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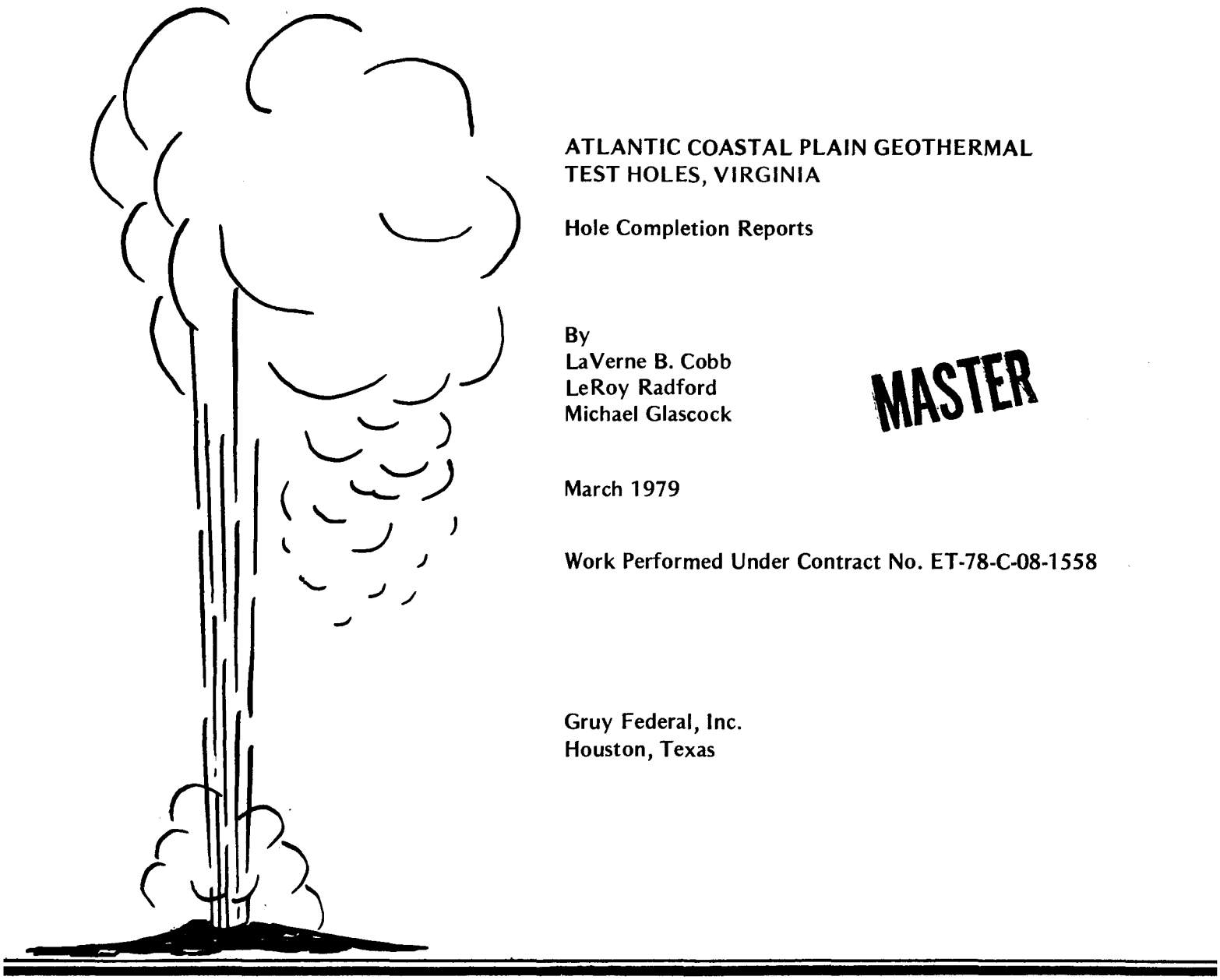


ATLANTIC COASTAL PLAIN GEOTHERMAL TEST HOLES, VIRGINIA

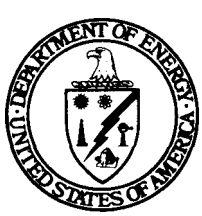
Hole Completion Reports

By
LaVerne B. Cobb
LeRoy Radford
Michael Glascock

March 1979

Work Performed Under Contract No. ET-78-C-08-1558

Gruy Federal, Inc.
Houston, Texas



U. S. DEPARTMENT OF ENERGY

Geothermal Energy

NOTICE

NVO-1558-4(Vol.1)
Distribution Category UC-66a

ATLANTIC COASTAL PLAIN

GEOTHERMAL TEST HOLES

VIRGINIA

HOLE COMPLETION REPORTS

LaVerne B. Cobb

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March 1979

Work Performed Under Contract

ET-78-C-08-1558

GRUY FEDERAL, INC.
2500 Tanglewilde, Suite 150
Houston, Texas 77063

EB

FOREWORD

This document summarized work performed by Gruy Federal, Inc. as part of the Atlantic Coastal Plain Geothermal Drilling Program under DOE Contract No. Et-78-C-08-1558. Five of sixteen holes drilled in Virginia under this program are summarized in this document.

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ABSTRACT

A description of the Atlantic Coastal Plain Geothermal Drilling Program and data for the following Geothermal test holes drilled in Virginia are summarized in this report:

Site No. 27	NASA/Wallops Island
Site No. 26	Isle of Wight
Site No. 25	Suffolk
Site No. 23	Oceana Naval Air Station
Site No. 28-A	Cheriton

SECTION 1. PROGRAM DESCRIPTION

I. INTRODUCTION

A. Program Responsibilities

Gruy Federal, Inc. of Houston, Texas, was selected by the Department of Energy (DOE), Division of Geothermal Energy, to plan, manage, and supervise the Atlantic Coastal Plain Geothermal Drilling Program (ACPGDP). The objectives of this program are:

1. To provide 50 or more heat flow measurement holes, approximately 1000 feet deep, in the sediments of the Atlantic Coastal Plain;

2. To provide these test holes over an area large enough to obtain a statistically comprehensive understanding of the heat flow characteristics of the Atlantic Coastal Plain; and

3. To locate the optimum site for a geothermal resource exploratory well, drilled to basement (approximately 6000 feet deep), after analysis of the heat flow data.

The ACPGDP involves the cooperative effort of several organizations--the DOE, Virginia Polytechnic Institute and State University (VPI&SU), the U.S. Geological Survey (USGS), appropriate state agencies, and Gruy Federal, Inc.--in the selection of drilling sites, planning and execution of drilling and testing programs, establishment of engineering criteria, and development of work schedules.

Work performed by Gruy Federal, Inc. at all Virginia sites is described in this report. The Hole Data Reports Section contains information on site location, lease and permit requirements, drilling procedures, and hole completion and site cleanup at each of the Virginia sites.

B. Site Selection Procedure

Requirements for a geothermal resource beneath the Atlantic Coastal Plain Province are generally believed to consist of:

1. A radiogenic heat source (low-density granitic rock high in uranium and thorium content) to provide high heat generation;

2. An adequate thickness of insulating sedimentary rock overlying the heat source; and

3. Favorable reservoirs (sedimentary rock with sufficient porosity and permeability to transmit waters heated by the radiogenic source).

In preparing the ACPGDP drilling Plan, Gruy Federal evaluated the geologic and geomorphic characteristics of the Atlantic Coastal Plain as they pertain to subsurface geology and drilling procedures. The principal criteria used in this evaluation were:

1. Depth of sediments, based on basement surface data (Fig. 1) and

2. Type of sediment overlying basement rock (Table 1).

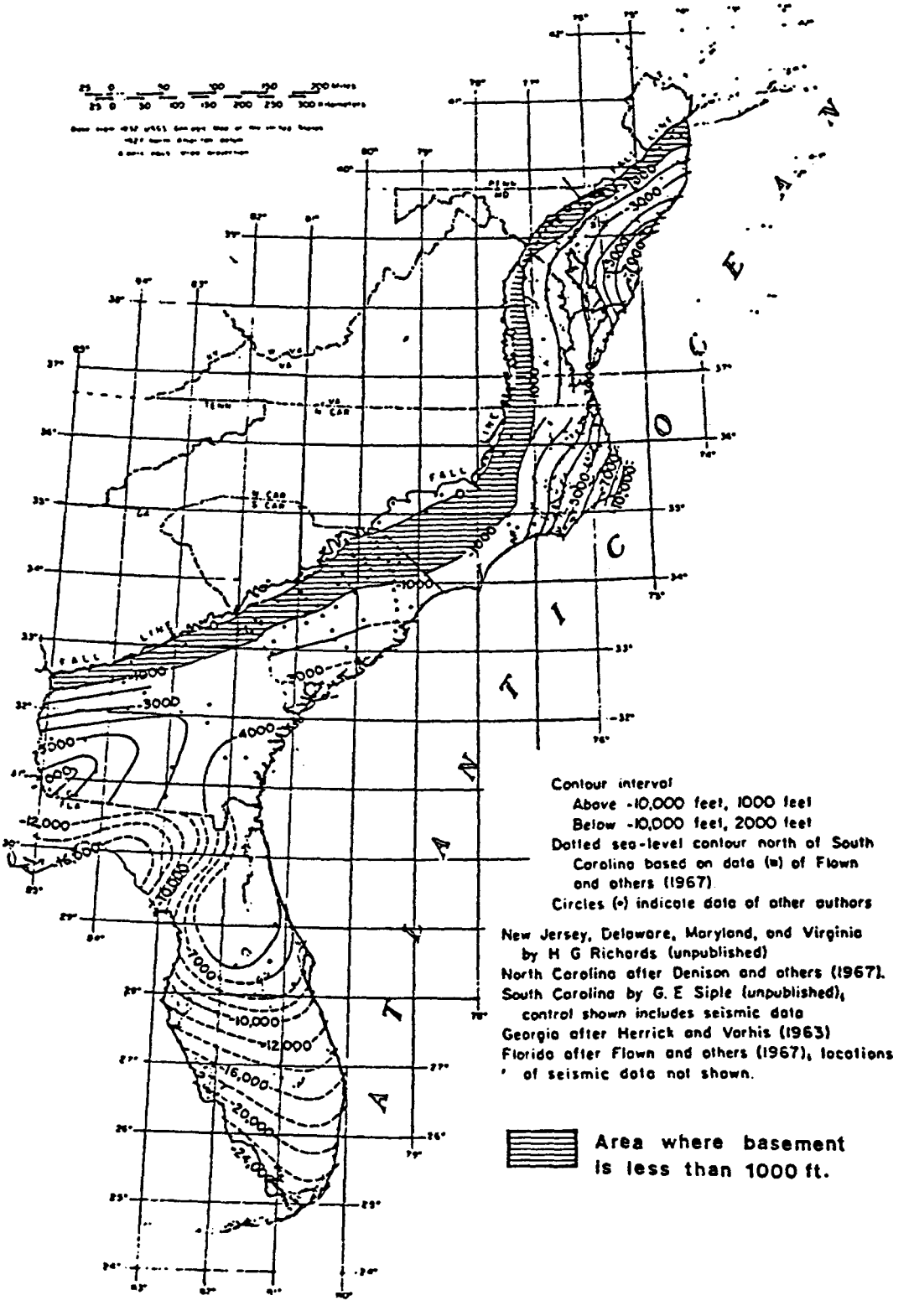


Figure 1. Contour Map of Basement Surface, Atlantic Coastal Plain (modified from Richards, 1974).

TABLE 1

ATLANTIC COASTAL PLAINS

Generalized Stratigraphic Sequences

Region	State	Stratigraphy*
I	Florida	Largely carbonates except for the basal-upper and lower Cretaceous clastic section.
II	Georgia S. Carolina	Upper Cretaceous sands and shales overlain by shales and carbonates of Paleocene through Miocene age.
III	S. Carolina N. Carolina	Largely upper Cretaceous sands and shales.
IV	Virginia Maryland Delaware New Jersey	Largely a sand-shale section, including a thick sequence of lower and upper Cretaceous clastic sediments overlain by a Paleocene-Pleistocene clastic sequence.

*Generalizing from the detailed work of Brown, Miller, and Swain (1972) and using earlier less-detailed studies of lithology distribution: Legrand (1961), Drake and others (1959), and Emery (1966).

Application of these criteria indicates that the Atlantic Coastal Plain can be divided into four regions, shown in Fig. 2.

The site locations (Table 2) for the 1000-foot heat flow measurement holes on the Atlantic Coastal Plain were selected by VPI&SU scientists on the basis of their interpretation of gravity field data and, in some cases, correlation between high geothermal gradient and negative gravity anomalies.

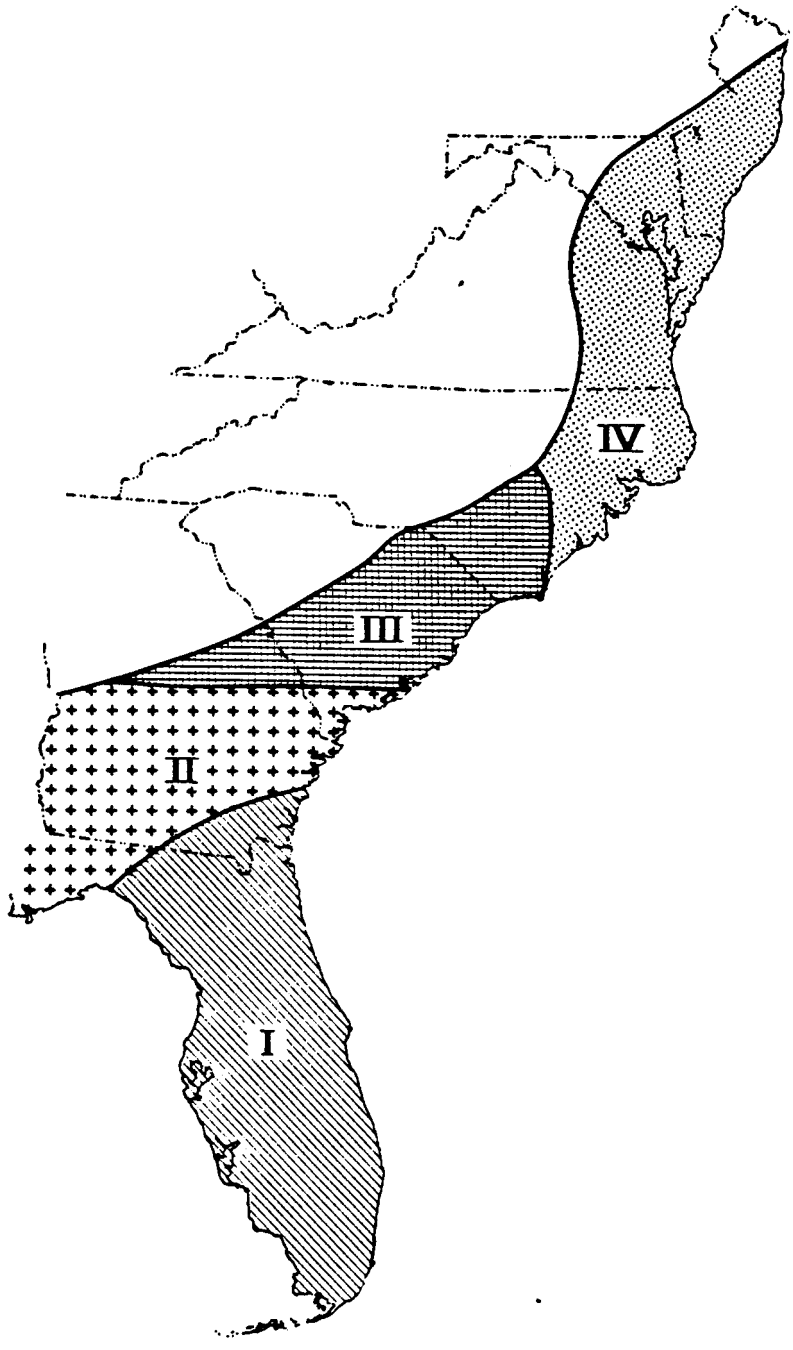


Figure 2. General Drilling Regions of the Atlantic Coastal Plain.

TABLE 2

DRILL SITE LOCATIONS

STATE	SITE LOCATION	VPI NO.	LATITUDE	LONGITUDE
New Jersey	Fort Monmouth	40	40° 18' 48" N	74° 03' 00" W
	Sea Girt	41	40° 07' 14" N	74° 02' 00" W
	Forked River	39	39° 50' 31" N	74° 10' 52" W
	Atlantic City	38	39° 22' 46" N	74° 27' 14" W
	Cape May	36	39° 00' 00" N	75° 54' 15" W
Delaware	Camp Barnes/Assawoman Bay	34-E	38° 29' 55" N	75° 05' 50" W
	Lewes	34	38° 47' 06" N	75° 09' 38" W
	State Tree Farm	34-C	38° 44' 35" N	75° 27' 43" W
	Dover AFB/Frederica	35	39° 06' 40" N	75° 27' 38" W
	Bridgeville	54	38° 46' 46" N	75° 37' 54" W
Maryland	Salisbury State College	31	38° 20' 26" N	75° 36' 28" W
	Crisfield Airport	32-A	38° 00' 57" N	75° 49' 34" W
	Cambridge	33-A	38° 24' 02" N	76° 11' 16" W
	Ocean City Airport	30-A	38° 18' 35" N	75° 07' 08" W
	Ocean City	43	38° 26' 00" N	75° 03' 25" W
	Ocean City	43-1	38° 26' 00" N	75° 03' 25" W
	Salisbury Airport	47	38° 19' 57" N	75° 30' 42" W
	Hebron	45	38° 23' 27" N	75° 41' 22" W
	Salisbury	46	38° 24' 14" N	75° 34' 20" W
	Snow Hill	53	38° 10' 24" N	75° 22' 45" W
	Princess Ann	52	38° 10' 30" N	75° 34' 47" W
	Kingston	51	38° 04' 52" N	75° 43' 32" W
	Rehobeth	50	38° 02' 09" N	75° 40' 19" W
Virginia	NASA/Wallops Station	29	37° 56' 40" N	75° 27' 17" W
	Isle of Wight	26	36° 54' 30" N	76° 42' 09" W
	City of Suffolk	25	36° 51' 01" N	76° 28' 45" W
	Oceana Naval Air Station	23	36° 48' 08" N	76° 02' 38" W
	Cheriton/Northampton	28-A	37° 17' 54" N	75° 55' 55" W
	Creeds	22	36° 36' 24" N	76° 00' 25" W
	Norfolk Naval Base	24	36° 57' 55" N	76° 16' 11" W
	Langley Air Force Base	27	37° 05' 32" N	76° 22' 12" W

DRILL SITE LOCATION CONT'D

STATE	SITE LOCATION	VPI NO.	LATITUDE	LONGITUDE
Virginia	Wattsville	48	37° 56' 05" N	75° 30' 37" W
	Withams	49	37° 57' 32" N	75° 35' 37" W
	Atlantic	57	37° 53' 18" N	75° 30' 03" W
	Accomack/Tagley	55	37° 42' 32" N	75° 43' 09" W
	Eastville	56	37° 21' 16" N	75° 59' 32" W
	Hampton	60	37° 02' 13" N	76° 19' 02" W
	Smith Point	59	37° 52' 59" N	76° 15' 03" W
	Suffolk	25-B	36° 51' 01" N	76° 28' 45" W
North Carolina	Engelhard	18	35° 31' 15" N	75° 59' 17" W
	Manns Harbor	19	35° 45' 27" N	75° 47' 42" W
	Elizabeth City	20	36° 16' 50" N	76° 12' 57" W
	Barco	21	36° 19' 46" N	76° 03' 37" W
	Kingston	16-A	35° 14' 15" N	77° 35' 45" W
	Cherry Point	16	34° 54' 29" N	76° 51' 57" W
	Beaufort	17	34° 46' 19" N	76° 39' 28" W
	Camp Le Jeune	15	34° 39' 03" N	77° 19' 16" W
	Sneads Ferry/Hayes	15-A	34° 31' 30" N	77° 27' 23" W
	Wilmington	14	34° 13' 34" N	77° 52' 12" W
	Southport	14-A	33° 57' 05" N	77° 59' 25" W
South Carolina	Myrtle Beach Air Force Base	13-A	33° 41' 00" N	78° 56' 40" W
	Georgetown	12-B	33° 22' 43" N	79° 18' 09" W
	Georgetown	12-A	33° 25' 54" N	79° 24' 08" W
	Charleston Air Force Base	10	32° 54' 26" N	80° 03' 44" W
	Seabrook	8-B	32° 31' 30" N	80° 46' 00" W
	Paris Island	8-A	32° 20' 03" N	80° 42' 24" W
	Delta Plantation	7-A	32° 08' 21" N	81° 01' 56" W
Georgia	Savannah Airport	44	32° 08' 07" N	81° 12' 27" W
	Shellman Bluff	6-A	31° 34' 09" N	81° 19' 33" W
	Ludowici	4-B	31° 36' 30" N	81° 35' 50" W
	Sea Island/Bay Colony	5-A	31° 12' 30" N	81° 22' 45" W
	Waverly	3-A	31° 04' 24" N	81° 49' 24" W

II. Special Federal, State, Local or Landowner Requirements

A. Virginia State Requirements

The State of Virginia does not require the licensing or bonding of out-of-state drillers. Well drilling permits are not required; however, the complementary completion reports are required. State Highway permits for moves within the state were required for all oversized/overweight vehicles, and in some instances, local highway permits were also required. Toll road permits were required for Highway 44 in Virginia Beach and a permit for the Hampton Bridge and Tunnel. The Federal military bases and stations required welding permits and water use permits. Certificates on Insurance were also required at military bases. Main gate passes were needed to enter each military facility.

SECTION 2. HOLE DATA REPORTS

I. Site No. 29, NASA/Wallops Island, Virginia

A. Site Location

The location of Site No. 29, NASA/Wallops Island, Virginia, heat flow measurement hole is shown on Figure 1-1, a section of USGS 7½' Quadrangle "Chincoteague West, Virginia". The coordinates of the drill site are longitude 75° 27' 17" W, latitude 37° 56' 40" N. The site, located near the Chincoteague Pumping Station on the NASA/Wallops Island Satellite Tracking Station, has a ground elevation of approximately 15 feet above sea level.

B. Lease/Letter Agreements, Permits, Licenses

Access to Site No. 29 was obtained by permission of the National Aeronautics and Space Administration by letter agreement (Exhibit I-1). A Commonwealth of Virginia Certification of Completion permit was required and is shown in Exhibit I-2.

C. Environmental Information Survey

The environmental information checklist supplementary information required for the "Environmental Assessment, Geothermal Exploratory Drilling Program, Eastern United States, Coastal Plains and Piedmont Provinces" (DOE/EA-0015) is shown in Exhibit I-3.

D. Drilling Activities

Drilling activities at Site No. 29, NASA/Wallops Island, Virginia, began September 6, 1978 and were completed September 11, 1978. Figure 1-2, a schematic diagram of the completed hole, summarizes data for Site No. 29. The daily drilling reports are shown in Exhibit I-4. Cores and cuttings taken from the hole during drilling

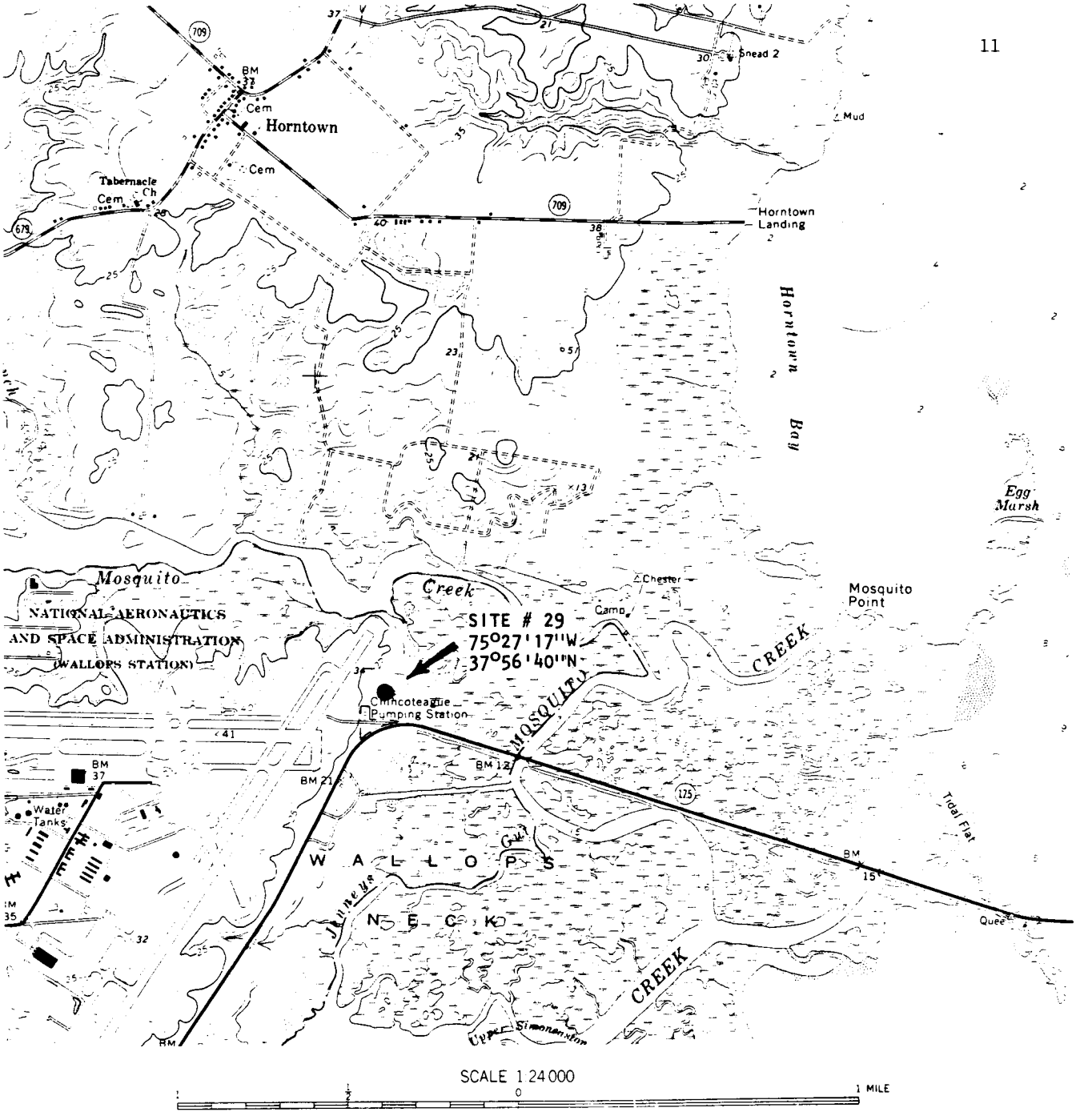


FIGURE 1-1 LOCATION SITE #29, NASA/WALLOP ISLAND, VA.
LONGITUDE 75°27'17" W, LATITUDE 37°56'40" N

CHINCOTEAGUE WEST, VA.
N3752.5—W7522.5/7.5

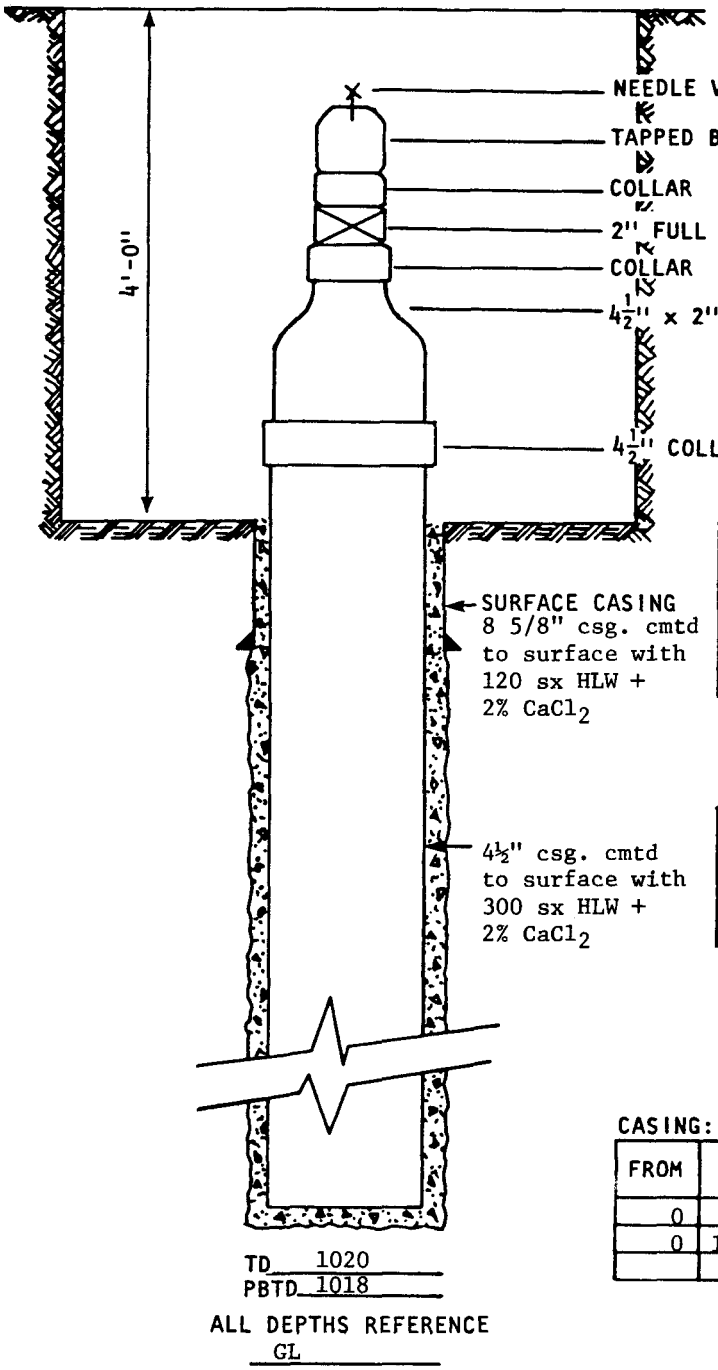
1965

AMS 5959 IV NW—SERIES V834

GRUY FEDERAL, INC.

SITE NO. 29
WELL NAME NASA, WALLOPS ISLAND
LOCATION: LAT. 37°56'40"
LONG. 75°27'17"

RIG: Warren George, Failing 1500 & Meyhew 1000 COUNTY Accomack STATE Virginia
DATE SPUDED: September 6, 1978 DATE COMPLETED: September 11, 1978



CORES:

NO.	FROM	TO	RECOVERY
1	540	565	0'
2	575	600	16'
3	980	1005	18'

HOLE SIZE:

DEPTH		HOLE	CSG.	MUD *	
FROM	TO	SIZE IN.	SIZE IN.	VIS.	WT.
0	120	12¼	8-5/8	40	9.0
120	1020	7-7/8	4½	45	9.5

* approximate

CASING:

FROM	TO	SIZE IN.	WT #/FT	GRADE	THREAD	NO. JTS
0	120	8-5/8	240	H 40	ST&C	3
0	1020	4½	95	J 55	ST&C	25

FIGURE 1-2 WELL SCHEMATIC WITH COMPLETION INFORMATION

were delivered to VPI&SU. No electric logs were run on this hole. Temperature logs were run by VPI&SU after the hole was cased; however, these data were not made available to Gruy. The completed hole was left filled with water containing corrosion inhibitor.

E. Site Preparation, Layout and Cleanup

Prior to initiation of drilling at Wallops Island, Virginia, the site area was almost level and had a well groomed grass covering. For site preparation, a bulldozer dug one pit 35' long, 35' wide, and 4' deep, and shallow pits for the water tank, mud pits, and pumps. The 4' x 4' cellar was dug by hand 4' deep and boarded over. After the hole was completed, the wellhead was installed and an iron grate was placed over the cellar and locked. The mud pit was vacuumed and the site was backfilled and leveled.

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
703/979-2955

July 27, 1978

Dr. Robert Krieger
National Aeronautics and Space
Administration
Wallops Flight Center
Wallops Island, VA 23337

Dear Dr. Krieger:

Gruy Federal, Inc. is under Contract ET-78-C-08-1558 with the Division of Geothermel Energy, U. S. Department of Energy, to drill a series of bore holes along the Atlantic Coastal Plain from New Jersey to Florida. The sites have been, or will be, coordinated with the respective State Geological or Water Resources Boards and are under the overall coordination of Dr. J. K. Costain, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

The purpose of the drilling is to conduct a scientific geological study attempting to find sources of residual heat in the coastal bed rocks. Use of the site described below is critical to the study. The drilling program was started at Fort Monmouth, NJ, and is continuing on the New Jersey coast at present.

Gruy Federal requests permission to drill, case and cement one heat gradient bore hole of 1,000' depth at a site described below:

Chincoteague West Quadrangle
Accomack County, Virginia
U. S. Department of Interior Geological Survey Map
Coordinates: N 37° 56' 38"
W 75° 27' 11"
or
Coordinates: N 37° 56' 25"
W 75° 27' 23"

Find site selection to be by mutual agreement between your representative and a representative of Gruy Federal.

An area of approximately one acre will be required for the site during actual drilling operations for a period of about five days. Some soil disturbance will occur, but will be restored to its original condition, leaving only a 4' x 4' x 4' cement lined pit with a hinged steel cover on the site. The cover

will be flush with the surface. The 1,000' cased hole will be filled with fresh water. For one year following, scientists from the State, Virginia Polytechnic Institute, the U. S. Geological Survey and the U. S. Department of Energy, under Gruy Federal responsibility, will conduct heat gradient measurements of this water.

Gruy Federal shall be responsible and liable for accidents, injuries or damages arising from its operations. The site will be restored insofar as possible to its original condition, including resodding or replanting grass. At your election, on completion of the heat gradient tests, the bore hole will be returned to you for any use deemed appropriate or Gruy Federal will plug and abandon the hole in accordance with federal and state laws.

The Division of Geothermel Energy, Department of Energy has made an Environmental Impact Assessment of Geothermel Drilling Activity, Coastal Plain and Piedmont Physiographic Provinces, Eastern United States, dated December 1977. NEPA requirements for this action have been met by the Department of Energy and there are no anticipated atmospheric, ecological, environmental or historical site factors developing from this operation.

Your cooperation and assistance in this research are sincerely appreciated. If you have any further questions concerning this operation, please call Mr. G. W. Duncan, Manager Drilling and Resource Evaluation Division, Houston, TX, at AC 703-785-9200, collect.

Mr. M. Keith Wible of your staff has been briefed on this matter.

If agreeable, you need only to countersign the original of this letter agreement.

Respectfully yours,

W. Edward McCain

W. Edward McCain
Agent and Attorney-in-fact

APPROVED _____

Form GW-2
1978-10,000

EXHIBIT I-2

16

COMMONWEALTH OF VIRGINIA
WATER WELL COMPLETION REPORT
• BWCM No. _____

(Certification of Completion/County Permit)

State Water Control Board
P. O. Box 11143
2111 North Hamilton St.
Richmond, Va. 23230

SWCB Permit _____
County Permit _____

Certification of inspecting official:
This well does _____ does not _____ meet code/law requirements.
S. _____
Date _____

For Office Use

CHINCOTEAGUE WEST QUAD

County/City Stamp

• Virginia Plane Coordinates
_____ N
_____ E

Latitude & Longitude
37°56'40" N
75°27'17" W

• Topo. Map No. _____
• Elevation 15 ft.
• Formation _____
• Lithology _____
• River Basin _____
• Province _____
• Type Logs _____
• Cuttings EACH 10 ft.
• Water Analysis _____
• Aquifer Test _____

• Owner NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
• Well Designation or Number SITE # 29
Address WALLOPS ISLAND, VIRGINIA
Phone _____

• Drilling Contractor GRUY FEDERAL INC.
Address 2500 TANGLEWILDE #150 HOUSTON
Phone _____ TEXAS

Tax Map I.D. No. _____
Subdivision _____
Section _____
Block _____
Lot _____
Class Well: I _____, IIA _____
IIB _____, IIIA _____, IIIB _____

WELL LOCATION: _____ (feet/miles _____ direction) of _____
and _____ feet/miles _____ (direction) of _____
(If possible please include map showing location marked)

Date started _____ • Date completed SEP. 11, 1978 Type rig ROTARY

1. WELL DATA: New ✓ Reworked _____ Deepened _____
• Total depth 1000 ft. ft.
• Depth to bedrock — ft.
• Hole size (Also include reamed zones)
• 7⅞ inches from 0 to 1000' ft.
• _____ inches from _____ to _____ ft.
• _____ inches from _____ to _____ ft.
• Casing size (I.D.) and material
• 4½ inches from 2 to 1000' ft.
Material _____
Wt. per foot _____ or wall thickness _____ in.
• _____ inches from _____ to _____ ft.
Material _____
Wt. per foot _____ or wall thickness _____ in.
• _____ inches from _____ to _____ ft.
Material _____
Wt. per foot _____ or wall thickness _____ in.
• Screen size and mesh for each zone (where applicable)
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• Gravel pack
• From _____ to _____ ft.
• From _____ to _____ ft.
• Grout
• From 2 to 1000 ft., Type CLASS A CEMENT
• From _____ to _____ ft., Type _____

2. WATER DATA • Water temperature _____ °F
• Static water level (unpumped level-measured) _____ ft
• Stabilized measured pumping water level _____ ft
• Stabilized yield _____ gpm after _____ hours
Natural Flow: Yes _____ No _____, flow rate: _____ gpm
Comment on quality _____

3. WATER ZONES: From _____ To _____
From _____ To _____ . From _____ To _____
From _____ To _____ . From _____ To _____

4. USE DATA:
Type of use: Drinking _____, Livestock Watering _____, Irrigation _____ Food processing _____, Household _____ Manufacturing _____, Fire safety _____, Cleaning _____ Recreation _____, Aesthetic _____, Cooling or heating _____ Injection _____, Other _____
• Type of facility: Domestic _____, Public water supply _____ Public institution _____ Farm _____, Industry _____ Commercial _____, Other _____

5. PUMP DATA: Type _____ • Rated H.P. _____
• Intake depth _____ • Capacity _____ at _____ head

6. WELLHEAD: Type well seal SEE FIGURE #4
Pressure tank _____ gal., Loc. _____
Sample tap _____, Measurement port _____
Well vent _____, Pressure relief valve _____
Gate valve _____, Check valve (when required) _____
Electrical disconnect switch on power supply _____

7. DISINFECTION: Well disinfected _____ yes _____ no
Date _____, Disinfectant used _____
Amount _____, Hours used _____

8. ABANDONMENT (where applicable) • yes _____ no _____
Casing pulled yes _____ no _____ not applicable _____
Plugging grout From _____ to _____ material _____

Owner _____

9. State law requires submitting to the Virginia State Water Control Board information about groundwater and wells for every well made in the State intended for water, or any other non-exempt well. This information must be submitted whether the well is completed, on standby, or abandoned. Information required includes: an accurately and completely prepared water well completion report, full data from any aquifer pumping tests, drill cuttings taken at ten foot intervals (unless exemption is secured), the results of any chemical analyses, and copies of any geophysical logs. Quarterly pumpage and use reports are required from owners of public supply and industrial wells. County or State permits to drill may be required in some parts of the state. Some counties require submission of a water well completion report. The Virginia State Health Department requires a water well completion report for public supply wells.

10. DRILLERS LOG (use additional Sheets if necessary)				11.	12. DIAGRAM OF WELL CONSTRUCTION (with dimensions)
DEPTH (feet) From	To	TYPE OF ROCK OR SOIL (color, material, fossils, hardness, etc.)	REMARKS (water, caving, cavities, broken, core, shot, (etc.)	Drilling Time (Min.)	
METERS					
0	6	SAND			
6	73	SILT AND CLAY w/SHELL FRAGMENTS			
73	97	GRAVEL SOME SAND w/ABUNDANT SHELL FRAGMENT			
97	299	SILT AND CLAY			
		THE DESCRIPTIONS OF THIS WELL ARE UNPUBLISHED. FOR MORE INFORMATION CALL OR WRITE			
		VIRGINIA POLYTECH INST. GEOPHYSICS DEPT. DR. JOE LAMBIASE (703) 961-6112			

State Water Control Board Regional Offices

Valley Reg. Off.
116 North Main Street
P. O. Box 268
Bridgewater, Va. 22812
703-828-2595

Piedmont Reg. Off.
4010 West Broad Street
P. O. Box 6616
Richmond, Va. 23230
804-257-1006

Southwest Reg. Off.
408 East Main Street
P. O. Box 476
Abingdon, Va. 24210
703-628-5183

Tidewater Reg. Off.
287 Pembroke Office Park
Suite 310 Pembroke No. 2
Va. Beach, Va. 23462
804-499-8742

West Central Reg. Off.
Executive Park
5306 A Peters Creek Road
Roanoke, Va. 24019
703-563-0354

Northern Virginia Reg. Off.
5515 Cherokee Avenue
Suite 404
Alexandria, Va. 22312
703-750-9111

13. Well lot dedicated? _____; Size _____ ft. X _____ ft.; Well house? _____
Distance to *nearest* pollutant source _____ ft., Type _____
Distance to nearest property line _____ ft., Building _____ ft.

14. I certify that the information contained herein is true and correct and that this well and/or system has been installed and constructed in accordance with the requirements for well construction as specified in compliance with appropriate county or independent city ordinances and the laws and rules of the Commonwealth of Virginia.

Signature Michael R. Glascock (Seal), Date FEB. 13, 1979
(Well driller or authorized person)

License No. _____

EXHIBIT I-3

SITE-SPECIFIC ENVIRONMENTAL INFORMATION CHECKLIST

HEAT GRADIENT HOLES

ATLANTIC COASTAL PLAIN GEOTHERMAL TEST PROGRAM

Site No. 29 State Va

Location National Aeronautics & Space Administration @ Wallops Island, Va

A. GENERAL

1. Has federal, state and/or local environmental assessment been conducted previously for the proposed drill site? Yes____ No ✓ If yes, provide a copy, if available.

2. Have all required permits, licenses, and/or agreements for the proposed drill site been obtained? Yes ✓ No____ If no, explain. ____

3. Does the drill site fall within the habitat of rare or endangered species? Yes____ No____ If yes, explain. Eastern flyway, but no species occupy the area at the test site.

4. Are known archeological sites, historic sites, prime or unique farmland, or natural landmarks within or visible from the site area? Yes____ No ✓ If yes, explain. ____

5. Will casing left in the hole protect all ground water aquifers? Yes ✓ No____ If no, explain. ____

6. Will a directional survey be conducted in the drill hole? Yes____ No ✓ If yes, at what interval? ____ feet. If no, explain. Not necessary for 1000' nonproducing hole

7. Will expected continuous noise levels from site operations be 65 dBA or less at the nearest residence? Yes____ No ✓ If no, explain. Each 8V-71 GMC engine equipped with two 4" No. SRU04-0196 Maxim silencers; maximum noise level 32.0 dBA, 250 center frequency; for residential use.

B. SITE CONSTRUCTION

1. Will additional land clearing be required for the drilling and data collection activities (e.g., preparation of drill pad, road construction, mud reserve pits, pipeline)? Yes____ No ✓ If yes, describe.

2. Will the drill site and related roads be treated to minimize dust? Yes____ No ✓ If no, explain. ____

3. Are portable sanitary facilities or an approved septic system to be used at the drill site? Yes ✓ No____ If no, explain. ____

4. Will liquid and solid wastes be disposed in accordance with local regulations? Yes ✓ No____ If no, explain. ____

5. Will erosion control be required for excavated areas? Yes____ No ✓ If yes, explain. ____

6. Upon completion of proposed drilling and data collection activities, will the site be restored to as natural a condition as possible by regrading, filling, and reseeding? Yes ✓ No ____ If no, explain. ____

C. SAFETY

1. Will blowout preventers be used? Yes ✓ No ____ If no, explain.

2. Will fire extinguishers be located onsite? Yes ✓ No ____ If no, explain. ____

3. Will engineering and mud logging personnel be onsite during drilling operations? Yes ✓ No ____ If no, explain. ____

4. Does an emergency plan exist for evacuating personnel? Yes ✓ No ____ If no, explain. ____

5. Will the drilling operations be conducted under a safety policy that ensures safe operating procedures and attention to job safety and health protection? Yes ✓ No ____ If no, explain. ____

Completed from onsite inspection by:

Michael R. Hasbrook
Signature

Position: Field Engineer

Date: Aug 29, 1978

SAFETY POLICY

1. The safety policies of Gruy Federal, Inc. are defined by the joint requirements of:
   a. the Occupational Safety and Health Act of 1970, as defined and enforced by the Occupational Safety and Health Administration (OSHA) of the Department of Labor with respect to job safety and health protection, and
   b. the safe operating procedures, inspection and training programs, and accident investigation forms of the International Association of Drilling Contractors, whether involving drilling rigs or other equipment.

2. OSHA requirements are summarized in the 10" X 16" plastic laminated JOB SAFETY AND HEALTH PROTECTION sign, GPO: 1974 0 - 537-604; IADC procedures and inspection and report forms are summarized in the booklet Outline for Drilling Rig Safety Program, compiled by the IADC Safety Publications Subcommittee, revised 1976. Both of these documents are required to be displayed, reviewed at regular intervals by all supervisory personnel, and followed in concept and practice in all Gruy Federal operations involving job safety and health protection.

3. All Gruy Federal subcontractors and/or third party services are required to maintain meaningful and effective safety programs that include scheduled training and drills for personnel, and scheduled maintenance and testing of safety equipment.

4. In addition, all Gruy Federal field operations and all subcontractors and/or third party services to Gruy Federal field operations are required to maintain familiarity with and follow the recommended safe operating procedures and guidelines of the Accident Prevention Manual, IADC, revised edition, October, 1975.

5. The Gruy Federal Project Manager or his designated field representative shall have responsibility for maintaining these safety policies through:
   a. inspection of all equipment and materiel,
   b. inspection of personnel and equipment performance in safety drill or demonstration, upon request, and
   c. shutdown or exclusion from the job of any operation, materiel or personnel whose temporary condition or malfunction violates or jeopardizes the requirements of these safety policies.

February, 1978

Alan Lohse
Executive Vice President

Meyhew 1000
GRUY FEDERAL, INC.

EXHIBIT I-4
2500 TANGLEWILDE, SUITE 150
HOUSTON, TEXAS 77063
(713) 785-9200

DAILY DRILLING REPORT

JOB NO. 3022

WELL NO. #29-NASA/WALLOPS STATION

DATE September 6, 7, 1978

COUNTY Accomack

STATE Virginia

REPORT NO. 1

REPORTED BY Radford

DEPTH

PROGRESS

ACTIVITY AT REPORT TIME

TIME LOG FROM	TO	ELAPSED	OPERATIONS
			Meyhew 1000 drilled to 120 feet, ran surface casing (3jts 8-5/8") and cemented to 120 feet

Failing 1500
GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #29-NASA/WALLOPS STATION

DATE September 8,9, 1978 COUNTY Accomack STATE Virginia

REPORT NO. 2 REPORTED BY Radford

DEPTH PROGRESS

ACTIVITY AT REPORT TIME Waiting on rig to complete hole.

TIME LOG FROM	TO	ELAPSED	OPERATIONS
			Waiting on rig to complete hole.

Failing 1500
GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022

WELL NO. 29-NASA/Wallops Station

DATE September 10, 1978

COUNTY Accomack

STATE Virginia

REPORT NO. 3

REPORTED BY Radford

DEPTH

PROGRESS

ACTIVITY AT REPORT TIME Preparing to run casing.

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
			Drilled to 540 feet. Core #1, 540 to 565 feet, no recovery. Drilled to 575 feet. Core #2, 575 to 600 feet, 16 feet recovery. Drilled to 980 feet. Core #3, 980 feet to 1005 feet, 18 feet recovery. Drilled to 1020 feet.

Failing 1500
GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022

WELL NO. #29 - NASA

DATE September 11, 1978

COUNTY Accomack STATE Virginia

REPORT NO. 4

REPORTED BY Radford/Smith

DEPTH --

PROGRESS --

ACTIVITY AT REPORT TIME

TIME LOG FROM	TO	ELAPSED	OPERATIONS
			Ran 28 joints 4-1/2 9.5# per ft. J-55 ST&C casing. Cemented with 300 sxs HCL. Good Returns. Bump plug at 2145 hours. Held OK Ran Halliburton wireline to 1000 ft. Well Complete. Rigging down to move to Ocean City #43

II. Site No. 26, Isle of Wight, Virginia

A. Site Location

The location of Site No. 26, Isle of Wight, Virginia, heat flow measurement hole is shown on Figure 2-1, a section of USGS 7½' Quadrangle "Smithfield, Virginia". The coordinates of the drill site are longitude 76° 42' 09" W, latitude 36° 54' 30" N. The site, located in an agricultural field east of Isle of Wight, Virginia, has a ground elevation of approximately 70 feet above sea level.

B. Lease/Letter Agreements, Permits, Licenses

Access to Site No. 26 was obtained by permission of the County Administrator, Isle of Wight County, by letter of agreement Exhibit II-1. A Commonwealth of Virginia Certification of Completion permit was required and is shown in Exhibit II-2.

C. Environmental Information Survey

The environmental information checklist, supplementary information required for the "Environmental Assessment, Geothermal Exploratory Drilling Program, Eastern United States, Coastal Plains and Piedmont Provinces" (DOE/EA-0015) is shown in Exhibit II-3.

D. Drilling Activities

Drilling activities at Site No. 26, Isle of Wight, Virginia, began September 20, 1978 and were completed on September 26, 1978. Figure 2-2, a schematic diagram of the completed hole, summarizes data for Site No. 26. The daily drilling reports are shown in Exhibit II-4 and Exhibit II-5 is an operations summary of Site No. 26. Cores

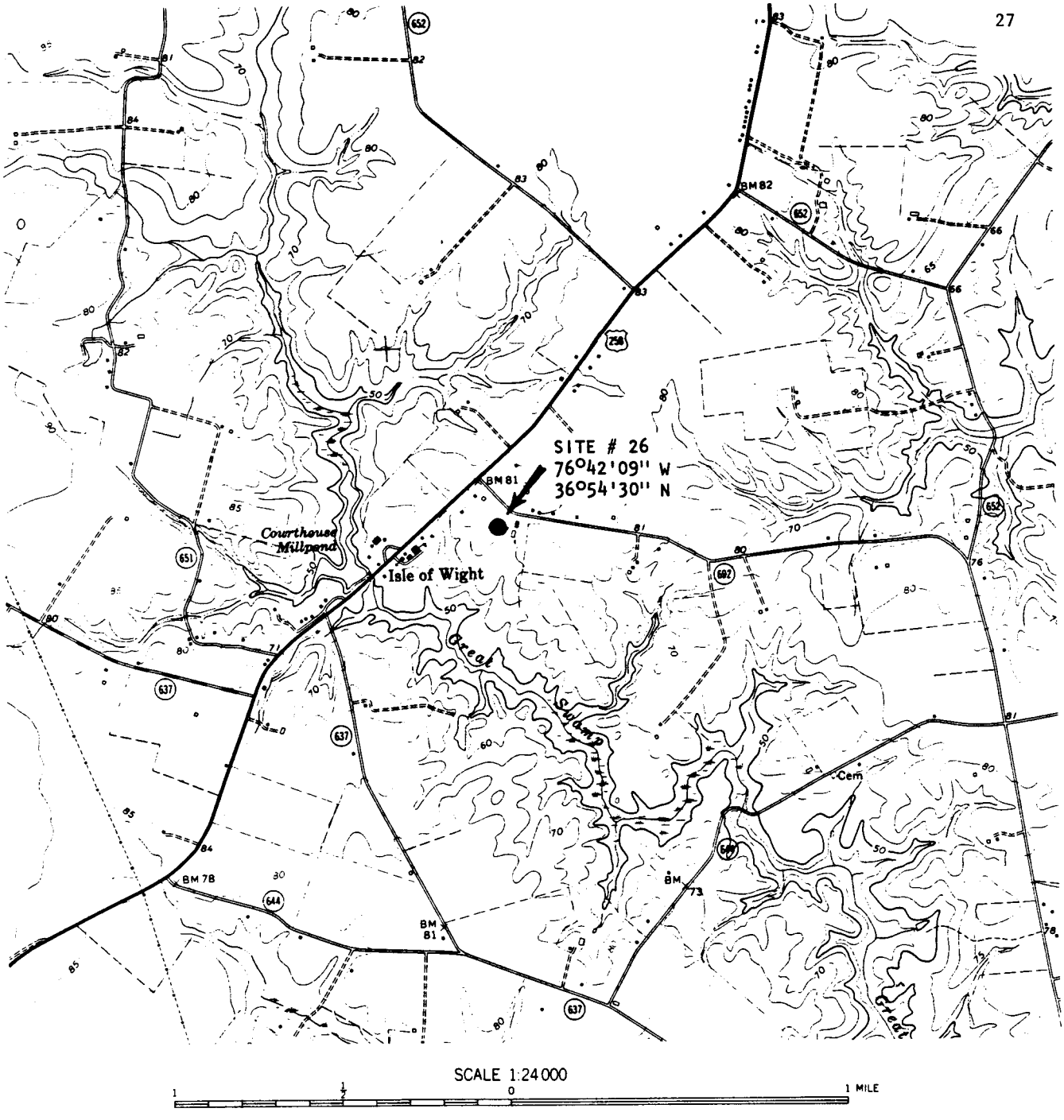


FIGURE 2-1 LOCATION SITE #26, ISLE OF WIGHT, VA.
LONGITUDE 76°24'09" W, LATITUDE 36°54'03" N

SMITHFIELD, VA.
N3652.5—W7637.5/7.5

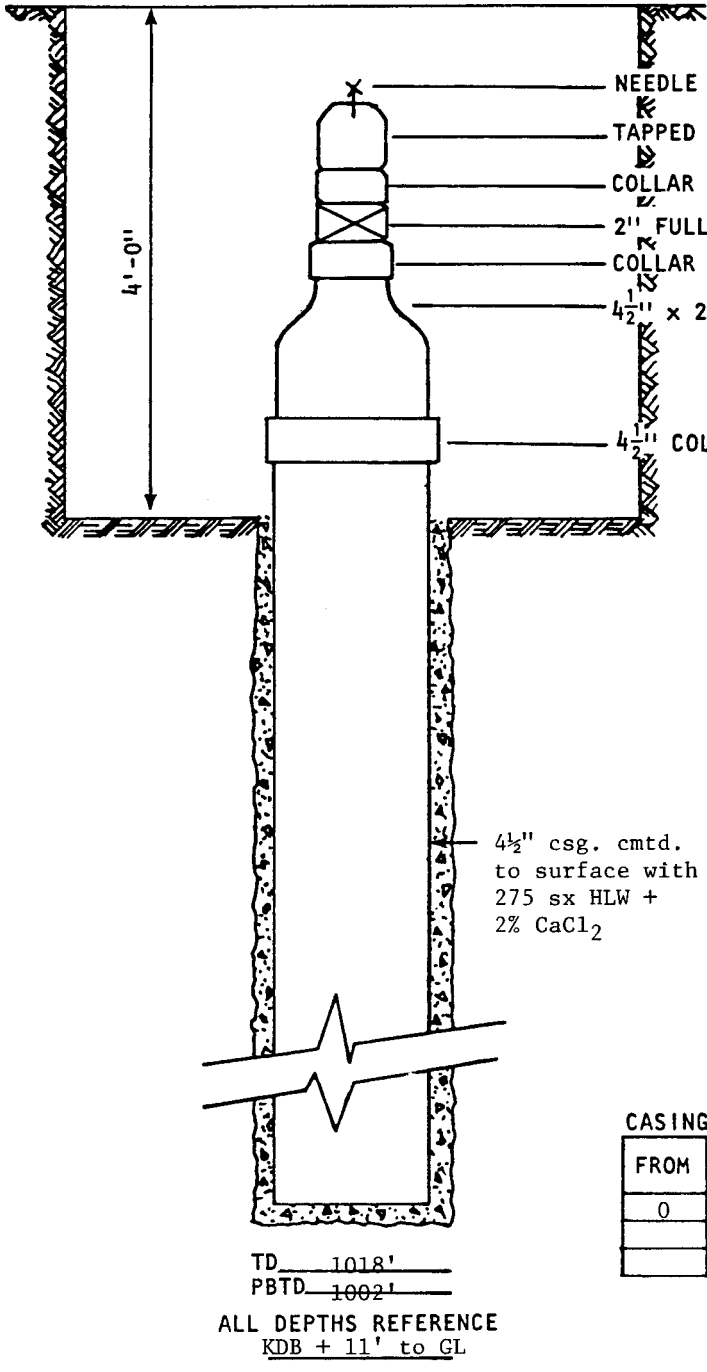
1968

AMS 5657 I NW—SERIES V834

GRUY FEDERAL, INC.

SITE NO. 26
WELL NAME Isle of Wight 28
LOCATION: LAT. 36°54'03" N
LONG. 76°24'09" W

RIG: ENERGY SERVICE COMPANY- Rig 17 COUNTY Isle of Wight STATE Virginia
DATE SPUDED: September 23, 1978 DATE COMPLETED: September 25, 1978



CORES:

NO.	FROM	TO	RECOVERY
1	256	281	12 feet
2	978	1003	15 feet

HOLE SIZE:

DEPTH		HOLE	CSG.	MUD*	
FROM	TO	SIZE IN.	SIZE IN.	VIS.	WT.
0	1018	7-7/8	4½	45	9.5

* approximate

CASING:

FROM	TO	SIZE IN.	WT #/FT	GRADE	THREAD	NO. JTS
0	1004	4½	9.5	J-55	ST&C	25

FIGURE 2-2 WELL SCHEMATIC WITH COMPLETION INFORMATION

and cuttings taken from the hole during drilling were delivered to VPI&SU. No electric logs were run on this hole. Temperature logs were run by VPI&SU after the hole was cased; however, these data were not made available to Gruy.

E. Site Preparation, Layout and Cleanup

Prior to initiation of drilling at Isle of Wight, Virginia, the site area was almost level and had a mature crop of peanuts that covered it. For site preparation, a bulldozer dug two pits 35' long, 5' wide, and 4' deep, and cleared one acre of the planted peanuts. The 4' x 4' cellar was dug by hand 4' deep and boarded over. After the hole was completed, the wellhead was installed and an iron grate was placed over the cellar and locked. The mud pit was vacuumed and the site was backfilled and leveled.

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
703/979-2955

August 4, 1978

AUG 7 1978

Mr. Michael Myers
County Administrator
Isle of Wight County
Isle of Wight, Va. 23397

Dear Sir:

Gruy Federal, Inc. is under Contract ET-78-C-08-1558 with the Division of Geothermal Energy, U. S. Department of Energy, to drill a series of bore holes along the Atlantic Coastal Plain from New Jersey to Florida. The sites have been, or will be, coordinated with the respective State Geological or Water Resources Boards and are under the overall coordination of Dr. J. K. Costain, Virginia Polytechnical Institute and State University, Blacksburg, Virginia.

The purpose of the drilling is to conduct a scientific geological study attempting to find sources of residual heat in the coastal bed rocks. Use of the site described below is critical to the study. The drilling was started at Fort Monmouth, N. J. and is continuing on the New Jersey coast at present.

Gruy Federal requests permission to drill, case and cement one heat gradient bore hole of 1,000' depth at the site described below:

Smithfield Quadrangle
Isle of Wight County, Va.
U. S. Department of Interior Geological Survey Map
Coordinates: N36° 54' 42"
W76° 42' 18"

Final site selection to be by mutual agreement between your representative and a representative of Gruy Federal.

An area of approximately one acre is required for the site during actual drilling operations for a period of about five days. Some soil disturbance will occur but will be restored to its original condition leaving only a 4' X 4' X 4' cement lined pit with a hinged steel cover on the site. The cover will be flush with the surface. The cased hole will be filled with fresh water. For one year following, scientists from the State, Virginia Polytechnical Institute, the U. S. Geological Survey and the U. S. Department of Energy, under Gruy Federal responsibility, will conduct heat gradient measurements of this water.

Gruy Federal shall be responsible and liable for accidents, injuries or damages arising from its operations. The site will be restored insofar as possible to its original condition, including resodding or replanting grass. On completion of the heat gradient tests, at your election the bore hole will be turned over to you for any use deemed appropriate or Gruy Federal will plug and abandon the hole in accordance with federal or state laws.

The Division of Geothermal Energy, Department of Energy, has made an Environmental Impact Assessment of Geothermal Drilling Activity, Coastal Plain and Piedmont Physiographic Provinces, Eastern United States dated December 1977. NEPA requirements for this action have been met by the Department of Energy and there are no anticipated atmospheric, ecological, environmental or historic site factors developing from this action. The assessment is on file with Mr. E. W. Ramsey, Director, Hydrologic Division, State Water Control Board, 2111 Hamilton St., Richmond, Va. Phone 804-257-0056.

Your cooperation and assistance in this research are sincerely appreciated. If you have any further questions concerning this matter, please call Mr. G. W. Duncan, Manager, Drilling and Resource Evaluation Division, Gruy Federal, Houston, Tx at AC 713-785-9200, collect.

If agreeable, you need only to countersign the original of this letter agreement and mail it to Mr. Duncan at our Houston office.

Respectfully yours,

W. Edward McCain

W. Edward McCain
Agent and Attorney-in-fact

Approved _____

'orm GW-2
1978-10,000

EXHIBIT II-2 32

COMMONWEALTH OF VIRGINIA
WATER WELL COMPLETION REPORT
• BWCM No. _____

(Certification of Completion/County Permit)

State Water Control Board
P. O. Box 11143
111 North Hamilton St.
Richmond, Va. 23230

SWCB Permit _____
County Permit _____

Certification of inspecting official:
This well does ____ does not ____
meet code/low requirements.
S. _____
Date _____
For Office Use

SMITHFIELD QUAD

County/City Stamp

• Virginia Plane Coordinates
_____ N
_____ E

Latitude & Longitude
36°54'30" N
76°42'09" W

• Topo. Map No. _____
• Elevation 70 ft.
• Formation _____
• Lithology _____
• River Basin _____
• Province _____
• Type Logs _____
• Cuttings EACH 10ft
• Water Analysis _____
• Aquifer Test _____

• Owner ISLE OF WIGHT
• Well Designation or Number SITE # 26
Address ISLE OF WIGHT, VIRGINIA 23397
Phone _____

• Drilling Contractor GRUY FEDERAL INC.
Address 2500 TANGLEWILDE #150 HOUSTON
Phone _____ TEXAS

Tax Map I.D. No. _____
Subdivision _____
Section _____
Block _____
Lot _____
Class Well: I _____, IIA _____
IIB _____, IIIA _____, IIIB _____

WELL LOCATION: 0.5 (feet/miles SW direction) of ROAD 10 ON ROAD 258
and _____ feet/miles _____ (direction) of _____
(If possible please include map showing location marked)

Date started 9/20/78 • Date completed 9/26/78 Type rig ROTARY

WELL DATA: New ✓ Reworked _____ Deepened _____
• Total depth 1018' ft.
• Depth to bedrock — ft.
• Hole size (Also include reamed zones)
• 7 7/8 inches from 0 to 1018 ft.
• _____ inches from _____ to _____ ft.
• _____ inches from _____ to _____ ft.
• Casing size (I.D.) and material
• 4 1/2 inches from 2 to 1014 ft.
Material _____
Wt. per foot _____ or wall thickness _____ in.
• _____ inches from _____ to _____ ft.
Material _____
Wt. per foot _____ or wall thickness _____ in.
• _____ inches from _____ to _____ ft.
Material _____
Wt. per foot _____ or wall thickness _____ in.
• Screen size and mesh for each zone (where applicable)
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• Gravel pack
• From _____ to _____ ft.
• From _____ to _____ ft.
• Grout
• From 2 to 1014 ft., Type CLASS A CEMENT
• From _____ to _____ ft., Type _____

2. WATER DATA • Water temperature _____ °F
• Static water level (unpumped level-measured) _____ ft
• Stabilized measured pumping water level _____ ft
• Stabilized yield _____ gpm after _____ hours
Natural Flow: Yes ____ No ____, flow rate: _____ g pm
Comment on quality _____

3. WATER ZONES: From _____ To _____
From _____ To _____ . From _____ To _____
From _____ To _____ . From _____ To _____

4. USE DATA:
Type of use: Drinking _____, Livestock Watering _____
Irrigation _____ Food processing _____, Household _____
Manufacturing _____, Fire safety ____, Cleaning _____
Recreation _____, Aesthetic ____, Cooling or heating _____
Injection ____, Other _____
• Type of facility: Domestic _____, Public water supply _____
Public institution _____, Farm _____, Industry _____
Commercial _____, Other _____

5. PUMP DATA: Type _____ • Rated H.P. _____
• Intake depth _____ • Capacity _____ at _____ head

6. WELLHEAD: Type well seal SEE FIGURE #4
Pressure tank _____ gal., Loc. _____
Sample tap _____, Measurement port _____
Well vent _____, Pressure relief valve _____
Gate valve _____, Check valve (when required) _____
Electrical disconnect switch on power supply _____

7. DISINFECTION: Well disinfected _____ yes _____ no
Date _____, Disinfectant used _____
Amount _____, Hours used _____

8. ABANDONMENT (where applicable) • yes ____ no ____
Casing pulled yes ____ no ____ not applicable _____
Plugging grout From _____ to _____ material _____

Owner _____

9. State law requires submitting to the Virginia State Water Control Board information about groundwater and wells for every well made in the State intended for water, or any other non-exempt well. This information must be submitted whether the well is completed, on standby, or abandoned. Information required includes: an accurately and completely prepared water well completion report, full data from any aquifer pumping tests, drill cuttings taken at ten foot intervals (unless exemption is secured), the results of any chemical analyses, and copies of any geophysical logs. Quarterly pumpage and use reports are required from owners of public supply and industrial wells. County or State permits to drill may be required in some parts of the state. Some counties require submission of a water well completion report. The Virginia State Health Department requires a water well completion report for public supply wells.

10. DRILLERS LOG (use additional Sheets if necessary)

DEPTH (feet) From	DEPTH (feet) To	TYPE OF ROCK OR SOIL (color, material, fossils, hardness, etc.)	REMARKS (water, caving, cavities, broken, core, shot, (etc.)	11. Drilling Time (Min.)
METERS				
0	64	silty fine sand		
64	95	fine-coarse sand		
95	125	glauconitic sand		
125	134	silty sand		
134	192	fine-coarse sand		
192	201	silty fine-med sand		
201	213	coarse-very coarse sand		
213	293	silty fine-coarse sand		
293	296	fine medium sand		

The descriptions of this well are unpublished. For more information call or write

Virginia Polytech Inst.
Geophysics Dept.
Dr. Joe Lambiase
(703) 961-6112

12. DIAGRAM OF WELL CONSTRUCTION (with dimensions)

State Water Control Board Regional Offices

Valley Reg. Off.
116 North Main Street
P. O. Box 268
Bridgewater, Va. 22812
703-828-2595

Piedmont Reg. Off.
4010 West Broad Street
P. O. Box 6616
Richmond, Va. 23230
804-257-1006

Southwest Reg. Off.
408 East Main Street
P. O. Box 476
Abingdon, Va. 24210
703-628-5183

Tidewater Reg. Off.
287 Pembroke Office Park
Suite 310 Pembroke No. 2
Va. Beach, Va. 23462
804-499-8742

West Central Reg. Off.
Executive Park
5306 A Peters Creek Road
Roanoke, Va. 24019
703-563-0354

Northern Virginia Reg. Off.
5515 Cherokee Avenue
Suite 404
Alexandria, Va. 22312
703-750-9111

13. Well lot dedicated? _____; Size _____ ft. X _____ ft.; Well house? _____
Distance to nearest pollutant source _____ ft., Type _____
Distance to nearest property line _____ ft., Building _____ ft.

14. I certify that the information contained herein is true and correct and that this well and/or system has been installed and constructed in accordance with the requirements for well construction as specified in compliance with appropriate county or independent city ordinances and the laws and rules of the Commonwealth of Virginia.

Signature Michael R. Glascock (Seal), Date FEB. 15, 1979
(Well driller or authorized person)

License No. _____

SITE-SPECIFIC ENVIRONMENTAL INFORMATION CHECKLIST

HEAT GRADIENT HOLES

ATLANTIC COASTAL PLAIN GEOTHERMAL TEST PROGRAM

Site No. 26 State VIR.

Location ISLE OF Wight, VIR.

A. GENERAL

1. Has federal, state and/or local environmental assessment been conducted previously for the proposed drill site? Yes____ No X If yes, provide a copy, if available.

2. Have all required permits, licenses, and/or agreements for the proposed drill site been obtained? Yes X No____ If no, explain. ____

3. Does the drill site fall within the habitat of rare or endangered species? Yes____ No X If yes, explain. EASTERN FLYWAY, but NO SPECIES OCCUPY THE AREA AT THE TEST SITE

4. Are known archeological sites, historic sites, prime or unique farmland, or natural landmarks within or visible from the site area? Yes____ No X If yes, explain. ____

5. Will casing left in the hole protect all ground water aquifers? Yes X No____ If no, explain. ____

6. Will a directional survey be conducted in the drill hole? Yes____ No X If yes, at what interval? ____feet. If no, explain. NOT NECESSARY FOR 1000' NONPRODUCING HOLE

7. Will expected continuous noise levels from site operations be 65 dBA or less at the nearest residence? Yes____ No X If no, explain.
EACH 8V-71 GMC ENGINE EQUIPPED WITH TWO 4" No SRV04-0196 MAXIM SILENCERS, MAXIMUM NOISE LEVEL 32dBA, 250 CENTER FREQUENCY, FOR RESIDENTIAL USE.

B. SITE CONSTRUCTION

1. Will additional land clearing be required for the drilling and data collection activities (e.g., preparation of drill pad, road construction, mud reserve pits, pipeline)? Yes____ No X If yes, describe.

2. Will the drill site and related roads be treated to minimize dust? Yes____ No X If no, explain. NOT NEEDED PAVED ROADS AND GRAVEL

3. Are portable sanitary facilities or an approved septic system to be used at the drill site? Yes X No____ If no, explain. ____

4. Will liquid and solid wastes be disposed in accordance with local regulations? Yes X No____ If no, explain. ____

5. Will erosion control be required for excavated areas? Yes____ No X If yes, explain. ____

6. Upon completion of proposed drilling and data collection activities, will the site be restored to as natural a condition as possible by regrading, filling, and reseeding? Yes X No____ If no, explain. ________

____

____

C. SAFETY

1. Will blowout preventers be used? Yes X No____ If no, explain.

____

____

____

2. Will fire extinguishers be located onsite? Yes X No____ If no, explain. ________________________________

____

3. Will engineering and mud logging personnel be onsite during drilling operations? Yes X No____ If no, explain. ________________

____

4. Does an emergency plan exist for evacuating personnel? Yes X No____ If no, explain. ________________________________

____

5. Will the drilling operations be conducted under a safety policy that ensures safe operating procedures and attention to job safety and health protection? Yes X No____ If no, explain. ________________

____

Completed from onsite inspection by:

Michael R. [signature]
Signature

Position: FIELD ENGINEER

____

Date: Sep. 17, 1978

SAFETY POLICY

1. The safety policies of Gruy Federal, Inc. are defined by the joint requirements of:
   a. the Occupational Safety and Health Act of 1970, as defined and enforced by the Occupational Safety and Health Administration (OSHA) of the Department of Labor with respect to job safety and health protection, and
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2. OSHA requirements are summarized in the 10" X 16" plastic laminated JOB SAFETY AND HEALTH PROTECTION sign, GPO: 1974 0 - 537-604; IADC procedures and inspection and report forms are summarized in the booklet Outline for Drilling Rig Safety Program, compiled by the IADC Safety Publications Subcommittee, revised 1976. Both of these documents are required to be displayed, reviewed at regular intervals by all supervisory personnel, and followed in concept and practice in all Gruy Federal operations involving job safety and health protection.

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4. In addition, all Gruy Federal field operations and all subcontractors and/or third party services to Gruy Federal field operations are required to maintain familiarity with and follow the recommended safe operating procedures and guidelines of the Accident Prevention Manual, IADC, revised edition, October, 1975.

5. The Gruy Federal Project Manager or his designated field representative shall have responsibility for maintaining these safety policies through:
   a. inspection of all equipment and materiel,
   b. inspection of personnel and equipment performance in safety drill or demonstration, upon request, and
   c. shutdown or exclusion from the job of any operation, materiel or personnel whose temporary condition or malfunction violates or jeopardizes the requirements of these safety policies.

February, 1978

Alan Lohse
Executive Vice President

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #26 - Isle of Wright

DATE September 20, 1978 COUNTY South Hampton STATE Virginia

REPORT NO. 1 REPORTED BY Radford/Smith

DEPTH -- PROGRESS --

ACTIVITY AT REPORT TIME Rig enroute from Dover AFB

TIME LOG FROM	TO	ELAPSED	OPERATIONS
			Rig enroute from Dover Air Force Base. Overnight vicinity of Fort Belvar. ETA rig - Isle of Wright - 1600 hours 9/20/78

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #26 - Isle of Wright

DATE September 21, 1978 COUNTY South Hampton STATE Virginia

REPORT NO. 2 REPORTED BY Radford/Smith

DEPTH PROGRESS

ACTIVITY AT REPORT TIME Moving to location

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0700	0600	23 hrs.	Moving. Rig on location at 1830 hours. Moving in other equipment. Rigging up Estimate speed this PM.

Rig 17

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022

WELL NO. #26 - Isle of Wright

DATE September 22,1978

COUNTY Southampton STATE Virginia

REPORT NO. 3

REPORTED BY Radford/Smith

DEPTH

PROGRESS

ACTIVITY AT REPORT TIME

TIME LOG FROM	TO	ELAPSED	OPERATIONS
0600	0600	24 hrs.	Moving in and rigging up. Truck with tools, mud materials, and pick-up with power swivel did not arrive at location. Had departed Snow Hills. Could not locate on road. Spud use delayed accordingly

Rig 17

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #26 - Isle of Wright

DATE September 23, 1978 COUNTY Southampton STATE Virginia

REPORT NO. 4 REPORTED BY Radford/Smith

DEPTH 350' PROGRESS 350'

ACTIVITY AT REPORT TIME Drilling

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0600	1530	9-1/2 hrs.	RU and change over to power swivel. Mount power swivel controls, change connection on hose to fit power swivel.
1530	1900	3-1/2	Drilling mouse hole and rat hole
1900	2200	3	Drill from 0 - 256'. First core point
2200	2230	.5	POH
2230	2300	.5	PU core barrel
2300	2330	.5	GIH with core barrel
2330	0100	1-1/2	Cored 265 - 281'
0100	0130	.5	POH with core barrel
0130	0300	1-1/2	LD and dress core barrel. 12 feet recovery
0300	0400	1	RIH with 7-7/8" bit
0400	0600	2	Drill 281 - 350'
	Total	24 hrs.	

Rig 17

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #26 - Isle of Wright

DATE September 27, 1978 COUNTY Southampton STATE Virginai

REPORT NO. 5 REPORTED BY Radford/Smith

DEPTH 978' PROGRESS 628'

ACTIVITY AT REPORT TIME RIH with core barrel

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0600	2200	16 hrs.	Drill from 350 - 885'
2200	2230	.5 hr.	Replace packing in centrifugal pumps
2230	0500	6-1/2 hrs.	Drill from 885 - 978'
0500	0600	1 hr.	Circulate and POH to core
	Total	24 hrs.	

Rig 17

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #26 - Isle of Wright

DATE September 25, 1978 COUNTY Southampton STATE Virginia

REPORT NO. 6 REPORTED BY Radford/Smith

DEPTH 1018' PROGRESS 43'

ACTIVITY AT REPORT TIME Preparing to move

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0600	0630	.5 hrs	PU core barrel
0630	0730	1	RIH with core barrel
0730	0900	1.5	Cored 978' - 1003'
0900	0930	.5	POH with core
0930	1030	1	L.D. core barrel. Recovered 15'. Dress core barrel
1030	1100	.5	RIH with 7-7/8 inch bit
1100	1200	1	Drill to 1018'
1200	1330	1.5	POH. L.D. drill pipe
1330	1430	1	RU to run 4-1/2 inch casing
1430	1630	2	Run 25 joints 4-1/2" casing. Tally 1014 feet
1630	1730	1	Cement with 275 sxs Halliburton light weight with 2 per cent calcium chloride mixed at 13.6 ppg. Bump plug 1000 psi
1730	1800	.5	RD Halliburton
1800	0600	12	R. D. Heading out trucks and change oil in engine
	Total	24 hrs	

(Rig 17)

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #26 - Isle of Wright

DATE September 26, 1978 COUNTY Southampton STATE Virginia

REPORT NO. 7 REPORTED BY Radford/Smith

DEPTH 1018' PROGRESS

ACTIVITY AT REPORT TIME Complete well

TIME LOG FROM	TO	ELAPSED	OPERATIONS
0600	0930	3.5 hrs.	Wait on moving hours for permit loads

Final Report - Moving to Site #25, City of Suffolk

October 3, 1978

OPERATIONS SUMMARY

OPERATOR : Gruy Federal
LEASE : Isle of Wright
WELL : No. #26
COUNTY : Isle of Wright, Virginia

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9/21/78 Report #1. Rig & equipment in route from Dover, Delaware to Isle of Wright, Virginia. Rig got on location last night @ 6:30 p.m. on 9-20-78. Part of the equipment is still in route.

9/22/78 Report #2. Activity at report time: RU. Operations last 24 hrs.: The reports still in process of moving equip. from Dover, Delaware to Isle of Wight #26 in Virginia.

9/23/78 Report #3. TD 350'. Activity at report time: Drlg. Operations last 24 hrs.: 11½ hrs. moving rig & RU. Changing over to power swivel. Change over controls, kelly hose unions. RU 1" hose for power swivel, hydraulic hoses. 3½ hrs. drlg. mouse hole & rate hole. 3 hrs. drld. to 256' @ 1st. core pt. ½ hr. POH for 1st. core. ½ hr. WIH w/core barrel. 2 hrs. coring from 256'-276'. ½ hr. POH w/core barrel #1. 1½ hrs. LD core barrel. Re-dressing core barrel. Had 12' recovery. 1 hr. GIH. 2 hrs. drlg. from 281'-350'.

9/24/78 Report #4. TD 350'. Activity at report time: Drlg. Operations last 24 hrs.: 16 hrs. drlg. from 350'-885'. ½ hr. shut down pack centrifugal charge pump. 6½ hrs. drlg. from 885'-995' to coring zone. 1 hr. POH to core.

9/25/78 Report #5. TD 1018'. Activity at report time: Preparing to move rig. Operations last 24 hrs.: ½ hr. PU core barrel. 1 hr. GIH w/core barrel. 1½ hrs. cored from 978'-1003'. ½ hr. POH w/core. Recovery 15'. 1 hr. LD core barrel. Re-dressed core barrel. ½ hr. GIH w/bit. 1 hr. drl. 20' & circ. hole. 1½ hrs. LD D.P. 1 hr. RU to run 4½" csg. 2 hrs. run 4½" csg. 25 jts. Pipe tally 1014'. 1 hr. cmt. 4½" csg. w/275 sks. of Halliburton lite wt. w/2% CaCl 13.6 ppg & 1.54 yield. ½ hr. RD Halliburton. 11 hrs. RD & loading on trucks. WO Monday morning to move rig @ 9:30.

III. Site No. 25, Suffolk, Virginia

A. Site Location

The location of Site No. 25, Suffolk, Virginia, heat flow measurement hole is shown on Figure 3-1, a section of USGS 7½' Quadrangle "Bowers Hill, Virginia". The coordinates of the drill site are longitude 75° 28' 45" W, latitude 36° 51' 01" N. The site, located in an abandoned Army Nike site, has a ground elevation of approximately 25 feet above sea level.

B. Lease/Letter Agreements, Permits, Licenses

Access to Site No. 25 was obtained by permission of the Superintendent of the Suffolk School Board by letter of agreement (Exhibit III-1). A Commonwealth of Virginia Certification of Completion permit was required and is shown in Exhibit III-2.

C. Environmental Information Survey

The environmental information checklist, supplementary information required for the "Environmental Assessment, Geothermal Exploratory Drilling Program, Eastern United States, Coastal Plains and Piedmont Provinces" (DOE/EA-0015) is shown in Exhibit III-3.

D. Drilling Activities

Drilling activities at Site No. 25, Suffolk, Virginia, began September 26, 1978 and were completed September 28, 1978. Figure 3-2, a schematic diagram of the completed hole, summarizes data for Site No. 25. The daily drilling reports are shown in Exhibit III-4 and Exhibit III-5 is an operations summary of Site No. 25.

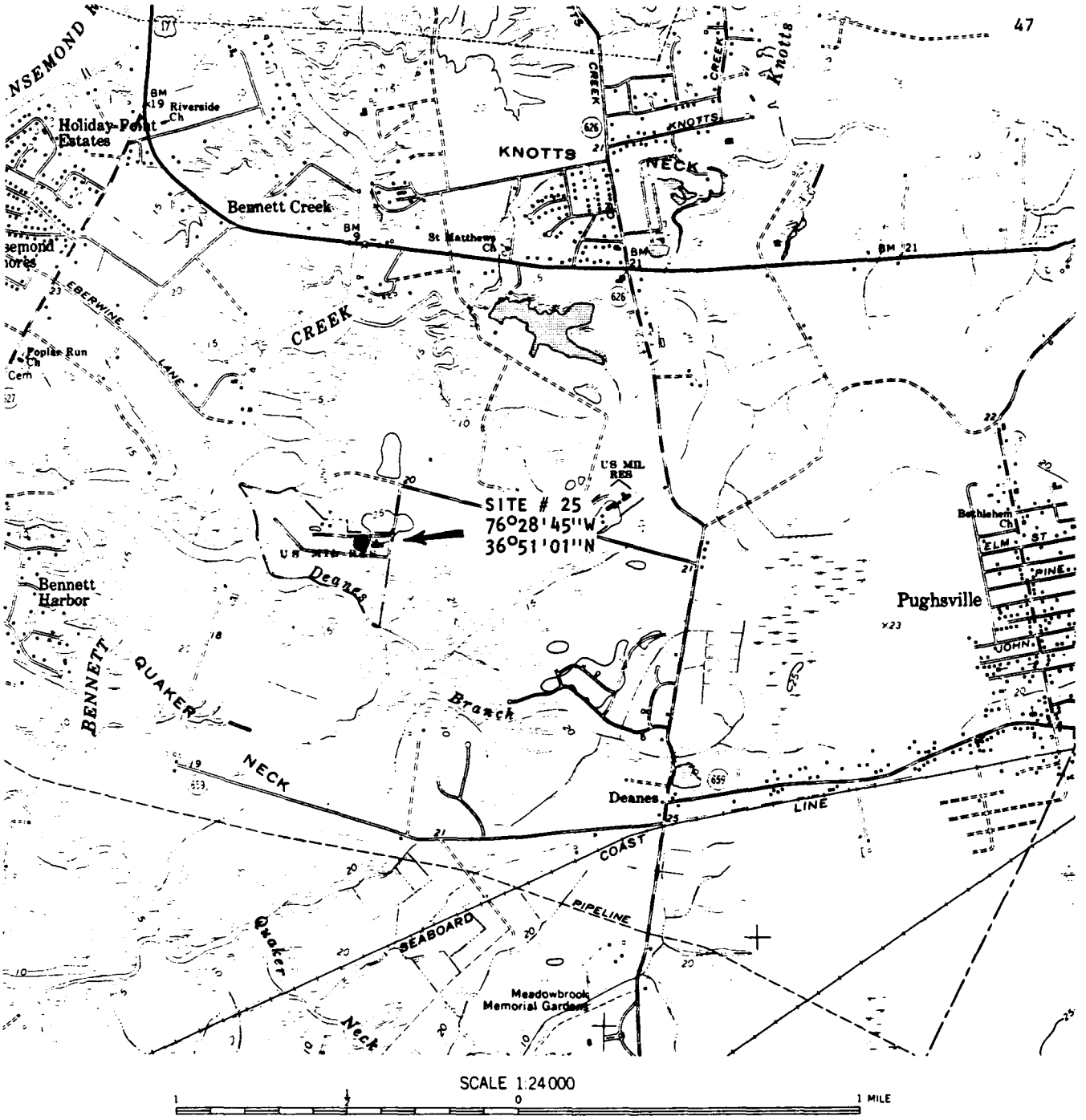


FIGURE 3-1 LOCATION SITE #25, SUFFOLK, VA.
LONGITUDE 76°28'25" W, LATITUDE 36°51'01" N

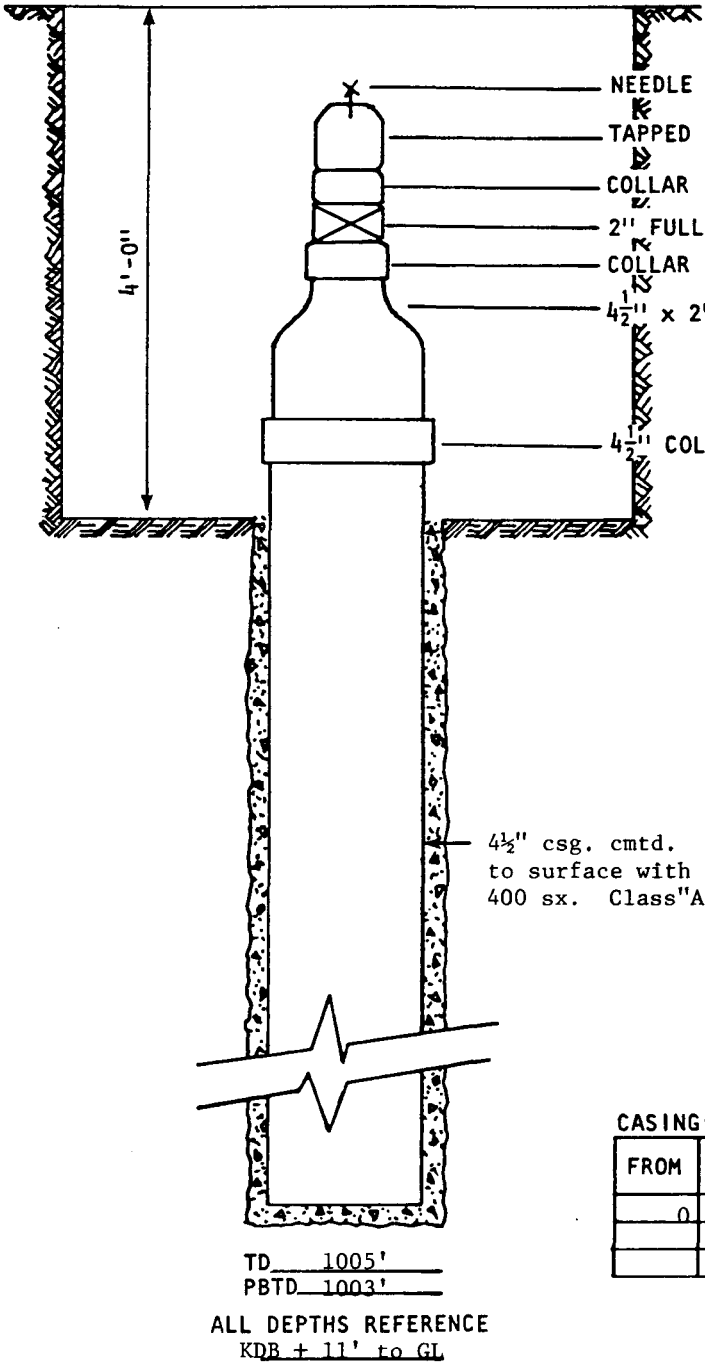
BOWERS HILL, VA.
SW/4 NEWPORT NEWS 15 QUADRANGLE
N3645—W7522.5/7.5

1965
PHOTOREVISED 1970
AMS 5757 IV SW—SERIES V834

GRUY FEDERAL, INC.

SITE NO. 25
WELL NAME City of Suffolk
LOCATION: LAT. 35°51'01" N
LONG. 76°28'45" W

RIG: Energy Service Company-Rig 17 COUNTY Suffolk STATE Virginia
DATE SPUDED: September 26, 1978 DATE COMPLETED: September 28, 1978



CORES:

NO.	FROM	TO	RECOVERY
1	339	364	0 feet
2	977	1002	13 feet

HOLE SIZE:

DEPTH		HOLE	CSG.	MUD*	
FROM	TO	SIZE IN.	SIZE IN.	VIS.	WT.
0	1005	7-7/8	4½	45	9.5

* approximate

CASING:

FROM	TO	SIZE IN.	WT #/FT	GRADE	THREAD	NO. JTS
0	1005	4½	9.5	J-55	ST&C	25

FIGURE 3-2 WELL SCHEMATIC WITH COMPLETION INFORMATION

Cores and cuttings taken from the hole during drilling were delivered to VPI&SU. No electric logs were run on this hole. Temperature logs were run by VPI&SU after the hole was cased; however, these data were not made available to Gruy.

E. Site Preparation, Layout and Cleanup

Prior to initiation of drilling at Suffolk, Virginia, the site area was almost level and had an ungroomed grass covering. For site preparation, a bulldozer dug two pits 35' long, 5' wide, and 4' deep. The 4' x 4' cellar was dug by hand 4' deep and boarded over. After the hole was completed, the wellhead was installed and an iron grate was placed over the cellar and locked. The mud pit was vacuumed and the site was backfilled and leveled.

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
703/979-2955

August 2, 1978

Mr. William F. Davis, Chairman
City of Suffolk, Virginia School Board
c/o Mr. Forrest L. Frazier, Superintendant
P. O. Box 1549
Suffolk, Virginia 23434

Dear Sir:

Gruy Federal, Inc. is under Contract ET-78-C-08-1558 with the Division of Geothermal Energy, U. S. Department of Energy, to drill a series of bore holes along the Atlantic Coastal Plain from New Jersey to Florida. The sites have been, or will be, coordinated with the respective State Geological or Water Resources Boards and are under the overall coordination of Dr. J. K. Costain, Virginia Polytechnical Institute and State University, Blacksburg, Virginia.

The purpose of the drilling is to conduct a scientific geological study attempting to find sources of residual heat in the coastal bed rocks. Use of the site described below is critical to the study. The drilling program was started at Fort Monmouth, N. J., and is continuing on the New Jersey coast at present.

Gruy Federal requests permission to drill, case and cement one heat gradient bore hole of 1,000' depth at a site described below:

Bowers Hill Quadrangle
City of Suffolk, Virginia
U. S. Department of Interior Geological Survey
Map Coordinates: N 36 Degrees, 51 Minutes, 00 Seconds
W 76 Degrees, 28 Minutes, 48 Seconds

Final site selection to be by mutual agreement between your representative and a representative of Gruy Federal.

An area of approximately one acre will be required for the site during actual drilling operations for a period of about five days. Some soil disturbace will occur but will be restored to its original condition, leaving only a 4' X 4' X 4' cement lined pit with a hinged steel cover on the site. The cover will be flush with the surface. The 1,000' cased hole will be filled with fresh water. For one year following, scientists from the State, Virginia Polytechnical Institute, the U. S. Geological survey and the U. S. Department of Energy, under Gruy Federal responsibility, will conduct heat gradient measurements of this water.

Gruy Federal shall be responsible and liable for accidents, injuries or damages arising from its operations. The site will be restored insofar as possible it its original condition, including resodding or replanting grass. At your election, on completing the heat gradient tests, the bore hole will be returned to you for any use deemed appropriate or Gruy Federal will plug and abandon the hole in accordance with federal and state laws.

The Division of Geothermal Energy, Department of Energy, has made an Environmental Impact Assessment of Geothermal Drilling Activity, Coastal Plain and Piedmont Physiographic Provinces, Eastern United States, dated December 1977. NEPA requirements for this action have been met by the Department of Energy and there are no anticipated atmospheric, ecological, environmental or historical site factors developing from this operation.

Your cooperation and assistance in this research are sincerely appreciated. If you have any further questions concerning this matter, please call Mr. G. W. Duncan, Manager, Drilling and Resource Evaluation Division, Houston, Texas at AC 703-785-9200, collect.

The City Manager and the Superintendant of Schools have been briefed on this matter.

If agreeable, you need only to countersign the original of this letter agreement and mail it to Mr. Duncan at our Houston office.

Respectfully yours,

W. Edward McCain

W. Edward McCain
Agent and Attorney-in-fact

Approved Jarvis H. Jones

Date 8/11/78

Suffolk Public Schools

POST OFFICE BOX 1549 - SUFFOLK, VIRGINIA 23434 - PHONE 804/539-8797

August 11, 1978

Gruy Federal, Inc.
2500 Tanglewilde, Suite 150
Houston, Texas 77063

Attention: Mr. G. W. Duncan

Dear Mr. Duncan:

The attached agreement is being signed with the understanding that your firm will provide a plan and/or procedures by which the owner could convert this 1000' shaft into a fresh water well. Also, it is understood that your firm would indicate where any equipment needed to make this conversion would be available and an approximate cost as of this date.

It would also be understood that your firm would indicate the various depths of the water veins and/or pockets located within the 1000' well.

Very truly yours,

Forrest L. Frazier, Superintendent

FLF:jc

Enclosure

AUG 14 1978

Form GW-2
1978-10,000

EXHIBIT III-2 53

COMMONWEALTH OF VIRGINIA
WATER WELL COMPLETION REPORT

• SWCM No. _____

(Certification of Completion/County Permit)

State Water Control Board
P. O. Box 11143
2111 North Hamilton St.
Richmond, Va. 23230

SWCB Permit _____
County Permit _____

Certification of inspecting official:
This well does _____ does not _____ meet code/low requirements.
S. _____
Date _____
For Office Use

BOWERS HILL QUAD

County/City Stamp

- Virginia Plane Coordinates
  _____ N
  _____ E
- Latitude & Longitude
  36°51'01" N
  76°28'45" W
- Topo. Map No. _____
- Elevation 25 ft.
- Formation _____
- Lithology _____
- River Basin _____
- Province _____
- Type Logs _____
- Cuttings each 10Ft
- Water Analysis _____
- Aquifer Test _____

• Owner SUFFOLK SCHOOL BOARD
• Well Designation or Number SITE #25
Address 510 NORTH MAIN ST. SUFFOLK, VIR. 23434
Phone _____

• Drilling Contractor GRUY FEDERAL INC.
Address 2500 TANGLEWILDE #150 HOUSTON TEXAS
Phone _____

Tax Map I.D. No. _____
Subdivision _____
Section _____
Block _____
Lot _____
Class Well: I _____, IIA _____, IIB _____, IIIA _____, IIIB _____

WELL LOCATION: 1.0 (~~feet~~/miles WEST direction) of ROAD 626 ON ROAD 757 and _____ feet/miles _____ (direction) of _____
(If possible please include map showing location marked)

Date started 9/26/78 • Date completed 9/28/78 Type rig ROTARY

WELL DATA: New ✓ Reworked _____ Deepened _____
- Total depth 1007 ft.
- Depth to bedrock — ft.
- Hole size (Also include reamed zones)
  - 7 7/8 inches from 0 to 1007 ft.
  - _____ inches from _____ to _____ ft.
  - _____ inches from _____ to _____ ft.
- Casing size (I.D.) and material
  - 4 1/2 inches from 2 to 1007 ft.
    Material _____
    Wt. per foot _____ or wall thickness _____ in.
  - _____ inches from _____ to _____ ft.
    Material _____
    Wt. per foot _____ or wall thickness _____ in.
  - _____ inches from _____ to _____ ft.
    Material _____
    Wt. per foot _____ or wall thickness _____ in.
- Screen size and mesh for each zone (where applicable)
  - _____ inches from _____ to _____ ft.
  - Mesh size _____ Type _____
  - _____ inches from _____ to _____ ft.
  - Mesh size _____ Type _____
  - _____ inches from _____ to _____ ft.
  - Mesh size _____ Type _____
  - _____ inches from _____ to _____ ft.
  - Mesh size _____ Type _____
- Gravel pack
  - From _____ to _____ ft.
  - From _____ to _____ ft.
- Grout
  - From 2 to 1007 ft., Type CLASS A CEMENT
  - From _____ to _____ ft., Type _____

2. WATER DATA • Water temperature _____ °F
- Static water level (unpumped level-measured) _____ ft.
- Stabilized measured pumping water level _____ ft.
- Stabilized yield _____ gpm after _____ hours
  Natural Flow: Yes _____ No _____, flow rate: _____ g pm
  Comment on quality _____

3. WATER ZONES: From _____ To _____
From _____ To _____ . From _____ To _____
From _____ To _____ . From _____ To _____

4. USE DATA:
Type of use: Drinking _____, Livestock Watering _____, Irrigation _____ Food processing _____, Household _____, Manufacturing _____, Fire safety _____, Cleaning _____, Recreation _____, Aesthetic _____, Cooling or heating _____, Injection _____, Other _____
- Type of facility: Domestic _____, Public water supply _____, Public institution _____ Farm _____, Industry _____, Commercial _____, Other _____

5. PUMP DATA: Type _____ • Rated H.P. _____
- Intake depth _____ • Capacity _____ at _____ head

6. WELLHEAD: Type well seal SEE FIGURE #4
Pressure tank _____ gal., Lcc. _____
Sample tap _____, Measurement port _____
Well vent _____, Pressure relief valve _____
Gate valve _____, Check valve (when required) _____
Electrical disconnect switch on power supply _____

7. DISINFECTION: Well disinfected _____ yes _____ no
Date _____, Disinfectant used _____
Amount _____, Hours used _____

8. ABANDONMENT (where applicable) • yes _____ no _____
Casing pulled yes _____ no _____ not applicable _____
Plugging grout From _____ to _____ material _____

Owner _____

9. State law requires submitting to the Virginia State Water Control Board information about groundwater and wells for every well made in the State intended for water, or any other non-exempt well. This information must be submitted whether the well is completed, on standby, or abandoned. Information required includes: an accurately and completely prepared water well completion report, full data from any aquifer pumping tests, drill cuttings taken at ten foot intervals (unless exemption is secured), the results of any chemical analyses, and copies of any geophysical logs. Quarterly pumpage and use reports are required from owners of public supply and industrial wells. County or State permits to drill may be required in some parts of the state. Some counties require submission of a water well completion report. The Virginia State Health Department requires a water well completion report for public supply wells.

10. DRILLERS LOG (use additional Sheets if necessary)				11.	12. DIAGRAM OF WELL CONSTRUCTION (with dimensions)
DEPTH (feet) From	To	TYPE OF ROCK OR SOIL (color, material, fossils, hardness, etc.)	REMARKS (water, caving, cavities, broken, core, shot, (etc.)	Drilling Time (Min.)	
METERS					
3	131	VERY FINE-MEDIUM GRAIN SAND			
131	134	MUDDY SILT			
134	296	VERY FINE- MEDIUM GRAIN SAND			
		THE DESCRIPTIONS OF THIS WELL ARE UNPUBLISHED. FOR MORE INFORMATION CALL OR WRITE			
		VIRGINIA POLYTECH INST. GEOPHYSICS DEPT. DR. JOE LAMBIASE (703) 961-6112			

State Water Control Board Regional Offices

Valley Reg. Off.
116 North Main Street
P. O. Box 268
Bridgewater, Va. 22812
703-828-2595

Piedmont Reg. Off.
4010 West Broad Street
P. O. Box 6616
Richmond, Va. 23230
804-257-1006

Southwest Reg. Off.
408 East Main Street
P. O. Box 476
Abingdon, Va. 24210
703-628-5183

Tidewater Reg. Off.
287 Pembroke Office Park
Suite 310 Pembroke No. 2
Va. Beach, Va. 23462
804-499-8742

West Central Reg. Off.
Executive Park
5306 A Peters Creek Road
Roanoke, Va. 24019
703-563-0354

Northern Virginia Reg. Off.
5515 Cherokee Avenue
Suite 404
Alexandria, Va. 22312
703-750-9111

13. Well lot dedicated? _____; Size _____ ft. X _____ ft.; Well house? _____
Distance to nearest pollutant source _____ ft., Type _____
Distance to nearest property line _____ ft., Building _____ ft.

14. I certify that the information contained herein is true and correct and that this well and/or system has been installed and constructed in accordance with the requirements for well construction as specified in compliance with appropriate county or independent city ordinances and the laws and rules of the Commonwealth of Virginia.

Signature Michael R. Glascock (Seal), Date FEB. 14, 1979
(Well driller or authorized person)

License No. _____

SITE-SPECIFIC ENVIRONMENTAL INFORMATION CHECKLIST
HEAT GRADIENT HOLES
ATLANTIC COASTAL PLAIN GEOTHERMAL TEST PROGRAM

Site No. 25 State VIR.

Location BENNETTS CREEK PARK AND NIKE SITE - SUFFOLK, VIR.

A. GENERAL

1. Has federal, state and/or local environmental assessment been conducted previously for the proposed drill site? Yes____ No X If yes, provide a copy, if available.

2. Have all required permits, licenses, and/or agreements for the proposed drill site been obtained? Yes X No____ If no, explain. ____

3. Does the drill site fall within the habitat of rare or endangered species? Yes____ No X If yes, explain. EASTERN ELYWAY BUT NO SPECIES OCCUPY THE AREA AT THE TEST SITE

4. Are known archeological sites, historic sites, prime or unique farmland, or natural landmarks within or visible from the site area? Yes____ No X If yes, explain. ____

5. Will casing left in the hole protect all ground water aquifers? Yes X No____ If no, explain. ____

6. Will a directional survey be conducted in the drill hole? Yes____ No X If yes, at what interval? ____ feet. If no, explain. NOT NECESSARY FOR 1000' NONPRODUCING HOLE

7. Will expected continuous noise levels from site operations be 65 dBA or less at the nearest residence? Yes____ No X If no, explain.
EACH 8V-71 GMC ENGINE EQUIPPED WITH TWO 4" NO. SRV04-0196 MAXIM SILENCERS; MAXIMUM NOISE LEVEL 32dBA, 250 CENTER FREQUENCY; FOR RESIDENTIAL USE.

B. SITE CONSTRUCTION

1. Will additional land clearing be required for the drilling and data collection activities (e.g., preparation of drill pad, road construction, mud reserve pits, pipeline)? Yes____ No X If yes, describe.

2. Will the drill site and related roads be treated to minimize dust? Yes____ No X If no, explain. NOT NEEDED PAVED ROADS

3. Are portable sanitary facilities or an approved septic system to be used at the drill site? Yes X No____ If no, explain. ____

4. Will liquid and solid wastes be disposed in accordance with local regulations? Yes X No____ If no, explain. ____

5. Will erosion control be required for excavated areas? Yes____ No X If yes, explain. ____

6. Upon completion of proposed drilling and data collection activities, will the site be restored to as natural a condition as possible by regrading, filling, and reseeding? Yes X No____ If no, explain. _____

C. SAFETY

1. Will blowout preventers be used? Yes X No____ If no, explain.

2. Will fire extinguishers be located onsite? Yes X No____ If no, explain. _____

3. Will engineering and mud logging personnel be onsite during drilling operations? Yes X No____ If no, explain. _____

4. Does an emergency plan exist for evacuating personnel? Yes X No____ If no, explain. _____

5. Will the drilling operations be conducted under a safety policy that ensures safe operating procedures and attention to job safety and health protection? Yes X No ? If no, explain. _____

Completed from onsite inspection by:

Michael K Wilcox
Signature

Position: Field Engineer

Date: Sep 18, 1979

SAFETY POLICY

1. The safety policies of Gruy Federal, Inc. are defined by the joint requirements of:
   a. the Occupational Safety and Health Act of 1970, as defined and enforced by the Occupational Safety and Health Administration (OSHA) of the Department of Labor with respect to job safety and health protection, and
   b. the safe operating procedures, inspection and training programs, and accident investigation forms of the International Association of Drilling Contractors, whether involving drilling rigs or other equipment.

2. OSHA requirements are summarized in the 10" X 16" plastic laminated JOB SAFETY AND HEALTH PROTECTION sign, GPO: 1974 0 - 537-604; IADC procedures and inspection and report forms are summarized in the booklet Outline for Drilling Rig Safety Program, compiled by the IADC Safety Publications Subcommittee, revised 1976. Both of these documents are required to be displayed, reviewed at regular intervals by all supervisory personnel, and followed in concept and practice in all Gruy Federal operations involving job safety and health protection.

3. All Gruy Federal subcontractors and/or third party services are required to maintain meaningful and effective safety programs that include scheduled training and drills for personnel, and scheduled maintenance and testing of safety equipment.

4. In addition, all Gruy Federal field operations and all subcontractors and/or third party services to Gruy Federal field operations are required to maintain familiarity with and follow the recommended safe operating procedures and guidelines of the Accident Prevention Manual, IADC, revised edition, October, 1975.

5. The Gruy Federal Project Manager or his designated field representative shall have responsibility for maintaining these safety policies through:
   a. inspection of all equipment and materiel,
   b. inspection of personnel and equipment performance in safety drill or demonstration, upon request, and
   c. shutdown or exclusion from the job of any operation, materiel or personnel whose temporary condition or malfunction violates or jeopardizes the requirements of these safety policies.

February, 1978

Alan Lohse
Executive Vice President

Rig 17

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. City of Suffolk #25

DATE September 26, 1978 COUNTY Suffolk STATE Virginia

REPORT NO. 1 REPORTED BY Radford/Smith

DEPTH 364' PROGRESS 364'

ACTIVITY AT REPORT TIME RIH with 7-7/8 inch bit

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0930	1130	2 hrs.	Moving rig from #26-#25
1130	1900	7-1/2	Rigging up
1900	2000	1	Drill mouse hole, lost mud, rebuild mud volume
2000	2030	.5	Drill 30'. Lost circulation
2030	2230	2	Hauling water and building mud volume
2230	2400	1.5	Drill from 30' to 318'
2400	0230	2-1/2	Shut down to work on swivel packing. Re-pack swivel. Drill to 339'
0230	0300	.5	POH for core #1
0300	0430	1-1/2	PU core barrel. Mix mud
0430	0500	.5	RIH with core barrel
0500	0530	.5	Core 339 - 364'
0530	0600	.5	POH with core barrel
	Total	20-1/2 hrs.	

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #25 - City of Suffolk

DATE September 27, 1978 COUNTY Suffolk STATE Virginia

REPORT NO. 2 REPORTED BY Radford/Smith

DEPTH 1007' PROGRESS 643'

ACTIVITY AT REPORT TIME Running 4-1/2" casing. Prepare to move to Oceana #23

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0600	0630	1/2 hr.	Lay down and dress core barrel
0630	0730	1 hr.	RIH and ream to bottom
0730	1630	9 hrs.	Drill from 364 to 977'
1630	1730	1	POH two stands. Pipe dragging. Ream back to bottom
1730	1830	1 hr.	Condition mud and circulate
1830	1930	1 hr.	POH with drill pipe for core #2
1930	2000	1/2 hr.	PU core barrel
2000	2030	1/2 hr.	RIH with core barrel
2030	2100	1/2 hr.	Coring 977 - 1022'
2100	2200	1 hr.	POH with core barrel
2200	2400	2 hrs.	Lay down core barrel and redress. 13 feet of recovery
2400	0200	2 hrs.	RIH with drill pipe. Ream core hole.
0200	0300	1 hr.	Drill 5 feet C & C hole
0300	0430	1-1/2 hrs.	C & C hole
0430	0600	1-1/2 hrs.	Lay down drill pipe
		24 hrs.	Location on pipe rack. Start in the hole

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #25 - City of Suffolk

DATE September 28, 1978 COUNTY Suffolk STATE Virginia

REPORT NO. 3 REPORTED BY Radford/Smith

DEPTH 1007' PROGRESS --

ACTIVITY AT REPORT TIME Well complete - Final report

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0600	0830	2-1/2 hrs.	Finish running 4-1/2" casing 25 joints. Tally 996 feet. Set at 1007 feet.
0830	1000	1-1/2 hrs	Wash down last two joints casing. C & C mud before cementing.
1000	1100	1 hr.	Cemented with 400 sacks class "A" cement. Bump plug with 1000 psi
1100	1300	2 hrs.	RD and load out
		7 hrs.	

1300 hours - Move rig off location

Well complete

Final Report

(move to #23 - Oceana Naval Air Station)

October 3, 1978

OPERATIONS SUMMARY

OPERATOR : Gruy Federal
LEASE : Suffolk
WELL : No. 5
COUNTY : Suffolk, Virginia

****

9/26/78 Report #1. TD 364'. Activity at report time: GIH w/7-7/8" bit. Operations last 24 hrs.: 3½ hrs. WO time to move which is 9:30 by State Laws on heavy equipment. 2½ hrs. moving rig. 7½ hr. RU. 1 hr. drl. mouse hole. ½ hr. drl. 30' lost circ. 2 hrs. bldg. mud volume back up. 1½ hrs. drl. from 30'-318'. 2½ hrs. drlg. & re-packing swivel. Drld. to 339'. ½ hr. POH for 1st. core. 1½ hrs. PU core barrel & re-build mud volume again lost circ. ½ hr. WIH w/core barrel. ½ hr. cored from 339'-364'. ½ hr. POH w/core barrel. No recovery. Lost circ. during whole job. Had to mix mud 4 different times to build mud volume back up.

9/27/78 Report #2. TD 1007'. Activity at report time: ½ hr. LD core barrel & re-dressed. 1 hr. GIH & reamed to btm. 9 hrs. drl. from 364'-977'. 1 hr. POH w/2 stands & work pipe back to btm. Pipe was hanging up. Hole had caved in so we stopped & pulled out a couple of jts., then mudded back up. 1 hr. circ. & build up mud viscosity. 1 hr. POH for core #2. ½ hr. PU core barrel. ½ hr. GIH w/core barrel. ½ hr. cored from 977'-1002'. 1 hr. POH w/core barrel. 2 hrs. LD core barrel & re-dressed core barrel. Had 13' recovery. 2 hrs. GIH w/D.P. & reamed to btm. Drld. 5' rat hole. 1 hr. circ. Build mud back up & cond. hole. 1½ hrs. LD D.P. 1½ hrs. load csg. on racks & tally. Start in hole w/4½" csg.

9/28/78 Report #3. TD 1007'. Elapsed time: 2½ hrs. run to finish running 4½" csg. Run 25 jts. 2 hrs. washed down last 2 jts. & circ. & cond. hole. 1 hr. cmt. 4½" csg. w/400 sks. Class "A" 14.6 ppg 1.18 yield, no additives in cmt. 2 hrs. bump plug w/1000# press. Start RD, 2 hrs. 3 hrs. moving rig from Suffolk #25 to Oceana Naval Air Force Base #23. 4 hrs. RU & shut down during the night. Did not have any way to get water, tore up vacuum truck on way to location.

IV. Site No. 23, Oceana Naval Air Station, Virginia

A. Site Location

The location of Site No. 23, Oceana NAS, Virginia, heat flow measurement hole is shown on Figure 4-1, a section of USGS 7½' Quadrangle "Princess Ann, Virginia". The coordinates of the drill site are longitude 76° 02' 38" W, latitude 36° 48' 08" N. The site, located on the Naval Air Station, has a ground elevation of approximately 17 feet above sea level.

B. Lease/Letter Agreements, Permits, Licenses

Access to Site No. 23 was obtained by permission of the Commanding Officer of the Naval Air Station by letter agreement (Exhibit IV-1). A Commonwealth of Virginia Certification of Completion permit was required and is shown in Exhibit IV-2.

C. Environmental Information Survey

The environmental information checklist, supplementary information required for the "Environmental Assessment, Geothermal Exploratory Drilling Program, Eastern United States, Coastal Plains and Piedmont Provinces (DOE/EA-0015) is shown in Exhibit IV-3.

D. Drilling Activities

Drilling activities at Site No. 23, Oceana NAS, Virginia, began September 28, 1978 and were completed October 1, 1978. Figure 4-2, a schematic diagram of the completed hole, summarizes data for Site No. 23. The daily drilling reports are shown in Exhibit IV-4 and Exhibit IV-5 is an operations summary of Site No. 23. Cores and

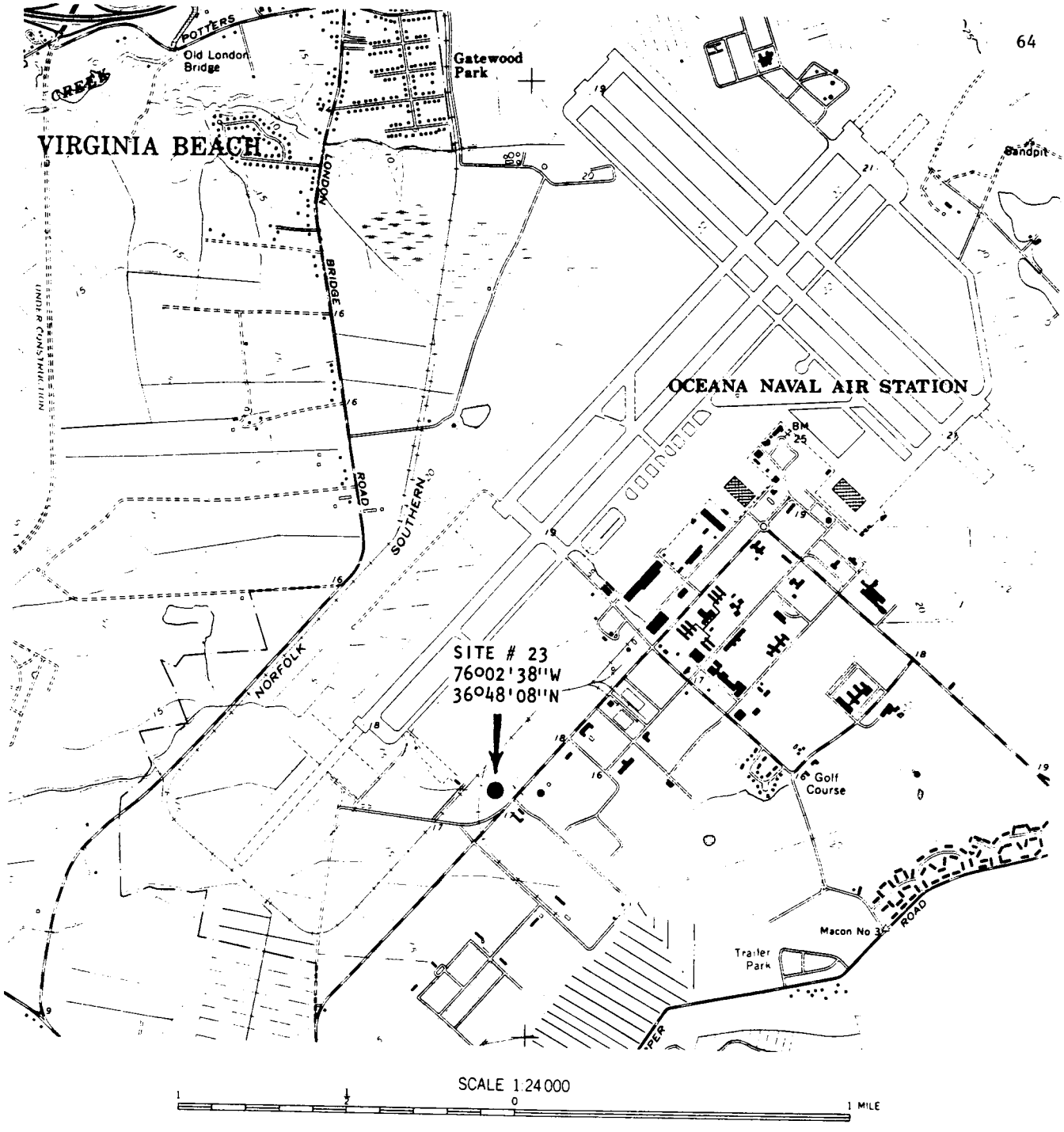


FIGURE 4-1 LOCATION SITE #23, OCEANA NAS, VA.
LONGITUDE 76°02'38" W, LATITUDE 38°48'08" N

PRINCESS ANNE, VA.

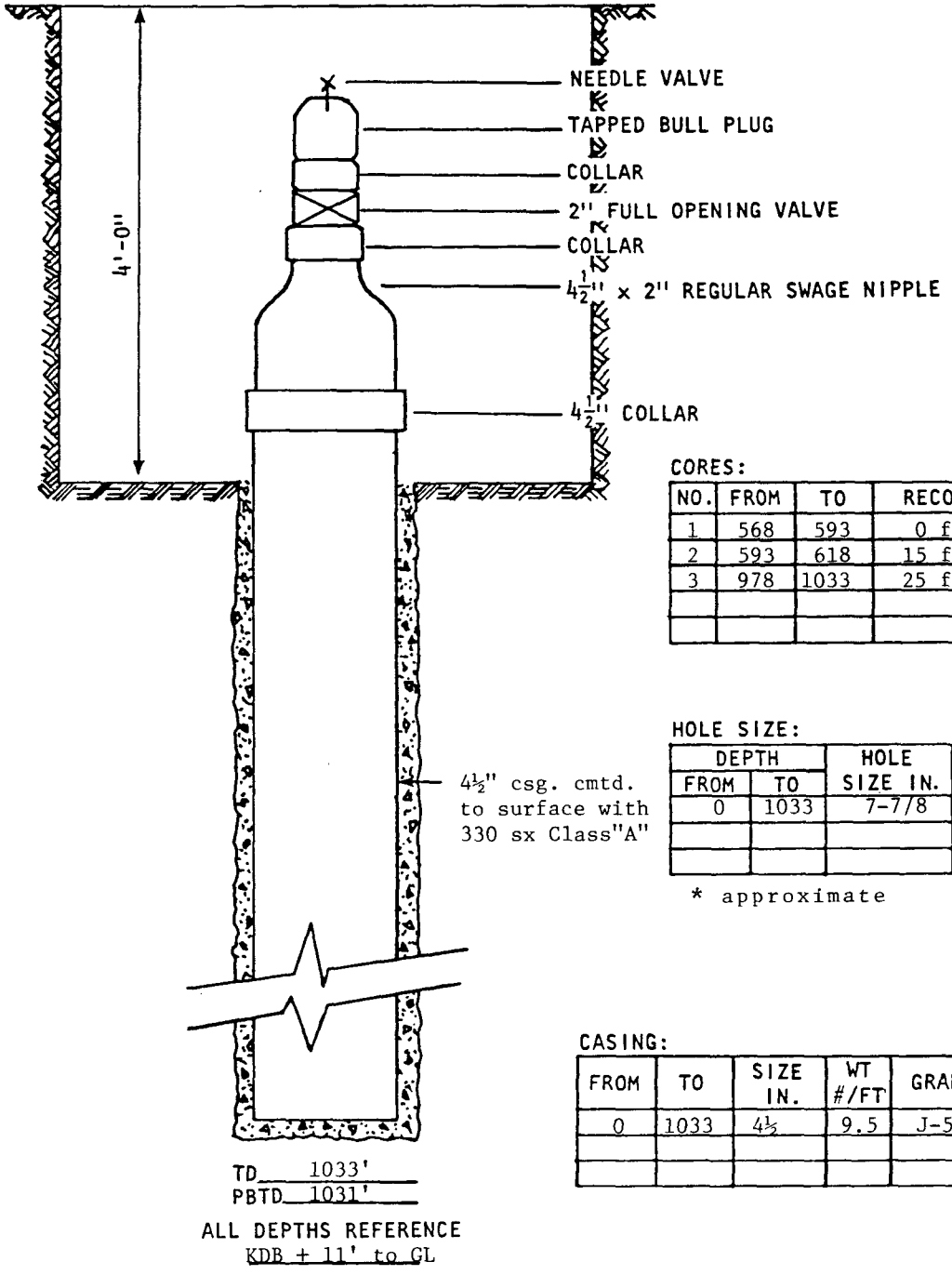
N3645—W7600/7.5

1965
PHOTOREVISED 1970 AND 1973
AMS 5757 I SE—SERIES V834

GRUY FEDERAL, INC.

SITE NO. 23
WELL NAME Oceana Naval Air Station
LOCATION: LAT. 36°48'08" N
LONG. 76°02'38" W

RIG: Energy Service Company-Rig 17 COUNTY Virginia Beach STATE Virginia
DATE SPUDED: September 29, 1978 DATE COMPLETED: September 30, 1978



CORES:

NO.	FROM	TO	RECOVERY
1	568	593	0 feet
2	593	618	15 feet
3	978	1033	25 feet

HOLE SIZE:

DEPTH		HOLE	CSG.	MUD*	
FROM	TO	SIZE IN.	SIZE IN.	VIS.	WT.
0	1033	7-7/8	4½	45	9.5

* approximate

CASING:

FROM	TO	SIZE IN.	WT #/FT	GRADE	THREAD	NO. JTS
0	1033	4½	9.5	J-55	ST&C	26

FIGURE 4-2 WELL SCHEMATIC WITH COMPLETION INFORMATION

cuttings taken from the hole during drilling were delivered to VPI&SU. No electric logs were run on this hole. Temperature logs were run by VPI&SU after the hole was cased, however these data were not made available to Gruy.

E. Site Preparation, Layout and Cleanup

Prior to initiation of drilling at Oceana NAS, Virginia, the site area was almost level and had an ungroomed grass covering. For site preparation, a bulldozer dug two pits 35' long, 5' wide, and 4' deep. The 4' x 4' cellar was dug by hand 4' deep and boarded over. After the hole was completed, the wellhead was installed and an iron grate was placed over the cellar and locked. The mud pit was vacuumed and the site was backfilled and leveled.

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
703/979-2955

August 17, 1978

Commanding Officer
Naval Air Station Oceana
Department of the Navy
Virginia Beach, Virginia 23460

Dear Sir:

Gruy Federal, Incorporated is under contract ET-78-C-08-1558 with the Division of Geothermal Energy, U.S. Department of Energy, to drill a series of bore holes along the Atlantic Coastal Plain from New Jersey to Florida. The sites have been, or will be, coordinated with the respective State Geological or Water Resources Branch and are under the overall coordination of Dr. T. K. Costain, Virginia Polytechnical Institute and State University, Blacksburg, Virginia.

The purpose of the drilling is to conduct a scientific geothermal study attempting to find sources of residual usable heat in the coastal bed rocks. Use of the site described below is critical to the study.

Gruy Federal, Incorporated requests issuance of a license of non-federal use of real property to drill, case and cement one heat gradient bore hole of 1,000' depth on the following described site; the license to expire no later than 1 November 1979:

Geographic Coordinates: N36° 48' 08"
W76° 02' 36"

This is an area adjacent to the Navy spur railroad line to a magazine area locally known as the "Contractor's Area." It is just off Station London Bridge Road about 4,500' northeast of the Back Gate. Station road usage will be confined to the stretch of London Bridge Road from the Back Gate to the drill site. See enclosure (1) for site location and road usage as posted in red on the map of the Master Shore Station Development Plan.

Final site selection to be by mutual agreement between your representative and a representative of Gruy Federal.

An area of approximately one acre will be required for the site during actual drilling operations for a period of about five 24 hour days. Some soil disturbance will occur but will be restored to its original condition leaving only a 4'x4'x4' cement lined pit with a hinged steel cover on the site. The cover will be flush with the surface. The 1,000' cased hole will be filled with fresh water. For approximately one year following, scientists from the

State, Virginia Polytechnical Institute, the U.S. Geological Survey and the U.S. Department of Energy, under Gruy Federal responsibility, will conduct heat gradient measurements of this water.

Gruy Federal shall be responsible for accidents, injuries or damages, including roads and streets, arising from its operations. Gruy Federal agrees to conform to all security, safety, traffic and other applicable Naval regulations while performing the drilling and testing of the heat gradient hole. The site will be restored insofar as possible to its original condition, including resodding or reseeding grass. At your election, upon completion of the heat gradient tests, the bore hole will be returned to you for any use deemed appropriate or Gruy Federal will plug and abandon the hole in accordance with federal and state laws.

Gruy Federal will provide its Certificate of Insurance for this license in accordance with Item 9, License for Non-federal Use of Real Property.

The Division of Geothermal Energy, Department of Energy has made an Environmental Impact Assessment of Geothermal Drilling Activity, Coastal Plain and Piedmont Physiographic Provinces, Eastern United States. NEPA requirements for this action have been met and there are no anticipated atmospheric, ecological, environmental or historical site factors developing from this operation. A site-specific assessment is attached (Enclosure (2)).

The Station Public Works office has been briefed on this matter. If you have further questions, please call Mr. G. W. Duncan; Manager, Drilling and Resources Evaluation Division; Gruy Federal; Houston, Texas, at AC 713/785-9200.

If agreeable, please indicate your approval to Mr. A. R. Young; Director, Real Estate Division; Atlantic Division; Naval Facilities Command, Code 2414; Norfolk, Virginia 23511.

Your cooperation and assistance in this research are sincerely appreciated.

Respectfully yours,

W. Edward McCain

W. EDWARD McCAIN
Agent and Attorney-in-Fact

DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
VIRGINIA BEACH, VIRGINIA 23460

IN REPLY REFER TO:

NAS:RAP
11011
Ser 183P/2088
20 SEP 1978

Mr. W. Edward McCain
Gruy Federal, Inc.
Suite 500
1911 Jefferson Davis Highway
Arlington, Virginia 22202

Dear Mr. McCain:

A fully executed copy of Navy License LO-3(78) for the use of U. S. Government property at the Naval Air Station Oceana is forwarded for your records.

Sincerely,

D. O. MICHAELS
Captain, U. S. Navy
Commanding Officer

Enclosure

LICENSE FOR NONFEDERAL USE OF REAL PROPERTY
NAVFAC 11011/29 (6-75) *(Supersedes NavDocks 2260)*

THIS LICENSE TO USE THE U.S. GOVERNMENT PROPERTY HEREIN DESCRIBED IS ISSUED BY THE DEPARTMENT OF THE NAVY TO THE LICENSEE NAMED BELOW FOR THE PURPOSE HEREIN SPECIFIED UPON THE TERMS AND CONDITIONS SET FORTH BELOW AND THE GENERAL PROVISIONS ON THE REVERSE SIDE HEREOF. BY THE EXECUTION HEREOF THE LICENSEE AGREES TO COMPLY WITH ALL SUCH TERMS, CONDITIONS AND GENERAL PROVISIONS.

LICENSE NUMBER: LO-3(78)

1. NAVAL ACTIVITY *(Property location)*
NAVAL AIR STATION OCEANA
VIRGINIA BEACH, VA 23460

2. DATES COVERED *(Inclusive)*
FROM TO 1 NOVEMBER 1979

3. DESCRIPTION OF PROPERTY *(Include room and building numbers where appropriate)*
Geographic Coordinates: N36° 48' 08" and W76° 02' 36". This area is adjacent to the Navy railroad, locally known as "Contracting Area"
See attached Drawing - Exhibit "A"

4. PURPOSE OF LICENSE
To drill, case and cement one heat gradient bore hole of 1000 feet depth, to conduct a scientific geothermal study for the U. S. Department of Energy.

5. LICENSOR
UNITED STATES OF AMERICA
DEPARTMENT OF THE NAVY

5a. LOCAL REPRESENTATIVE, DEPT. OF NAVY OFFICIAL *(Title and address)*
Commanding Officer
Naval Air Station Oceana, Virginia Beach, Virginia

6. LICENSEE *(Name and address)*
Gruy Federal, Inc. 2500 Tanglewilde, Suite 150, Houston, Texas 77063

6a. LOCAL REPRESENTATIVE *(Name and address)*
W. Edward McCain, 1911 Jefferson Hwy., Suite 500, Arlington, VA 22202

7. CASH PAYMENT BY LICENSEE (Payable in advance)
(If no cash payment is required, enter "None" under item 7a "Amount")

a. AMOUNT *(Each payment)*	b. FREQUENCY PAYMENTS DUE	c. FIRST DUE DATE	d. TO *(Title and address of local representative of the Government)*
NONE			

8. DEPOSIT FOR UTILITIES AND SERVICES (Payable in advance)
(If no cash payment is required, enter "None" under item 8a "Amount")

a. AMOUNT *(Each deposit)*	b. FREQUENCY PAYMENTS DUE	c. FIRST DUE DATE	d. TO *(Mailing address)*
NONE			

9. INSURANCE REQUIRED AT EXPENSE OF LICENSEE
(If any or all insurance requirements have been waived, enter "None" in a,b,c, or d as appropriate)

TYPE	MINIMUM AMOUNT	TYPE	MINIMUM AMOUNT
a. FIRE AND EXTENDED COVERAGE	$ NONE	c. THIRD PARTY PERSONAL INJURY PER PERSON	$ 100,000
b. THIRD PARTY PROPERTY DAMAGE	$ 25,000	d. THIRD PARTY PERSONAL INJURY PER ACCIDENT	$ 300,000

10. GENERAL PROVISIONS *(See Reverse Side)*

11. EXECUTION OF LICENSE

FOR	BY NAME AND TITLE *(Typed)*	BY SIGNATURE	DATE
DEPARTMENT OF THE NAVY	Commanding Officer	D. J. Richard	
LICENSEE	Gruy Federal, Inc.	R. N. Lane	Sept 6, 1978

If Licensee is a Corporation, Certification of signature is attached ☐

Enclosure (1) to NAS Oceana ltr
NAS:RAP 11000 Ser 183P/_____ of
_____ SEP, 1978

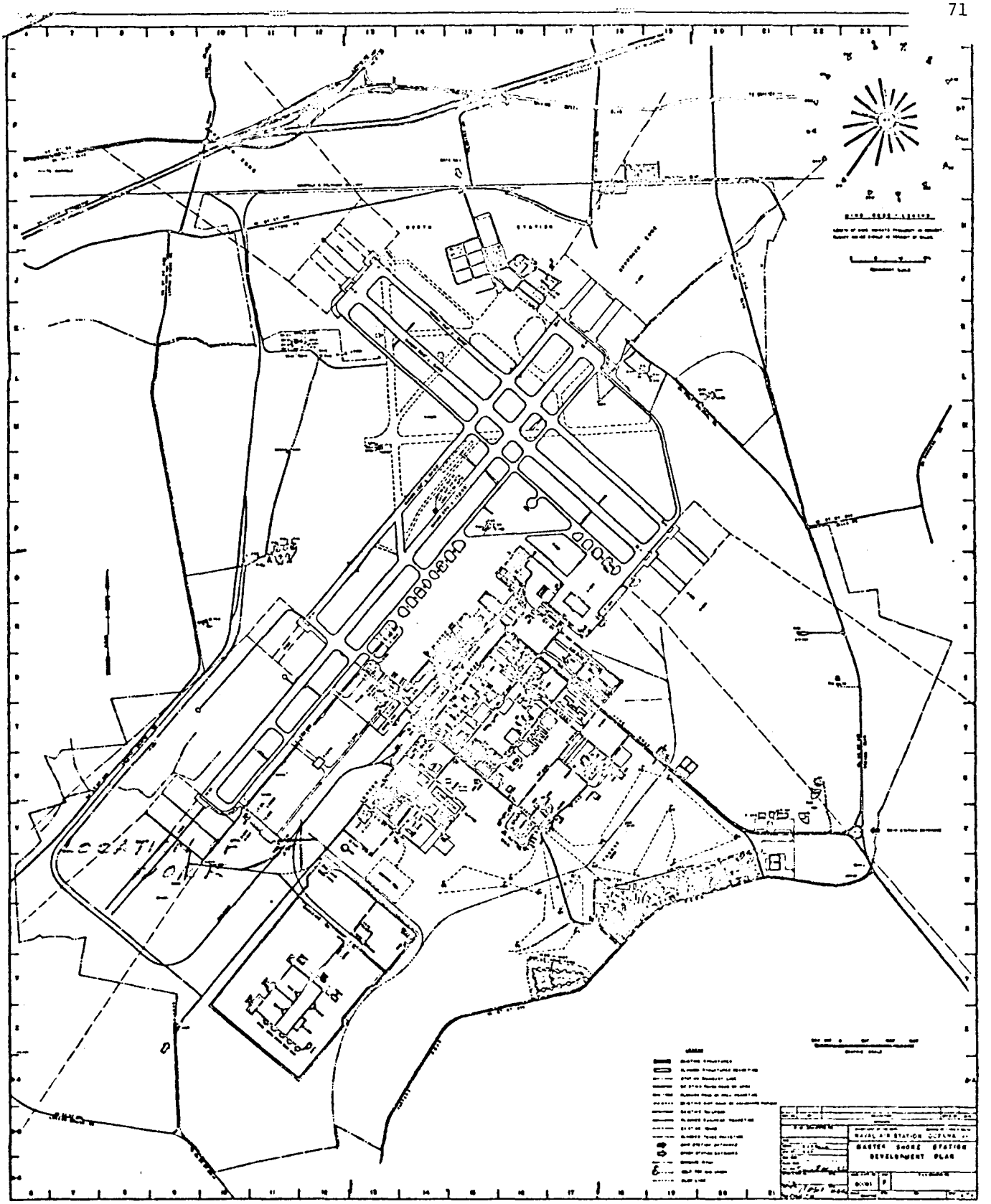


EXHIBIT A

Form GW-2
1978-10,000

EXHIBIT IV-2 72

COMMONWEALTH OF VIRGINIA
WATER WELL COMPLETION REPORT
(Certification of Completion/County Permit)

• BWCM No. _____

State Water Control Board
P. O. Box 11143
2111 North Hamilton St.
Richmond, Va. 23230

SWCB Permit _____
County Permit _____

Certification of inspecting official:
This well does _____ does not _____
meet code/low requirements.
S. _____
Date _____
For Office Use

PRINCESS ANNE QUAD

County/City Stamp

• Virginia Plane Coordinates
_____ N
_____ E
Latitude & Longitude
36° 48' 08" N
76° 02' 38" W
• Topo. Map No. _____
• Elevation 17 ft.
• Formation _____
• Lithology _____
• River Basin _____
• Province _____
• Type Logs _____
• Cuttings EACH 10 FT.
• Water Analysis _____
• Aquifer Test _____

• Owner DEPARTMENT OF THE NAVY
• Well Designation or Number SITE # 23
Address NAVAL AIR STATION OCEANA, VIR. BEACH, VIR.
Phone 23460

• Drilling Contractor GRUY FEDERAL INC.
Address 2500 TANGLEWILDE #150 HOUSTON
Phone TEXAS

Tax Map I.D. No. _____
Subdivision _____
Section _____
Block _____
Lot _____
Class Well: I _____, IIA _____
IIB _____, IIIA _____, IIIB _____

WELL LOCATION: _____ (feet/miles _____ direction) of _____
and _____ feet/miles _____ (direction) of _____
(If possible please include map showing location marked)

Date started 9/28/78 • Date completed 10/1/78 Type rig ROTARY

1. WELL DATA: New ✓ Reworked _____ Deepened _____
• Total depth 1033' ft.
• Depth to bedrock — ft.
• Hole size (Also include reamed zones)
• 7 7/8 inches from 0 to 1033 ft.
• _____ inches from _____ to _____ ft.
• _____ inches from _____ to _____ ft.
• Casing size (I.D.) and material
• 4 1/2 inches from 2 to 1033 ft.
Material _____
Wt. per foot _____ or wall thickness _____ in.
• _____ inches from _____ to _____ ft.
Material _____
Wt. per foot _____ or wall thickness _____ in.
• _____ inches from _____ to _____ ft.
Material _____
Wt. per foot _____ or wall thickness _____ in.
• Screen size and mesh for each zone (where applicable)
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• _____ inches from _____ to _____ ft.
• Mesh size _____ Type _____
• Gravel pack
• From _____ to _____ ft.
• From _____ to _____ ft
• Grout
• From 2 to 1033 ft., Type CLASS A CEMENT
• From _____ to _____ ft., Type _____

2. WATER DATA • Water temperature _____ °F
• Static water level (unpumped level-measured) _____ ft
• Stabilized measured pumping water level _____ ft
• Stabilized yield _____ gpm after _____ hours
Natural Flow: Yes _____ No _____, flow rate: _____ g pm
Comment on quality _____

3. WATER ZONES: From _____ To _____
From _____ To _____ . From _____ To _____
From _____ To _____ . From _____ To _____

4. USE DATA:
Type of use: Drinking _____, Livestock Watering _____
Irrigation _____ Food processing _____, Household _____
Manufacturing _____, Fire safety _____, Cleaning _____
Recreation _____, Aesthetic _____, Cooling or heating _____
Injection _____, Other _____
• Type of facility: Domestic _____, Public water supply _____
Public institution _____ Farm _____, Industry _____
Commercial _____, Other _____

5. PUMP DATA: Type _____ • Rated H.P. _____
• Intake depth _____ • Capacity _____ at _____ head

6. WELLHEAD: Type well seal SEE FIGURE 4
Pressure tank _____ gal., Loc. _____
Sample tap _____, Measurement port _____
Well vent _____, Pressure relief valve _____
Gate valve _____, Check valve (when required) _____
Electrical disconnect switch on power supply _____

7. DISINFECTION: Well disinfected _____ yes _____ no
Date _____, Disinfectant used _____
Amount _____, Hours used _____

8. ABANDONMENT (where applicable) • yes _____ no _____
Casing pulled yes _____ no _____ not applicable _____
Plugging grout From _____ to _____ material _____

Owner _____

9. State law requires submitting to the Virginia State Water Control Board information about groundwater and wells for every well made in the State intended for water, or any other non-exempt well. This information must be submitted whether the well is completed, on standby, or abandoned. Information required includes: an accurately and completely prepared water well completion report, full data from any aquifer pumping tests, drill cuttings taken at ten foot intervals (unless exemption is secured), the results of any chemical analyses, and copies of any geophysical logs. Quarterly pumpage and use reports are required from owners of public supply and industrial wells. County or State permits to drill may be required in some parts of the state. Some counties require submission of a water well completion report. The Virginia State Health Department requires a water well completion report for public supply wells.

10. DRILLERS LOG (use additional Sheets if necessary)				11.	12. DIAGRAM OF WELL CONSTRUCTION (with dimensions)
DEPTH (feet)		TYPE OF ROCK OR SOIL	REMARKS	Drilling Time (Min.)	
From	To	(color, material, fossils, hardness, etc.)	(water, caving, cavities, broken, core, shot, (etc.)		
		The descriptions of this well are unpublished. For information call or write Virginia Polytech Inst. Geophysics Dept. Dr. Joe Lambiase (703) 961-6112			

State Water Control Board Regional Offices

Valley Reg. Off.
116 North Main Street
P. O. Box 268
Bridgewater, Va. 22812
703-828-2595

Piedmont Reg. Off.
4010 West Broad Street
P. O. Box 6616
Richmond, Va. 23230
804-257-1006

Southwest Reg. Off.
408 East Main Street
P. O. Box 476
Abingdon, Va. 24210
703-628-5183

Tidewater Reg. Off.
287 Pembroke Office Park
Suite 310 Pembroke No. 2
Va. Beach, Va. 23462
804-499-8742

West Central Reg. Off.
Executive Park
5306 A Peters Creek Road
Roanoke, Va. 24019
703-563-0354

Northern Virginia Reg. Off.
5515 Cherokee Avenue
Suite 404
Alexandria, Va. 22312
703-750-9111

13. Well lot dedicated? _____; Size _____ ft. X _____ ft.; Well house? _____
Distance to nearest pollutant source _____ ft., Type _____
Distance to nearest property line _____ ft., Building _____ ft.

14. I certify that the information contained herein is true and correct and that this well and/or system has been installed and constructed in accordance with the requirements for well construction as specified in compliance with appropriate county or independent city ordinances and the laws and rules of the Commonwealth of Virginia.

Signature Michael R. Glascock (Seal), Date FEB 16, 1979
(Well driller or authorized person)

License No. _____

SITE-SPECIFIC ENVIRONMENTAL INFORMATION CHECKLIST

HEAT GRADIENT HOLES

ATLANTIC COASTAL PLAIN GEOTHERMAL TEST PROGRAM

Site No. 23 State VIR.

Location OCEANA NAVAL AIR STATION
VIRGINIA BEACH, VIRGINIA

A. GENERAL

1. Has federal, state and/or local environmental assessment been conducted previously for the proposed drill site? Yes____ No X If yes, provide a copy, if available.

2. Have all required permits, licenses, and/or agreements for the proposed drill site been obtained? Yes X No____ If no, explain. ____

3. Does the drill site fall within the habitat of rare or endangered species? Yes____ No X If yes, explain. EASTERN FLYWAY, BUT NO SPECIES OCCUPY THE AREA AT THE TEST SITE.

4. Are known archeological sites, historic sites, prime or unique farmland, or natural landmarks within or visible from the site area? Yes____ No X If yes, explain. ____

5. Will casing left in the hole protect all ground water aquifers? Yes X No____ If no, explain. ____

6. Will a directional survey be conducted in the drill hole? Yes____ No X If yes, at what interval? ____ feet. If no, explain. NOT NECESSARY FOR 1000' NONPRODUCING HOLE

7. Will expected continuous noise levels from site operations be 65 dBA or less at the nearest residence? Yes____ No X If no, explain. EACH 8V-71 GMC ENGINE EQUIPPED WITH TWO 4" No. SRV04-0196 MAXIM SILENCERS; MAXIMUM NOISE LEVEL 32.0 dBA, 250 CENTER FREQUENCY; FOR RESIDENTIAL USE.

B. SITE CONSTRUCTION

1. Will additional land clearing be required for the drilling and data collection activities (e.g., preparation of drill pad, road construction, mud reserve pits, pipeline)? Yes____ No X If yes, describe.

2. Will the drill site and related roads be treated to minimize dust? Yes____ No X If no, explain. NOT NEEDED PAVED ROADS TO SITE

3. Are portable sanitary facilities or an approved septic system to be used at the drill site? Yes X No____ If no, explain.

4. Will liquid and solid wastes be disposed in accordance with local regulations? Yes X No____ If no, explain.

5. Will erosion control be required for excavated areas? Yes____ No X If yes, explain.

6. Upon completion of proposed drilling and data collection activities, will the site be restored to as natural a condition as possible by regrading, filling, and reseeding? Yes X No_____ If no, explain. _____

C. SAFETY

1. Will blowout preventers be used? Yes X No_____ If no, explain.

2. Will fire extinguishers be located onsite? Yes X No_____ If no, explain. _____

3. Will engineering and mud logging personnel be onsite during drilling operations? Yes X No_____ If no, explain. _____

4. Does an emergency plan exist for evacuating personnel?. Yes X No_____ If no, explain. _____

5. Will the drilling operations be conducted under a safety policy that ensures safe operating procedures and attention to job safety and health protection? Yes X No_____ If no, explain. _____

Completed from onsite inspection by:

Michael R. Gleason
Signature

Position: FIELD ENGINEER

Date: Sep 25, 1978

SAFETY POLICY

1. The safety policies of Gruy Federal, Inc. are defined by the joint requirements of:
   a. the Occupational Safety and Health Act of 1970, as defined and enforced by the Occupational Safety and Health Administration (OSHA) of the Department of Labor with respect to job safety and health protection, and
   b. the safe operating procedures, inspection and training programs, and accident investigation forms of the International Association of Drilling Contractors, whether involving drilling rigs or other equipment.

2. OSHA requirements are summarized in the 10" X 16" plastic laminated JOB SAFETY AND HEALTH PROTECTION sign, GPO: 1974 0 - 537-604; IADC procedures and inspection and report forms are summarized in the booklet Outline for Drilling Rig Safety Program, compiled by the IADC Safety Publications Subcommittee, revised 1976. Both of these documents are required to be displayed, reviewed at regular intervals by all supervisory personnel, and followed in concept and practice in all Gruy Federal operations involving job safety and health protection.

3. All Gruy Federal subcontractors and/or third party services are required to maintain meaningful and effective safety programs that include scheduled training and drills for personnel, and scheduled maintenance and testing of safety equipment.

4. In addition, all Gruy Federal field operations and all subcontractors and/or third party services to Gruy Federal field operations are required to maintain familiarity with and follow the recommended safe operating procedures and guidelines of the Accident Prevention Manual, IADC, revised edition, October, 1975.

5. The Gruy Federal Project Manager or his designated field representative shall have responsibility for maintaining these safety policies through:
   a. inspection of all equipment and materiel,
   b. inspection of personnel and equipment performance in safety drill or demonstration, upon request, and
   c. shutdown or exclusion from the job of any operation, materiel or personnel whose temporary condition or malfunction violates or jeopardizes the requirements of these safety policies.

February, 1978

Alan Lohse
Executive Vice President

Site-Specific Environmental Impact Assessment

Oceana Naval Air Station
Coordinates: N36°48'08"
W76°02'36"

1. General:

a. The proposed action assessed herein is in support of the Division of Geothermal Energy, U. S. Department of Energy, Contract ET-78-C-08-1558 of exploration for geothermal energy along the Atlantic Coastal Plain from New Jersey to Florida. The exploration consists of locating and drilling, casing and cementing of up to 60 1,000' bore holes and up to five deeper holes to evaluate the heat flow, conductivity and water resources of the substrata encountered. Drilling will be accomplished by a portable truck-mounted rig and will be confined to approved areas and roads. Waste fluids and solids will be confined to holding tanks and/or shallow pits. No significant effects on land or water use, socioeconomics, seismicity or historical and archeological resourses are expected.

b. Drilling requires a relatively level area of approximately one acre cleared of vegetation sufficient to allow movement of the rig and associated trucks and vehicles. Excavation consists of one mud-mixing pit 45'x40'x2' deep and the borehole cellar 4'x4'x4' deep. The 45'x40'x2' mud pit will be restored to its original condition upon completing of drilling. The borehole cellar will be used for access to the borehole for testing the heat gradient in the hole for about one year. Some off-road vehicle traffic will be required for trucks and passenger vehicles. Due to the load spread by axle weight of each vehicle, damage to hard surface roads or rutting of earth will be none or minimal.

c. There are no known pre-existing environmental issues.

2. Potential Environmental Impacts:

a. The principal geological impacts that could occur would be subsidence and induced seismicity but these are not likely as water will not be produced.

b. Erosion of the site could increase suspended sediment loads in surface water; off-road vehicle movement could add to this problem. maintaining an undisturbed buffer zone between hole site and surface water and promptly revegetating the site will minimize the threat of erosion. Following drilling, all drilling fluids and other wastes will be removed from the site for reuse or disposed of in an approved manner.

c. Cementing and casing the hole will minimize the possibility of commingling and/or contaminating ground water aquifers and no fluids will be produced from the hole. Consequently, chemical and thermal contamination of surface waters by geothermal fluids would occur only in the unlikely event of a blowout.

d. The diesel drive for the rig will produce CO, NOx, SOx, hydrocarbons and particulates during a five 24-hour drilling period. These emissions should contribute an insignificant amount to ambient pollution levels. No dust will be generated. No steam or gaseous emissions from the hole are anticipated.

e. There are no known federal noise regulations applicable.

f. Maximun impact on terrestrial ecology would result if the hole were to be located in a wooded area. The actual impact will be negated by using the existing open disturbed area. As no deleterious material will be left, revegetation should occur rapidly.

g. Maintenance of buffer zones and prompt revegetation will prevent erosion and consequent sedimentation of aquatic habitats thus protecting aquatic biota. No geothermal fluids will be brought to the surface.

h. There will be no loss of farm-use land.

i. Drilling will not involve a large consumption of water nor will it compete with existing water uses.

j. No socioeconomic effects are expected. The small drilling crews have their own house trailers for the most part and a few will find local living accommodations for the few days in the area. No appreciable increase on local services or boost to local income is expected.

k. Care has been taken to avoid all historical sites, archeological resources and natural landmarks.

l. The most likely accident is an uncontrolled release of fluid. The possibility is slight but does exist. The installation of a blowout preventer would reduce this slight risk to a negligible one.

3. Site-Specific Assessment:

a. There are no known archeological sites, historical sites, prime or unique farmland or natural landmarks within or visible from the site.

b. The casing left in the hole will protect ground water aquifers.

c. Expected continuous noise levels will be minimal. Each 8V-71 GMC engine (two) is equipped with two 4" No. SRV04-0196 silencers; maximum noise level 32.2 dBA, 250 center frequency for residential use.

d. The drill site and related roads will not be treated to minimize dust as paved roads and soil conditions preclude such treatment.

e. Portable sanitary facilities will be in place at the drill site.

f. Liquid and solid waste will be disposed of in accordance with Naval, State and other Federal regulations.

g. Erosion control will not be required for the disturbed area due to its small size and location.

h. Upon completion of proposed drilling and data collection activities, the site will be restored to as natural a condition as possible by regrading, filling and seeding. Road damage, if any, will be repaired.

i. The site falls within the Eastern Flyway but no species of birds occupy the site area. There is no impact on the habitat of rare or endangered species of any sort.

j. Blowout preventers will be used. Fire extinguishers will be located on site. All personnel will wear hard hats. Engineering and mud-logging personnel will be on-site during drilling operations. An emergency plan exists for evacuating personnel. The drilling operations will be conducted under a safety policy that insures safe operations and attention to job safety and health protection.

k. Enclosure (1) shows the preferred drill site location and the heavy vehicle travel route.

4. Long Range Effects: There are no known conflicts with local, state or regional plans or programs. If a heat source is found it is unlikely to be of sufficient temperatures to be used for electrical generation or process heat; the most likely use would be space heating. The hole may prove useful as a water well.

5. Alternative to the proposed action: Abandon or delay the operation.

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022

WELL NO. #23 - Oceana Naval Air Station

DATE September 28, 1978

COUNTY Virginia Beach STATE Virginia

REPORT NO. 1

REPORTED BY Radford/Smith

DEPTH --

PROGRESS --

ACTIVITY AT REPORT TIME Wait on fuel and water

TIME LOG

FROM	TO	ELAPSED		OPERATIONS
1300	1600	3	hrs.	Move to location
1600	2400	8	hrs	Rig up
2400	0600	6	hrs.	Wait on water and fuel
		17	hrs.	

(Drive shaft out of Energy Service, water truck.)

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. Oceana NAS No. 23

DATE 9/28/78 COUNTY Va. Beach STATE Virginia

REPORT NO. 2 REPORTED BY Radford

DEPTH 694 PROGRESS 694

ACTIVITY AT REPORT TIME Drilling

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0600	1230	6½	Finish Rig up. Drill mouse hole
1230	1700	4½	Drill 0-568'
1700	1730	½	Circulate and condition hole
1730	1830	1	POH and pull up core barrel
1830	1930	1	RIH with core barrel
1930	2000	½	Circulate and core 568' - 593'
2000	2100	1	POH with core barrel. No recovery
2100	2200	1	RIH with core barrel. Circulate
2200	2300	1	Mix 14 sacks gel, 35x Gel x. Condition mud
2300	2400	1	Core 593'-618'
2400	2430	½	POH
2430	0230	2	Lay down core barrel. Remove core. 15' recovery
0230	0300	½	RIH
0300	0400	1	Clean pits. Repack charge pump
0400	0600	2	Drill 618'-694'

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. Oceana NAS No. 23

DATE 9/30/78 COUNTY Va. Beach STATE Virginia

REPORT NO. 3 REPORTED BY Radford

DEPTH 1033 PROGRESS 339

ACTIVITY AT REPORT TIME Rigging down

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0600	1300	7	Drill 694' to 978'
1300	1330	½	Circulate and condition hole
1330	1430	1	POH for core #2
1430	1530	1	Pull up core barrel, and RIH
1530	1700	1½	Core 978' to 1003'
1700	1730	½	POH
1730	1800	½	Lay down and dress core barrel. 25' recovery
1800	1830	½	RIH with 7-7/8" bit
1830	1930	1	Ream core hole
1930	2000	½	Drill 30' and circulate to 1033'
2000	2030	½	Circulate and condition hole
2030	2230	2	Lay down drill pipe
2230	0030	2	Rig up gin pole and move casing to pipe racks
0030	0200	1½	Run 4½" casing. 26 joints. Talley 1043'
0200	0300	1	Wash down last joint casing and circulate
0300	0330	½	Rig up Halliburton
0330	0430	1	Cement with 330 sacks Class A cement. Bump plug with 100 psi. Rig down Halliburton. Cement circulatic
0430	0600	1½	Rigging down

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. Oceana NAS No. 23

DATE 10/1/78 COUNTY Va. Beach STATE Virginia

REPORT NO. 4 REPORTED BY Radford

DEPTH -- PROGRESS --

ACTIVITY AT REPORT TIME Rig Down

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
0600	1000	4	Rig Down

Final Report - Well Complete

October 17, 1978

OPERATIONS SUMMARY

OPERATOR : Gruy Federal
LEASE : Oceana Naval Air Station
WELL : No. 23
COUNTY : Virginia Beach, Virginia

****

9/28/78 Elapsed time: RU to run 4½" csg. 2½ hrs. run 4½" csg. 2 hrs. wash down 2 jts. & circ. & cond. mud. 1 hr. cmt. 4½" cm. w/400 sks. Class "A" 1Y.6-1.8. 2 hrs. RD. 3 hrs. moving rig @ 1:00 p.m. 10 hrs. shut down rig because of no water truck. Twisted drive-line into while moving.

9/29/78 Report #2. TD 694'. Activity at report time: Drlg. Elapsed time: 6½ hrs. FRU. Drl. mouse hole. 4½ hrs. drlg. from 0-568'. ½ hr. circ. & cond. hole, mixed mud. 1 hr. POH, PU core barrel. 1 hr. GIH w/core barrel. ½ hr. core from 568'-593'. 1 hr. POH w/core barrel. No core recovery. 1 hr. go back in hole w/core barrel. Reamed last 15' core to btm. 1 hr. circ. & mix 14 sks. of gel, 3 sks. of quick gel or gelex to bring viscosity up to 55. 1 hr. dropped ball in core barrel. Start coring @ 593' & cored to 618'. ½ hr. POH w/core barrel. 2 hrs. LD core barrel & re-dressed. Recovered 15' of core. ½ hr. GIH w/bit. 1 hr. cleaned suction on pump & repacked charger centrifugal pump. 2 hrs. drl. from 618'-694'.

9/30/78 Report #3. TD 1033'. Activity: RD. Elapsed time: 7 hrs. drlg. from 694'-978'. ½ hr. circ. hole for btm. core. 1 hr. POH for core #2. 1 hr. PU core barrel & RIH. 1½ hr. coring from 978'-1003'. ½ hr. POH w/core barrel. ½ hr. LD core barrel & redressed. Had 25' recovery. ½ hr. GIH w/D.P. & 7-7/8" bit. 1 hr. reamed 30' core zone. ½ hr. drld. 30' to 1033'. ½ hr. circ. & cond. hole for running pipe. 2 hr. LD D.P. 2 hrs. loading csg. on pipe racks & tallied csg. 1½ hrs. run 26 jts. of 4½ csg. 1 hr. washed down last jt. of csg. ½ hr. RU Halliburton. 1 1 hr. pmpd. 330 sks. Class "A" cmt. Circ. & bumped plug @ 1000# over pmpg. press. RD Halliburton. 1½ hrs. started RD. FINAL REPORT.

V. Site No. 28-A, Cheriton, Virginia

A. Site Location

The location of Site No. 28-A, Cheriton, Virginia, heat flow measurement hole is shown on Figure 5-1, a section of USGS 7½' Quadrangle "Cheriton, Virginia". The coordinates of the drill site are longitude 75° 55' 55" W, latitude 37° 17' 54" N. The site, located on the south end of the county landfill, has a ground elevation of approximately 33 feet above sea level.

B. Lease/Letter Agreements, Permits, Licenses

Access to Sie No. 28-A was obtained by permission of the Board of Supervisors of Northampton County by letter agreement (Exhibit V-1). A Commonwealth of Virginia Certification of Completion permit was required and is shown in Exhibit V-2.

C. Environmental Information Survey

The environmental information checklist, supplementary information required for the "Environmental Assessment, Geothermal Exploratory Drilling Program, Eastern United States, Coastal Plains and Piedmont Provinces", (DOE/EA-0015) is shown in Exhibit V-3.

D. Drilling Activities

Drilling activities at Site No. 28-A, Cheriton, Virginia, began September 11, 1978 with the surface pipe being set by the Mayhew 1000 rig. Drilling continued on September 29th and was completed on October 3, 1978 by the Failing 1500. Figure 5-2, a schematic diagram of the completed hole, summarizes data for Site No. 28-A. The daily drilling reports are shown in Exhibit V-4. Cores and

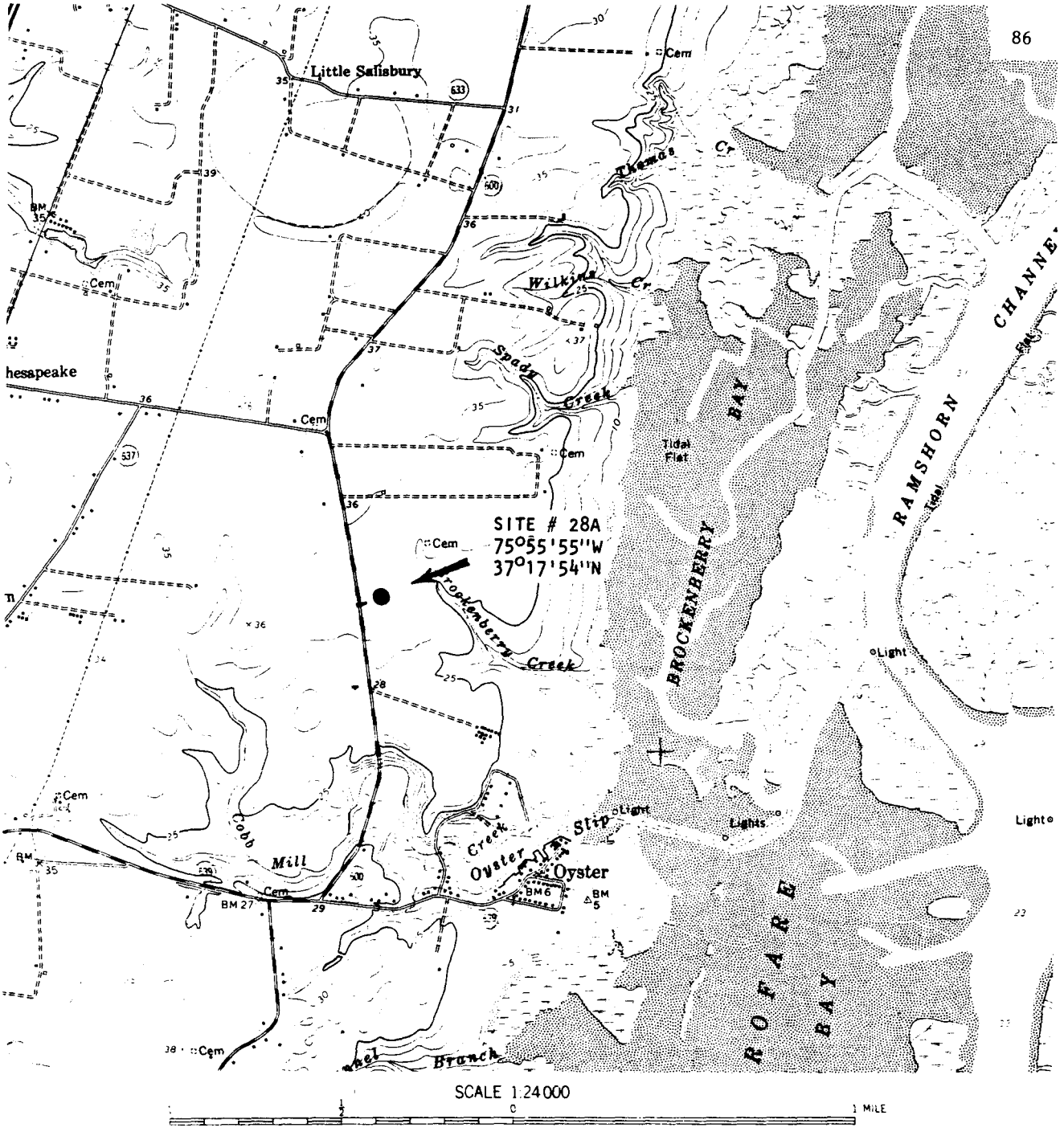


FIGURE 5-1 LOCATION SITE #28A, CHERITON, VA.
LONGITUDE 75°55'55" W, LATITUDE 37°17'54" N

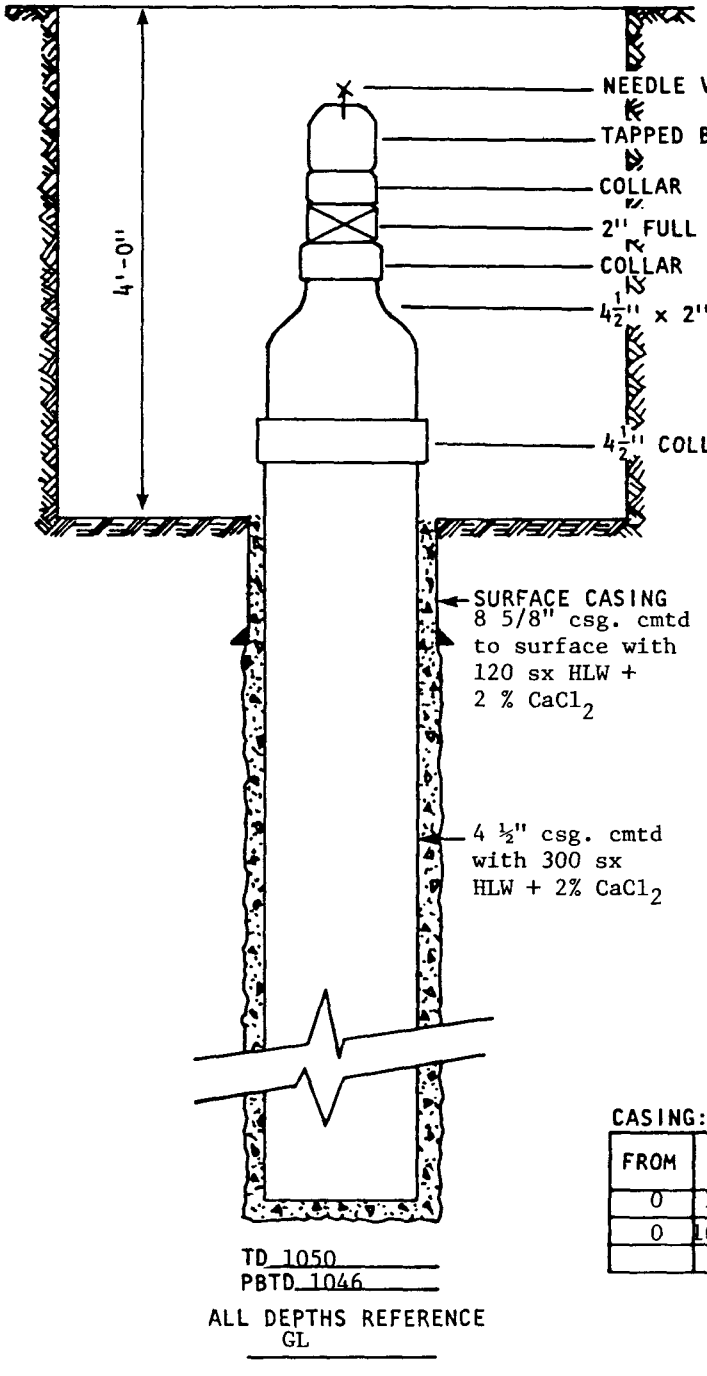
CHERITON, VA.
N3715—W7552.5/7.5

1968

AMS 5858 IV SW—SERIES V834

GRUY FEDERAL, INC.

SITE NO. 28 A
WELL NAME Cheriton/Northampton
LOCATION: LAT. 37°17'54" N
LONG. 75°55'55" W
RIG: Warren George Failing 1500 COUNTY Northampton STATE Virginia
DATE SPUDED: September 11, 1978 DATE COMPLETED: October 3, 1978



CORES:

NO.	FROM	TO	RECOVERY
1	695	710	15 feet
2	710	725	15 feet
3	975	990	15 feet
4	990	1005	15 feet

HOLE SIZE:

DEPTH		HOLE	CSG.	MUD *	
FROM	TO	SIZE IN.	SIZE IN.	VIS.	WT.
0	120	12¼	8-5/8	40	9.0
120	1050	7-7/8	4½	45	9.5

* approximate

CASING:

FROM	TO	SIZE IN.	WT #/FT	GRADE	THREAD	NO. JTS
0	120	8-5/8	24.0	H-40	ST&C	3
0	1048	4½	9.5	J55	ST&C	26

FIGURE 5-2 WELL SCHEMATIC WITH COMPLETION INFORMATION

cuttings taken from the hole during drilling were delivered to VPI&SU. No electric logs were run on this hole. Temperature logs were run by VPI&SU after the hole was cased; however, these data were not made available to Gruy.

E. Site Preparation, Layout and Cleanup

Prior to initiation of drilling at Cheriton, Virginia, the site area was almost level and was used as an agricultural field. For site preparation, a bulldozer dug two pits 35' long, 5' wide, and 4' deep. The 4' x 4' cellar was dug by hand 4' deep and boarded over. After the hole was completed, the wellhead was installed and an iron grate was placed over the cellar and locked. The mud pit was vacuumed and the site was backfilled and leveled.

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
703/979-2955

August 14, 1978

Replaces L.A. dtd July 28

Holland, John
J. T. Chairman
Board of Supervisors of
Northampton County
P. O. Box 66
Eastville, Va. 23347

Dear Sir:

Gruy Federal, Inc. is under Contract ET-78-C-08-1558 with the Division of Geothermel Energy, U. S. Department of Energy, to drill a series of bore holes among the Atlantic Coastal Plain from New Jersey to Florida. The sites have been, or will be, coordinated with the respective State Geological or Water Resources Boards and are under the overall coordination of Dr. J. K. Costain, Virginia Polytechnical Institute and State University, Blacksburg, Virginia.

The purpose of the drilling is to conduct a scientific geological study attempting to find sources of residual heat in the coastal bed rocks. Use of the site described below is critical to the study. The drilling program was started at Fort Monmouth, NJ, and is continuing on the New Jersey Coast at present.

Gruy Federal requests permission to drill, case and cement one heat gradient bore hole of 1,000' depth at a site described below:

Cheriton Quadrangle
Northampton County, Virginia
U. S. Department of Interior Geological Survey Map
Coordinates: N 37° 17' 52"
W 75° 55' 41"

Finalsite selection to be by mutual agreement between your representative ano a representative of Gruy Federal.

An area of approximately one acre will be required for the site during actual drilling operations for a period of about five days. Some soil disturbance will occur, but will be restored to its original condition, leaving only a 4' x 4' x 4' cement lined pit with a hinged steel cover on the site. The cover will be flush with the surface. The 1,000' cased hole will be filled with fresh water. For one year following, scientists from the State, Virginia Polytechnical Institute, the U. S. Geological Survey and the U. S. Department of

Energy, under Gruy Federal responsibility, will conduct heat gradient measurements of this water.

Gruy Federal shall be responsible and liable for accidents, injuries or damages arising from its operations and shall defend and save harmless Northampton County, its officers and agents, by reason of any claims made or judgments rendered in connection with such work. The site will be restored insofar as possible to its original condition, including resodding or replanting grass. At your election, on completion of the heat gradient tests, the bore hole will be returned to your for any use deemed appropriate or Gruy Federal will plug and abandon the hole in accordance with federal and state laws.

The Division of Geothermel Energy, Department of Energy, has made an Environmental Impact Assessment of Geothermel Drilling Activity, Coastal Plain and Piedmont Physiographic Provinces, Eastern United States, dated December 1977. NEPA requirements for this action have been met by the Department of Energy and there are no anticipated atmospheric, ecological, environmental or historical site factors developing from this operation.

Your cooperation and assistance in this research are sincerely appreciated. If you have any further questions concerning this operation, please call Mr. G. W. Duncan, Manager Drilling and Resource Evaluation Division, Houston, TX, at AC 703-785-9200, collect.

Mr. R. Keith Bull, County Administrator, has been briefed on this matter.

If agreeable, you need only to countersign the original of this letter agreement, and mail to Mr. Duncan at our Houston Office.

Respectfully yours,

W. Edward McCain
Agent and Attorney-in-fact

APPROVED _____

County Administrator
Northampton County

Form GW-2
1978-10,000

COMMONWEALTH OF VIRGINIA
WATER WELL COMPLETION REPORT

• BWCM No. _____

(Certification of Completion/County Permit)

State Water Control Board
P. O. Box 11143
2111 North Hamilton St.
Richmond, Va. 23230

SWCB Permit _____
County Permit _____

Certification of inspecting official:
This well does _____ does not _____
meet code/low requirements.
S. _____
Date _____

For Office Use

CHERITON QUAD

County/City Stamp

- Virginia Plane Coordinates
  _____ N
  _____ E
- Latitude & Longitude
  37°17'54" N
  75°55'55" W
- Topo. Map No. _____
- Elevation 33 ft.
- Formation _____
- Lithology _____
- River Basin _____
- Province _____
- Type Logs _____
- Cuttings EACH 10'
- Water Analysis _____
- Aquifer Test _____

- Owner NORTHAMPTON COUNTY
- Well Designation or Number SITE 28A
  Address P.O. Box 66 EASTVILLE, VIRGINIA
  Phone 23337
- Drilling Contractor GRUY FEDERAL INC.
  Address 2500 TANGLEWILDE #150 HOUSTON
  Phone TEXAS

Tax Map I.D. No. _____
Subdivision _____
Section _____
Block _____
Lot _____
Class Well: I _____, IIA _____
IIB _____, IIIA _____, IIIB _____

WELL LOCATION: 0.5 (feet/miles SOUTH direction) of ROAD 636 on ROAD 600
and _____ feet/miles _____ (direction) of _____
(If possible please include map showing location marked)

Date started 9/27/78 • Date completed 10/3/78 Type rig ROTARY

1. WELL DATA: New ✓ Reworked _____ Deepened _____
- Total depth 1050' ft.
- Depth to bedrock — ft.
- Hole size (Also include reamed zones)
  - 7 7/8 inches from 0 to 1050' ft.
  - _____ inches from _____ to _____ ft.
  - _____ inches from _____ to _____ ft.
- Casing size (I.D.) and material
  - 4 1/2 inches from 2 to 1048 ft.
    Material _____
    Wt. per foot _____ or wall thickness _____ in.
  - _____ inches from _____ to _____ ft.
    Material _____
    Wt. per foot _____ or wall thickness _____ in.
  - _____ inches from _____ to _____ ft.
    Material _____
    Wt. per foot _____ or wall thickness _____ in.
- Screen size and mesh for each zone (where applicable)
  - _____ inches from _____ to _____ ft.
    Mesh size _____ Type _____
  - _____ inches from _____ to _____ ft.
    Mesh size _____ Type _____
  - _____ inches from _____ to _____ ft.
    Mesh size _____ Type _____
  - _____ inches from _____ to _____ ft.
    Mesh size _____ Type _____
- Gravel pack
  - From _____ to _____ ft.
  - From _____ to _____ ft
- Grout
  - From 2 to 1048 ft., Type CLASS A CEMENT
  - From _____ to _____ ft., Type _____

2. WATER DATA • Water temperature _____ °F
- Static water level (unpumped level-measured) _____ ft.
- Stabilized measured pumping water level _____ ft.
- Stabilized yield _____ gpm after _____ hours
  Natural Flow: Yes _____ No _____, flow rate: _____ g pm
  Comment on quality _____

3. WATER ZONES: From _____ To _____
From _____ To _____ . From _____ To _____
From _____ To _____ . From _____ To _____

4. USE DATA:
Type of use: Drinking _____, Livestock Watering _____,
Irrigation _____ Food processing _____, Household _____
Manufacturing _____, Fire safety _____, Cleaning _____
Recreation _____, Aesthetic _____, Cooling or heating _____
Injection _____, Other _____
- Type of facility: Domestic _____, Public water supply _____
  Public institution _____, Farm _____, Industry _____
  Commercial _____, Other _____

5. PUMP DATA: Type _____ • Rated H.P. _____
- Intake depth _____ • Capacity _____ at _____ head

6. WELLHEAD: Type well seal SEE FIGURE # 4
Pressure tank _____ gal., Loc. _____
Sample tap _____, Measurement port _____
Well vent _____, Pressure relief valve _____
Gate valve _____, Check valve (when required) _____
Electrical disconnect switch on power supply _____

7. DISINFECTION: Well disinfected _____ yes _____ no
Date _____, Disinfectant used _____
Amount _____, Hours used _____

8. ABANDONMENT (where applicable) • yes _____ no _____
Casing pulled yes _____ no _____ not applicable _____
Plugging grout From _____ to _____ material _____

Owner _____ 92

9. State law requires submitting to the Virginia State Water Control Board information about groundwater and wells for every well made in the State intended for water, or any other non-exempt well. This information must be submitted whether the well is completed, on standby, or abandoned. Information required includes: an accurately and completely prepared water well completion report, full data from any aquifer pumping tests, drill cuttings taken at ten foot intervals (unless exemption is secured), the results of any chemical analyses, and copies of any geophysical logs. Quarterly pumpage and use reports are required from owners of public supply and industrial wells. County or State permits to drill may be required in some parts of the state. Some counties require submission of a water well completion report. The Virginia State Health Department requires a water well completion report for public supply wells.

10. DRILLERS LOG (use additional Sheets if necessary)

DEPTH (feet) From	To	TYPE OF ROCK OR SOIL (color, material, fossils, hardness, etc.)	REMARKS (water, caving, cavities, broken, core, shot, (etc.)	11. Drilling Time (Min.)
METERS				
0	33	SAMPLES MISSING		
33	116	VERY FINE SANDY SILT	W/SHELL FRAGMENTS	
116	280	SILT AND CLAY		
		THE DESCRIPTIONS OF THIS WELL ARE UNPUBLISHED. FOR MORE INFORMATION CALL OR WRITE		
		VIRGINIA POLYTECH INST. GEOPHYSICS DEPT. DR. JOE LAMBIASE (703) 961-6112		

12. DIAGRAM OF WELL CONSTRUCTION (with dimensions)

State Water Control Board Regional Offices

Valley Reg. Off.
116 North Main Street
P. O. Box 268
Bridgewater, Va. 22812
703-828-2595

Piedmont Reg. Off.
4010 West Broad Street
P. O. Box 6616
Richmond, Va. 23230
804-257-1006

Southwest Reg. Off.
408 East Main Street
P. O. Box 476
Abingdon, Va. 24210
703-628-5183

Tidewater Reg. Off.
287 Pembroke Office Park
Suite 310 Pembroke No. 2
Va. Beach, Va. 23462
804-499-8742

West Central Reg. Off.
Executive Park
5306 A Peters Creek Road
Roanoke, Va. 24019
703-563-0354

Northern Virginia Reg. Off.
5515 Cherokee Avenue
Suite 404
Alexandria, Va. 22312
703-750-9111

13. Well lot dedicated? _____; Size _____ ft. X _____ ft.; Well house? _____
Distance to nearest pollutant source _____ ft., Type _____
Distance to nearest property line _____ ft., Building _____ ft.

14. I certify that the information contained herein is true and correct and that this well and/or system has been installed and constructed in accordance with the requirements for well construction as specified in compliance with appropriate county or independent city ordinances and the laws and rules of the Commonwealth of Virginia.

Signature Michael K. Glascock (Seal), Date FEB. 13, 1979
(Well driller or authorized person)

License No. _____

SITE-SPECIFIC ENVIRONMENTAL INFORMATION CHECKLIST

HEAT GRADIENT HOLES

ATLANTIC COASTAL PLAIN GEOTHERMAL TEST PROGRAM

Site No. 28A State Va

Location 2 miles east of Cheriton, Va

A. GENERAL

1. Has federal, state and/or local environmental assessment been conducted previously for the proposed drill site? Yes____ No✓ If yes, provide a copy, if available.

2. Have all required permits, licenses, and/or agreements for the proposed drill site been obtained? Yes✓ No____ If no, explain. ____

3. Does the drill site fall within the habitat of rare or endangered species? Yes____ No✓ If yes, explain. Eastern flyway, but no species occupy the area at the test site

4. Are known archeological sites, historic sites, prime or unique farmland, or natural landmarks within or visible from the site area? Yes____ No✓ If yes, explain. ____

5. Will casing left in the hole protect all ground water aquifers? Yes✓ No____ If no, explain. ____

6. Will a directional survey be conducted in the drill hole? Yes____ No✓ If yes, at what interval? ____ feet. If no, explain. Not necessary for 1000' nonproducing hole

7. Will expected continuous noise levels from site operations be 65 dBA or less at the nearest residence? Yes____ No✓ If no, explain.
Each 8V-71 GMC engine equipped with two 4" No. SRV04-0196 Maxim silencers; maximum noise level 32.0 dBA, 250 center frequency; for residential use.

B. SITE CONSTRUCTION

1. Will additional land clearing be required for the drilling and data collection activities (e.g., preparation of drill pad, road construction, mud reserve pits, pipeline)? Yes____ No✓ If yes, describe.

2. Will the drill site and related roads be treated to minimize dust? Yes____ No✓ If no, explain. ____

3. Are portable sanitary facilities or an approved septic system to be used at the drill site? Yes✓ No____ If no, explain. ____

4. Will liquid and solid wastes be disposed in accordance with local regulations? Yes✓ No____ If no, explain. ____

5. Will erosion control be required for excavated areas? Yes____ No✓ If yes, explain. ____

6. Upon completion of proposed drilling and data collection activities, will the site be restored to as natural a condition as possible by regrading, filling, and reseeding? Yes ✓ No ____ If no, explain. ____

C. SAFETY

1. Will blowout preventers be used? Yes ✓ No ____ If no, explain.

2. Will fire extinguishers be located onsite? Yes ✓ No ____ If no, explain. ____

3. Will engineering and mud logging personnel be onsite during drilling operations? Yes ✓ No ____ If no, explain. ____

4. Does an emergency plan exist for evacuating personnel? Yes ✓ No ____ If no, explain. ____

5. Will the drilling operations be conducted under a safety policy that ensures safe operating procedures and attention to job safety and health protection? Yes ✓ No ____ If no, explain. ____

Completed from onsite inspection by:

Michael R. Glascock
Signature

Position: Field Engineer

Date: Aug 29, 1978

SAFETY POLICY

1. The safety policies of Gruy Federal, Inc. are defined by the joint requirements of:
   a. the Occupational Safety and Health Act of 1970, as defined and enforced by the Occupational Safety and Health Administration (OSHA) of the Department of Labor with respect to job safety and health protection, and
   b. the safe operating procedures, inspection and training programs, and accident investigation forms of the International Association of Drilling Contractors, whether involving drilling rigs or other equipment.

2. OSHA requirements are summarized in the 10" X 16" plastic laminated JOB SAFETY AND HEALTH PROTECTION sign, GPO: 1974 0 - 537-604; IADC procedures and inspection and report forms are summarized in the booklet Outline for Drilling Rig Safety Program, compiled by the IADC Safety Publications Subcommittee, revised 1976. Both of these documents are required to be displayed, reviewed at regular intervals by all supervisory personnel, and followed in concept and practice in all Gruy Federal operations involving job safety and health protection.

3. All Gruy Federal subcontractors and/or third party services are required to maintain meaningful and effective safety programs that include scheduled training and drills for personnel, and scheduled maintenance and testing of safety equipment.

4. In addition, all Gruy Federal field operations and all subcontractors and/or third party services to Gruy Federal field operations are required to maintain familiarity with and follow the recommended safe operating procedures and guidelines of the Accident Prevention Manual, IADC, revised edition, October, 1975.

5. The Gruy Federal Project Manager or his designated field representative shall have responsibility for maintaining these safety policies through:
   a. inspection of all equipment and materiel,
   b. inspection of personnel and equipment performance in safety drill or demonstration, upon request, and
   c. shutdown or exclusion from the job of any operation, materiel or personnel whose temporary condition or malfunction violates or jeopardizes the requirements of these safety policies.

February, 1978

Alan Lohse
Executive Vice President

Mayhew 1000

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

DAILY DRILLING REPORT

JOB NO. 3022

WELL NO. #28-A - Cheriton/Northampton

DATE September 11, 1978

COUNTY Northampton STATE Virginia

REPORT NO. 1

REPORTED BY Radford/Smith

DEPTH --

PROGRESS --

ACTIVITY AT REPORT TIME

TIME LOG FROM	TO	ELAPSED	OPERATIONS
			Surface hole drilled to 120 feet. Ran 3 jts 8-5/8. Cemented 3 joints of 8-5/8" casing w/100 sxs of HCL. Good returns

Failing 1500
GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. #28A - Cheriton/Northampton

DATE September 29, 1978 COUNTY Northampton STATE Virginia

REPORT NO. 2 REPORTED BY Radford

DEPTH PROGRESS

ACTIVITY AT REPORT TIME Failing 1500 rigging up to complete hole.

TIME LOG FROM	TO	ELAPSED	OPERATIONS
			Move in.
			Rigging up.

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. 28 A - Cheriton/Northampton

DATE September 30, 1978 COUNTY Northampton STATE Virginia

REPORT NO. 3 REPORTED BY Radford

DEPTH 545 PROGRESS 485

ACTIVITY AT REPORT TIME Drilling

TIME LOG FROM	TO	ELAPSED	OPERATIONS
			Drilled to 545 feet.

Failing 1500

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022

WELL NO. 28A - Cheriton/Northampton

DATE October 1, 1978

COUNTY Northampton

STATE Virginia

REPORT NO. 4

REPORTED BY Radford

DEPTH 725 feet

PROGRESS 180 feet

ACTIVITY AT REPORT TIME Run in Hole with 7-7/8 " bit.

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
			Drilled to 695 feet. Took Core #1, 695-710 feet. 100 % recovery. Core #2, 710 -725 feet. 100 % recovery. Prepare to resume drilling.

GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022 WELL NO. 28 A- Cheriton/Northampton

DATE October 2, 1978 COUNTY Northampton STATE Virginia

REPORT NO. 5 REPORTED BY Radford

DEPTH 975 PROGRESS 250

ACTIVITY AT REPORT TIME Drilling and preparing to core #3

TIME LOG FROM	TO	ELAPSED	OPERATIONS
			Drilled to 975 feet. Preparing to take core #3.

Failing 1500
GRUY FEDERAL, INC.

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

DAILY DRILLING REPORT

JOB NO. 3022

WELL NO. 28A-Cheriton/Northampton

DATE October 3, 1978

COUNTY Northampton STATE Virginia

REPORT NO. 6

REPORTED BY Radford

DEPTH

PROGRESS

ACTIVITY AT REPORT TIME

TIME LOG

FROM	TO	ELAPSED	OPERATIONS
			Core #3 from 975 to 990 feet, 15 feet recovery. Core #4 from 990 to 1005 feet, 15 feet recovery.
			Drill to 1050 feet.
			Ran 26 jts 4½", 9.5#/ft csg, set at 1048 feet.
			Cmtd with 300 sx HLW, BP with 1000 psi. cmt circ. well complete. final report.
			Prepare to move to North Carolina.

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