson & Colson Harberry 236.6 ac

JOHN DUNN

WEST

EAST

NICHOLAS FAGAN SURVEY 4-25

Fagan Estate

STATE HIGHWAY

SOUTH

SWELL TRUST
TRUSTEES TO HOLD IN TRUST FOR THE BENEFIT OF THE ESTATE OF JOHN DUNN

1961 ST. 1000

RECEIVED

Scale of Plat 1" = 600'

I, A. G. Tashikar, being first duly sworn on oath, state that I have knowledge of the facts and matter herein set forth and that the same are true and correct.

Name A. G. Tashikar Title Petroleum Engineer

Subscribed and sworn to before me this 12 day of April, 1961

Correspondence regarding this well should be addressed to:

Name Glen Humphrey, Jr. Address Box 91 Beeville, Texas

Notary Public Refugio County, Texas.

NOTICE
NO ALLOWABLE WILL BE ASSIGNED to any well which does not have sufficient surface casing to protect all fresh water sands. Where Commission rules do not specify surface casing requirements, it will be necessary to contact Board of Water Engineers, Austin, Texas, to ascertain the depth to which fresh water sands must be protected.

Figure 3.36: Example of Form 1 from TRRC files. (page 2)

Please Refer
to No. _____

RAILROAD COMMISSION OF TEXAS
OIL AND GAS DIVISION

Form 2A
Application
To Plug and
Well Record

FILE IN DUPLICATE WITH DEPUTY SUPERVISOR OF DISTRICT IN WHICH
WELL IS LOCATED FIVE FULL DAYS PRIOR TO PLUGGING.

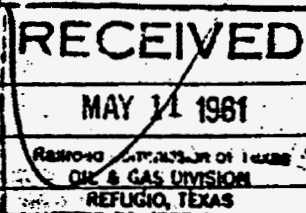
Company Glen Humphrey, Jr. Address Beaville, Texas
Sec. No. _____ Block No. _____ Survey Nicholas Egan County Refugio
Well No. 1 Name of Lease Harberry No. of Acres 160 Elev. 70' DF
Name of Field in which well is located McPaddin
Located 8 Miles West Direction from Tivoli (Nearest P. O. or Town)
Form 1, "Notice of Intention to Drill," was filed in name of Glen Humphrey, Jr.
Drilling Commenced April 28, 1961. Drilling Completed May 4, 1961
Has this well ever produced Oil? No or Gas? No
Character of Well (Oil, Gas or Dry) Dry Total Depth 2354
Date you wish to Plug May 4, 1961.
Name of Party Plugging Well Dowell Inc. Address Victoria, Texas
Correspondence regarding this well should be sent to: Name Glen Humphrey, Jr.
Address P. O. Box 91 Beaville, Texas
Initial Production of Gas: Volume (MCF) _____ 24 hrs. Pressure _____ lbs. per square inch
Initial Production of Oil: Barrels _____

Give notice before plugging to all available Lease Owners, as required by Rule (10).

When plugging completed, file final Plugging Report, duly signed and sworn to. All necessary forms will be furnished by the Deputy Supervisor of district in which well is located.

NOTE: If no log available, so state and give all information that can be obtained to as to total depth, whether or not cemented, producing formation, water sands, and at near as possible date well was drilled.

General Remarks: _____



FILL OUT PERMITS AND AFFIDAVIT ON REVERSE SIDE

Figure 3.37: Example of a Form 2a from TRRC files.

Show All Formations, Especially All Samsas, and Character and Contents Thereof

Method of shutting off water: Cement Is water completely shut off? Yes
Amount of water with oil: 100 per cent.

I, A. G. Toshkan, being first duly sworn on oath state that I have knowledge of the facts and matter herein set forth and that the same are true and correct.

Subscribed and sworn to before me this 20th day of May 1961

Notary Public
 Refugio _____ County, Texas

Figure 3.37: Example of a Form 2a from TRRC files. (page 2)

Please Refer to
File No. _____
6

RAILROAD COMMISSION OF TEXAS
OIL AND GAS DIVISION

Form 4
Plugging Record

FILE IN DUPLICATE WITH DEPUTY SUPERVISOR OF DISTRICT IN WHICH WELL IS LOCATED

Company Glen Humphrey, Jr. Address Box 91 Beeville, Texas
Sec. No. _____ Block No. _____ Survey Nicholas Fagan County Refugio
Well No. 1 Name of Lease Marberry No. of Acres 160
Name of Field in which well is located McPaddin Date well was plugged May 4, 1961

Form 1 (Notice of Intention to Drill) Was Filed in Name of Glen Humphrey, Jr.

Character of Well at the time of completion: Oil NO bbls: Gas NO Cu. Ft.: Dry yes
(Initial Production) (Initial Production)
Amount well producing when plugged: Oil - bbls: Gas - Cu. Ft.: Water - bbls.

Has this well ever produced oil or gas? No

Total Depth 2358 feet. Top of each producing sand none feet.

Was the well filled with mud-laden fluid, according to regulations of the Railroad Commission? Yes

How was mud applied? Circulated through pipe

Were plugs used? Yes If so, show all shoulders left for casing, depth of each, and size of casing, size and kind of plugs used, and depth placed. Also amount of cement and rock was well shot? No

Cement plugs from 1680 to 1580 feet; from 300 to 200 feet and from 10 feet to surface.

SIZE PIPE	NO. OF FEET IN WELL	FEET PULLED OUT	FEET LEFT IN WELL	PACKERS AND SHOES
<u>R 5/8</u>	<u>247</u>	<u>247</u>	<u>247</u>	

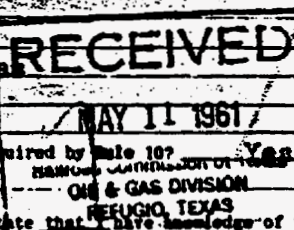
Show depth found and thickness of all water, oil and gas formations fresh water sands from 1660 to 253 feet

Have all abandoned wells on this lease been plugged according to Commission rules? Yes

Manner of confining all oil, gas or water to strata: cement plugs and mud-laden fluid

The names of adjacent lease, royalty and landowners with their addresses in each instance as follows:

Cox and Hamon Dallas, Texas
Colton and Colton San Antonio, Texas
Sunray-Midcontinent Corpus Christi, Texas
N. H. Marberry Tivoli, Texas



Was notice given before plugging to all available adjacent lease owners as required by Rule 107? Yes

I, A. G. Leshikar, being first duly sworn on oath, state that I have knowledge of the facts and the matter herein set forth and that the same are true and correct.

Signature A. G. Leshikar Title Petroleum Engineer

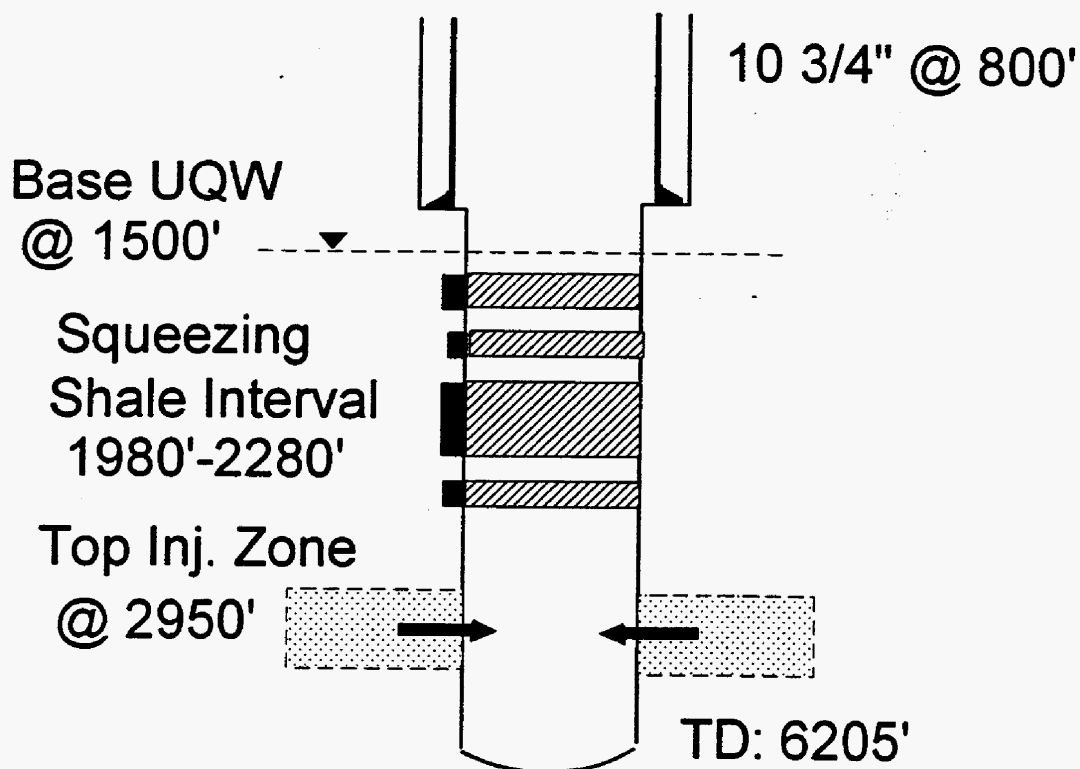
Subscribed and sworn to before me this 10 day of May, 1961

Signature A. G. Leshikar
Notary Public Refugio County, Texas

Correspondence regarding this well should be addressed to:

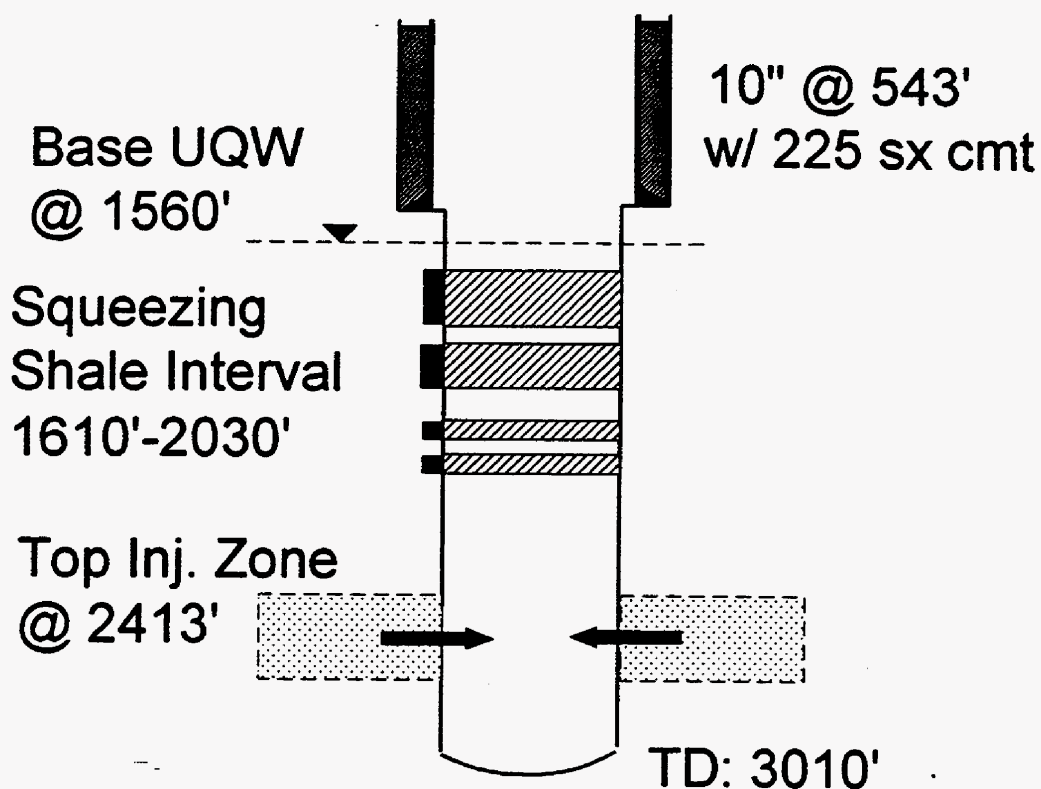
Name Glen Humphrey, Jr. Address P. O. Box 91 Beeville, Texas

Figure 3.38: Example of a Form 4 from TRRC files.



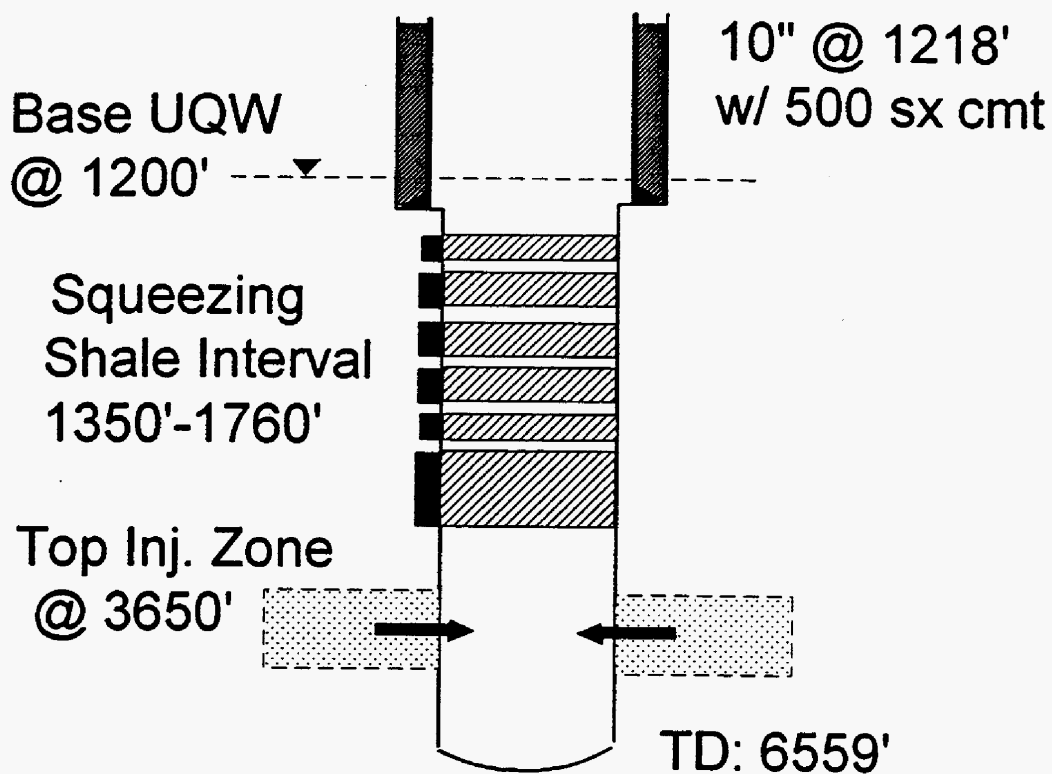
County: Refugio
 Field: Tom O'Connor
 Lease Name: Lambert M. F.
 Well API Number: 391-01350
 Completion Date: 7/19/38 Drilling Date: 6/21/38
 Status At Completion: Dry
 Conversions During Life: P&A

Figure 3.39



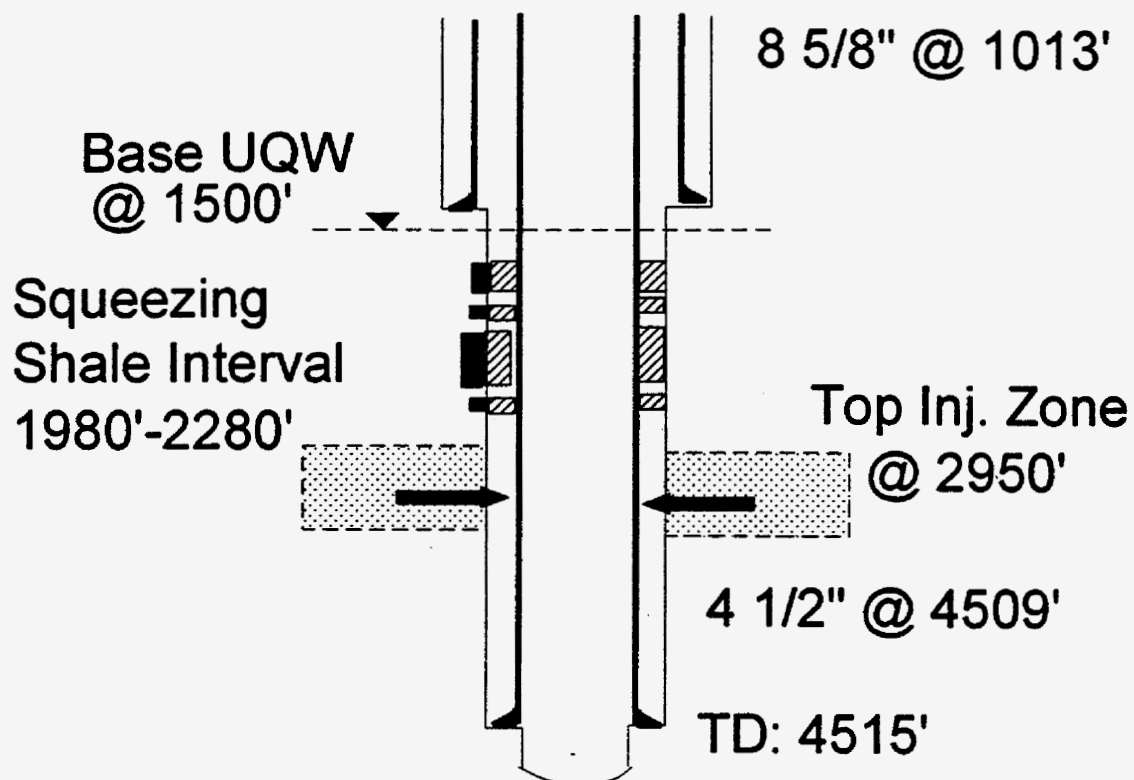
County: Victoria
 Field: Coletto Creek
 Lease Name: Dietzel Wm.
 Well API Number: 469-01124
 Completion Date: 4/2/36 Drilling Date: 3/13/36
 Status At Completion: Dry
 Conversions During Life: P&A

Figure 3.40



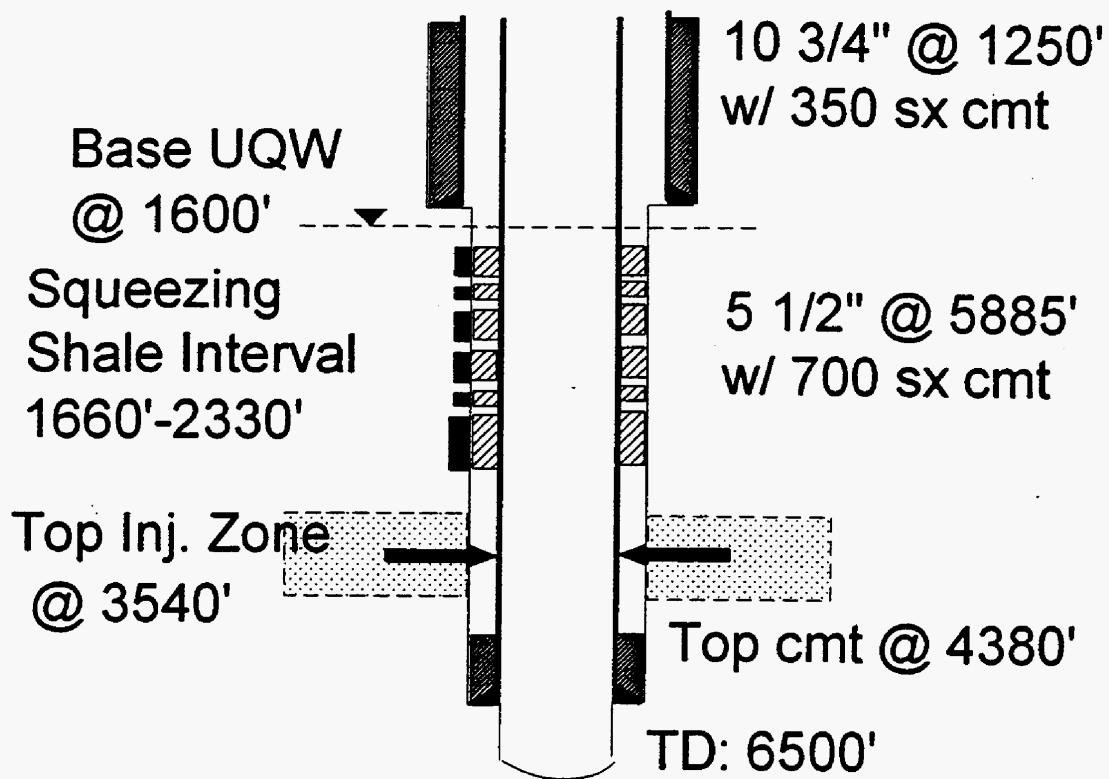
County: Refugio
 Field: Bonnie View
 Lease Name: C. Arnold
 Well API Number: 391-03712
 Completion Date: 2/4/36 Drilling Date: 12/15/35
 Status At Completion: Dry
 Conversions During Life: P&A 2/4/36

Figure 3.41



County: Refugio
 Field: Tom O'Connor
 Lease Name: Thomas O'Connor
 Well API Number: 391-03804
 Completion Date: 12/?/63 Drilling Date: 7/12/63
 Status At Completion: Dry
 Conversions During Life: P&A

Figure 3.42



County: Jackson
 Field: West Ranch
 Lease Name: E. H. Duenow
 Well API Number: 239-02289
 Completion Date: 6/4/52 Drilling Date: 5/10/52
 Status At Completion: Dry
 Conversions During Life: P&A

Figure 3.43

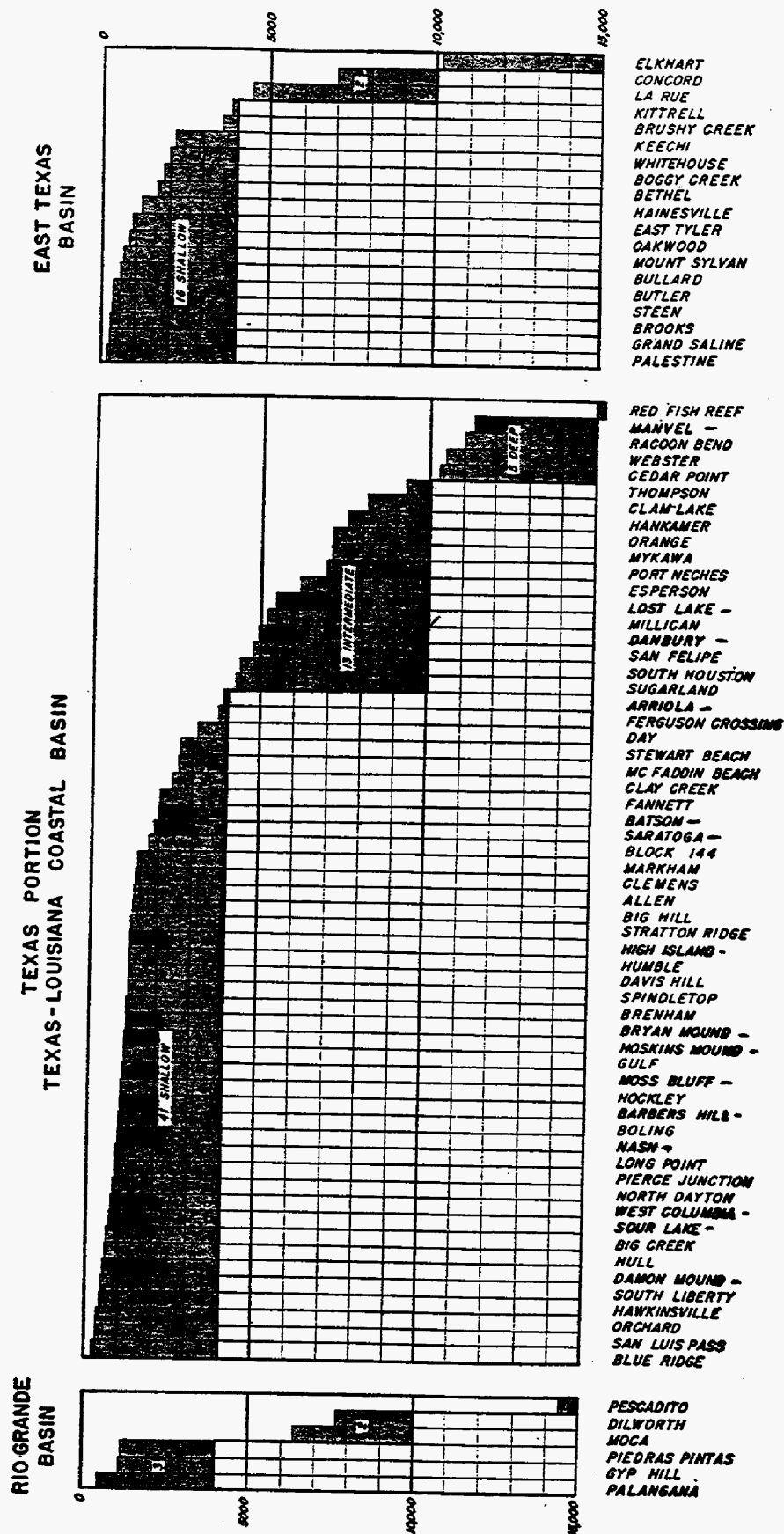


Table 3.1: Depth of burial for salt domes of the Texas and Louisiana Gulf Coast. From Halbouty¹⁴.

SYSTEM/ SERIES	GROUP/Formation NAMES	SHALLOW AND UPDIP (AQUIFERS)	DEEP AND DOWNDIP (OILFIELDS)
HOLOCENE	Alluvium		
PLEISTOCENE	Beaumont Lissie	Chicot Aquifer	
PLIOCENE	Willis		
MIOCENE	Goliad Fm. FLEMING GROUP Lagarto Fm. Oakville Fm.	Evangeline Aquifer Burkeville Confining Jasper Aquifer	Minor production Minor production
OLIGOCENE	CATAHOULA GROUP Anahuac Frio Fm. Vicksburg	Catahoula Confining Not present Not present Vicksburg Confining	Minor production MAJOR SHALE MAJOR PRODUCTION Significant production
EOCENE	JACKSON GROUP CLAIBORNE GROUP Yegua Fm. Cook Mountain Sparta Sand Weches Fm. Queen City Reklaw Fm. Carrizo Sand WILCOX GROUP MIDWAY GROUP	Jackson Confining U. Claiborne Aquifer M. Claiborne Confining Sparta Aquifer Queen City Aquifer L. Claiborne Confining CARRIZO-WILCOX MAJOR AQUIFER Midway Confining	Significant production Significant production Minor production Minor production Minor production Minor production Minor production
PALEOCENE			
CRETACEOUS	15 formations		Significant production
JURASSIC	5 formations including Louann Salt		
TRIASSIC	Eagle Mills		
PALEOZOIC			Ouachita Facies

Table 3.2: Texas Gulf Coast stratigraphic nomenclature. Oil field information from Galloway¹⁶, aquifer and confining layer data from Ryder and Ardis¹⁷, and Tertiary Series boundaries updated from Galloway²³.

Table 3.3: Field types, discovery dates and depth to principal producing horizons for the 73 injection fields of this study. Data from Galloway¹⁶, Halbouty¹⁴, and Kusters¹⁹. Where different discovery dates were reported, the earlier date is recorded here.

STRATIGRAPHIC NOTATIONS					STRUCTURAL NOTATIONS				
=====					=====				
FL	=	FLUVIAL			FLT	=	FAULTED		
BI	=	BARRIER ISLAND			PART	=	PARTLY PRODUCTIVE		
SP	=	STRAND PLAIN			SSD	=	SHALLOW SALT DOME		
DEL	=	DELTA			ISD	=	INTERMEDIATE SALT DOME		
					DSD	=	DEEP SALT DOME		
					TCR	=	TOP CAP ROCK DEPTH		
					TS	=	TOP SALT DEPTH		
COUNTY & FIELD	DISC DATE	DEPTH	PRINCIPAL PRODUCING HORIZON		TRAP TYPE				
=====	=====	=====	=====		=====				
REFUGIO COUNTY									
Bonnie View	1944	4500	FRIO BI-SP		ANTICLINE				
Greta	1933	4400	FRIO BI-SP		FLT-ANTICLINE				
La Rosa	1938	5700	FRIO BI-SP		FLT-ANTICLINE				
Lake Pasture	1959	4500	FRIO BI-SP		ANTICLINE				
McFaddin	1938	4400	FRIO BI-SP		ANTICLINE				
Mary E O'Connor	1953	5900	FRIO BI-SP		ANTICLINE				
New Refugio	<71	5500	FRIO BI-SP						
Old Refugio									
Tom O'Connor	1934	5100	FRIO BI-SP		FLT-ANTICLINE				
BRAZORIA COUNTY									
Bryan Mound	1935		MIOCENE		SSD, TCR = 680				
Damon Mound	1915		FRIO, MIOC		SSD, TCR = 529				
Damon Mound E.									
Danbury	1930		FRIO DEL, MIOC		ISD, TS = 4948				
Hastings E.	1934	6100	FRIO		DSD				
Hoskins Mound	1904				SSD, TC = 574				
Lochridge	1936	6325	FRIO DEL		FANT				
Manvel	1931	5400	FRIO		DSD, TS = 11,274				
Nash Dome					SSD, TCR = 620				
West Columbia	1904		MIOCENE, FRIO		SSD, TCR = 650				
Old Ocean	1934	9600	FRIO BI-SP		FLT-ANTICLINE				
CHAMBERS COUNTY									
Anahuac	1935	7100	FRIO DEL		DSD				
Barbers Hill	1916		MIOCENE-PLIO		SSD, TCR = 350				
Fig Ridge	1941	8500	FRIO DEL		DSD				
High Island	1922		MIOCENE, FRIO		SSD, TCR= 150				
Lost Lake	1929		FRIO		ISD, TS = 5430, TCR=3272				
Moss Bluff	1926				SSD, TCR = 591				
Oyster Bayou	1929	8300	FRIO		DSD				
Stowell			FRIO BI-SP						
HARDIN COUNTY									
Arriola	1928		MIOCENE-PLIO		SSD, TS = 3,929				
Batson New									

Table 3.3: (con't)

Batson Old	1903		FRIO, YEGUA	SSD, TCR = 1,080
Saratoga	1901		YEGUA	SSD, TCR = 1,500
Saratoga W.				
Sour Lake	1902	VAR	FRIO-YEGUA	SSD, TCR = 660
JACKSON COUNTY				
Cordele				
Ganado	1940	6200	FRIO BI-SP	FLT-ANTICLINE
Ganado W.	1940	4700	FRIO BI-SP	FLT-ANTICLINE
La Ward N.	1941	5200	FRIO BI-SP	ANTICLINE
Lolita	1940	5600	FRIO BI-SP	
Maurbro	1941	5200	FRIO BI-SP	FLT-ANTICLINE
Stewart				
West Ranch	1939	5600	FRIO BI-SP	ANTICLINE
NUECES COUNTY				
Agua Dulce	1942	5700	FRIO	COMBINATION
Baldwin				
Clara Driscoll				
London Gin	1949	4500	FRIO BI-SP	PART
Richard King				
Saxet	1944	5000	FRIO BI-FL	FLT-ANTICLINE
White Point E.	1938	5700	FRIO BI-SP	FLT-ANTICLINE
SAN PATRICIO COUNTY				
Midway	<42	5500	FRIO BI-SP	COMBINATION
Odem	<46	VAR	SINTON	
Plymouth	1936	5600	FRIO BI-SP	
Plymouth E.				
Portilla	1950	7300	FRIO BI-SP	ANTICLINE
Sinton W.				
Taft	1935	4000	FRIO BI-SP	
White Point E.	1938	5700	FRIO BI-SP	FLT-ANTICLINE
STARR COUNTY				
Garcia	1942	3800	FRIO FL-DEL	FLT-ANTICLINE
Jay Simmons				
Kelsey S.	1941	4700	FRIO FL-DEL	FLT-ANTICLINE
Reyna				
Ricaby	<54	1500	FRIO, VICKS	
Rincon	1940	4500	FRIO FL-DEL	FLT-ANTICLINE
Sun	1941	4300	FRIO FL-DEL	COMBINATION
Sun N.	1942	4400	FRIO FL-DEL	COMBINATION
VICTORIA COUNTY				
Bloomington	1947	4600	FRIO BI-SP	FLT-ANTICLINE
Coletto Creek	1962	3000	FRIO FL-DEL	FLT-ANTICLINE
Helen Gohlke	1950	8100	WLX FL-DEL-BI	FLT-ANTICLINE
Helen Gohlke W.	1953	8200	WILCOX FL-DEL	FLT-ANTICLINE
Heyser	1936	5400	FRIO BI-SP	COMBINATION
Keeran	<54	VAR		
McFaddin	1938	4400	FRIO BI-SP	COMBINATION
Placedo	1937	4700	FRIO BI-SP	FLT-ANTICLINE
Placedo E.				
Pridham Lake				

Table 3.4: TRRC Well Counts from OGWBS for Selected Fields in Refugio County

Field	Total Wells	Wells w/ Locations	Plugged Wells	Injectors	Producers
Bonnie View	101	86	48	2	31
No Dates	20	10	5	1	4
Pre-1967	16	14	1	0	12
1967-1982	27	25	13	0	8
Post-1982	38	37	29	1	7
Greta	332	296	106	10	163
No Dates	81	56	9	0	46
Pre-1967	36	34	3	1	26
1967-1982	84	81	12	6	56
Post-1982	131	125	82	3	35
Lake Pasture	422	341	22	8	290
No Dates	106	30	1	1	28
Pre-1967	75	73	3	1	64
1967-1982	154	151	8	5	130
Post-1982	87	87	10	1	68
LaRosa	100	91	29	3	53
No Dates	15	8	5	0	3
Pre-1967	40	40	1	2	33
1967-1982	22	21	3	0	16
Post-1982	23	22	20	1	1
McFaddin	75	56	16	0	30
No Dates	16	2	1	0	1
Pre-1967	13	12	1	0	6
1967-1982	30	26	7	0	15
Post-1982	16	16	7	0	8
Mary Ellen O'Connor	259	233	114	4	106
No Dates	55	38	24	0	14
Pre-1967	36	35	6	1	24
1967-1982	88	80	22	3	53
Post-1982	80	80	62	0	15

Table 3.4: Continued

Refugio New	88	67	24	0	41
No Dates	40	20	5	0	14
Pre-1967	11	10	1	0	8
1967-1982	20	20	7	0	13
Post-1982	17	17	11	0	6
Refugio Old	99	77	47	1	19
No Dates	32	14	3	0	8
Pre-1967	8	8	1	0	4
1967-1982	15	13	5	1	4
Post-1982	44	42	38	0	3
Tom O'Connor	1336	1065	110	26	890
No Dates	494	238	4	1	230
Pre-1967	190	183	12	7	146
1967-1982	344	337	18	9	297
Post-1982	308	307	76	9	217

**Table 3.5: Pre-1967 Abandoned Well Counts for Gulf Coast Study Counties
from Petroleum Information**

County	Field	Pre-1967 # of Abandoned Wells
Brazoria		859
	Bryan Mound	29
	Chocolate Bayou	0
	Damon Mound	281
	Damon Mound E	1
	Danbury	107
	Hastings East	1
	Hastings West	0
	Hoskins Mound	39
	Lochridge	13
	Marvel	98
	Nash Dome	34
	West Columbia	236
	West Columbia New	0
	Old Ocean	17
	<hr/>	
	Total in Selected Fields	856
	Total w/ locational data	662
Chambers		292
	Anahuac	44
	Barbers Hill	157
	Fig Ridge	12
	High Island	13
	Lost Lake	27
	Moss Bluff	12
	Oyster Bayou	15
	Stowell	12
	<hr/>	
	Total in Selected Fields	292
	Total w/ locational data	224

Table 3.5: Continued

County	Field	Pre-1967 # of Abandoned Wells
Hardin		705
	Arriola	31
	Batson New	88
	Batson Old	129
	Saratoga	160
	Saratoga West	13
	Sour Lake	281
	Village Mills E	0
	<hr/>	
	Total in Selected Fields	702
	Total w/ locational data	520
Jackson		190
	Cordele	24
	Ganado	18
	Ganado W	21
	La Ward N	33
	Lolita	26
	Maurbro	14
	Stewart	16
	West Ranch	38
	<hr/>	
	Total in Selected Fields	190
	Total w/ locational data	183
Nueces		430
	Agua Dulce	156
	Baldwin	21
	London Gin	23
	Richard King	12
	Saxet	183
	Clara Driscoll	24
	White Point E	11
	<hr/>	
	Total in Selected Fields	430
	Total w/ locational data	319

Table 3.5: Continued

County	Field	Pre-1967 # of Abandoned Wells
Refugio		919
	Bonnie View	22
	Greta	34
	Lake Pasture	3
	McFaddin	22
	Mary Ellen O'Connor	10
	Refugio New	3
	Refugio Old	12
	Tom O'Connor	28
<hr/>		
	Total in Selected Fields	138
	Total w/ locational data	134
San Patricio		266
	Midway	63
	Odem	19
	Plymouth	50
	Plymouth E	12
	Portilla	9
	Sinton W	55
	Taft	29
	White Point E	29
<hr/>		
	Total in Selected Fields	266
	Total w/ locational data	181

Table 3.5: Continued

County	Field	Pre-1967 # of Abandoned Wells
Starr		349
	Garcia	52
	Jay Simmons	14
	Kelsey S	22
	Reyna	7
	Ricaby	37
	Rincon	115
	Sun	38
	Sun N	64
	<hr/>	
	Total in Selected Fields	349
	Total w/ locational data	328
Victoria		164
	Bloomington	15
	Coletto Creek	25
	Helen Gohlke	10
	Helen Gohlke W	2
	Heyser	7
	Keeran	16
	Koontz	0
	McFaddin	15
	Placedo	34
	Placedo E	22
	Pridham Lake	18
	<hr/>	
	Total in Selected Fields	164
	Total w/ locational data	145

Table 3.6: Texas Railroad Commission Well Records

The following is a list of the Forms and other data sheets that were received from Banks Information Solutions in their search for TRRC file data on pre-67 wells. Also indicated is the information that was useful in this study on each form. The data that are present on each form are variable and even though the form has a data entry location, this does not guarantee that the data are present.

<u>Form #</u>	<u>Form Name</u>	<u>Information</u>
Form 1	Application to Drill or Deepen	Location of Well Lease Name Year Drilled
Form 2	Well Record	Location of Well Lease Name Field Name Type of Well Dates, Drilled & Completed Construction Data
Form 2A	Appl. to Plug and Well Record	Location of Well Lease Name Field Name Type of Well Dates, Drilled & Completed Formations
Form 3	Potential Test	Location of Well Lease Name Field Name Type of Well Date Completed Surface and Production CSG Tubing Perforated Interval Total Depth (PBSD)
Form 4	Plugging Record	Location of Well Lease Name Field Name Construction Data Plugging Data Formation Record Total Depth

Table 3.6: Continued

Form 15	Appl. to Shoot or Treat w/Acid	Location of Well Lease Name Field Name Stimulation Planned Some Construction Data
Form 16	Statement of the Condition of Well after Shoot or Treat	Location of Well Lease Name Stimulation Performed
Form W-1	Application to Drill, Deepen, PB, or ReEnter	Location of Well Lease Name Field Name Operator
Form W-1C	Compliance Certification	Filed with Form W-1
Form W-2	Oil Well Potential Test Completion, or Recompletion Report and Log	Location of Well Lease Name Field Name Type of Well Dates, Drilled & Completed Construction Data Tubing Perfd Interval Total Depth (PBSD) Formations
Form W-3	Plugging Record	Location of Well Lease Name Field Name Dates, Drilled & Comp. & Plug Construction Data (No cmt) Pulled Casing Plugs Bottom Fresh Water Total Depth (PBSD)
Form W-15	Cementing Report	Shows Cement Put in Hole (generally only plugs are reported on Form and is filed with Form W-3)

Table 3.6: Continued

Form I-I	Inclination Report	Location of Well Lease Name Field Name
Form X-1313		Location of Well Lease Name Field Name
Form CD-MID	Condition of Hole and Procedure	Lease Name Field Name Workover Procedures P&A Procedure & Data Construction Data Perforated Interval Total Depth (PBD) Sketch of Wellbore
Rule 14	Notice of P&A	Location of Well Lease Name Field Name Construction Data Perforated Interval Plan for Plugging
	Proration Schedule	Current Status of Well

County	Field	API #'s	Current Status	Form 4 (W-3)	P&A Date
Refugio	Bonnie View				
		391-03243	P&A	Y	8-30-78
		391-03555	P&A	Y	3-17-72
		391-03628	P&A	Y	8-25-79
		391-03629	P&A	Y	8-29-79
		391-03634	P&A	Y	5-4-82
		391-03637	P&A	Y	9-2-79
		391-03638	P&A	Y	9-4-79
		391-03646	P&A	Y	2-19-71
		391-03647	P&A	Y	2-19-71
		391-80438	P&A	Y	12-5-77
		391-80441	Shut-In	na	na
	Greta				
		391-00777	Producer	na	na
		391-00782	P&A	Y	7-31-80
		391-00790	P&A	Y	5-30-79
		391-00792	P&A	Y	4-24-80
		391-00795	P&A	Y	12-15-82
		391-00798	P&A	Y	3-5-79
		391-00805	P&A	Y	9-15-75
		391-00870	Producer	na	na
		391-00886	P&A	Y	4-26-95
		391-00947	P&A	Y	12-19-78
		391-00954	P&A	Y	12-11-81
		391-00968	P&A	Y	9-30-82
		391-00969	P&A	Y	6-23-72
		391-01012	P&A	Y	11-1-72
		391-01031	Shut-In	na	na
		391-01032	Shut-In	na	na
		391-01043	P&A	Y	6-11-75
		391-01205	Disposal	na	na
		391-03978	P&A	Y	10-6-82
		391-80947	P&A	Y	3-18-78
		391-80953	P&A	Y	10-16-72
		391-82008	P&A	Y	12-5-83
	Lake Pasture				
		391-00180	P&A	Y	4-23-82
		391-00358	P&A	Y	6-23-81
		391-00464	P&A	Y	1-25-82
		391-01890	P&A	Y	1-31-70
		391-03635	P&A	Y	5-3-82
		391-03780	Shut-In	na	na
		391-03894	P&A	Y	4-25-88
		391-30221	Producer	na	na
	La Rosa				
		391-03332	P&A	Y	1-5-78
		391-03405	P&A	Y	10-21-71
		391-03365	Producer	na	na
		391-80450	P&A	Y	1-9-78
		391-80713	P&A	Y	4-26-71
		391-80810	P&A	Y	9-8-77
		391-81023	P&A	Y	1-22-77
	McFaddin				
		391-00159	P&A	Y	6-18-82
		391-00166	Shut-In	na	na
		391-01946	P&A	Y	12-30-80
		391-30178	P&A	Y	4-21-82

Table 3.7: Data for post-1966 Refugio County abandoned wells. Wells identified from TRRC OGWS database. Data from TRRC files.

	391-80701	P&A	Y	8-9-73
	391-80908	P&A	Y	6-8-79
	391-80911	P&A	Y	8-22-73
Mary Ellen O'Connor				
	391-01799	P&A	Y	1-31-75
	391-01820	Disposal	na	na
	391-01821	P&A	Y	4-2-73
	391-01831	P&A	Y	5-25-73
	391-01832	P&A	Y	1-19-73
	391-01844	P&A	Y	5-30-73
	391-01845	P&A	Y	5-29-73
	391-01859	P&A	Y	3-7-73
	391-01860	P&A	Y	3-3-73
	391-01874	P&A	Y	7-24-73
	391-01892	Producer	na	na
	391-01896	P&A	Y	8-2-73
	391-01897	P&A	Y	2-18-72
	391-01898	P&A	Y	12-10-81
	391-01908	P&A	Y	10-24-79
	391-01909	P&A	Y	7-25-73
	391-01910	P&A	Y	10-30-79
	391-01911	Shut-in	na	na
	391-01912	P&A	Y	12-17-82
	391-01927	Producer	na	na
	391-01928	P&A	Y	9-11-76
	391-01930	P&A	Y	12-1-82
	391-01935	P&A	Y	2-23-72
	391-01937	Producer	na	na
	391-01941	P&A	Y	7-8-72
	391-01945	P&A	Y	9-24-90
	391-01946	P&A	Y	12-30-80
	391-01949	Shut-in	na	na
	391-01950	P&A	Y	7-1-72
	391-01951	P&A	Y	4-11-72
	391-01955	P&A	Y	4-6-72
	391-01956	P&A	Y	3-10-72
	391-01960	P&A	Y	11-2-79
	391-01962	P&A	Y	4-13-82
	391-02800	P&A	Y	4-5-68
	391-02833	P&A	Y	7-8-67
	391-03220	P&A	Y	11-12-79
	391-03232	P&A	Y	3-27-72
	391-03235	P&A	Y	4-17-80
	391-03243	P&A	Y	8-30-78
	391-03729	P&A	Y	12-4-81
	391-03805	P&A	Y	3-16-79
	391-04028	P&A	Y	11-8-72
	391-04045	P&A	Y	11-20-78
	391-30575	P&A	Y	2-19-82
	391-31230	P&A	Y	12-18-82
	391-80805	P&A	Y	2-28-73
Refugio New				
	391-03015	P&A	Y	2-28-73
	391-03046	P&A	Y	10-5-78
	391-03323	P&A	Y	11-7-79
	391-80520	P&A	Y	11-7-75
	391-80722	P&A	Y	6-22-78
	391-80732	P&A	Y	4-7-71
	391-80734	P&A	Y	3-18-71
	391-80736	P&A	Y	8-9-93
	391-80737	P&A	Y	6-27-78
	391-80741	P&A	Y	6-27-78
Refugio Old				
	391-02318	P&A	Y	4-27-75

Table 3.7: Continued

		391-02467	P&A	Y	5-14-82
		391-02470	P&A	Y	5-11-82
		391-02474	P&A	Y	12-10-76
		391-02498	Temp. A.	na	na
		391-02647	P&A	Y	12-4-71
		391-80539	P&A	Y	5-18-74
		391-80540	P&A	Y	4-8-75
	Tom O'Connor				
		391-00420	Shut-In	na	na
		391-00464	P&A	Y	1-25-82
		391-00474	Shut-In	na	na
		391-00670	P&A	Y	7-18-77
		391-00736	Producer	na	na
		391-00765	P&A	Y	3-20-80
		391-01476	Producer	na	na
		391-01526	Shut-In	na	na
		391-02023	Shut-In	na	na
		391-02026	Shut-In	na	na
		391-02032	Disposal	na	na
		391-03046	P&A	Y	10-5-78
		391-03803	P&A	Y	8-18-71
		391-80115	P&A	Y	8-12-74
		391-80320	P&A	Y	2-5-82
		391-80636	P&A	Y	6-21-88
		391-81159	Shut-In	na	na
		391-82075	P&A	Y	8-30-82

Table 3.7: Continued

Post '66 Wells - Summary

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Post '66 P&A w/ Form 4	Post '66 P&A No Form4
Refugio	Bonnie View	11	1	0	10	10	0
	Greta	22	5	0	17	17	0
	Lake Pasture	8	2	0	6	6	0
	La Rosa	7	1	0	6	6	0
	McFaddin	7	1	0	6	6	0
	Mary Ellen O'Connor	47	6	0	41	41	0
	Refugio New	10	0	0	10	10	0
	Refugio Old	8	1	0	7	7	0
	Tom O'Connor	18	9	0	9	9	0
TOTAL		138	26	0	112	112	0

Table 3.8: Summary of data for post-1966 Refugio County abandoned wells. Wells identified from TRRC OGWBS database. Data from TRRC files.

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Pre '67 P&A w/ Form 4	Possible Pre '67 P&A No Form4
Refugio	Bonnie View	20	0	0	2	17	1
	Greta	28	5	0	2	13	8
	Lake Pasture	8	0	0	0	7	1
	La Rosa	21	0	0	0	21	0
	McFaddin	4	0	0	0	4	0
	Mary Ellen O'Connor	10	0	0	2	8	0
	Refugio New	3	0	0	0	3	0
	Refugio Old	12	0	1	1	9	2
	Tom O'Connor	28	2	0	1	18	7
	TOTAL	134	7	1	8	100	19

Table 3.9: Summary of data for pre-1967 Refugio County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	API #	Current Status	Form 4	P&A Date	Comments:
Refugio	Bonnie View					
		391-03276	P&A	Y	08-24-48	
		391-03547	P&A	Y	02-10-59	
		391-03554	P&A	Y	04-03-47	
		391-03583	P&A	Y	11-25-59	
		391-03584	P&A	Y	09-14-53	
		391-03585	P&A	Y	02-20-51	
		391-03594	P&A	Y	01-09-70	Post 66.
		391-03606	P&A	Y	02-18-45	
		391-03608	P&A	Y	05-09-39	
		391-03631	P&A	Y	06-25-51	
		391-03633	P&A	Y	02-17-47	
		391-03665	P&A	Y	08-27-56	
		391-03692	P&A	Y	10-09-62	
		391-03695	P&A	Y	05-02-55	
		391-03696	P&A	Y	05-10-51	
		391-03697	P&A	Y	09-22-56	
		391-03698	P&A	Y	10-02-49	
		391-03712	P&A?	N	-	App. to Plug indicates no plugs, no mud.
		391-03875	P&A	Y	06-27-65	
		391-03880	P&A	Y	08-30-78	Post 66.
	Greta					
		391-00538	P&A	Y	08-21-54	
		391-00613	P&A	Y	09-14-44	
		391-00616	P&A?	N	-	Form 1 only; PI data indicates Casing set.
		391-00620	P&A	Y	03-05-34	
		391-00625	P&A	Y	05-16-34	
		391-00777	Producer	na	na	
		391-00787	P&A	Y	01-14-64	
		391-00788	P&A?	N	-	No Form 4 or P&A data. Plug date on Form 1 is 4-30-54.
		391-00789	P&A	Y	01-29-34	
		391-00810	P&A	Y	02-28-34	
		391-00811	P&A?	N	-	Form 1 only; well was drilled.
		391-00812	P&A?	N	-	No RRC forms; records lost in 1937.
		391-00814	P&A?	N	-	Form 1 only.
		391-00829	P&A?	N	-	Forms 1 & 3 only.
		391-00916	Injector	na	na	On schedule as disposal well.
		391-00980	P&A	Y	12-13-40	
		391-00981	P&A	Y	12-13-40	
		391-00991	P&A	Y	01-21-87	Post 66.
		391-01004	P&A	Y	11-17-59	
		391-01016	P&A?	N	-	Blowout and cratered. No form 4 or P&A data.
		391-01030	P&A	Y	05-03-34	
		391-01047	P&A	Y	07-28-37	
		391-01103	P&A	Y	05-13-70	Post 66.
		391-01192	Producer	na	na	
		391-01194	Shut-in	na	na	Shut-in gas well.
		391-01197	P&A?	N	-	Blowout. "Shut-in & Abd." on 6-21-34. No Form 4.
		391-01220	Shut-in	na	na	Shut-in gas well.
		391-03911	P&A	Y	12-26-65	
	Lake Pasture					
		391-00201	P&A	Y	03-09-53	
		391-00226	P&A?	N	-	Producing as of 6-23-67. No Form 4.
		391-00389	P&A	Y	12-07-65	
		391-00391	P&A	Y	07-29-57	
		391-00393	P&A	Y	04-20-62	
		391-00397	P&A	Y	04-30-63	
		391-00405	P&A	Y	07-17-59	
		391-00413	P&A	Y	05-20-58	

Table 3.10: Data for pre-1967 Refugio County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

	La Rosa					
		391-03088	P&A	Y	04-10-62	
		391-03306	P&A	Y	03-03-41	
		391-03313	P&A	Y	08-08-40	
		391-03317	P&A	Y	07-03-39	
		391-03327	P&A	Y	05-07-40	
		391-03328	P&A	Y	06-06-40	
		391-03343	P&A	Y	03-14-40	
		391-03361	P&A	Y	01-31-62	
		391-03385	P&A	Y	06-23-41	
		391-03386	P&A	Y	02-02-47	
		391-03388	P&A	Y	03-28-57	
		391-03397	P&A	Y	09-21-61	
		391-03399	P&A	Y	11-17-61	
		391-03427	P&A	Y	05-03-41	
		391-03430	P&A	Y	11-19-52	
		391-03431	P&A	Y	12-13-52	
		391-03434	P&A	Y	06-18-61	
		391-03446	P&A	Y	04-04-57	
		391-03508	P&A	Y	06-11-41	
		391-03829	P&A	Y	02-06-65	
		391-03902	P&A	Y	10-02-65	
	McFaddin					
		391-00065	P&A	Y	04-14-42	
		391-00067	P&A	Y	05-04-61	
		391-00153	P&A	Y	04-01-42	
		391-00172	P&A	Y	08-25-41	
	Mary Ellen O'Connor					
		391-01817	P&A	Y	03-11-55	
		391-01863	P&A	Y	04-19-56	
		391-01890	P&A	Y	01-31-73	Post 66.
		391-01913	P&A	Y	02-01-55	
		391-01916	P&A	Y	01-28-54	
		391-01932	P&A	Y	03-21-55	
		391-01951	P&A	Y	04-11-72	Post 66.
		391-01956	P&A	Y	02-15-55	
		391-01971	P&A	Y	04-19-56	
		391-03805	P&A	Y	03-05-64	
	Refugio New					
		391-02188	P&A	Y	04-15-49	
		391-02988	P&A	Y	03-24-61	
		391-02995	P&A	Y	04-19-40	
	Refugio Old					
		391-01985	P&A	Y	01-07-57	
		391-01987	P&A	Y	04-14-87	Post 66.
		391-01992	P&A	Y	12-25-57	
		391-02186	P&A	Y	06-18-47	
		391-02240	P&A	Y	03-16-56	
		391-02276	P&A?	N	-	No Form 4 or P&A data. Only Form 1.
		391-02293	P&A?	N	-	No Form 4 or P&A data. Only Form 1.
		391-02308	P&A	Y	06-05-47	
		391-02346	P&A	Y	08-11-60	
		391-02416	P&A	Y	05-12-52	
		391-02874	P&A	Y	10-18-60	No Intersection. TD:1536'
		391-02901	P&A	Y	04-23-63	
	Tom O'Connor					
		391-00414	P&A	Y	11-11-61	
		391-00474	Shut-in	na	na	
		391-00478	P&A	Y	08-28-47	
		391-00489	P&A	Y	10-24-61	

Table 3.10: Continued

		391-00502	P&A	Y	05-30-49	
		391-00503	P&A	Y	03-02-62	
		391-00508	P&A	Y	06-04-46	
		391-00523	P&A	Y	12-23-49	
		391-00530	P&A	Y	01-15-62	
		391-00541	P&A	Y	07-16-52	
		391-00675	P&A	N	03-27-37	Blowout; no Form 4; cement pumped.
		391-00800	P&A	Y	02-02-73	Post 66.
		391-00849	P&A	Y	04-13-50	
		391-01318	P&A	Y	08-15-38	
		391-01350	P&A?	N	-	No Form 4; Forms 1 & 2.
		391-01351	P&A	Y	11-22-45	
		391-01623	P&A?	N	-	No Form 4.
		391-01674	P&A	Y	11-17-49	
		391-01721	P&A	Y	02-12-38	
		391-01761	P&A	Y	11-23-50	
		391-01768	P&A	Y	02-11-50	
		391-01772	P&A?	N	-	No Form 4; Forms 1 & 2.
		391-01773	P&A	Y	07-21-51	
		391-01819	P&A?	N	-	Application to plug, but no Form 4 or P&A data.
		391-01820	P&A?	N	-	Application to plug, but no Form 4 or P&A data.
		391-02040	P&A	Y	07-27-46	
		391-03784	Producer	na	na	Gas well.
		391-03804	P&A?	N	-	No Form 4 or P&A data. Only Form 1.

Table 3.10: Continued

County	Total Wells	Not Abd.	No Int.	Post '66 P&A	Pre '67 P&A w/ Form 4	Possible Pre '67 P&A No Form4
Brazoria	92	1	7	6	65	20
Chambers	34	4	0	6	17	7
Hardin	73	0	7	5	49	19
Jackson	23	0	0	1	19	3
Nueces	48	1	0	5	37	5
Refugio	134	7	1	8	100	19
San Patricio	29	1	0	1	23	4
Starr	39	1	0	2	34	2
Victoria	21	1	1	0	18	2
TOTAL	493	16	16	34	362	81

Table 3.11: Summary of data for pre-1967 abandoned wells in all Texas Gulf Coast study counties. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Pre '67 P&A w/ Form 4	Possible Pre '67 P&A No Form4
Brazoria	Bryan Mound	3	0	3	0	2	1
	Damon Mound	29	0	3	0	20	9
	Damon Mound E.	2	0	0	0	2	0
	Danbury	11	0	0	1	9	1
	Hastings E.	1	0	0	0	1	0
	Hoskins Mound	4	0	1	3	1	0
	Lochridge	2	1	0	0	1	0
	Manvel	10	0	0	0	9	1
	Nash Dome	4	0	0	1	3	0
	Old Ocean	2	0	0	0	2	0
	West Columbia	24	0	0	1	15	8
	TOTAL	92	1	7	6	65	20

Table 3.12: Summary of data for pre-1967 Brazoria County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Pre '67 P&A	Possible Pre '67 P&A
Chambers						w/ Form 4	No Form4
	Anhuac	5	0	0	2	3	0
	Barbers Hill	16	3	0	2	8	3
	Fig Ridge	2	0	0	0	1	1
	High Island	2	0	0	1	1	0
	Lost Lake	3	0	0	0	2	1
	Moss Bluff	2	0	0	0	1	1
	Oyster Bayou	2	0	0	0	1	1
	Stowell	2	1	0	1	0	0
	TOTAL	34	4	0	6	17	7

Table 3.13: Summary of data for pre-1967 Chambers County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Pre '67 P&A w/ Form 4	Possible Pre '67 P&A No Form4
Hardin	Arriola	4	0	0	0	3	1
	Batson New	9	0	0	0	3	6
	Batson Old	13	0	7	1	7	5
	Saratoga	16	0	0	1	11	4
	Saratoga West	2	0	0	0	2	0
	Sour Lake	29	0	0	3	23	3
	TOTAL	73	0	7	5	49	19

Table 3.14: Summary of data for pre-1967 Hardin County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Pre '67 P&A w/ Form 4	Possible Pre '67 P&A No Form4
Jackson	Cordele	3	0	0	0	3	0
	Ganado	2	0	0	0	2	0
	Ganado West	3	0	0	0	3	0
	La Ward North	4	0	0	1	3	0
	Lolita	3	0	0	0	2	1
	Maurbro	2	0	0	0	2	0
	Stewart	2	0	0	0	2	0
	West Ranch	4	0	0	0	2	2
	TOTAL	23	0	0	1	19	3

Table 3.15: Summary of data for pre-1967 Jackson County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Possible Pre '67 P&A	
						w/ Form 4	No Form4
Nueces	Agua Dulce	16	1	0	1	11	3
	Baldwin	3	0	0	0	3	0
	Clara Driscoll	3	0	0	0	3	0
	London Gin	3	0	0	0	3	0
	Richard King	2	0	0	0	2	0
	Saxet	19	0	0	4	14	1
	White Point E.	2	0	0	0	1	1
	TOTAL	48	1	0	5	37	5

Table 3.16: Summary of data for pre-1967 Nueces County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Pre '67 P&A w/ Form 4	Possible Pre '67 P&A No Form4
San Patricio	Midway	7	0	0	0	7	0
	Odem	2	0	0	0	2	0
	Plymouth	5	0	0	0	4	1
	Plymouth E.	2	0	0	1	1	0
	Portilla	1	0	0	0	1	0
	Sinton W.	6	0	0	0	4	2
	Taft	3	0	0	0	2	1
	White Point E.	3	1	0	0	2	0
	TOTAL	29	1	0	1	23	4

Table 3.17: Summary of data for pre-1967 San Patricio County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Pre '67 P&A w/ Form 4	Possible Pre '67 P&A No Form4
Starr	Garcia	6	0	0	0	6	0
	Jay Simmons	2	1	0	0	1	0
	Kelsey S.	3	0	0	1	2	0
	Reyna	1	0	0	0	1	0
	Ricaby	4	0	0	0	2	2
	Rincon	12	0	0	0	12	0
	Sun	4	0	0	1	3	0
	Sun N.	7	0	0	0	7	0
	TOTAL	39	1	0	2	34	2

Table 3.18: Summary of data for pre-1967 Starr County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	Total Wells	Not Abd.	No Int.	Post '66 P&A	Pre '67 P&A w/ Form 4	Possible Pre '67 P&A No Form4
Victoria	Bloomington	2	0	0	0	2	0
	Coletto Creek	3	1	0	0	1	1
	Helen Gohlke	1	0	0	0	1	0
	Helen Gohlke W.	1	0	0	0	1	0
	Heyser	1	0	0	0	1	0
	Keeran	2	0	0	0	2	0
	McFaddin	2	0	1	0	2	0
	Placedo	4	0	0	0	4	0
	Placedo E.	3	0	0	0	3	0
	Pridham Lake	2	0	0	0	1	1
	TOTAL	21	1	1	0	18	2

Table 3.19: Summary of data for pre-1967 Victoria County abandoned wells. Wells identified from PI abandoned well database. Data from TRRC files.

County	Field	API #	Current Status	Form 4	P&A Date	Comments:
Brazoria						
	Bryan Mound					
		039-04538	P&A?	N	-	No Forms. PI Data show no intersection.
		039-04558	P&A	Y	05-01-64	No intersection.
		039-04555	P&A	Y	05-14-40	No intersection.
	Damon Mound					
		039-02024	P&A	Y	11-26-55	
		039-02034	P&A	Y	04-16-49	
		039-02049	P&A	Y	04-15-54	
		039-02057	P&A	Y	01-10-55	
		039-02068	P&A	Y	06-10-53	
		039-02092	P&A	Y	04-09-58	
		039-02093	P&A	Y	04-16-58	
		039-02099	P&A	Y	09-02-58	
		039-02131	P&A	Y	10-01-36	
		039-02164	P&A	Y	06-26-53	
		039-02168	P&A	Y	08-11-48	No intersection. TD:382'
		039-02178	P&A	Y	07-11-61	
		039-02185	P&A?	N	-	No P&A data; Form 1 only.
		039-02257	P&A	Y	09-27-54	
		039-02267	P&A?	N	-	No P&A data; Form 1 only.
		039-02269	P&A	Y	03-25-57	
		039-02289	P&A	Y	12-22-49	
		039-02290	P&A	Y	11-23-49	
		039-02333	P&A?	N	-	No P&A data; Form 1 only.
		039-02361	P&A	Y	07-16-43	
		039-02363	P&A?	N	-	No P&A data; Forms 1 & 2.
		039-02422	P&A?	N	-	No P&A data; no intersection. TD:647'
		039-02433	P&A?	N	-	No P&A data; no intersection. TD: 447'
		039-02466	P&A?	N	-	No P&A data; Form 1; mud fill(drillers log
		039-02622	P&A?	N	-	No Forms; letter req. permit be cancelled.

Table 3.20: Data for pre-1967 abandoned wells in Brazoria, Chambers, Hardin, Jackson, Nueces, San Patricio, Starr and Victoria Counties. Wells identified from PI abandoned well database. Data from TRRC files.

Table 3.20: Continued

039-02658	P&A?	Y	09-28-33		
039-02667	P&A	Y	07-27-54		
039-02689	P&A	Y	09-26-54		
039-04906	P&A?	N	-	No P&A data; Form 1 only.	
Damon Mound E					
(A)	P&A	Y	04-07-56		
(B)	P&A	Y	10-20-55		
Danbury					
039-01599	P&A	Y	03-16-40		
039-01634	P&A	Y	02-14-49		
039-01635	P&A	Y	01-21-53		
039-01639	P&A	Y	12-31-30		
039-01643	P&A	Y	04-29-38		
039-01650	P&A	Y	09-05-48		
039-01710	P&A	Y	04-08-42		
039-01751	P&A?	N	-	No P&A data; Form 1 only.	
039-01790	P&A	Y	10-10-34		
039-04251	P&A	Y	07-11-54		
039-04260	P&A	Y	02-14-90	Post 66	
Hastings E					
039-00765	P&A	Y	06-06-63		
Hoskins Mound					
039-04920	P&A	Y	07-24-66	No intersection. TD: 919'	
039-05061	P&A	Y	08-05-76	Post 66	
039-05067	P&A	Y	09-26-94	Post 66	
039-30005	P&A	Y	05-21-84	Post 66	
Lochridge					
039-01847	P&A	Y	07-30-43		
039-01890	Producer	na	na		

	Manvel	039-00016	P&A	Y	07-01-57	
		039-00019	P&A	Y	05-27-63	
		039-00022	P&A	Y	04-03-44	
		039-00030	P&A	Y	09-16-37	
		039-00078	P&A	Y	05-23-60	
		039-00192	P&A	Y	05-13-57	
		039-01211	P&A?	N	-	No P&A data; Form 1 only.
		039-01308	P&A	Y	08-01-34	
		039-01310	P&A	Y	04-13-35	
		039-04877	P&A	Y	11-20-65	
	Nash Dome					
		039-01971	P&A	Y	05-09-55	
		039-04761	P&A	Y	11-22-63	
		039-04852	P&A	Y	11-11-66	
		039-05034	P&A	Y	06-15-73	Post 66.
	Old Ocean					
		039-02811	P&A	Y	02-11-39	
		039-04024	P&A	Y	07-27-45	
	West Columbia					
		039-02872	P&A?	N	-	No P&A data; Form 1 & App. To Plug.
		039-02885	P&A?	N	-	No P&A data; Form 1 only.
		039-02888	P&A	Y	??-??-49	
		039-03015	P&A?	N	-	No P&A data; Form 1 only (intent to plug)
		039-03187	P&A?	N	-	No Forms.
		039-03203	P&A	Y	12-29-24	
		039-03209	P&A?	N	-	No P&A data; Form 1 only.
		039-03220	P&A	Y	10-01-90	Post 66.
		039-03266	P&A	Y	10-14-23	
		039-03267	P&A	Y	11-30-20	
		039-03273	P&A	Y	10-05-19	
		039-03285	P&A	Y	09-10-20	

Table 3.20: Continued

		039-03434	P&A	Y	11-11-52	
		039-03476	P&A	Y	08-14-53	
		039-03493	P&A	Y	01-31-57	
		039-03516	P&A?	N	-	Form 1 (shows intent to plug).
		039-03519	P&A?	N	-	No Forms.
		039-03528	P&A	Y	10-05-52	
		039-03597	P&A	Y	06-28-55	
		039-03639	P&A	Y	06-29-33	
		039-03653	P&A	Y	04-29-23	
		039-03657	P&A	Y	04-17-20	
		039-03737	P&A?	N	-	No Forms.
		039-03743	P&A	Y	08-27-56	
Chambers						
	Anahuac					
		071-01243	P&A	Y	05-24-38	
		071-01449	P&A	Y	02-20-38	
		071-01597	P&A	Y	11-12-47	
		071-01625	P&A	Y	08-27-87	Post 66.
		071-01682	P&A	Y	11-02-79	Post 66.
	Barbers Hill					
		071-00020	P&A	Y	12-22-81	Post 66.
		071-00066	P&A	Y	06-19-62	
		071-00095	P&A?	N	-	Forms 1 & 2.
		071-00112	P&A?	N	-	Form 1 only.
		071-00225	P&A	Y	11-10-63	
		071-00245	P&A	Y	10-09-84	Post 66.
		071-00264	P&A	Y	09-30-53	
		071-00266	P&A	Y	05-11-67	
		071-00360	P&A	Y	05-20-58	
		071-00544	P&A?	N	-	Forms 1, 2 & SW-1.
		071-00649	P&A	Y	05-01-29	
		071-00684	Producer	na	na	
		071-00706	Shut-in	na	na	

Table 3.20: Continued

		071-00727	P&A	Y	77-24-26	
		071-00767	P&A	Y	08-14-56	
		071-00791	Producer	na	na	
	Fig Ridge					
		071-01867	P&A?	N	-	Form 1 & 2A.
		071-01929	P&A	Y	05-27-43	
	High Island					
		071-02263	P&A	Y	02-22-47	
		071-03380	P&A	Y	09-14-83	Post 66.
	Lost Lake					
		071-01060	P&A	Y	11-09-61	
		071-01078	P&A	Y	05-20-47	
		071-03423	P&A?	N	-	
	Moss Bluff					
		071-01083	P&A	Y	11-25-51	
		071-01099	P&A?	N	-	Form 2 only.
	Oyster Bayou					
		071-02344	P&A?	N	-	Form 1 only.
		071-02349	P&A	Y	11-24-50	
	Stowell					
		071-01824	Producer	na	na	
		071-03416	P&A?	N	-	No Forms; PI shows Post 66.
Hardin						
	Arriola					
		199-03063	P&A	Y	12-17-34	
		199-03077	P&A?	N	-	Form 1 only.
		199-03079	P&A	Y	10-17-32	
		199-03093	P&A	Y	09-24-59	

Table 3.20: Continued

	Batson New					
		199-00818	P&A	Y	10-04-55	
		199-00834	P&A?	N	-	No Forms.
		199-00844	P&A?	N	-	Form 1 & SW-1.
		199-00871	P&A	Y	01-18-57	
		199-00880	P&A	Y	03-27-51	
		199-02051	P&A?	N	-	Form 1 only.
		199-02077	P&A?	N	-	Form 1 only.
		199-02091	P&A?	N	-	No Forms.
		199-02092	P&A?	N	-	Form 1 only.
	Batson Old					
		199-00832	P&A	Y	12-27-57	
		199-00998	P&A?	N	-	Forms 1 & 2.
		199-01195	P&A?	N	-	No intersection; Form 1 only. TD: 456'
		199-01278	P&A	N	-	No intersection. Forms 1 & 2. TD:1162'
		199-01296	P&A	Y	12-23-57	No intersection. TD: 837'
		199-01311	P&A?	N	-	No intersection. Forms 1 & 2. TD:1306'
		199-01458	P&A	Y	11-7-61	
		199-02086	P&A	Y	09-15-34	
		199-02089	P&A	Y	06-12-58	
		199-03139	P&A	Y	10-06-64	No intersection. TD: 535'
		199-03209	P&A?	N	-	No intersection. Form 1 only. TD:920'
		199-03308	P&A	Y	07-24-65	
		199-03412	P&A	Y	04-11-77	No intersection; Post 66. TD: 366'
	Saratoga					
		199-00701	P&A	Y	02-18-52	
		199-00743	P&A	Y	04-11-50	
		199-00944	P&A	Y	08-22-75	Post 66.
		199-00967	P&A	Y	12-05-51	
		199-00973	P&A	Y	04-26-56	
		199-01530	P&A	Y	08-16-59	

Table 3.20: Continued

		199-01587	P&A	Y	02-25-58	
		199-01631	P&A?	N	-	Forms 1 & 2.
		199-01633	P&A	Y	04-01-60	
		199-01660	P&A?	N	-	Forms 1 & 2.
		199-01661	P&A	Y	10-06-57	
		199-01691	P&A?	N	-	Form 1 only.
		199-01695	P&A	Y	08-03-59	
		199-01779	P&A?	N	-	Form 1 only.
		199-01897	P&A	Y	02-19-51	
		199-02099	P&A	Y	10-24-55	
	Saratoga West					
		199-01555	P&A	Y	08-16-58	
		199-01671	P&A	Y	02-01-55	
	Sour Lake					
		199-02158	P&A?	N	-	No P&A data.
		199-02168	P&A	Y	11-30-50	
		199-02172	P&A	Y	10-29-54	
		199-02181	P&A	Y	02-27-53	
		199-02263	P&A	Y	04-24-49	
		199-02276	P&A	Y	12-01-50	
		199-02334	P&A	Y	07-14-39	
		199-02450	P&A	Y	09-27-45	
		199-02451	P&A	Y	02-24-48	
		199-02452	P&A	Y	12-12-42	
		199-02454	P&A	Y	04-22-43	
		199-02461	P&A	Y	07-27-48	
		199-02595	P&A	Y	08-20-62	
		199-02628	P&A	Y	01-28-63	
		199-02638	P&A	Y	03-13-61	
		199-02641	P&A	Y	05-01-62	
		199-02664	P&A	Y	08-24-54	
		199-02713	P&A?	N	-	No P&A data.
		199-02728	P&A	Y	10-05-47	

Table 3.20: Continued

		199-02740	P&A?	N	-	No P&A data.
		199-02742	P&A	Y	08-08-50	
		199-02836	P&A	Y	07-27-59	
		199-02858	P&A	Y	12-13-47	
		199-02954	P&A	Y	02-03-50	
		199-02977	P&A	Y	05-18-67	
		199-03167	P&A	Y	07-26-76	Post 66.
		199-03174	P&A	Y	08-19-66	
		199-03186	P&A	Y	10-24-84	Post 66.
		199-03187	P&A	Y	10-24-84	Post 66.
Jackson						
	Cordele					
		239-00157	P&A	Y	10-13-58	
		239-03879	P&A	Y	06-02-39	
		239-03881	P&A	Y	03-28-45	
	Ganado					
		239-00772	P&A	Y	06-27-41	
		239-01062	P&A	Y	03-29-45	
	Ganado West					
		239-00525	P&A	Y	06-24-42	
		239-00532	P&A	Y	07-12-46	
		239-03464	P&A	Y	04-27-65	
	La Ward North					
		239-01207	P&A	Y	03-27-73	Post 66.
		239-01250	P&A	Y	11-30-44	
		239-01378	P&A	Y	12-14-44	
		239-01629	P&A	Y	09-05-43	
	Lolita					
		239-02002	P&A?	N	-	Form 1 only.
		239-02010	P&A	Y	10-04-62	

Table 3.20: Continued

		239-02130	P&A	Y	04-11-48	
	Maurbro					
		239-01090	P&A	Y	10-24-62	
		239-01107	P&A	Y	01-22-41	
	Stewart					
		239-01073	P&A	Y	12-20-58	
		239-03892	P&A	Y	09-11-42	
	West Ranch					
		239-02289	P&A?	N	-	Form 1 & App. to Plug.
		239-02821	P&A	Y	01-08-62	
		239-02940	P&A	Y	01-23-46	
		239-03338	P&A?	N	-	Forms 1 & 2.
	Nueces					
	Agua Dulce					
		355-00316	P&A	Y	07-05-50	
		355-00346	P&A	Y	11-21-54	
		355-00364	P&A	Y	08-02-85	Post 66.
		355-00429	P&A	Y	08-19-54	
		355-00433	P&A	Y	01-10-59	
		355-00448	P&A	Y	03-16-58	
		355-00553	P&A	Y	01-25-45	
		355-00724	P&A	Y	10-05-51	
		355-04672	P&A?	N	-	Form 1 only.
		355-04675	P&A	Y	04-27-46	
		355-04704	Producer	na	na	
		355-04714	P&A	Y	06-22-39	
		355-05017	P&A?	N	-	Form 1 & 2-A (App. to Plug).
		355-05252	P&A?	N	-	Form 1 & 2.
		355-06212	P&A	Y	07-24-66	
		355-06233	P&A	Y	08-18-66	

Table 3.20: Continued

	Baldwin					
		355-03326	P&A	Y	01-20-44	
		355-03375	P&A	Y	04-11-51	
		355-03390	P&A	Y	01-01-54	
	Clara Driscoll					
		355-04355	P&A	Y	09-08-57	
		355-04369	P&A	Y	08-14-37	
		355-04654	P&A	Y	08-20-54	
	London Gin					
		355-03254	P&A	Y	03-10-56	
		355-03255	P&A	Y	02-02-56	
		355-03423	P&A	Y	04-23-50	
	Richard King					
		355-00094	P&A	Y	11-08-56	
		355-00188	P&A	Y	08-21-33	
	Saxet					
		355-01314	P&A	Y	04-08-41	
		355-01352	P&A	Y	02-13-36	
		355-01374	P&A	Y	03-17-76	Post 66.
		355-01471	P&A	Y	10-08-40	
		355-01552	P&A?	N	-	Forms 1 & 2; well cratered in 1932.
		355-01590	P&A	Y	11-14-70	Post 66.
		355-01610	P&A	Y	09-03-86	Post 66.
		355-01614	P&A	Y	03-19-49	
		355-01630	P&A	Y	03-18-58	
		355-01635	P&A	Y	04-11-60	
		355-01643	P&A	Y	04-24-54	
		355-01718	P&A	Y	01-23-63	
		355-01885	P&A	Y	04-13-49	
		355-02123	P&A	Y	12-07-73	Post 66.
		355-02344	P&A	Y	11-25-31	

Table 3.20: Continued

		355-05767	P&A	Y	06-09-64	
		355-05804	P&A	Y	10-28-64	
		355-05986	P&A	Y	03-22-65	
		355-06099	P&A	Y	11-24-65	
	White Point E.					
		355-02209	P&A	Y	02-09-45	
		355-02220	P&A?	N	-	
	San Patricio					
	Midway					
		409-02665	P&A	Y	01-13-50	
		409-02738	P&A	Y	04-13-50	
		409-02755	P&A	Y	10-17-43	
		409-02902	P&A	Y	12-02-48	
		409-02905	P&A	Y	07-08-53	
		409-02934	P&A	Y	01-18-52	
		409-04062	P&A	Y	09-26-64	
	Odem					
		409-03782	P&A	Y	06-05-42	
		409-03876	P&A	Y	04-20-66	
	Plymouth					
		409-01251	P&A	Y	03-26-37	
		409-01474	P&A	Y	10-28-36	
		409-01517	P&A	Y	02-06-63	
		409-01526	P&A?	N	-	Form 3 only.
		409-01842	P&A	Y	01-21-38	
	Plymouth E.					
		409-02076	P&A	Y	03-21-54	
		409-02080	P&A	Y	09-15-70	Post 66.
	Portilla					

Table 3.20: Continued

		409-01728	P&A	Y	07-27-53	
	Sinton W.					
		409-00418	P&A	Y	12-16-48	
		409-00456	P&A?	N	-	Forms 1, 2 & SW-1.
		409-00557	P&A	Y	09-10-50	
		409-00642	P&A	Y	06-05-62	
		409-00710	P&A	Y	10-08-50	
		409-00842	P&A?	N	-	Form 1 only.
	Taft					
		409-01305	P&A?	N	-	Form 1 only.
		409-01345	P&A	Y	12-19-52	
		409-01972	P&A	Y	12-28-37	
	White Point E.					
		409-02813	P&A	Y	08-21-50	
		409-03189	Producer	na	na	
		409-03335	P&A	Y	08-25-54	
	Starr					
	Garcia					
		427-03906	P&A	Y	04-01-48	
		427-04083	P&A	Y	03-27-52	
		427-04094	P&A	Y	12-24-50	
		427-04229	P&A	Y	03-07-46	
		427-04233	P&A	Y	01-06-54	
		427-04250	P&A	Y	06-29-44	
	Jay Simmons					
		427-00305	Producer	na	na	
		427-00374	P&A	Y	01-02-58	
	Kelsey S.					
		427-00196	P&A	Y	09-21-84	Post 66.

Table 3.20: Continued

		427-00336	P&A	Y	02-02-49	
		427-04800	P&A	Y	03-07-66	
	Reyna					
		427-02365	P&A	Y	03-21-56	
	Ricaby					
		427-02969	P&A	Y	01-16-57	
		427-02973	P&A?	N	-	No Forms.
		427-03038	P&A	Y	05-27-50	
		427-03131	P&A?	N	-	Forms 1 & 2.
	Rincon					
		427-01493	P&A	Y	04-25-52	
		427-01536	P&A	Y	06-03-41	
		427-03005	P&A	Y	11-21-41	
		427-03382	P&A	Y	02-21-52	
		427-03390	P&A	Y	05-22-44	
		427-03709	P&A	Y	11-05-50	
		427-03729	P&A	Y	04-10-55	
		427-03743	P&A	Y	02-24-51	
		427-03756	P&A	Y	12-30-51	
		427-03759	P&A	Y	06-19-43	
		427-03866	P&A	Y	01-10-51	
		427-03878	P&A	Y	08-26-52	
	Sun					
		427-00899	P&A	Y	05-19-48	
		427-00941	P&A	Y	05-13-40	
		427-04418	P&A	Y	12-27-63	
		427-04873	P&A	Y	08-10-79	Post 66.
	Sun N.					
		427-00493	P&A	Y	11-03-43	
		427-00508	P&A	Y	02-27-48	

Table 3.20: Continued

		427-00619	P&A	Y	08-02-63	
		427-00640	P&A	Y	08-29-59	
		427-00648	P&A	Y	04-22-47	
		427-00654	P&A	Y	06-22-47	
		427-04704	P&A	Y	09-26-65	
Victoria						
	Bloomington					
		469-01684	P&A	Y	06-30-52	
		469-02896	P&A	Y	01-08-66	
	Coletto Creek					
		469-01124	P&A?	N	-	Forms 1 & 2.
		469-01223	Injector	na	na	
		469-01336	P&A	Y	08-05-54	
	Helen Gohlke					
		469-00106	P&A	Y	04-20-52	
	Helen Gohlke W.					
		469-00067	P&A	Y	10-27-53	
	Heyser					
		469-01986	P&A	Y	10-20-38	
	Keeran					
		469-00238	P&A	Y	02-20-62	
		469-02949	P&A	Y	03-14-66	
	McFaddin					
		469-01570	P&A	Y	07-18-32	No intersection. TD: 2840'
		469-02282	P&A	Y	09-04-54	
	Placedo					
		469-01868	P&A	Y	10-17-53	

Table 3.20: Continued

		469-01879	P&A	Y	02-05-42	
		469-01972	P&A	Y	04-13-63	
		469-02583	P&A	Y	05-27-56	
	Placedo E.					
		469-02710	P&A	Y	07-10-53	
		469-02749	P&A	Y	09-23-59	
		469-02812	P&A	Y	06-29-55	
	Pridham Lake					
		469-00994	P&A	Y	01-06-60	
		469-01041	P&A?	N	-	Form 1 only.

Table 3.20: Continued

County	Field	1	2	3	4	5	6
Brazoria							
	Bryan Mound	-	4610	-	na	na	na
	Damon Mound	1550	950	1060	na	na	na
	Damon Mound E.	1150	1850	1855	na	na	na
	Danbury Dome	1250	1600	1600	na	na	na
	Hastings E.	1700	1830	1850	2620	920	920/390 = 2.36
	Hoskins Mound	1000	1331	1331	na	na	na
	Lochridge	1300	1900	1900	2120	820	820/300 = 2.73
	Manvel	2000	1650	1950	2525	525	525/250 = 2.10
	Nash Dome	1150	3212	4510	na	na	na
	Old Ocean	1200	1675	1698	2390	na	na
	West Columbia	1000	590	590	na	na	na
							Avg = 2.40

Table 3.21: Data for Brazoria County study fields. Data from Appendix 1 and Appendix 2. Columns 1-6 include:

Column 1 - Deepest base of usable quality groundwater for any UIC database well in the field.

Column 2 - The shallowest permitted top of injection for any UIC database well in the field.

Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.

Column 4 - The base of the shale isolation section from the field log in Appendix 2.

Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.

Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

County	Field	1	2	3	4	5	6
Chambers							
	Anahuac	1450	1000	1200	2135	685	$685/250 = 2.74$
	Barbers Hill	1800	575	975	na	na	na
	Fig Ridge	1250	1000	1000	1935	685	$685/360 = 1.90$
	High Island	100	9330	-	na	na	na
	Lost Lake	500	1107	1940	1995	na	na
	Moss Bluff	700	5565	5565	na	na	na
	Oyster Bayou	1250	1400	1400	3170	1920	$1920/700 = 2.74$
	Stowell	600	1177	1600	1125	525	$525/250 = 2.10$
							Avg = 2.37

Table 3.22: Data for Chambers County study fields. Data from Appendix 1 and Appendix 2. Columns 1-6 include:

Column 1 - Deepest base of usable quality groundwater for any UIC database well in the field.

Column 2 - The shallowest permitted top of injection for any UIC database well in the field.

Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.

Column 4 - The base of the shale isolation section from the field log in Appendix 2.

Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.

Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

County	Field	1	2	3	4	5	6
Hardin							
	Arriola	1700	2610	2610	na	na	na
	Batson New	1550	1825	2150	na	na	na
	Batson Old	1900	238	238	na	na	na
	Saratoga	2250	350	834	na	na	na
	Saratoga W.	2250	2373	2373	na	na	na
	Sour Lake	1900	400	400	na	na	na

Table 3.23: Data for Hardin County study fields. Data from Appendix 1 and Appendix 2. Columns 1-6 include:

Column 1 - Deepest base of usable quality groundwater for any UIC database well in the field.

Column 2 - The shallowest permitted top of injection for any UIC database well in the field.

Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.

Column 4 - The base of the shale isolation section from the field log in Appendix 2.

Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.

Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

County	Field	1	2	3	4	5	6
Jackson							
	Cordele	1450	1855	2130	1850	400	$400/250 = 1.60$
	Ganado	1700	2170	3850	2400	na	na
	Ganado W.	2150	1885	3975	2450	300	$300/250 = 1.20$
	La Ward N.	1575	1400	1920	2235	660	$660/250 = 2.64$
	Lolita	1650	1678	1767	2470	820	$820/250 = 3.28$
	Maurbro	1600	2000	2100	2110	510	$510/295 = 1.73$
	Stewart	1750	4100	4100	2275	525	$525/280 = 1.87$
	West Ranch	1600	1885	3540	2330	730	$730/375 = 1.95$
							Avg = 2.04

Table 3.24: Data for Jackson County study fields. Data from Appendix 1 and Appendix 2. Columns 1-6 include:

Column 1 - Deepest base of usable quality groundwater for any UIC database well in the field.

Column 2 - The shallowest permitted top of injection for any UIC database well in the field.

Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.

Column 4 - The base of the shale isolation section from the field log in Appendix 2.

Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.

Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

County	Field	1	2	3	4	5	6
Nueces							
	Aqua Dulce	1150	1490	2670	1500	435	$435/250 = 1.82$
	Baldwin	500	1550	2400	1650	na	na
	Clara Driscoll	1000	2200	2200	1790	790	$790/280 = 2.82$
	London Gin	950	1500	2016	1735	785	$785/250 = 3.14$
	Richard King	1150	1600	2050	2075	925	$925/350 = 2.64$
	Saxet	900	1799	1799	1770	870	$870/440 = 1.98$
	White Point E.	100	3040	3040	1665	na	na
							Avg = 2.48

Table 3.25: Data for Nueces County study fields. Data from Appendix 1 and Appendix 2. Columns 1-6 include:

Column 1 - Deepest base of usable quality groundwater for any UIC database well in the field.

Column 2 - The shallowest permitted top of injection for any UIC database well in the field.

Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.

Column 4 - The base of the shale isolation section from the field log in Appendix 2.

Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.

Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

County	Field	1	2	3	4	5	6
Refugio							
	Bonnie View	1200	3362	3650	1760	560	$560/270 = 2.07$
	Greta	1650	1600	1795	2170	520	$520/320 = 1.62$
	Lake Pasture	1525	3074	3416	1920	395	$395/295 = 1.34$
	La Rosa	1200	2650	4500	2350	1150	$1150/425 = 2.70$
	McFaddin	1640	1635	2000	1975	325	$325/250 = 1.30$
	M. E. O'Connor	1300	1800	1800	1835	635	$535/250 = 2.14$
	New Refugio	1300	2610	2610	1825	na	na
	Old Refugio	1280	1750	4290	1645	355	$365/250 = 1.46$
	Tom O'Connor	1500	1700	2950	2080	580	$580/250 = 2.32$
							Avg = 2.07

Table 3.26: Data for Refugio County study fields. Data from Appendix 1 and Appendix 2. Columns 1-6 include:

Column 1 - Deepest base of usable quality groundwater for any UIC database well in the field.

Column 2 - The shallowest permitted top of injection for any UIC database well in the field.

Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.

Column 4 - The base of the shale isolation section from the field log in Appendix 2.

Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.

Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

County	Field	1	2	3	4	5	6
San Patricio							
	Midway	1080	1540	1604	1780	700	700/270 = 2.59
	Odern	350	1300	2200	2120	na	na
	Plymouth	1080	1500	1500	1930	850	850/450 = 1.89
	Plymouth E.	500	1400	1400	1720	1220	1220/255 = 4.78
	Portilla	1170	1000	1000	1935	765	765/250 = 3.06
	Sinton W.	1050	1110	1484	1420	370	370/250 = 1.48
	Taft	750	1360	3475	2075	1325	1325/400 = 3.30
	White Point E.	300	1275	1275	1610	1310	1310/260 = 5.03
							Avg = 3.16

Table 3.27: Data for San Patricio County study fields. Data from Appendix 1 and Appendix 2. Columns 1-6 include:

Column 1 - Deepest base of usable quality groundwater for any UIC database well in the field.

Column 2 - The shallowest permitted top of injection for any UIC database well in the field.

Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.

Column 4 - The base of the shale isolation section from the field log in Appendix 2.

Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.

Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

County	Field	1	2	3	4	5	6
		1					
Starr							
	Garcia	250	3149	3727	1005	755	$755/250 = 3.02$
	Jay Simmons	1500	5735	6050	2060	560	$560/295 = 1.90$
	Kelsey S.	1500	5240	5240	2145	645	$645/295 = 2.19$
	Reyna	400	649	-	720	320	$320/250 = 1.28$
	Ricaby	250	1367	1367	865	na	na
	Rincon	550	1680	1680	1020	na	na
	Sun	1200	3830	3835	2310	na	na
	Sun N.	1200	3306	4346	2090	890	$890/290 = 3.07$
							Avg = 2.29

Table 3.28: Data for Starr County study fields. Data from Appendix 1 and Appendix 2. Columns 1-6 include:

Column 1 - Deepest base of usable quality groundwater for any UIC database well in the field.

Column 2 - The shallowest permitted top of injection for any UIC database well in the field.

Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.

Column 4 - The base of the shale isolation section from the field log in Appendix 2.

Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.

Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

County	Field	1	2	3	4	5	6
Victoria							
	Bloomington	2050	3300	3300	2580	530	530/320 = 1.66
	Coletto Creek	1560	1560	2413	2030	480	480/250 = 1.92
	Helen Gohlke	1250	1250	3350	2100	850	850/250 = 3.40
	Helen Gohlke W.	1900	1920	1920	2435	535	535/290 = 1.84
	Heyser	1700	1992	4100	2060	360	360/250 = 1.44
	Keeran	2100	3336	3400	2430	330	330/250 = 1.32
	McFaddin	1800	3600	3600	2200	400	400/250 = 1.60
	Placedo	2000	1954	1954	2390	390	390/250 = 1.56
	Placedo E.	2000?	2350	2350	2340	340	340/250 = 1.36
	Pridham Lake	1800	1728	1960	2330	530	530/340 = 1.56
							Avg = 1.77

Table 3.29: Data for Victoria County study fields. Data from Appendix 1 and Appendix 2. Columns 1-6 include:

Column 1 - Deepest base of usable quality groundwater for any UIC database well in the field.

Column 2 - The shallowest permitted top of injection for any UIC database well in the field.

Column 3 - The shallowest permitted top of injection for any active UIC database well in the field.

Column 4 - The base of the shale isolation section from the field log in Appendix 2.

Column 5 - The total thickness of interval from the base of usable quality groundwater to the base of the shale isolation section. This value is not given where the field log of Appendix 2 did not extend to the base of usable quality groundwater.

Column 6 - Column 5 divided by the actual amount (feet) of shale in the total Column 5 interval as shown in the field logs of Appendix 2.

County	Field	API #	Current Status	BP	TP	# Plugs	Form 4	250' Total Shale	100' Cont. Shale	P&A Date	Comments:
Brazoria	Bryan Mound										
		039-04538	P&A?	-	-	-	N	na	na	-	No Forms. PI Data show no intersection.
		039-04558	P&A				Y	na	na	05-01-64	No intersection.
		039-04555	P&A				Y	na	na	05-14-40	No intersection.
	Damon Mound										
		039-02024	P&A				Y	na	na	11-26-55	
		039-02034	P&A				Y	na	na	04-16-49	
		039-02049	P&A				Y	na	na	04-15-54	
		039-02057	P&A				Y	na	na	01-10-55	
		039-02068	P&A				Y	na	na	06-10-53	
		039-02092	P&A				Y	na	na	04-09-58	
		039-02093	P&A				Y	na	na	04-16-58	
		039-02099	P&A				Y	na	na	09-02-58	
		039-02131	P&A				Y	na	na	10-01-36	
		039-02164	P&A				Y	na	na	06-26-53	
		039-02168	P&A				Y	na	na	08-11-48	No intersection. TD: 382'
		039-02178	P&A				Y	na	na	07-11-61	
		039-02185	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1 only.
		039-02257	P&A				Y	na	na	09-27-54	
		039-02267	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1 only.
		039-02269	P&A				Y	na	na	03-25-57	
		039-02289	P&A				Y	na	na	12-22-49	
		039-02290	P&A				Y	na	na	11-23-49	
		039-02333	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1 only.
		039-02361	P&A				Y	na	na	07-16-43	
		039-02363	P&A?	-	-	-	N	na	na	-	No P&A data; Forms 1 & 2.
		039-02422	P&A?	-	-	-	N	na	na	-	No P&A data; no intersection. TD: 647'
		039-02433	P&A?	-	-	-	N	na	na	-	No P&A data; no intersection. TD: 447'
		039-02466	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1; mud fill(drillers log).
		039-02622	P&A?	-	-	-	N	na	na	-	No Forms; letter req. permit be cancelled.

Table 3.30: Data for flow-barrier analysis for pre-1967 abandoned wells in all Texas Gulf Coast Study counties. This table combines data from Tables 3.10 and 3.20 and adds the flow-barrier data columns. The 250' Total Shale Column and 100' Continuous Shale Column confirm the availability of those shale intervals as determined from the well logs of Appendix 2. An "na" in those columns applies to shallow to shallow-intermediate depth salt dome fields.

BP = Number of behind pipe flow barriers, including cement and squeezing shale barriers.

TP = Number of through pipe (or through open borehole) flow barriers, including casing, cement plugs and squeezing shale barriers.

Plugs = Number of TP cement plugs or squeezing shale barriers.

This analysis is only performed for wells without a Form 4.

		039-02658	P&A?				Y	na	na	09-28-33	
		039-02667	P&A				Y	na	na	07-27-54	
		039-02689	P&A				Y	na	na	09-26-54	
		039-04906	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1 only.
	Damon Mound E										
	(A)	039-02039	P&A				Y	na	na	04-07-56	
	(B)	039-02039	P&A				Y	na	na	10-20-55	
	Danbury										
		039-01599	P&A				Y	na	na	03-16-40	
		039-01634	P&A				Y	na	na	02-14-49	
		039-01635	P&A				Y	na	na	01-21-53	
		039-01639	P&A				Y	na	na	12-31-30	
		039-01643	P&A				Y	na	na	04-29-38	
		039-01650	P&A				Y	na	na	09-06-48	
		039-01710	P&A				Y	na	na	04-08-42	
		039-01751	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1 only.
		039-01790	P&A				Y	na	na	10-10-34	
		039-04251	P&A				Y	na	na	07-11-54	
		039-04260	P&A				Y	na	na	02-14-90	Post 66.
	Hastings E										
		039-00765	P&A				Y	Y	Y	06-06-63	
	Hoskins Mound										
		039-04920	P&A				Y	na	na	07-24-66	No intersection. TD: 919'
		039-05061	P&A				Y	na	na	08-05-76	Post 66.
		039-05067	P&A				Y	na	na	09-26-94	Post 66.
		039-30005	P&A				Y	na	na	05-21-84	Post 66.
	Lochridge										
		039-01847	P&A				Y	Y	Y	07-30-43	
		039-01890	Producer	-	-	-	na	Y	Y	na	

Table 3.30: Continued

	Manvel										
		039-00016	P&A				Y	Y	Y	07-01-57	
		039-00019	P&A				Y	Y	Y	05-27-63	
		039-00022	P&A				Y	Y	Y	04-03-44	
		039-00030	P&A				Y	Y	Y	09-16-37	
		039-00078	P&A				Y	Y	Y	05-23-60	
		039-00192	P&A				Y	Y	Y	05-13-57	
		039-01211	P&A?	na	1	1	N	Y	Y	-	No P&A data; Form 1 only.
		039-01308	P&A				Y	Y	Y	08-01-34	
		039-01310	P&A				Y	Y	Y	04-13-35	
		039-04877	P&A				Y	Y	Y	11-20-65	
	Nash Dome										
		039-01971	P&A				Y	na	na	05-09-55	
		039-04761	P&A				Y	na	na	11-22-63	
		039-04952	P&A				Y	na	na	11-11-66	
		039-05034	P&A				Y	na	na	06-15-73	Post 66.
	Old Ocean										
		039-02811	P&A				Y	Y	Y	02-11-39	
		039-04024	P&A				Y	Y	Y	07-27-45	
	West Columbia										
		039-02872	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1 & App. To Plug.
		039-02885	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1 only.
		039-02888	P&A				Y	na	na	??-??-49	
		039-03015	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1 only (intent to plug).
		039-03187	P&A?	-	-	-	N	na	na	-	No Forms.
		039-03203	P&A	-	-	-	Y	na	na	12-29-24	
		039-03209	P&A?	-	-	-	N	na	na	-	No P&A data; Form 1 only.
		039-03220	P&A	-	-	-	Y	na	na	10-01-90	Post 66.
		039-03266	P&A				Y	na	na	10-14-23	
		039-03267	P&A				Y	na	na	11-30-20	
		039-03273	P&A				Y	na	na	10-05-19	
		039-03285	P&A				Y	na	na	09-10-20	

Table 3.30: Continued

		039-03434	P&A				Y	na	na	11-11-52	
		039-03476	P&A				Y	na	na	08-14-53	
		039-03493	P&A				Y	na	na	01-31-57	
		039-03516	P&A?	-	-	-	N	na	na	-	Form 1 (shows intent to plug).
		039-03519	P&A?	-	-	-	N	na	na	-	No Forms.
		039-03528	P&A				Y	na	na	10-05-52	
		039-03597	P&A				Y	na	na	06-28-55	
		039-03639	P&A				Y	na	na	06-29-33	
		039-03653	P&A				Y	na	na	04-29-23	
		039-03657	P&A				Y	na	na	04-17-20	
		039-03737	P&A?	-	-	-	N	na	na	-	No Forms.
		039-03743	P&A				Y	na	na	08-27-56	
Chambers											
	Anahuac										
		071-01243	P&A				Y	Y	Y	05-24-38	
		071-01449	P&A				Y	Y	Y	02-20-38	
		071-01597	P&A				Y	Y	Y	11-12-47	
		071-01625	P&A				Y	Y	Y	08-27-87	Post 66.
		071-01682	P&A				Y	Y	Y	11-02-79	Post 66.
	Barbers Hill										
		071-00020	P&A				Y	na	na	12-22-81	Post 66.
		071-00066	P&A				Y	na	na	06-19-62	
		071-00095	P&A?	-	-	-	N	na	na	-	Forms 1 & 2.
		071-00112	P&A?	-	-	-	N	na	na	-	Form 1 only.
		071-00225	P&A				Y	na	na	11-10-63	
		071-00245	P&A				Y	na	na	10-09-84	Post 66.
		071-00264	P&A	-	-	-	Y	na	na	09-30-53	
		071-00266	P&A				Y	na	na	05-11-67	
		071-00360	P&A				Y	na	na	05-20-56	
		071-00544	P&A?	-	-	-	N	na	na	-	Forms 1, 2 & SW-1.
		071-00649	P&A				Y	na	na	05-01-29	
		071-00684	Producer	-	-	-	na	na	na	na	
		071-00706	Shut-in	-	-	-	na	na	na	na	Forms 1, 2, SW-1 & P-4.

Table 3.30: Continued

Table 3.30: Continued

		P&A	071-00727						Y	na	na	77-24-26	
		P&A	071-00767						Y	na	na	08-14-56	
		Producer	071-00791	-	-	-			na	na	na		
	Fig Ridge	P&A?	071-01867	1	3	1			N	Y	Y	-	Form 1 & 2A.
		P&A	071-01829						Y	Y	Y	05-27-43	
	High Island	P&A	071-02263						Y	na	na	02-22-47	
		P&A	071-03380						Y	na	na	09-14-83	Post 66.
	Lost Lake	P&A	071-01060						Y	Y	Y	11-09-61	
		P&A	071-01078						Y	Y	Y	05-20-47	
		P&A?	071-03423	1	na	na			N	Y	Y	-	
	Moss Bluff	P&A	071-01083						Y	na	na	11-25-51	
		P&A?	071-01099	-	-	-			N	na	na	-	Form 2 only.
	Oyster Bayou	P&A?	071-02344	na	1	1			N	Y	Y	-	Form 1 only.
		P&A	071-02349						Y	Y	Y	11-24-50	
	Stowell	Producer	071-01824	-	-	-			na	Y	Y	na	No Forms. Pl. shows Post 66.
		P&A?	071-03416	na	1	1			N	Y	Y	-	
	Hardin												
	Arriola	P&A	199-03063						Y	na	na	12-17-34	
		P&A?	189-03077	-	-	-			N	na	na	-	Form 1 only.
		P&A	189-03079						Y	na	na	10-17-32	
		P&A	199-03093						Y	na	na	09-24-59	

	Batson New										
		199-00818	P&A				Y	na	na	10-04-55	
		199-00834	P&A?	-	-	-	N	na	na	-	No Forms.
		199-00844	P&A?	-	-	-	N	na	na	-	Form 1 & SW-1.
		199-00871	P&A				Y	na	na	01-18-57	
		199-00880	P&A				Y	na	na	03-27-51	
		199-02051	P&A?	-	-	-	N	na	na	-	Form 1 only.
		199-02077	P&A?	-	-	-	N	na	na	-	Form 1 only.
		199-02091	P&A?	-	-	-	N	na	na	-	No Forms.
		199-02092	P&A?	-	-	-	N	na	na	-	Form 1 only.
	Batson Old										
		199-00832	P&A				Y	na	na	12-27-57	
		199-00998	P&A?	-	-	-	N	na	na	-	Forms 1 & 2.
		199-01195	P&A?	-	-	-	N	na	na	-	No intersection; Form 1 only. TD: 456'
		199-01278	P&A	-	-	-	N	na	na	-	No intersection. Forms 1 & 2. TD:1162'
		199-01296	P&A				Y	na	na	12-23-57	No intersection. TD: 837'
		199-01311	P&A?	-	-	-	N	na	na	-	No intersection. Forms 1 & 2. TD:1306'
		199-01458	P&A				Y	na	na	11-7-61	
		199-02086	P&A				Y	na	na	09-15-34	
		199-02089	P&A				Y	na	na	06-12-58	
		199-03139	P&A				Y	na	na	10-06-64	No intersection. TD: 535'
		199-03209	P&A?	-	-	-	N	na	na	-	No intersection. Form 1 only. TD:920'
		199-03308	P&A				Y	na	na	07-24-65	
		199-03412	P&A				Y	na	na	04-11-77	No intersection; Post 66. TD: 366'
	Saratoga										
		199-00701	P&A				Y	na	na	02-18-52	
		199-00743	P&A				Y	na	na	04-11-50	
		199-00944	P&A				Y	na	na	08-22-75	Post 66.
		199-00967	P&A				Y	na	na	12-05-51	
		199-00973	P&A				Y	na	na	04-26-56	
		199-01530	P&A				Y	na	na	08-16-59	

Table 3.30: Continued

		199-01587	P&A				Y	na	na	02-25-58	
		199-01631	P&A?	-	-	-	N	na	na	-	Forms 1 & 2.
		199-01633	P&A				Y	na	na	04-01-60	
		199-01660	P&A?	-	-	-	N	na	na	-	Forms 1 & 2.
		199-01661	P&A				Y	na	na	10-06-57	
		199-01691	P&A?	-	-	-	N	na	na	-	Form 1 only.
		199-01695	P&A				Y	na	na	08-03-59	
		199-01779	P&A?	-	-	-	N	na	na	-	Form 1 only.
		199-01897	P&A				Y	na	na	02-19-51	
		199-02099	P&A				Y	na	na	10-24-55	
	Saratoga West										
		199-01555	P&A				Y	na	na	08-16-58	
		199-01671	P&A				Y	na	na	02-01-55	
	Sour Lake										
		199-02158	P&A?	-	-	-	N	na	na	-	No P&A data.
		199-02168	P&A				Y	na	na	11-30-50	
		199-02172	P&A				Y	na	na	10-29-54	
		199-02181	P&A				Y	na	na	02-27-53	
		199-02263	P&A				Y	na	na	04-24-49	
		199-02276	P&A				Y	na	na	12-01-50	
		199-02334	P&A				Y	na	na	07-14-39	
		199-02450	P&A				Y	na	na	09-27-45	
		199-02451	P&A				Y	na	na	02-24-48	
		199-02452	P&A				Y	na	na	12-12-42	
		199-02454	P&A				Y	na	na	04-22-43	
		199-02461	P&A				Y	na	na	07-27-48	
		199-02595	P&A				Y	na	na	08-20-62	
		199-02628	P&A				Y	na	na	01-28-63	
		199-02638	P&A				Y	na	na	03-13-61	
		199-02641	P&A				Y	na	na	05-01-62	
		199-02664	P&A				Y	na	na	08-24-54	
		199-02713	P&A?	-	-	-	N	na	na	-	No P&A data.
		199-02728	P&A				Y	na	na	10-05-47	

Table 3.30: Continued

		199-02740	P&A?	-	-	-	N	na	na	-	No P&A data.
		199-02742	P&A				Y	na	na	08-08-50	
		199-02836	P&A				Y	na	na	07-27-59	
		199-02858	P&A				Y	na	na	12-13-47	
		199-02954	P&A				Y	na	na	02-03-50	
		199-02977	P&A				Y	na	na	05-18-67	
		199-03167	P&A				Y	na	na	07-26-76	Post 66.
		199-03174	P&A				Y	na	na	08-19-66	
		199-03186	P&A				Y	na	na	10-24-84	Post 66.
		199-03187	P&A				Y	na	na	10-24-84	Post 66.
Jackson											
	Cordele										
		239-00157	P&A				Y	Y	Y	10-13-58	
		239-03879	P&A				Y	Y	Y	06-02-39	
		239-03881	P&A				Y	Y	Y	03-28-45	
	Ganado										
		239-00772	P&A				Y	Y	Y	06-27-41	
		239-01062	P&A				Y	Y	Y	03-29-45	
	Ganado West										
		239-00525	P&A				Y	Y	Y	06-24-42	
		239-00532	P&A				Y	Y	Y	07-12-46	
		239-03464	P&A				Y	Y	Y	04-27-65	
	La Ward North										
		239-01207	P&A				Y	Y	Y	03-27-73	Post 66.
		239-01250	P&A				Y	Y	Y	11-30-44	
		239-01378	P&A				Y	Y	Y	12-14-44	
		239-01629	P&A				Y	Y	Y	09-05-43	
	Lolita										
		239-02002	P&A?	na	1	1	N	Y	Y	-	Form 1 only.
		239-02010	P&A				Y	Y	Y	10-04-62	

Table 3.30: Continued

		239-02130	P&A				Y	Y	Y	04-11-48	
	Maubro										
		239-01090	P&A				Y	Y	Y	10-24-62	
		239-01107	P&A				Y	Y	Y	01-22-41	
	Stewart										
		239-01073	P&A				Y	Y	Y	12-20-58	
		239-03892	P&A				Y	Y	Y	09-11-42	
	West Ranch										
		239-02289	P&A?	1	na	na	N	Y	Y	-	Form 1 & App. to Plug.
		239-02821	P&A				Y	Y	Y	01-08-62	
		239-02940	P&A				Y	Y	Y	01-23-46	
		239-03338	P&A?	na	1	1	N	Y	Y	-	Forms 1 & 2.
	Nueces										
	Agua Dulce										
		355-00316	P&A				Y	Y	Y	07-05-50	
		355-00346	P&A				Y	Y	Y	11-21-54	
		355-00364	P&A				Y	Y	Y	08-02-85	Post 66.
		355-00429	P&A				Y	Y	Y	08-19-54	
		355-00433	P&A				Y	Y	Y	01-10-59	
		355-00448	P&A				Y	Y	Y	03-16-58	
		355-00553	P&A				Y	Y	Y	01-25-45	
		355-00724	P&A				Y	Y	Y	10-05-51	
		355-04672	P&A?	na	1	1	N	Y	Y	-	Form 1 only.
		355-04675	P&A				Y	Y	Y	04-27-46	
		355-04704	Producer	-	-	-	na	Y	Y	na	
		355-04714	P&A				Y	Y	Y	06-22-39	
		355-05017	P&A?	na	1	1	N	Y	Y	-	Form 1 & 2-A (App. to Plug).
		355-05252	P&A?	1	na	na	N	Y	Y	-	Form 1 & 2.
		355-06212	P&A				Y	Y	Y	07-24-66	
		355-06233	P&A				Y	Y	Y	08-18-66	

Table 3.30: Continued

		355-05767	P&A				Y	Y	Y	06-09-64	
		355-05804	P&A				Y	Y	Y	10-28-64	
		355-05986	P&A				Y	Y	Y	03-22-65	
		355-06099	P&A				Y	Y	Y	11-24-65	
	White Point E.										
		355-02209	P&A				Y	Y	Y	02-09-45	
		355-02220	P&A?	1	3	1	N	Y	Y	-	
Refugio											
	Bonnie View										
		391-03276	P&A				Y	Y	Y	08-24-48	
		391-03547	P&A				Y	Y	Y	02-10-59	
		391-03554	P&A				Y	Y	Y	04-03-47	
		391-03583	P&A				Y	Y	Y	11-25-59	
		391-03584	P&A				Y	Y	Y	09-14-53	
		391-03585	P&A				Y	Y	Y	02-20-51	
		391-03594	P&A				Y	Y	Y	01-09-70	Post 66.
		391-03606	P&A				Y	Y	Y	02-18-45	
		391-03608	P&A				Y	Y	Y	05-09-39	
		391-03631	P&A				Y	Y	Y	06-25-51	
		391-03633	P&A				Y	Y	Y	02-17-47	
		391-03665	P&A				Y	Y	Y	08-27-56	
		391-03692	P&A				Y	Y	Y	10-09-62	
		391-03695	P&A				Y	Y	Y	05-02-55	
		391-03696	P&A				Y	Y	Y	05-10-51	
		391-03697	P&A				Y	Y	Y	09-22-56	
		391-03698	P&A				Y	Y	Y	10-02-49	
		391-03712	P&A?	1	3	1	N	Y	Y	-	App. to Plug indicates no plugs, no mud.
		391-03875	P&A				Y	Y	Y	06-27-65	
		391-03880	P&A				Y	Y	Y	08-30-78	Post 66.
	Greta										
		391-00538	P&A				Y	Y	Y	08-21-54	
		391-00613	P&A				Y	Y	Y	09-14-44	

Table 3.30: Continued

		391-00616	P&A?	1	1	0	N	Y	Y	-	Form 1 only; PI data indicates Casing set.
		391-00620	P&A				Y	Y	Y	03-05-34	
		391-00625	P&A				Y	Y	Y	05-16-34	
		391-00777	Producer				na	Y	Y	na	
		391-00787	P&A				Y	Y	Y	01-14-64	
		391-00788	P&A?	1	1	0	N	Y	Y	-	No Form 4 ; Plug date(Form 1) 4-30-54.
		391-00789	P&A				Y	Y	Y	01-29-34	
		391-00810	P&A				Y	Y	Y	02-28-34	
		391-00811	P&A?	na	1	1	N	Y	Y	-	Form 1 only; well was drilled.
		391-00812	P&A?	na	1	1	N	Y	Y	-	No RRC forms; records lost in 1937.
		391-00814	P&A?	na	1	1	N	Y	Y	-	Form 1 only.
		391-00829	P&A?	1	1	0	N	Y	Y	-	Forms 1 & 3 only.
		391-00916	Injector				na	Y	Y	na	On schedule as disposal well.
		391-00980	P&A				Y	Y	Y	12-13-40	
		391-00981	P&A				Y	Y	Y	12-13-40	
		391-00991	P&A				Y	Y	Y	01-21-87	Post 66.
		391-01004	P&A				Y	Y	Y	11-17-59	
		391-01016	P&A?	na	1	1	N	Y	Y	-	Blowout and cratered. No form 4 or P&A dat
		391-01030	P&A				Y	Y	Y	05-03-34	
		391-01047	P&A				Y	Y	Y	07-28-37	
		391-01103	P&A				Y	Y	Y	05-13-70	Post 66.
		391-01192	Producer				na	Y	Y	na	
		391-01194	Shut-in				na	Y	Y	na	Shut-in gas well.
		391-01197	P&A?	na	1	1	N	Y	Y	-	Blowout. Shut-in & Abd. 6-21-34. No Form 4
		391-01220	Shut-in				na	Y	Y	na	Shut-in gas well.
		391-03911	P&A				Y	Y	Y	12-26-65	
	Lake Pasture										
		391-00201	P&A				Y	Y	Y	03-09-53	
		391-00226	P&A?	2	na	na	N	Y	Y	-	Producing as of 6-23-67. No Form 4.
		391-00389	P&A				Y	Y	Y	01-10-57	
		391-00391	P&A				Y	Y	Y	07-29-57	
		391-00393	P&A				Y	Y	Y	04-20-62	
		391-00397	P&A				Y	Y	Y	04-30-63	
		391-00405	P&A				Y	Y	Y	07-17-59	

Table 3.30: Continued

		391-00413	P&A				Y	Y	Y	05-20-58	
	La Rosa										
		391-03088	P&A				Y	Y	Y	04-10-62	
		391-03306	P&A				Y	Y	Y	03-03-41	
		391-03313	P&A				Y	Y	Y	08-08-40	
		391-03317	P&A				Y	Y	Y	07-03-39	
		391-03327	P&A				Y	Y	Y	05-07-40	
		391-03328	P&A				Y	Y	Y	06-06-40	
		391-03343	P&A				Y	Y	Y	03-14-40	
		391-03361	P&A				Y	Y	Y	01-31-62	
		391-03385	P&A				Y	Y	Y	06-23-41	
		391-03386	P&A				Y	Y	Y	02-02-47	
		391-03388	P&A				Y	Y	Y	03-28-57	
		391-03397	P&A				Y	Y	Y	09-21-61	
		391-03399	P&A				Y	Y	Y	11-17-61	
		391-03427	P&A				Y	Y	Y	05-03-41	
		391-03430	P&A				Y	Y	Y	11-19-52	
		391-03431	P&A				Y	Y	Y	12-13-52	
		391-03434	P&A				Y	Y	Y	06-18-61	
		391-03446	P&A				Y	Y	Y	04-04-57	
		391-03508	P&A				Y	Y	Y	06-11-41	
		391-03829	P&A				Y	Y	Y	02-06-65	
		391-03902	P&A				Y	Y	Y	10-02-65	
	McFaddin										
		391-00065	P&A				Y	Y	Y	04-14-42	
		391-00067	P&A				Y	Y	Y	05-04-61	
		391-00153	P&A				Y	Y	Y	04-01-42	
		391-00172	P&A				Y	Y	Y	08-25-41	
	Mary Ellen O'Conn										
		391-01817	P&A				Y	Y	Y	03-11-55	
		391-01863	P&A				Y	Y	Y	04-19-56	
		391-01890	P&A				Y	Y	Y	01-31-73	Post 66.

Table 3.30: Continued

		391-01913	P&A				Y	Y	Y	02-01-55	
		391-01916	P&A				Y	Y	Y	01-28-54	
		391-01932	P&A				Y	Y	Y	03-21-55	
		391-01951	P&A				Y	Y	Y	04-11-72	Post 66.
		391-01956	P&A				Y	Y	Y	02-15-55	
		391-01971	P&A				Y	Y	Y	04-19-56	
		391-03805	P&A				Y	Y	Y	03-05-64	
	Refugio New										
		391-02188	P&A				Y	Y	Y	04-15-49	
		391-02988	P&A				Y	Y	Y	03-24-61	
		391-02995	P&A				Y	Y	Y	04-19-40	
	Refugio Old										
		391-01985	P&A				Y	Y	Y	01-07-57	
		391-01987	P&A				Y	Y	Y	04-14-87	Post 66.
		391-01992	P&A				Y	Y	Y	12-25-57	
		391-02186	P&A				Y	Y	Y	06-18-47	
		391-02240	P&A				Y	Y	Y	03-16-56	
		391-02276	P&A?	na	1	1	N	Y	Y	-	No Form 4 or P&A data. Only Form 1.
		391-02293	P&A?	na	1	1	N	Y	Y	-	No Form 4 or P&A data. Only Form 1.
		391-02308	P&A				Y	Y	Y	06-05-47	
		391-02346	P&A				Y	Y	Y	08-11-60	
		391-02416	P&A				Y	Y	Y	05-12-52	
		391-02874	P&A				Y	Y	Y	10-18-60	No intersection. TD:1536'
		391-02901	P&A				Y	Y	Y	04-23-63	
	Tom O'Connor										
		391-00414	P&A				Y	Y	Y	11-11-61	
		391-00474	Shut-in				na	Y	Y	na	
		391-00478	P&A				Y	Y	Y	08-28-47	
		391-00489	P&A				Y	Y	Y	10-24-61	
		391-00502	P&A				Y	Y	Y	05-30-49	
		391-00503	P&A				Y	Y	Y	03-02-62	
		391-00508	P&A				Y	Y	Y	06-04-46	

Table 3.30: Continued

		391-00523	P&A				Y	Y	Y	12-23-49	
		391-00530	P&A				Y	Y	Y	01-15-62	
		391-00541	P&A				Y	Y	Y	07-16-52	
		391-00675	P&A	na	1	1	N	Y	Y	03-27-37	Blowout. No Form 4; cement pumped.
		391-00800	P&A				Y	Y	Y	02-02-73	Post 66.
		391-00849	P&A				Y	Y	Y	04-13-50	
		391-01318	P&A				Y	Y	Y	08-15-38	
		391-01350	P&A?	na	1	1	N	Y	Y	-	No Form 4; Forms 1 & 2.
		391-01351	P&A				Y	Y	Y	11-22-45	
		391-01623	P&A?	na	1	1	N	Y	Y	-	No Form 4.
		391-01674	P&A				Y	Y	Y	11-17-49	
		391-01721	P&A				Y	Y	Y	02-12-38	
		391-01761	P&A				Y	Y	Y	11-23-50	
		391-01768	P&A				Y	Y	Y	02-11-50	
		391-01772	P&A?	na	1	1	N	Y	Y	-	No Form 4; Forms 1 & 2.
		391-01773	P&A				Y	Y	Y	07-21-51	
		391-01819	P&A?	na	1	1	N	Y	Y	-	App. to plug, but no Form 4 or P&A data.
		391-01820	P&A?	2	3	na	N	Y	Y	-	App. to plug, but no Form 4 or P&A data.
		391-02040	P&A				Y	Y	Y	07-27-46	
		391-03784	Producer				na	Y	Y	na	Gas well.
		391-03804	P&A?	1	1	na	N	Y	Y	-	No Form 4 or P&A data. Only Form 1.
San Patricio											
	Midway										
		409-02665	P&A				Y	Y	Y	01-13-50	
		409-02738	P&A				Y	Y	Y	04-13-50	
		409-02755	P&A				Y	Y	Y	10-17-43	
		409-02902	P&A				Y	Y	Y	12-02-48	
		409-02905	P&A				Y	Y	Y	07-08-53	
		409-02934	P&A				Y	Y	Y	01-18-52	
		409-04062	P&A				Y	Y	Y	09-26-64	
	Odem										
		409-03782	P&A				Y	Y	Y	06-05-42	
		409-03876	P&A				Y	Y	Y	04-20-66	

Table 3.30: Continued

Table 3.30: Continued

[illegible]

		427-03906	P&A				Y	Y	Y	04-01-48	
		427-04083	P&A				Y	Y	Y	03-27-52	
		427-04094	P&A				Y	Y	Y	12-24-50	
		427-04229	P&A				Y	Y	Y	03-07-46	
		427-04233	P&A				Y	Y	Y	01-06-54	
		427-04250	P&A				Y	Y	Y	06-29-44	
	Jay Simmons										
		427-00305	Producer	-	-	-	na	Y	Y	na	
		427-00374	P&A				Y	Y	Y	01-02-58	
	Kelsey S.										
		427-00196	P&A				Y	Y	Y	09-21-84	Post 66.
		427-00336	P&A				Y	Y	Y	02-02-49	
		427-04800	P&A				Y	Y	Y	03-07-66	
	Reyna										
		427-02365	P&A				Y	Y	Y	03-21-56	
	Ricaby										
		427-02969	P&A				Y	Y	Y	01-16-57	
		427-02973	P&A?	na	1	1	N	Y	Y	-	No Forms.
		427-03038	P&A				Y	Y	Y	05-27-50	
		427-03131	P&A?	na	1	1	N	Y	Y	-	Forms 1 & 2.
	Rincon										
		427-01493	P&A				Y	Y	Y	04-25-52	
		427-01536	P&A				Y	Y	Y	06-03-41	
		427-03005	P&A				Y	Y	Y	11-21-41	
		427-03382	P&A				Y	Y	Y	02-21-52	
		427-03390	P&A				Y	Y	Y	05-22-44	
		427-03709	P&A				Y	Y	Y	11-05-50	
		427-03729	P&A				Y	Y	Y	04-10-55	
		427-03743	P&A				Y	Y	Y	02-24-51	
		427-03756	P&A				Y	Y	Y	12-30-51	

Table 3.30: Continued

		427-03759	P&A				Y	Y	Y	06-19-43	
		427-03866	P&A				Y	Y	Y	01-10-51	
		427-03878	P&A				Y	Y	Y	08-26-52	
	Sun										
		427-00899	P&A				Y	Y	Y	05-19-48	
		427-00941	P&A				Y	Y	Y	05-13-40	
		427-04418	P&A				Y	Y	Y	12-27-63	
		427-04873	P&A				Y	Y	Y	08-10-79	Post 66.
	Sun N.										
		427-00493	P&A				Y	Y	Y	11-03-43	
		427-00508	P&A				Y	Y	Y	02-27-48	
		427-00619	P&A				Y	Y	Y	08-02-63	
		427-00640	P&A				Y	Y	Y	08-29-59	
		427-00648	P&A				Y	Y	Y	04-22-47	
		427-00654	P&A				Y	Y	Y	06-22-47	
		427-04704	P&A				Y	Y	Y	09-26-65	
Victoria											
	Bloomington										
		469-01684	P&A				Y	Y	Y	06-30-52	
		469-02896	P&A				Y	Y	Y	01-08-66	
	Coletto Creek										
		469-01124	P&A?	na	1	1	N	Y	Y	-	Forms 1 & 2.
		469-01223	Injector				na	Y	Y	na	
		469-01336	P&A				Y	Y	Y	08-05-54	
	Helen Gohlke										
		469-00106	P&A				Y	Y	Y	04-20-52	
	Helen Gohlke W.										
		469-00067	P&A				Y	Y	Y	10-27-53	

Table 3.30: Continued

	Heyser										
		469-01986	P&A				Y	Y	Y	10-20-38	
	Keeran										
		469-00238	P&A				Y	Y	Y	02-20-62	
		469-02949	P&A				Y	Y	Y	03-14-66	
	McFaddin										
		469-01570	P&A				Y	Y	Y	07-18-32	No intersection. TD: 2840'
		469-02282	P&A				Y	Y	Y	09-04-54	
	Placedo										
		469-01868	P&A				Y	Y	Y	10-17-53	
		469-01879	P&A				Y	Y	Y	02-05-42	
		469-01972	P&A				Y	Y	Y	04-13-63	
		469-02583	P&A				Y	Y	Y	05-27-56	
	Placedo E.										
		469-02710	P&A				Y	Y	Y	07-10-53	
		469-02749	P&A				Y	Y	Y	09-23-59	
		469-02812	P&A				Y	Y	Y	06-29-55	
	Pridham Lake										
		469-00994	P&A				Y	Y	Y	01-06-60	
		469-01041	P&A?	1	na	na	N	Y	Y	-	Form 1 only.

Table 3.30: Continued

APPENDIX 1

Listing of selected data for TRRC UIC database wells in Texas Gulf Coast study fields

MONITORING REPORT (FORM H-10) STATUS CODES (ON THE LAST DAY OF H-10 CYCLE)

- 1 AUTHORIZED TO INJECT, BUT NOT YET DRILLED
- 2 DRILLED BUT NOT YET CONVERTED TO INJ/DISP
- 3 ACTIVE INJECTION/DISPOSAL
- 4 TEMPORARILY ABANDONED/SHUT-IN
- 5 OTHER (OLD FORM H-10) / CONV. TO PROD. (NEW FORM H-10, >=09/01/93)
- 6* PERMIT CANCELLED
- 7* WELL PLUGGED AND ABANDONED
- 8* WELL PLUGGED AND ABANDONED AND PERMIT CANCELLED
- 9 OTHER STATUS (MISC. STATUS FROM NEW H-10 FORMS, MAILED >=09/01/93)

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA
Field (Reservoir) : BRYAN MOUND

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3931253	8	0/ 0/ 0	0	4610
3931284	8	0/ 0/ 0	0	5710
3931259	8	0/ 0/ 0	0	5650
3931332	8	0/ 0/ 0	0	5885
3931260	8	0/ 0/ 0	0	5680
3931288	8	0/ 0/ 0	0	5742
3900000	3	0/ 0/ 0	0	0
3900000	3	0/ 0/ 0	0	0
3931372	3	0/ 0/ 0	0	0
3931373	3	0/ 0/ 0	0	0
3900000	4	0/ 0/ 0	0	0
3931383	3	0/ 0/ 0	0	0
3931385	3	0/ 0/ 0	0	0
3931388	3	0/ 0/ 0	0	0
3931387	3	0/ 0/ 0	0	0
3931421	3	0/ 0/ 0	0	0
3931390	3	0/ 0/ 0	0	0
3931398	3	0/ 0/ 0	0	0
3931402	3	0/ 0/ 0	0	0
3931391	3	0/ 0/ 0	0	0
3931393	3	0/ 0/ 0	0	0
3931368	3	0/ 0/ 0	0	0
3931361	3	0/ 0/ 0	0	0
3931376	3	0/ 0/ 0	0	0
3931379	3	0/ 0/ 0	0	0
3931404	3	0/ 0/ 0	0	0
3931405	3	0/ 0/ 0	0	0
3931329	3	0/ 0/ 0	0	0
3931410	3	0/ 0/ 0	0	0
3931413	3	0/ 0/ 0	0	0
3931814	3	0/ 0/ 0	0	0
3931816	3	0/ 0/ 0	0	0
3931818	3	0/ 0/ 0	0	0
3931820	3	0/ 0/ 0	0	0
3931371	3	0/ 0/ 0	0	0
3931397	3	0/ 0/ 0	0	0
3931345	3	0/ 0/ 0	0	0
3931399	3	0/ 0/ 0	0	0
3931400	3	0/ 0/ 0	0	0
3931403	3	0/ 0/ 0	0	0
3931363	3	0/ 0/ 0	0	0
3931392	3	0/ 0/ 0	0	0
3931380	3	0/ 0/ 0	0	0
3931328	3	0/ 0/ 0	0	0
3931394	3	0/ 0/ 0	0	0
3931375	3	0/ 0/ 0	0	0
3931411	3	0/ 0/ 0	0	0
3931815	3	0/ 0/ 0	0	0
3931817	3	0/ 0/ 0	0	0
3931819	3	0/ 0/ 0	0	0
3931821	3	0/ 0/ 0	0	0

3931263	3	0/	0/	0	0	0
3931374	3	0/	0/	0	0	0
3931415	3	0/	0/	0	0	0

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA

Field (Reservoir) : DAMON MOUND

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3981672	8	12/13/60	0	2238
3902500	6	1/ 1/ 1	1550	0
3902514	8	0/ 0/ 0	900	2698
3902109	7	0/ 0/ 0	0	0
3902531	3	2/19/60	950	1060
3902315	3	9/12/69	1100	3052
3902148	4	11/10/78	1000	1980
3902483	3	11/29/71	950	1982
3902101	3	7/ 3/68	600	1615
3980524	7	2/27/67	480	950
3902514	8	0/ 0/ 0	0	0
3980513	3	2/16/68	1000	2214
3931294	3	0/ 0/ 0	0	4500
3902514	8	9/18/75	900	2698
3905003	4	8/ 4/69	900	1104
3902686	3	0/ 0/ 0	0	3015
3932331	7	7/ 7/89	1150	3000
3932127	2	5/ 7/90	1000	3990
3932373	8	1/28/91	1100	4700
3932032	2	6/10/91	900	2774

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA

Field (Reservoir) : DAMON MOUND EAST (FLT BLK 1)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3902198	3	1/27/77	0	1855
3902195	6	9/13/68	0	1850
3902194	6	10/21/70	0	3956
3902248	3	6/ 9/76	1000	4512
3981880	4	10/28/69	1150	1944

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA
 Field (Reservoir) : DANBURY DOME
 Field (Reservoir) : DANBURY DOME (F-5-B)
 Field (Reservoir) : DANBURY DOME (5655 SAND)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3901657	8	6/20/72	0	3280
3901649	8	5/ 4/62	0	2260
3901738	8	5/ 9/80	1000	1832
3904262	7	0/ 0/ 0	0	2300
3901620	8	6/ 7/73	1200	1600
3901629	8	0/ 0/ 0	1250	2000
3981388	8	11/ 8/73	900	1900
3931559	3	9/13/82	0	0
3901618	3	0/ 0/ 0	0	2000
3901656	3	0/ 0/ 0	0	1956
3901672	3	9/21/92	1000	1750
3901734	3	1/15/93	750	1600

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA

Field (Reservoir) : HASTINGS EAST

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3900578	7	7/24/73	0	2300
3900580	8	11/ 3/69	1650	2000
3900697	8	10/19/79	1200	2400
3900743	3	0/ 0/ 0	0	2000
3900746	3	8/25/55	0	1850
3900747	7	7/15/55	0	2174
3900750	3	0/ 0/ 0	0	1900
3900768	7	0/ 0/ 0	0	1900
3931264	3	11/ 8/79	1200	1900
3900681	8	9/13/78	1410	2750
3900690	8	9/27/73	0	2300
3900647	4	7/24/74	1200	2320
3900606	3	0/ 0/ 0	1200	2300
3900608	7	0/ 0/ 0	0	2000
3900648	8	7/24/78	1200	2500
3900526	4	11/25/68	1200	2100
3900525	3	10/28/53	1300	1930
3900510	4	7/15/77	1700	2500
3900512	8	2/10/54	1200	1930
3900513	8	3/ 1/73	0	2100
3900520	7	5/12/75	1600	1830
3900624	4	11/18/66	1500	2100
3931282	3	0/ 0/ 0	0	1950
3900533	7	9/26/83	1550	2500
3981066	7	0/ 0/ 0	0	2300
3900579	8	0/ 0/ 0	0	2300
3930732	3	0/ 0/ 0	0	1950
3930499	3	4/17/85	1200	3000
3900682	7	0/ 0/ 0	0	2000
3900623	3	2/ 1/89	1425	2550
3931261	4	9/16/91	1650	4050

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA
Field (Reservoir) : HOSKINS MOUND

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3904934	3	3/10/67	1000	1331
3905040	8	0/ 0/ 0	0	5894
3904988	6	0/ 0/ 0	0	4720
3904984	6	0/ 0/ 0	0	5160
3904993	6	0/ 0/ 0	0	5311
3930059	6	0/ 0/ 0	0	5059
3930161	6	0/ 0/ 0	0	5546
3930347	6	0/ 0/ 0	0	5792
3930363	6	0/ 0/ 0	0	5040
3930389	6	0/ 0/ 0	0	5611

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA
Field (Reservoir) : LOCHRIDGE

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3901849	4	4/10/50	1300	2458
3901878	3	10/25/68	0	1900
3980614	3	7/11/79	1300	2645
3901868	7	12/12/90	1300	3220
3901871	3	12/21/93	1250	2510

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA

Field (Reservoir) : MANVEL (BASAL MIOCENE)
Field (Reservoir) : MANVEL (F.B. I OLIGOCENE)
Field (Reservoir) : MANVEL (F.B. II OLIGOCENE)
Field (Reservoir) : MANVEL (FB-III OLIGOCENE)
Field (Reservoir) : MANVEL (FB-III OLIGOCENE SEG A)
Field (Reservoir) : MANVEL (MIOCENE)
Field (Reservoir) : MANVEL (FRIO -E-)
Field (Reservoir) : MANVEL (MIOCENE 3600)
Field (Reservoir) : MANVEL (4970)
Field (Reservoir) : MANVEL (FB-III OLIGOCENE -C-)
Field (Reservoir) : MANVEL

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3981667	8	12/18/78	0	4330
3981496	3	6/20/68	1600	1950
3901274	3	9/23/74	1850	2060
3901289	3	2/ 8/73	1650	2100
3901295	7	0/ 0/ 0	0	0
3931215	3	8/ 6/79	1650	5600
3901315	7	3/ 9/64	0	2448
3901321	4	12/13/71	1650	4240
3901243	3	11/11/74	1650	2300
3981669	4	8/ 9/63	1650	2000
3901265	6	0/ 0/ 0	1850	2120
3900139	6	1/ 1/ 1	1100	0
3900022	3	5/11/73	1850	2300
3904860	7	6/21/72	950	5238
3930487	8	1/22/75	0	5422
3930698	4	1/22/75	1100	5412
3900199	8	0/ 0/ 0	0	0
3900200	8	1/ 7/75	2000	2550
3980621	8	9/ 3/76	1250	1650
3901232	3	7/15/77	1600	2160
3901239	3	7/15/77	1650	2370
3930373	8	0/ 0/ 0	0	0
3900203	3	9/23/76	100	2300
3901271	3	5/19/72	1650	2200
3900176	3	7/ 5/74	1600	2000
3900185	8	5/14/71	2000	4100
3900163	7	11/27/72	0	2600
3900147	3	10/18/76	0	2580
3900162	3	3/ 9/64	1900	2600
3900144	4	12/ 9/80	1900	5760
3930346	3	10/10/74	2000	4600
3901262	6	12/ 5/72	0	2600
3901292	8	8/25/64	1650	2000
3900163	8	11/27/72	0	2600
3931568	4	9/ 3/82	1550	1965
3930487	5	5/10/83	0	0
3900151	8	3/31/82	1850	2450
3901301	7	0/ 0/ 0	0	0
3901275	8	0/ 0/ 0	0	5097
3901276	8	0/ 0/ 0	0	5029
3901279	6	0/ 0/ 0	0	5015

3901280	8	0/ 0/ 0	0	5052
3901282	8	0/ 0/ 0	0	5030
3901286	6	0/ 0/ 0	0	5054
3901287	6	0/ 0/ 0	0	5046
3901294	6	0/ 0/ 0	0	5089
3901297	8	0/ 0/ 0	0	4991
3901298	6	0/ 0/ 0	0	5086
3901300	6	0/ 0/ 0	0	5097
3930188	6	0/ 0/ 0	0	5052
3930333	6	0/ 0/ 0	0	5010
3930502	6	0/ 0/ 0	0	5020
3930503	6	0/ 0/ 0	0	5008
3930686	6	0/ 0/ 0	0	4952
3930525	6	0/ 0/ 0	0	5090
3930529	6	0/ 0/ 0	0	5076
3930527	6	0/ 0/ 0	0	5133
3931217	6	0/ 0/ 0	0	5036
3931216	6	0/ 0/ 0	0	4981
3930277	3	1/17/84	0	2350
3900125	8	6/24/88	1900	3999
3930690	3	4/ 9/90	1825	2740
3930384	3	3/ 9/92	1850	5586

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA
Field (Reservoir) : NASH DOME

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3901955	7	7/ 2/51	0	3212
3901969	7	8/ 8/68	0	4486
3930035	7	10/ 1/69	0	4452
3930763	3	9/21/81	1150	4510
3931214	3	6/18/85	0	4610
3931338	6	6/18/84	0	4510
3901981	6	10/17/85	0	5922
3930028	4	10/17/85	0	5703

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA

Field (Reservoir) : OLD OCEAN (ARMSTRONG)

Field (Reservoir) : OLD OCEAN (F- 8)

Field (Reservoir) : OLD OCEAN (CHENAULT)

Field (Reservoir) : OLD OCEAN (LARSEN)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3903963	3	3/ 4/68	1100	1698
3903980	6	0/ 0/ 0	0	0
3980798	6	11/14/67	0	1675
3931250	4	5/16/78	1200	2100
3903983	6	5/17/49	0	0
3903980	6	2/28/55	0	0
3903975	6	10/27/59	0	0
3903960	6	10/ 3/58	0	0
3903961	6	8/20/48	0	0
3903984	6	3/15/48	0	0
3902820	6	12/19/47	0	0
3903982	6	5/14/48	0	0
3903949	4	0/ 0/ 0	0	0
3904041	8	11/12/82	1000	6900
3903911	6	11/12/82	0	0
3904078	8	11/12/82	0	0
3903900	6	11/12/82	0	0
3903910	4	11/12/82	1000	6900
3902848	4	1/19/89	1000	6900
3980070	4	1/19/89	1000	6900
3903961	3	4/ 2/90	1050	1800
3904054	4	8/14/90	1000	6000
3903909	4	8/21/90	1000	6900
3904057	4	8/21/90	1000	6900
3904040	4	8/21/90	1000	6900
3904044	4	8/21/90	1000	6900
3904043	4	8/21/90	1000	6900
3904042	7	8/21/90	1000	6900

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA
Field (Reservoir) : WEST COLUMBIA

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3980830	3	1/29/52	1000	1646
3903609	8	0/ 0/ 0	0	0
3930581	7	8/25/76	0	1350
3903686	7	0/ 0/ 0	0	0
3980835	8	9/16/57	0	700
3903220	8	2/10/59	100	873
3903151	7	0/ 0/ 0	0	0
3903550	8	0/ 0/ 0	0	0
3905005	3	3/19/69	1000	1720
3903344	7	5/25/53	0	738
3980842	3	2/ 3/72	550	590
3903356	3	0/ 0/ 0	800	733
3903337	3	8/ 7/53	0	770
3903156	7	0/ 0/ 0	900	2335
3903433	7	0/ 0/ 0	0	0
3903289	6	0/ 0/ 0	0	0
3900000	6	0/ 0/ 0	0	0
3903350	6	0/ 0/ 0	0	0
3903321	6	0/ 0/ 0	0	0
3903370	6	0/ 0/ 0	0	0
3903372	6	0/ 0/ 0	0	3370
3903374	6	0/ 0/ 0	0	0
3900000	6	0/ 0/ 0	0	0
3905016	6	0/ 0/ 0	0	0
3905122	6	0/ 0/ 0	0	0
3930031	6	0/ 0/ 0	0	0
3930048	6	0/ 0/ 0	0	0
3900000	6	0/ 0/ 0	0	0
3930101	6	0/ 0/ 0	0	0
3930108	6	0/ 0/ 0	0	0
3930107	6	0/ 0/ 0	0	0
3930156	6	0/ 0/ 0	0	0
3930186	6	0/ 0/ 0	0	0
3930189	6	0/ 0/ 0	0	0
3930176	6	0/ 0/ 0	0	0
3903331	7	0/ 0/ 0	0	1800
3903371	7	0/ 0/ 0	0	1200
3930297	7	0/ 0/ 0	0	1600

Selected Injection Well Data from the
Texas RRC UIC Database

County : CHAMBERS

Field (Reservoir) : ANAHUAC

Field (Reservoir) : ANAHUAC (MARGINULINA 7100)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
7101452	8	6/12/78	0	6588
7101441	7	4/ 3/70	0	1350
7180545	7	0/ 0/ 0	0	2150
7101446	8	0/ 0/ 0	0	1009
7101453	8	0/ 0/ 0	0	6588
7101272	7	0/ 0/ 0	0	1500
7101445	8	10/10/78	650	1682
7101611	8	10/18/68	650	1400
7101625	8	12/12/72	450	1500
7101625	8	0/ 0/ 0	0	1500
7101613	8	0/ 0/ 0	400	1600
7101604	8	0/ 0/ 0	0	1800
7101599	8	4/ 3/70	0	1450
7101455	8	4/ 3/70	0	1800
7181999	8	7/13/54	400	1550
7101480	8	8/ 8/73	600	1260
7101246	8	10/ 2/74	600	1037
7101501	8	0/ 0/ 0	600	1550
7180657	8	6/12/78	0	6588
7180659	8	7/15/71	600	1200
7101454	8	11/10/65	0	1000
7101704	8	6/12/68	0	1065
7101699	4	9/19/73	400	1050
7101766	7	0/ 0/ 0	0	1532
7181987	8	4/ 3/70	0	1300
7130131	3	7/19/71	600	1200
7101392	8	2/23/56	0	2030
7101393	8	8/21/68	0	1570
7101395	8	3/12/75	0	1534
7101522	8	1/ 7/80	400	1775
7101571	4	3/31/78	1450	1690
7101560	4	4/22/68	1450	1870
7101743	4	2/26/68	400	2200
7180785	3	0/ 0/ 0	400	1400
7101294	8	1/27/76	0	1400
7101295	8	5/23/71	0	1358
7101296	4	7/24/74	500	1400
7101297	7	10/ 7/47	0	2290
7130002	4	0/ 0/ 0	100	1000
7101482	7	8/ 3/71	850	6912
7101519	6	3/26/64	400	6663
7101508	8	6/26/64	0	0
7101506	6	6/10/64	400	6872
7103285	6	3/17/70	850	6852
7101520	6	6/ 5/64	850	6705
7130854	8	1/ 8/80	400	2035
7130257	8	3/20/81	0	1800
7101495	8	7/30/71	0	0
7101615	8	0/ 0/ 0	400	1600
7101420	8	5/27/81	400	1600

7101426	4	5/21/81	400	1600
7131329	3	8/ 4/82	400	1600
7101292	7	0/ 0/ 0	0	2300
7131174	3	12/10/82	400	1700
7180185	4	0/ 0/ 0	400	1730
7101445	8	0/ 0/ 0	0	1750
7100000	6	0/ 0/ 0	0	1800
7100000	6	0/ 0/ 0	0	1600
7101501	6	0/ 0/ 0	0	1550
7100000	6	0/ 0/ 0	0	1400
7101402	3	0/ 0/ 0	0	1800
7101701	3	2/15/85	400	1800
7130347	3	2/25/85	450	1800
7101708	7	2/ 5/85	400	1800
7101396	3	0/ 0/ 0	0	3580
7101403	4	3/ 9/89	400	3400
7101724	6	10/10/89	400	1250
7101554	3	5/15/90	400	1400
7131917	3	3/ 6/90	400	1670
7101409	4	10/23/91	400	1600
7101412	2	10/23/91	450	1600
7101425	2	10/23/91	450	1600
7101427	2	10/23/91	450	1600
7131427	3	10/23/91	400	1600
7131487	3	10/23/91	400	1600
7131968	3	2/14/92	400	1790
7130373	0	2/28/95	450	2000

Selected Injection Well Data from the
Texas RRC UIC Database

County : CHAMBERS

Field (Reservoir) : BARBERS HILL

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
7100631	8	0/ 0/ 0	0	3630
7130881	8	0/ 0/ 0	0	1400
7100178	8	8/ 1/67	950	1900
7100299	6	8/ 1/67	700	995
7100451	6	8/ 1/67	700	1050
7100466	8	3/30/71	900	1300
7180792	7	10/ 7/75	0	2380
7100609	6	5/17/68	1100	1100
7100345	6	10/ 5/67	800	850
7130827	3	2/16/78	0	0
7130826	7	0/ 0/ 0	0	0
7130908	6	5/10/79	500	575
7181630	7	5/12/69	0	0
7130344	3	5/12/69	0	0
7181631	3	5/12/69	0	0
7181632	3	5/12/69	0	0
7130120	3	5/12/69	0	0
7181652	3	1/20/66	0	0
7130374	7	11/18/75	0	837
7181654	3	1/23/61	0	0
7181655	1	3/26/76	0	0
7181656	3	9/30/65	0	0
7181657	3	3/15/68	0	0
7181658	3	3/15/68	0	0
7130824	3	12/16/77	0	0
7100055	6	5/ 1/64	1000	1348
7100658	3	0/ 0/ 0	1000	2052
7100706	4	0/ 0/ 0	1470	3452
7103373	8	6/20/82	1420	2615
7100589	7	0/ 0/ 0	0	0
7103296	6	8/14/72	800	912
7181593	8	8/23/62	700	820
7181594	3	11/23/53	0	0
7181595	3	11/23/53	0	0
7181596	3	11/23/53	0	0
7181659	3	1/26/56	0	0
7181660	8	4/16/56	650	745
7181661	3	1/26/56	0	0
7181662	3	0/ 0/ 0	0	0
7181663	3	5/ 1/61	0	0
7130116	3	3/ 4/71	0	0
7130229	3	8/10/73	0	0
7130811	3	12/ 1/77	0	0
7130899	3	10/25/78	0	0
7130236	8	7/15/75	250	500
7181559	4	11/18/53	0	0
7181560	4	6/ 9/55	0	0
7181561	3	10/26/55	0	0
7130078	3	10/ 9/70	0	0
7130146	3	12/ 9/71	0	0
7130333	3	11/13/74	0	0

7130378	3	6/30/75	0	0
7130441	3	1/30/76	0	0
7130503	3	9/17/76	0	0
7181563	3	8/17/59	0	0
7181564	3	5/25/59	0	0
7101533	3	2/23/60	0	0
7181566	3	3/28/61	0	0
7181567	3	9/ 5/61	0	0
7181568	3	5/24/62	0	0
7120164	3	5/26/69	0	0
7130079	3	1/20/71	0	0
7130153	3	2/ 8/72	0	0
7130202	3	2/13/73	0	0
7130216	3	4/23/73	0	0
7130237	3	10/ 5/73	0	0
7130269	3	2/21/74	0	0
7100267	6	11/13/69	0	0
7130293	6	6/19/74	156	800
7100783	3	6/21/73	0	5566
7181665	3	12/ 1/73	0	0
7181666	3	12/ 1/73	0	0
7130460	3	7/ 1/76	0	975
7181669	3	12/ 1/73	0	0
7130543	6	1/27/77	156	800
7181670	3	12/ 1/73	0	0
7181671	3	12/ 1/73	0	0
7181672	3	12/ 1/73	0	0
7181673	3	12/ 1/73	0	0
7181674	3	2/ 2/59	0	0
7181675	3	12/ 1/73	0	0
7181676	4	12/ 1/73	0	0
7181677	3	12/ 1/73	0	0
7181678	3	12/ 1/73	0	0
7181679	3	12/ 1/73	0	0
7181680	3	12/ 1/73	0	0
7181681	4	12/ 1/73	0	0
7120162	3	12/ 1/73	0	0
7120311	3	12/ 1/73	0	0
7130053	3	12/ 1/73	0	0
7181685	3	12/ 1/73	0	0
7130241	3	12/12/73	0	0
7130250	3	12/28/73	0	0
7181688	3	10/20/76	0	0
7130513	3	10/20/76	0	0
7130512	3	10/20/76	0	0
7130540	3	1/ 5/77	0	0
7130228	4	6/21/73	1500	5200
7181636	6	11/18/75	400	848
7130351	3	6/11/75	0	0
7130355	3	6/11/75	0	0
7130354	3	6/11/75	0	0
7181637	3	6/11/75	0	0
7181638	3	6/11/75	0	0
7130463	3	6/11/75	0	0
7130462	3	6/11/75	0	0
7130461	3	6/11/75	0	0
7181639	3	6/11/75	0	0
7130557	3	6/11/75	0	0
7130505	3	6/11/75	0	0
7130555	3	6/11/75	0	0

7130556	3	6/11/75	0	0
7130983	3	11/16/78	0	0
7131021	3	11/16/78	0	0
7130952	6	11/28/79	650	900
7130985	3	11/16/78	0	0
7130956	3	6/11/75	0	0
7131056	3	6/11/75	0	0
7130874	6	0/ 0/ 0	0	0
7130272	4	4/ 2/71	0	0
7130122	3	2/ 5/75	0	0
7130121	3	2/ 5/75	0	0
7130134	3	7/16/71	0	0
7130265	4	2/21/74	0	0
7130436	3	1/29/76	0	0
7130385	3	7/16/75	0	0
7130386	3	8/15/80	0	0
7130266	3	2/21/74	0	0
7130039	3	2/ 5/75	0	0
7131237	3	6/29/59	0	0
7130526	6	10/ 1/79	0	6400
7181667	8	7/ 1/76	400	800
7181599	3	0/ 0/ 0	0	0
7130481	8	4/17/77	350	755
7181600	7	0/ 0/ 0	0	0
7181601	3	0/ 0/ 0	0	0
7181602	3	0/ 0/ 0	0	0
7181603	3	0/ 0/ 0	0	0
7181604	3	0/ 0/ 0	0	0
7181605	3	0/ 0/ 0	0	0
7130117	3	0/ 0/ 0	0	0
7130300	3	0/ 0/ 0	0	0
7130323	3	0/ 0/ 0	0	0
7130334	3	0/ 0/ 0	0	0
7130868	8	11/18/75	500	600
7130993	6	4/13/79	760	1120
7130870	6	4/13/79	760	1114
7181606	3	7/23/56	0	0
7131198	3	4/12/82	0	0
7131031	3	10/15/79	0	0
7131032	3	10/15/79	0	0
7130521	3	11/ 2/76	0	0
7100000	1	6/29/79	850	1000
7100000	6	0/ 0/ 0	400	800
7100000	6	0/ 0/ 0	0	800
7100000	6	3/19/79	900	1350
7130874	3	10/15/79	0	0
7100000	6	4/10/84	0	2104
7100120	7	0/ 0/ 0	0	2670
7131066	3	10/26/81	0	0
7131065	3	1/26/56	0	0
7130982	3	3/25/80	0	0
7130876	3	3/19/79	0	0
7130240	3	0/ 0/ 0	0	2380
7131034	3	0/ 0/ 0	0	0
7182024	3	0/ 0/ 0	0	0
7131562	4	1/13/88	1400	2960
7100000	6	0/ 0/ 0	0	0
7131830	8	7/18/88	1450	840
7182018	4	4/10/84	1450	2104
7131895	3	12/ 2/88	0	1800

7131592	4	8/ 1/89	1525	2800
7131896	4	1/27/89	1800	5700
7182021	3	10/11/90	1400	2120
7131648	2	1/16/91	1500	2560
7131937	3	7/ 7/77	0	0
7130522	0	11/ 2/76	0	0
7132000	3	5/ 7/92	1700	5400
7130538	3	1/24/94	850	3410
7130577	3	1/24/94	850	3340
7130781	3	1/24/94	850	3455
7131977	3	2/24/94	800	3400
7131970	2	2/24/94	800	3600
7132016	0	11/ 5/93	0	5300
7132013	0	5/28/93	0	5700
7100000	0	5/ 7/92	1500	5700
7100000	0	2/ 6/89	1800	6500
7100000	0	2/ 6/89	1800	6500
7100000	0	2/ 6/89	1800	6500
7100000	0	2/14/89	1800	5600
7100000	0	2/14/89	1800	5600

Selected Injection Well Data from the
Texas RRC UIC Database

County : CHAMBERS

Field (Reservoir) : FIG RIDGE

Field (Reservoir) : FIG RIDGE (SEABREEZE)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
7101939	7	4/ 7/54	850	8610
7101940	8	4/ 7/54	850	8671
7181584	4	4/ 7/54	850	8594
7120261	4	4/ 7/54	850	8620
7181587	8	3/ 4/63	400	1000
7101904	3	0/ 0/ 0	1250	2283
7101893	6	4/28/47	0	1600
7101883	6	4/28/67	0	2000
7101894	6	3/ 3/70	0	2000
7101889	6	11/22/72	0	2100
7181591	6	4/28/47	0	1600
7102127	6	5/18/76	0	1780
7101872	3	3/ 4/63	320	1000
7101892	7	4/28/47	0	1600
7101877	3	4/28/67	1035	2000
7101894	4	0/ 0/ 0	400	1700
7101889	4	11/22/72	400	2100
7102133	7	3/ 9/71	0	2930
7102143	7	8/22/72	0	2810
7101876	8	9/15/47	0	2970
7102138	3	0/ 0/ 0	400	3145
7102142	4	5/ 2/75	400	2690
7130842	3	0/ 0/ 0	900	1200
7131279	3	0/ 0/ 0	0	1750
7102103	3	3/24/83	400	1400
7100000	6	0/ 0/ 0	0	1780
7101896	4	0/ 0/ 0	0	1730
7102144	3	0/ 0/ 0	0	1750
7102127	4	7/30/85	0	3702

Selected Injection Well Data from the
Texas RRC UIC Database

County : CHAMBERS
Field (Reservoir) : HIGH ISLAND

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
7102239	6	2/ 9/68	100	9330
7102250	7	8/ 2/65	0	0
7102252	6	7/20/67	100	9952
7181373	6	8/ 2/65	100	10184
7181374	6 *	8/ 2/65	100	10144

Selected Injection Well Data from the
Texas RRC UIC Database

County : CHAMBERS

Field (Reservoir) : LOST LAKE

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
7101017	6	0/ 0/ 0	0	1107
7131160	7	5/26/82	500	1540
7131166	4	12/12/84	0	1500
7131209	4	0/ 0/ 0	0	2800
7131434	3	8/ 4/89	500	1940

Selected Injection Well Data from the
Texas RRC UIC Database

County : CHAMBERS
Field (Reservoir) : MOSS BLUFF

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
7181450	3	9/29/69	700	5565

Selected Injection Well Data from the
Texas RRC UIC Database

County : CHAMBERS

Field (Reservoir) : OYSTER BAYOU

Field (Reservoir) : OYSTER BAYOU (FB-3A FRIO 2)

Field (Reservoir) : OYSTER BAYOU (FRIO 2)

Field (Reservoir) : OYSTER BAYOU (FRIO 2 FB-3)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
7102333	3	2/ 4/63	1250	1400
7102292	6	7/ 5/50	350	8424
7181024	3	2/ 4/63	1250	1400
7102052	3	7/31/50	400	8349
7130247	4	12/21/73	400	1400
7102053	6	7/31/50	350	8294
7181029	4	7/31/50	350	8316
7102050	7	7/31/50	0	8392
7102340	3	7/31/50	350	8387
7102051	4	7/31/50	350	8403
7102321	3	7/31/50	400	8318
7102316	7	7/31/50	350	8410
7102340	3	9/30/76	400	8260
7102296	6	4/25/74	0	0
7102318	6	7/31/50	350	8410
7130497	3	7/31/50	400	8354
7130800	6	7/31/50	350	8390
7102322	3	4/ 5/78	350	8288
7181062	3	7/31/50	350	8250
7181065	4	7/31/70	350	8410
7102311	3	10/14/70	400	8290
7132017	4	7/ 5/50	350	8293
7102306	4	2/14/78	350	8225
7102310	4	7/31/50	350	8244
7102319	7	1/ 7/81	350	8292
7102317	3	6/26/64	350	8328
7102302	6	8/12/82	0	8311
7102327	6	4/15/83	0	0
7102328	6	0/ 0/ 0	0	8190
7131089	4	9/ 8/81	350	8390
7102338	3	2/10/84	0	8385
7130379	3	12/17/85	0	8343
7102328	6	1/31/78	0	0
7102341	5	1/ 7/87	400	8330

Selected Injection Well Data from the
Texas RRC UIC Database

County : CHAMBERS

Field (Reservoir) : STOWELL
 Field (Reservoir) : STOWELL (DISCORBIS)
 Field (Reservoir) : STOWELL (MIOCENE 6250)
 Field (Reservoir) : STOWELL (6180)
 Field (Reservoir) : STOWELL (5950)
 Field (Reservoir) : STOWELL (MIOCENE 5650)
 Field (Reservoir) : STOWELL (CRAWFORD U-1)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
7101834	8	4/ 7/66	0	1177
7120118	3	10/10/67	400	1790
7181650	7	4/26/63	0	1125
7181475	7	9/26/72	0	2260
7181592	4	10/ 1/68	6400	1312
7101830	8	10/ 2/74	450	3456
7103180	4	1/18/80	0	2000
7130061	4	7/28/89	350	4800
7101823	2	5/20/92	400	1600
7100000	0	8/ 9/93	600	2890

Selected Injection Well Data from the
Texas RRC UIC Database

County : HARDIN

Field (Reservoir) : ARRIOLA*

Field (Reservoir) : ARRIOLA (VICKSBURG 7050)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
19903075	7	2/26/69	0	2830
19903053	8	0/ 0/ 0	1700	2730
19903610	3	8/14/74	0	0
19903065	7	5/ 4/77	0	2695
19930436	3	0/ 0/ 0	1700	2812
19930435	3	3/23/82	1700	2638
19931708	3	4/ 6/87	1650	2610
19931856	4	0/ 0/ 0	1700	7190

Selected Injection Well Data from the
Texas RRC UIC Database

County : HARDIN
Field (Reservoir) : BATSON NEW

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
19903352	8	2/10/72	0	3000
19903414	3	10/ 2/67	1400	3290
19931915	6	11/ 6/67	0	2955
19901029	7	7/23/64	0	0
19931264	3	0/ 0/ 0	1300	2630
19901037	7	3/ 1/68	0	0
19930176	4	0/ 0/ 0	0	3300
19930197	4	0/ 0/ 0	0	3300
19901032	6	5/18/76	1300	2684
19901040	6	0/ 0/ 0	1300	2920
19901196	6	0/ 0/ 0	1350	2260
19930666	6	5/18/76	1100	3119
19900000	7	5/18/76	1550	3815
19901026	8	5/18/76	1550	3191
19900000	8	0/ 0/ 0	0	3319
19931793	2	0/ 0/ 0	0	3600
19932178	7	0/ 0/ 0	0	2973
19931914	4	0/ 0/ 0	0	4100
19981659	3	0/ 0/ 0	0	3500
19930483	3	11/14/85	1250	2949
19900839	3	3/28/68	1400	3420
19903353	8	11/29/66	1500	2890
19932061	5	0/ 0/ 0	0	2984
19901104	6	12/ 9/63	1300	1825
19932153	3	8/15/89	1350	2150

Selected Injection Well Data from the
Texas RRC UIC Database

County : HARDIN

Field (Reservoir) : BATSON OLD

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
19930689	3	2/ 1/77	250	1141
19930796	3	0/ 0/ 0	150	1200
19901451	3	7/13/78	250	1300
19901459	4	5/15/75	250	1150
19931284	3	0/ 0/ 0	300	1160
19980267	3	0/ 0/ 0	650	1156
19920178	8	5/23/68	0	1200
19931931	3	9/ 2/83	200	1140
19932223	3	0/ 0/ 0	0	1400
19931474	6	0/ 0/ 0	0	1200
19931670	3	1/30/85	250	1156
19931863	4	0/ 0/ 0	0	1200
19981780	7	4/ 3/67	1900	920
19901157	3	3/ 3/92	375	1030
19932638	3	10/27/94	275	238
19932677	3	10/27/94	200	250

Selected Injection Well Data from the
Texas RRC UIC Database

County : HARDIN
Field (Reservoir) : SARATOGA
Field (Reservoir) : SARATOGA (EY)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
19900723	3	9/28/64	1700	4100
19901620	6	6/ 9/76	0	4476
19930119	8	3/22/71	600	1690
19901773	3	11/28/66	720	1635
19980450	3	7/ 7/77	950	1842
19920098	7	0/ 0/ 0	1100	1495
19900691	8	8/ 7/64	2000	6833
19901902	7	12/ 1/70	1100	880
19930409	6	11/20/75	1100	882
19901884	7	12/ 1/70	1100	883
19930033	7	5/25/73	500	825
19930160	7	12/ 1/70	1100	1000
19930223	6	12/ 1/70	1100	1071
19930227	7	12/ 1/70	1100	629
19930323	6	12/ 1/70	0	0
19931191	6	0/ 0/ 0	0	0
19930675	4	7/ 2/81	1100	712
19931600	6	5/19/81	1100	940
19931517	6	7/24/81	1100	813
19930322	4	12/ 1/70	0	0
19931695	3	3/16/82	900	1439
19930843	6	3/22/82	1100	957
19930116	7	0/ 0/ 0	0	1724
19931603	3	0/ 0/ 0	0	4000
19901936	3	5/31/83	0	1440
19931531	3	0/ 0/ 0	0	1632
19932352	3	0/ 0/ 0	0	1712
19931547	6	0/ 0/ 0	0	1300
19932316	6	0/ 0/ 0	0	1000
19932400	4	8/13/86	0	350
19932411	4	8/13/86	1100	480
19932397	4	8/13/86	0	350
19932409	6	8/13/86	0	350
19932404	6	8/13/86	0	350
19932301	6	2/13/87	1000	790
19932398	4	3/27/87	1100	480
19931629	3	6/ 3/87	1025	1684
19901881	8	8/ 6/80	1100	1017
19930028	6	1/16/73	600	1000
19930076	6	4/12/73	1100	872
19932486	5	5/ 4/89	950	1385
19932555	4	5/30/90	1200	501
19932560	4	5/30/90	1200	502
19932601	4	4/ 2/91	650	594
19932605	4	4/ 2/91	750	749
19932603	5	4/ 2/91	750	760
19932606	5	4/ 2/91	750	530
19932597	4	4/ 2/91	750	530
19932595	4	4/ 2/91	750	524
19932608	4	5/ 1/91	600	600

19932598	1	5/ 1/91	550	1400
19931494	2	5/21/91	2250	5800
19932410	5	12/ 1/70	500	535
19932214	4	9/23/92	2125	2315
19932593	0	11/ 3/93	1100	608
19931896	3	11/ 8/93	550	834

Selected Injection Well Data from the
Texas RRC UIC Database

County : HARDIN

Field (Reservoir) : SARATOGA WEST

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
19930780	6	9/18/79	1950	2392
19901659	7	6/ 5/68	0	7106
19901732	7	6/ 6/66	0	2850
19901570	8	8/15/58	0	3570
19980997	3	6/30/66	2100	3400
19901591	7	0/ 0/ 0	0	0
19901620	4	0/ 0/ 0	2200	4476
19901655	3	7/28/80	550	2373
19981455	4	1/14/77	2250	7037
19930685	4	3/26/86	0	3640
19930702	2	0/ 0/ 0	0	3560
19930781	2	0/ 0/ 0	2050	3510
19932235	3	5/19/93	2150	2930

Selected Injection Well Data from the
Texas RRC UIC Database

County : HARDIN
Field (Reservoir) : SOUR LAKE

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
19981036	8	1/24/67	0	1385
19930185	6	9/30/70	600	1462
19903298	8	0/ 0/ 0	0	2646
19902288	8	0/ 0/ 0	0	1422
19930439	7	0/ 0/ 0	650	954
19930503	4	0/ 0/ 0	500	1193
19902149	6	6/18/63	600	3039
19902587	7	2/12/68	0	1220
19902749	5	11/ 3/78	1600	2142
19903175	3	4/ 7/77	1450	2414
19902483	8	0/ 0/ 0	1000	1370
19902485	3	4/19/56	0	1415
19902390	3	1/ 8/64	1200	3050
19902630	3	6/11/71	0	0
19930412	3	10/ 6/72	600	1526
19980769	3	7/22/68	1300	4170
19902134	3	5/24/66	1800	2100
19902458	6	0/ 0/ 0	0	1810
19902988	8	2/ 4/52	0	964
19902969	8	10/31/71	0	0
19902971	2	6/ 2/77	900	400
19902974	7	0/ 0/ 0	350	400
19902979	7	3/16/72	0	0
19903229	7	3/16/72	0	0
19930083	7	6/ 2/77	0	0
19930128	7	6/12/77	0	0
19930349	7	1/29/76	0	400
19930365	7	3/ 6/74	0	0
19902990	3	0/ 0/ 0	0	0
19902991	3	0/ 0/ 0	0	0
19902992	3	0/ 0/ 0	0	0
19902993	4	0/ 0/ 0	0	0
19902927	3	1/20/81	1300	3690
19930269	7	0/ 0/ 0	0	4630
19902619	3	0/ 0/ 0	1060	1820
19903489	3	3/ 9/81	900	1882
19930270	3	0/ 0/ 0	0	3700
19903009	8	3/ 9/81	0	800
19930761	3	1/ 9/81	1450	3820
19902916	3	9/ 3/81	1350	3700
19931229	7	2/25/82	350	480
19931274	7	0/ 0/ 0	0	0
19931275	2	0/ 0/ 0	0	0
19931276	7	0/ 0/ 0	0	0
19931466	7	2/22/82	325	987
19981434	3	3/26/81	500	1450
19931627	7	0/ 0/ 0	0	3500
19930728	7	0/ 0/ 0	0	0
19980748	7	0/ 0/ 0	0	1700
19902989	7	0/ 0/ 0	0	0
19902960	8	4/ 8/82	0	0

19930063	7	0/ 0/ 0	925	400
19930606	7	0/ 0/ 0	0	0
19930712	2	0/ 0/ 0	0	0
19931227	6	4/ 8/82	0	0
19930609	7	0/ 0/ 0	0	0
19931313	6	0/ 0/ 0	0	0
19931653	8	0/ 0/ 0	0	0
19902490	8	0/ 0/ 0	0	1730
19931754	2	4/ 7/83	600	400
19931745	2	4/ 7/83	600	400
19931746	2	4/ 7/83	600	1583
19931747	2	4/ 7/83	600	400
19931765	2	4/ 7/83	600	400
19931764	2	4/ 7/83	600	400
19931797	2	4/ 7/83	600	400
19931815	2	4/ 7/83	600	400
19980780	6	4/ 8/82	0	0
19980781	7	0/ 0/ 0	0	0
19902908	8	0/ 0/ 0	0	0
19902909	7	0/ 0/ 0	0	0
19902910	6	4/ 8/82	0	0
19902911	2	0/ 0/ 0	0	0
19902923	8	0/ 0/ 0	0	0
19902929	7	0/ 0/ 0	0	0
19902930	8	0/ 0/ 0	0	0
19902962	8	4/ 8/82	0	0
19902966	8	4/ 8/82	0	0
19902967	6	4/ 8/82	0	0
19902972	7	0/ 0/ 0	0	0
19902980	6	4/ 8/82	0	0
19902980	6	4/ 8/82	0	0
19903042	7	0/ 0/ 0	0	0
19902982	6	4/ 8/82	0	0
19902982	6	4/ 8/82	0	0
19902984	6	4/ 8/82	0	0
19903295	7	0/ 0/ 0	0	0
19903365	2	0/ 0/ 0	0	465
19903377	6	4/ 8/82	0	0
19903379	7	0/ 0/ 0	0	0
19930551	6	4/ 8/82	0	0
19903528	8	4/ 8/82	0	0
19903592	6	4/ 8/82	0	0
19930026	6	4/ 8/82	0	0
19930045	7	0/ 0/ 0	0	0
19930080	6	4/ 8/82	0	0
19930081	6	4/ 8/82	0	0
19930089	6	4/ 8/82	0	0
19930087	2	4/ 8/82	0	0
19930088	6	4/ 8/82	0	0
19930106	6	4/ 8/82	0	0
19930127	6	4/ 8/82	0	0
19930125	8	0/ 0/ 0	0	0
19930140	6	4/ 8/82	0	0
19930144	6	4/ 8/82	0	0
19930143	6	4/ 8/82	0	0
19930152	6	4/ 8/82	0	0
19931169	7	0/ 0/ 0	0	1004
19930171	6	4/ 8/82	0	0
19930173	6	4/ 8/82	0	0
19930183	6	4/ 8/82	0	0

19930184	6	4/ 8/82	0	0
19930207	7	0/ 0/ 0	0	0
19930244	6	4/ 8/82	0	0
19930242	2	0/ 0/ 0	0	0
19930608	6	4/ 8/82	0	0
19930607	6	4/ 8/82	0	0
19930613	7	0/ 0/ 0	0	0
19930610	6	4/ 8/82	0	0
19930603	7	0/ 0/ 0	0	0
19930602	6	4/ 8/82	0	0
19930600	7	0/ 0/ 0	0	0
19930599	6	4/ 8/82	0	0
19930598	6	4/ 8/82	0	0
19930597	6	4/ 8/82	0	0
19930625	6	4/ 8/82	0	0
19930626	6	4/ 8/82	0	0
19930629	7	4/ 8/82	0	0
19930630	7	0/ 0/ 0	0	0
19930636	6	4/ 8/82	0	0
19930634	6	4/ 8/82	0	0
19930633	6	4/ 8/82	0	0
19930635	7	0/ 0/ 0	0	1082
19930631	6	4/ 8/82	0	0
19930637	6	4/ 8/82	0	0
19930638	6	4/ 8/82	0	0
19930713	7	0/ 0/ 0	0	0
19930714	6	4/ 8/82	0	0
19930717	6	4/ 8/82	0	0
19930726	6	4/ 8/82	0	0
19930727	7	0/ 0/ 0	0	0
19930730	6	4/ 8/82	0	0
19930748	6	4/ 8/82	0	0
19930747	6	4/ 8/82	0	0
19930746	6	4/ 8/82	0	0
19930755	6	4/ 8/82	0	0
19931217	6	4/ 8/82	0	0
19931228	6	4/ 8/82	0	0
19931241	6	4/ 8/82	0	0
19931243	6	4/ 8/82	0	0
19931272	6	4/ 8/82	0	0
19931273	6	4/ 8/82	0	0
19931277	6	4/ 8/82	0	0
19931317	6	4/ 8/82	0	0
19931314	6	4/ 8/82	0	0
19931315	6	4/ 8/82	0	0
19931464	6	4/ 8/82	0	0
19931465	6	4/ 8/82	0	0
19931491	6	4/ 8/82	0	0
19930558	6	4/ 8/82	0	0
19930601	6	4/ 8/82	0	0
19980783	8	5/ 3/82	600	400
19902900	8	5/ 3/82	600	400
19902901	6	5/ 3/82	316	400
19902902	6	5/ 3/82	316	400
19902903	6	5/ 3/82	900	400
19902904	6	5/ 3/82	316	400
19902906	6	5/ 3/82	600	400
19902907	8	0/ 0/ 0	316	400
19902912	6	5/ 3/82	900	400
19902913	6	5/ 3/82	900	400

19902933	8	5/ 3/82	350	400
19902961	8	5/ 3/82	950	400
19902963	6	5/ 3/82	950	400
19902964	6	5/ 3/82	316	400
19902965	8	5/ 3/82	950	400
19903453	4	0/ 0/ 0	0	1900
19902968	6	5/ 3/82	316	400
19902970	8	5/ 3/82	950	400
19902973	8	5/ 3/82	350	400
19902975	8	5/ 3/82	316	400
19902976	6	5/ 3/82	350	400
19902983	6	5/ 3/82	900	400
19902983	6	5/ 3/82	950	400
19903180	6	5/ 3/82	350	400
19903180	6	5/ 3/82	800	400
19930546	6	5/ 3/82	925	400
19930547	2	3/ 3/82	925	1500
19903251	7	0/ 0/ 0	0	0
19903338	6	5/ 3/82	350	400
19903343	6	5/ 3/82	950	400
19903344	6	5/ 3/82	925	400
19903349	6	5/ 3/82	350	400
19903341	6	5/ 3/82	350	400
19903362	6	5/ 3/82	350	400
19903376	6	5/ 3/82	950	400
19903378	7	0/ 0/ 0	0	0
19903471	6	5/ 3/82	200	400
19903535	8	5/ 3/82	350	400
19903432	6	5/ 3/83	350	400
19930553	6	5/ 3/82	925	400
19903593	6	5/ 3/82	350	400
19930025	6	5/ 3/82	925	400
19930023	6	5/ 3/82	350	400
19930044	8	0/ 0/ 0	350	400
19930043	6	5/ 3/82	350	400
19930042	6	5/ 3/82	350	400
19930052	6	5/ 3/82	350	400
19930050	6	5/ 3/82	350	400
19930049	7	0/ 0/ 0	0	0
19930048	8	0/ 0/ 0	350	400
19930058	6	5/ 3/82	350	400
19930105	6	5/ 3/82	350	400
19930121	2	3/ 3/82	600	1190
19930126	6	5/ 3/82	925	400
19930139	6	5/ 3/82	925	400
19930145	8	0/ 0/ 0	925	400
19930153	6	5/ 3/82	925	400
19930157	6	0/ 0/ 0	350	400
19930156	6	5/ 3/82	925	400
19930187	8	0/ 0/ 0	925	400
19930189	2	0/ 0/ 0	925	400
19930206	6	5/ 3/82	925	400
19930219	8	5/ 3/82	925	400
19930238	6	5/ 3/82	950	400
19930239	6	5/ 3/82	350	400
19930246	6	5/ 8/82	925	400
19930245	6	5/ 3/82	350	400
19930549	6	5/ 3/82	925	400
19930357	6	5/ 3/82	350	400
19930367	6	5/ 3/82	925	400

19930366	2	0/ 0/ 0	350	400
19930533	6	5/ 3/82	925	400
19930532	6	5/ 3/82	350	400
19930535	6	5/ 3/82	600	400
19930534	6	5/ 3/82	925	400
19930552	7	0/ 0/ 0	925	400
19930556	6	5/ 3/82	925	400
19930037	6	0/ 0/ 0	0	0
19930576	6	5/ 3/82	600	400
19930575	2	0/ 0/ 0	925	400
19930574	7	0/ 0/ 0	925	400
19930573	6	5/ 3/82	925	400
19930572	6	5/ 3/82	925	400
19930582	6	5/ 3/82	925	400
19930581	6	5/ 3/82	925	400
19930580	6	5/ 3/82	925	400
19930579	6	5/ 3/82	925	400
19930578	6	5/ 3/82	925	400
19930710	2	0/ 0/ 0	925	400
19930711	6	5/ 3/82	925	400
19930740	2	0/ 0/ 0	850	400
19930741	6	5/ 3/82	925	400
19930744	6	0/ 0/ 0	0	0
19930749	6	5/ 3/82	925	400
19930753	7	0/ 0/ 0	925	400
19930752	6	5/ 3/82	925	400
19930769	7	0/ 0/ 0	900	400
19931216	6	5/ 3/82	600	400
19931219	7	0/ 0/ 0	925	400
19931218	6	5/ 3/82	925	400
19903257	6	5/ 3/82	900	400
19931242	6	5/ 3/82	925	400
19903166	8	0/ 0/ 0	0	1510
19980753	7	3/17/67	1900	2142
19903430	3	0/ 0/ 0	0	1598
19930719	3	2/26/82	1350	3800
19931654	2	4/ 8/82	0	0
19931753	6	4/ 8/82	0	0
19980682	7	0/ 0/ 0	1050	1811
19902919	3	0/ 0/ 0	0	3740
19930736	3	9/29/83	1500	3490
19902128	7	0/ 0/ 0	0	5300
19900000	7	0/ 0/ 0	0	2500
19931651	2	4/ 8/82	0	0
19930353	8	4/ 8/82	0	0
19931868	6	3/ 9/84	0	2015
19931917	6	3/ 9/84	0	2116
19931886	6	3/ 9/84	0	540
19932058	2	0/ 0/ 0	0	1380
19932055	6	3/ 9/84	0	1056
19932065	8	3/ 9/84	0	999
19932064	6	3/ 9/84	0	1274
19932086	6	3/ 9/84	0	512
19932089	2	4/23/84	600	400
19932087	2	4/23/84	600	400
19902300	3	5/ 1/84	500	1155
19981784	4	8/ 1/84	0	2722
19932199	7	0/ 0/ 0	0	400
19932198	2	0/ 0/ 0	600	400
19932196	2	0/ 0/ 0	600	400

19932202	6	0/ 0/ 0	0	400
19932201	2	0/ 0/ 0	0	400
19932206	2	0/ 0/ 0	600	400
19932204	2	0/ 0/ 0	0	400
19932203	6	0/ 0/ 0	0	400
19932207	2	0/ 0/ 0	0	400
19932209	2	0/ 0/ 0	0	400
19932208	2	0/ 0/ 0	0	400
19932254	2	0/ 0/ 0	0	400
19932194	2	0/ 0/ 0	0	400
19932200	2	0/ 0/ 0	0	400
19932195	7	0/ 0/ 0	600	400
19932205	2	0/ 0/ 0	600	400
19930335	4	7/ 9/85	1500	3411
19931649	6	4/ 8/82	0	400
19930669	3	7/18/85	1500	3500
19902981	3	7/18/85	1500	3734
19930336	8	7/22/85	1500	3588
19930670	3	7/28/85	1500	3546
19932288	2	0/ 0/ 0	925	400
19932285	2	0/ 0/ 0	925	400
19932286	2	0/ 0/ 0	925	400
19932287	2	0/ 0/ 0	925	400
19932284	2	0/ 0/ 0	925	400
19981650	6	0/ 0/ 0	0	1628
19902937	2	0/ 0/ 0	0	400
19902938	2	0/ 0/ 0	0	400
19902940	2	0/ 0/ 0	0	400
19902942	7	12/ 4/85	0	400
19902986	2	0/ 0/ 0	0	400
19902987	2	0/ 0/ 0	0	400
19902931	7	12/ 4/85	0	400
19902932	7	12/ 4/85	0	400
19902936	8	12/ 4/85	0	400
19903179	2	0/ 0/ 0	0	400
19903185	2	0/ 0/ 0	0	400
19903224	2	0/ 0/ 0	0	400
19903190	2	0/ 0/ 0	0	400
19903237	2	0/ 0/ 0	0	400
19903235	2	0/ 0/ 0	0	400
19903266	2	0/ 0/ 0	0	400
19903271	2	0/ 0/ 0	0	400
19903290	2	0/ 0/ 0	0	400
19903291	2	0/ 0/ 0	0	400
19903287	2	0/ 0/ 0	0	400
19903289	2	0/ 0/ 0	0	400
19903333	2	0/ 0/ 0	0	400
19903346	2	0/ 0/ 0	0	400
19903342	2	0/ 0/ 0	0	400
19903286	2	0/ 0/ 0	0	400
19903285	2	0/ 0/ 0	0	400
19903366	2	0/ 0/ 0	0	400
19903372	2	0/ 0/ 0	0	400
19903373	2	0/ 0/ 0	0	400
19903446	6	12/ 4/85	0	400
19903478	7	0/ 0/ 0	0	400
19903553	2	0/ 0/ 0	0	400
19930010	2	0/ 0/ 0	0	400
19930011	2	0/ 0/ 0	0	400
19903534	7	0/ 0/ 0	0	400

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19930014	2	0/ 0/ 0	0	400
19930015	2	0/ 0/ 0	0	400
19930016	2	0/ 0/ 0	0	400
19930041	2	0/ 0/ 0	0	400
19930061	2	12/ 4/85	0	400
19930079	2	0/ 0/ 0	0	400
19930091	2	0/ 0/ 0	0	400
19930107	2	0/ 0/ 0	0	400
19930124	2	0/ 0/ 0	0	400
19930155	2	0/ 0/ 0	0	400
19930204	2	0/ 0/ 0	0	400
19930221	2	0/ 0/ 0	0	400
19930217	7	0/ 0/ 0	0	400
19930218	2	0/ 0/ 0	0	400
19930243	2	0/ 0/ 0	0	400
19930279	2	0/ 0/ 0	0	400
19930287	2	0/ 0/ 0	0	400
19930350	2	0/ 0/ 0	0	400
19930358	2	0/ 0/ 0	0	400
19930364	2	0/ 0/ 0	0	400
19930663	7	0/ 0/ 0	0	400
19900000	6	0/ 0/ 0	0	400
19930661	2	0/ 0/ 0	0	400
19930659	7	0/ 0/ 0	0	400
19930660	2	0/ 0/ 0	0	400
19931236	2	0/ 0/ 0	0	400
19931316	2	0/ 0/ 0	0	400
19931339	2	0/ 0/ 0	0	400
19931489	2	0/ 0/ 0	0	400
19931681	2	0/ 0/ 0	0	400
19903238	2	0/ 0/ 0	0	400
19903288	2	0/ 0/ 0	0	400
19932361	7	0/ 0/ 0	0	1450
19980672	8	9/25/86	1000	3120
19903247	3	0/ 0/ 0	0	1380
19931810	3	0/ 0/ 0	0	2030
19981484	4	3/24/87	900	2221
19930616	3	10/18/74	0	1000
19930695	3	5/24/76	0	1000
19930694	3	5/24/76	0	1000
19930789	3	5/24/76	0	1000
19932427	6	0/ 0/ 0	1000	2800
19902716	2	1/26/88	1500	3472
19902920	2	0/ 0/ 0	155	3650
19902920	6	0/ 0/ 0	0	0
19930250	6	4/ 8/82	0	0
19930352	8	4/ 8/82	0	0
19930354	2	4/ 8/82	0	0
19930355	6	4/ 8/82	0	0
19930559	6	4/ 8/82	0	0
19931647	6	4/ 8/82	0	0
19931648	6	4/ 8/82	0	0
19931650	8	4/ 8/82	0	0
19931652	6	4/ 8/82	0	0
19931655	6	4/ 8/82	0	0
19932473	3	6/ 2/89	1350	3174
19932459	2	6/ 2/89	1350	3814
19932543	3	8/17/90	650	2290
19932390	3	11/15/91	1000	3390
19902586	3	10/ 5/81	900	1675

Selected Injection Well Data from the
Texas RRC UIC Database

County : JACKSON

Field (Reservoir) : CORDELE (M-2)

Field (Reservoir) : CORDELE (2600)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
23900257	8	6/24/65	0	2760
23900239	7	8/26/74	0	0
23900200	7	10/ 1/73	0	0
23900259	7	0/ 0/ 0	0	2590
23900265	3	8/28/72	1450	2130
23900000	6	9/13/79	0	2130
23981452	3	0/ 0/ 0	1450	2184
23900170	8	0/ 0/ 0	0	1855

Selected Injection Well Data from the
Texas RRC UIC Database

County : JACKSON

Field (Reservoir) : GANADO
 Field (Reservoir) : GANADO (MARG. 2)
 Field (Reservoir) : GANADO (3620)
 Field (Reservoir) : GANADO (3700)
 Field (Reservoir) : GANADO (4200)
 Field (Reservoir) : GANADO (F- 3)
 Field (Reservoir) : GANADO (F-3-H LOWER)
 Field (Reservoir) : GANADO (F- 4-C SEG 2)
 Field (Reservoir) : GANADO (3675)
 Field (Reservoir) : GANADO (F- 4-A)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
23900831	7	0/ 0/ 0	0	3880
23900842	7	3/27/74	0	4315
23980725	4	0/ 0/ 0	0	3970
23901052	7	1/ 7/77	0	3610
23900738	7	0/ 0/ 0	0	3950
23900886	7	8/11/67	0	3880
23980988	3	5/18/82	0	3850
23900880	5	12/10/79	1700	6413
23930339	3	0/ 0/ 0	0	4320
23930051	6	0/ 0/ 0	0	0
23930654	6	0/ 0/ 0	0	4325
23930261	6	12/10/79	1700	6394
23981465	8	0/ 0/ 0	0	2170
23900879	3	11/30/70	0	4314
23900871	8	5/20/52	0	4330
23932350	0	3/31/88	1650	4430

Selected Injection Well Data from the
Texas RRC UIC Database

County : JACKSON

Field (Reservoir) : GANADO WEST (CHARLES SAND)
Field (Reservoir) : GANADO WEST (4700 ZONE)
Field (Reservoir) : GANADO WEST (5100)
Field (Reservoir) : GANADO WEST (5440)
Field (Reservoir) : GANADO WEST
Field (Reservoir) : GANADO WEST (5300)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
23900603	4	0/ 0/ 0	1700	4119
23903804	6	11/15/72	0	4020
23900594	3	0/ 0/ 0	2150	3975
23981478	6	0/ 0/ 0	0	1885
23920161	4	3/20/67	2050	4040
23903447	7	0/ 0/ 0	0	2662
23903480	7	4/13/70	0	4810
23931536	3	9/24/80	1850	4050
23900605	4	0/ 0/ 0	0	4085
23903512	4	0/ 0/ 0	0	4777
23900563	7	0/ 0/ 0	0	3600
23932106	6	5/ 3/88	1725	4120

Selected Injection Well Data from the
Texas RRC UIC Database

County : JACKSON

Field (Reservoir) : LA WARD NORTH
 Field (Reservoir) : LA WARD NORTH (5100)
 Field (Reservoir) : LA WARD NORTH (6550)
 Field (Reservoir) : LA WARD NORTH (5500)
 Field (Reservoir) : LA WARD NORTH (5530)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
23931424	8	12/ 6/79	1530	1602
23901222	3	6/10/77	1500	4395
23901224	3	4/18/67	0	4390
23901785	7	4/ 2/69	0	2240
23920284	8	8/11/67	0	2040
23901751	4	0/ 0/ 0	1500	4440
23900000	7	0/ 0/ 0	0	1602
23932130	3	1/30/85	925	1920
23981458	8	5/24/51	850	1400
23903827	6	0/ 0/ 0	0	3850
23903827	4	6/28/85	1500	3850
23901219	2	5/25/89	1525	2250
23901233	3	3/15/91	1575	4100
23932283	2	9/27/82	0	0
23901244	3	7/14/94	1575	4250

Selected Injection Well Data from the
Texas RRC UIC Database

County : JACKSON

Field (Reservoir) : LOLITA (MARGINULINA ZONE)

Field (Reservoir) : LOLITA (MOPAC SAND)

Field (Reservoir) : LOLITA (WARD ZONE)

Field (Reservoir) : LOLITA (TONEY ZONE)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
23980993	4	9/14/72	1650	4502
23902139	8	0/ 0/ 0	0	1678
23902199	7	11/12/73	0	4425
23903672	8	11/22/72	1300	1980
23902053	7	11/16/64	0	4438
23902059	8	10/ 7/75	0	5384
23902244	8	12/ 8/75	0	2078
23902162	8	1/ 5/82	0	5380
23902125	8	2/20/76	0	2060
23902234	3	0/ 0/ 0	1300	2088
23900000	6	0/ 0/ 0	0	3900
23902273	3	10/29/74	1300	1767
23930124	4	0/ 0/ 0	1300	4330

Selected Injection Well Data from the
Texas RRC UIC Database

County : BRAZORIA
Field (Reservoir) : BRYAN MOUND

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
3931253	8	0/ 0/ 0	0	4610
3931284	8	0/ 0/ 0	0	5710
3931259	8	0/ 0/ 0	0	5650
3931332	8	0/ 0/ 0	0	5885
3931260	8	0/ 0/ 0	0	5680
3931288	8	0/ 0/ 0	0	5742
3900000	3	0/ 0/ 0	0	0
3900000	3	0/ 0/ 0	0	0
3931372	3	0/ 0/ 0	0	0
3931373	3	0/ 0/ 0	0	0
3900000	4	0/ 0/ 0	0	0
3931383	3	0/ 0/ 0	0	0
3931385	3	0/ 0/ 0	0	0
3931388	3	0/ 0/ 0	0	0
3931387	3	0/ 0/ 0	0	0
3931421	3	0/ 0/ 0	0	0
3931390	3	0/ 0/ 0	0	0
3931398	3	0/ 0/ 0	0	0
3931402	3	0/ 0/ 0	0	0
3931391	3	0/ 0/ 0	0	0
3931393	3	0/ 0/ 0	0	0
3931368	3	0/ 0/ 0	0	0
3931361	3	0/ 0/ 0	0	0
3931376	3	0/ 0/ 0	0	0
3931379	3	0/ 0/ 0	0	0
3931404	3	0/ 0/ 0	0	0
3931405	3	0/ 0/ 0	0	0
3931329	3	0/ 0/ 0	0	0
3931410	3	0/ 0/ 0	0	0
3931413	3	0/ 0/ 0	0	0
3931814	3	0/ 0/ 0	0	0
3931816	3	0/ 0/ 0	0	0
3931818	3	0/ 0/ 0	0	0
3931820	3	0/ 0/ 0	0	0
3931371	3	0/ 0/ 0	0	0
3931397	3	0/ 0/ 0	0	0
3931345	3	0/ 0/ 0	0	0
3931399	3	0/ 0/ 0	0	0
3931400	3	0/ 0/ 0	0	0
3931403	3	0/ 0/ 0	0	0
3931363	3	0/ 0/ 0	0	0
3931392	3	0/ 0/ 0	0	0
3931380	3	0/ 0/ 0	0	0
3931328	3	0/ 0/ 0	0	0
3931394	3	0/ 0/ 0	0	0
3931375	3	0/ 0/ 0	0	0
3931411	3	0/ 0/ 0	0	0
3931815	3	0/ 0/ 0	0	0
3931817	3	0/ 0/ 0	0	0
3931819	3	0/ 0/ 0	0	0
3931821	3	0/ 0/ 0	0	0

Selected Injection Well Data from the
Texas RRC UIC Database

County : JACKSON

Field (Reservoir) : MAURBRO

Field (Reservoir) : MAURBRO (MARGINULINA 5100)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
23932130	3	5/ 8/64	1600	2100
23901101	6	0/ 0/ 0	0	4350
23901281	8	3/ 3/72	1600	5172
23900000	6	0/ 0/ 0	0	2000
23980914	4	0/ 0/ 0	1550	2000
23901101	3	11/20/78	1550	3850
23932128	2	10/31/94	950	2000

Selected Injection Well Data from the
Texas RRC UIC Database

County : JACKSON
Field (Reservoir) : STEWART
Field (Reservoir) : STEWART (6220)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
23900794	3	0/ 0/ 0	1650	4290
23900791	4	2/15/67	1750	4300
23900807	7	5/17/66	0	4400
23930485	4	0/ 0/ 0	1600	4290
23900796	4	12/ 1/76	0	4410
23980989	3	1/27/72	1750	4235
23903458	4	0/ 0/ 0	0	4215
23900000	6	0/ 0/ 0	0	4410
23931816	3	0/ 0/ 0	0	4100

Selected Injection Well Data from the
Texas RRC UIC Database

County : JACKSON

Field (Reservoir) : WEST RANCH (GLASSCOCK)
Field (Reservoir) : WEST RANCH (GRETA)
Field (Reservoir) : WEST RANCH (OTHER ZONES)
Field (Reservoir) : WEST RANCH (WARD)
Field (Reservoir) : WEST RANCH (TONEY)
Field (Reservoir) : WEST RANCH (98-A)
Field (Reservoir) : WEST RANCH (41-A)
Field (Reservoir) : WEST RANCH (MARGINULINA 5000)
Field (Reservoir) : WEST RANCH (BENNVUE)
Field (Reservoir) : WEST RANCH (FRIO 6200)
Field (Reservoir) : WEST RANCH (DIXON SAND)
Field (Reservoir) : WEST RANCH (3800)
Field (Reservoir) : WEST RANCH (MIOCENE -H-)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
23902309	4	2/22/72	1300	2676
23902363	6	0/ 0/ 0	0	0
23902388	7	0/ 0/ 0	0	0
23902394	6	0/ 0/ 0	0	0
23902416	7	0/ 0/ 0	0	0
23980586	7	0/ 0/ 0	0	0
23902482	6	11/ 3/66	0	0
23902515	7	0/ 0/ 0	0	0
23902700	7	0/ 0/ 0	0	0
23902797	6	1/30/75	0	4190
23902304	4	1/30/76	1450	4290
23902381	6	0/ 0/ 0	0	0
23902496	8	4/ 3/58	0	4310
23902542	7	5/ 6/74	0	4225
23902556	7	4/ 7/58	0	4320
23902582	7	10/ 8/70	0	4135
23902879	8	9/ 3/75	0	0
23902319	6	0/ 0/ 0	0	2350
23902541	3	2/12/70	0	5798
23902610	7	0/ 0/ 0	0	0
23902750	6	0/ 0/ 0	0	0
23902784	6	2/12/70	1400	5762
23903055	7	5/ 2/69	0	1885
23902422	6	0/ 0/ 0	0	4505
23902451	6	0/ 0/ 0	0	0
23902532	7	0/ 0/ 0	0	0
23902639	6	0/ 0/ 0	0	0
23902786	8	3/14/73	0	0
23902788	8	0/ 0/ 0	0	0
23902391	6	0/ 0/ 0	0	0
23902485	7	0/ 0/ 0	0	0
23902791	6	1/ 1/ 1	0	0
23902451	4	12/ 3/80	1500	4340
23931619	7	0/ 0/ 0	0	4200
23902513	4	0/ 0/ 0	0	4315
23903777	7	0/ 0/ 0	0	4350
23902372	3	11/14/80	1300	4320
23902375	8	12/ 3/80	1300	4170
23902786	8	12/ 3/80	0	4230

23930061	3	2/ 6/81	1500	4322
23902675	4	10/ 7/82	0	4493
23902507	7	2/12/70	0	5168
23902449	4	4/11/83	0	4327
23902418	8	12/ 2/77	1500	5166
23930061	6	9/ 2/77	0	4375
23902756	7	0/ 0/ 0	0	0
23902372	6	0/ 0/ 0	0	4370
23902594	8	0/ 0/ 0	0	0
23981467	6	0/ 0/ 0	0	0
23902590	4	4/ 5/78	1475	5140
23980641	6	0/ 0/ 0	0	0
23980622	8	0/ 0/ 0	0	4120
23902797	7	0/ 0/ 0	0	3772
23902457	8	0/ 0/ 0	0	5042
23902654	8	4/11/83	0	0
23902563	8	11/30/82	0	4065
23902422	3	0/ 0/ 0	0	4330
23903823	5	2/11/80	1500	6120
23902500	6	0/ 0/ 0	0	5465
23902517	4	6/28/84	0	5470
23902562	7	9/17/87	1475	5135
23902712	3	9/17/87	0	5700
23902782	3	9/17/87	0	5730
23902430	4	10/16/84	0	5740
23902467	3	10/16/84	0	3782
23902499	3	9/17/87	0	5760
23903049	3	0/ 0/ 0	0	3700
23902588	3	1/23/85	0	5582
23902652	4	0/ 0/ 0	0	4310
23902601	3	11/ 6/85	1475	5160
23902374	4	11/ 6/85	0	5172
23902521	8	1/ 3/86	0	5177
23902598	3	12/17/85	0	5194
23902585	3	1/ 3/86	0	5160
23902531	8	6/27/86	0	5740
23902686	3	7/ 9/86	1500	4140
23902784	3	0/ 0/ 0	0	5568
23902424	8	2/ 6/67	1600	4998
23902596	8	12/16/86	0	5510 :
23902377	7	3/ 2/87	1500	5130
23902602	4	3/ 2/87	1500	5125
23902605	4	3/ 2/87	1500	5110
23902753	3	3/19/87	1500	3950
23902475	3	9/ 2/77	1500	5100
23900000	6	9/ 2/77	1500	5090
23902703	3	9/ 2/77	1500	5075
23902778	3	9/ 2/77	1500	5070
23902395	8	9/ 2/77	1500	5087
23902516	2	3/23/90	1500	5180
23902495	2	3/23/90	1500	5150
23930826	2	3/14/90	1500	4150
23902691	3	7/17/90	1500	3540
23902764	3	11/ 7/91	1400	4210
23932022	3	8/ 1/91	1550	5170
23902651	3	12/21/92	1450	4330
23902842	3	12/14/92	1450	4325
23902846	2	1/12/93	1400	4320
23902374	3	4/27/94	1500	4324

Selected Injection Well Data from the
Texas RRC UIC Database

County : NUECES

Field (Reservoir) : AGUA DULCE
 Field (Reservoir) : AGUA DULCE (DABNEY)
 Field (Reservoir) : AGUA DULCE (PFLUGER LO.)
 Field (Reservoir) : AGUA DULCE (AUSTIN LOWER)
 Field (Reservoir) : AGUA DULCE (CONSOLIDATED FRIO)
 Field (Reservoir) : AGUA DULCE (COMSTOCK -B-)
 Field (Reservoir) : AGUA DULCE (COMSTOCK UPPER)
 Field (Reservoir) : AGUA DULCE (2070)
 Field (Reservoir) : AGUA DULCE (SPONBERG)
 Field (Reservoir) : AGUA DULCE (6800 N.)
 Field (Reservoir) : AGUA DULCE (7000)
 Field (Reservoir) : AGUA DULCE (GERHARDT)
 Field (Reservoir) : AGUA DULCE (6900 SALGE SAND)
 Field (Reservoir) : AGUA DULCE (6240)
 Field (Reservoir) : AGUA DULCE (STRAY 5100)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
35581469	3	3/ 1/71	1150	3814
35500722	3	8/14/67	1100	4918
35581686	4	11/15/79	1100	1785
35504943	8	3/29/78	0	2240
35504772	3	0/ 0/ 0	1150	3865
35531426	3	0/ 0/ 0	0	4217
35500366	7	2/20/68	0	3820
35504718	3	3/22/73	1200	3700
35504803	3	0/ 0/ 0	1150	4180
35500465	3	9/18/68	900	2670
35504798	4	6/22/64	1150	2685
35530506	7	1/30/74	0	0
35581760	8	3/17/67	0	0
35531575	6	0/ 0/ 0	0	4914
35530867	8	0/ 0/ 0	0	2100
35530686	4	6/ 5/85	1150	4038
35532454	3	0/ 0/ 0	0	5000
35500498	7	11/21/66	0	1490
35532572	3	7/27/87	1100	3800
35505713	3	12/14/88	1060	4145
35506232	3	10/ 8/92	1100	3850

Selected Injection Well Data from the
Texas RRC UIC Database

County : NUECES

Field (Reservoir) : BALDWIN
Field (Reservoir) : BALDWIN (7400)
Field (Reservoir) : BALDWIN (7800)
Field (Reservoir) : BALDWIN (BARNHART)
Field (Reservoir) : BALDWIN (2830 LAGARTO)
Field (Reservoir) : BALDWIN (7050)
Field (Reservoir) : BALDWIN (7100)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
35503371	7	9/ 9/68	0	0
35503323	3	5/ 7/73	500	2400
35503320	4	5/ 7/73	500	2400
35530029	3	1/25/78	450	3214
35530194	3	0/ 0/ 0	450	3702
35503384	7	0/ 0/ 0	0	0
35581386	3	12/28/83	450	3370
35500000	6	0/ 0/ 0	0	2850
35530626	7	8/ 6/84	0	1550
35532795	2	3/30/93	300	3530
35532795	2	3/30/93	300	3530

Selected Injection Well Data from the
Texas RRC UIC Database

County : NUECES

Field (Reservoir) : CLARA DRISCOLL

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
35530209	3	9/ 5/86	1000	3660
35506494	4	12/19/86	925	2200
35504376	4	9/26/87	1000	3802
35506499	3	3/15/88	950	2200
35532766	3	1/31/92	1000	3780
35533000	0	3/27/95	975	2350

Selected Injection Well Data from the
Texas RRC UIC Database

County : NUECES

Field (Reservoir) : LONDON GIN

Field (Reservoir) : LONDON GIN (BURKE SAND)

Field (Reservoir) : LONDON GIN (4800)

Field (Reservoir) : LONDON GIN (MASS. CATAHOULA)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
35580498	7	1/23/79	450	1500
35503450	4	0/ 0/ 0	0	1500
35503432	4	7/12/79	350	3680
35503529	8	0/ 0/ 0	0	3910
35503430	4	2/15/80	350	3400
35503517	8	0/ 0/ 0	0	0
35503464	6	0/ 0/ 0	0	3588
35503459	3	6/24/82	350	3847
35580493	8	11/18/75	450	3560
35503460	3	0/ 0/ 0	0	3607
35503429	3	0/ 0/ 0	0	0
35532166	3	7/ 5/89	950	2016
35503465	4	3/23/90	350	3600
35503469	3	7/13/92	350	4433

Selected Injection Well Data from the
Texas RRC UIC Database

County : NUECES

Field (Reservoir) : RICHARD KING

Field (Reservoir) : RICHARD KING (5600 UPPER)

Field (Reservoir) : RICHARD KING (5400 UPPER)

Field (Reservoir) : RICHARD KING (5875)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
35581655	8	0/ 0/ 0	0	1600
35500074	3	3/24/80	1100	2050
35500096	7	2/ 4/66	0	2350
35530693	3	0/ 0/ 0	0	2203
35530320	4	0/ 0/ 0	0	2390
35500157	6	0/ 0/ 0	0	5654
35500109	3	0/ 0/ 0	0	2268
35530613	2	0/ 0/ 0	1150	2260
35500179	3	0/ 0/ 0	750	2320

Selected Injection Well Data from the
Texas RRC UIC Database

County : NUECES

Field (Reservoir) : SAXET
 Field (Reservoir) : SAXET (1 900)
 Field (Reservoir) : SAXET (3 300)
 Field (Reservoir) : SAXET (2 800)
 Field (Reservoir) : SAXET (2 400)
 Field (Reservoir) : SAXET (FRIO)
 Field (Reservoir) : SAXET (3 000)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
35501559	8	4/ 2/73	100	3546
35506157	3	0/ 0/ 0	0	5316
35501812	7	3/ 2/73	0	3665
35502145	7	0/ 0/ 0	300	3374
35501434	3	8/ 3/73	100	3444
35501799	3	2/23/73	100	3660
35502132	7	6/14/71	0	0
35501948	7	7/24/74	0	3650
35501569	3	8/ 3/77	100	3605
35502361	8	3/13/73	0	3715
35582199	8	6/ 6/73	900	3640
35505808	3	0/ 0/ 0	0	3500
35581735	3	0/ 0/ 0	0	3150
35502031	7	0/ 0/ 0	0	2148
35501524	7	0/ 0/ 0	0	2396
35506034	3	0/ 0/ 0	0	3643
35580707	8	2/24/73	100	3734
35506040	3	9/27/89	100	1779
35501564	3	1/23/92	100	3900

Selected Injection Well Data from the
Texas RRC UIC Database

County : NUECES

Field (Reservoir) : WHITE POINT EAST

Field (Reservoir) : WHITE POINT EAST (2300)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
35502191	3	6/30/93	100	3040

Selected Injection Well Data from the
Texas RRC UIC Database

County : REFUGIO

Field (Reservoir) : BONNIE VIEW

Field (Reservoir) : BONNIE VIEW (4200 D-1)

Field (Reservoir) : BONNIE VIEW (FRIO 4650)

Field (Reservoir) : BONNIE VIEW (4550 STRINGER)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
39103571	6	0/ 0/ 0	0	0
39103558	3	3/22/73	1100	3650
39180445	6	5/11/73	1200	3630
39103582	3	3/22/73	1160	3650
39103603	8	3/22/73	0	3362
39180436	8	4/ 3/73	0	4495
39103624	8	7/30/73	0	3975
39103571	3	6/ 4/74	1150	3680
39131436	6	0/ 0/ 0	0	3840
39103619	3	1/23/90	1125	3650
39131761	3	0/ 0/ 0	1150	3650

Selected Injection Well Data from the
Texas RRC UIC Database

County : REFUGIO

Field (Reservoir) : GRETA (MASSIVE CATAHOULA)
Field (Reservoir) : GRETA (O-6)
Field (Reservoir) : GRETA (4400)
Field (Reservoir) : GRETA (O-4)
Field (Reservoir) : GRETA (C-1)
Field (Reservoir) : GRETA (C-2)
Field (Reservoir) : GRETA (F-2 WEST)
Field (Reservoir) : GRETA (L- 2)
Field (Reservoir) : GRETA (L- 3)
Field (Reservoir) : GRETA (L- 4)
Field (Reservoir) : GRETA (L-13)
Field (Reservoir) : GRETA (L-14 SOUTH)
Field (Reservoir) : GRETA (O-1)
Field (Reservoir) : GRETA (L-15)
Field (Reservoir) : GRETA (L- 5)
Field (Reservoir) : GRETA (L-16)
Field (Reservoir) : GRETA (C-5)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
39101213	3	6/17/71	1250	3600
39181500	3	11/27/78	1350	3356
39100916	7	0/ 0/ 0	0	0
39130227	3	7/27/72	1300	3450
39100990	6	9/29/73	0	3654
39100994	6	2/15/78	1250	2740
39100917	4	8/ 7/79	1250	2696
39101003	8	10/13/70	0	3980
39100794	8	7/25/69	1300	3565
39100795	8	7/ 5/74	0	3620
39130183	3	8/15/85	1200	3155
39100866	3	4/10/86	1250	3100
39100875	3	9/14/70	1325	3100
39100878	3	3/23/72	1250	3100
39100879	3	3/23/77	1250	3510
39130209	3	2/28/85	1250	3146
39100894	7	2/28/54	0	1944
39130252	3	5/21/74	1300	3500
39101208	3	0/ 0/ 0	1650	3550
39101202	3	12/10/76	1650	3575
39101205	3	2/14/57	1300	3600
39100932	4	9/14/76	1450	3470
39100933	4	3/15/74	0	38
39100939	8	11/14/80	1300	3500
39101045	3	8/22/72	0	3326
39101056	8	2/ 1/73	0	4525
39181491	3	0/ 0/ 0	0	3575
39130062	3	11/ 9/78	1325	3189
39101021	3	2/26/79	1250	3798
39100920	7	8/ 6/73	0	3534
39100807	7	10/23/73	0	3500
39101014	3	4/ 7/69	1275	3342
39100987	6	7/ 8/71	1300	3550
39100742	8	5/26/71	1250	1710
39101025	7	0/ 0/ 0	0	1868

39102025	8	3/22/79	1200	1815
39100450	3	3/22/79	1200	1795
39101046	6	0/ 0/ 0	1400	3328
39101258	8	2/16/68	0	1600
39130197	7	0/ 0/ 0	0	1900
39101025	7	0/ 0/ 0	0	1868
39100903	6	0/ 0/ 0	0	0
39101246	3	11/ 8/68	1200	3800
39100903	6	0/ 0/ 0	0	0
39100652	3	8/ 1/79	0	3206
39101565	8	8/ 9/79	1375	3379
39101002	8	3/ 8/54	1100	3865
39100913	6	2/17/81	0	3438
39182074	7	2/ 4/58	0	3750
39100996	8	4/11/80	0	2730
39100868	3	4/10/86	0	3100
39130189	6	3/ 7/80	0	3250
39100796	7	0/ 0/ 0	0	1915
39100996	7	4/11/80	0	2730
39100721	3	0/ 0/ 0	1350	3198
39100740	7	0/ 0/ 0	0	1925
39130295	8	6/17/83	0	3470
39100791	7	0/ 0/ 0	1300	3530
39102021	8	0/ 0/ 0	0	3401
39180926	7	6/11/80	1315	4407
39131490	6	7/12/84	0	3120
39130198	7	0/ 0/ 0	0	1750
39131490	3	7/12/84	1250	3120
39100000	6	7/30/87	1250	3710
39100804	8	1/10/86	0	3140
39100864	3	4/10/86	1250	3100
39100797	4	8/15/85	1250	3148
39100862	2	7/ 8/86	1250	3100
39100000	6	6/20/86	0	3130
39130118	6	0/ 0/ 0	1350	2200
39101046	3	7/16/85	1400	3180
39131756	4	0/ 0/ 0	1400	3140
39101027	3	7/22/85	1250	3136
39100642	5	12/ 8/88	1400	3354
39100743	3	4/24/90	1325	2200
39103798	3	7/23/90	1350	2925
39131634	3	8/22/90	1325	4400
39100817	2	8/ 3/90	0	4350
39100000	2	8/ 3/90	0	4350
39100962	3	1/21/91	1350	4352
39131158	2	1/14/91	1275	4340
39100983	3	5/14/91	1300	3550
39100957	3	7/12/91	1350	4352
39100780	2	4/13/93	1325	4350
39101050	3	7/ 1/93	1275	4361
39100875	6	7/15/94	1250	3100
39100912	0	8/31/94	1275	4250
39130338	0	9/30/94	1325	4360
39182067	0	9/30/94	1325	4350

Selected Injection Well Data from the
Texas RRC UIC Database

County : REFUGIO

Field (Reservoir) : LAKE PASTURE
Field (Reservoir) : LAKE PASTURE (FS-515)
Field (Reservoir) : LAKE PASTURE (FS-538)
Field (Reservoir) : LAKE PASTURE (FT-569)
Field (Reservoir) : LAKE PASTURE (H-440 SAND)
Field (Reservoir) : LAKE PASTURE (FS-509)
Field (Reservoir) : LAKE PASTURE (M-330)
Field (Reservoir) : LAKE PASTURE (M-295)
Field (Reservoir) : LAKE PASTURE (FS-503)
Field (Reservoir) : LAKE PASTURE (6050)
Field (Reservoir) : LAKE PASTURE (H-434)
Field (Reservoir) : LAKE PASTURE (L-206)
Field (Reservoir) : LAKE PASTURE (FS-536)
Field (Reservoir) : LAKE PASTURE (FT-562)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
39100353	3	8/10/78	0	3726
39100218	8	6/27/79	1500	3849
39130281	3	4/20/79	0	3940
39180858	3	3/29/56	1525	3810
39100220	5	8/19/64	1500	5381
39100272	6	8/16/71	1300	5700
39100295	6	8/12/77	1300	5755
39104012	3	3/ 8/77	1300	5734
39100267	4	4/ 5/73	1300	5700
39182081	3	7/13/64	1475	4434
39131175	3	10/14/77	1500	3740
39104042	3	6/14/77	1500	4447
39100291	4	1/27/77	1500	4440
39130323	6	2/20/76	0	3720
39100363	3	10/ 6/77	1350	4456
39100267	6	0/ 0/ 0	0	5772
39100380	3	0/ 0/ 0	0	3760
39100382	3	0/ 0/ 0	1525	3770
39100384	3	11/30/77	1525	3894
39100385	3	0/ 0/ 0	0	3750
39130026	3	5/12/74	1350	4431
39100202	3	10/ 2/73	1350	3733
39100229	6	7/10/68	0	3724
39131192	4	0/ 0/ 0	1500	3820
39100325	3	8/31/72	1500	3700
39100326	3	7/ 5/76	1350	4460
39130513	3	9/22/76	1500	3898
39131224	6	6/ 2/78	1500	3740
39100495	3	3/22/72	1500	3765
39100205	8	10/23/79	1300	3380
39181544	3	2/ 9/81	1500	4150
39130534	3	7/11/80	1500	3416
39130332	4	11/18/80	1500	6520
39100349	4	11/12/80	1500	4110
39181960	3	0/ 0/ 0	0	3890
39131190	6	0/ 0/ 0	0	3920
39100000	6	4/20/79	0	3940
39100000	6	8/10/78	0	3726

39130534	6	0/ 0/ 0	0	3750
39100273	6	4/ 4/84	0	4440
39130327	6	0/ 0/ 0	0	3760
39100206	3	6/11/84	1500	3660
39131260	6	0/ 0/ 0	0	3466
39131196	5	10/23/84	1500	3074
39130327	3	0/ 0/ 0	1500	3760
39131260	3	0/ 0/ 0	0	3466
39131244	8	4/25/84	0	4530
39131737	3	7/12/84	0	4510
39100270	3	1/13/71	1350	4432
39131781	3	6/15/87	1450	3770
39100371	3	11/20/84	1500	3821
39100224	3	10/28/88	1500	3835
39100301	6	1/ 1/ 1	0	0
39131789	3	2/ 5/91	1450	4427
39103783	3	2/19/91	1475	5696
39130229	3	6/ 3/92	1475	4396

Selected Injection Well Data from the
Texas RRC UIC Database

County : REFUGIO

Field (Reservoir) : LA ROSA
Field (Reservoir) : LA ROSA (SPAULDING)
Field (Reservoir) : LA ROSA (5900 SAND)
Field (Reservoir) : LA ROSA (6000)
Field (Reservoir) : LA ROSA (4800)
Field (Reservoir) : LA ROSA (6800)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
39103371	4	11/ 9/76	1200	4500
39181052	7	3/10/76	0	4525
39103384	3	8/23/65	0	4500
39103393	4	0/ 0/ 0	1200	2650
39181055	8	5/ 3/71	0	4000
39103422	5	2/15/78	1000	4730
39103412	7	1/ 3/67	0	4500
39180714	7	9/ 7/71	0	0
39103319	7	2/ 2/54	0	4700
39103424	4	3/ 3/54	1000	4868
39103408	3	9/19/72	1200	4500
39103382	8	0/ 0/ 0	1200	2650
39103407	7	6/23/67	0	4513
39103370	7	0/ 0/ 0	0	4000
39103320	4	0/ 0/ 0	0	4882

Selected Injection Well Data from the
Texas RRC UIC Database

County : REFUGIO

Field (Reservoir) : MCFADDIN (4400)
Field (Reservoir) : MCFADDIN (5300)
Field (Reservoir) : MCFADDIN (2200)
Field (Reservoir) : MCFADDIN (2250)
Field (Reservoir) : MCFADDIN (2300)
Field (Reservoir) : MCFADDIN
Field (Reservoir) : MCFADDIN (3200)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
39100245	3	8/ 9/74	1350	3796
39103865	3	0/ 0/ 0	1350	2211
39100177	7	8/ 1/72	0	1635
39100061	6	0/ 0/ 0	0	0
39180021	3	8/ 6/68	1640	2000
39181543	3	0/ 0/ 0	1320	2070
39131226	7	0/ 0/ 0	0	2284
39130214	3	0/ 0/ 0	0	3274

Selected Injection Well Data from the
Texas RRC UIC Database

County : REFUGIO

Field (Reservoir) : MARY ELLEN OCONNOR (FQ- 9)
 Field (Reservoir) : MARY ELLEN OCONNOR (FQ-40 SAND)
 Field (Reservoir) : MARY ELLEN OCONNOR (FS-96)
 Field (Reservoir) : MARY ELLEN OCONNOR (FT-18 SAND)
 Field (Reservoir) : MARY ELLEN OCONNOR (D-1)
 Field (Reservoir) : MARY ELLEN OCONNOR (FQ-25)
 Field (Reservoir) : MARY ELLEN OCONNOR (FQ-30)
 Field (Reservoir) : MARY ELLEN OCONNOR (FS-1)
 Field (Reservoir) : MARY ELLEN OCONNOR (H- 12)
 Field (Reservoir) : MARY ELLEN OCONNOR (5000)
 Field (Reservoir) : MARY ELLEN OCONNOR (FS-75)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
39101861	8	0/ 0/ 0	1300	3600
39101868	8	8/14/68	0	2585
39101930	8	11/ 6/73	0	3555
39101945	8	11/28/73	0	3600
39101820	3	1/ 1/ 1	1200	3852
39101838	3	0/ 0/ 0	1000	3597
39101804	8	0/ 0/ 0	0	4050
39120348	4	1/ 2/70	1300	2576
39103684	6	9/14/72	0	2570
39101834	3	11/13/72	1300	3950
39101973	8	6/21/73	1300	3590
39101835	8	8/ 5/71	0	3917
39101945	8	0/ 0/ 0	0	0
39101931	3	0/ 0/ 0	1300	4445
39101861	8	0/ 0/ 0	0	0
39101878	8	2/ 4/74	0	3600
39130481	6	6/26/79	1200	3620
39130009	3	0/ 0/ 0	0	1800
39101875	8	5/ 2/84	1200	3595
39131217	4	0/ 0/ 0	1200	4240
39101894	0	5/25/94	1200	3580

Selected Injection Well Data from the
Texas RRC UIC Database

County : REFUGIO

Field (Reservoir) : REFUGIO NEW

Field (Reservoir) : REFUGIO NEW (3670)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
39182012	7	11/29/73	0	4900
39103017	3	5/24/68	1250	3870
39103023	8	0/ 0/ 0	0	3616
39102575	3	9/20/74	1300	4210
39103027	3	0/ 0/ 0	0	3900
39102985	3	2/ 4/88	1000	2610

Selected Injection Well Data from the
Texas RRC UIC Database

County : REFUGIO
Field (Reservoir) : REFUGIO OLD
Field (Reservoir) : REFUGIO OLD (6400)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
39181492	6	12/22/76	0	3530
39102467	7	0/ 0/ 0	0	5000
39102648	5	3/12/73	1280	3100
39180063	7	0/ 0/ 0	0	5675
39131393	8	11/ 7/80	1250	3770
39180537	8	6/ 6/73	0	5514
39102196	8	0/ 0/ 0	0	1750
39180897	7	0/ 0/ 0	0	3625
39102479	8	0/ 0/ 0	0	4420
39182025	3	12/15/61	0	4290
39102212	4	0/ 0/ 0	1200	4300

Selected Injection Well Data from the
Texas RRC UIC Database

County : REFUGIO

Field (Reservoir) : TOM OCONNOR
 Field (Reservoir) : TOM OCONNOR (5800)
 Field (Reservoir) : TOM OCONNOR (5100 EAST)
 Field (Reservoir) : TOM OCONNOR (4400)
 Field (Reservoir) : TOM OCONNOR (4500 GRETA MASS.)
 Field (Reservoir) : TOM OCONNOR (5400 SAND)
 Field (Reservoir) : TOM OCONNOR (5500 SAND)
 Field (Reservoir) : TOM OCONNOR (5425 SAND)
 Field (Reservoir) : TOM OCONNOR (3900)
 Field (Reservoir) : TOM OCONNOR (3500)
 Field (Reservoir) : TOM OCONNOR (3550)
 Field (Reservoir) : TOM OCONNOR (5300 EAST)
 Field (Reservoir) : TOM OCONNOR (5440)
 Field (Reservoir) : TOM OCONNOR (5680)
 Field (Reservoir) : TOM OCONNOR (7930)
 Field (Reservoir) : TOM OCONNOR (3560)
 Field (Reservoir) : TOM OCONNOR (4150)
 Field (Reservoir) : TOM OCONNOR (5900 SAND)
 Field (Reservoir) : TOM OCONNOR (4200)
 Field (Reservoir) : TOM OCONNOR (5770 U SOUTH)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
39102040	3	3/17/55	1300	3700
39101653	3	4/ 9/70	1300	3865
39101661	3	12/16/70	1250	3855
39101674	8	3/17/55	0	3700
39101679	7	4/ 9/53	0	3800
39101691	4	6/16/78	1250	5878
39101408	3	1/15/80	1300	3125
39101410	4	11/24/75	1200	3900
39103944	8	0/ 0/ 0	1300	3680
39182065	3	5/18/70	1230	3690
39130165	3	0/ 0/ 0	0	3204
39104056	3	8/30/77	1380	3622
39100571	3	11/28/73	1350	3768
39100573	4	3/12/73	1350	3760
39100574	6	5/ 1/72	1350	3778
39101536	6	0/ 0/ 0	0	3690
39102031	3	12/ 5/72	0	3680
39101555	3	1/29/79	1400	3002
39102032	3	4/20/72	1380	3770
39102022	6	12/11/75	1350	3780
39102024	8	11/ 3/72	1350	3740
39181447	6	0/ 0/ 0	0	0
39100470	6	1/10/69	1300	3594
39100444	3	2/ 1/73	0	2950
39100458	3	12/ 5/78	1360	3383
39100460	3	5/ 4/78	1360	3270
39181308	3	3/22/79	0	3052
39101322	3	10/16/74	1200	3680
39103954	3	4/18/68	0	4010
39101700	3	9/11/67	0	3675
39102023	4	11/19/71	1250	3830
39100721	6	11/27/81	0	3125

39180918	3	0/ 0/ 0	0	3630
39101525	7	0/ 0/ 0	0	3820
39101760	7	9/ 3/74	0	3790
39101361	3	0/ 0/ 0	1300	3650
39101381	3	0/ 0/ 0	1250	3618
39102035	3	0/ 0/ 0	1400	3810
39103950	8	5/13/66	0	3180
39101325	3	5/19/75	1300	3670
39181220	8	4/22/54	1250	3800
39101652	3	12/ 1/76	1350	3915
39101668	3	7/ 1/76	1350	5894
39101669	3	7/ 1/76	1350	5903
39101684	3	7/ 1/76	1350	5867
39101580	6	0/ 0/ 0	0	3753
39101536	3	7/ 9/76	1400	3690
39101554	3	1/29/79	1400	3257
39101503	4	3/31/78	1350	3284
39181447	3	0/ 0/ 0	1400	3378
39100421	6	1/26/79	0	5800
39100482	3	0/ 0/ 0	1500	3385
39100490	6	7/ 1/76	1350	5900
39101546	6	0/ 0/ 0	0	3090
39101556	3	2/18/77	1400	3800
39101766	6	6/ 1/76	0	0
39131401	6	5/ 8/80	1250	6500
39100754	3	5/ 9/66	0	3607
39101451	4	8/29/63	1250	3804
39101377	8	1/14/77	0	3880
39100752	3	5/ 1/72	1300	3820
39101450	3	9/14/70	1350	3766
39101360	3	3/12/68	1250	3800
39102620	3	11/ 7/80	1250	3807
39101114	3	0/ 0/ 0	1200	3624
39101648	7	6/16/78	0	0
39101527	3	1/30/79	0	3846
39101403	3	6/27/69	1350	3880
39101452	3	5/ 6/74	0	3625
39100848	3	0/ 0/ 0	1350	3790
39101232	3	0/ 0/ 0	1400	3675
39130588	6	1/27/81	0	0
39101455	8	4/12/78	1250	3876
39101756	8	0/ 0/ 0	0	3840
39101657	4	9/28/81	1250	5827
39180636	8	0/ 0/ 0	0	1955
39130588	6	1/27/81	1300	6580
39100709	3	0/ 0/ 0	0	3639
39130206	2	2/17/82	1400	4322
39101757	3	0/ 0/ 0	0	3833
39100754	6	5/ 2/66	0	0
39100774	6	10/18/82	0	3880
39101313	3	1/31/83	0	3890
39101677	6	0/ 0/ 0	0	5165
39100000	6	0/ 0/ 0	0	3335
39130078	6	0/ 0/ 0	0	3784
39101762	6	0/ 0/ 0	0	3855
39130046	3	0/ 0/ 0	0	3650
39101764	6	0/ 0/ 0	0	3860
39101759	3	0/ 0/ 0	0	3295
39101372	6	0/ 0/ 0	0	3200
39100000	6	0/ 0/ 0	0	3876

39100000	6	0/ 0/ 0	0	3435
39101554	6	1/29/79	1400	3257
39100000	6	0/ 0/ 0	0	3780
39100000	6	12/ 5/78	0	3383
39181357	6	0/ 0/ 0	0	3441
39100000	6	0/ 0/ 0	0	3050
39100000	6	0/ 0/ 0	0	3690
39101613	3	0/ 0/ 0	0	5872
39100747	3	0/ 0/ 0	0	5867
39100569	3	0/ 0/ 0	0	5798
39100420	6	0/ 0/ 0	0	5788
39100849	3	0/ 0/ 0	0	5888
39100528	3	0/ 0/ 0	0	5851
39103784	5	3/ 9/84	0	5891
39101677	6	0/ 0/ 0	0	5848
39101651	3	0/ 0/ 0	0	5840
39181954	8	10/16/70	0	3611
39131742	6	0/ 0/ 0	0	5778
39131743	6	0/ 0/ 0	0	5758
39131744	6	0/ 0/ 0	0	5768
39101631	4	0/ 0/ 0	0	3790
39100801	4	8/ 6/84	0	5919
39101621	3	0/ 0/ 0	0	5800
39100570	3	0/ 0/ 0	0	5770
39181459	3	0/ 0/ 0	0	5807
39101406	3	0/ 0/ 0	0	3235
39100741	8	2/15/85	1375	1700
39103795	5	0/ 0/ 0	0	3790
39101699	3	0/ 0/ 0	0	5834
39100419	3	0/ 0/ 0	0	5780
39100768	3	0/ 0/ 0	0	3766
39100710	3	1/ 8/86	1400	3678
39181448	3	0/ 0/ 0	0	5749
39100422	3	0/ 0/ 0	0	5775
39101609	6	5/27/86	1300	5852
39101580	3	10/13/86	1375	3455
39101720	3	0/ 0/ 0	1250	5812
39100418	3	0/ 0/ 0	1350	5757
39101588	3	0/ 0/ 0	1250	5797
39101593	3	0/ 0/ 0	1250	5808
39100671	5	6/ 1/76	1400	5716
39101561	3	0/ 0/ 0	1400	5769
39100708	3	8/27/87	1350	5734
39101140	6	0/ 0/ 0	1400	5743
39101151	5	0/ 0/ 0	1400	5738
39103867	3	6/ 1/86	1300	5788
39101600	3	0/ 0/ 0	1300	5841
39101727	3	6/14/89	1300	5842
39101559	6	6/14/89	1375	5838
39101310	3	7/26/89	1200	5860
39101312	3	7/26/89	1200	5840
39101506	3	9/ 1/89	1350	5794
39101327	3	9/27/89	1200	5887
39101566	3	6/ 1/76	1400	5696
39101744	3	6/ 1/76	1300	5846
39101745	3	6/ 1/76	100	5822
39101563	3	0/ 0/ 0	1400	5814
39101558	2	5/31/90	1375	5841
39101504	3	7/13/90	1350	5770
39101512	3	7/13/90	1350	5740

39101514	3	7/13/90	1350	5739
39181273	6	8/30/90	1250	5796
39101714	3	8/30/90	1250	5777
39101731	2	12/10/90	1250	5784
39131679	3	1/21/92	1300	3644
39101637	3	3/31/92	1300	3600
39101636	2	9/ 8/92	1300	3600
39101581	3	6/14/93	1300	5784
39132034	0	11/10/93	1350	5900
39101460	0	1/10/94	1300	5734
39101499	0	3/31/94	1450	3690
39101589	0	9/21/94	1300	5810
39101123	0	9/21/94	1350	5885
39101518	0	9/21/94	1350	5749

3931263	3	0/	0/	0	0	0
3931374	3	0/	0/	0	0	0
3931415	3	0/	0/	0	0	0

Selected Injection Well Data from the
Texas RRC UIC Database

County : SAN PATRICIO

Field (Reservoir) : MIDWAY
 Field (Reservoir) : MIDWAY (MAIN MIDWAY SAND)
 Field (Reservoir) : MIDWAY (5110)
 Field (Reservoir) : MIDWAY (3600)
 Field (Reservoir) : MIDWAY (6550-A-)
 Field (Reservoir) : MIDWAY (5730)
 Field (Reservoir) : MIDWAY (6190)
 Field (Reservoir) : MIDWAY (1072)
 Field (Reservoir) : MIDWAY (MIOCENE)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
40902572	8	0/ 0/ 0	0	3260
40981124	3	12/27/72	0	4140
40981126	8	2/ 6/73	0	1540
40902737	6	7/25/79	0	3240
40981220	4	4/23/69	300	4010
40902581	7	0/ 0/ 0	0	2235
40902888	3	7/22/74	300	1900
40931235	3	3/ 5/79	0	5304
40980121	8	0/ 0/ 0	0	2148
40930246	6	0/ 0/ 0	350	1420
40981302	3	3/ 9/64	150	1604
40981123	4	1/18/74	300	4160
40981263	6	0/ 0/ 0	0	3275
40931631	3	1/ 5/83	300	3655
40904109	4	10/ 3/83	300	2461
40900000	6	8/ 7/79	300	3260
40902887	3	7/11/86	0	2480
40902580	4	3/27/69	1080	5289
40981263	3	11/12/93	0	3140

Selected Injection Well Data from the
Texas RRC UIC Database

County : SAN PATRICIO

Field (Reservoir) : ODEM
Field (Reservoir) : ODEM (5900)
Field (Reservoir) : ODEM (6100 UP)
Field (Reservoir) : ODEM (6160)
Field (Reservoir) : ODEM (MASSIVE FRIO)
Field (Reservoir) : ODEM (5050 S.)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
40903757	7	8/31/71	0	1610
40930152	6	2/25/77	0	0
40930221	3	10/ 7/80	350	2200
40930237	8	0/ 0/ 0	0	1300
40903761	6	0/ 0/ 0	0	0
40930219	6	2/25/77	0	0
40930336	4	2/25/77	350	6133
40903808	3	5/14/81	0	2350
40903811	3	0/ 0/ 0	0	2702
40930012	3	3/15/82	350	2230
40903661	3	5/14/81	350	3700
40903665	8	8/15/63	0	1465
40930152	6	2/25/77	300	6176

Selected Injection Well Data from the
Texas RRC UIC Database

County : SAN PATRICIO

Field (Reservoir) : PLYMOUTH
Field (Reservoir) : PLYMOUTH (MAIN GRETA SAND)
Field (Reservoir) : PLYMOUTH (5800 SAND)
Field (Reservoir) : PLYMOUTH (6100 SAND)
Field (Reservoir) : PLYMOUTH (6500-A)
Field (Reservoir) : PLYMOUTH (6100 SOUTH)
Field (Reservoir) : PLYMOUTH (5100)
Field (Reservoir) : PLYMOUTH (GRETA STRINGER)
Field (Reservoir) : PLYMOUTH (8350)
Field (Reservoir) : PLYMOUTH (5470)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
40901535	3	1/23/93	750	4700
40901953	3	7/15/77	600	4150
40901564	4	4/25/78	0	4880
40901566	6	1/ 4/73	0	0
40901810	8	10/10/74	750	4902
40901570	6	0/ 0/ 0	0	0
40901865	3	8/10/72	0	3860
40901846	4	9/ 7/72	0	3875
40901449	7	2/15/80	500	4150
40901451	7	9/22/76	600	4100
40901452	3	12/17/71	600	4080
40901873	3	11/13/72	0	4760
40901876	8	11/13/72	0	4870
40901811	7	11/13/72	0	4874
40901812	7	11/13/72	0	4910
40902143	8	11/13/72	0	4935
40902144	7	11/13/72	0	4890
40901774	3	7/24/72	0	4000
40901505	4	9/27/71	750	4000
40901751	7	7/25/74	100	1740
40901755	7	9/27/71	0	4000
40901754	6	6/24/71	0	0
40901595	3	1/23/73	750	4708
40981229	8	0/ 0/ 0	0	0
40930291	6	0/ 0/ 0	0	3955
40901571	3	3/ 3/77	700	4750
40980325	4	8/19/83	0	4768
40902102	3	0/ 0/ 0	0	4020
40901916	3	0/ 0/ 0	0	0
40980327	6	3/22/82	750	4690
40901916	3	0/ 0/ 0	0	2733
40901621	6	0/ 0/ 0	0	0
40901623	6	0/ 0/ 0	0	0
40901628	6	0/ 0/ 0	0	0
40930448	6	0/ 0/ 0	0	0
40930449	6	0/ 0/ 0	0	0
40930544	6	0/ 0/ 0	0	0
40930329	6	0/ 0/ 0	0	0
40901771	3	0/ 0/ 0	750	4000
40903958	8	0/ 0/ 0	0	3892
40901552	2	0/ 0/ 0	0	4920
40930291	4	6/10/85	600	3955

40930175	4	0/ 0/ 0	0	7450
40901444	4	0/ 0/ 0	600	2068
40981651	3	2/22/73	700	4032
40901796	3	2/22/73	750	4700
40901271	8	3/14/66	750	5507
40901815	8	3/14/66	350	5480
40901803	8	3/14/66	300	5492
40980966	8	3/14/66	400	5497
40901771	6	7/24/72	1080	4664
40980399	6	7/24/72	950	4668
40901762	6	7/24/72	750	4685
40901754	6	9/27/71	750	4710
40901756	6	9/27/71	750	4720
40901759	6	9/27/71	750	4710
40901920	2	1/ 4/94	550	1500

Selected Injection Well Data from the
Texas RRC UIC Database

County : SAN PATRICIO

Field (Reservoir) : PLYMOUTH EAST

Field (Reservoir) : PLYMOUTH EAST (5100)

Field (Reservoir) : PLYMOUTH EAST (HAVELKA SD.)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
40930079	6	1/17/74	500	4813
40902053	8	0/ 0/ 0	0	0
40981461	2	0/ 0/ 0	500	4913
40980776	8	11/ 3/72	500	4820
40931505	4	0/ 0/ 0	0	4895
40902055	3	4/ 2/86	500	1400
40930079	3	10/ 9/90	500	4030

Selected Injection Well Data from the
Texas RRC UIC Database

County : SAN PATRICIO

Field (Reservoir) : PORTILLA (5700 SAND)
Field (Reservoir) : PORTILLA (7100 SAND)
Field (Reservoir) : PORTILLA (8100 SAND)
Field (Reservoir) : PORTILLA (7400 SAND)
Field (Reservoir) : PORTILLA (7300 SAND)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
40901173	8	8/25/55	0	2014
40901679	6	3/10/80	1100	1990
40901712	4	9/18/69	900	4700
40901713	8	9/30/73	0	4705
40901715	4	9/26/72	1100	4690
40904119	7	7/ 8/71	0	1600
40901694	3	0/ 0/ 0	900	1000
40901707	7	0/ 0/ 0	0	4735
40901671	3	1/ 8/79	0	3300
40901688	3	7/ 9/80	950	4800
40901682	3	9/11/80	1170	4700
40901692	7	0/ 0/ 0	0	4700
40901654	3	0/ 0/ 0	0	4700
40901664	3	0/ 0/ 0	0	4680
40901678	3	5/14/85	0	4750
40901178	3	0/ 0/ 0	0	4746
40901666	3	0/ 0/ 0	0	4700

Selected Injection Well Data from the
Texas RRC UIC Database

County : SAN PATRICIO
Field (Reservoir) : SINTON WEST (SHALLOW)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
40900423	8	3/29/73	1050	1675
40900719	7	6/13/74	0	2041
40900720	7	6/13/74	0	1458
40900724	8	2/25/74	0	1570
40900518	7	7/24/75	0	1560
40900546	7	0/ 0/ 0	0	1830
40900629	8	0/ 0/ 0	0	1110
40981490	2	0/ 0/ 0	0	0
40932247	3	7/ 6/88	1000	3770
40932210	3	11/28/88	900	1484
40981000	4	11/ 2/89	850	1920
40931861	3	10/31/91	1050	2518
40980537	3	12/ 9/92	900	3085

Selected Injection Well Data from the
Texas RRC UIC Database

County : SAN PATRICIO

Field (Reservoir) : TAFT (4000)

Field (Reservoir) : TAFT (4550)

Field (Reservoir) : TAFT (3700 CATAHOULA)

Field (Reservoir) : TAFT (4900)

Field (Reservoir) : TAFT (4300)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
40901354	3	11/12/73	600	3507
40901330	3	1/18/71	550	3495
40901355	3	1/18/71	600	3490
40901367	3	2/15/72	550	4200
40901365	3	2/15/72	550	4200
40901366	3	2/15/72	550	4200
40901401	7	1/ 1/ 1	550	0
40981039	7	0/ 0/ 0	550	3050
40901297	6	11/22/72	550	3728
40901316	7	3/25/73	550	4475
40901308	7	8/11/72	0	4041
40901417	8	2/21/73	500	4045
40901316	7	1/23/73	550	0
40904351	7	1/23/73	0	0
40901307	7	1/23/73	0	0
40901998	6	2/26/73	750	4130
40901999	4	2/26/73	750	4130
40901342	3	3/18/68	600	3475
40901329	8	0/ 0/ 0	600	3500
40981024	8	4/ 9/65	600	1360
40901353	7	5/18/52	0	0
40904120	8	3/16/81	500	4030
40901325	4	1/10/83	500	3470
40901335	7	0/ 0/ 0	0	4624
40901312	6	10/17/75	550	3780
40981044	3	5/15/80	550	4356
40901326	7	0/ 0/ 0	0	3540
40901404	8	2/ 1/73	550	3997
40901416	7	0/ 0/ 0	0	3992
40903935	2	5/10/88	500	3920
40903935	2	5/10/88	500	3920
40981021	3	2/23/89	500	3800
40901370	7	2/15/72	550	4200
40932055	3	6/16/89	550	3940
40981021	6	2/23/89	550	3800

Selected Injection Well Data from the
Texas RRC UIC Database

County : SAN PATRICIO
Field (Reservoir) : WHITE POINT EAST
Field (Reservoir) : WHITE POINT EAST (2300)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
40903150	8	8/ 6/73	0	3670
40981667	8	8/22/69	150	1260
40903314	8	0/ 0/ 0	0	4155
40903105	3	3/31/93	250	1275
40903092	3	11/ 5/93	300	1350
40903187	2	12/15/93	300	4364

Selected Injection Well Data from the
Texas RRC UIC Database

County : STARR

Field (Reservoir) : GARCIA
Field (Reservoir) : GARCIA (MILLER -B- VI)
Field (Reservoir) : GARCIA (MILLER -C- 1)
Field (Reservoir) : GARCIA (3150)
Field (Reservoir) : GARCIA (FROST -A-)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
42704218	4	10/14/70	250	3732
42704223	3	8/ 1/74	250	3727
42704224	8	0/ 0/ 0	0	0
42704235	3	3/ 4/75	250	3719
42704471	8	0/ 0/ 0	0	0
42703881	8	0/ 0/ 0	0	0
42704266	4	4/13/70	0	3149
42704227	8	0/ 0/ 0	0	0
42704234	7	0/ 0/ 0	0	0
42780214	3	12/27/71	250	3733

Selected Injection Well Data from the
Texas RRC UIC Database

County : STARR

Field (Reservoir) : JAY SIMMONS

Field (Reservoir) : JAY SIMMONS (A)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
42700398	6	0/ 0/ 0	0	0
42700304	6	6/17/80	1500	6475
42700418	6	3/11/81	1500	6405
42700392	8	0/ 0/ 0	0	6400
42700390	3	12/14/64	1500	6112
42700388	6	0/ 0/ 0	0	5778
42700397	6	6/26/68	1000	5778
42700393	4	9/ 4/87	1450	4268
42700389	6	8/19/64	1500	5771
42700396	6	8/19/64	1500	5738
42700400	6	10/30/67	1500	5735
42700403	6	12/14/64	0	6000
42700000	3	0/ 0/ 0	1450	6050

Selected Injection Well Data from the
Texas RRC UIC Database

County : STARR

Field (Reservoir) : KELSEY SOUTH (ZONE 19-B S)
 Field (Reservoir) : KELSEY SOUTH (ZONE 20-A S)
 Field (Reservoir) : KELSEY SOUTH (CLARK UP.)
 Field (Reservoir) : KELSEY SOUTH (ZONE 16-A)
 Field (Reservoir) : KELSEY SOUTH (ZONE 19-B)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
42700261	8	10/11/61	1500	6020
42700262	7	10/11/61	0	0
42704959	6	10/11/61	0	0
42730141	7	12/15/70	1500	5998
42700310	8	3/15/65	0	5956
42780043	4	10/25/66	1425	5609
42704513	2	8/ 6/85	0	5240
42700000	7	10/11/61	1500	5999
42700230	3	3/ 6/92	1500	5700

Selected Injection Well Data from the
Texas RRC UIC Database

County : STARR

Field (Reservoir) : REYNA (HOCKLEY SAND)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
42702368	7	9/24/70	100	670
42702418	5	12/16/68	200	670
42702415	5	7/30/63	200	649
42702417	5	12/16/68	200	662
42702371	5	12/14/88	400	673

Selected Injection Well Data from the
Texas RRC UIC Database

County : STARR
Field (Reservoir) : RICABY

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
42702948	3	10/26/78	250	1375
42702949	4	10/26/78	250	1370
42702954	3	10/26/78	250	1381
42702941	3	10/26/78	250	1367
42702963	6	8/21/69	0	0

Selected Injection Well Data from the
Texas RRC UIC Database

County : STARR
Field (Reservoir) : RINCON
Field (Reservoir) : RINCON (VICKSBURG SAND)
Field (Reservoir) : RINCON (H)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
42701543	7	8/ 7/73	0	4212
42703548	8	11/23/62	0	0
42701518	7	2/11/75	0	0
42701607	8	7/ 6/72	0	0
42701595	5	7/ 6/72	450	4500
42730164	8	2/11/75	500	3836
42701583	8	3/ 1/72	350	3935
42730124	7	12/ 9/75	350	3860
42701582	8	1/17/73	500	3874
42781482	7	0/ 0/ 0	0	0
42781158	7	0/ 0/ 0	0	0
42781160	7	0/ 0/ 0	0	0
42701567	7	0/ 0/ 0	0	0
42701609	8	10/24/72	450	3872
42781177	7	0/ 0/ 0	0	0
42781181	7	2/14/77	0	0
42701716	7	0/ 0/ 0	0	0
42730386	7	0/ 0/ 0	0	0
42781185	7	0/ 0/ 0	0	0
42781186	7	0/ 0/ 0	0	0
42781187	7	0/ 0/ 0	0	0
42701476	7	0/ 0/ 0	0	0
42701617	7	2/14/77	0	0
42701581	7	0/ 0/ 0	0	0
42701613	7	0/ 0/ 0	0	0
42701472	8	2/14/77	0	3837
42781447	8	7/22/69	0	0
42701616	8	12/ 1/64	450	4174
42701589	8	11/25/87	500	3800
42780982	7	6/12/73	450	3924
42701467	8	12/28/64	450	4040
42701468	8	12/28/64	450	4050
42701477	8	12/28/64	450	4095
42701480	8	12/28/64	450	4102
42701481	8	12/28/64	450	4066
42700000	7	12/28/64	450	4128
42701485	8	12/28/64	450	3654
42701487	8	12/28/64	450	4195
42700000	7	12/28/64	500	4042
42701513	7	12/28/64	500	4030
42701461	8	12/28/64	500	4073
42701516	7	12/28/64	500	4044
42701565	7	12/28/64	0	4090
42701603	8	12/28/64	450	4080
42701520	6	2/15/84	450	3704
42703553	8	10/ 7/63	450	3970
42701604	8	12/28/64	450	4042
42700000	7	12/28/64	450	4196
42701612	7	12/28/64	450	4143

42700000	7	12/28/64	450	4140
42701594	8	12/28/64	450	4095
42701597	8	12/28/64	400	4026
42781237	7	12/28/64	350	4070
42703551	7	7/29/68	450	3660
42700000	7	11/ 4/65	500	4026
42700000	7	8/29/66	500	3990
42701542	3	6/30/89	350	1680
42701541	8	8/24/73	450	4212
42704736	3	12/ 5/85	550	4680
42701570	3	5/27/93	450	3745
42732615	2	6/30/94	350	3890

Selected Injection Well Data from the
Texas RRC UIC Database

County : STARR

Field (Reservoir) : SUN

Field (Reservoir) : SUN (F-1-M 4950)

Field (Reservoir) : SUN (F-2 LO. NW.)

Field (Reservoir) : SUN (D-1)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
42704897	8	6/ 1/69	0	0
42704922	8	6/ 1/69	0	0
42700687	8	0/ 0/ 0	0	4195
42700695	8	12/15/70	0	5083
42700606	8	3/27/72	1200	4850
42730364	8	7/31/72	200	4994
42700893	7	6/ 1/69	0	0
42730170	4	12/28/70	1050	4856
42700610	4	10/ 5/81	1200	3856
42700691	3	0/ 0/ 0	0	4619
42731560	8	1/26/82	0	3990
42731621	3	1/ 7/87	1000	3835
42700699	4	6/25/87	950	3830
42700703	8	2/19/88	950	4615
42700708	8	2/19/88	950	4628
42730743	3	2/19/88	950	4555
42700567	7	8/17/94	1050	4856

Selected Injection Well Data from the
Texas RRC UIC Database

County : STARR

Field (Reservoir) : SUN NORTH
 Field (Reservoir) : SUN NORTH (BURRITO)
 Field (Reservoir) : SUN NORTH (5800)
 Field (Reservoir) : SUN NORTH (F-3-G)
 Field (Reservoir) : SUN NORTH (WAHEAH)
 Field (Reservoir) : SUN NORTH (5200 SAND)
 Field (Reservoir) : SUN NORTH (D-2-G)
 Field (Reservoir) : SUN NORTH (JEWEL)
 Field (Reservoir) : SUN NORTH (C-3-B)
 Field (Reservoir) : SUN NORTH (D-3-D)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
42780733	8	0/ 0/ 0	0	3306
42780733	8	7/16/80	1200	3306
42700562	7	9/29/75	0	0
42700888	8	12/13/65	0	0
42700582	7	12/14/65	0	0
42700910	8	0/ 0/ 0	0	0
42700906	8	11/26/68	0	0
42700949	7	4/20/72	1200	5180
42700580	8	2/15/80	0	4320
42700923	7	0/ 0/ 0	0	5027
42700600	3	0/ 0/ 0	0	4346
42700609	4	0/ 0/ 0	0	3874
42780736	8	8/18/87	1000	4803
42700911	8	0/ 0/ 0	1200	4955
42700913	8	0/ 0/ 0	1200	4950
42700914	8	0/ 0/ 0	1200	4961
42700915	7	0/ 0/ 0	1200	4938
42700925	7	0/ 0/ 0	1200	4970
42700920	7	0/ 0/ 0	1200	4954

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA

Field (Reservoir) : BLOOMINGTON (4600)

Field (Reservoir) : BLOOMINGTON (6100)

Field (Reservoir) : BLOOMINGTON (GRETA STRINGER)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46901992	7	0/ 0/ 0	0	0
46980587	6	0/ 0/ 0	0	4150
46901999	8	0/ 0/ 0	0	0
46901997	8	6/23/78	1700	3380
46902003	8	0/ 0/ 0	0	3400
46902023	8	9/ 3/75	1600	3400
46902041	8	8/28/75	1700	3300
46902049	8	3/ 3/77	2000	3300
46902139	8	12/ 3/79	1000	4760
46902129	4	9/ 6/62	1850	4000
46902106	4	3/20/61	1870	4205
46902102	7	4/ 1/68	0	4185
46902110	4	2/21/74	1750	4180
46902054	8	5/16/69	0	3300
46980006	8	6/28/72	1700	3625
46902082	8	4/ 3/69	0	3880
46901991	3	3/ 3/77	2050	3380
46902135	7	0/ 0/ 0	0	0
46902144	7	0/ 0/ 0	1575	3430
46902073	8	10/29/68	2000	3370
46902109	3	4/20/83	0	4185
46902076	8	0/ 0/ 0	0	3590
46930236	3	3/ 2/93	1450	3930
46902085	1	12/31/93	1450	3460
46902122	0	11/ 3/92	1650	3480

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA

Field (Reservoir) : COLETTO CREEK
Field (Reservoir) : COLETTO CREEK (2800)
Field (Reservoir) : COLETTO CREEK (4700)
Field (Reservoir) : COLETTO CREEK (3500)
Field (Reservoir) : COLETTO CREEK (4650)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46930103	7	8/10/79	0	2508
46901257	8	5/ 8/72	1550	3120
46901268	7	10/10/66	0	2487
46901600	7	0/ 0/ 0	0	1850
46901223	3	0/ 0/ 0	1560	2413
46901288	8	3/21/72	0	3100
46901243	3	6/29/62	1450	3260
46901257	8	0/ 0/ 0	0	0
46901258	3	4/27/64	1400	3120
46901250	4	5/25/64	500	3143
46901250	6	5/25/64	0	3180
46980009	6	0/ 0/ 0	0	3120
46980010	4	0/ 0/ 0	0	0
46900000	1	10/ 1/82	0	3100
46932009	6	4/ 1/83	0	3200
46932279	2	0/ 0/ 0	0	2882
46932009	3	0/ 0/ 0	0	2940
46901271	4	0/ 0/ 0	1350	2400

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA

Field (Reservoir) : HELEN GOHLKE (WILCOX)

Field (Reservoir) : HELEN GOHLKE (YEGUA K)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46980613	5	5/18/72	0	2601
46900047	3	3/22/91	1250	3550

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA

Field (Reservoir) : HELEN GOHLKE W. (WILCOX)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46900057	3	0/ 0/ 0	1850	2400
46903002	8	6/ 8/64	0	2452
46900048	3	8/19/81	1250	1920
46930448	2	8/ 1/88	1900	3880
46900064	7	8/ 1/88	1900	3910

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA
 Field (Reservoir) : HEYSER
 Field (Reservoir) : HEYSER (5400 #3)
 Field (Reservoir) : HEYSER (5400 #2)
 Field (Reservoir) : HEYSER (6700)
 Field (Reservoir) : HEYSER (6450)
 Field (Reservoir) : HEYSER (3900)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46902519	8	0/ 0/ 0	1600	1992
46902537	8	12/10/75	1600	3631
46902441	7	4/ 4/62	0	4035
46902470	8	6/14/63	0	4048
46902472	4	7/25/66	0	4120
46902496	6	12/ 5/63	0	5370
46902553	8	0/ 0/ 0	0	4057
46931935	8	0/ 0/ 0	0	4900
46932005	3	0/ 0/ 0	0	4100
46902430	8	7/25/85	0	3735
46902538	3	3/21/88	1600	4970
46902536	3	11/29/89	1600	4945
46902521	4	12/11/89	1600	3975
46932853	3	9/13/91	1500	5450
46932844	3	2/ 4/92	1600	5442
46932836	3	6/ 7/91	1700	5470
46902465	4	3/19/91	1600	4000
46902469	3	3/11/91	1600	5349
46932836	6	11/ 3/93	1700	5570
46902476	2	3/18/94	1550	5467
46902477	3	3/18/94	1550	5479
46900000	0	3/19/91	1600	4000
46902460	0	3/11/91	1600	5350
46931670	0	3/11/91	1600	5368

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA
Field (Reservoir) : KEERAN
Field (Reservoir) : KEERAN (3900)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46980626	6	7/24/74	0	3336
46902825	6	3/ 5/53	1250	3601
46902815	6	10/22/63	2100	3574
46900236	7	10/24/74	0	3712
46900217	3	0/ 0/ 0	2050	4875
46900219	6	0/ 0/ 0	0	4930
46900221	4	0/ 0/ 0	0	0
46981094	8	6/11/62	0	3630
46900746	3	10/23/90	2025	3400

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA

Field (Reservoir) : MCFADDIN (4400)
Field (Reservoir) : MCFADDIN (5000)
Field (Reservoir) : MCFADDIN (2200)
Field (Reservoir) : MCFADDIN (2800)
Field (Reservoir) : MCFADDIN (3600)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46902251	8	5/16/49	1800	4535
46901574	3	7/12/49	1775	4600
46901577	3	8/ 5/52	1100	4413
46902222	6	5/19/69	0	3740
46902229	3	10/ 9/69	1800	4413
46902277	8	8/23/65	1800	4600
46902278	7	10/ 5/48	0	4500
46980857	8	2/ 4/57	1100	4480
46902225	4	5/26/71	1800	4403
46902221	3	7/12/82	0	3600
46902207	3	3/24/83	0	3600
46902245	3	0/ 0/ 0	0	3715
46932291	6	0/ 0/ 0	0	4375
46980724	3	1/23/89	1800	3605
46902212	3	6/25/93	1650	3602

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA

Field (Reservoir) : PLACEDO

Field (Reservoir) : PLACEDO (4250)

Field (Reservoir) : PLACEDO (5770)

Field (Reservoir) : PLACEDO (4700)

Field (Reservoir) : PLACEDO (4000 CATAHOULA)

Field (Reservoir) : PLACEDO (4150 CATAHOULA)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46902633	8	10/ 2/78	1400	4050
46902630	8	7/21/75	2000	4165
46902621	3	1/21/64	850	3500
46901816	3	1/ 6/69	1600	4900
46901848	7	0/ 0/ 0	0	4150
46901914	4	7/30/51	1200	4890
46902649	8	10/25/76	0	3605
46902565	8	3/23/83	0	3520
46900000	4	2/18/83	0	0
46902643	4	0/ 0/ 0	0	4930
46901897	8	11/16/64	0	4180
46900000	3	5/12/77	1450	1954
46931608	7	0/ 0/ 0	0	4834
46980644	3	5/30/57	1400	4915
46902578	3	0/ 0/ 0	0	4910
46902804	6	7/11/61	0	3500
46901825	3	11/20/86	1450	2100
46901906	3	0/ 0/ 0	1500	4050
46931828	3	10/16/87	1450	4790
46930618	7	0/ 0/ 0	1450	3950
46901831	5	3/17/89	1525	3235
46902564	3	4/25/90	1450	3970
46902640	3	0/ 0/ 0	1550	4700

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA
Field (Reservoir) : PLACEDO EAST
Field (Reservoir) : PLACEDO EAST (5500)
Field (Reservoir) : PLACEDO EAST (6050 SD.)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46902752	4	0/ 0/ 0	0	4030
46902759	7	6/16/67	0	4065
46902756	8	6/14/63	0	3610
46902729	3	3/27/75	0	2350
46902751	7	5/31/49	0	4050
46902746	8	0/ 0/ 0	0	4760
46900000	6	0/ 0/ 0	0	4970
46902746	8	4/ 4/84	0	4025
46902750	3	0/ 0/ 0	0	4030
46902759	8	6/16/67	0	4810

Selected Injection Well Data from the
Texas RRC UIC Database

County : VICTORIA

Field (Reservoir) : PRIDHAM LAKE
Field (Reservoir) : PRIDHAM LAKE (CATAHOULA)
Field (Reservoir) : PRIDHAM LAKE (OAKVILLE)
Field (Reservoir) : PRIDHAM LAKE (TYNG)
Field (Reservoir) : PRIDHAM LAKE (3800)
Field (Reservoir) : PRIDHAM LAKE (3900)
Field (Reservoir) : PRIDHAM LAKE (1560)

API #	H-10 Status	Auth. Date	Base UQW	Top of Inj. Zone
46901024	7	3/28/78	1650	3000
46980858	8	7/21/76	1800	3300
46901036	7	5/16/68	0	4747
46930244	4	8/ 3/77	1650	3000
46930290	8	2/ 1/80	0	1728
46901036	8	5/17/68	0	4747
46980340	7	5/26/76	0	2468
46901107	7	10/ 2/74	0	2064
46980088	3	5/ 5/69	0	1960
46901035	3	12/22/80	1650	3000
46901033	7	0/ 0/ 0	0	0
46931721	6	0/ 0/ 0	0	0
46931717	8	0/ 0/ 0	0	0
46901019	4	0/ 0/ 0	0	2580
46930534	3	2/ 3/88	1675	2600
46931721	3	0/ 0/ 0	1525	3305
46931885	8	5/23/91	1500	2640
46932793	3	4/10/92	1425	3054

APPENDIX 2

Copies of portions of borehole logs from Texas Gulf Coast study fields showing 250 foot cumulative and 100 foot continuous shale intervals as interpreted from the logs.

Base of usable quality groundwater from Appendix 1.

Shallow salt domes oilfields are excluded from analysis.

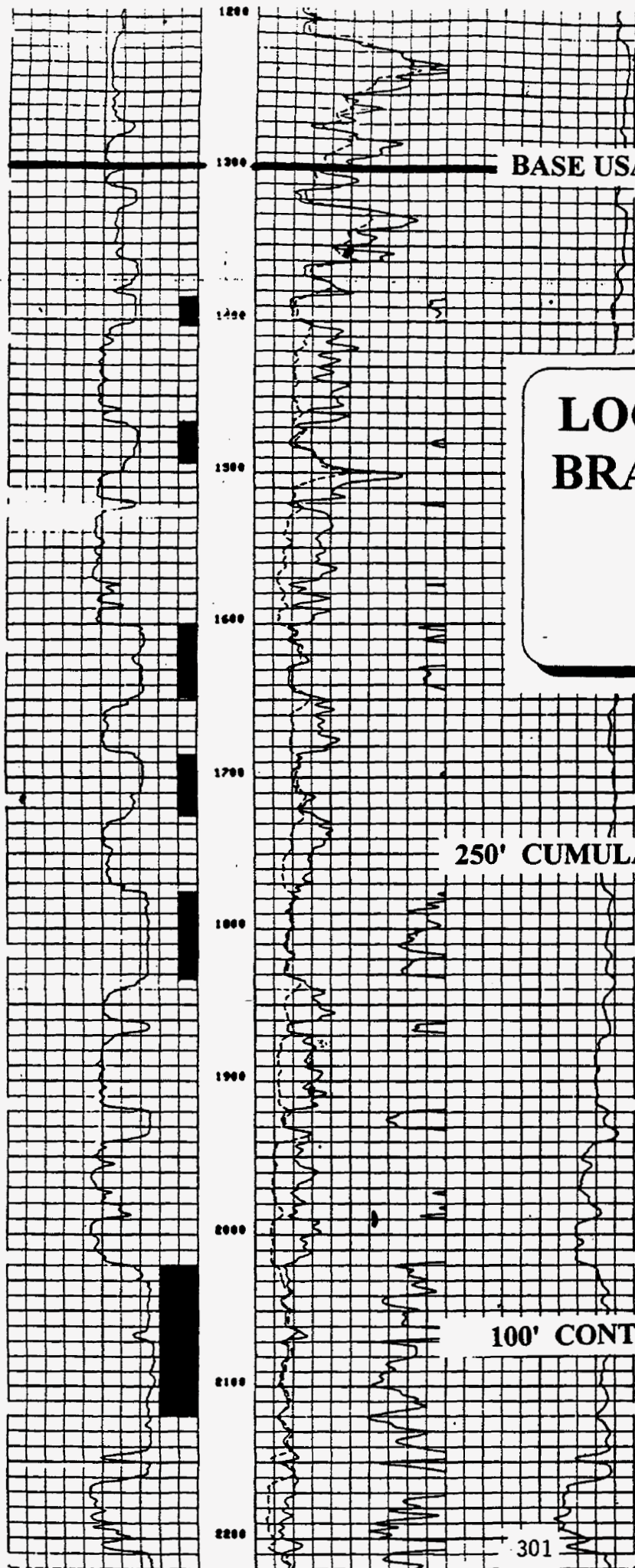
BASE USABLE GROUNDWATER = 1700'

HASTINGS FIELD BRAZORIA COUNTY

Stanolind
J. W. Surface #6

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE



BASE USABLE GROUNDWATER = 1300'

LOCHRIDGE FIELD BRAZORIA COUNTY

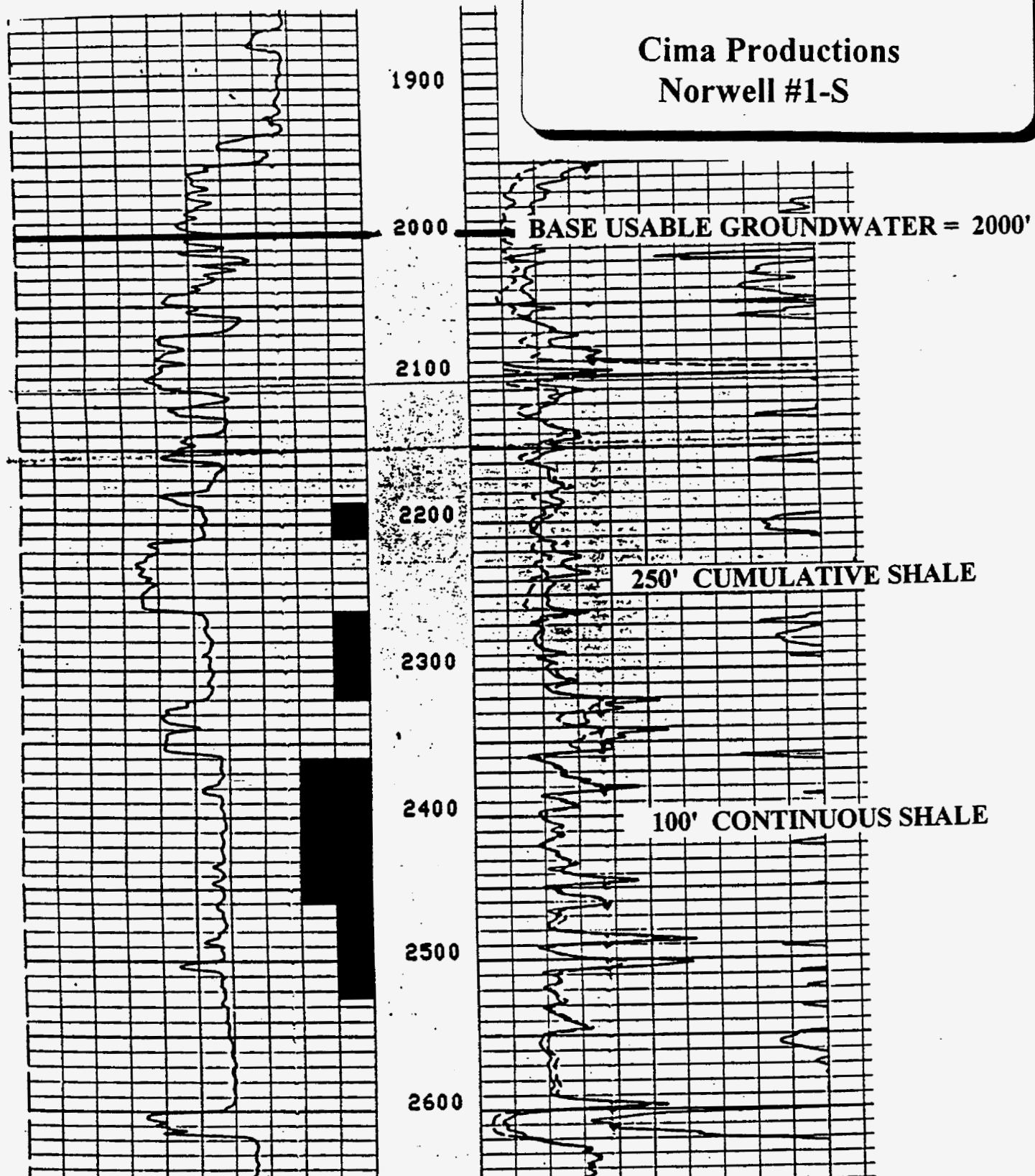
Burns Petroleum
Wilkes-Smith #1

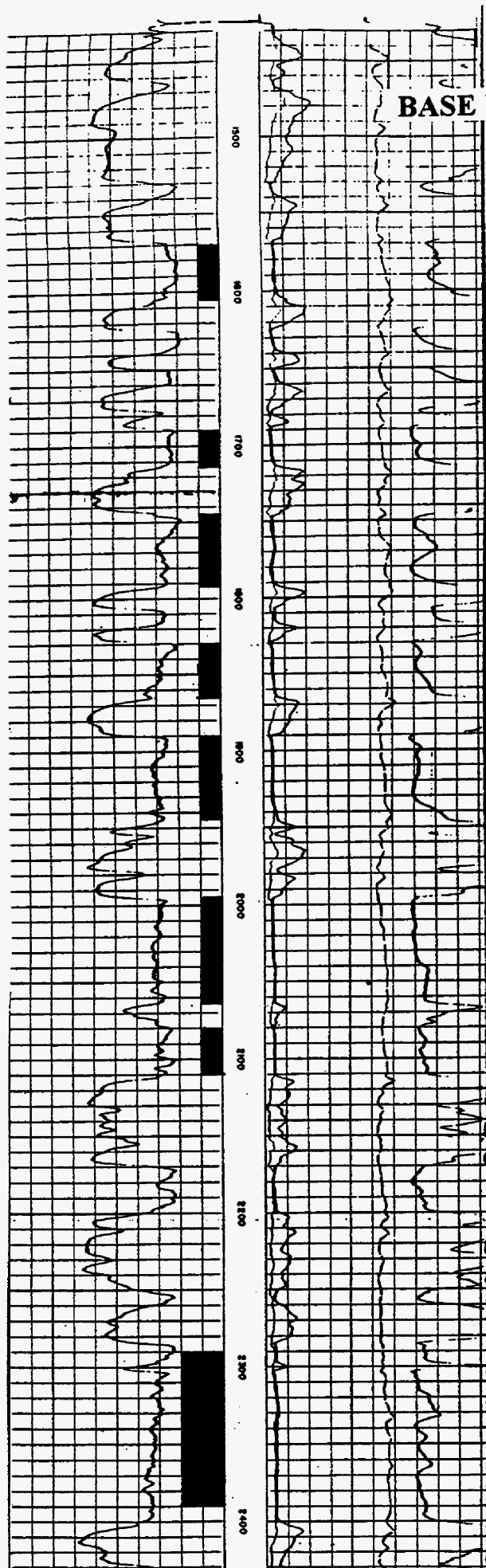
250' CUMULATIVE SHALE

100' CONTINUOUS SHALE

MANVEL FIELD BRAZORIA COUNTY

Cima Productions
Norwell #1-S





BASE USABLE GROUNDWATER = 1200'

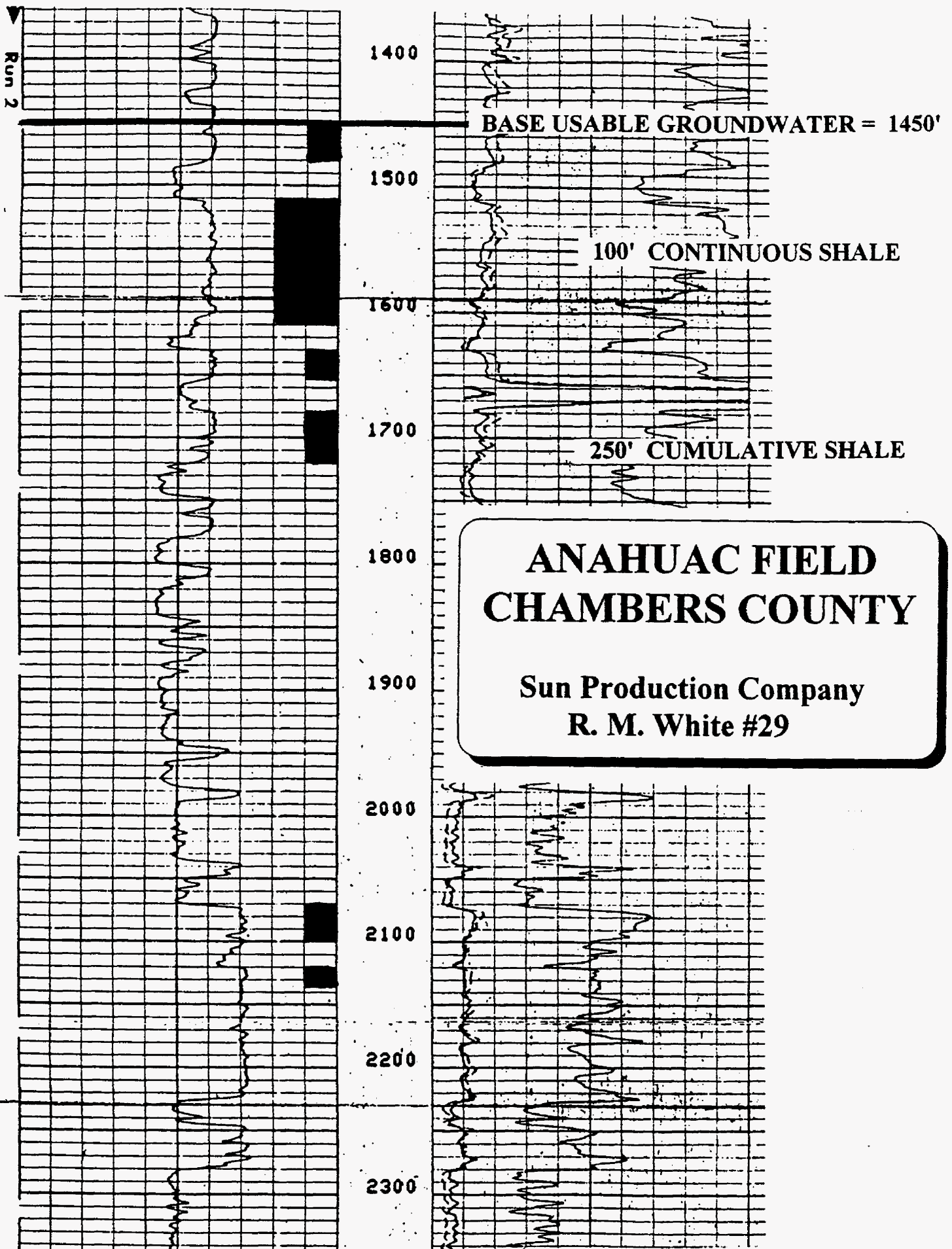


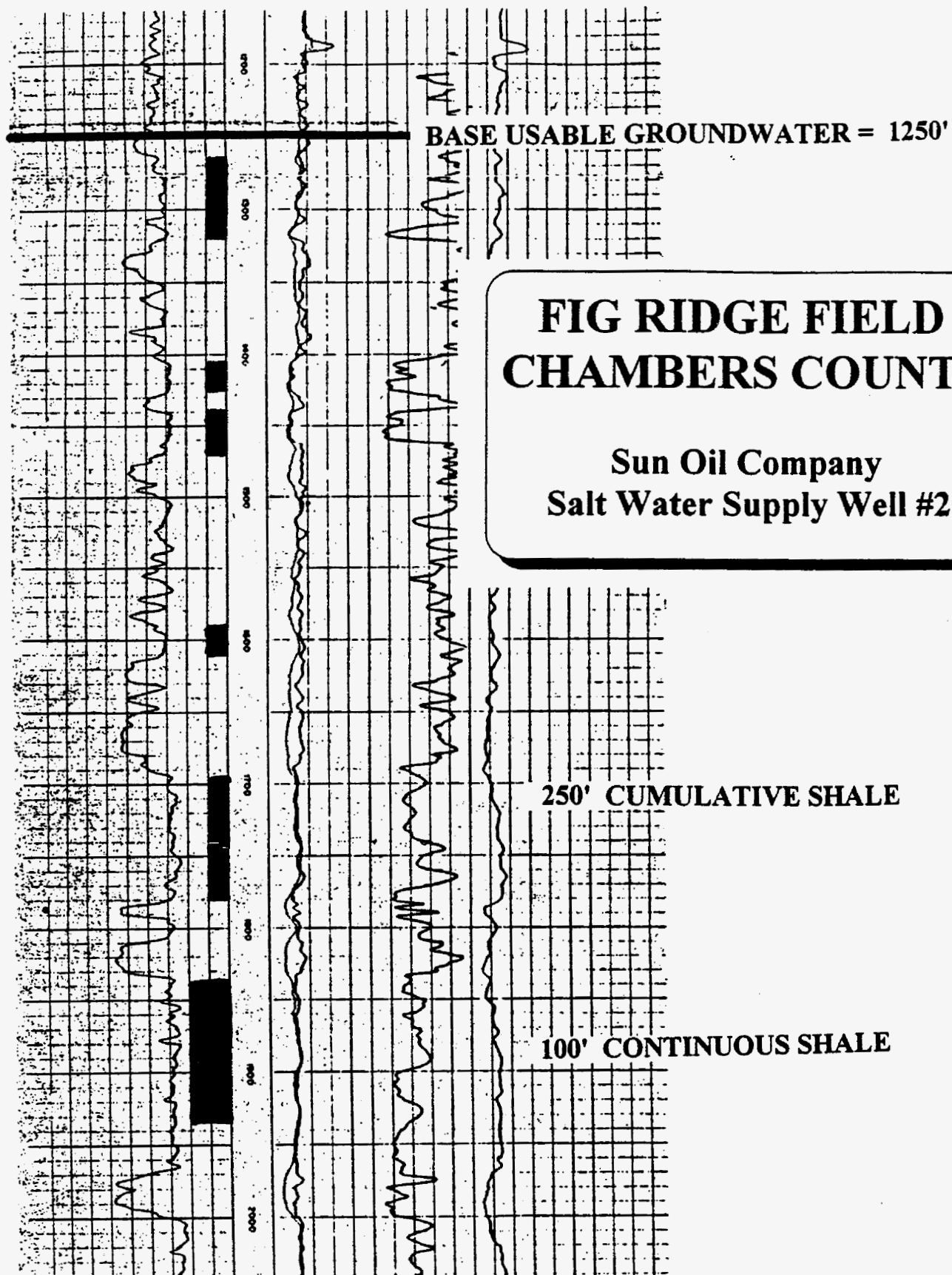
OLD OCEAN FIELD BRAZORIA COUNTY

**La Gloria Corporation
San Bernard River-State #1**

250' CUMULATIVE SHALE

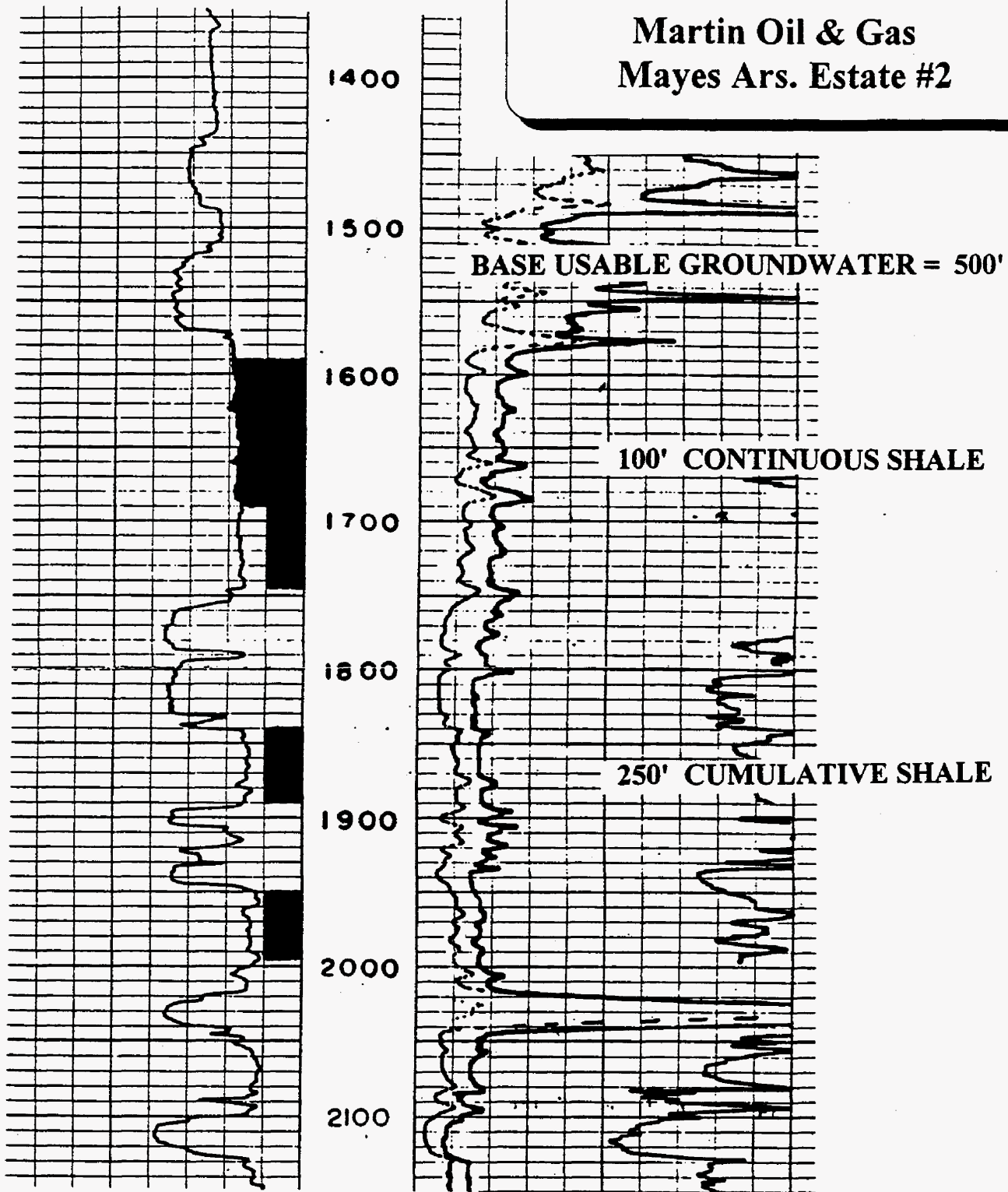
100' CONTINUOUS SHALE

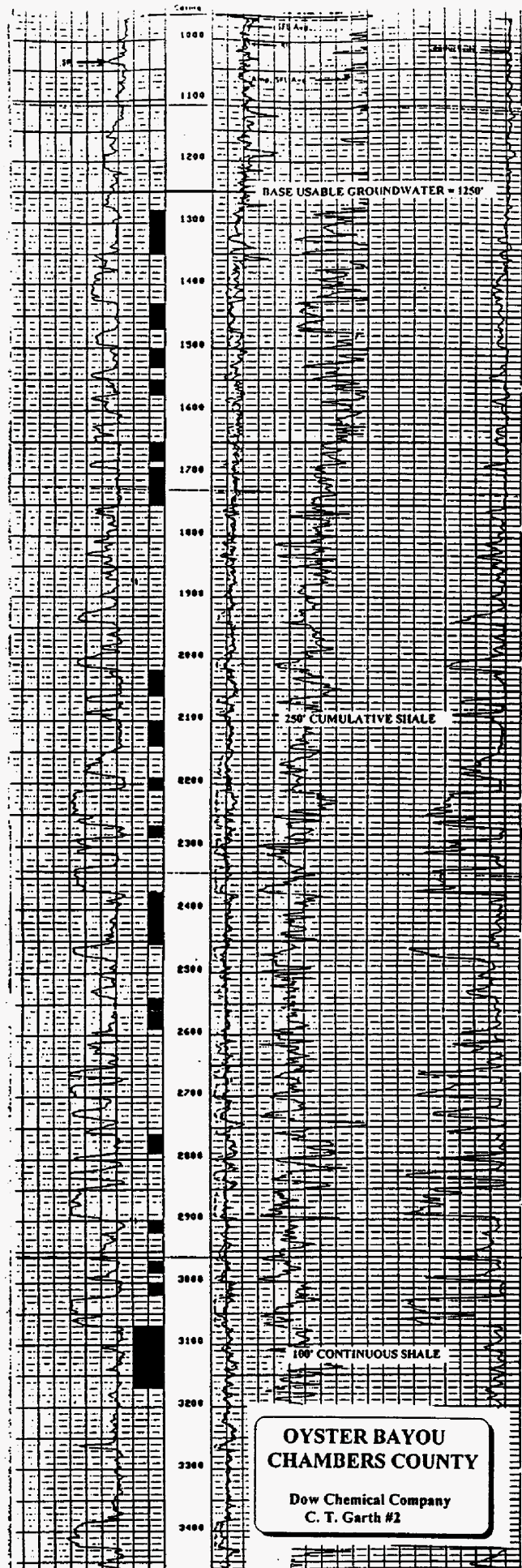




LOST LAKE FIELD CHAMBERS COUNTY

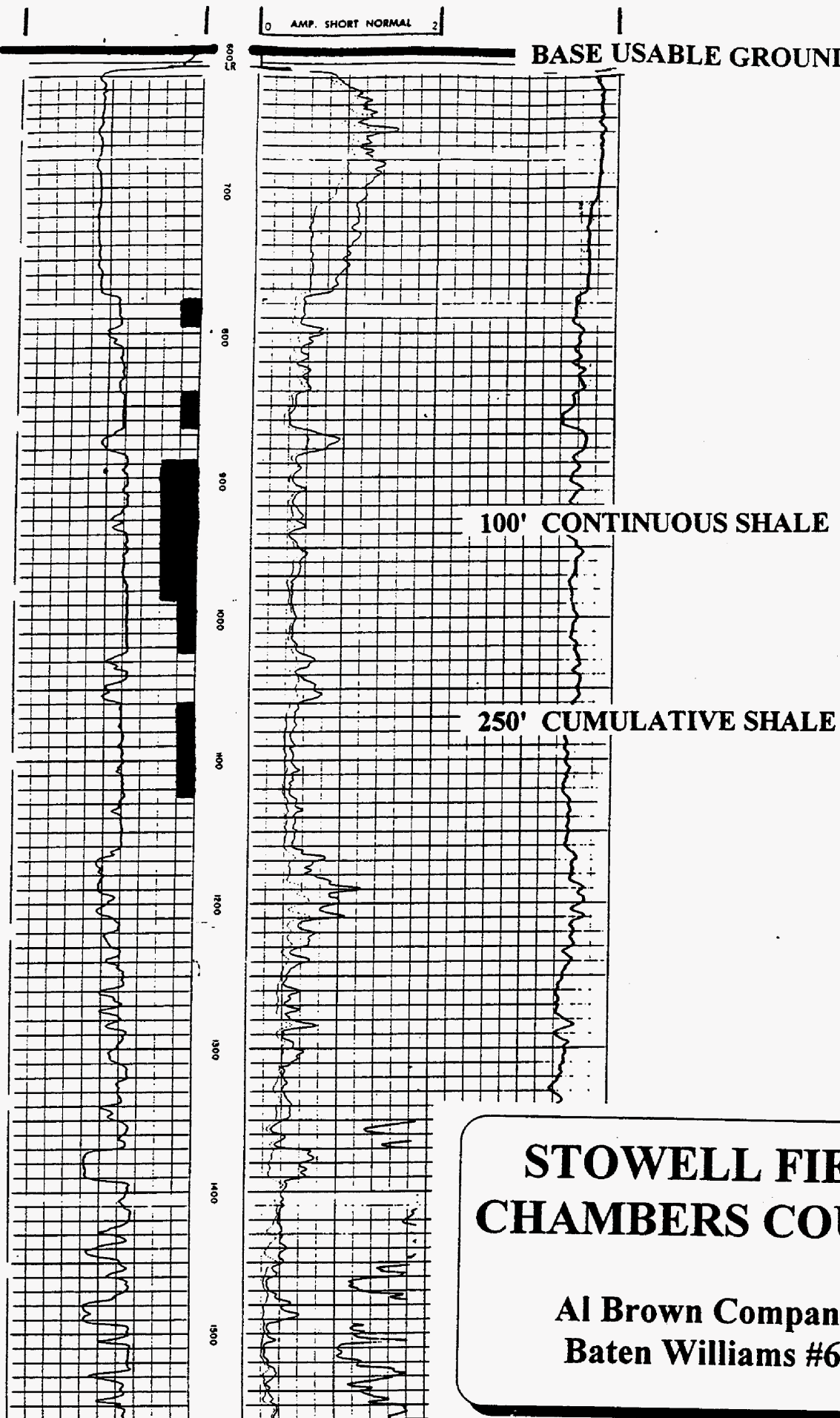
Martin Oil & Gas
Mayes Ars. Estate #2

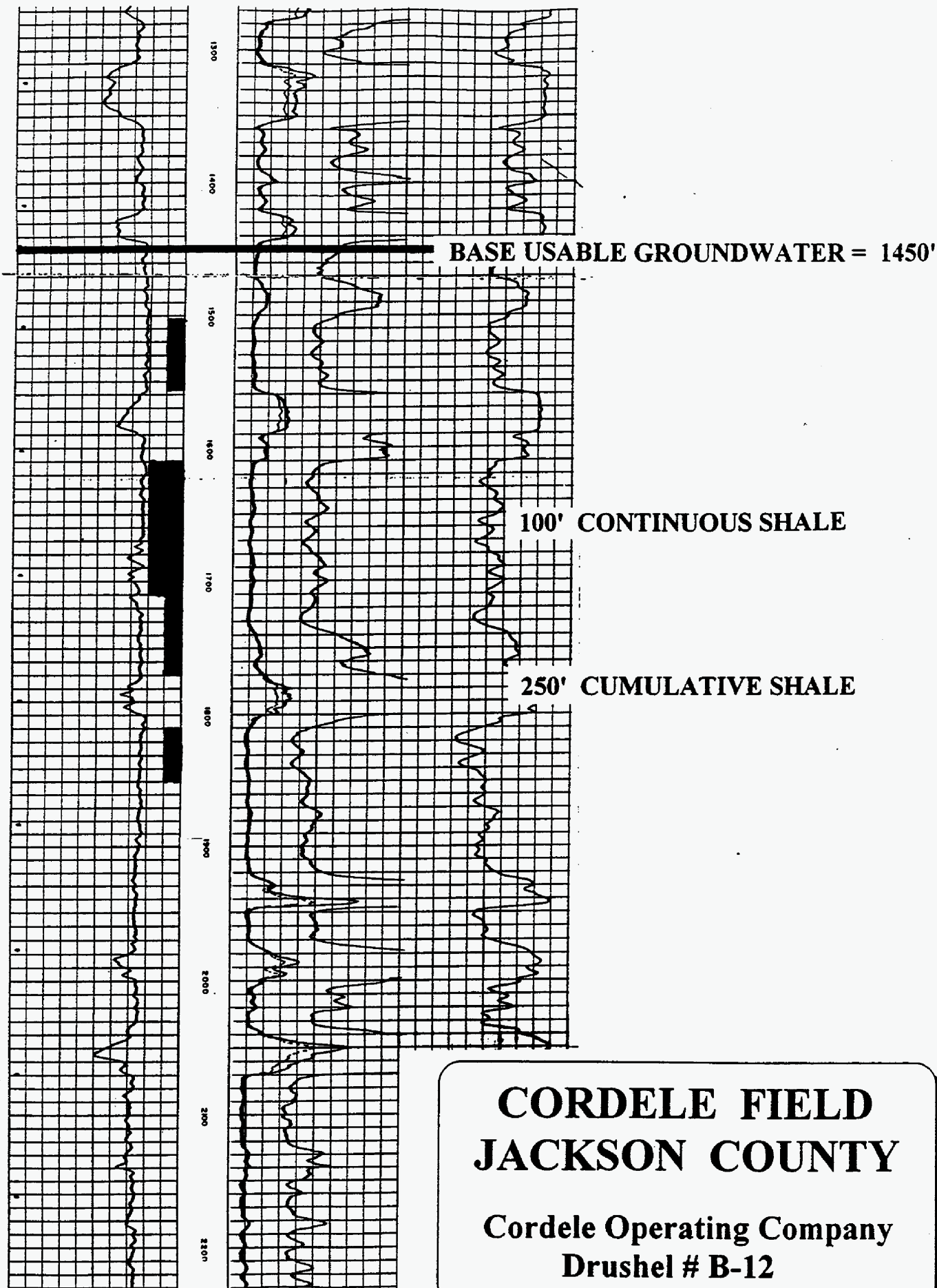




0 AMP. SHORT NORMAL 2

BASE USABLE GROUNDWATER = 600'



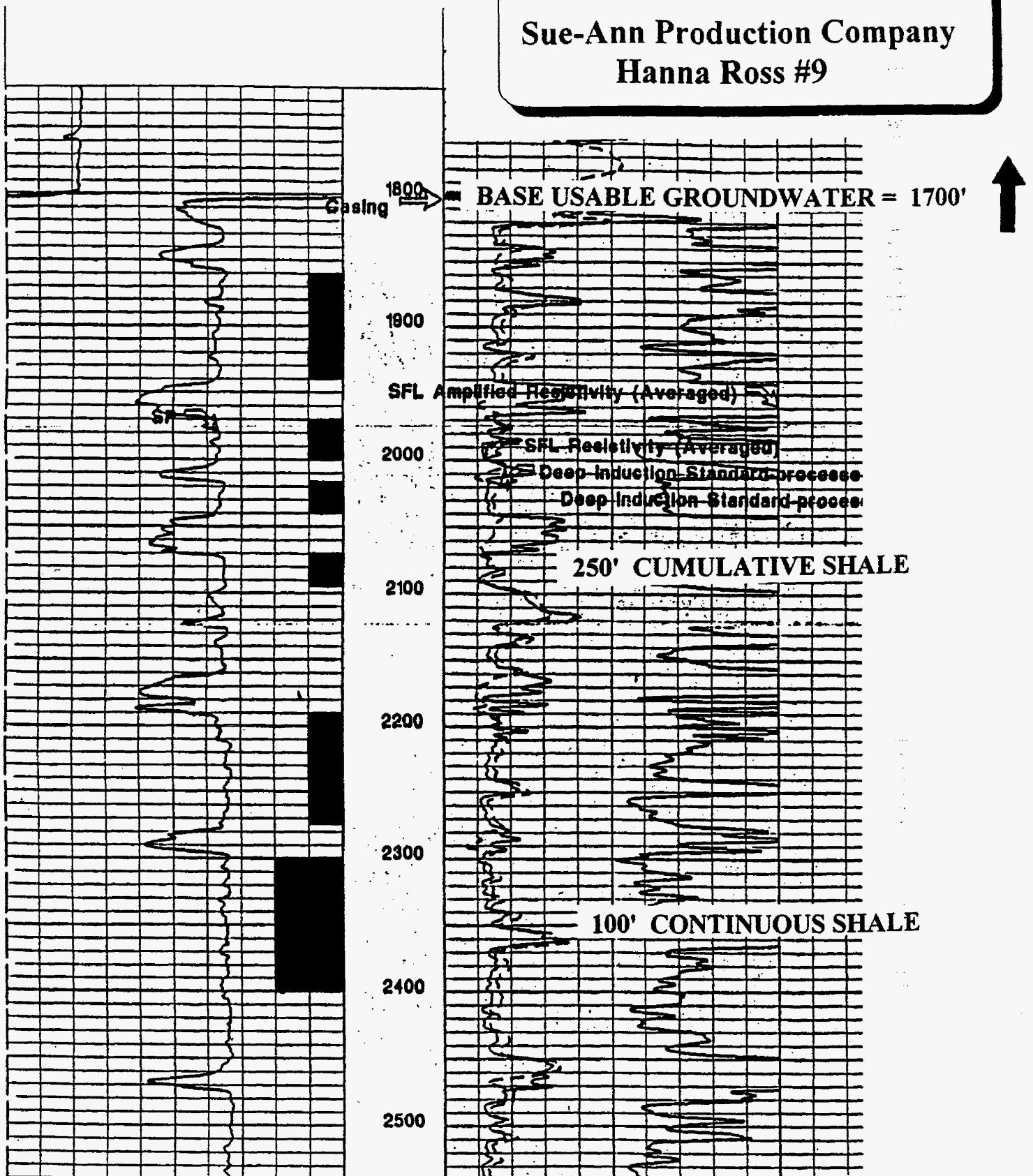


CORDELE FIELD JACKSON COUNTY

**Cordele Operating Company
Drushel # B-12**

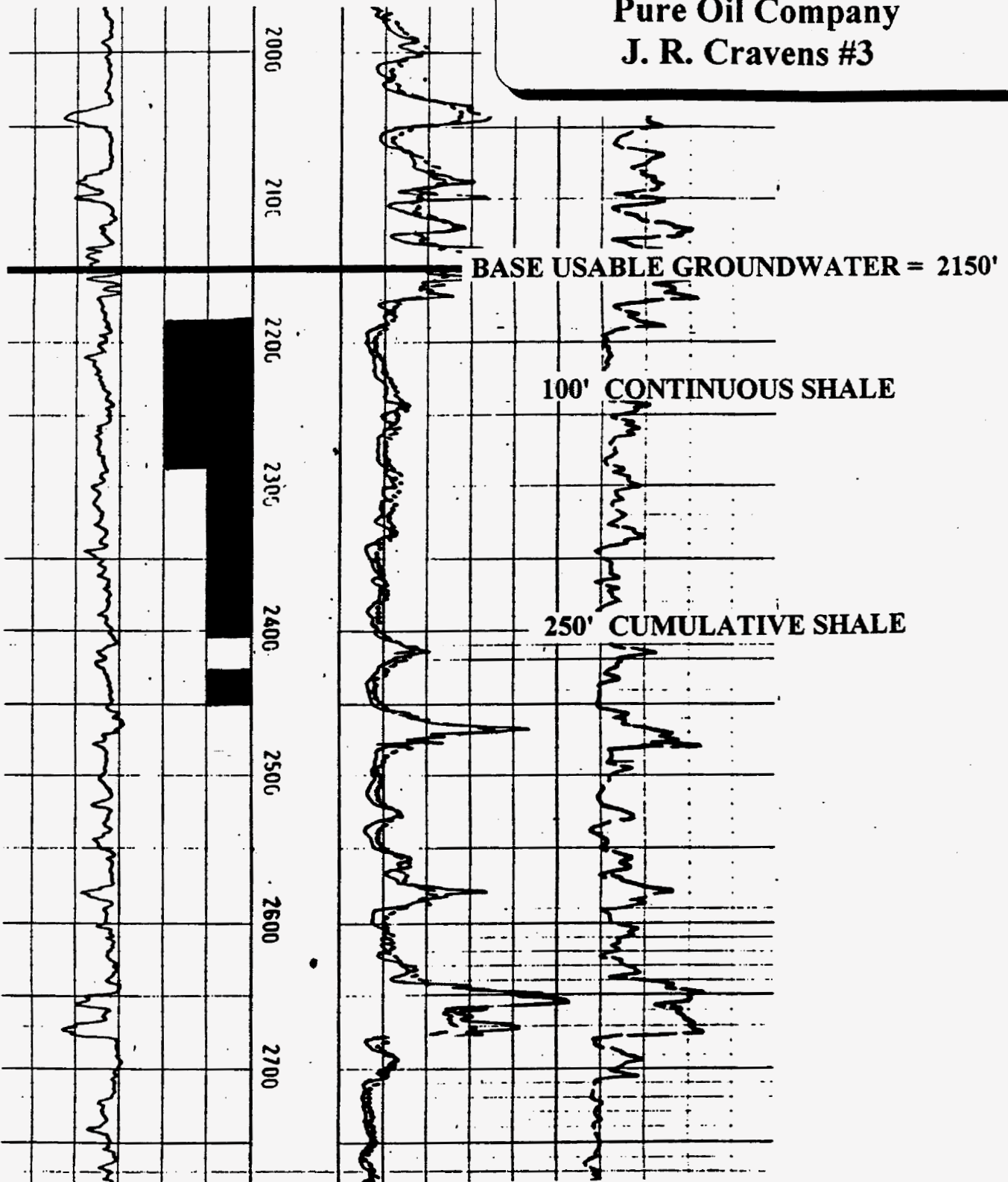
GANADO FIELD JACKSON COUNTY

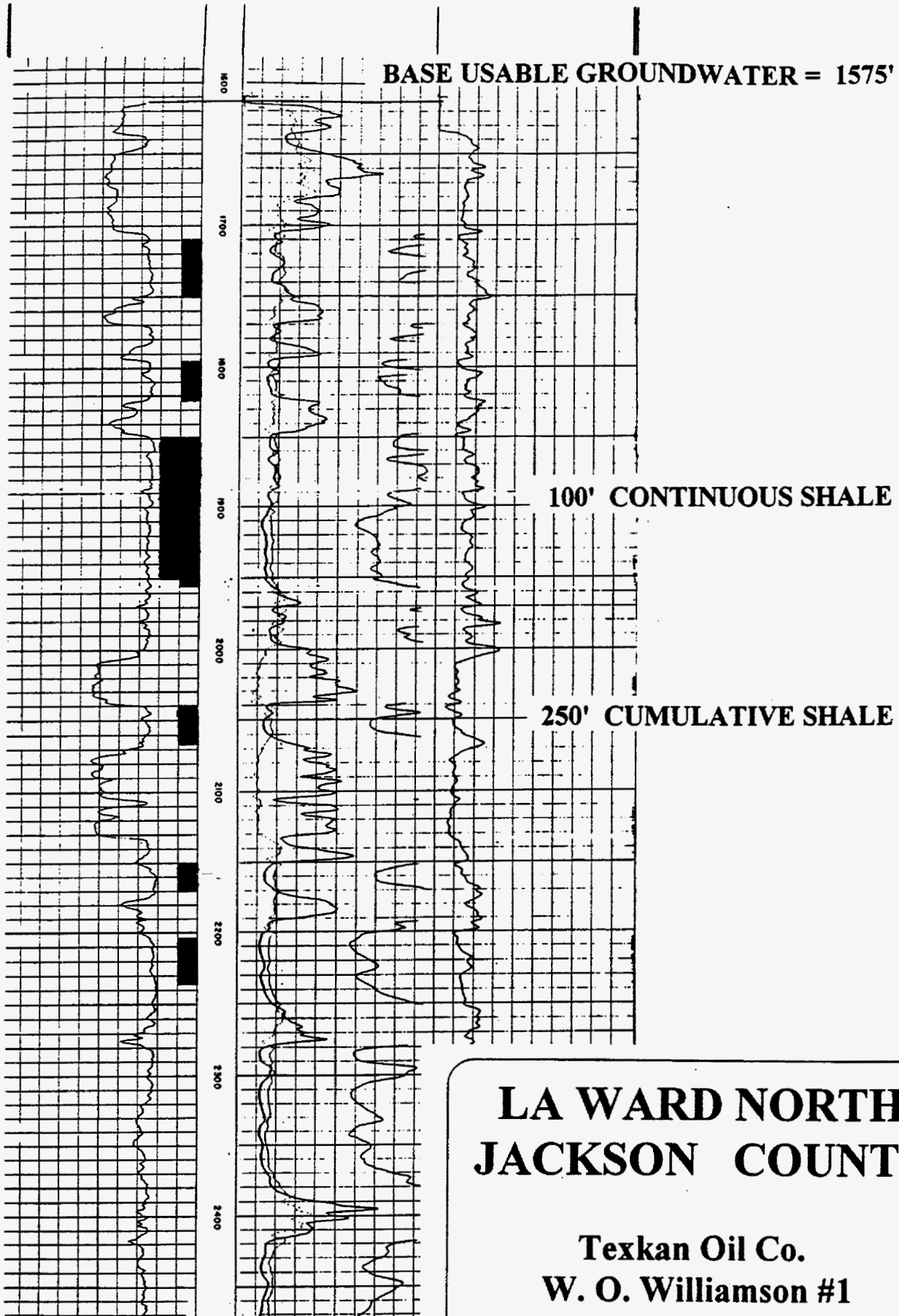
Sue-Ann Production Company
Hanna Ross #9



GANADO WEST JACKSON COUNTY

Pure Oil Company
J. R. Cravens #3





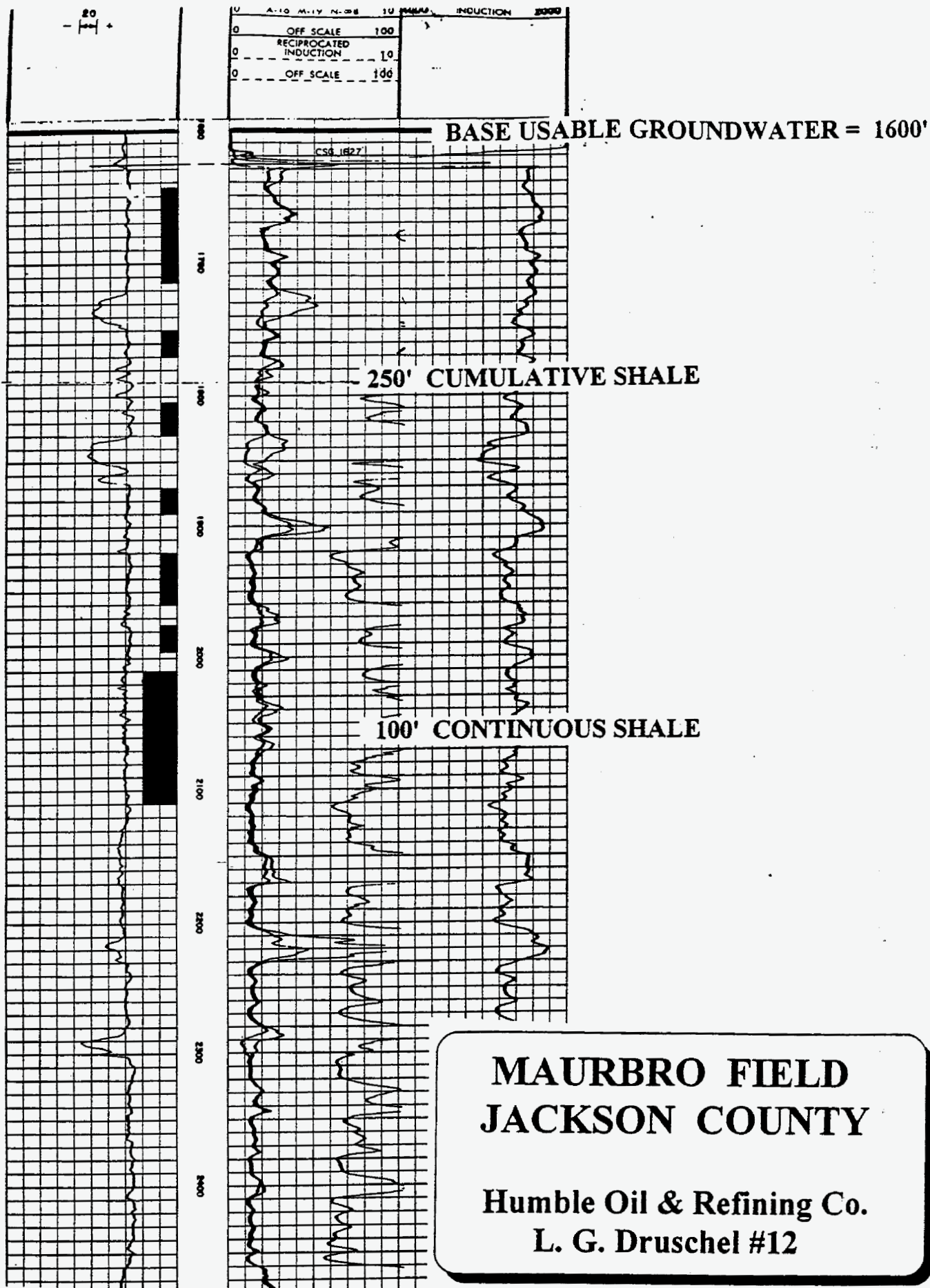
BASE USABLE GROUNDWATER = 1650'

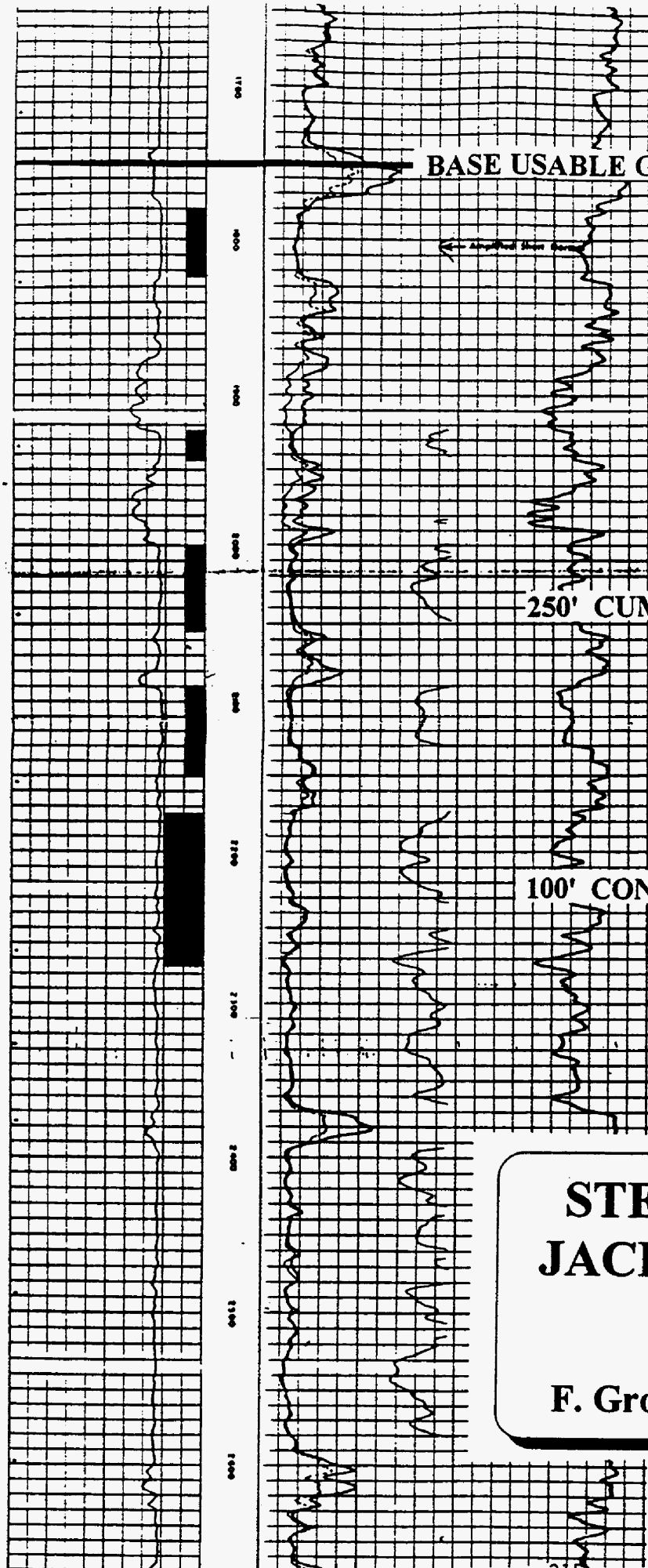
LOLITA FIELD JACKSON COUNTY

Antares Oil Comporation
Arthur White #1

100' CONTINUOUS SHALE

250' CUMULATIVE SHALE





BASE USABLE GROUNDWATER = 1750'

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE

STEWART FIELD JACKSON COUNTY

Texaco Inc.
F. Grobert NCT-10 O/A #8

WEST RANCH JACKSON COUNTY

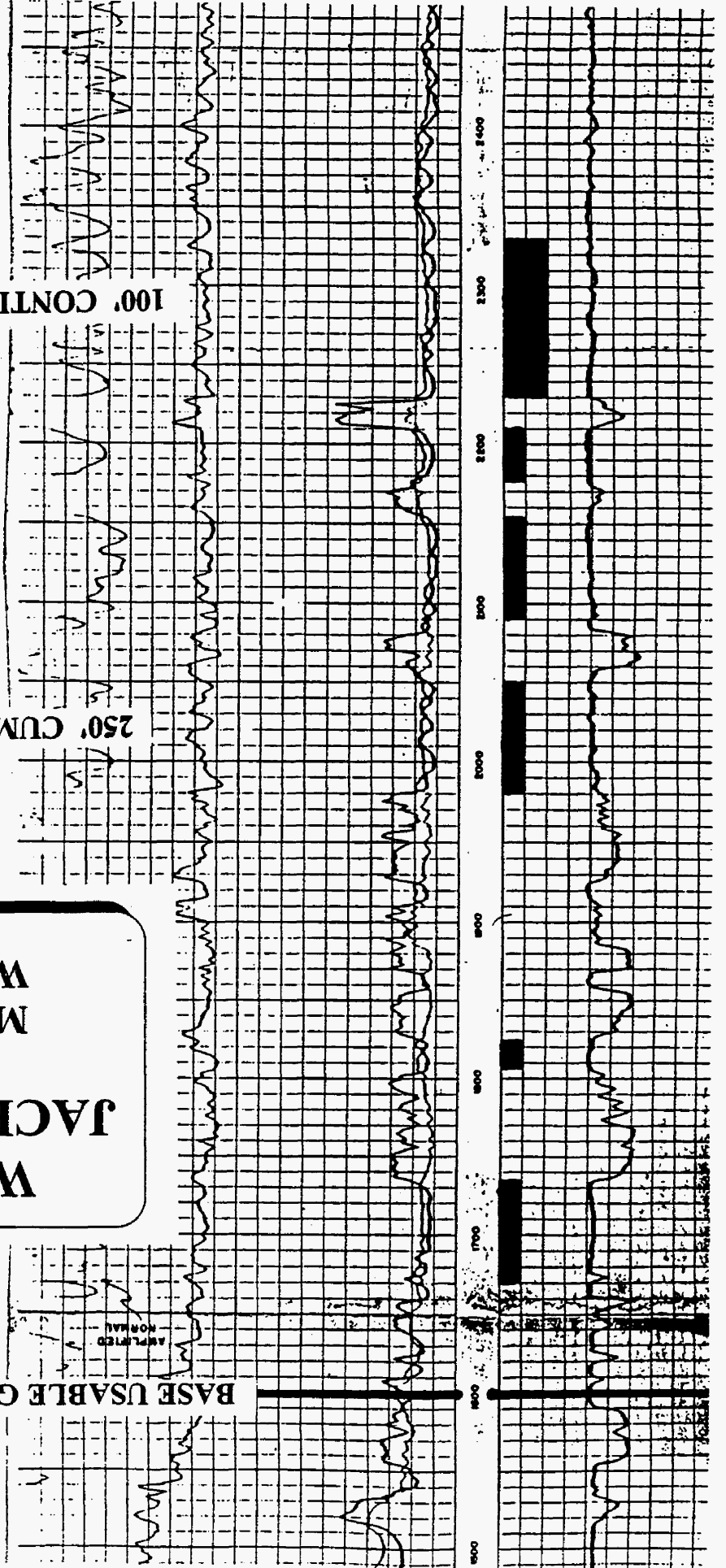
Magnolia Petroleum
West Ranch #A-337

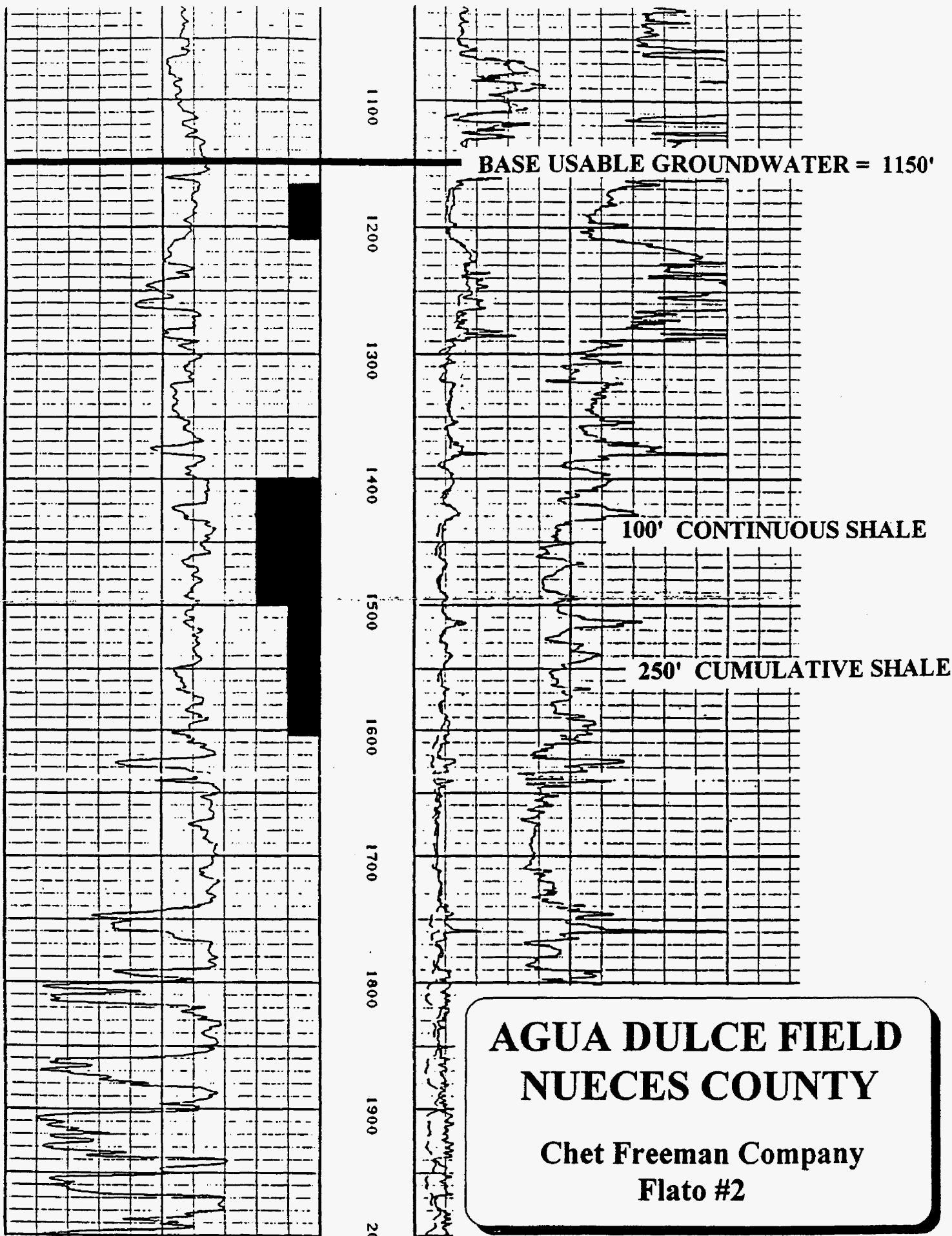
BASE USABLE GROUNDWATER = 1600'

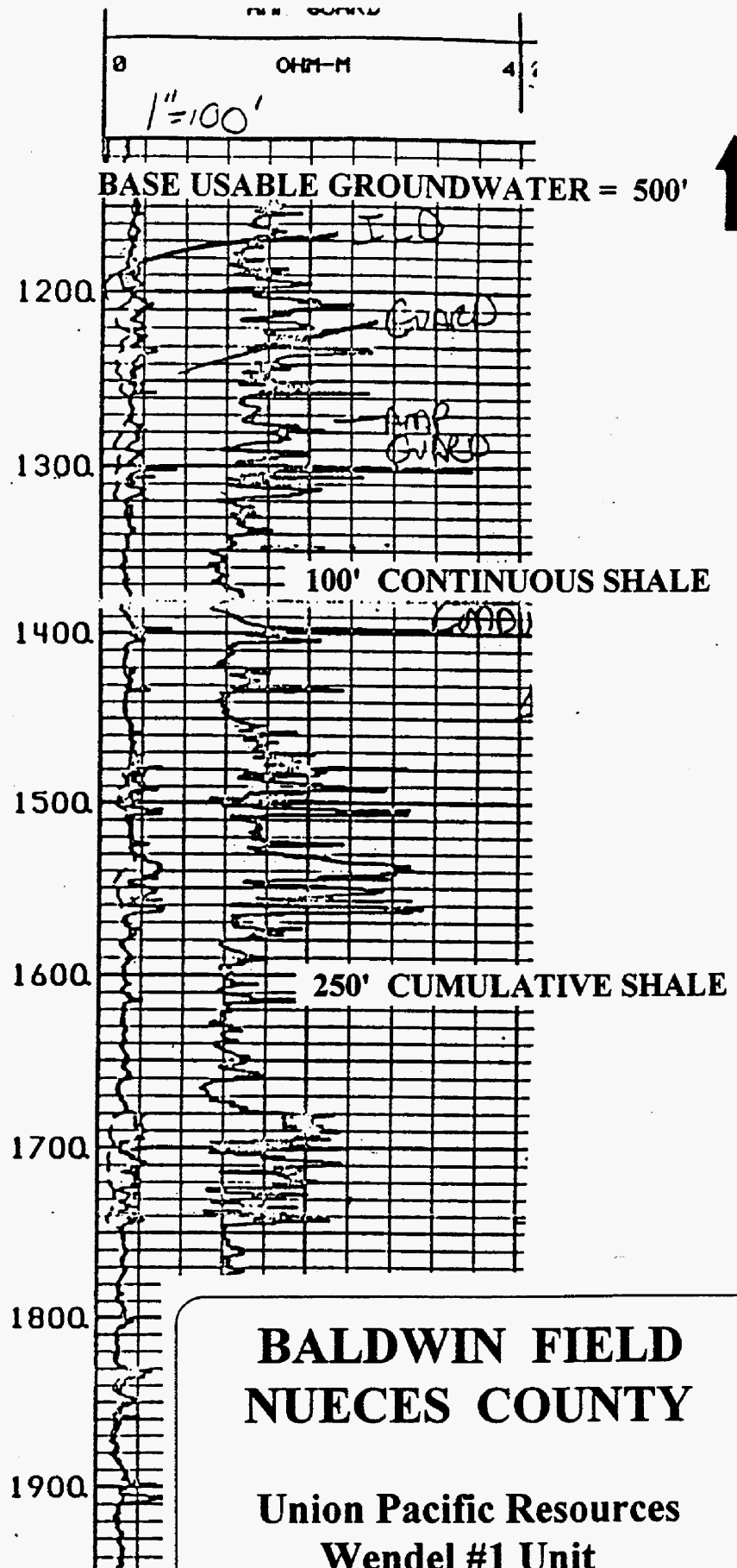
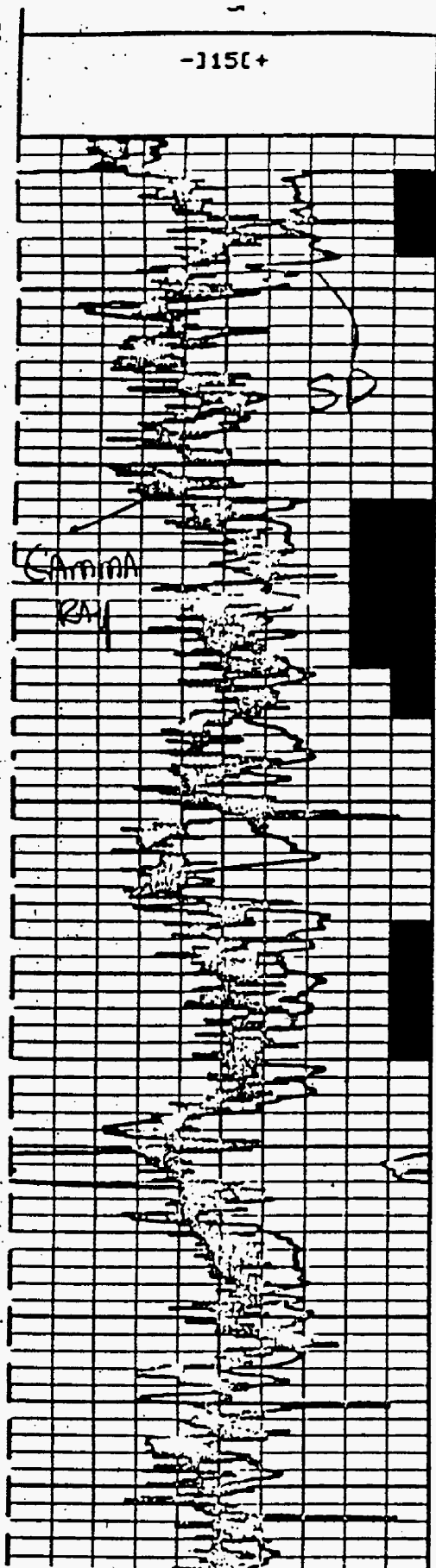
AMPLIFIED
NORMAL

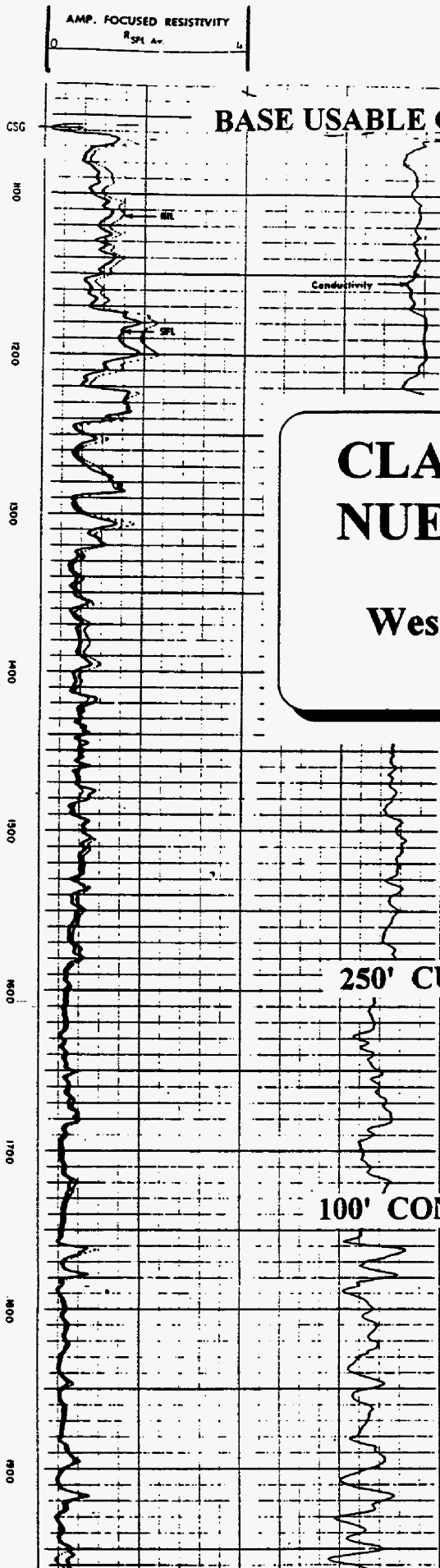
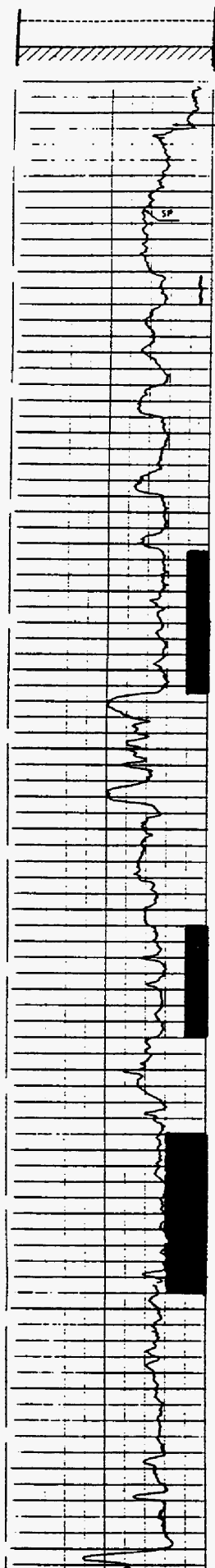
250' CUMULATIVE SHALE

100' CONTINUOUS SHALE









AMP. FOCUSED RESISTIVITY
R_{SPL} Av.

BASE USABLE GROUNDWATER = 1000'

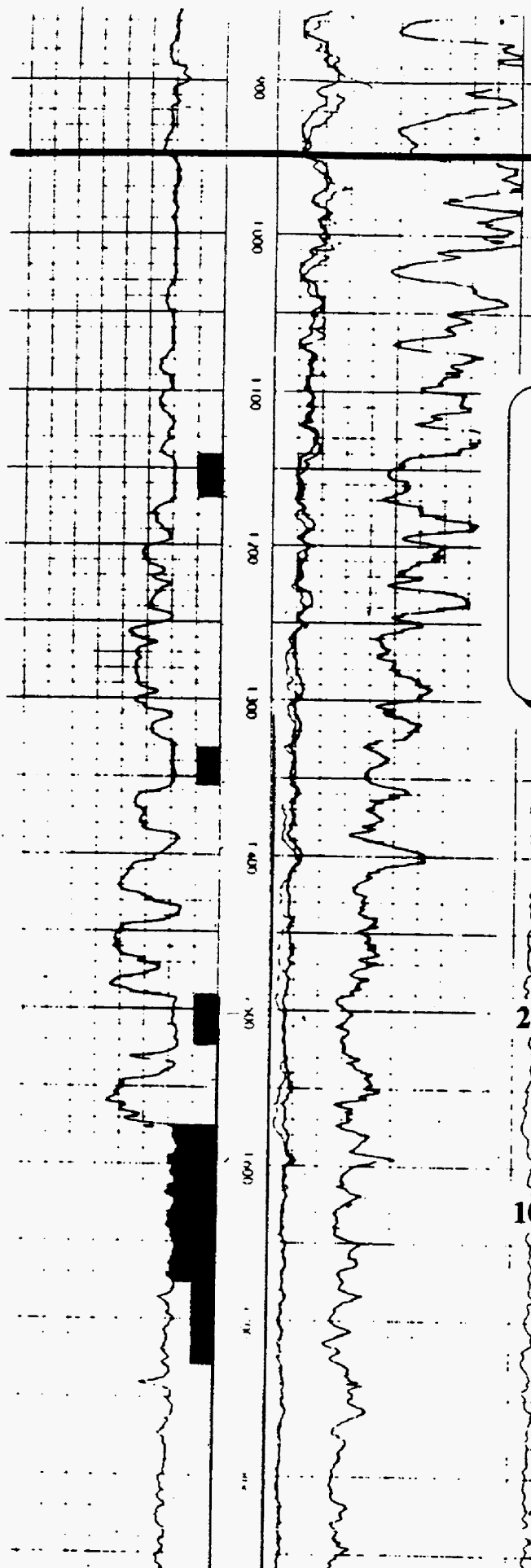


CLARA DRISCOLL NUECES COUNTY

Western Gulf Oil & Gas
Sevier #1

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE



BASE USABLE GROUNDWATER = 950'

LONDON GIN NUECES COUNTY

Atlantic Refining Co.
Ollie London #9

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE

FOURTH CURVE

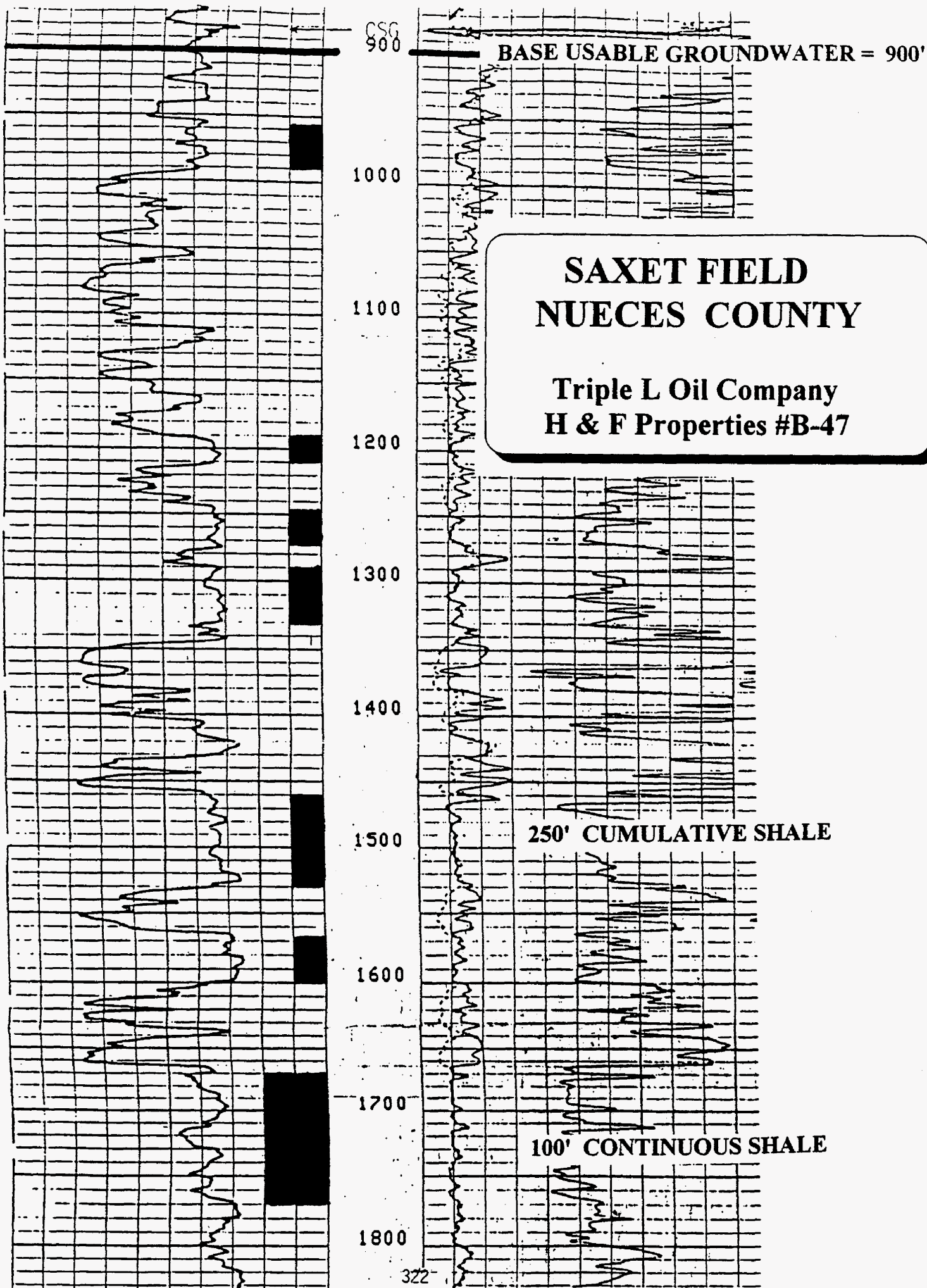
BASE USABLE GROUNDWATER = 1150'

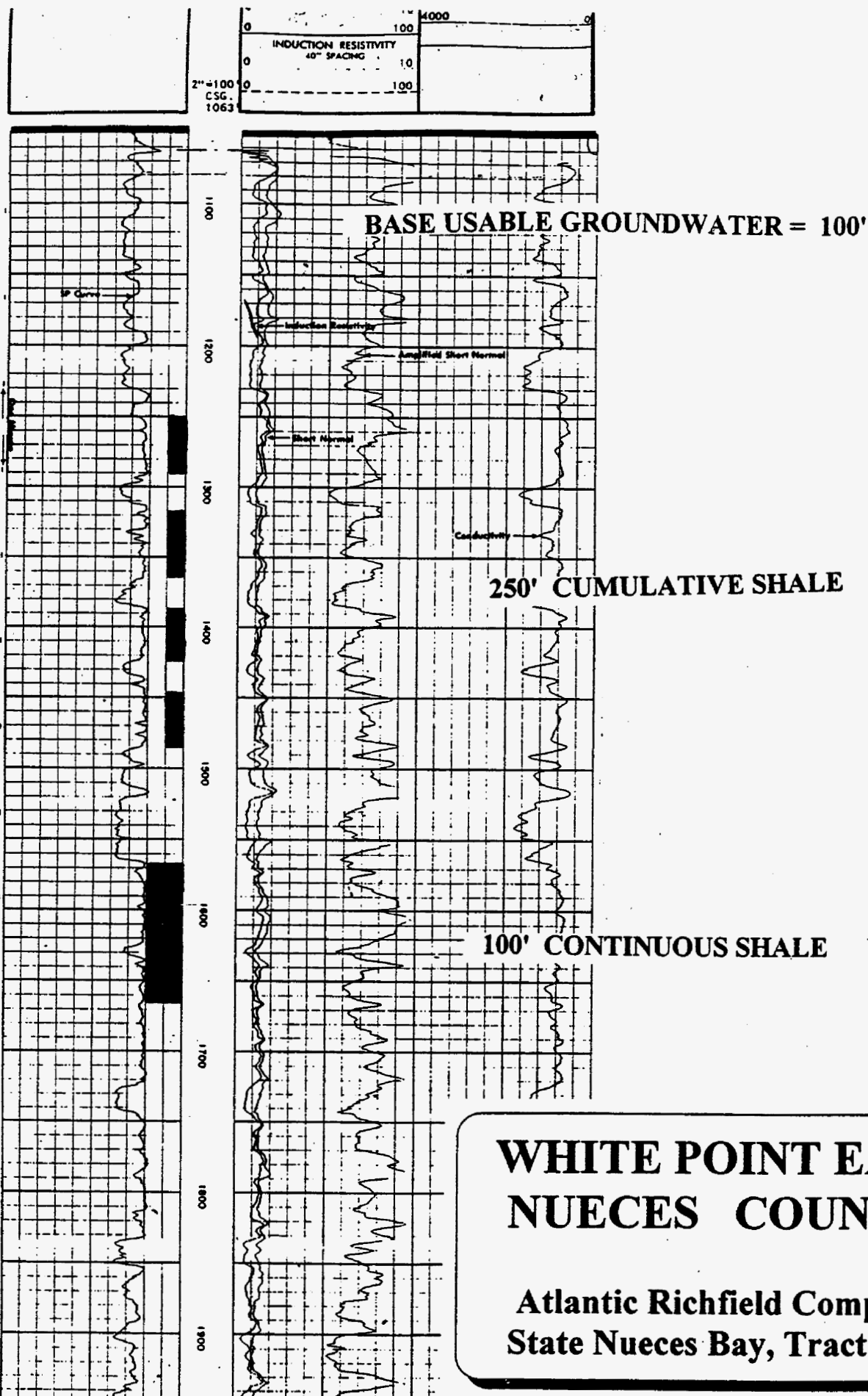
RICHARD KING NUECES COUNTY

Southern Minerals
Ida Walker #4

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE





01200

BASE USABLE GROUNDWATER = 1200'

01300

01400

01500

01600

01700

01800

01900

02000

02100

250 FEET CUMULATIVE SHALE

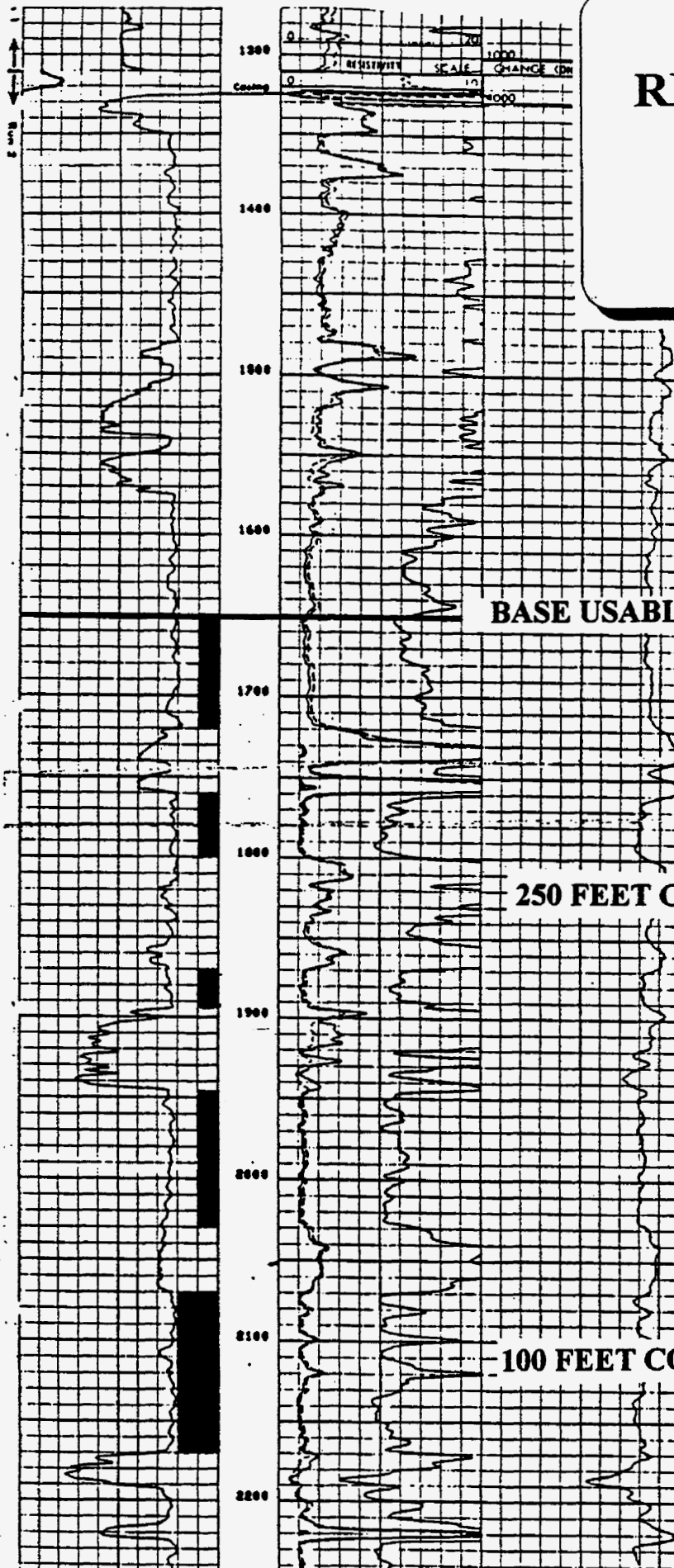
100 FEET CONTINUOUS SHALE

BONNIE VIEW FIELD REFUGIO COUNTY

Christopher Oil & Gas
Schirmer et. al. #3

GRETA FIELD REFUGIO COUNTY

Atlantic Richfield
J.F.B. Heard #3



BASE USABLE GROUNDWATER = 1650'

250 FEET CUMULATIVE SHALE

100 FEET CONTINUOUS SHALE

LAKE PASTURE FIELD REFUGIO COUNTY

Quintana Petroleum
Maude Williams "A" #O-5

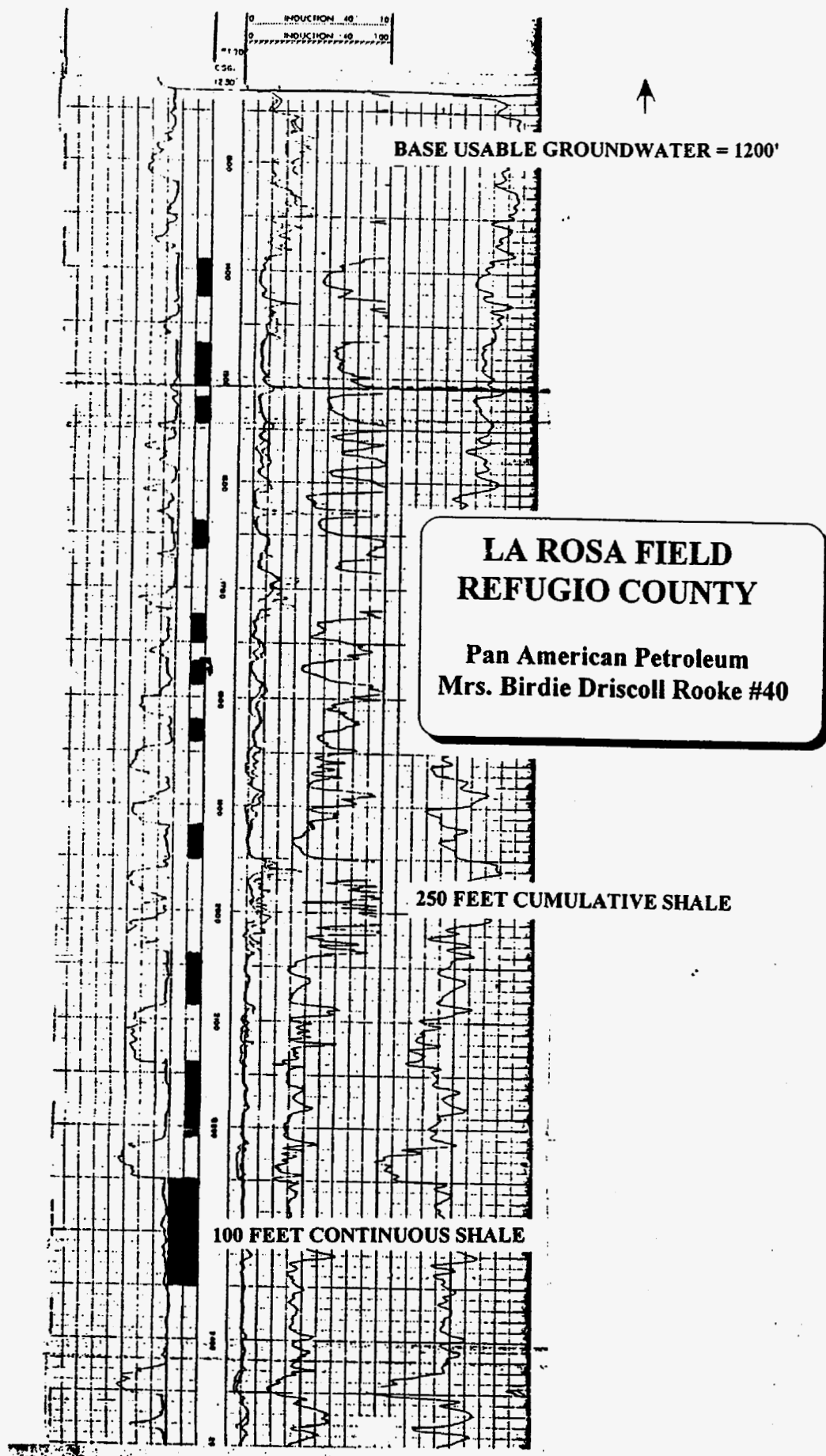
SPONTANEOUS-POTENTIAL millivolts	DEPTH feet	RESISTIVITY ohms. m ² /m
- 20 +	0	AMP. AM 16° 4
	0	AM 16° 20 0
	0	AM 16° 200
	0	AM 16° 20
	2210'	

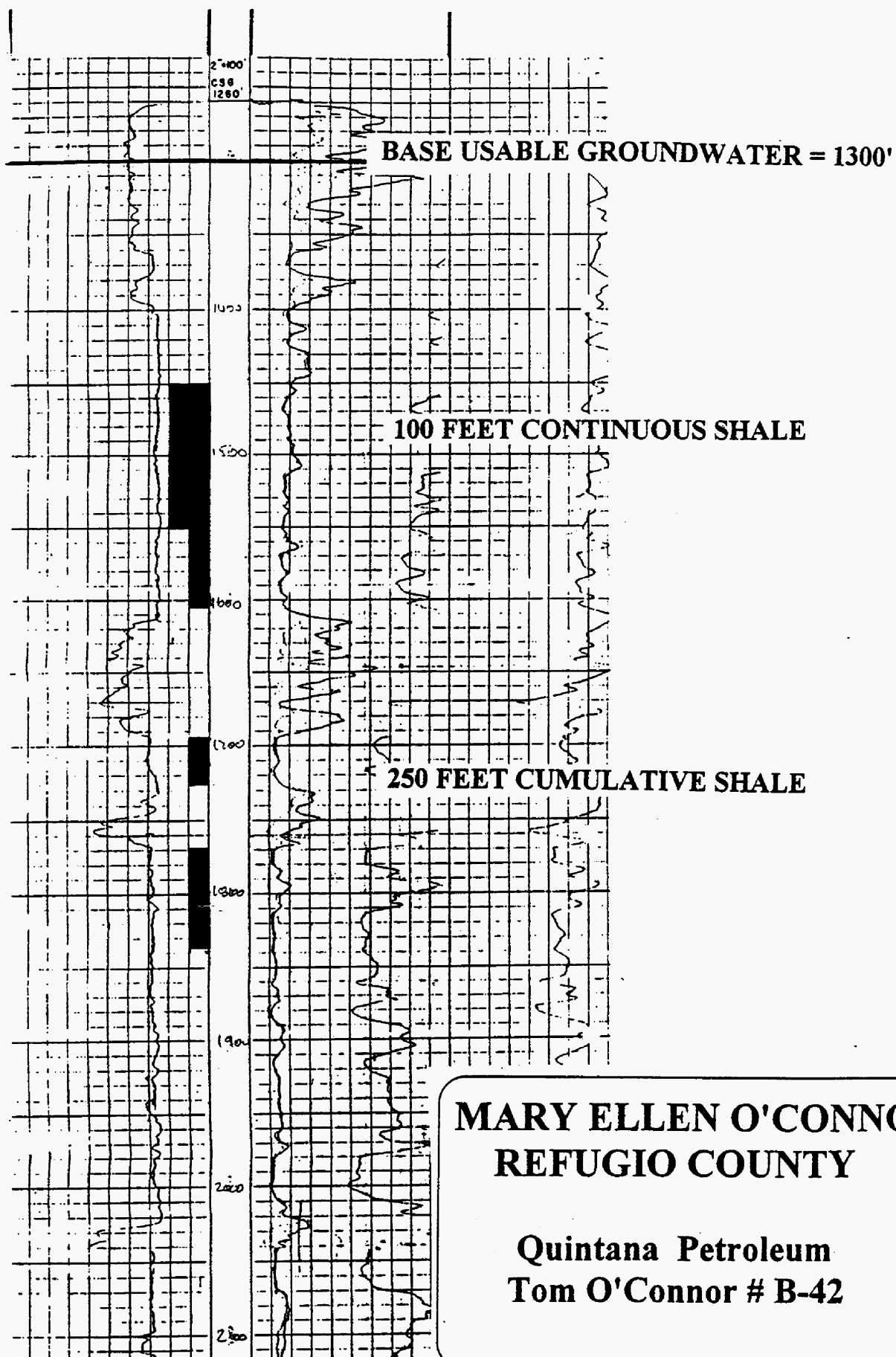
CS6
1514

BASE USABLE GROUNDWATER = 1525'

250 FEET CUMULATIVE SHALE

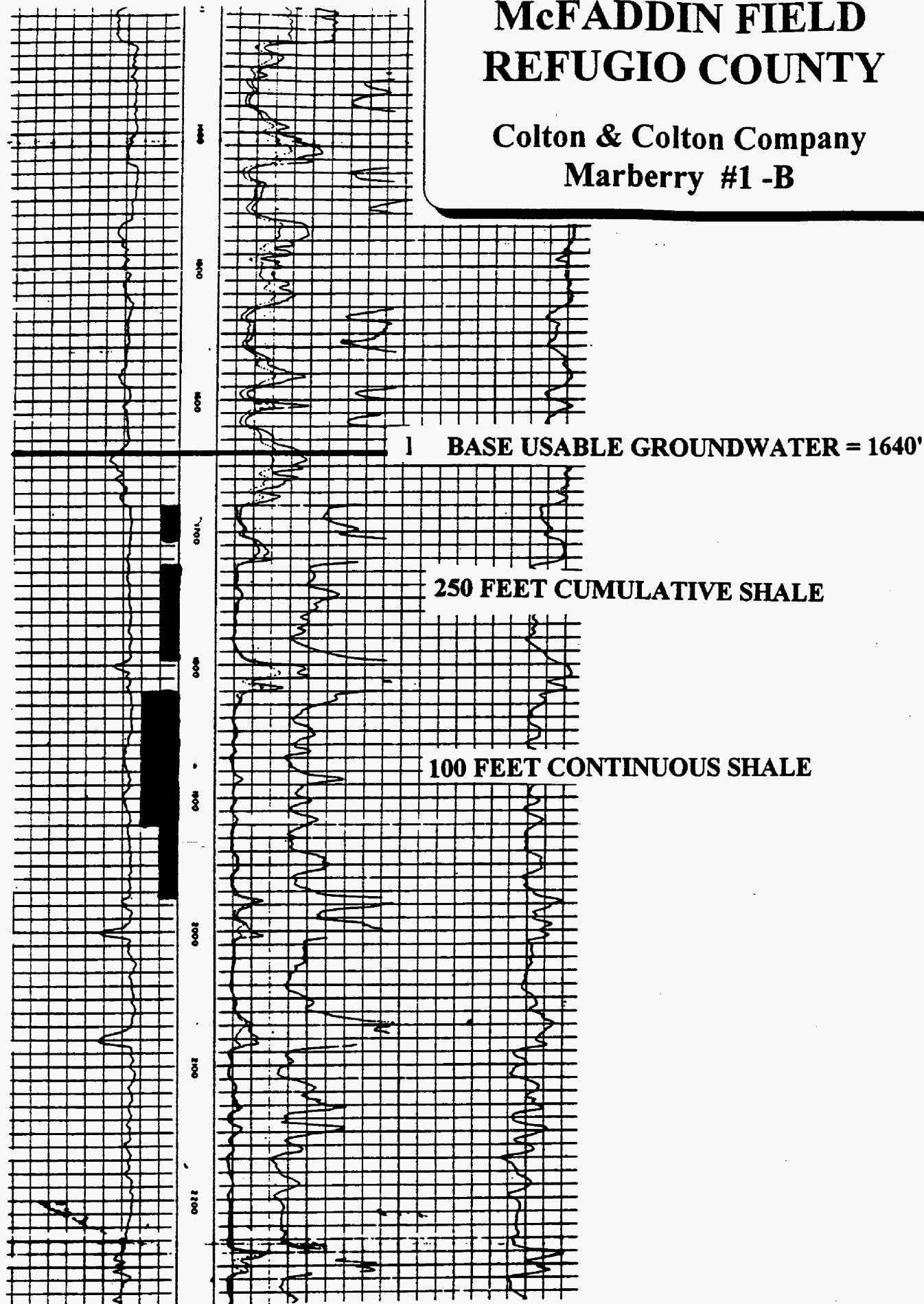
100 FEET CONTINUOUS SHALE





McFADDIN FIELD REFUGIO COUNTY

Colton & Colton Company
Marberry #1 -B



NEW REFUGIO FIELD REFUGIO COUNTY

Atlantic Richfield
P. H. Rooke # 68

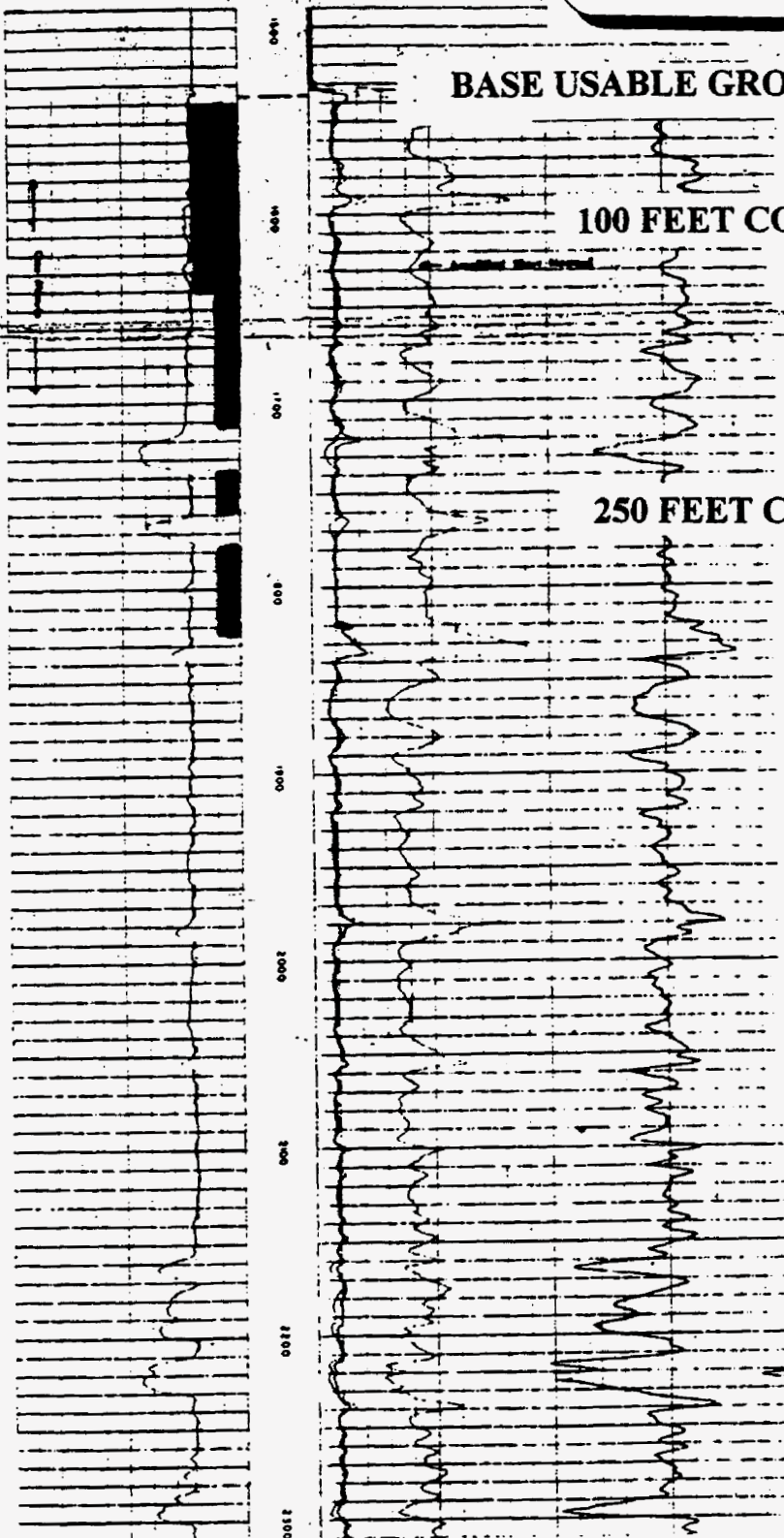
SPONTANEOUS POTENTIAL mV/m	DEPTH ft	RESISTIVITY Ohm m
	0	16" NORMAL
	100	10
	200	100
	300	10
	0	INDUCTION RESISTIVITY of MACH
	100	10
	200	100
	300	10

BASE USABLE GROUNDWATER = 1300'



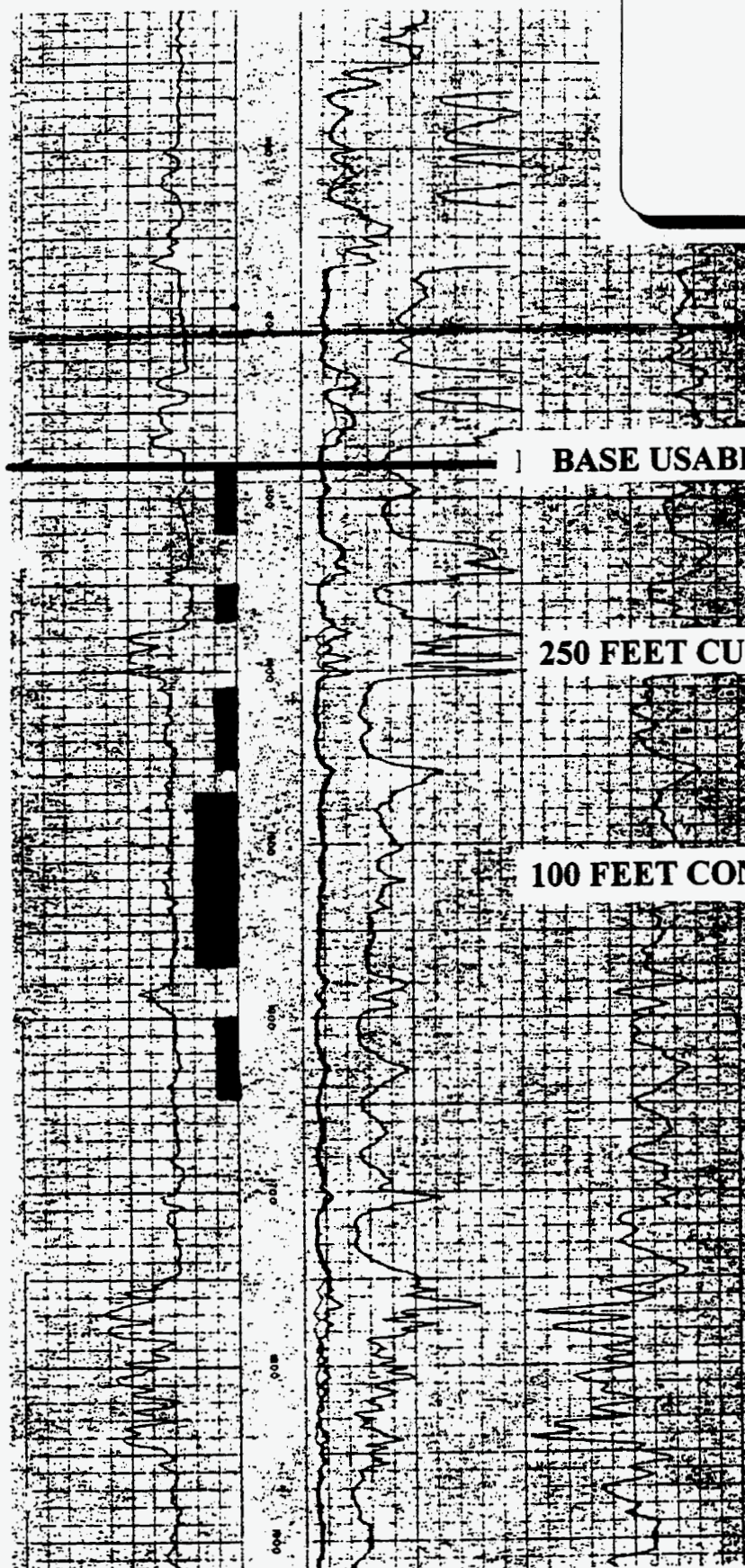
100 FEET CONTINUOUS SHALE

250 FEET CUMULATIVE SHALE



OLD REFUGIO FIELD REFUGIO COUNTY

Appen Petroleum
A. R. Craz #1



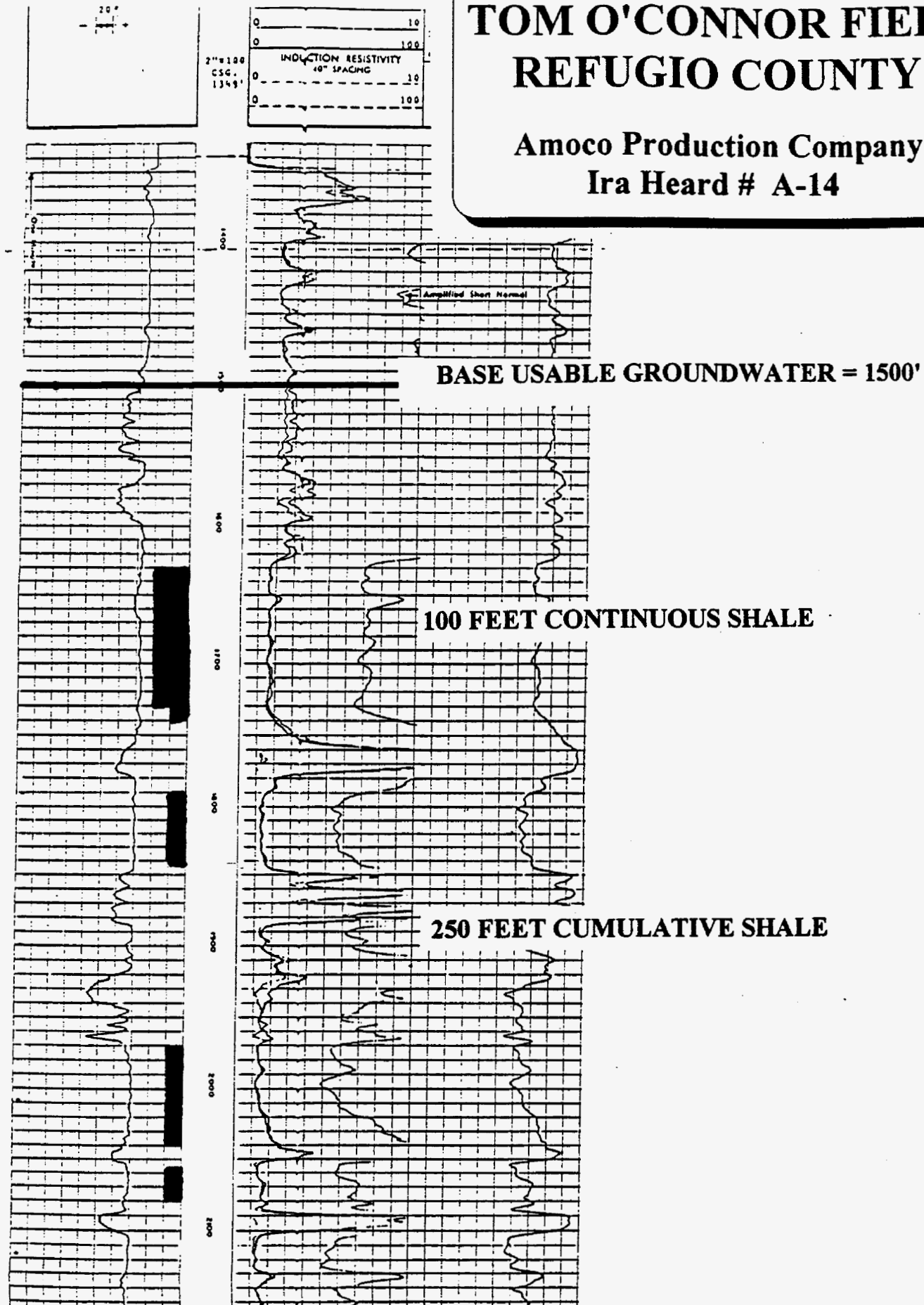
BASE USABLE GROUNDWATER = 1280'

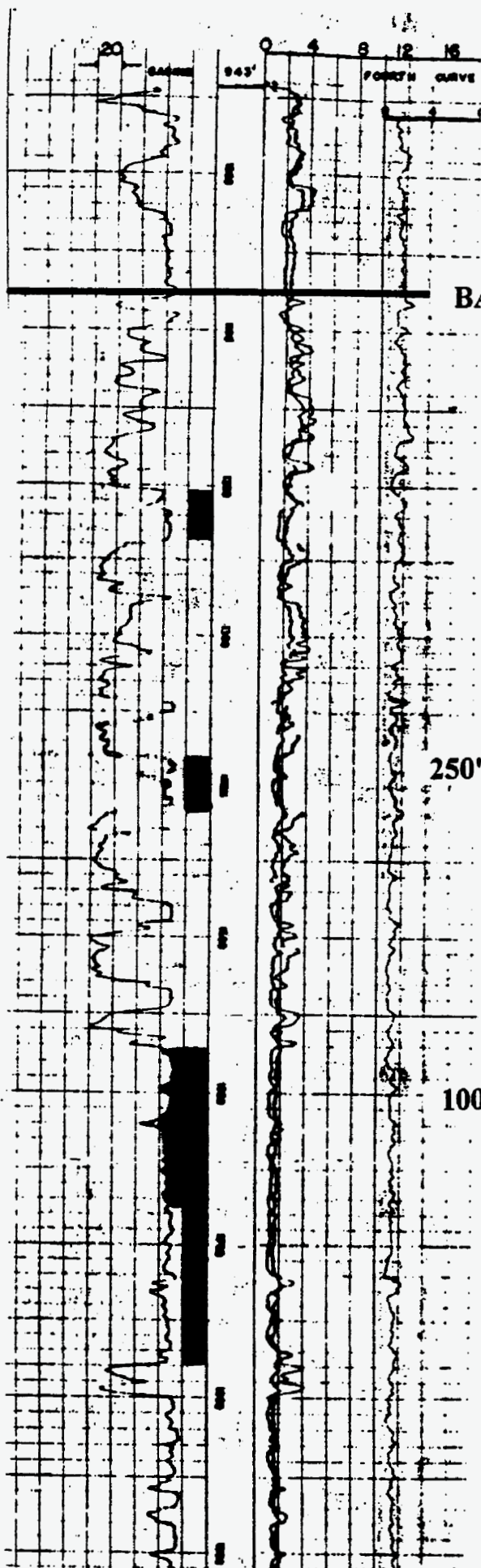
250 FEET CUMULATIVE SHALE

100 FEET CONTINUOUS SHALE

TOM O'CONNOR FIELD REFUGIO COUNTY

Amoco Production Company
Ira Heard # A-14





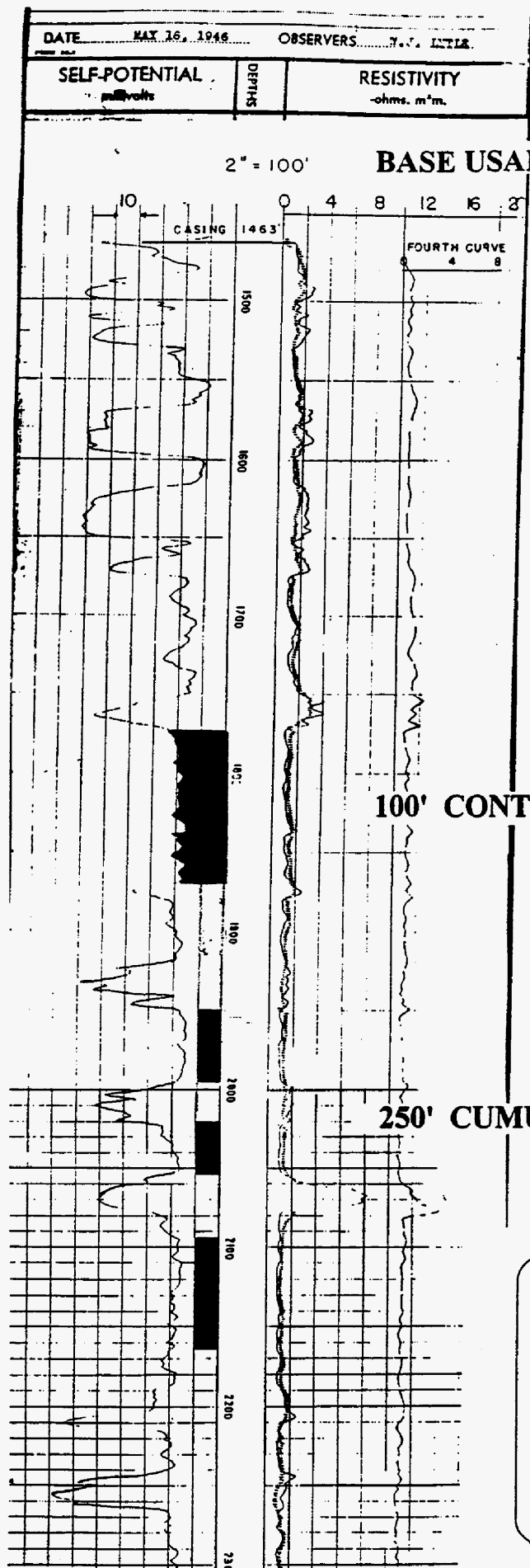
BASE USABLE GROUNDWATER = 1080'

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE

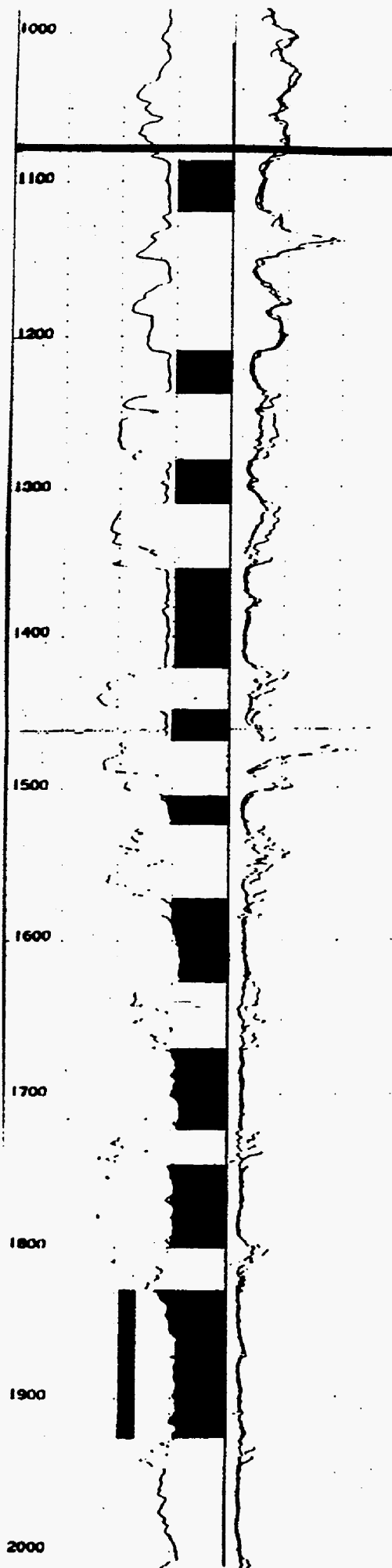
MIDWAY FIELD SAN PATRICIO COUNTY

**Pan American Production
Ora L. Smith B-1**



ODEM FIELD SAN PATRICIO COUNTY

Seaboard Oil Company
N. R. Smith #3



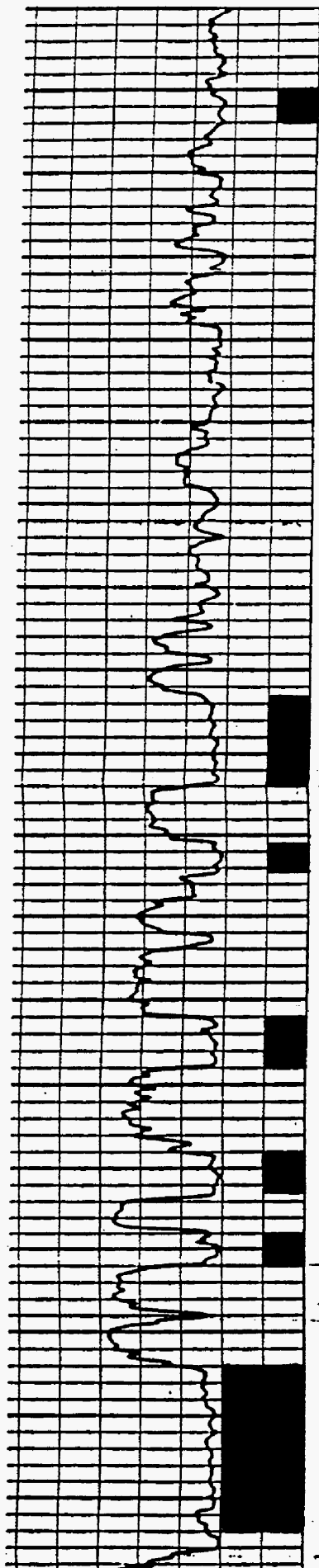
BASE USABLE GROUNDWATER = 1080'

PLYMOUTH FIELD SAN PATRICIO COUNTY

Plymouth Oil Company
E. N. Welder # C-113

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE



900

1000

1100

1200

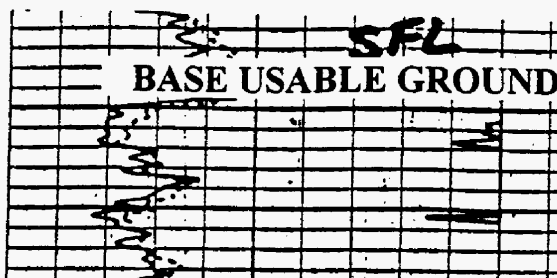
1300

1400

1500

1600

1700



SFL

BASE USABLE GROUNDWATER = 500'

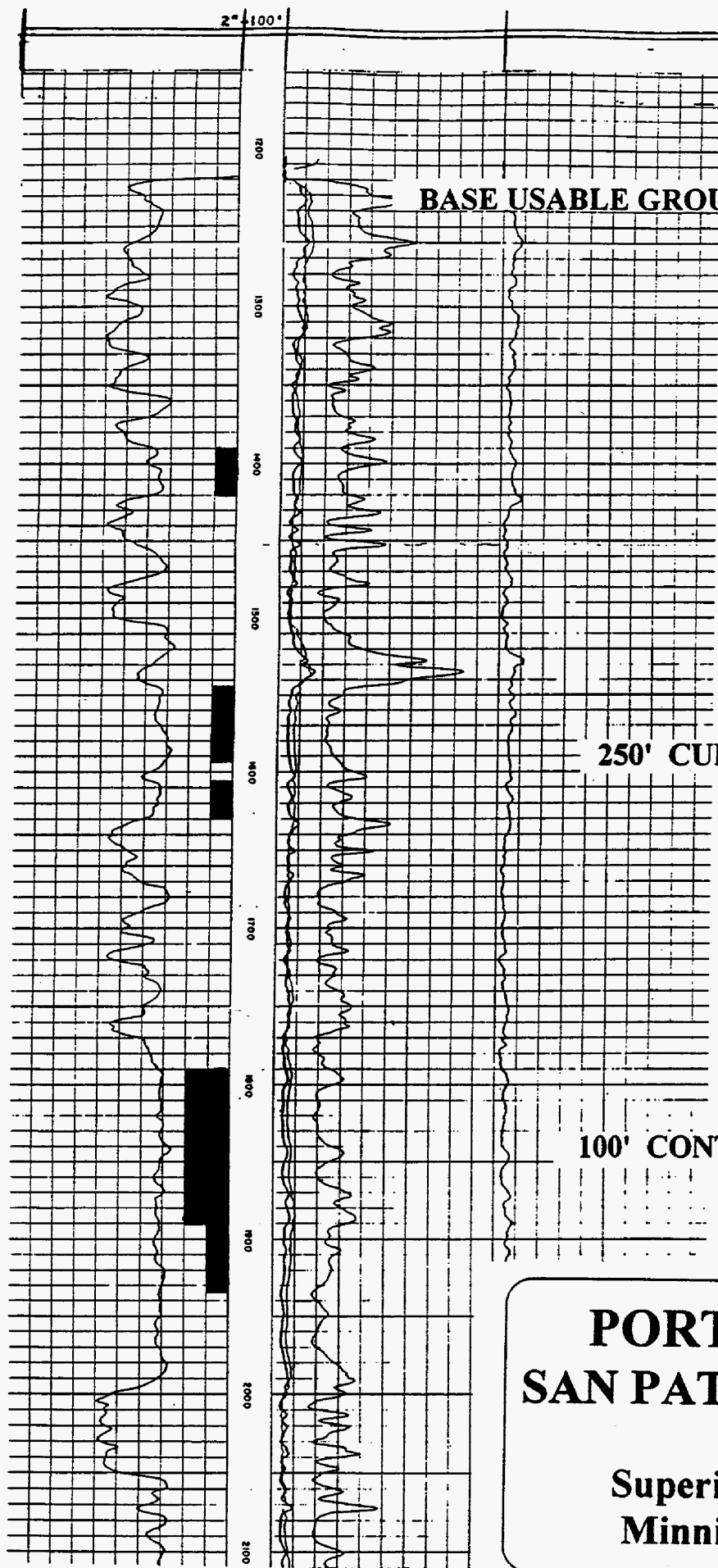


EAST PLYMOUTH SAN PATRICIO COUNTY

Alcorn Production Company
W. L. Roots Estate #1

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE

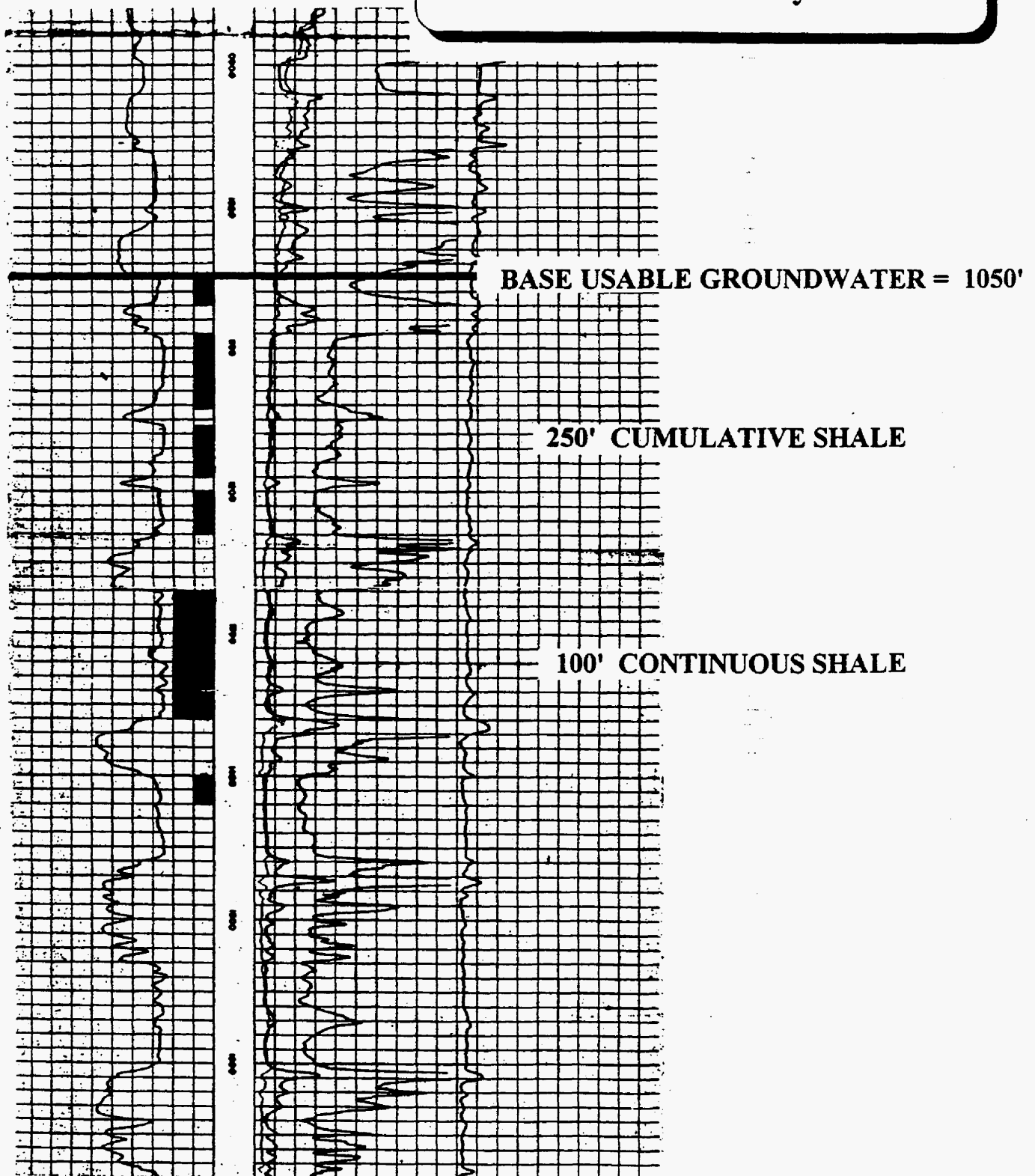


**PORTILLA FIELD
SAN PATRICIO COUNTY**

**Superior Oil Company
Minnie S. Welder #28**

SINTON WEST FIELD SAN PATRICIO COUNTY

Armstrong & Sutton
San Patricio County #3



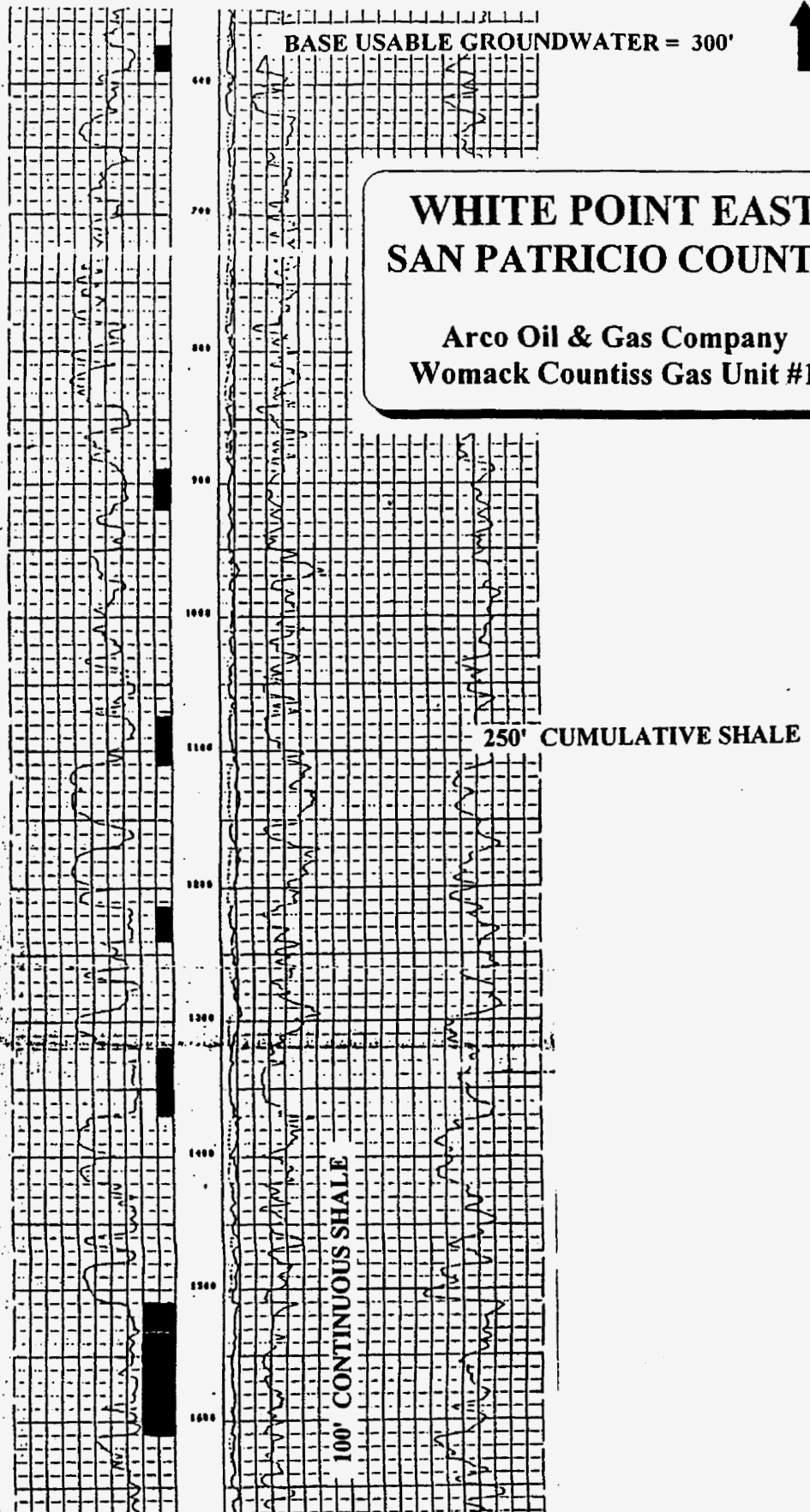
BASE USABLE GROUNDWATER = 750'

**TAFT FIELD
SAN PATRICIO COUNTY**

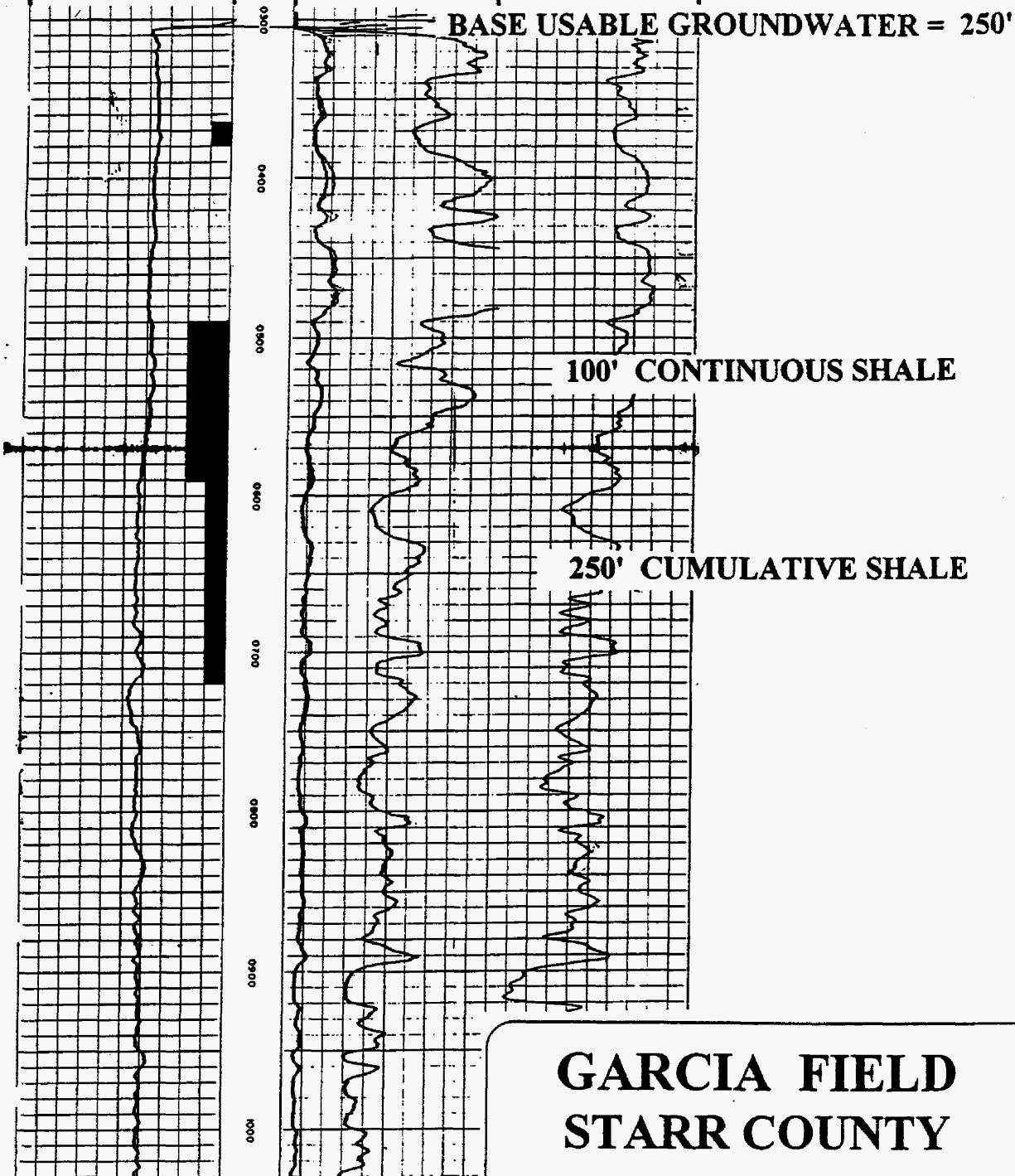
**Humble Oil & Refining
B. C. Baldwin #1**

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE

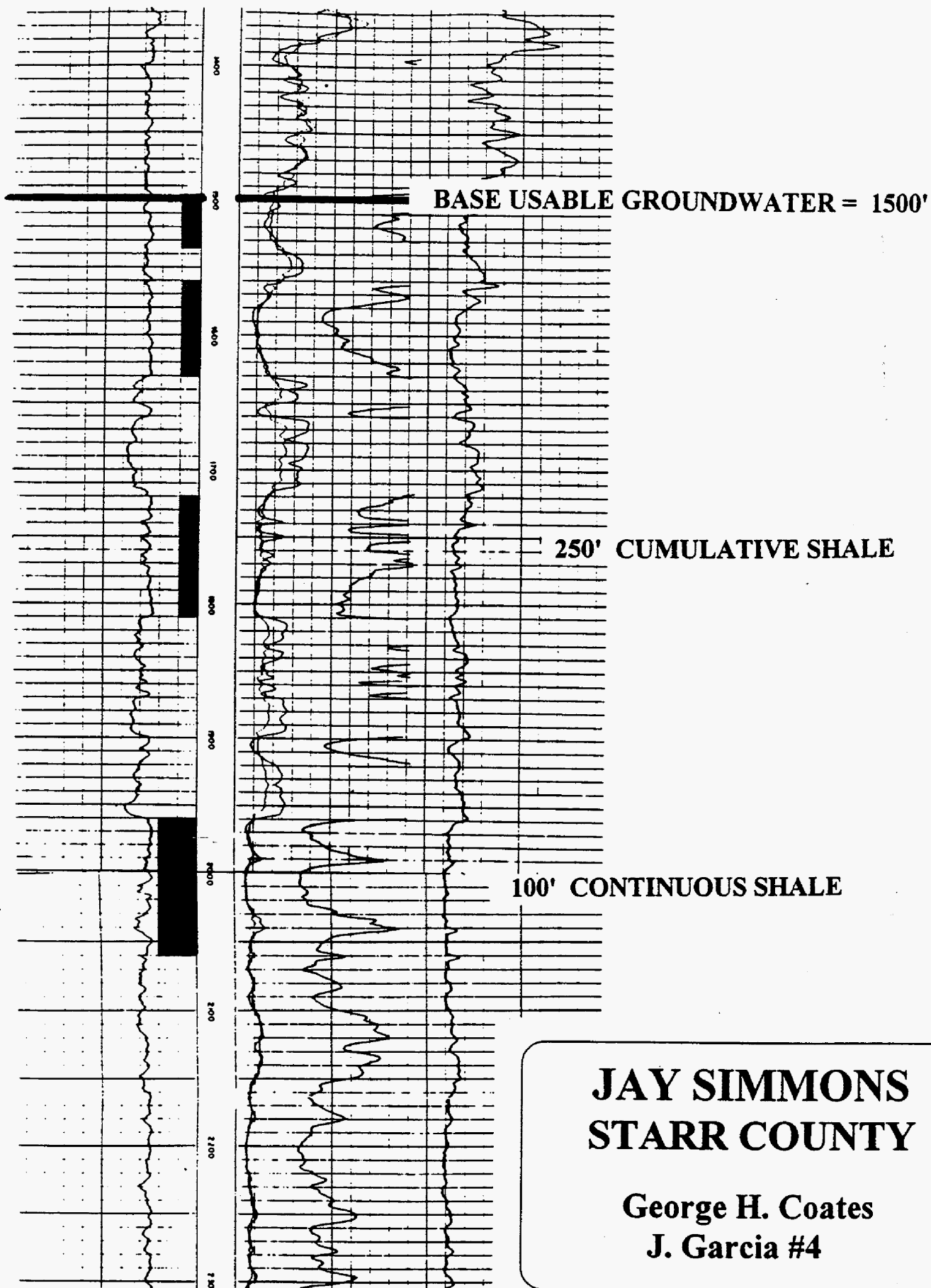


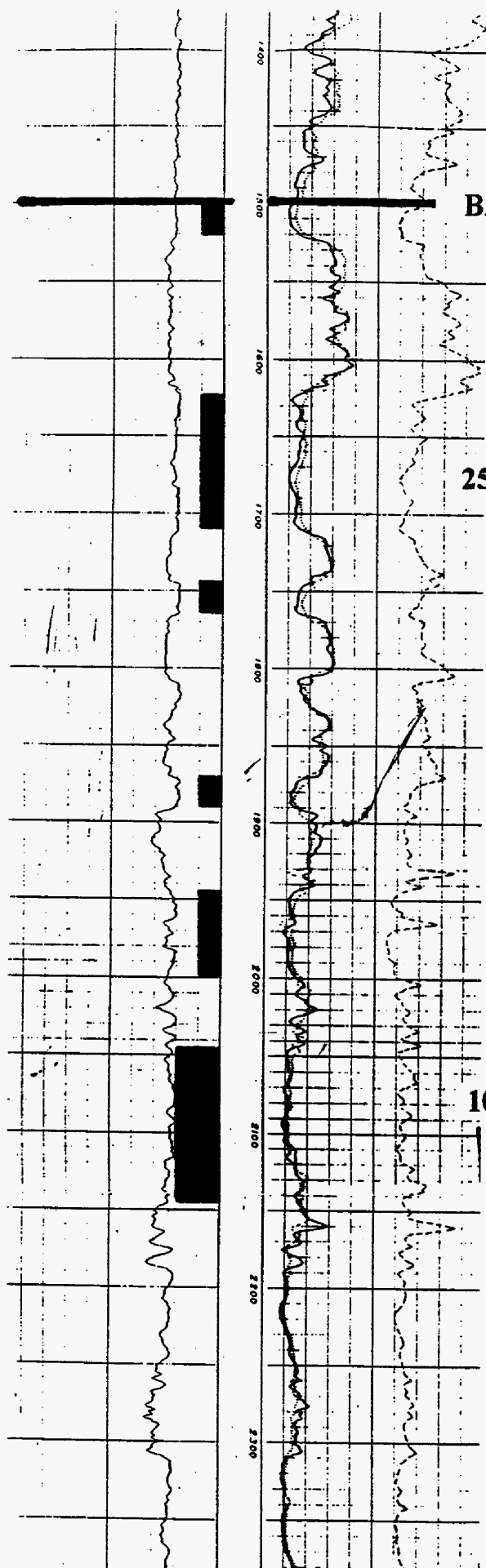
SPONTANEOUS POTENTIAL millivolts	DEPTHS	RESISTIVITY ohms - m ² /m	CONDUCTIVITY millimhos/m = $\frac{1000}{\text{ohms} \cdot \text{m}^2/\text{m}}$
10 - +	2" = 100' CSG. 305'	A - 16" - M SHORT NORMAL	5 FF40 INDUCTION
		0 4	0 1000
		0 20	0 1000
		0 200	0 1000
		INDUCTION	
		0 20	
		0 200	



GARCIA FIELD STARR COUNTY

Sun Oil Company
Frost National Bank "B" #29





BASE USABLE GROUNDWATER = 1500'

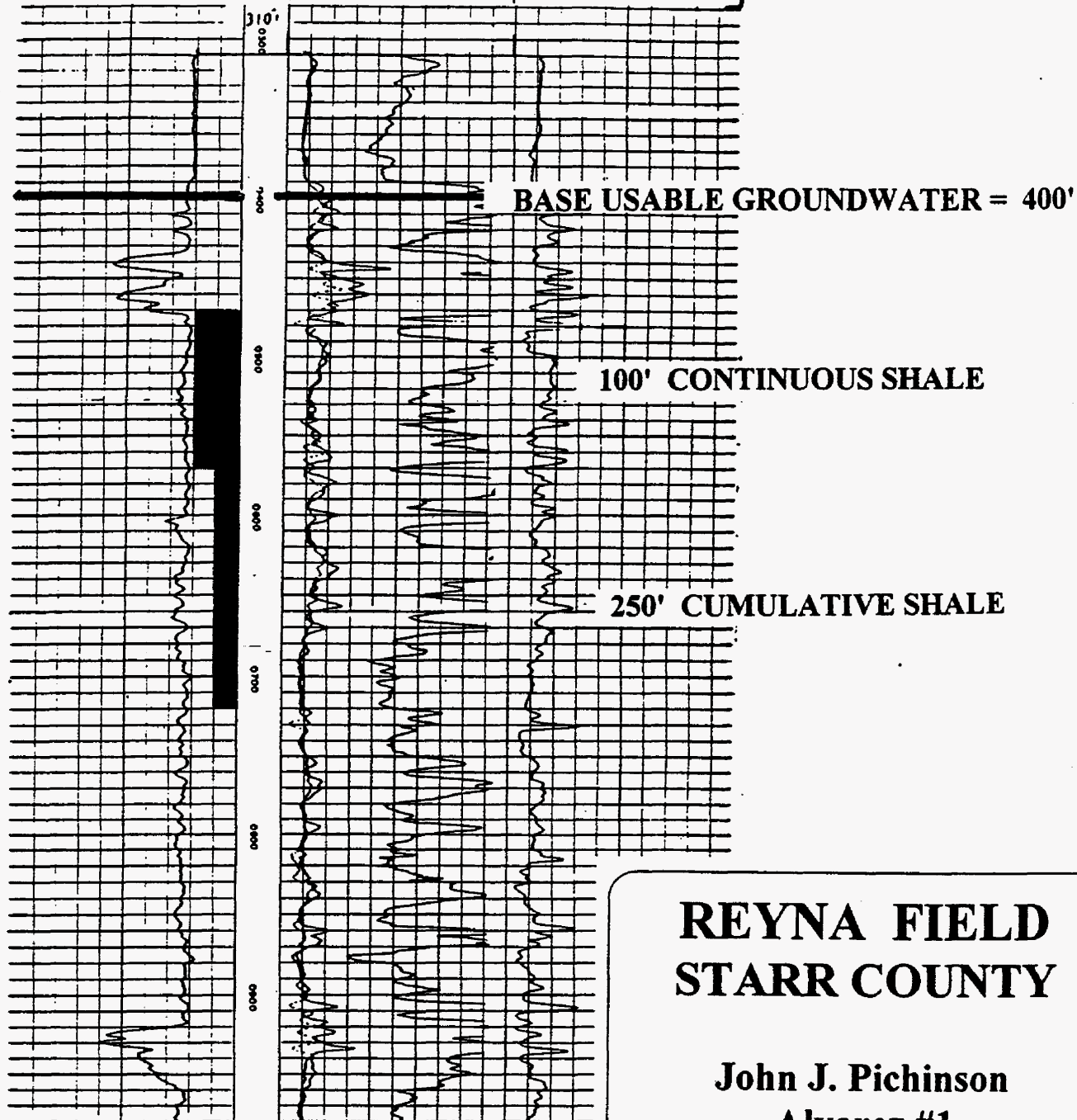
250' CUMULATIVE SHALE

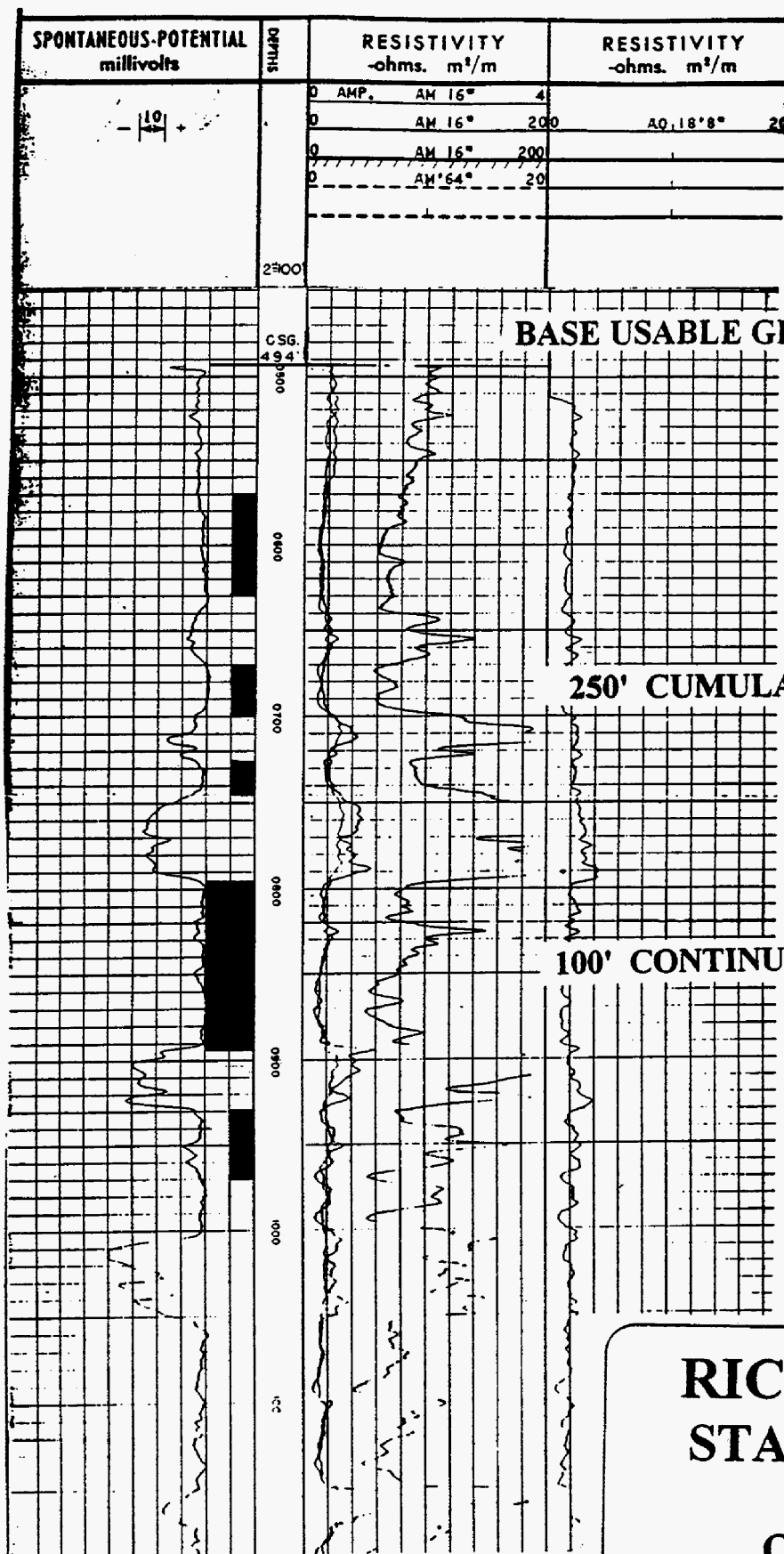
100' CONTINUOUS SHALE

**KELSEY SOUTH
STARR COUNTY**

**J. O. Clark, Jr.
Gonzales - Unit #A-5**

SPONTANEOUS-POTENTIAL millivolts	DEPTH	RESISTIVITY -ohms. m ² /m	RESISTIVITY -ohms. m ² /m
<div style="text-align: center;">10</div> <div style="text-align: center;">- ↔ +</div>	0	AMP. AM 16"	4
	0	AM 16"	20
	0	AM 16"	200
	0	AM 64"	20
	0	AM 64"	200

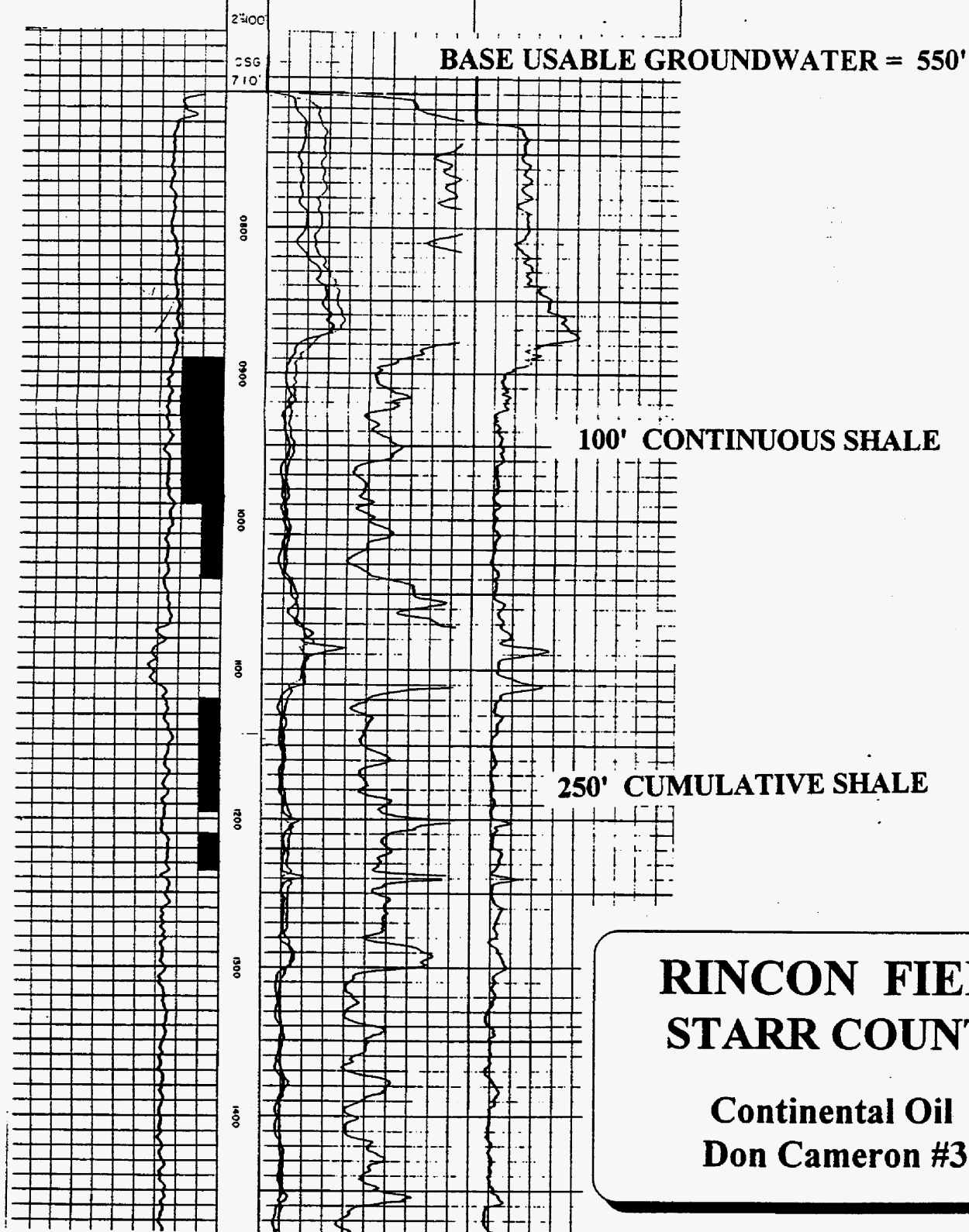


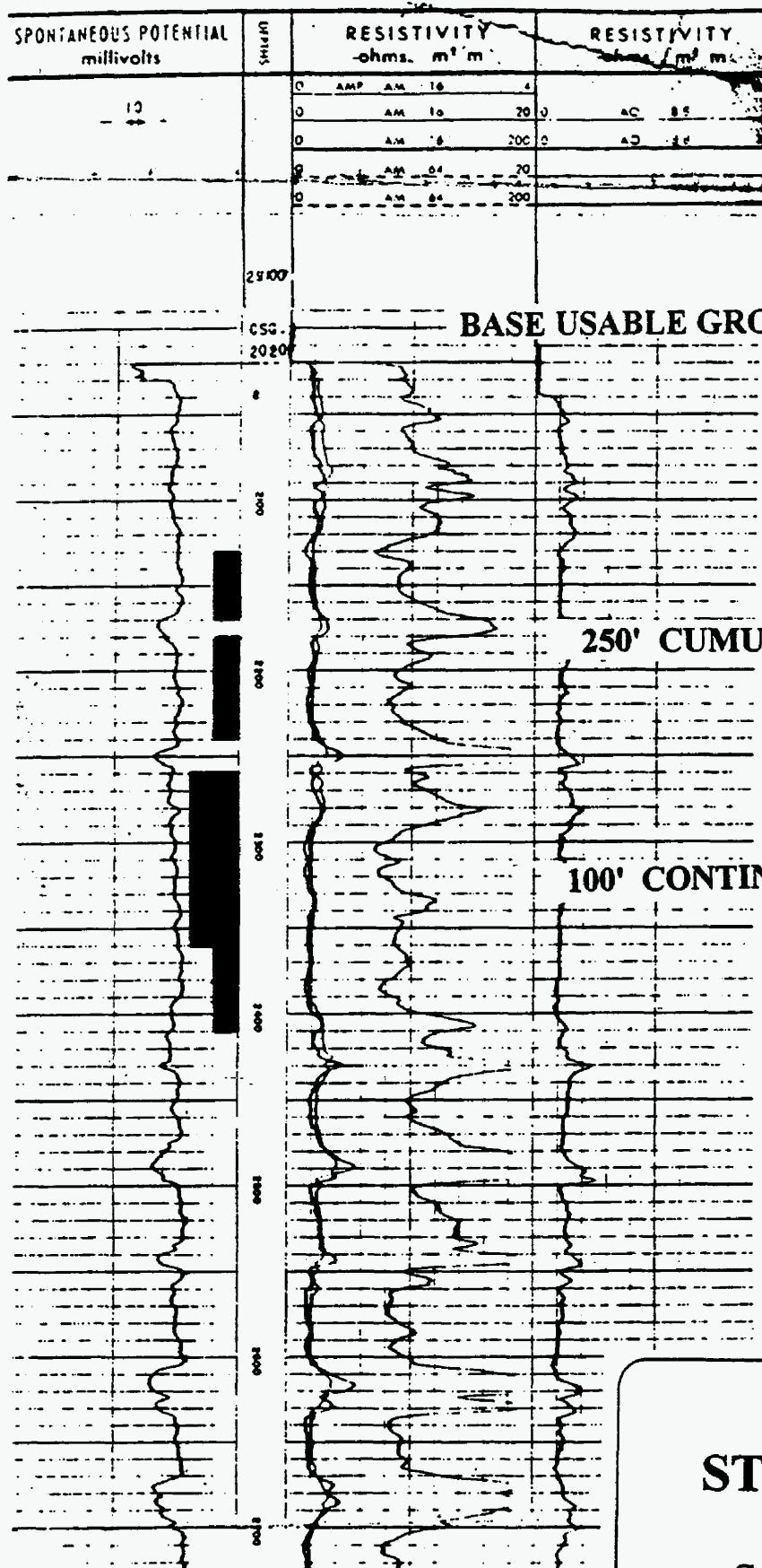


RICABY FIELD STARR COUNTY

Owen & Moss
W. S. Parks #4

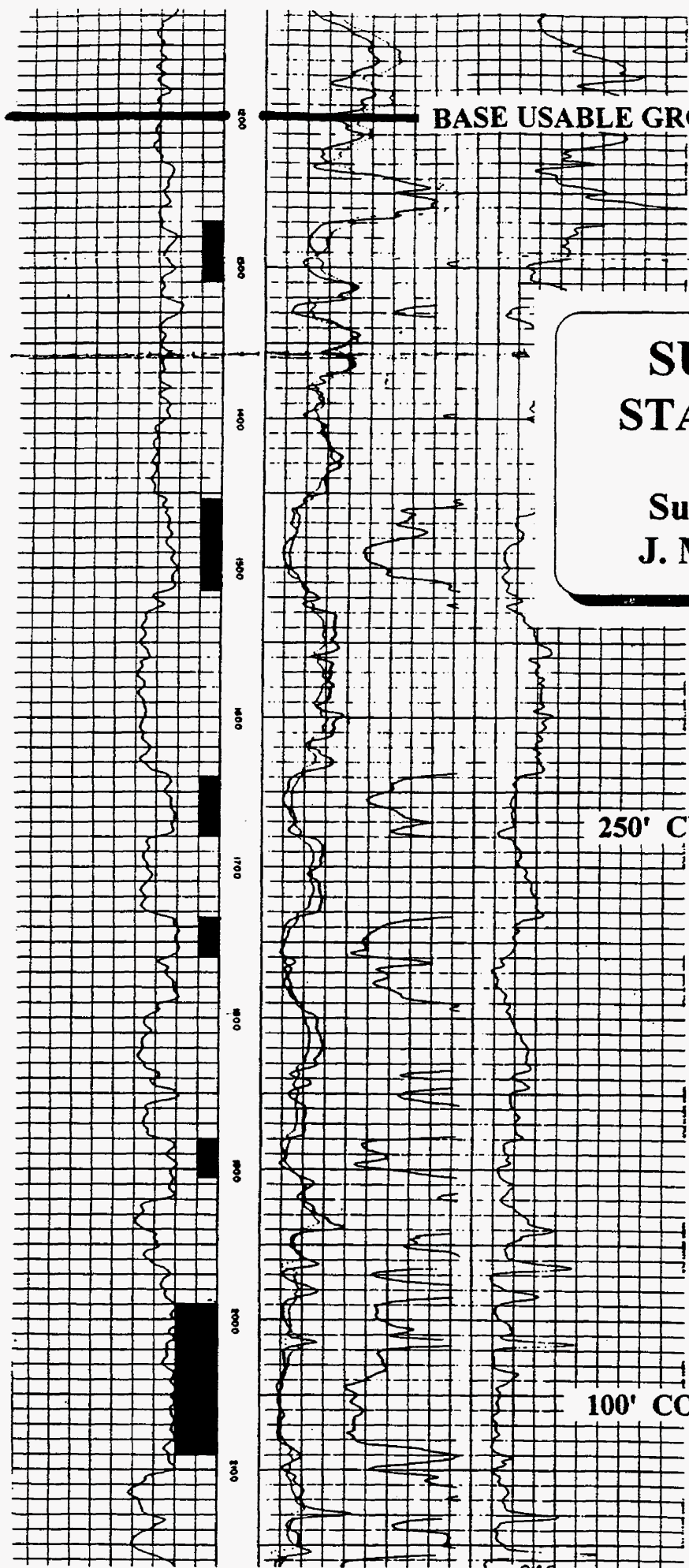
SPONTANEOUS-POTENTIAL millivolts	DEPTHS	RESISTIVITY -ohms. m ² /m	RESISTIVITY -ohms. m ² /m
<div style="text-align: center;">10</div> <div style="text-align: center;">- ↔ +</div>	0	AMP. AM 16" 4	
	0	AM 16" 20	0 AO 18.8 20
	0	AM 16" 200	0 AO 18.8 200
	0	AM 64" 20	
	0	AM 64" 200	





SUN FIELD STARR COUNTY

Sun Oil Company
George H. Speer #19



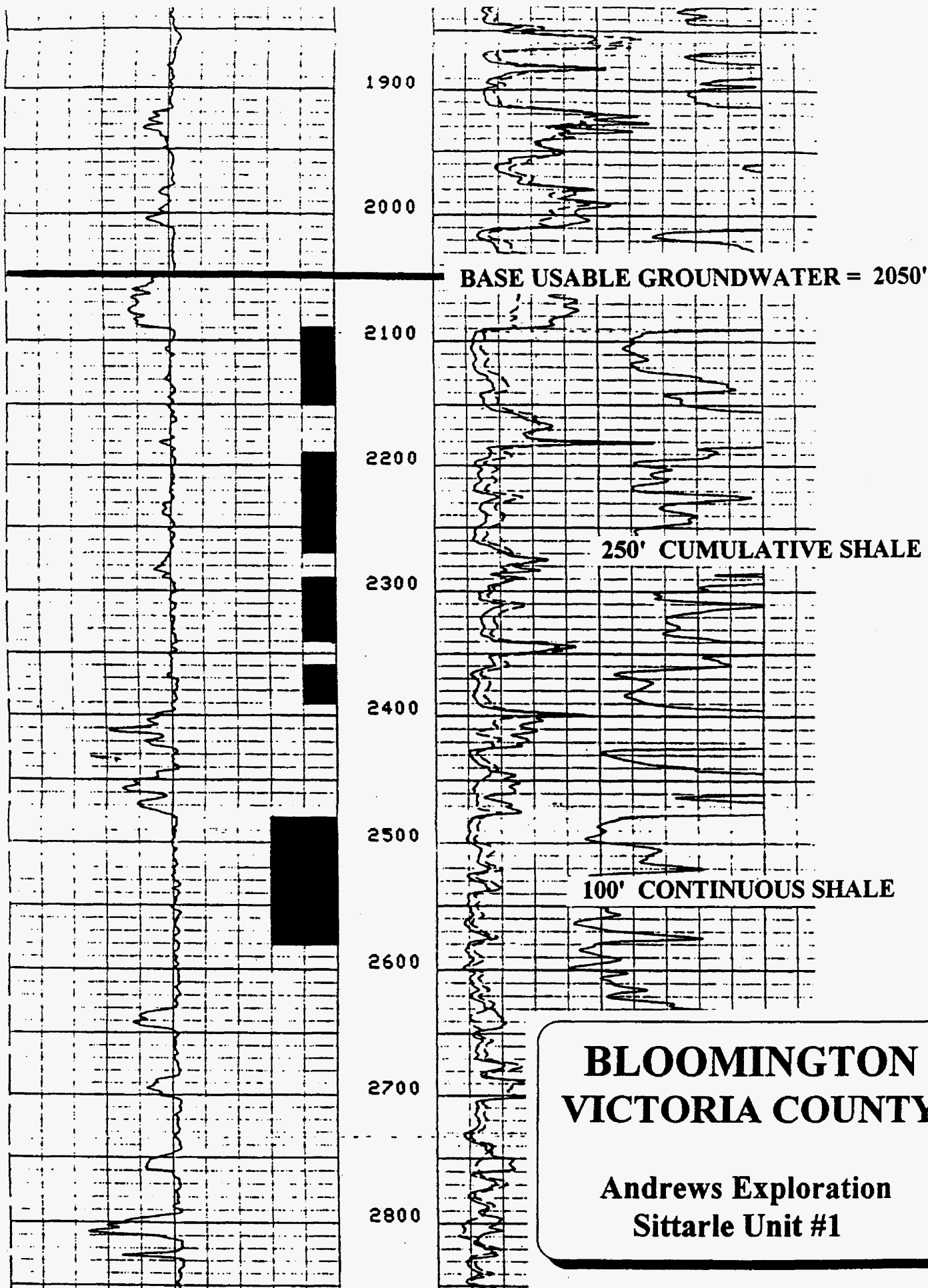
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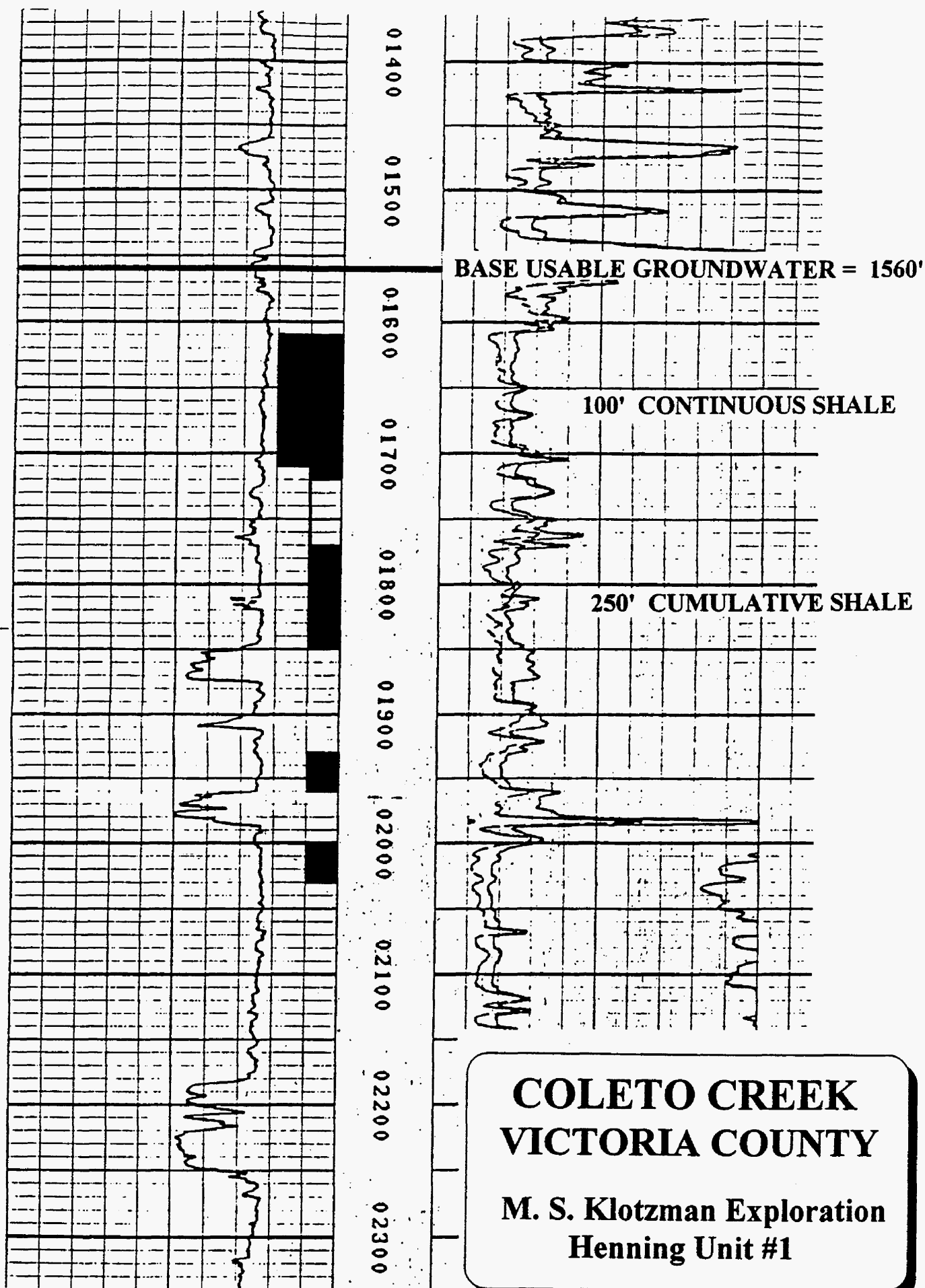
SUN NORTH STARR COUNTY

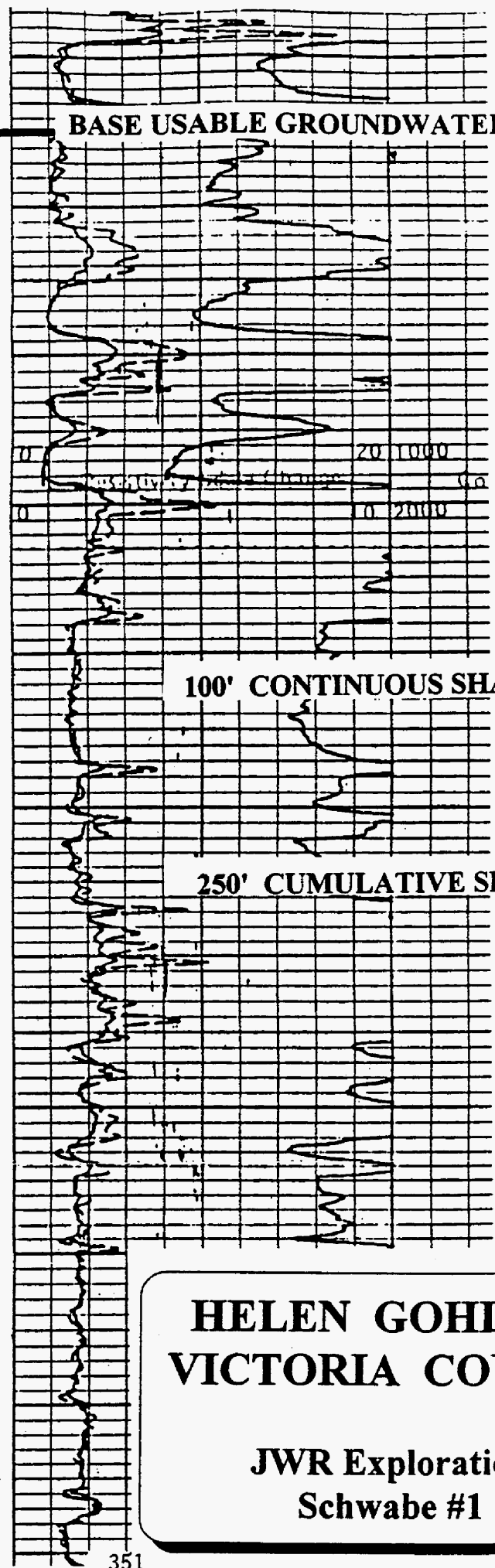
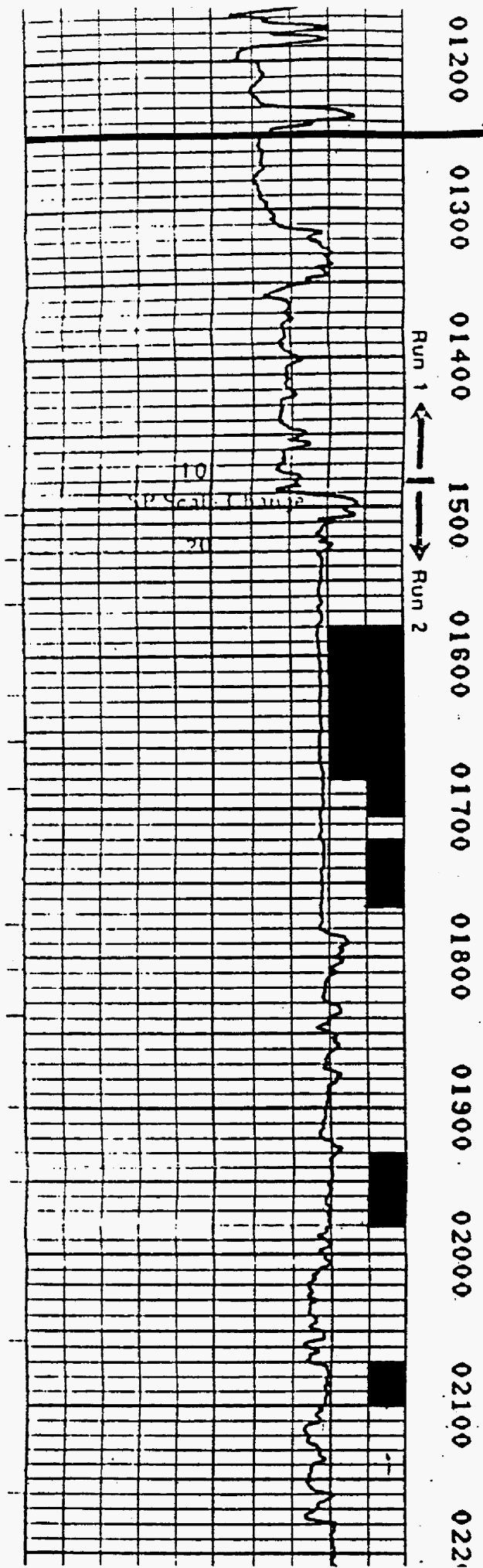
Sun Oil Company
J. M. De Garza #7

250' CUMULATIVE SHALE

100' CONTINUOUS SHALE







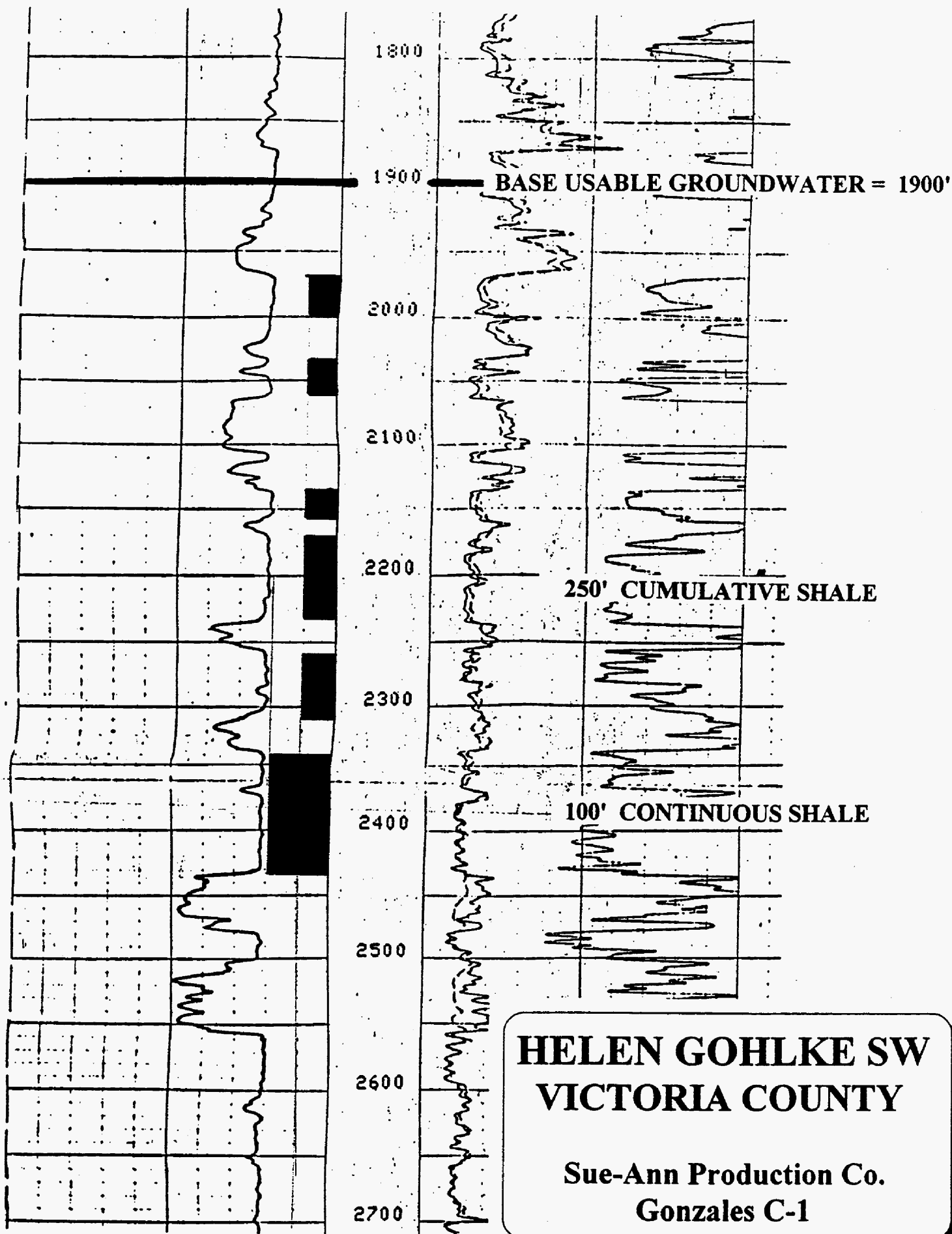
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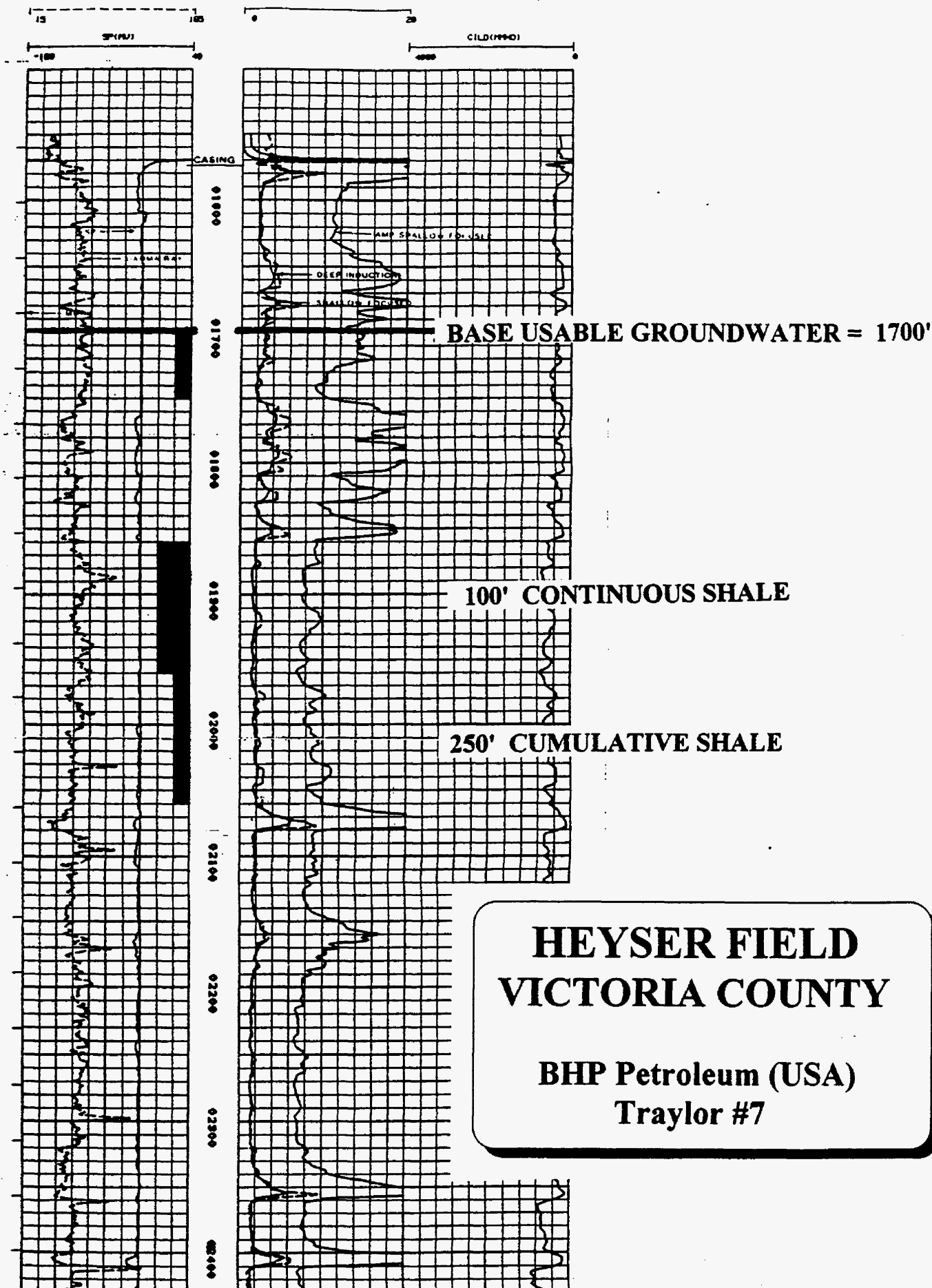
100' CONTINUOUS SHALE

250' CUMULATIVE SHALE

HELEN GOHLKE
VICTORIA COUNTY

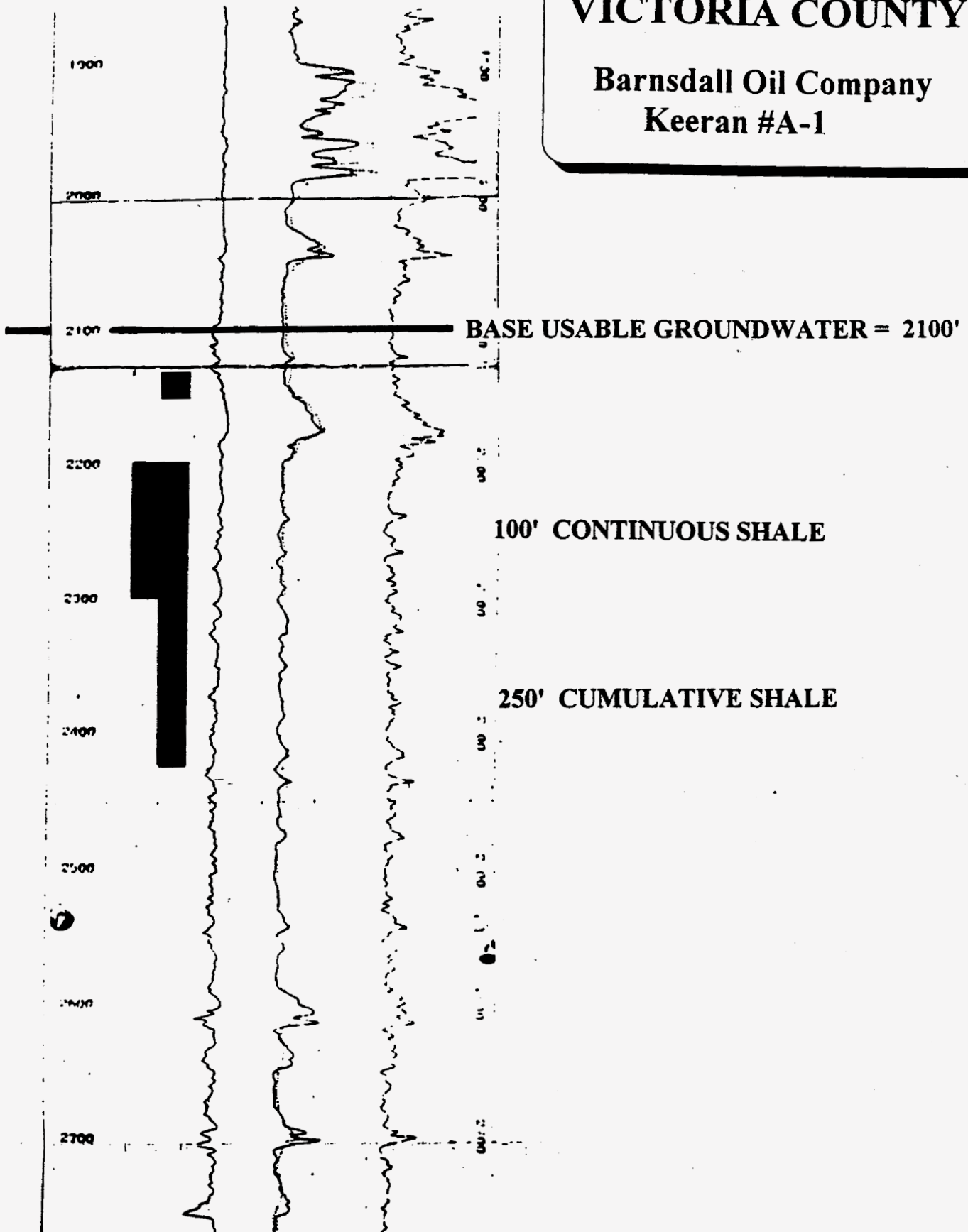
JWR Exploration
Schwabe #1

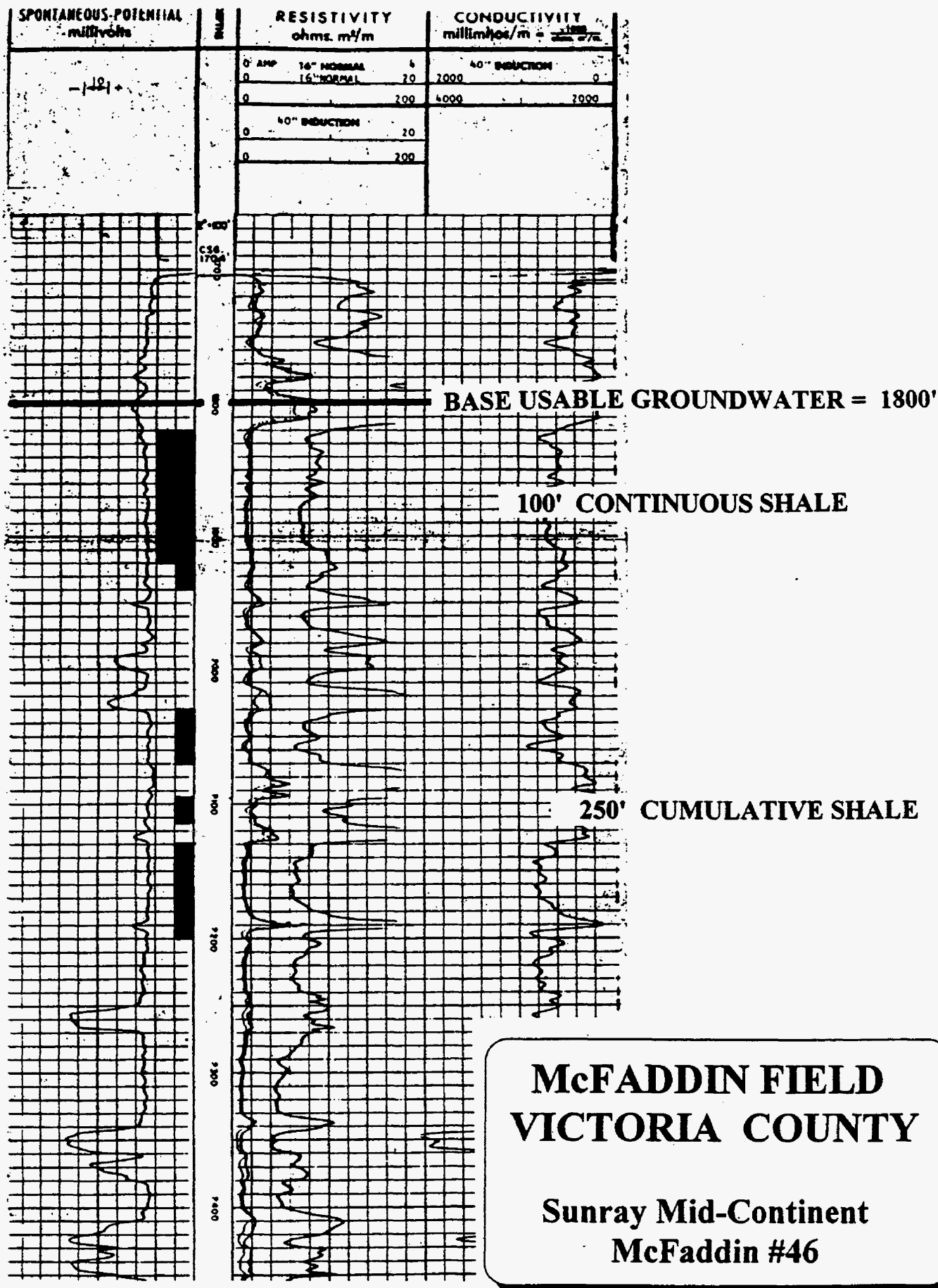


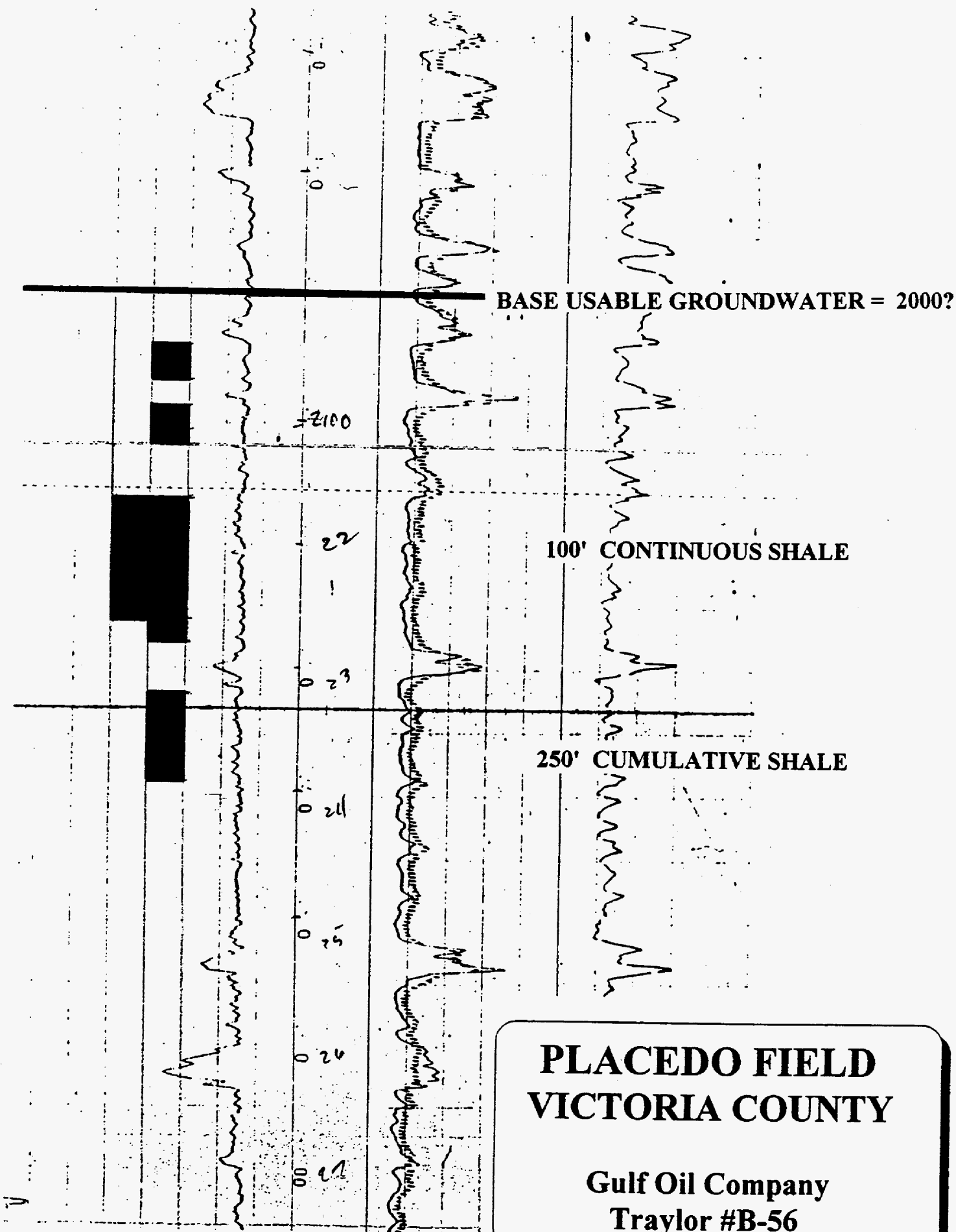


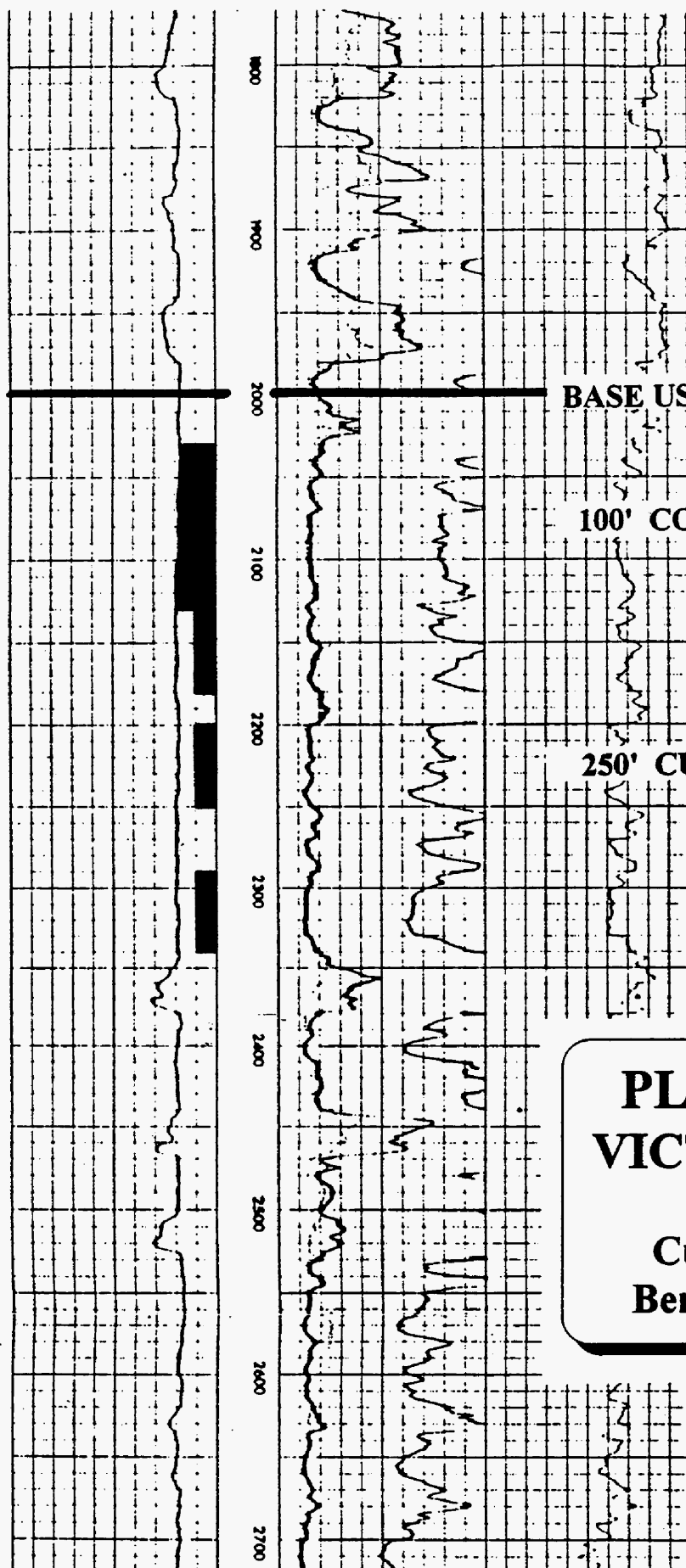
KEERAN FIELD VICTORIA COUNTY

Barnsdall Oil Company
Keeran #A-1









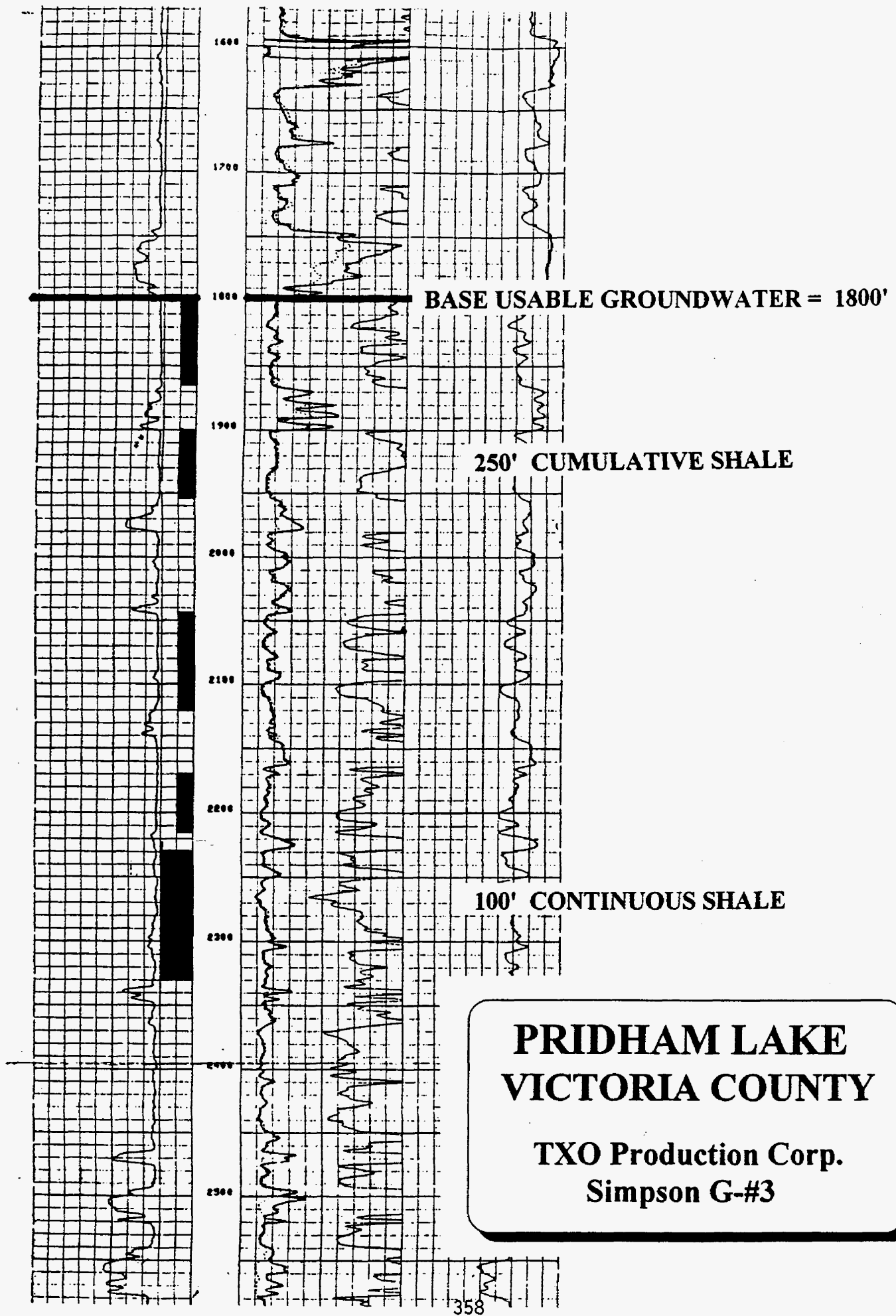
BASE USABLE GROUNDWATER = 2000?

100' CONTINUOUS SHALE

250' CUMULATIVE SHALE

PLACEDO EAST VICTORIA COUNTY

**Cummins & Walker
Ben Shelton "A" # A-2**



**PRIDHAM LAKE
VICTORIA COUNTY**

**TXO Production Corp.
Simpson G-#3**

APPENDIX 3

Gulf Coast Borehole Closure Test Paper



James E. Clark
Corporate Remediation - CHEMICALS
MA 83 - P. O. Box 3269
Beaumont, Texas 77704
(409) 727-9855

January 10, 1995

Mr. Fernando Deleon
Texas Railroad Commission
Environmental Services
Capitol Station
Austin, Texas 78711

RE: Gulf Coast Borehole Closure Test - Orangefield, Texas

Dear Mr. Deleon

Per your request, enclosed is a copy of the DuPont Sabine River Works, Borehole Closure Test which was conducted at Orange, Texas. I have also included a copy of the Gulf Coast Closure Test Well paper. Please feel free to call me at (713) 586-5643 if I can answer any questions concerning the enclosed material or be of further assistance to you.

DuPont Environmental Remediation Services

Phil Papadeas/aa

Phil Papadeas
Senior Geologist

PP/aa
"ENCL"

SOLUTION MINING RESEARCH INSTITUTE

**812 MURIEL STREET
WOODSTOCK, ILLINOIS 60098
815-338-8579**

**MEETING
PAPER**



GULF COAST BOREHOLE CLOSURE TEST WELL ORANGFIELD, TEXAS

by

J. E. Clark, P. W. Papadeas, D. K. Sparks, R. R. McGowen

**E. I. du Pont de Nemours & Co., Inc.
P. O. Box 3269
Beaumont, Texas 77704**

Presented at Solution Mining Research Institute Meeting

October 27 - 29, 1991 - Las Vegas, Nevada

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ORANGEFIELD, TEXAS**

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Beaumont, Texas 77704

ABSTRACT

A borehole closure protocol for a Gulf Coast site near Orangefield, Texas was developed by Du Pont. These procedures were based largely upon recommendations provided by EPA Region 6 and created a borehole closure test to demonstrate that, under a worst case scenario, any artificial penetration will seal naturally. The borehole closure test successfully demonstrated natural sealing. Within one week of setting the screen, tubing and pressure transducers in the borehole, testing confirmed the absence of upward movement of fluid from the test sand. The documentation for the absence of upward movement included: 1) Schlumberger Water Flow Log* and 2) the absence of pressure response on the upper transducer located outside the tubing and inside the casing. Testing was conducted in accordance using specified procedures, with pressure testing conducted at even higher pressures to allow an added margin of confidence. The borehole closure test provides a significant additional margin of confidence that there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous.

INTRODUCTION

The borehole closure study was conducted to address concerns associated with the movement of injected fluids toward the Orange Salt Dome from the injection wells operated at the Du Pont Sabine River Works. The borehole closure test well (Orange Petroleum #35 Hagar) is located on the east bank of Cow Bayou on the eastern flank of Orange Salt Dome, east-southeast of the town of Orangefield, Texas (see Figure 1). The study was performed in response to EPA's request for additional information sufficient to demonstrate that, even assuming a worst-case basis that wastes might migrate across the faults at Orange Salt Dome, there would be no migration of hazardous constituents from the injection zone upward through artificial penetrations.

* Mark of Schlumberger

Previous studies (Johnston and Greene, 1979; Davis, 1986; Johnston and Knappe 1986; Clark et al., 1987) have reported qualitatively that wells drilled in unconsolidated (soft) rock, such as the Gulf Coastal Plain in Texas, experience natural borehole closure. This study was developed by Du Pont for a quantitative analysis on natural borehole closure and was based upon recommendations provided by EPA. The worst-case scenario developed for this study included: 1) a test interval within the injection zone consisting of a thin injection sand overlain by a thick, sand-free shale; 2) an open borehole with a diameter equal to the largest hole diameter expected to be encountered among the abandoned wells at Orange Salt Dome; 3) a mud program designed in accordance with drilling practices in general use at the time the abandoned boreholes in question were drilled (1919), and 4) actual testing with a 9.0 lb/gal brine since this is the worst-case condition for abandoned holes without plugging records. The test protocol provided that the test would be successful if, when a 100 psi pressure increase was applied, a Water Flow Log or oxygen activation (OA) log run at stations above the injection sand interval showed no upward channeling and an upper pressure transducer showed no pressure buildup.

The maximum calculated value for potential pressure increase at this site is <80 psi, which includes all possible sources of pressure increase: 1) maximum density contrast between natural formation fluid and the injected waste (0.075) and 2) a worst-case density drive if the plume extended from the plant to the dome (maximum dip 2400 feet). More likely, the long-term effect of buoyancy occurs where the plume has drifted from the plant to the dome and the number of feet of dip is considerably less, only 300 feet. In the latter case, the pressure due to buoyancy would be <10 psi. Thus, testing the borehole closure well to 100 psi increase is an extremely conservative approach.

If an artificial penetration had been abandoned with casing in place, the casing would corrode, thus 'exposing' whatever was in the borehole to the formation. This corrosion information was based on conservative data from Orange Salt Dome artificial penetration data and National Association of Corrosion Engineers data (Graver, 1985). Using a maximum casing wall thickness of 0.557 inch for 8 5/8-inch casing and a conservative corrosion rate of 20 mils per year, the casing would corrode in 28 years, which is long before waste reaches Orange Salt Dome in approximately 5,000 years. This value is consistent with casing corrosion data available from producing wells in the Orangefield area.

The geologic formations present at depths of 2000 ft to 8000 ft consist mainly of middle to upper Miocene sands, with lower Oligocene Anahuac Shale, and Frio sands at greater depth (see Figure 2). Tertiary sands and shales were deposited in a series of stacked progradational wedges, which dip and ultimately thicken toward the Gulf of Mexico. The lower Miocene Lagarto and the middle Miocene Oakville Formation are both characterized by very thick, fine to very fine grained sands, silts and shales deposited in a fluvial and deltaic environment. The regional geologic structural setting is one characteristic of salt tectonics, with salt dome intrusions, minor salt ridges and deep synclines. Orange Salt Dome is a piercement type salt dome (top of salt approximately 7000 feet) where considerable quantities of hydrocarbons have been produced since 1919.

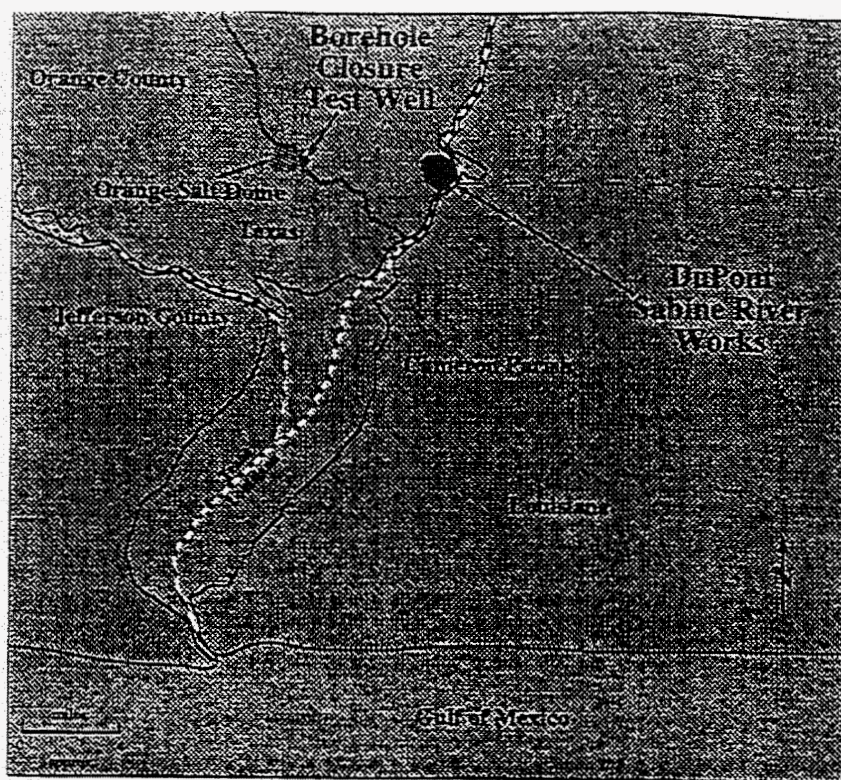


Figure 1 : Geographic Location Map of the Sabine River Works and the Borehole Closure Test Well

<i>Period</i>	<i>Epoch</i>	<i>Stage or Group</i>	<i>Formation</i>
QUATERNARY	HOLOCENE	Undifferentiated	
		12,000 YA	
	PLEISTOCENE	Houston L. Wisconsin	Beaumont
		Wisconsin E. Wisconsin	
		Sangamon L. Illinois	
		Pre-Sangamon E. Illinois	Lissie
		Yamouth Kansan	
		Aftonian Nebraskan	Willis
TERTIARY	PLIOCENE	2.5 MYA Grosvenor Group	Goliad
	MIOCENE	5.2 MYA	Lagarto
		Fleming Group	Oakville
	OLIGOCENE	24 MYA Caraboula Group	Anahaze
		37 MYA Vicksburg Group	Vicksburg

**Figure 2: Stratigraphic Column for Eastern Gulf Coast.
Adapted from Jackson and Galloway, 1984.**

PROCEDURES

Following evaluation and analysis of the mudlog, lithology samples, openhole logs, and visual examination of sidewall cores obtained from the test well, several sand and shale zones were determined to be potential candidates for the test interval. Using the protocol developed by Du Pont with recommendations from the EPA, the criteria for test interval selection called for a thin clean injection sand, overlain by a thick sand-free shale within the injection zone. The injection sand selected contains 30 net feet of clean sand (2932 feet - 2962 feet) with 88 net feet of clean shale (2838 feet - 2926 feet). The casing was set at 2838 feet into the shale of the test interval. This graphic is presented in the well construction schematic using the electric log as a base (see Figure 3).

Analysis of two sidewall cores for particle size distribution from the injection sand was an important factor in determining the screen size. Sidewall core plugs from 2937 feet and 2945 feet were analyzed for porosity, permeability and lithology. Silt and clay particle analysis indicated a median grain size of 0.0046 inches. Using this information, the size of the screen assembly selected was 0.006 inches, the best gauge of screen that would most closely fit the particle size of the formation for a natural completion. Porosity within the test sand ranges from 29.6 to 31.8% (neutron-density log porosity ranges from 29 to 31%), with permeabilities on the order of 900 to 1400 millidarcies (md).

In order to satisfy a further worst case condition, Du Pont, at EPA's request investigated and evaluated electric logs of representative wells located within the confines of the 10,000-year waste plume. These artificial penetrations were evaluated for continuity of shale overlying the test sand. The shale of the test interval was demonstrated to be continuous and correlatable in its areal extent across the highest point of Orange Salt Dome. In addition, this test interval was at a shallow depth which minimized the geologic overburden pressures and the forces causing shale creep into the open wellbore.

BOREHOLE CLOSURE TESTING

OVERVIEW

Borehole closure testing started April 21, 1991 and was completed May 4, 1991. This sequence of borehole closure testing consisted of the following general steps:

Step 1

With drill bit and drill string still in hole, condition 9.7 lbs/gal mud in the open borehole. See Figure 4 for a schematic diagram depicting the mud circulation in the open borehole.

Step 2

Pulled drill string into casing and displaced mud with 9.1 lbs/gal filtered brine near the casing shoe to clean up the well bore casing and fluids prior to running the screen, transducers, and tubing assembly. (See Figure 5).

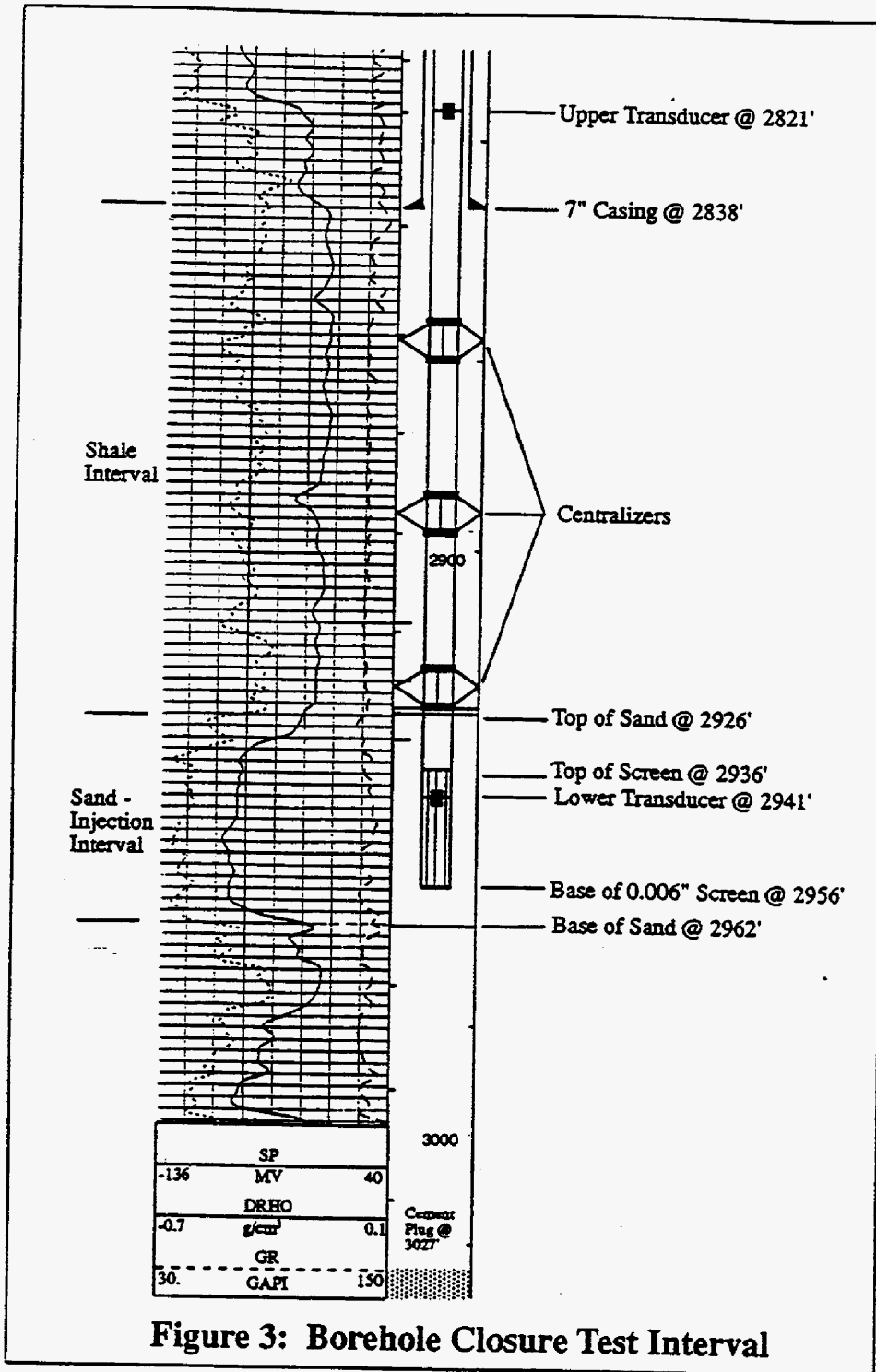


Figure 3: Borehole Closure Test Interval

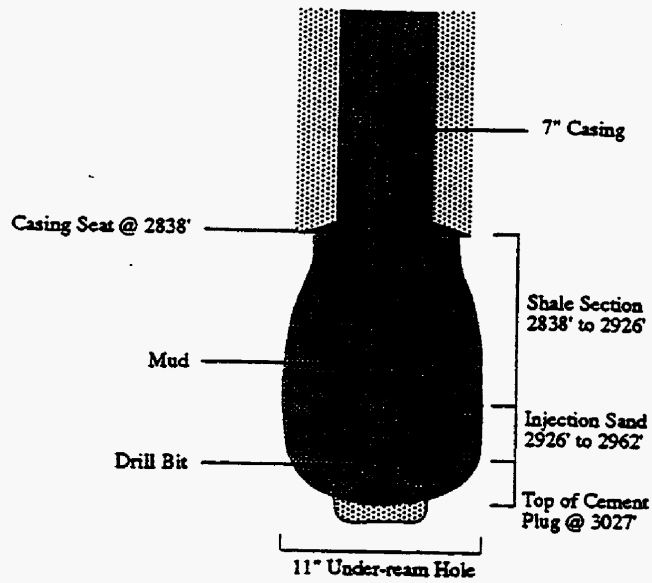


Figure 4: Mud Circulation

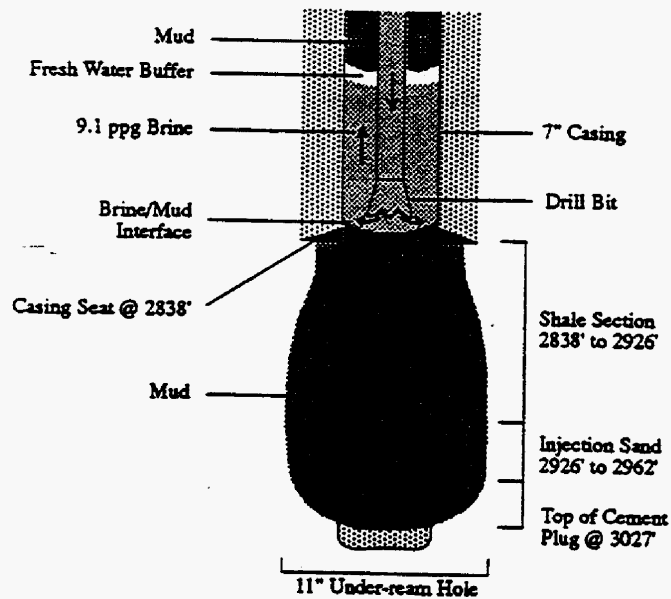


Figure 5: Mud Displacement with Brine Near Casing Shoe

Step 3

After the well bore casing was displaced with 9.1 lbs/gal filtered brine, the screen assembly, transducers, and tubing were placed near the bottom of the casing shoe. A transducer test was conducted to ensure that the electrical equipment was operating properly before running the screen assembly in the open borehole. In addition, filtered brine was pumped at various flow rates up to a maximum of 8.5 barrels per minute (bbl/min) to determine the friction loss in the screen section next to the lower transducer. See Figure 6. Transducer Test at Bottom of Casing.

Step 4

After the completion of the transducer test, the screen assembly was placed through the injection sand from 2936 feet to 2956 feet. Once this was completed, displacement of the remaining 9.7 lbs/gal mud with 9.1 lbs/gal filtered brine in the open borehole began immediately. See Figure 7. Screen Placement.

Step 5

A total of 401 barrels of 9.1 lbs/gal filtered brine was circulated to clean up the well bore. Mud returns from the open well bore occurred on the surface after pumping 85 barrels of brine down the injection tubing. The well bore discharge line started to clean up after 200 barrels of brine were pumped into the injection tubing. An additional 200 barrels of brine were pumped at decreasing flow rates until the discharge line indicated clean fluids in the return. See Figure 8. Brine Circulation After Mud Displacement.

Step 6

After displacement of the mud from the well bore with the 401 barrels of brine, the well was shut-in. See Figure 9. showing well shut-in with brine and recording falloff pressures.

Step 7

After waiting one week, during which time the formation pressure achieved equilibrium, a pre-injection slug test was conducted. The pre-injection slug test verified that the screen was open and that the injection formation was responding properly. Next, a Halliburton pump truck was placed on location along with a control valve to regulate the low flow rates anticipated for the pressure build-up testing. The initial injection testing indicated that borehole closure had occurred and Schlumberger was called out to run their Water Flow Log. Schlumberger performed the logging runs at various pressure rates and depths which indicated that there was no upward channeling of fluid and that borehole closure had indeed occurred. See Figure 10 for a schematic depicting Water Flow Log and Pressure Testing with Brine Injection.

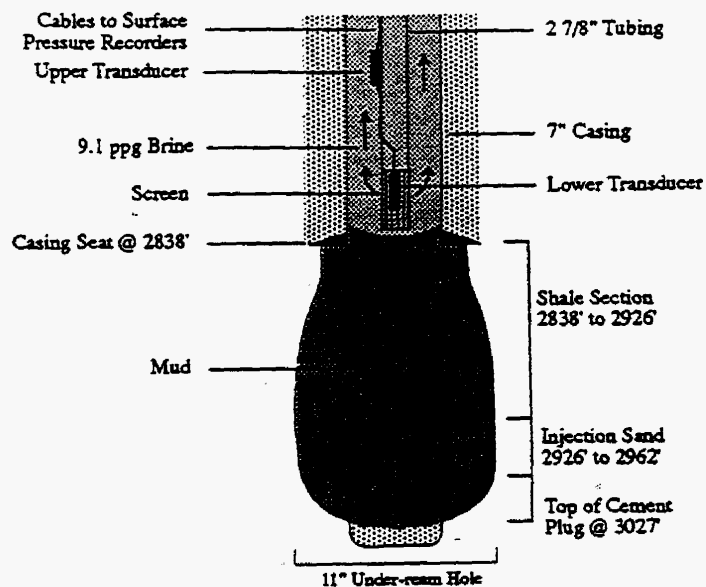


Figure 6: Transducer Test at Bottom of Casing

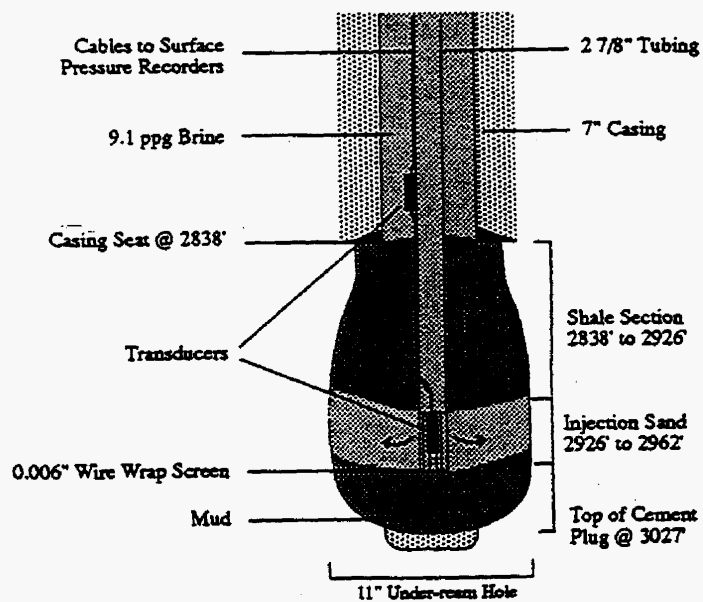


Figure 7: Screen Placement

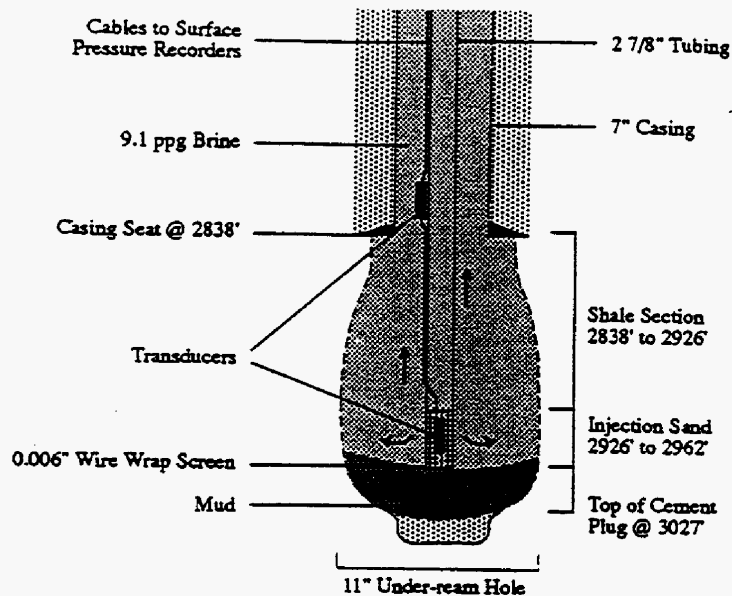


Figure 8: Brine Circulation After Mud Displacement

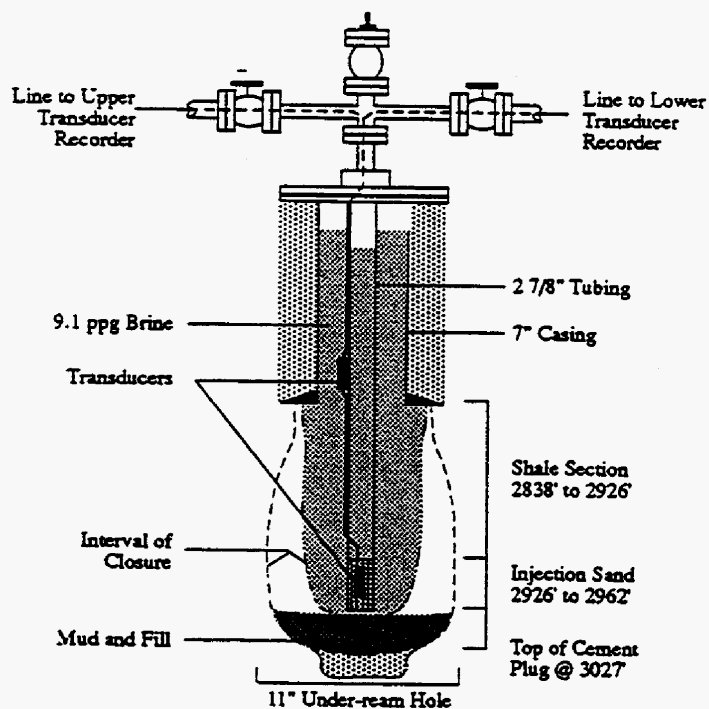


Figure 9: Shut Well In and Record Pressures

DETAILS FROM CONDITIONING HOLE TO MUD DISPLACEMENT

After the open borehole was conditioned with 9.7 lbs/gal mud the drill bit and pipe were tripped out of the open borehole and placed inside the casing above the casing shoe. Drilling mud inside the casing was displaced with 9.1 lbs/gal filtered brine near the casing shoe to limit mud invasion of the well screen. Once the mud was displaced from the casing and clear brine returns appeared on the surface, brine injection stopped, and the drill bit and pipe were tripped out of the casing. The lower transducer was installed inside the well screen, approximately four feet from the top of the screen openings. An upper transducer was attached to the outside of the 2 7/8 inch tubing approximately 120 feet above the lower transducer. Next, the screen, lower and upper pressure transducers, and the tubing assembly were lowered inside the well bore to a depth near the casing shoe.

A transducer test was conducted April 23, 1991, inside the well casing prior to running the screen assembly inside the open borehole. This tested both transducers under static and dynamic conditions and ensured that all electrical equipment (transducers) was functioning properly. The lower transducer at 2758 feet had a static pressure reading of 1305 psi (see Figure 11). Therefore, the pressure transducer was operating correctly by measuring the hydrostatic pressure of the 9.1 lbs/gal brine ($0.052 \times 2758 \text{ ft} \times 9.1 \text{ lbs/gal} = 1305 \text{ psi}$). The upper transducer at 2638 feet (see Figure 12) also was operating properly by recording the static pressure of 1248 psi ($0.052 \times 2638 \text{ ft} \times 9.1 \text{ lbs/gal} = 1248 \text{ psi}$). Another method verifying that the transducers were recording accurately is to state that $(1305 \text{ psi} - 1248 \text{ psi}) / (0.052 \times 9.1) = 120 \text{ feet}$, the distance that the transducers are separated.

A dynamic test was conducted after obtaining the static pressure measurements from the lower and upper transducers (see Figures 11 and 12). This test was conducted at several production rates (1.5 to 8.5 bbl/min) per EPA Region 6 requests to determine the pressure drop or friction loss across the screen assembly. The screen assembly consists of a wire-wrapped (0.006 inch) re-inforced tubing with a total of 120 holes per foot of screen (3/8 inch diameter per hole). This type of construction minimizes friction losses in the screen assembly. The dynamic test conducted near the casing shoe revealed that the pressure loss would be less than 12 psi for 2 bbl/min flow rate in the screen assembly. The upper transducer reflected a 10 psi buildup for this same time period showing that the 12 psi loss is not all attributed to friction loss inside the screen. The injection test itself was conducted at less than 0.5 bbl/min.

DETAILS FROM MUD DISPLACEMENT TO END OF TESTING

The pressures recorded from mud displacement to the end of testing for the lower and upper transducers are presented in Figures 13 and 14, respectively. Once the screen was properly placed, the 9.7 lbs/gal mud in the open borehole was displaced immediately with 9.1 lbs/gal filtered brine. Details for each of the major historical sequences comprising the borehole closure demonstration are described below.

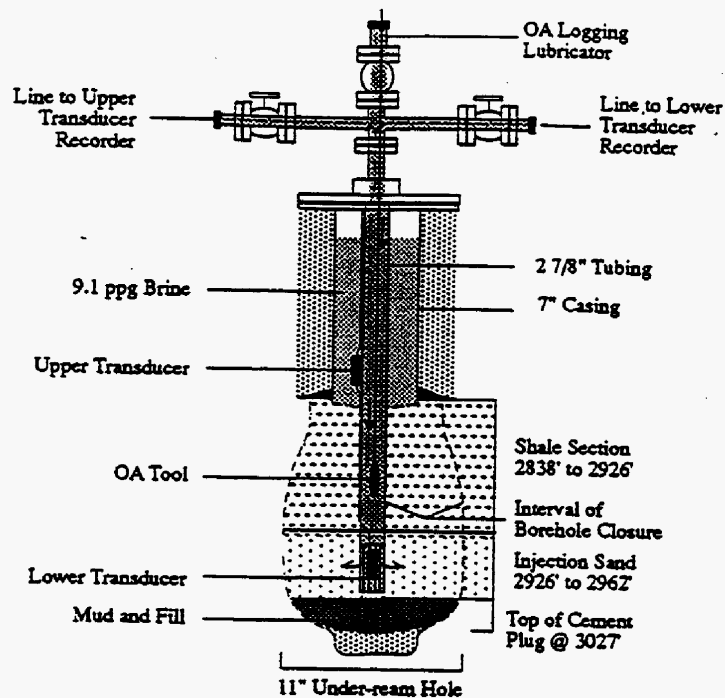


Figure 10: Water Flow Log and Pressure Testing with Brine Injection

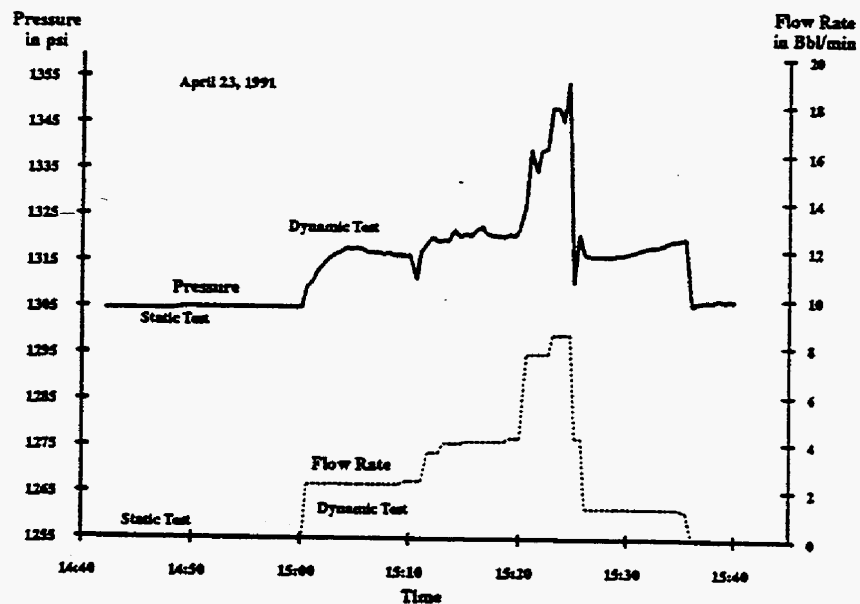


Figure 11: Transducer Test Near Casing Shoe With Lower Transducer at 2758 feet

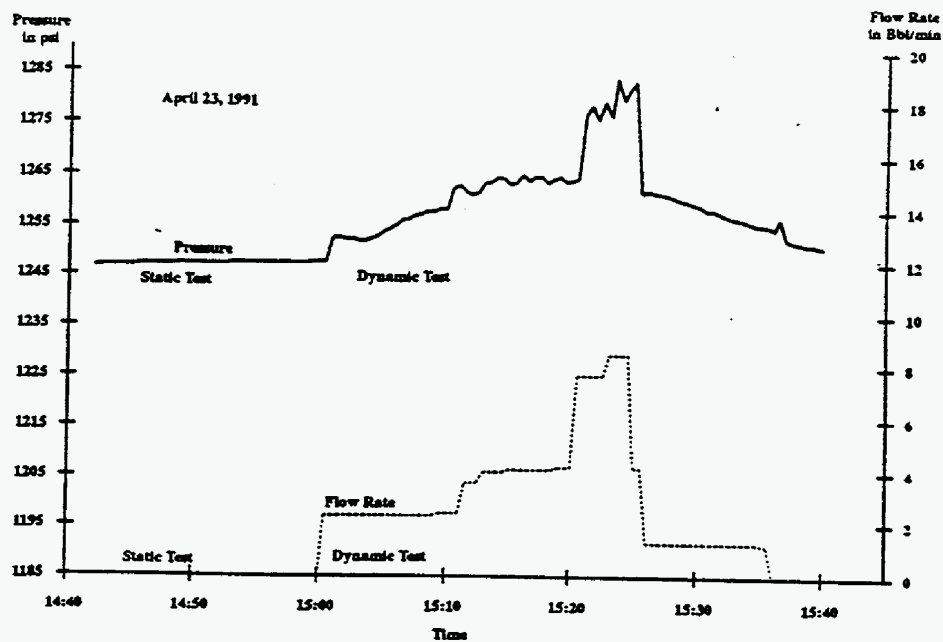


Figure 12: Transducer Test Near Casing Shoe With Upper Transducer at 2638 feet

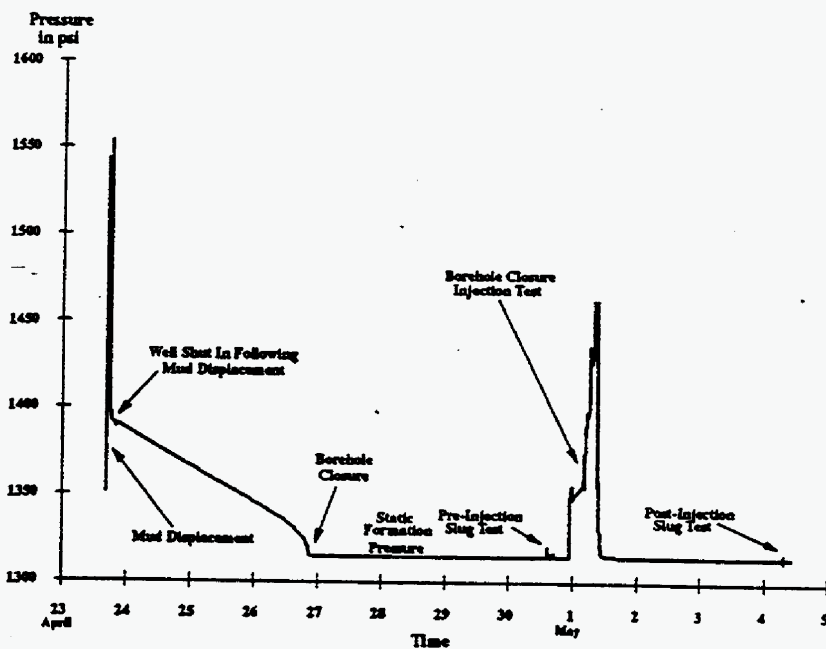


Figure 13: Lower Transducer Data From Mud Displacement to End of Testing

A total of 401 bbl of 9.1 lbs/gal filtered brine was pumped through the injection tubing with returns to the surface. Figure 15 shows that the mud displacement caused an increase in the pressure of the upper transducer at 2821 feet until mud was displaced from the well bore. After pumping 85 bbl of brine the drilling mud appeared on the surface and the discharge line was switched from the brine tank to the mud tank. The discharge rate near the end of the test was reduced gradually to prevent sudden well surges which could cause the well screen to fill with sand.

The final brine returns were clean with only minute traces of gumbo shale. After the mud displacement sequence, the well bore was shut-in and pressures were recorded. Recovery data (see Figure 16) show a slow pressure decline. Pressure data indicate that borehole closure occurred within 3 to 4 days after the well was shut-in following mud displacement. The screened interval or lower transducer reflects static formation pressure (1314 psi) within this time frame. Also, the upper transducer (inside the well casing) indicates a pressure-time slope change within this same time period. Only minor pressure changes occurred after this time period for the upper transducer, and this would be expected because the brine could still react with the shale below the casing shoe. Calculation of different fluid levels from the upper and lower transducers also show isolation of the two zones.

According to procedures agreed upon by Du Pont and EPA Region 6, it was Du Pont's decision to determine what duration to leave the well bore shut-in. Du Pont notified EPA Region 6 after placement of the screen assembly that it would leave the well in a static condition for a time period of approximately one week before starting the injection test.

A pre-injection slug test (see Figure 17) consisting of two separate series of five slugs (each slug equaled 2.5 gallons of brine) was performed April 30, 1991, one week after shut in. The purpose of this test was threefold: 1) to determine if the screen was open and operating properly, 2) to determine the volume of water that might be needed to conduct a pressure buildup in the formation, and 3) to determine if there was a pressure response in the upper transducer. As shown in Figure 17, the fall-off curves in the lower transducer indicated that the screen was open (i.e., not filled with sand). There was no pressure response in the upper transducer from the slug testing, indicating that the two transducers were indeed isolated. Finally, the testing revealed that a pump truck would be required to control the low flow rate of brine injection. In addition, because the required flow rates could be lower than a truck could pump (less than 20 gpm), a valve was installed to regulate even lower flow rates. Halliburton computer flow monitoring and pumping services, Otis filters and brine fluids were ordered to the location for the borehole closure injection test.

Early testing data showed that the lower transducer was recording pressure buildup with no pressure increase observed in the upper transducer. The flow rate was increased slightly from 16 gpm to 22 gpm to obtain a 40 psi buildup. At this point, before reaching 50 psi of formation buildup, Schlumberger was called to run a Water Flow Log which would check for upward fluid channeling. Schlumberger was contacted for logging services at 23:30 hours on April 30, 1991. In order to conserve brine the flow rate was reduced to 16 gpm. The upper transducer continued to show no pressure change from injection, except for minor temperature anomalies associated

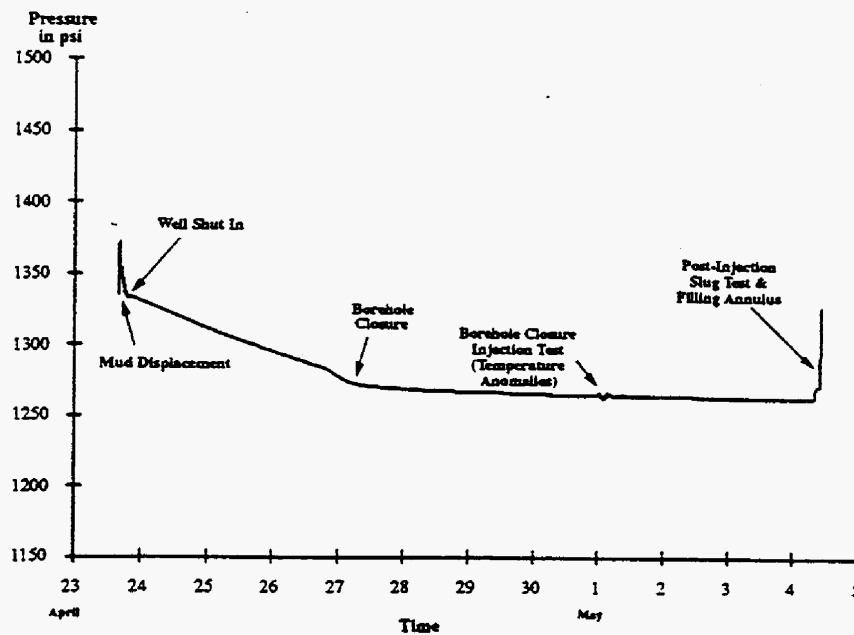


Figure 14: Upper Transducer Data from Mud Displacement to End of Testing

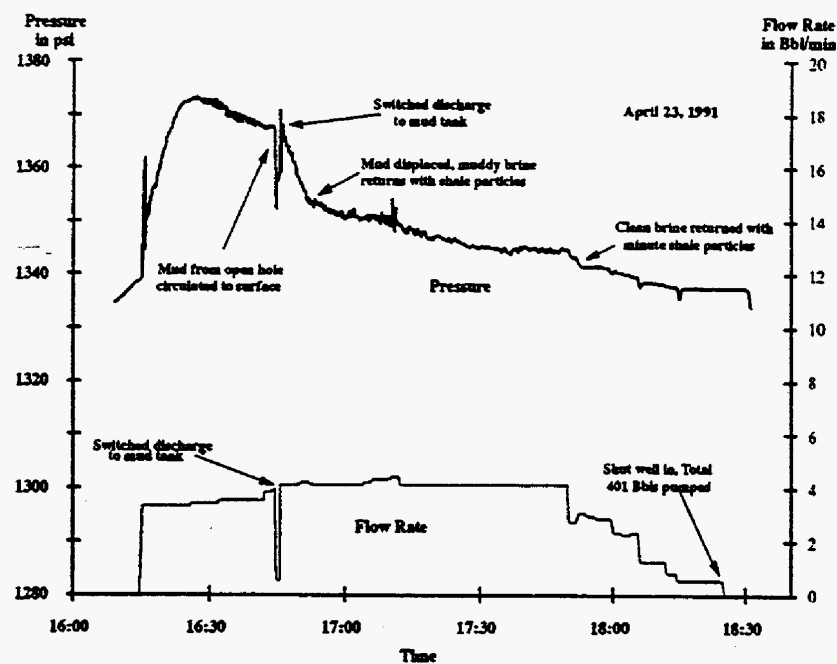


Figure 15: Mud Displacement With Upper Transducer at 2821 feet

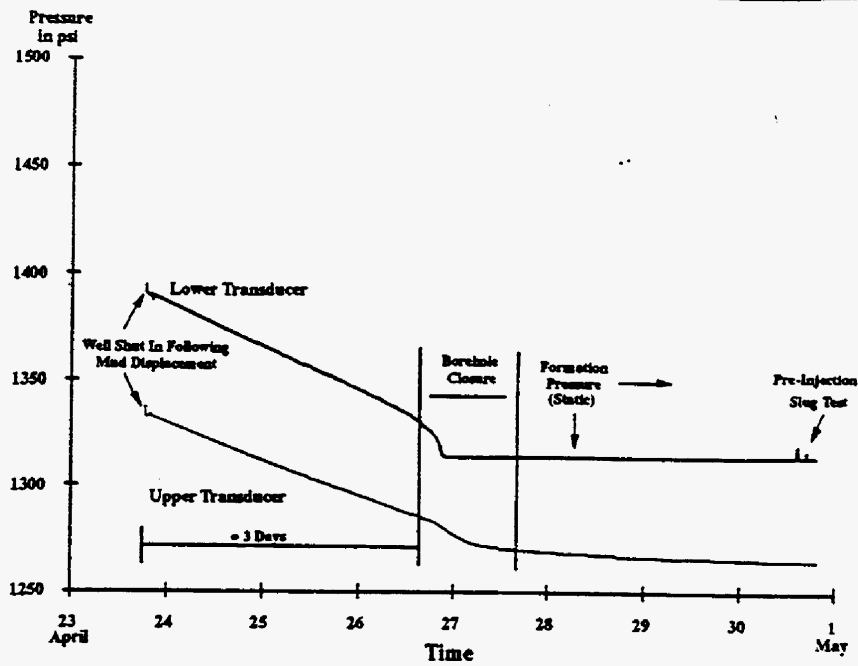


Figure 16: Recovery Following Mud Displacement

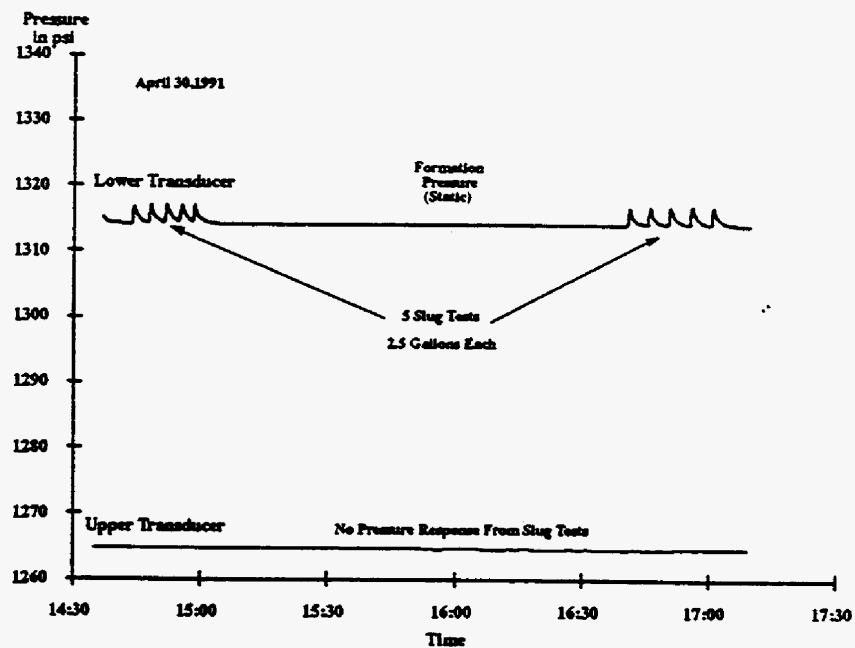


Figure 17: Pre-Injection Slug Test

with the cooling effect of injection fluids. Figure 18 presents an overview of the borehole closure injection test for the upper and lower transducer and a plot of fluid temperature. Figure 19 is an enlargement of fluid injection temperatures and the upper transducer pressures. This graph demonstrates the minute temperature anomalies associated with the cooling of fluids in the well bore.

Figure 20 is a plot of transducer pressure and flow rates during the borehole closure testing. The Water Flow Log was conducted within the tubing under pressure control conditions at 90 psi, 110 psi, and 140 psi above static formation pressure and at stations within the overlying shale interval at approximately 25 feet, 50 feet, and 75 feet above the test injection sand. In an attempt to maintain constant formation pressure during each OA log run, the flow rates were reduced. Flow rates were increased to obtain the next formation pressure OA log run; however, the formation pressures continued to increase and the flow rates were further reduced (see Figure 20) to maintain a consistent formation pressure increase over static. Both the upper transducer and the OA logging indicate no upward channeling of fluid. The final run of the Water Flow Log (OA) showed no upward movement of fluids even as shallow as 25 feet above the injection sand.

Du Pont conducted a post-injection test prior to cutting the transducer lines to the surface recorders and pulling the tubing and screen assembly. The purpose of this test was to verify that the lower transducer was still working and that the upper transducer would respond to fluid placed in the annulus. Figure 21 shows that the upper transducer was working and that there was no bleed-off of pressure into the lower transducer. This was the case even when the annulus was filled to the surface with fluid. This also demonstrated well closure and sealing of the shale section between the injection sand and the casing. Table 1 shows x-ray diffraction data for the test interval and indicates that the shale section consists of expandable smectite clay layers.

EPA was not only interested in whether natural borehole closure occurred, but also if a rate of borehole closure could be quantified. During this test, natural borehole closure was demonstrated, and a rate of borehole closure was 'quantified'.

CONCLUSION

The borehole closure test was designed and constructed according to EPA criteria for a worst-case scenario. This worst-case scenario assumes that hazardous waste migrates across a non-sealing fault and encounters an artificial penetration of maximum borehole diameter filled with 9.0 lb/gal brine. The test interval selected was a thin sand overlain by a thick, sand-free shale.

The test sand was pressured up to the pressure specified and greater with no upward fluid flow or channeling detected during oxygen activation logging station, even with a minimum of 25 feet of shale. Recorded pressures indicate no channeling of fluid because of the pressure differential between the two sensors. Results of the test provide conclusive evidence that a borehole closes naturally, even under a worst-case scenario.

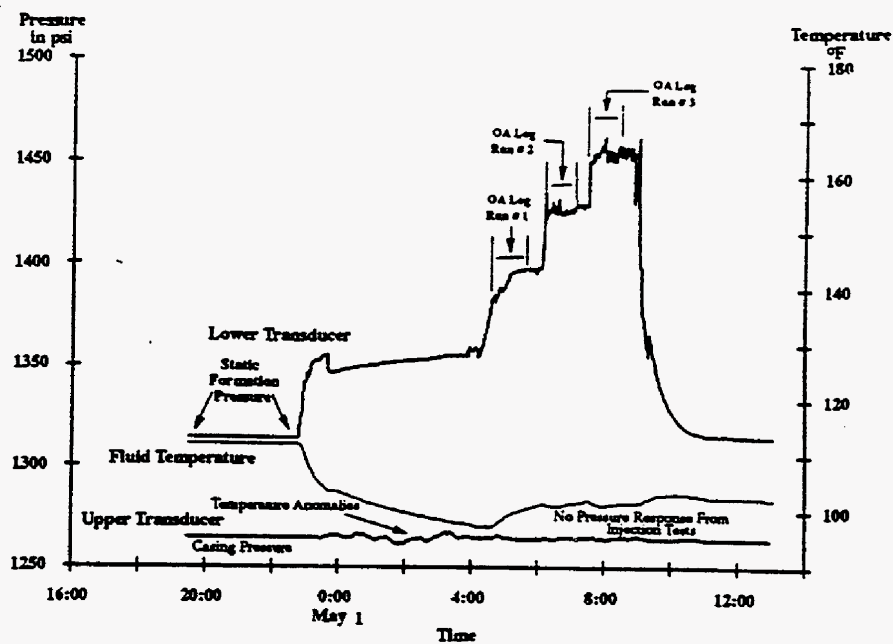


Figure 18: Borehole Closure Injection Test Upper and Lower Transducers- Pressure & Temperature

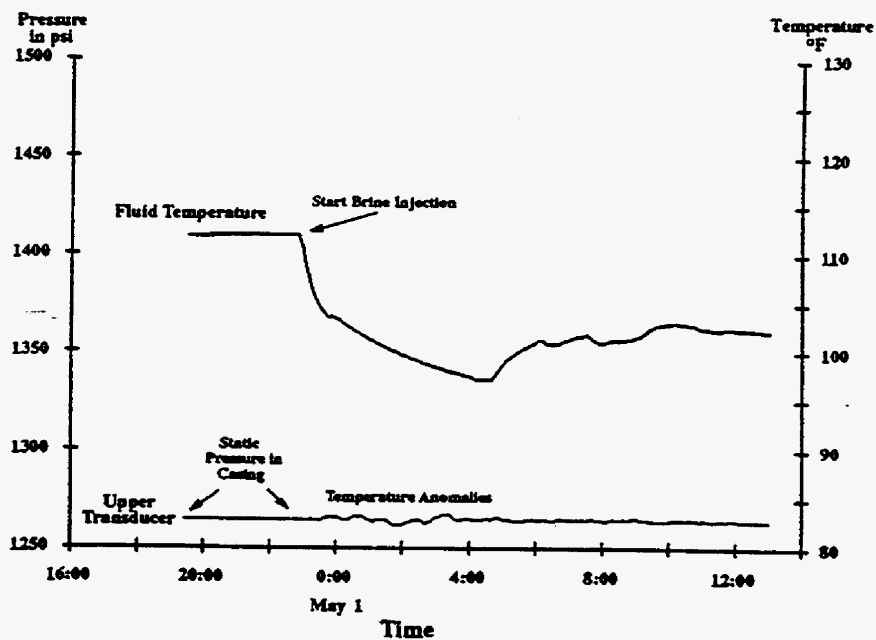


Figure 19: Borehole Closure Injection Test-Fluid Temperature Anomalies

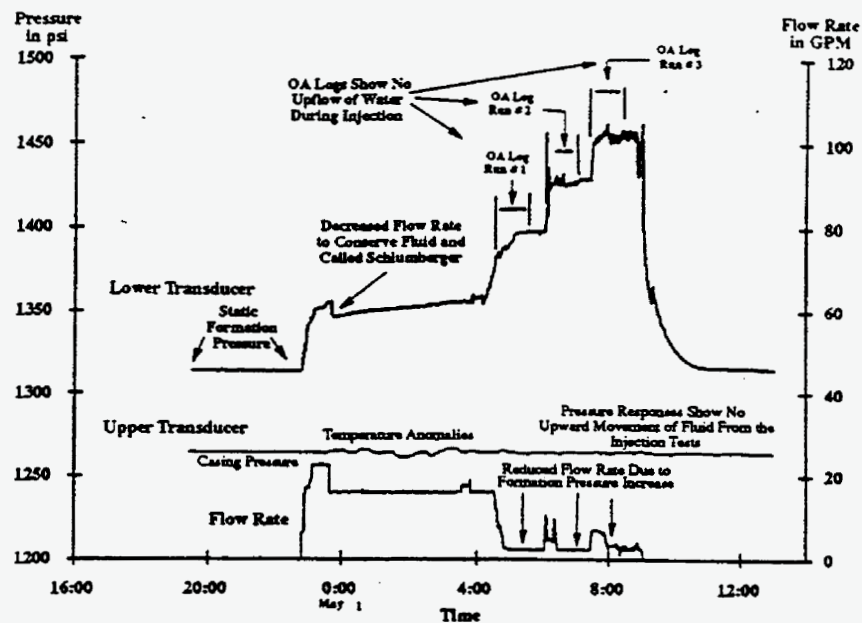


Figure 20: Borehole Closure Injection Test-Upper and Lower Transducer Pressure and Flow Rate

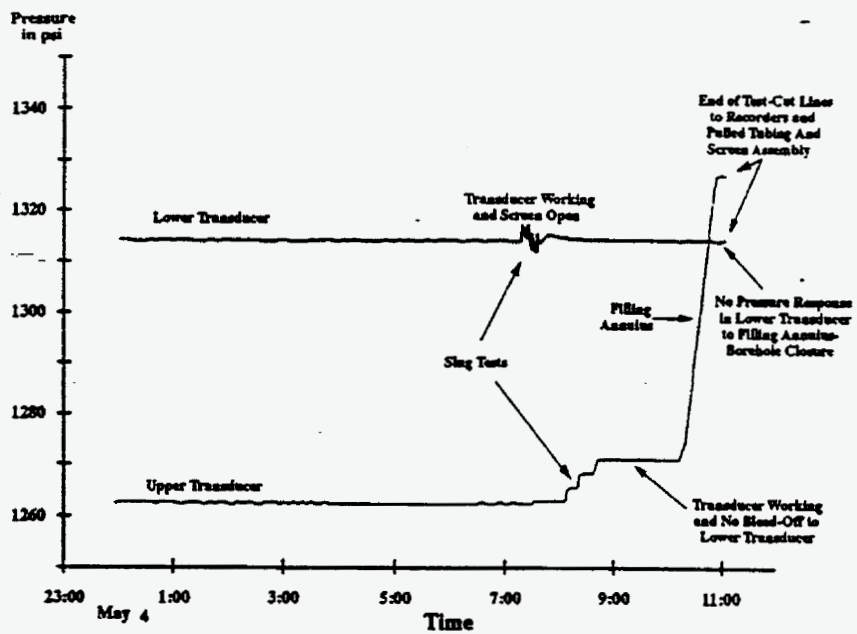


Figure 21: Post-Injection Transducer Testing

Table 1
Du Pont Borehole Closure
Orange Petroleum No. 35 Hager

X-RAY DIFFRACTION (XRD) DATA
(Weight Percent)

Depth:	2737	2900	2925	2940	3110
BULK MINERALOGY (Calculated)*					
Quartz	25	41	30	77	23
Total Feldspar	02	06	04	15	04
Plagioclase	01	03	02	06	02
K-Feldspar	01	03	02	09	02
Calcite	02	08	20	02	14
Dolomite	—	—	01	—	trace
Fe-Dolomite	—	trace	—	trace	—
Siderite	—	—	—	trace	—
Pyrite	04	01	08	—	trace
Total Clay	67	44	37	06	59
	100%	100%	100%	100%	100%
Relative Clay Abundance (Normalized to 100%)					
Kaolinite	05	05	09	08	05
Chlorite	02	02	02	02	03
Illite	05	06	08	04	08
Mixed-Layer Illite/Smectite**	88(80)	87(85)	81(85)	86(85)	84(75)
	100%	100%	100%	100%	100%

* Bulk mineralogy is calculated from sand/silt-size and clay-size XRD data.

** Numbers in () are percent expandable smectite interlayers in mixed layer clays.

ACKNOWLEDGMENTS

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BIOGRAPHICAL SKETCHES

James E. Clark holds a B.S. in geology (1972) from Auburn University and an M.S. in geophysical sciences (1977) from Georgia Institute of Technology. As a geohydrologist with Law Engineering Testing Co., he worked on suitability studies of salt domes as repositories for nuclear waste. He is a consultant with Du Pont's (E. I. du Pont de Nemours & Co., Inc., Engineering Department, P. O. Box 3269, Beaumont, TX 77704) solid waste and geological engineering group and is active in permitting and evaluation of disposal wells.

Philip W. Papadeas received his B.S. degree in geology from the University of New Hampshire (1978). As a field engineer with Schlumberger he was active both offshore and onshore Texas, and later served as petroleum geologist for Omega International, Inc., generating oil and gas exploration prospects. In 1988, he joined Du Pont's geological engineering group in Beaumont, Texas as a consulting geologist responsible for geological and hydrological modeling and evaluation of UIC Class I disposal wells.

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Ronney R. McGowen received his B.S. degree (1989) in geology from Lamar University in Beaumont, Texas. He is currently working toward his M.S. degree in geology at Texas A & M University. He has worked in the drilling industry for 9 years as a driller and rig superintendent in western Oklahoma and the Texas Gulf Coast. He is now working as a contract geologist for the Engineering Service Division of Du Pont, in evaluation of Class I disposal wells.

APPENDIX 4

**Listing of unstudied counties in Texas Gulf Coast
Frio Formation producing trend with fields that
have five or more active TRRC UIC database wells.**

Texas Railroad Commission
Underground Injection Control Database

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County	#	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
ARANSAS	7	13	1	4	0	0	0	18	3
BEE	25	92	14	6	0	0	0	112	33
BROOKS	47	31	13	49	0	0	0	93	45
CALHOUN	57	38	11	5	0	0	0	54	18
FORT BEND	157	164	26	45	0	3	8	246	85
GALVESTON	167	93	14	17	0	0	0	124	45
GOLIAD	175	48	10	14	0	0	0	72	28
HARRIS	201	227	64	90	0	20	29	430	143
HIDALGO	215	85	13	7	0	0	0	105	21
JEFFERSON	245	167	9	13	2	36	6	233	82
JIM WELLS	249	76	19	122	0	0	0	217	113
KENEDY	261	29	6	22	0	0	0	57	13
KLEBERG	273	63	19	115	0	0	0	197	132
MATAGORDA	321	146	5	74	0	31	2	258	116
ORANGE	361	21	6	28	0	0	0	55	4
WHARTON	481	183	75	32	37	0	4	331	88
WILLACY	489	32	13	104	0	0	2	151	28
7 Counties		1508	318	747	39	90	2	2753	997

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : ARANSAS RRC # 7

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
0 Fields (Reservoirs)		0	0	0	0	0	0	0	0

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : BEE RRC # 25

Field (Reservoir)	RRC #	-----Well Type-----							Total	No. Plug
		1	2	3	4	5	6			
YOUGEEN	99446	6	0	0	0	0	0		6	0
PAPALOTE E. (3250)	69044	10	0	1	0	0	0		11	1
PAPALOTE E. (3250 -B-)	69044	11	0	0	0	0	0		11	1
3 Fields (Reservoirs)		27	0	1	0	0	0		28	2

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : BROOKS RRC # 47

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
0 Fields (Reservoirs)		0	0	0	0	0	0	0	0

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : CALHOUN RRC # 57

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
HEYSER	40957	8	1	1	0	0	0	10	3
HEYSER (5400 #2)	40957	6	3	6	0	0	0	15	3
HEYSER (5400 #3)	40957	5	1	3	0	0	0	9	2
3 Fields (Reservoirs)		19	5	10	0	0	0	34	8

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : FORT BEND RRC # 157

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
KATY (I-B)	48278	10	0	2	0	0	0	12	3
THOMPSON	89525	77	7	11	0	0	0	95	30
THOMPSON SOUTH	89530	18	3	0	0	0	0	21	9
BIG CREEK	7808	10	2	1	0	0	0	13	3
BOLING	10229	15	5	1	0	0	4	25	9
NASH DOME	64535	8	0	3	0	0	0	11	4
SUGARLAND	86980	3	3	2	0	0	0	8	3
THOMPSON NORTH	89527	3	2	10	0	0	0	15	0
8 Fields (Reservoirs)		144	22	30	0	0	4	200	61

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : GALVESTON RRC # 167

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
GILLOCK SOUTH	34929	9	8	2	0	0	0	19	9
HITCHCOCK NE. (FRIO 9100)	41677	8	0	0	0	0	0	8	0
HIGH ISLAND	41139	3	5	5	0	0	0	13	3
HASTINGS EAST	39598	34	1	0	0	0	0	35	18
4 Fields (Reservoirs)		54	14	7	0	0	0	75	30

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : GOLIAD RRC # 175

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
LIVE OAK LAKE (5000)	54144	5	0	0	0	0	0	5	0
1 Fields (Reservoirs)		5	0	0	0	0	0	5	0

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : HARRIS RRC # 201

Field (Reservoir)	RRC #	1	2	3	4	5	6	Total	No. Plug
TOMBALL	90620	17	14	0	0	0	0	31	8
PIERCE JUNCTION	71444	22	11	1	0	19	0	53	23
WEBSTER	95731	36	7	48	0	0	0	91	26
DYERSDALE N. (Y-5)	26878	5	0	0	0	0	0	5	0
CLEAR LAKE	18847	10	0	0	0	0	0	10	5
GOOSE CREEK	35862	15	9	9	0	0	0	33	10
HUMBLE	43464	27	8	4	0	0	0	39	16
RANKIN	74691	1	1	7	0	0	0	9	3
KATY (I-B)	48278	10	0	2	0	0	0	12	3
ROTHERWOOD W. (COCKFIELD	-78482	0	2	8	0	0	0	10	0
HULL	43381	42	5	6	0	12	0	65	18
11 Fields (Reservoirs)		185	57	85	0	31	0	358	112

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : HIDALGO RRC # 215

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
0 Fields (Reservoirs)		0	0	0	0	0	0	0	0

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : JEFFERSON RRC # 245

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
STOWELL	86429	13	0	0	0	0	0	13	6
BEAUMONT WEST	6532	11	0	0	0	0	0	11	5
LOVELLS LAKE (MARG. 2)	55184	11	0	4	0	0	0	15	7
CLAM LAKE	18458	6	0	0	0	0	0	6	1
FANNETT	30153	7	1	1	2	6	0	17	8
LA BELLE	50638	9	0	0	0	0	0	9	2
SPINDLETOP	85195	13	2	6	0	0	6	27	13
BIG HILL	7884	12	1	0	0	30	0	43	4
8 Fields (Reservoirs)		82	4	11	2	36	6	141	46

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : JIM WELLS RRC # 249

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
LA GLORIA (LOS OLMOS)	50744	3	2	0	0	0	0	5	0
SEELIGSON (COMBINED ZONES)	82126	2	1	95	0	0	0	98	61
TIJERINA-CANALES-BLUCHER	89945	13	0	3	0	0	0	16	6
T.-C.-B. 21 (B-1) NORTH	89945	3	4	3	0	0	0	10	5
4 Fields (Reservoirs)		21	7	101	0	0	0	129	72

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
- Type 2 -- Disposal Well (Producing Zone)
- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : KENEDY RRC # 261

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
0 Fields (Reservoirs)		0	0	0	0	0	0	0	0

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

Type 1 -- Disposal Well (Non-Producing Zone)
Type 2 -- Disposal Well (Producing Zone)
Type 3 -- Secondary Recovery Injection Well
Type 4 -- Liquid Hydrocarbon Storage Well
Type 5 -- Gas Storage Well
Type 6 -- Other Injection Wells

County : KLEBERG RRC # 273

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
BORREGOS (COMBINED ZONES)	10730	13	4	26	0	0	0	43	31
TIJERINA-CANALES-BLUCHER	89945	13	0	3	0	0	0	16	6
T.-C.-B. 21 (B-1) NORTH	89945	3	4	3	0	0	0	10	5
ALAZAN NORTH (ALL ZONES)	1097	6	2	8	0	0	0	16	6
SEELIGSON (COMBINED ZONES)	82126	2	1	95	0	0	0	98	61
5 Fields (Reservoirs)		37	11	135	0	0	0	183	109

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

Type 1 -- Disposal Well (Non-Producing Zone)
Type 2 -- Disposal Well (Producing Zone)
Type 3 -- Secondary Recovery Injection Well
Type 4 -- Liquid Hydrocarbon Storage Well
Type 5 -- Gas Storage Well
Type 6 -- Other Injection Wells

County : MATAGORDA RRC # 321

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
ANAHUAC	2468	54	15	7	0	0	0	76	41
MARKHAM N.-BAY CITY N (CAR57578	57578	8	0	1	0	0	0	9	4
MARKHAM	57562	16	1	2	0	31	2	52	9
OLD OCEAN (ARMSTRONG)	67011	8	7	2	0	0	0	17	2
OLD OCEAN (LARSEN)	67011	0	0	14	0	0	0	14	3
BLESSING (F-15)	8871	0	1	19	0	0	0	20	10
6 Fields (Reservoirs)		86	24	45	0	31	2	188	69

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
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- Type 3 -- Secondary Recovery Injection Well
- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : ORANGE RRC # 361

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
ORANGE	67484	3	3	1	0	0	0	7	0
PORT NECHES	72441	6	2	1	0	0	0	9	0
PORT NECHES (MARG AREA 1)	72441	0	0	8	0	0	0	8	0
ROSE CITY NORTH	78261	0	0	7	0	0	0	7	0
ROSE CITY SOUTH	78263	0	0	5	0	0	0	5	0
MORGAN BLUFF (HACKBERRY)	62868	1	0	6	0	0	0	7	0
6 Fields (Reservoirs)		10	5	28	0	0	0	43	0

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
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- Type 4 -- Liquid Hydrocarbon Storage Well
- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : WHARTON RRC # 481

Field (Reservoir)	RRC #	-----Well Type-----						Total	No. Plug
		1	2	3	4	5	6		
MAGNET WITHERS	56688	35	44	9	17	0	0	105	15
PICKETT RIDGE	71337	6	3	0	3	0	0	12	3
PIERCE RANCH (4900)	71451	3	1	1	4	0	0	9	0
WITHERS NORTH	98290	7	3	3	8	0	0	21	1
WITHERS NORTH (-C- SAND)	98290	0	3	7	5	0	0	15	2
BOLING	10229	15	5	1	0	0	4	25	9
6 Fields (Reservoirs)		66	59	21	37	0	4	187	30

Texas Railroad Commission
Underground Injection Control Database
For Fields With 5 or More Active Wells of (Type 1 + 2 + 3)

Legend of Well Types

- Type 1 -- Disposal Well (Non-Producing Zone)
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- Type 5 -- Gas Storage Well
- Type 6 -- Other Injection Wells

County : WILLACY RRC # 489

Field (Reservoir)	RRC #	-----Well Type-----							No. Plug
		1	2	3	4	5	6	Total	
WILLAMAR WEST	97498	6	9	97	0	0	2	114	14
WILLAMAR	97491	8	1	2	0	0	0	11	3
2 Fields (Reservoirs)		14	10	99	0	0	2	125	17

