GRUY FEDERAL, INC.

INVESTIGATION AND EVALUATION OF GEOPRESSURED-GEOTHERMAL WELLS

DETAILED REENTRY PROGNOSIS FOR GEOPRESSURE-GEOTHERMAL TESTING OF GLADYS McCALL No. 1 WELL

GRUY FEDERAL, INC.
2500 TANGLEWILDE, SUITE 150
HOUSTON, TEXAS 77063
713/785-9200

JUNE 16, 1978

PREPARED FOR THE
DEPARTMENT OF ENERGY
DIVISION OF GEOTHERMAL ENERGY
UNDER CONTRACT EG-77-C-08-1528

DISCLAIMER

GRUY FEDERAL, INC.

CONSULTANTS IN ENERGY SYSTEMS

2500 TANGLEWILDE, SUITE 150
HOUSTON, TEXAS 77063
713/785-9200

1911 JEFFERSON DAVIS HWY., SUITE 500
ARLINGTON, VIRGINIA 22202
703/920-0113

Mr. Ronald T. Stearns
Engineering and Construction Division
DOE/Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Re: Contract No. EG-77-C-08-1528
Geo^2 Prospect L-2
"Wells of Opportunity" Program

Dear Mr. Stearns:

As a further step in the Gulf Coast geopressured-geothermal "Wells of Opportunity" program, we hereby transmit the third revision of the reentry and testing recommendations for the Geo^2 L-2 well in Cameron Parish, Louisiana.

This well was originally drilled as the Getty Oil Company and Buttes Gas and Oil Company, Gladys McCall No. 1 in the East Crab Lake Area.

This package is complete in that all plats and log sections are included and it will not be necessary to refer to previous submittals.

Attention is called to the estimated date for completion of road, bridge, and site preparation which, barring weather delays, is now estimated to be July 28.

Yours very truly,

R. J. Dobson

Richard J. Dobson
Vice President
Special Programs

RJD:je
Enclosures

TABLE OF CONTENTS

LIST OF FIGURES

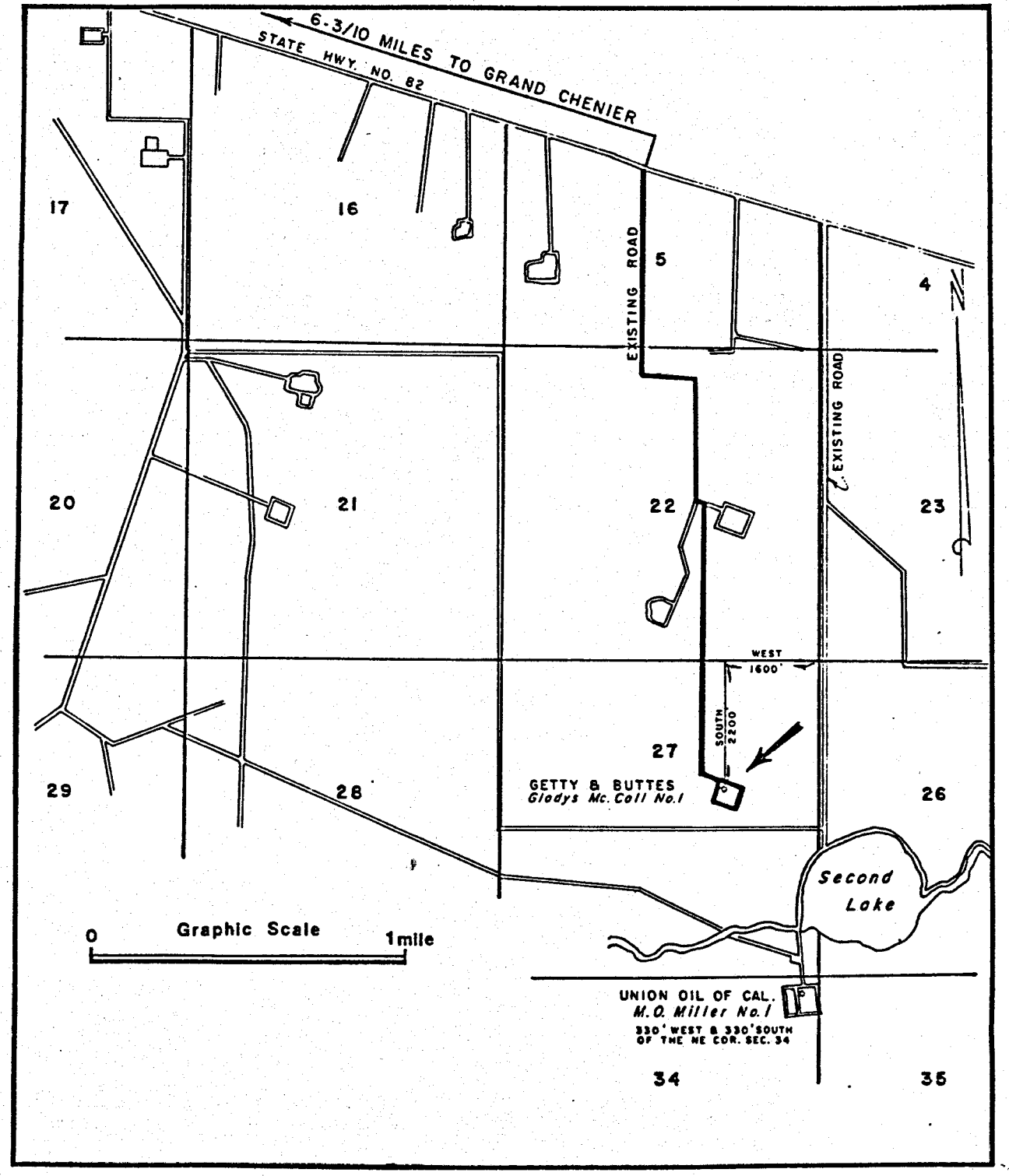
GEOPRESSURED-GEOTHERMAL REENTRY PROSPECT L-2
EAST CRAB LAKE AREA
CAMERON PARISH, LOUISIANA

Introduction

This Gruy Federal Type III-A geopressured-geothermal (Geo^2) prospect was drilled as the Getty Oil Company and Buttes Gas and Oil Company, No. 1 Gladys McCall. It is located in Section 27, Township 15S, Range 5W, Cameron Parish, Louisiana. The well is accessible by way of the original canal levee road, approximately 2-1/2 miles south of Louisiana State Route 82; one bridge must be replaced and a board road must be laid on the levee. (Figure 1). Buttes completed this well in January, 1970, as a shut-in gas well through perforations from 11,924 to 11,928 feet. It was plugged and abandoned in April, 1970, without having produced. The location is shown on the north central area of the USGS topographic sheet "Hog Bayou". A portion of this sheet is included as Figure II, which shows this well location as well as the State Lease 4183 Nos. 1 and 2 wells on the adjacent Rockefeller Wildlife Refuge and Game Preserve.

Geology

Figure III is a generalized structural interpretation which is contoured on the first Geo^2 sand in the lower Miocene section. This indicates a potential drainage area of as much as 4000 acres. Lack of precise control undoubtedly will reduce this due to unrecognized faulting, but it appears that the well is capable of draining from a substantial area. The only evidence for the down-to-the-north fault shown between this well and the major regional down-to-the-coast fault further north is the low structural position of the sand top in the Sun Sturlese No. 1.



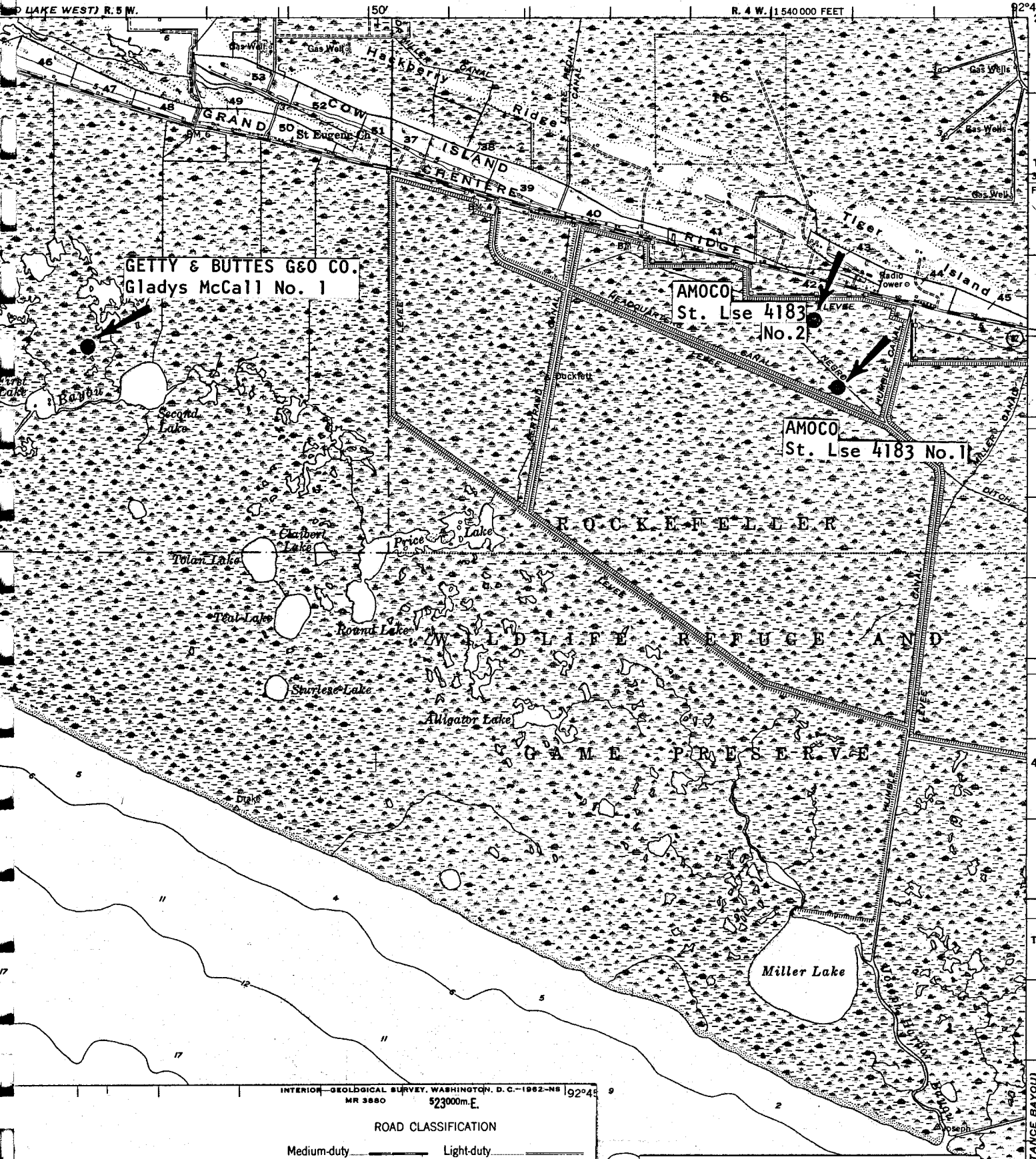
GRUY FEDERAL, INC.
Houston, Texas

Crab Lake Field Area
Cameron Parish, Louisiana

PLAT SHOWING EXISTING ROAD
FROM STATE HWY. NO.82 TO Well Loc.
GETTY & BUTTES - Gladys McCall No.1
IN SEC.27, T.15S., R.5W

FIGURE I

HOG BAYOU QUADRANGLE
LOUISIANA—CAMERON PARISH
15 MINUTE SERIES (TOPOGRAPHIC)



INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1962—NS
MR 3880

ROAD CLASSIFICATION

Medium-duty ——— Light-duty ———

Unimproved dirt - - - - - -

State Route

HOG BAYOU, LA.
N2930—W9245/15

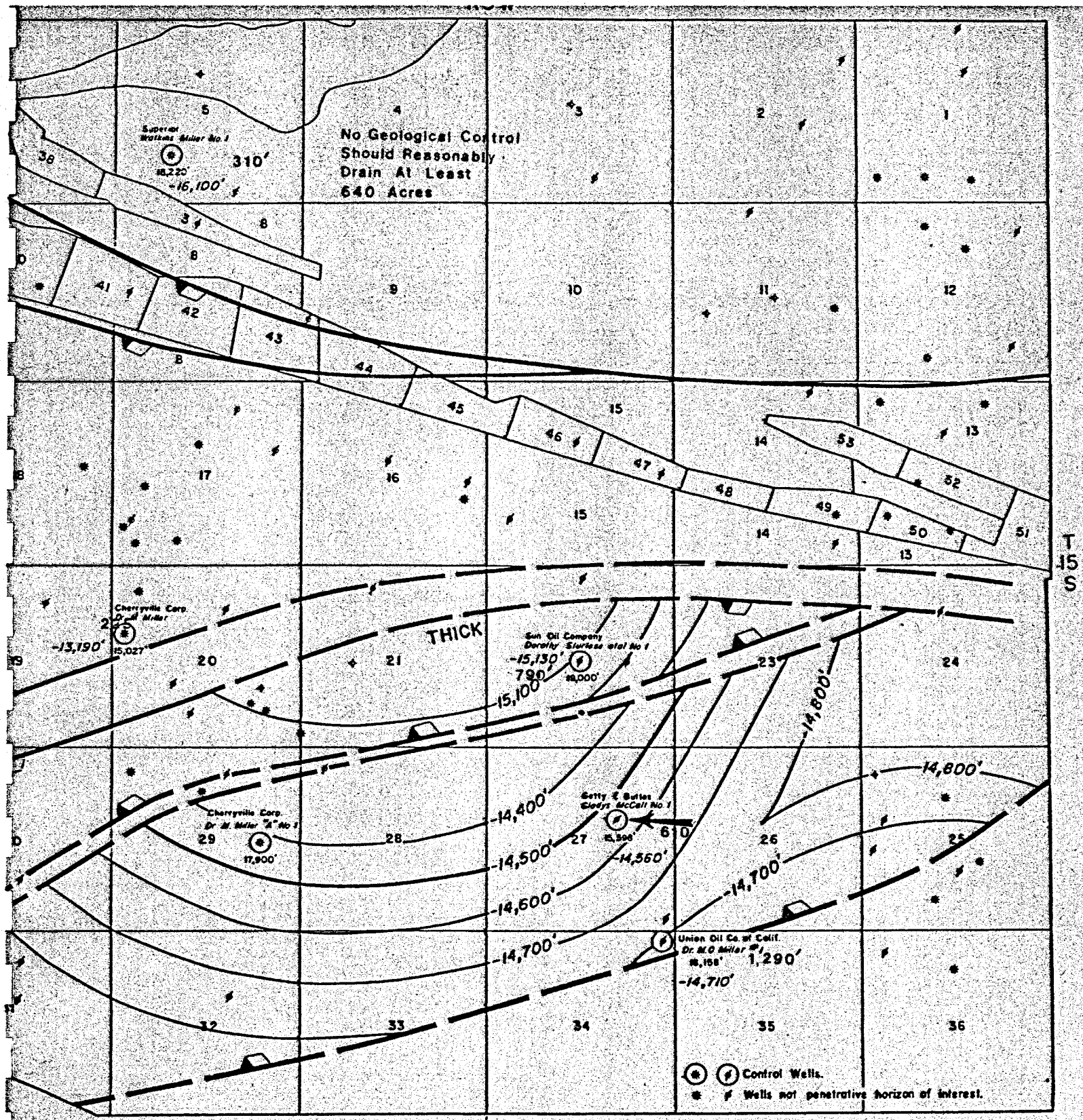
1955

3

GRUY FEDERAL, INC.
Houston, Texas

LOCATION MAP
Hog Bayou
Cameron Parish, Louisiana

FIGURE II



Designates Net Sand
Penetrated at 300° F+

Graphic Scale
0 1 mile

GRUY FEDERAL, INC.
Houston, Texas

Crab Lake Field Area
Cameron Parish, Louisiana

STRUCTURE: TOP OF POROSITY
AT FIRST GEO^2 SAND
IN LOWER MIOCENE SECTION

FIGURE III

The potential Geo^2 aquifers are encountered at depths from 14,560 to 14,780 feet, from 14,930 to 14,970 feet and from 15,145 to 15,598 feet (TD). All of these are Marginulina ascensionensis sands of lower Miocene age. No hydrocarbon saturation is evident on the resistivity log. During drilling operations through these sands the mud weight was 17.0 pounds per gallon. This would indicate that the static aquifer pressure at 15,300 feet is approximately 12,500 psi (assuming 1,000 psi overbalance). The maximum recorded mud temperature was 284 degrees Fahrenheit (140 degrees Centigrade) which would indicate an aquifer temperature of 313 degrees Fahrenheit (156 degrees Centigrade). This is based upon correction factors developed for South Louisiana by the AAPG.

A sonic log run on the well indicates that the massive sand body from 15,145 feet to 15,598 feet (TD) is fairly uniform. Copies of the applicable portions of these logs are contained in the pocket of this report. Calculated porosities range from 14.6 percent to 16.9 percent. The weighted average porosity is 15.8 percent over the net sand thickness of 271 feet. Thirty sidewall cores were taken in the geopressured sands, none of which were taken in the principal zone of interest. Porosities by core analyses compared with those computed from the sonic log show very little correlation; the core analyses porosities in all cases are higher which suggests that the cores experience a porosity increase when they are stress relieved. The low transit times in the surrounding shales tends to substantiate this compaction premise.

Mechanical Condition

Figure IV illustrates the present and proposed mechanical condition of the well. Information on the present condition was obtained from the plugging and abandonment report filed with the Louisiana Department of Conservation and from the completion card published by Petroleum Information Corporation. It will be necessary to run 3,585 feet of 7-inch OD casing with a casing patch tool and tie to the existing 7-inch casing. In terms of tubular requirements, this is the least expensive well proposed by Gruy Federal.

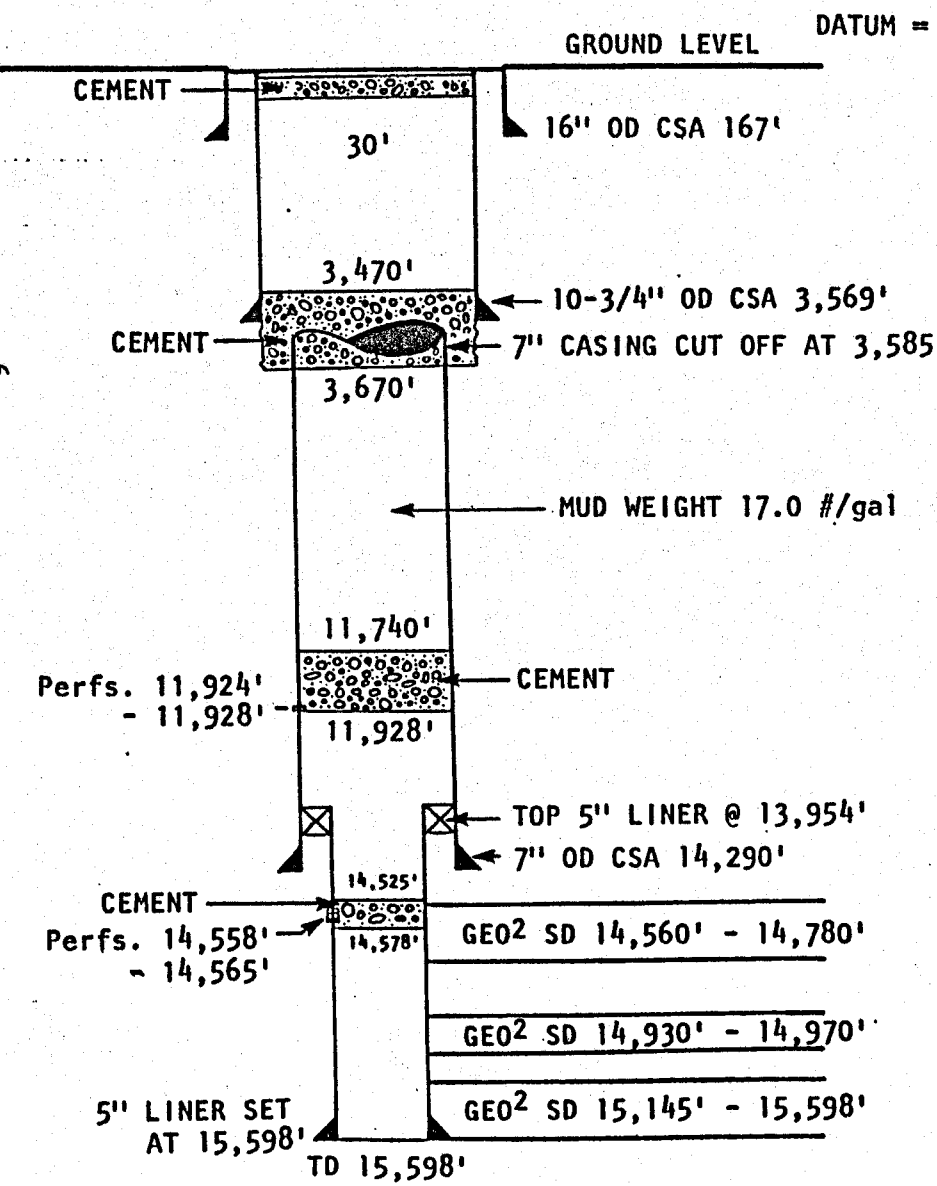
PROSPECT L-3

GETTY & BUTTES GAS & OIL CO.

GLADYS McCALL NO. 1

E. CRAB LAKE FIELD AREA

PRESENT STATUS



GETTY AND BUTTES GAS AND OIL CO.

GLADYS McCALL NO. 1

E. CRAB LAKE AREA

PROPOSED TEST CONFIGURATION

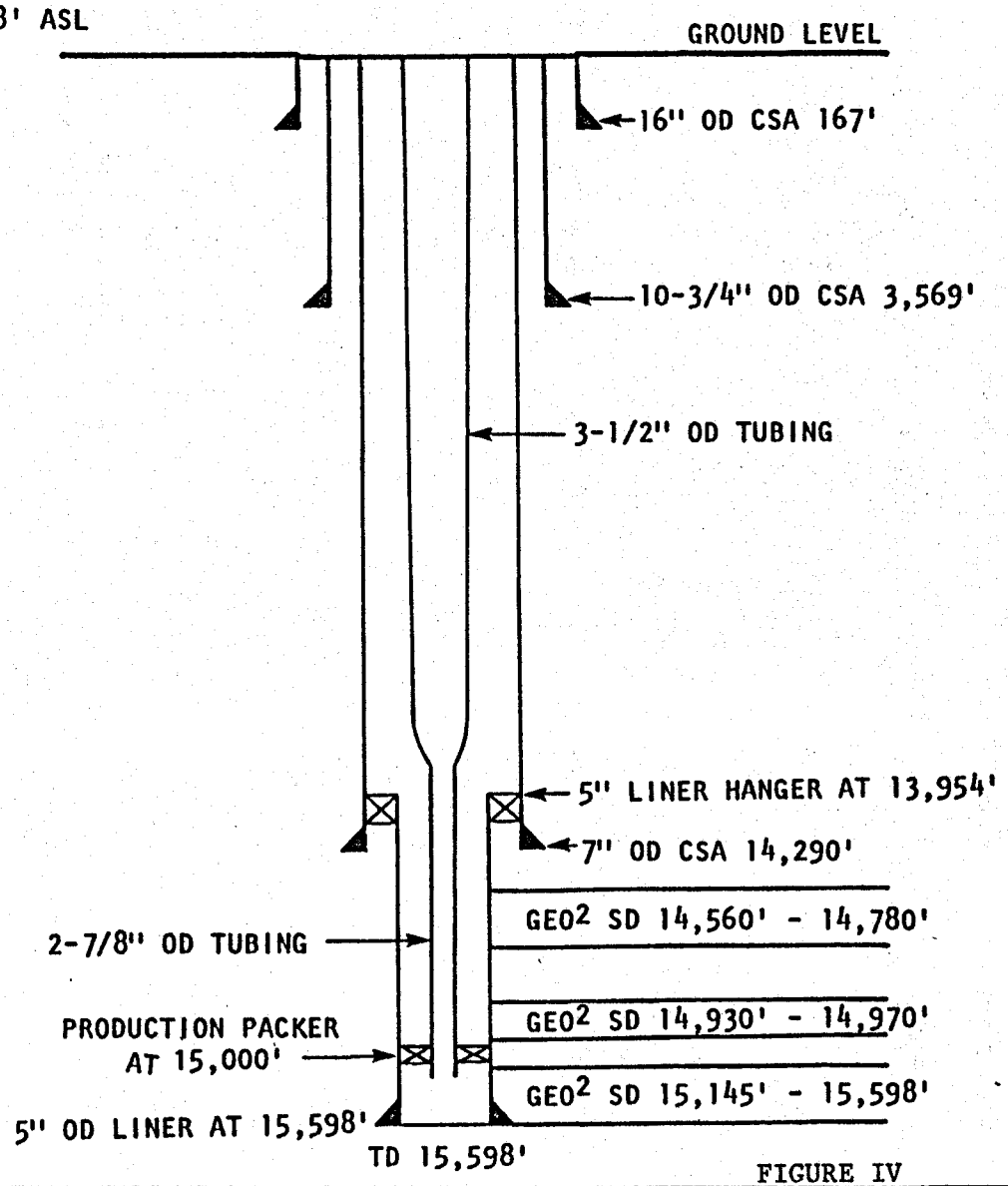


FIGURE IV

Reentry Technique

A detailed reentry and recompletion prognosis is included. In designing equipment and specifying procedures, the primary consideration was the safety of the operation. Procedures have been patterned after the experience of prudent operators who have successfully penetrated and produced from geopressured-geothermal gas reservoirs in the Louisiana Gulf Coast.

The design of the tubular program for each individual well is not optimal in the sense that it satisfies all mechanical constraints at minumum cost. Instead, tubular goods were selected on the basis of accomplishing the goals of a multi-well program at minimum cost.

Similarly, the drilling mud program was designed to track the mud weight and other physical characteristics used during the original drilling of the well. Provisions have been made to salvage as much of the heavy drilling mud as possible and store it between well operations and rig moves for subsequent reuse so that maximum savings on this item can be realized.

For estimating purposes the cost of equipment used during any reentry operation has not been allocated to each well but rather has been debited to the well for which it was first purchased. This method will cause some anomalous cost patterns between wells.

Casing Design - Since only a short tie back string of 7-inch OD casing is required, it was impractical to design a graded casing string. In order to accomodate the tensile load of hanging the casing in tension, P-110, 38 pound per foot, long tread and collar has been specified.

Tubing Design - Tubing has been selected on the basis of anticipated flow capacity, pressure requirements, and with joint connections that will withstand reuse in subsequent wells. To meet these requirements, we have selected the primary string to be 3-1/2" OD, 12.95# per foot, P-105 grade, PH-6

Hydril threaded pipe. No provisions have been made in this well to utilize the 3-1/2" OD tubing in inventory at Intracoastal City since it is contemplated that it will have already been in use in the first scheduled reentry project. It will, however, be used on subsequent wells as it becomes available even though the joint design is not as durable as a PH-6 Hydril connection.

This well has a 5" OD liner in the lower portion of the hole and therefore, requires that the tubing string be reduced to 2-7/8" OD, 8.70# per foot, P-105 within the 5" liner. Provisions have been made to utilize the 2-7/8" tubing which is in inventory at this time at Intracoastal City. No new tubing of this size will be required.

The tubing string will be equipped with a seal assembly on the production tube which extends through the production packer. A sufficient length of the seal assembly (approximately 10 feet) will be run to allow for expansion and contraction of the tubing within the packer element as a result of increased temperature during flowing operations and a decrease temperature during plug and abandonment operations. A landing nipple to receive the pressure bonds during production operations will be provided. A circulating, sliding sleeve valve will be placed in the tubing string immediately above the seal element to permit selective communication between the tubing and casing should this become necessary. This bottom hole tubing assembly is shown in Figure V.

Blowout Preventers - The well prognosis sets out the necessary safeguard specifications and procedures for surface blowout prevention as they have been adopted by IADC, API and prudent operators in Geo^2 areas. A diagrammatic sketch of the BOP hookup and choke manifold which we propose for use is shown in Figure VI.

Logging - Because the sands of interest are already behind the 5-inch OD casing, open hole logs cannot be run. Cased hole logs; namely, gamma ray, cement bond, and collar locator logs are necessary to establish the integrity of the cement bond and as a benchmark for perforating.

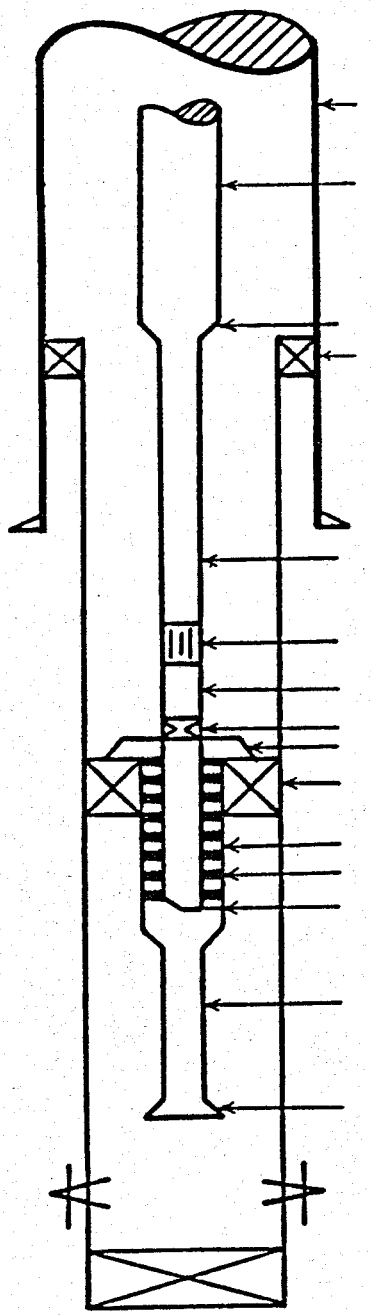
GETTY AND BUTTES GAS AND OIL CO.

GLADYS McCALL NO. 1

E. CRAB LAKE AREA

CAMERON PARISH, LOUISIANA

BOTTOM HOLE TUBING ASSEMBLY



1) 7" CASING

2) 3-1/2" 12.8# P-105 PH-6 TUBING - 2.764" I.D.; 2.639" DRIFT

3) 3-1/2" 12.8# CROSSOVER TO 2-7/8" 7.9# PH-6 TUBING

4) 5" 18# LINER - 4.276" I.D.; 4.151" DRIFT

5) 2-7/8" 7.9# PH-6 TUBING - 3.433" O.D.; 2.265" I.D.

6) 2-7/8" 7.9# "RA" SLEEVE - 2.188" I.D.

7) 2-7/8" 7.9# PH-6 ONE JOINT OF TUBING

8) 2-7/8" 7.9# PH-6 "RN" NIPPLE - 2.010" I.D.

9) PACKER LOCATOR MANDREL WITH 2-7/8" 7.9# PH-6 BOX

10) 5" 18# "WB" PERMANENT DRILLABLE PACKER - 2.55" I.D.

11) PACKER BORE EXTENSIONS - 16' LENGTH; 2.55" I.D.

12) EXTRA SEALING UNITS - 16' LENGTH; 1.80" I.D.

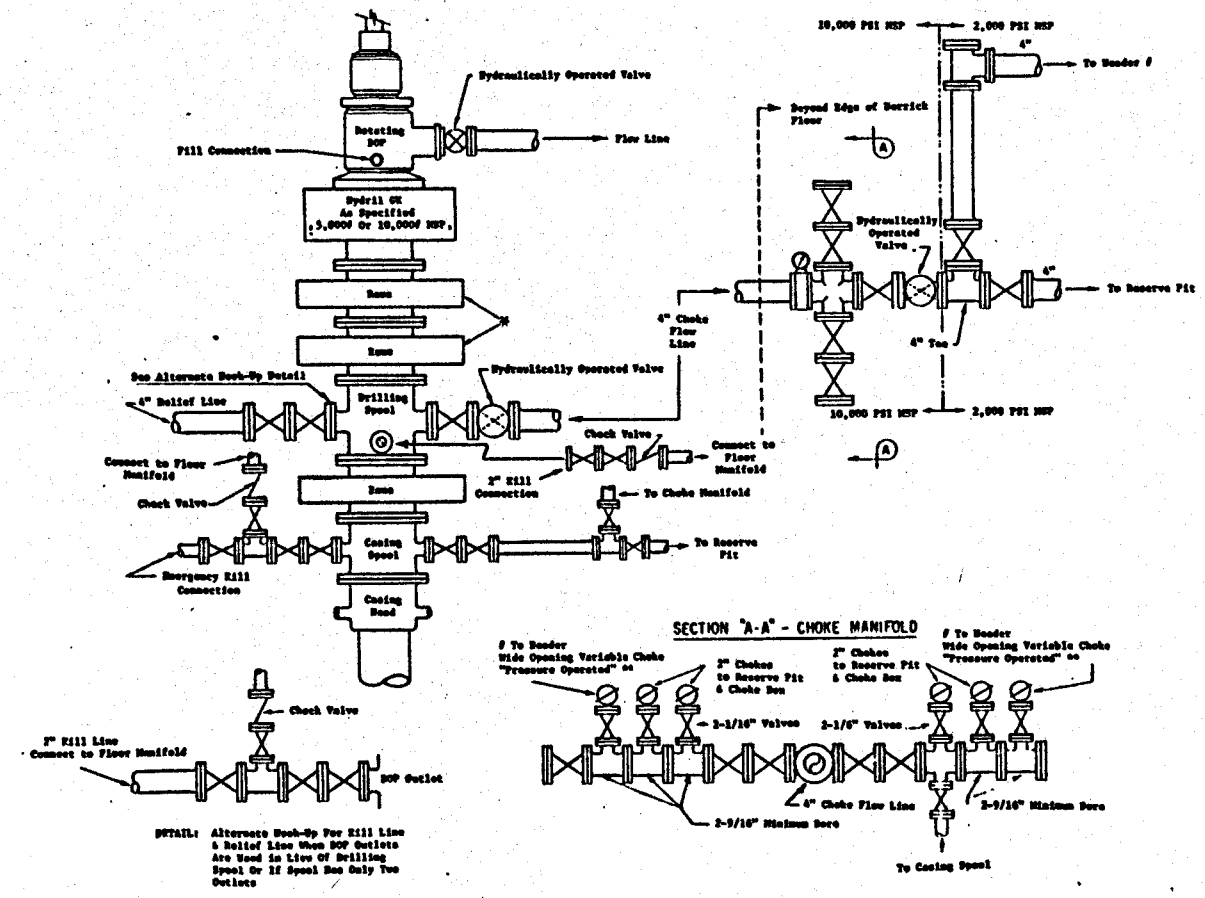
13) MULE SHOE GUIDE

14) 2-3/8" 5.95# "CS" PUP JOINT - 6' LENGTH

15) RE-ENTRY GUIDE

FIGURE V

BLOWOUT PREVENTER DESIGN



Minimum operating equipment for preventers will be as follows: (1) multiple pumps, driven by a continuous source of power, capable of fluid charging the total accumulator volume within twenty minutes; and (2) accumulators with a pre-charge of nitrogen at not less than 750 psi and capable of receiving a fluid charge from the (charging) pumps. Fluid charge volume shall be the amount required to increase accumulator pressure from nitrogen pre-charge pressure to rated pressure. Charging pumps are to be connected to the hydraulic operating system which is to be a closed system. When requested, an additional remote and equivalent source of power shall be available to operate the pumps. The pressurized fluid volume stored in the accumulators shall be sufficient to close all pressure operated devices simultaneously within 20 seconds with charging pumps shut down. Minimum accumulator pressure shall be 1500 psi initially and not less than 1200 psi when all preventors are closed.

The closing manifold and remote closing manifold (floor-mounted) will have a separate control for each pressure operated device. Each control will be labeled to designate which pressure device it controls and to show open and closed positions. A pressure reducer and regulator is to be provided for the Hydril GK. Hydraulic oil shall be used as the operating fluid. One-inch size seamless steel piping shall be used to connect the closing unit to the preventors. Piping is to be tested to maximum rated pump pressure. The choke manifold, the four-inch choke flowline and the four-inch relief line shall be supported by metal stands or reinforced concrete. The choke lines shall be anchored. No sharp bends or curves will be permitted in the choke flowline from the preventers to the pits. Header to have three way outlet: (1) to reserve pit, (2) to choke box, (3) to separator. Easy and safe access will be maintained to the choke manifold. If deemed necessary, walkways and stairways will be provided in and around choke manifold. All valves throughout the assembly shall be selected for operation in the presence of oil, gas and drilling fluids. Valves connected adjacent to the drilling spool and all ram-type preventers will be equipped with stem extensions, universal joints, if needed, and operating wheels which are to extend beyond edge of derrick substructure. Any other valves within the limits of the derrick substructure will be so equipped when requested.

FIGURE VI

Perforating - The perforating will be accomplished with a 1-11/16 inch high-temperature, through tubing jet perforating gun with four shots per foot and zero phasing. When fired, this jet creates a casing entry diameter of approximately 1/4-inch and an effective penetration of approximately two inches beyond the cement sheath. Assuming 100 percent firing efficiency, this configuration should provide a productivity equal to 70 percent of the calculated open hole productivity.

In selecting the portion of the net sand to open to production, the perforated interval length has been designed to achieve a productivity equal to 1/3 of the calculated open hole productivity. In the Gladys McCall No. 1 well, this productivity can be accomplished by perforating approximately 110 feet.

The well will be perforated with $CaCl_2$ water in the hole so that a pressure differential from the formation to the well bore will exist. When the first gun is fired, water from the formation will expand into the well bore and equilize the pressure on both sides of the casing. Perforating in this manner will prevent mud filtrate from entering the formation with a simultaneous build-up of mud cake on the wall of the perforation.

Wellhead Design - A detailed sketch of the wellhead equipment is shown in Figure VII. The christmas tree is rated to a working pressure of 10,000 psi. All valves have T-24 steel vertical runs with packing and seals for high temperature fluids (360 degrees Fahrenheit). The tree consists of two 3-1/16 inch master gate valves and a 3-1/16 inch swab valve. Between the master gate valve and the swab valve is a double wing assembly to house the choke bodies. One wing will contain a positive choke and the other will contain an adjustable choke. Each wing will consist of a Hi-Lo safety valve and a conventional wing valve. This specific design limits the anticipated high pressures to the tree assembly, thus permitting lighter weight pipe for all surface pipes and fittings.

During squeeze cementing to plug and abandon the well, the well head pressure may exceed 10,000 psi. To overcome this problem, it is planned to

GEO^2 CHRISTMAS TREE
TO BE ADAPTED FOR ALL REENTRY WELLS
BY GRUY FEDERAL, INC.

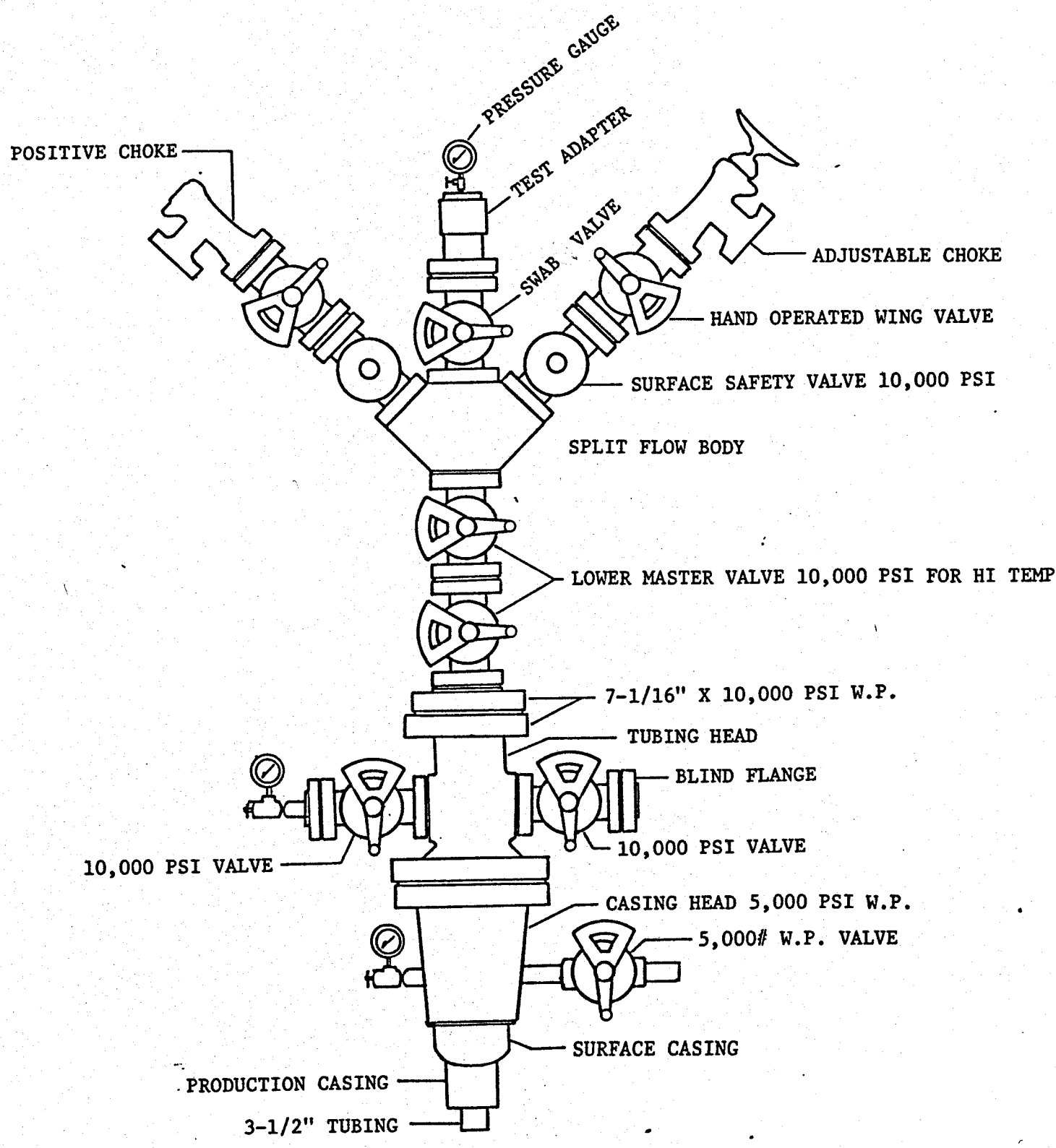


FIGURE VII

utilize a well head isolation tool developed by Halliburton. The tool is attached to the top of the swab valve on the tree and a mandrel is hydraulically positioned through the master gate valves, until it is locked in the production tubing. This device, rated at 20,000 psi working pressure, isolates the well head from the treating fluid pressure.

The casinghead used to set the production string has been designed to accept any casing size of the wells under consideration and be compatible both with the blow out preventers and the upper christmas tree assembly.

General Comments

The No. 1 Gladys McCall well has been proposed as a Geo^2 test prospect for the following reasons:

(1) The well is within, or within an extension of a geothermal fairway identified for the DOE/DGE by the Petroleum Engineering Department of L. S. U.

(2) The presence of thick, hot, porous and apparently permeable lower Miocene section has been established.

(3) It appears that this sand is in communication with a large drainage area.

(4) An agreement with the landowners whose land must be utilized or crossed has been executed.

NVO/1528-6A

WELL PROGNOSIS
FOR
GLADYS McCALL NO. 1
EAST CRAB LAKE FIELD AREA

Work Day
Schedule

1. Prepare location and drill salt water disposal well per its prognosis.

2. Dig out cellar, extend 10-3/4" casing to proper elevation and weld on casinghead.

15th 3. Move in and rig up drilling rig. Install BOP's.

19th 4. Clean out 10-3/4" OD casing with 9-7/8" OD rock bit to the top of the cut-off 7" OD casing. Run 9-7/8" OD rock bit, 6-1/2" OD drill collars, 3-1/2" OD drill pipe. Pull out of hole.

5. Run 9-1/2" OD lead impression block on bottom of 6-1/2" OD drill collars and 3-1/2" OD drill pipe. Pull out of hole.

6. If required from appearance of the lead impression block, run 6" OD long tapered carboloy junk mill to dress out top of cut-off 7" OD casing. Alternatively run a 6" OD rock bit. Run mill or bit on bottom of 4-1/8" OD drill collars and 3-1/2" OD drill pipe. Dress out top of cut-off 7" OD casing and clean out to approximately 75 feet below top of cut. Pull out of hole.

20th 7. Go in hole with two joints 8-5/8" OD 36# Hyd. FJ WP washover pipe, 9-3/4" tooth type carboloy rotary shoe, top bushing, and 4-1/2" API IF hydraulic oil jars on bottom of 6-1/2" OD drill collars and 3-1/2" OD drill pipe. Washover approximately 60 feet of the 7" OD casing. Pull out of hole.

8. Go in hole with hydraulic pressure operated mill dressed to cut 7" OD casing. Run on bottom of 4-1/8" OD drill collars and 3-1/2" OD drill pipe. Locate first casing collar using minimum pressure/slack-off technique, sliding cutter down-hole until cutter knives catch in joint and cutter stops moving down-hole. Bleed pressure, drop 5' to 10 feet below collar and make inside cut. Mill approximately 6" of the 7" OD casing to dress top smooth for external casing patch. Pull out of hole.

21st 9. Go in hole with 7" casing spear, 3 foot extension, 7-1/4" stop sub, bumper jars, and hydraulic oil jars on bottom of 4-1/8" OD drill collars. Retrieve fish.

10. Go in hole with external casing patch on bottom of 3,600 feet of 7" OD 38# P110 LT&C casing and tie casing together.

22nd 11. Nipple up 7" casing and install blowout preventers and test blowout preventers to 7,500 psi. Test casing patch to 7,500 psi. If casing patch leaks, repair same by squeeze cementing.

12. Go in hole with 3-1/2" drill pipe, drill collars and bit to top of cement plug at 11,740 feet.

23rd 13. Condition and increase mud weight to 17.0#/gal. Then drill out cement plug from 11,740 feet to 11,928 feet. Continue in hole to top of 5" liner at 13,954 feet and condition mud.

26th 14. Make trip and add 1,700' of 2-3/8" drill pipe on bottom. Continue in hole conditioning mud inside the 5" OD liner while maintaining 17.0#/gal. mud. Drill out cement from 14,525 feet to 14,578 feet. Then condition hole to top of float collar on 5" OD liner at approximately 15,975 feet.

28th 15. Make trip and test 7" OD casing from top of 5" liner at 13,954 feet to surface with 7,500 psi pressure. If casing leaks develop, locate and squeeze off leak with cement. Repeat until 7" OD casing will test to 7,500 psi.

30th 16. Run casing cement bond log from total depth to 13,950 feet.

17. Block squeeze poor bonding with cement, if necessary, then drill out cement.

32nd 18. Lay down drill pipe and pick up 13,900 feet of 3-1/2" OD 12.70#/foot P-105 PH6 hydril tubing and 600 feet of 2-7/8" OD work string. Condition hole to plug back total depth of approximately 15,575 feet and displace mud from hole with 10.0#/gal. $CaCl_2$ water. Test for leaks in casing string for one hour. If OK pull out of hole and remove the 600 feet of 2-7/8" OD tubing work string.

34th 19. Rig up wireline unit and set production packer at 15,000 feet.

20. Make up bottom hole completion equipment as shown on accompanying diagramatic sketch and go in hole with completion tubing. Test each joint of tubing to 10,000 psi while going in hole. Space out tubing and test packer to 6,500 psi differential from bottom and to 5,000 psi on top.

21. Hang tubing with wrap around hanger and nipple up christmas tree.

35th 22. Release drilling rig and rig down.

38th 23. Move rig out. Move in test equipment.

39th 24. Move in and rig up wireline lubricator on well. Perforate the electric log interval from 15,250 feet to 14,360 feet with 4 shots per foot with through tubing perforating gun. This will require three trips with tubing gun. After initial gun is fired, observe increased surface pressure for leak off of static fluid in casing to make sure there are no leaks in tubing or packing then rig down wireline unit.

GENERAL PROCEDURE FOR BLOWOUT PREVENTION:

1. Use BOP Design as attached. The minimum assembly will consist of 3 preventers. The bottom and middle preventers may be Cameron QRC, Cameron Type F or Shaffer Hydraulic Single, and the upper preventer will be Hydril GK. Double preventers or space savers may be used if approved by the company supervisor. An accumulator with a closing

unit is required. Accumulator reservoir pressure shall be sufficient to close all preventers simultaneously in 20 seconds with the charging pumps closed down. Minimum accumulator pressure shall be 1,500 psi initially and not less than 1200 psi when all preventers are closed.

2. When nippling up production casing, test BOP's and choke manifold to 7500 psi with cold water, or as specified by the company representative. BOP's will be tested at least once each day thereafter when working in open hole and once each week otherwise.

3. Have a full opening safety valve and Grey inside BOP with drill pipe connections on the rig floor.

4. Have extra pipe rams on location at all times while drilling or completing.

5. Locate all choke manifolds, lines and valves at the side of and away from the substructure. Adequately support and tie down the choke assembly.

GRUY FEDERAL, INC.

ESTIMATED REENTRY COST
For
GLADYS McCALL NO. 1
EAST CRAB LAKE AREA

Activity		Estimated Amount	
1.	Lease acquisition and legal fees	$ 75,000	
2.	Rig transportation cost	30,000	
3.	Location preparation	263,600	
4.	Rig time - 22 days at $6,000	132,000	
5.	Bits	2,000	
6.	Mud and chemicals	45,000	
7.	Casinghead	2,000	
8.	Christmas tree incl. surface safety controls	80,500	(1)
9.	Casing patch incl. mills equipment and service	11,500	
10.	Rental tools and equipment	20,000	
11.	3-1/2" drill pipe rental	20,000	
12.	Trucking (other than rig & tubular goods	10,000	
13.	Cement and services	12,000	
14.	Gamma ray and cement bond log	5,600	
15.	Perforating	28,500	
16.	1100' of 2-7/8" P-105 4.7# PH-6 Hydril tubing	2,000	(1) (2) (3)
17.	14,000' of 3-1/2" P-105 12.95# PH-6 Hydril tubing for location	287,000	(1) (2)
18.	Packer and subsurface equipment	3,500	
19.	3600' of 7" tieback casing per prognosis	69,500	
20.	Supervision (Consulting Drilling Engineer)	7,500	
21.	Miscellaneous	20,000	
22.	Contingencies	45,000	
23.	Material handling @1.3% of all except items 1, 20, and 22	13,500	
24.	G & A @ 18% of items 1 & 20	14,850	
	TOTAL	$1,200,550	

(See (1) (2) (3) next page)

GRUY FEDERAL, INC.

ESTIMATED REENTRY COST
For
GLADYS McCALL NO. 1
EAST CRAB LAKE AREA

(Continued)

(1) Requires minor shopping to reuse on other Geo^2 wells.

(2) 90% can be reused on other Geo^2 wells.

(3) All available tubing in stock at Intracoastal City, Louisiana.

SALT WATER DISPOSAL WELL
FOR
NO. 1 GLADYS McCALL

The available electric logs covering the shallow sands from the conductor pipe to a depth of 5,000 feet indicate that the fresh water sands extend to a depth of approximately 900 feet and that sands capable of accepting high flow rate salt water occur above 4500 feet. Detailed electric logs on the specific well will isolate the exact sand to be perforated.

The basic design of the casing program conforms with the requirements of the Department of Conservation. No tubing is recommended for the well because it acts to increase the surface injection pressure and would only be utilized if backflushing is required. The need for backflushing appears to be remote for the following reasons: (1) a volume of less than 200,000 barrels will be injected, (2) filters are provided downstream from the pumps to reduce solid and scale build-up, (3) the closed system prevents bacterial growth, and (4) two injection pumps (one of which is a standby) capable of delivering 10,000 barrels per day at an injection pressure of 500 psi.

In the event that formation plugging prevents disposal of the water, coiled tubing can be lubricated into the well and the sand backwashed using nitrogen.

Operational Day

0	1.	Drive 13-3/8' OD casing to refusal or ± 125 feet.
1st	2.	Move in and rig up water well rig.
3rd	3.	Drill 12-1/4" hole to 1,200 feet.

4th	4.	Run 1,200 feet of 9-5/8", 36.0#, H-40 casing with guide shoe on bottom and a float collar one joint above bottom. Use one centralizer per 100 feet of casing for bottom 500 feet and cement casing to surface.
6th	5.	Drill 8-3/4" hole below surface casing to 4,500 feet.
8th	6.	Run induction electric and density logs; take sidewall cores if desired.
9th	7.	Run 5-1/2" OD, 15.5#, J-55 casing with guide shoe on bottom and float collar two joints above bottom. Run centralizers on every other joint of casing for bottom 500 feet. Cement casing with sufficient cement to get returns at the surface.
10th	8.	Make trip with 2-7/8" work string and condition hole to float collar at approximately 4420 feet and displace mud in hole with water. Lay down work string.
11th	9.	Nipple up 5-1/2" casing and install christmas tree.
	10.	Test casing and tree to 2,000 psi surface pressure with water in hole.
12th	11.	Run gamma ray - cement bond log from total depth to 1,200 feet and block squeeze with cement, if necessary to obtain good bond.
13th	12.	Rig down and move out water well rig.
39th	13.	Perforate approximately 50 feet of the lowest clean sand determined from electrical logs with four shots per foot using a casing bullet gun and rig down wireline unit.

40th 14. Test injectivity of well with rig pumps or pump truck to achieve 10,000 barrels per day injection rate at 150 psi or less. If injection rate is not sufficient, select and perforate additional sand interval or consider treatment with mud cleanout acid, or both, if deemed necessary.

Estimated Cost

Move in rig, drill to 4,500 feet 13 days at $4,200/day	$ 54,600
Location preparation	5,000
130 feet of 13-3/8" 65# J-55 plain end casing	4,000
1,200 feet of 9-5/8" 36# H-40 casing ST & C or LT & C	14,000
4,500 feet of 5-1/2" 15.5# J-55 ST & C	24,000
Stand by rig time	4,200
Cement and Services	14,000
Electric logging	12,000
Perforating	8,000
Wellhead equipment	3,000
Stimulation	2,500
Supervision	3,900
Miscellaneous supplies and rentals	7,500
Trucking	3,000
Contingencies	14,000
Material handling at 1.3% on all items other than Supervision and Contingencies	2,000
	$175,700.00

WELL TEST PROCEDURE

The well test procedure was established to provide the maximum amount of reservoir rock and fluid information that can be obtained within the fixed time frame subject to the limitations of the available equipment. The only bottomhole pressure device capable of operating at these temperatures and pressures is a 15,000 psi (full scale deflection) Amerada RPG-3 bourdon tube pressure gauge. This gauge has no surface read-out capability and has 3, 5, and 7 day clocks. The maximum accuracy of the bomb is $\pm$ 0.25 percent (37.5 psi) under controlled calibration conditions. These limitations impact the scope of meaningful transient tests which can be conducted.

Before testing commences it will be necessary to flow the well into a reserve pit in order to clean the perforations of mud and foreign solids. After this has been accomplished the well will be shut-in to measure the static reservoir pressure. The well will be placed on production at a low rate through the test equipment in order to establish the drawdown characteristics at a safe level. Every 24 hours the rate will be increased until the choke size which allows flow at 10,000 barrels per day is determined. The well will be shut-in and the pressure build-up recorded. These data will be analyzed to determine the flow capacity of the formation and the skin effect or formation damage.

During each flow period, full flow stream samples will be taken and analyzed for chemical composition. Separator gas-water ratios will be carefully metered to detect changes as a function of the flow rate.

After the well bore pressure has returned to static conditions, the well will be flowed at a rate of 10,000 barrels per day for approximately two weeks. The pressure data from this flow can be used to verify the reservoir parameters computed from the build-up analysis.

At selected intervals throughout the flow periods, separator gas and liquid samples will be taken in order for laboratory recombination studies to be conducted.

NVO/1528-6A

TEST PROGNOSIS
FOR
GLADYS McCALL NO. 1
EAST CRAB LAKE AREA

Operational Day		
39th	1.	Move in and nipple up test equipment. Hydraulically test all systems with water to 400 psi.
42nd	2.	Run two Amerada RPG-3 pressure gauges with 24 hour clocks and 15,000 psi full-scale deflection to 16,060 feet, stopping for fifteen minutes each 3,000 feet. Hang bombs for two hours and record surface pressure with deadweight tester. Retrieve pressure bombs.
	3.	Hook up two-pen pressure recorder to tubing upstream from the choke and to the casing to observe for tubing or packer leaks.
	4.	Place well on production through adjustable choke at low setting and record surface flowing pressure every thirty minutes by deadweight tester.
	5.	Record gas and liquid flow rates by calibrating the liquid turbine meter with the test tank.

43rd 6. Gradually increase the flow rate in increments until either the maximum flow rate from the well or 10,000 barrels per day is achieved. Continue to flow at this rate for 24 hours while recording surface temperature, pressure, and gas and liquid production. If maximum flow rate of well not sufficient, do one of the following:

(1) acidize
(2) perforate more interval

44th 7. Shut well in and measure surface pressure build-up with deadweight tester.

45th 8. When wellbore pressure has stabilized, run two Amerada RPG-3 pressure bombs with five day clocks and latch into landing nipple at bottom of tubing.

46th 9. Place well on production at 1,000 barrels per day for 24 hours, monitor surface pressure, temperature and flow rates and take the following samples:

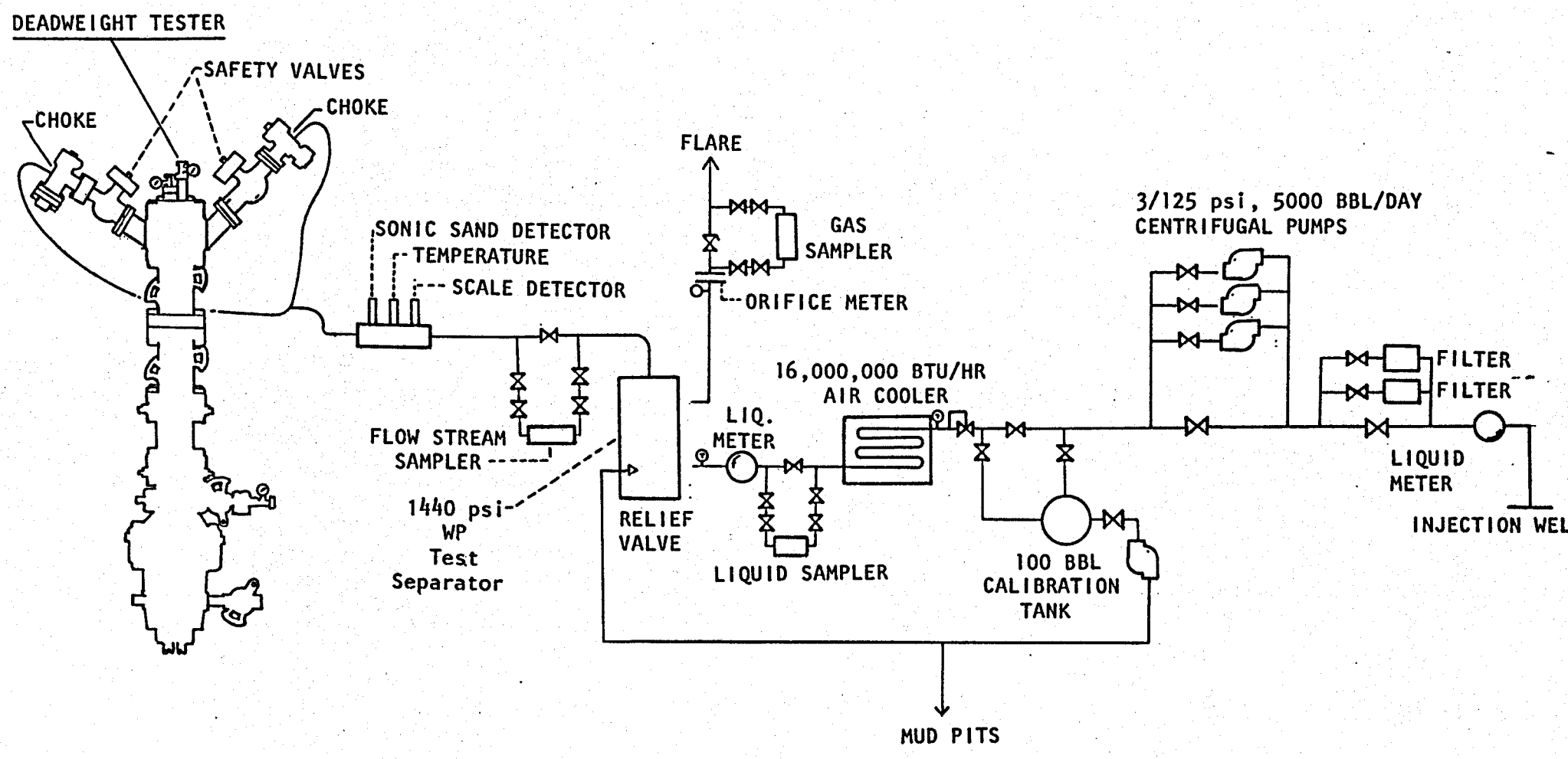
(a) Two, one liter, full well stream samples for chemical analysis.

(b) Three, one liter, separator liquid samples.

(c) Two, one liter, separator gas samples.

47th 10. Increase flow rate to 4,000 barrels per day for 24 hours and sample as before.

48th	11.	Increase flow rate to 7,000 barrels per day for 24 hours and sample as before.
49th	12.	Increase flow rate to 10,000 barrels per day for 24 hours and sample as before.
50th	13.	Shut well in, measure build-up for 24 hours, then retrieve pressure bombs.
51st	14.	Place well on production at low rate and gradually increase rate over a 12-hour period until it reaches 10,000 barrels per day.
	15.	Flow well at this rate for nine days while measuring surface pressure, temperature and flow rates.
	16.	Sample as before prior to shutting well in.
62nd	17.	Shut well in and run two pressure gauges to 16,060 feet and record until deadweight tester at surface indicates static conditions have been reached.
63rd	18.	Pull pressure gauges, release test equipment and move same out.
	19.	Proceed with plug and abandonment operations.



SURFACE TESTING FACILITIES
Gruy Federal, Inc.
FIGURE VIII

GRUY FEDERAL, INC.

ESTIMATED TESTING COST

For

NO. 1 GLADYS McCALL
EAST CRAB LAKE AREA

Activity		Estimated Amount	
1.	Two data headers	$ 108	
2.	Two-phase separator	3,780	
3.	100-barrel tank	1,090	
4.	Two 10,000 BPD centrifugal pumps	1,940	
5.	23,400,000 BTU/hr air cooler	3,459	
6.	Piping	740	
7.	Sonic sand detector	300	
8.	Wireline unit w/pressure gauge	1,440	
9.	Gate valve w/activator	500	
10.	House trailer w/power plant	850	
11.	Generator	20,000	
12.	Expansion loops	900	
13.	Supervision and Labor	46,200	
14.	Material handling	457	(1)
15.	Test Accessories	200	
	TOTAL	$ 81,964	

(1) Charged at a rate of 1.3% on all items except 14.

GETTY-BUTTES GLADYS McCALL NO. 1

CAMERON PARISH, LOUISIANA

Analyses Required for Geo^2 Water and Gas

Chemical Analysis of Water

A. Metals
   1. Copper
   2. Zinc
   3. Boron
   4. Arsenic
   5. Chromium
   6. Mercury
   7. Lead
   8. Cadmium

B. Solids
   1. Dissolved
   2. Total

C. Hardness
   1. Calcium Carbonate
   2. Magnesium Carbonate

D. Others
   1. Carbonate
   2. Bicarbonate
   3. Chloride
   4. Iron
   5. Sulfate
   6. Dissolved Silicate

GETTY-BUTTES GLADYS McCALL NO. 1

CAMERON PARISH, LOUISIANA

Chemical Analysis of Vapor

A. Hydrocarbons (percent)
   1. Methane
   2. Ethane
   3. Iso-propane
   4. Normal Propane
   5. Iso Butane
   6. Normal Butane
   7. Pentane
   8. C_6+

B. Other
   1. Hydrogen Sulfide
   2. Carbon Dioxide
   3. Radon

Chemical Properties of Water

1. Density
2. Compressibility
3. Conductivity
4. Viscosity
5. pH

Recombination PVT Analysis

1. Solution gas-water ratio
2. Formation volume factor for water
3. Supercompressibility factor of gas

GRUY FEDERAL, INC.

GETTY-BUTTES GLADYS McCALL NO. 1
CAMERON PARISH, LOUISIANA

Analytical Costs for Geo^2 Water and Gas

Recombination	
2 samples per well	$ 10,000
Chemical Analysis of water	
5 samples per well	750
Material handling @1.3%	140
TOTAL	$ 10,890

PLUGGING AND ABANDONMENT PROCEDURE
FOR
GETTY-BUTTES GLADYS McCALL No. 1

1. Move in and rig up pulling unit capable of plugging and abandonment.

2. Nipple up pump trucks to wellhead.

3. Squeeze cement perforations.

4. If squeeze pressure is not obtained overdisplace cement into formation with water and repeat squeeze cementing until successful.

5. When squeeze pressure is obtained, unbolt christmas tree from tubing hanger, pick up tubing out of packer and reverse excess cement.

6. Remove tree and install BOP's.

7. Run in hole with tubing and set cement plug 100' in and 100' out of 5" OD liner.

8. Pull tubing and set a plug from 50' to surface.

9. Cut off 13-3/8" casing 3' below ground level and weld on plate.

10. Release rig.

11. Send tubing and casing to pipe yard for inspection and repair.

12. Send christmas tree to shop for overhaul.

ESTIMATED PLUGGING COSTS

For

GETTY-BUTTES NO. 1 GLADYS McCALL
EAST CRAB LAKE AREA

	Activity	Amount
1.	Pulling unit at $1,000/day	$ 8,000
2.	Rental tools at $500/day	4,000
3.	Trucking	3,000
4.	Cement and services	4,000
5.	Supervision	2,000
6.	Contingencies	2,400
7.	Material handling on all but supervision and contingencies @1.3%	300
8.	G & A at 18% of item 5	400
	TOTAL	$ 24,100

SITE-SPECIFIC ENVIRONMENTAL INFORMATION CHECKLIST
GEOPRESSURED-GEOTHERMAL WELL TEST PROGRAM
GRUY FEDERAL, INC.
NO. L-3

(Drilled as Getty-Buttes-Gladys McCall No. 1)
Cameron Parish, Louisiana

A. GENERAL

1. Is the proposed site located in the area covered by the "Gulf Coast Programmatic Environmental Assessment, Geothermal Well Testing, the Frio Formation of Texas and Louisiana October 1977"?

   Yes X No_____ If no explain.

2. Has a federal, state and/or local environmental assessment been conducted previously for the proposed test well or other wells in the area?

   Yes_____ No X If yes, provide a copy, if available.

3. Have all required permits, licenses, and/or agreements for proposed project been obtained?

   Yes X No_____ If no, explain.

4. Does the project site fall within the habitat of rare or endangered species?

   Yes_____ No X If yes, explain.

5. Are known archeological sites, historic sites, or natural landmarks within or visible from the site area?

   Yes_____ No X If yes, explain.

6. Will expected continuous noise levels from site operations be 65 dBA or less at the nearest residence?

   Yes X No_____ If no, explain.

B. SITE CONSTRUCTION

1. Will additional land clearing be required for the test well (e.g., drill pad, road construction, mud reserve pits, pipeline)?

   Yes_____ No X If yes, describe.

2. Will additional land clearing be required for the disposal well (e.g., drill pad, reserve pits, utilities, road construction, pipeline)?

   Yes _____ No X If yes, describe.

GRUY FEDERAL, INC.

3. Will the site and related roads be treated to minimize dust?

   Yes_____ No X If no, explain.

   Road and work site to be boarded.

4. Are portable sanitary facilities or an approved septic system to be used at the site?

   Yes X No_____ If no, explain.

5. Will liquid and solid wastes be disposed in accordance with local regulations?

   Yes X No_____ If no, explain.

6. Will erosion control be required for excavated areas?

   Yes_____ No X If yes, explain.

7. Will dredge spoil be deposited in swamp forest or marshland?

   Yes_____ No X If yes, explain.

8. Upon completion of proposed test program, will the site be restored to as natural a condition as possible by regrading, filling, and reseeding?

   Yes X No_____ If no, explain.

GRUY FEDERAL, INC.

C. WELL TESTING AND SAFETY

1. Is fluid production from the well during testing expected to be 2 weeks or less in duration per formation?

Yes_____ No X If no, explain.

Test expected to require 4 weeks.

2. Is the total dissolved solids of the produced geopressure fluid expected to be 90,000 mg/l or less?

Yes X No_____ If no explain.

3. Is the volume of geopressure fluid to be produced and injected expected to be 3,000,000 barrels or less?

Yes X No_____ If no, explain

4. Is the temperature of produced geopressured fluid expected to be 260°C or less?

Yes X No_____ If no, explain.

5. Will the gas content of the produced fluid be flared?

Yes X No_____ If no, explain.

6. Will blowout preventers rated to at least 10,000 PSI be used?

Yes X No_____ If no, explain.

GRUY FEDERAL, INC.

7. Will production tubing rated to at least 20,000 PSI, be used?

Yes_____ No X If no, explain.

Burst pressure rating for 3-1/2" P-105 tubing is 18,000 psi.

8. Can safety valves be operated from remote locations?

Yes X No_____ If no, explain.

9. Will the test tree be rated to at least 10,000 PSI?

Yes X No_____ If no, explain.

10. Will a test well directional survey be conducted?

Yes_____ No X If yes, at what interval? _____Feet.
If no, explain.

Well already drilled and cased.

11. Will a lined pond be used to hold all liquid effluents and production fluids that are not injected?

Yes X No_____ If no, explain.

12. Has an injection permit been obtained?

Yes_____ No X If no, explain.

Application made as of June 16, 1978, and approval expected soon.

13. Will H_2S monitors be located onsite?

Yes_____ No_X_ If no, explain.

14. Will fire extinguishers be located onsite?

Yes_X_ No_____ If no, explain.

15. Do contingency plans exist for evacuating personnel should a blowout occur or high levels or H_2S be detected?

Yes_X_ No_____ If no, explain.

16. Will high-pressure engineering and mud logging personnel be onsite during production well drilling operations?

Yes_____ No_X_ If no, explain.

No mud logging personnel, because well is already cased, however, high pressure engineering or drilling personnel will be on site at all times.

SCHLUMBERGER SONIC LOG - GAMMA RAY

COUNTY CAMERON
FIELD or LOCATION EAST CRAB LAKE
WELL GLADYS MCCALL NO. 1
COMPANY GETTY OIL CO. & BUTTES OIL & GAS COMPANY

COMPANY GETTY OIL COMPANY AND BUTTES OIL & GAS COMPANY
WELL GLADYS MCCALL NO. 1
FIELD EAST CRAB LAKE
COUNTY CAMERON STATE LOUISIANA
LOCATION F NE/C SEC 27, GO S 2200' & W 1600' TO LOC
Sec. 27 Twp. 15S Rge. 5W
Other Services: I-ES, O-FT, ST

Permanent Datum: BHF, Elev.
Log Measured From KB 21.05 Ft. Above Perm. Datum
Drilling Measured From SAME
Elev.: K.B. D.F. G.L.

Date	12-19-69			
Run No.	THREE*			
Depth—Driller	15598			
Depth—Logger	15587			
Btm. Log Interval	15584			
Top Log Interval	14290			
Casing—Driller	14288	@	@	@
Casing—Logger	14290			
Bit Size	6"			
Type Fluid in Hole	SPERSENE XP-20-3%OIL			
Dens. / Visc.	17.0 / 50			
pH / Fluid Loss	10.0 / 3.2 ml	ml	ml	ml
Source of Sample	CIRCULATED			
R_m @ Meas. Temp.	1.14 @ 67 °F	@ °F	@ °F	@ °F
R_{mf} @ Meas. Temp.	0.45 @ 67 °F	@ °F	@ °F	@ °F
R_{mc} @ Meas. Temp.	3.60 @ 67 °F	@ °F	@ °F	@ °F
Source: R_{mf} / R_{mc}	M / C			
R_m @ BHT	0.24 @ 284 °F	@ °F	@ °F	@ °F
Time Since Circ.	9 HRS.			
Max. Rec. Temp.	284 °F	°F	°F	°F
Equip. / Location	4532 / LCT			
Recorded By	OWENS			
Witnessed By	MESSRS: COMEAUX-MILLIGAN			

FOLD HERE AD/MP The well name, location and borehole reference data were furnished by the customer.

REMARKS S.O. #25900

Changes in Mud Type or Additional Samples: Date, Sample No., Depth—Driller, Type Fluid in Hole, Dens., Visc., ph, Fluid Loss, Source of Sample, R_m @ Meas. Temp. @ °F, R_{mf} @ Meas. Temp. @ °F, R_{mc} @ Meas. Temp. @ °F, Source: R_{mf} R_{mc}, R_m @ BHT @ °F, R_{mf} @ BHT @ °F, R_{mc} @ BHT @ °F

Scale Changes: Type Log, Depth, Scale Up Hole, Scale Down Hole

Equipment Data: Run No., Tool Type, Pad Type, Tool Pos., Other

C.D.: NO S.O.: 0
*RUNS 1 & 2 WERE RUN BY GETTY OIL CO.. WELL TAKEN OVER FROM THEM.

Equip. Used: CART. No. 118 SGHA-151
PANEL No. 300
SONDE No. 188
VCD-644

CALIBRATION:	BACKGND. CPS.	SOURCE CPS.	GALV. INCR. DIVISIONS	SENS. TAP (FOR CAL.)	SENS. TAP (RECORD)	TIME CONST.	RECORDING SPEED (FT./MIN.)
GAMMA RAY:	30	390	8.25	500	300	2	30

Velocity (feet per second) = 1,000,000 / Interval Transit Time (microseconds per foot)

INTERVAL TRANSIT TIME
MICROSECONDS PER FOOT

T 3 R1 2 R2

150 100

DEPTHS

GAMMA RAY
API UNITS

0 120

SCHLUMBERGER INDUCTION-ELECTRICAL LOG

COUNTY CAMERON
FIELD or LOCATION EAST CRAB LAKE
WELL GLADYS MCCALL NO. 1
COMPANY GETTY OIL CO. & BUTTES OIL & GAS COMPANY

COMPANY GETTY OIL COMPANY AND BUTTES OIL & GAS COMPANY

GRAY FEDERAL, INC. HOUSTON, TEXAS

WELL GLADYS MCCALL NO. 1

FIELD EAST CRAB LAKE

COUNTY CAMERON STATE LOUISIANA

LOCATION F NE/C SEC 27, GO S 2200' & W 1600' TO LOCATION

Sec. 27 Twp. 15S Rge. 5W

Other Services: SLC, ST 0-FT

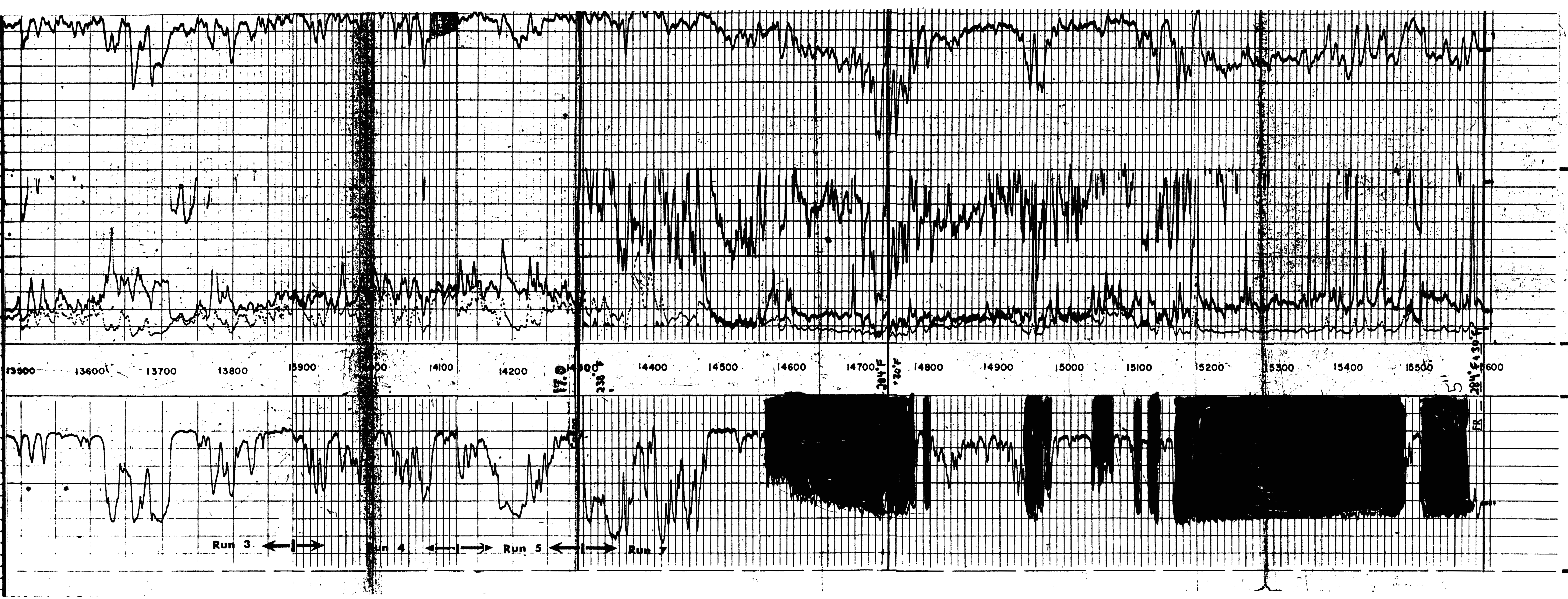
Permanent Datum: BHF, Elev. ______ Elev.: K.B. ______
Log Measured From KB, 21.05 Ft. Above Perm. Datum D.F. ______
Drilling Measured From SAME G.L. ______

Date	10-30-69	11-5-69	11-18-69	11-21-69
Run No.	ONE	TWO	THREE	FOUR
Depth—Driller	11944	13048	14000	14196
Depth—Logger	11955	13047	13946	14184
Btm. Log Interval	11954	13046	13945	14183
Top Log Interval	3574	11954	13045	13945
Casing—Driller	3569	3569	3569	3569
Casing—Logger	3574	3574	3574	3574
Bit Size	9 7/8"	9 7/8"	9 5/8"	9 7/8"
Type Fluid in Hole	GEL-CAUSTIC LIGNITE	MONO-THIN	MONO-THIN	MONO-THIN
Dens. | Visc.	10.4 | 42	11.1 | 51	11.5 | 58	12.5 | 52
pH | Fluid Loss	9.5 | 6.9 ml	8.3 | 5.3 ml	8.5 | 4.7 ml	8.2 | 4.7 ml
Source of Sample	PIT	PIT	PIT	PIT
R_m @ Meas. Temp.	1.00 @ 94°F	0.83 @ 104°F	0.86 @ 80°F	0.80 @ 100°F
R_{mf} @ Meas. Temp.	0.75 @ 94°F	0.60 @ 100°F	0.63 @ 80°F	0.58 @ 100°F
R_{mc} @ Meas. Temp.	1.55 @ 94°F	1.25 @ 104°F	1.29 @ 80°F	1.25 @ 100°F
Source: R_{mf} | R_{mc}	M | C	M | C	M | C	M | C
R_m @ BHT	0.46 @ 202°F	0.39 @ 222°F	0.45 @ 242°F	0.35 @ 242°F
Time Since Circ.	4 HRS.	5 HRS.	4 HRS.	5 HRS.
Max. Rec. Temp.	202 °F	222 °F	242 °F	242 °F
Equip. | Location	4534 | LCT	4532 | LCT	4533 | LCT	4532 | LCT
Recorded By	COCHRAN	COCHRAN	SENTER-LONERGAN	COCHRAN
Witnessed By	MESSRS. PENNEY-HERBLIN	HERBLIN-MILLIGAN		PENNEY

Depth—Driller				
Depth—Logger				
Btm. Log Interval				
Top Log Interval				
Casing—Driller	@	@	@	@
Casing—Logger				
Bit Size				
Type Fluid in Hole				
Dens. | Visc.				
pH | Fluid Loss	ml	ml	ml	ml
Source of Sample				
R_m @ Meas. Temp.	@ °F	@ °F	@ °F	@ °F
R_{mf} @ Meas. Temp.	@ °F	@ °F	@ °F	@ °F
R_{mc} @ Meas. Temp.	@ °F	@ °F	@ °F	@ °F
Source: R_{mf} R_{mc}				
R_m @ BHT	@ °F	@ °F	@ °F	@ °F
Time Since Circ.				
Max. Rec. Temp.	°F	°F	°F	°F
Equip. | Location				
Recorded By				
Witnessed By				

Permanent Datum: BHF, Elev. ______ Elev.: K.B. ______
Log Measured From KB 21.05 Ft. Above Perm. Datum D.F. ______
Drilling Measured From SAME G.L. ______

Date	11-23-69	12-8-69	12-9-69	
Run No.	FIVE	SIX**	SEVEN	
Depth—Driller	14300	14737	15598	
Depth—Logger	14302	14721	15589	
Btm. Log Interval	14301	14720	15588	
Top Log Interval	14183	14301	14290	
Casing—Driller	3579	14300	14288	@
Casing—Logger	3574	14290	14290	
Bit Size	9 7/8"	6	6"	
Type Fluid in Hole	MONO-THIN	SPERSENE XP-20	SPERSENE XP-20-3% OIL	
Dens. | Visc.	12.6 | 52	17.0 | 50	17.0 | 50	
pH | Fluid Loss	8.2 | 4.6 ml	10.0 | 3.2 ml	10.0 | 3.2 ml	ml
Source of Sample	PIT	CIRCULATED	CIRCULATED	
R_m @ Meas. Temp.	0.73 @ 98°F	1.14 @ 67°F	1.14 @ 67°F	@ °F
R_{mf} @ Meas. Temp.	0.55 @ 98°F	0.45 @ 67°F	0.45 @ 67°F	@ °F
R_{mc} @ Meas. Temp.	1.10 @ 98°F	3.60 @ 67°F	3.60 @ 67°F	@ °F
Source: R_{mf} | R_{mc}	C | C	M | C	M | C	
R_m @ BHT	0.30 @ 238°F	0.24 @ 284°F	0.24 @ 284°F	@ °F
Time Since Circ.	4 HRS.	5 HRS.	6 HRS.	
Max. Rec. Temp.	238 °F	244 °F	284 °F	°F
Equip. | Location	4533 | LCT	5636 | LCT	4532 | LCT	
Recorded By	BADON	ALCOCK	OWENS	
Witnessed By	PENNEY-LING	Y-MILLIGAN	SMITH-MILLIGAN	



AMP. SHORT NORMAL 0 2

A-16"-M SHORT NORMAL 0 10

0 100

INDUCTION 0 10

0 100

6 FF40 INDUCTION 4000 8000 40

RESISTIVITY ohms-m²/m

CONDUCTIVITY millimhos/m = 1000 / ohms-m²/m

DEPTHS

SPONTANEOUS-POTENTIAL millivolts

− 15 +

COMPANY GETTY OIL COMPANY AND BUTTES OIL & GAS COMPANY
WELL GLADYS MCCALL NO. 1
FIELD EAST CRAB LAKE

SCHL. FR 15588
SCHL. TD 15589
DRLR TD 15598
Elev: KB