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IDO-10069
(NVO-410-40)

COMPLETION REPORT

RAFT RIVER
GEOTHERMAL EXPLORATORY HOLE NO. 3
(RRGE-3)

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COMPILED BY

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ABSTRACT

Raft River Geothermal Exploratory Hole No. 3 (RRGE-3) is an exploratory hole with three directional legs, drilled to depths ranging from approximately 5,500 to 6,000 feet into intruded quartz monzonite basement rock of the Raft River valley of southeastern Idaho. The goal of the Raft River Geothermal R&D program is to determine the feasibility of developing and utilizing medium temperature (300°F) geothermal resources for power generation and nonelectrical applications.

This well was drilled to provide data to further investigate and evaluate the geothermal reservoir, as well as to optimize the location of possible future resource and/or injection wells and to develop methods to reduce the cost of geothermal wells.

This report describes the drilling and completion of RRGE-3 and includes the daily drilling reports, drill bit records, descriptions of the casing, cementing, logging and coring programs, and the containment techniques employed on RRGE-3. Future reports by the Idaho National Engineering Laboratory (INEL) will describe testing conducted in RRGE-3.

COMPLETION REPORT - RRGE-3

TABLE OF CONTENTS

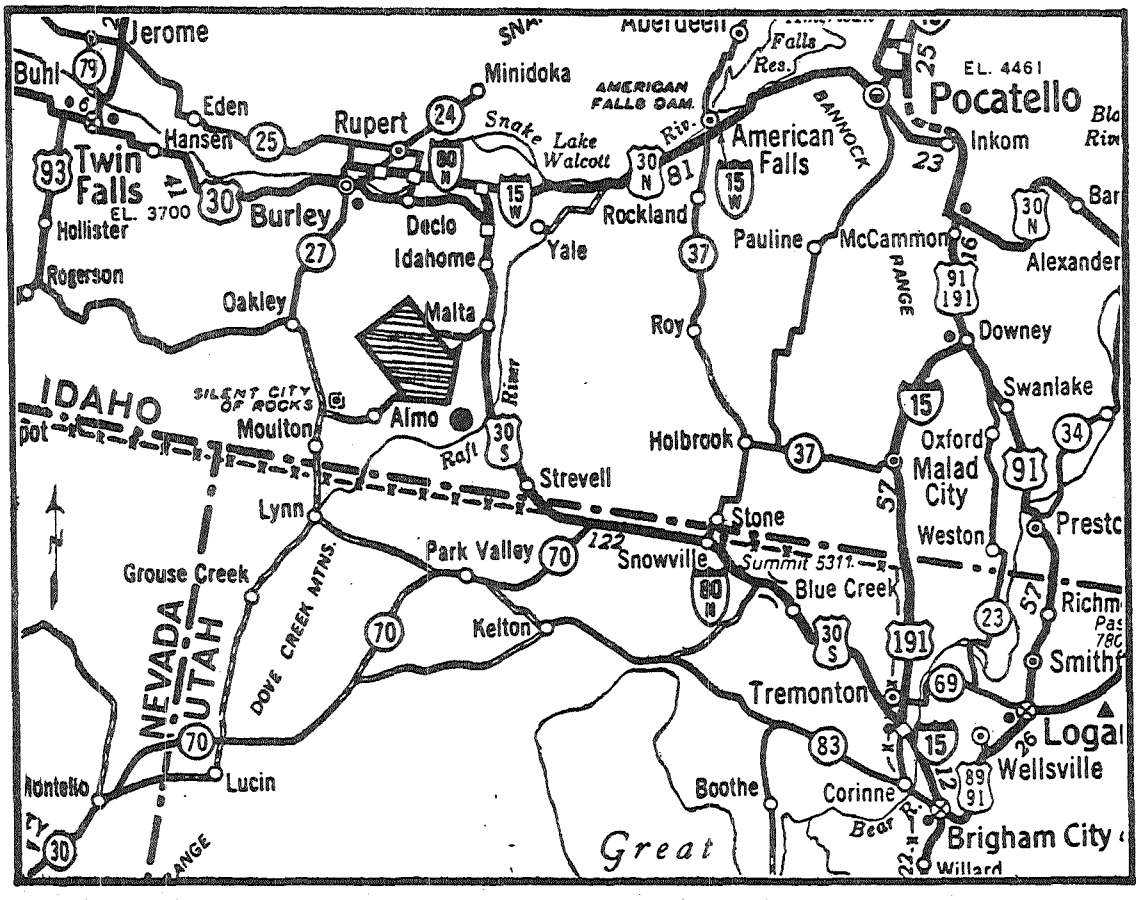
LIST OF ILLUSTRATIONS

I. INTRODUCTION

This report describes the drilling and completion of Raft River Geothermal Exploratory Hole No. 3 (RRGE-3). Preliminary testing and evaluation of the two previously drilled exploratory holes, RRGE-1 and RRGE-2, has established the existence of a geothermal reservoir of significant size. The purpose of the third deep exploratory hole is to provide data to further investigate and evaluate the geothermal reservoir, to optimize the location of future resource and/or injection wells, and to develop methods to reduce the cost of geothermal wells.

The site (see Figures 1, 2, and 3) for RRGE-3 was selected by the Idaho National Engineering Laboratory (INEL). This exploratory hole was designed as a possible reinjection well. A unique feature of this well was that it consisted of three directional legs originating from a single wellbore. Drilling operations commenced on March 28, 1976, after the drill rig was relocated from the RRGE-2 site. The last of the three directional legs of the well reached total depth on May 24, 1976. After a week of testing, the drill rig was disassembled and returned to the Nevada Test Site.

The drilling and completion of RRGE-3 was performed by Reynolds Electrical & Engineering Co., Inc. (REECo), under the direction of the U. S. Energy Research & Development Administration (ERDA), Nevada Operations Office (NV). Technical program requirements were provided by the Idaho National Engineering Laboratory (INEL). The Manager, ERDA, Idaho Operations Office (ID), was responsible for the coordination of all project related activities between NV/REECo and ID/INEL and for funding the drilling operation.



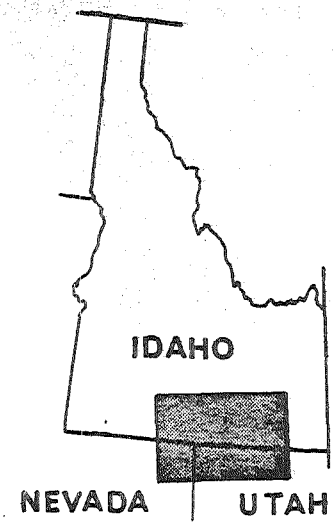


Figure 1. Idaho Geothermal R&D Project Site Location.

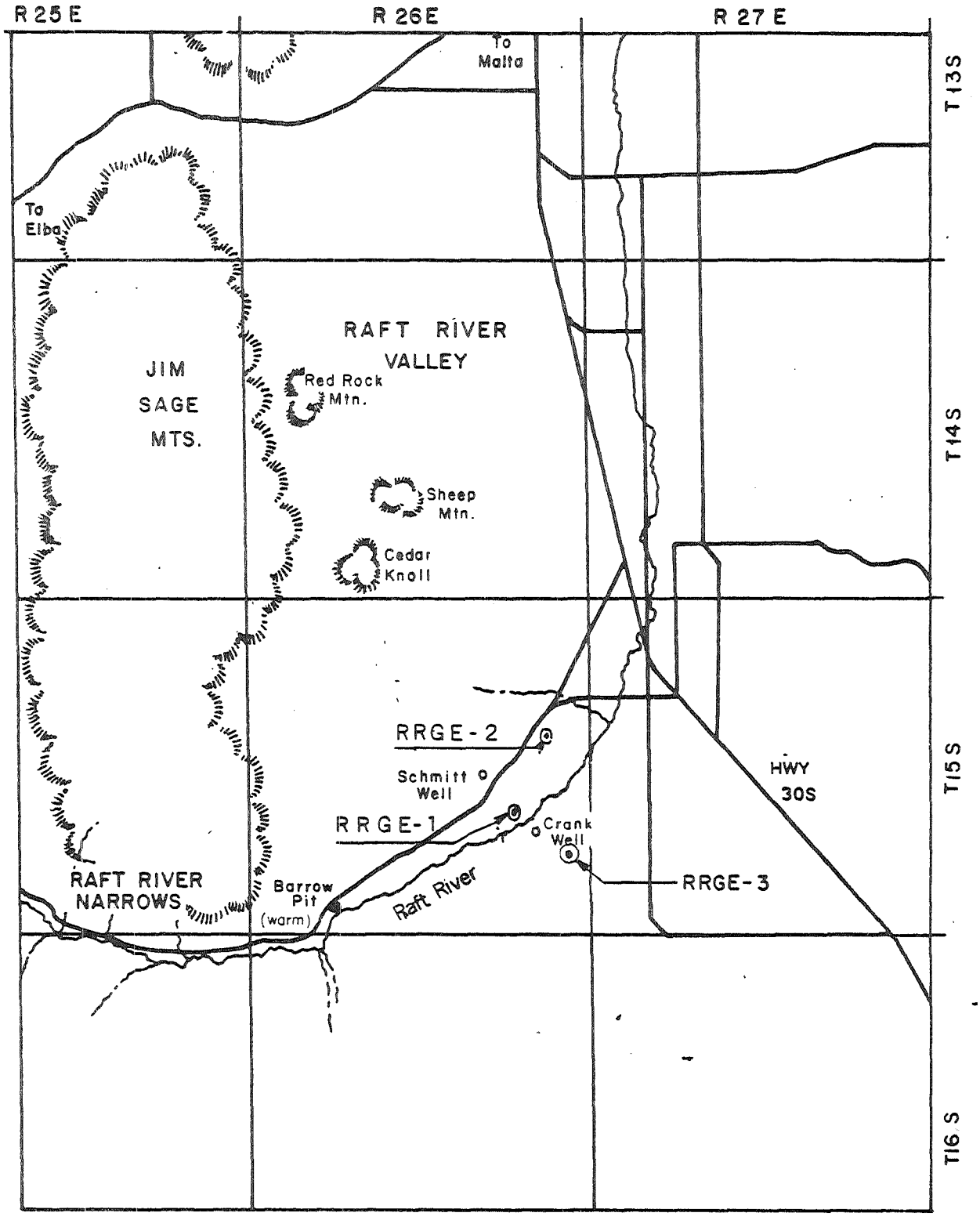


Figure 2. Raft River Valley with Drill Site Locations.

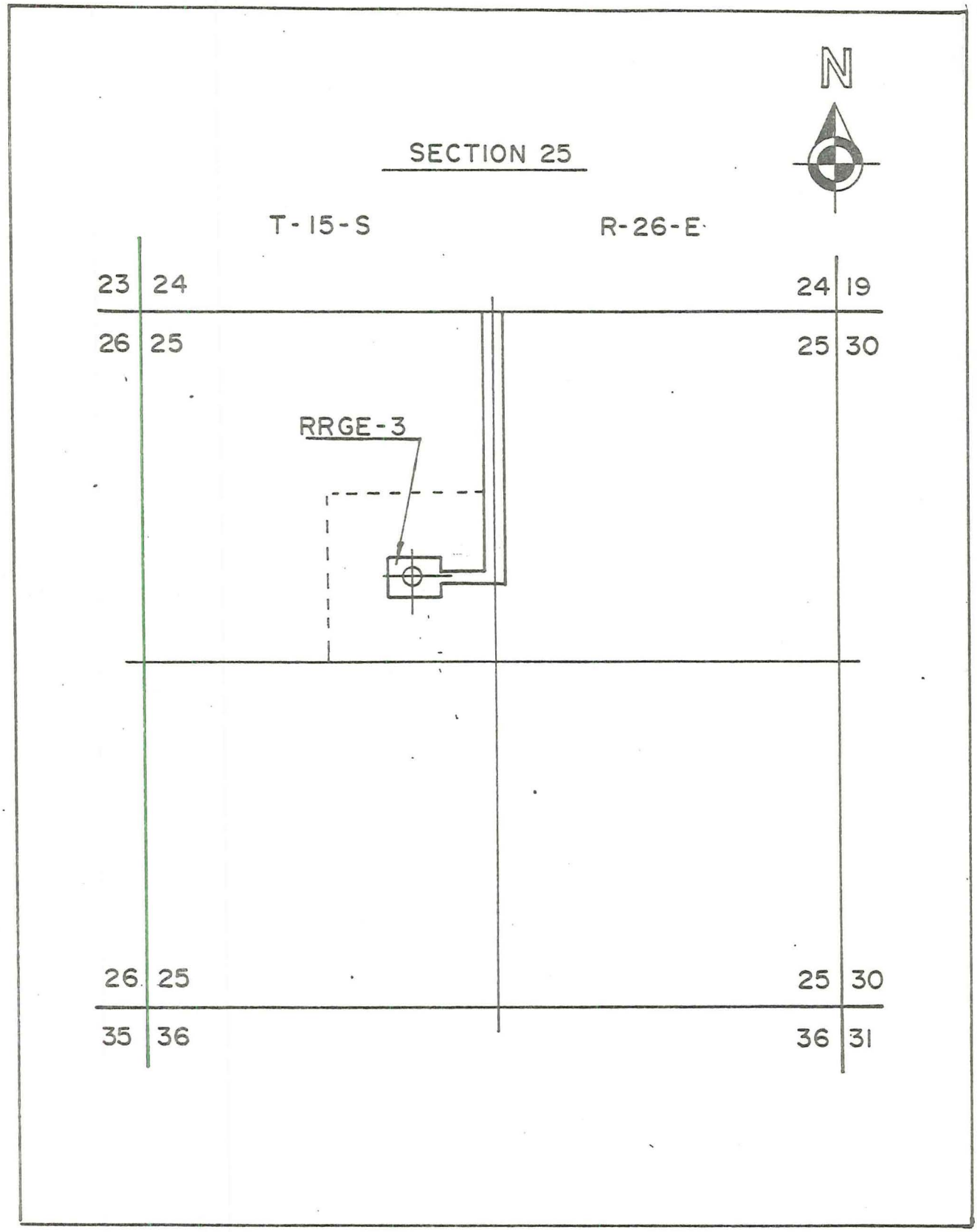


Figure 3. Location Survey

II. EXPLORATORY HOLE DRILLING

1. DRILLING SUMMARY

The drill site with approximate dimensions of 300 feet by 400 feet was prepared by INEL subcontractors. The preparation included: site leveling and grading, excavation of reserve and storage mud pits, drilling a 26-inch diameter conductor hole to 120 feet,[1] setting and cementing the 20-inch casing, constructing an eight foot deep concrete cellar around the conductor casing, cutting the casing at the cellar floor and welding a casing head in place. Additionally, a 200 foot deep water well was drilled to provide domestic water at the location.

On March 28, 1976, the REECo operated drill rig commenced activities by drilling out the cement in the 20-inch conductor casing from 50 to 120 feet. A 17-1/2-inch diameter hole was then drilled with mud as the circulating fluid to a total depth of 1,386 feet. The 13-3/8-inch intermediate casing string was set at 1,383 feet and cemented to the surface in one stage.

The 12-1/4-inch production hole was next drilled with water from 1,386 feet to a total depth of 4,241 feet. Loss of drilling fluid circulation was experienced intermittently throughout this drilling interval. Three cores were taken and flow testing was conducted. The hole was logged and circulated in preparation to run casing. A 9-5/8-inch casing liner was run to 4,237 feet with the liner hanger set at 1,188 feet. A two stage cementing operation was required to effectively cement the liner in place. The first stage involved pumping cement through the casing shoe and up the annulus to approximately 2,400 feet. The second stage was accomplished by pumping cement through ports in the liner hanger to fill the annulus from 2,400 feet to the liner hanger at 1,188 feet. A subsequent cement bond log indicated a satisfactory cement job throughout the liner interval. See Figure 4 for the Subsurface Well Status.

An 8-1/2-inch hole was next drilled to 4,342 feet or approximately 100 feet below the 9-5/8-inch liner shoe. Directional drilling with Eastman Whipstock services was initiated at this point. The hole drift angle was increased from 4-1/2° at 4,342 feet to 8-1/2° at 4,395 feet, using a Dyna-Drill downhole motor. Conventional drilling was resumed and the first directional leg, RRGE-3A, was completed at a total depth (TD) of 5,853 feet. Flow rate testing was conducted throughout the drilled interval. A maximum bottom hole temperature of approximately 285°F was recorded.

The second directional leg, RRGE-3B, was kicked off at 4,524 feet without setting a cement plug at the kick off point. The desired drift angle of approximately 8° was established after considerable difficulties. Conventional drilling was

[1] All depths unless otherwise noted are measured from ground level (GL).

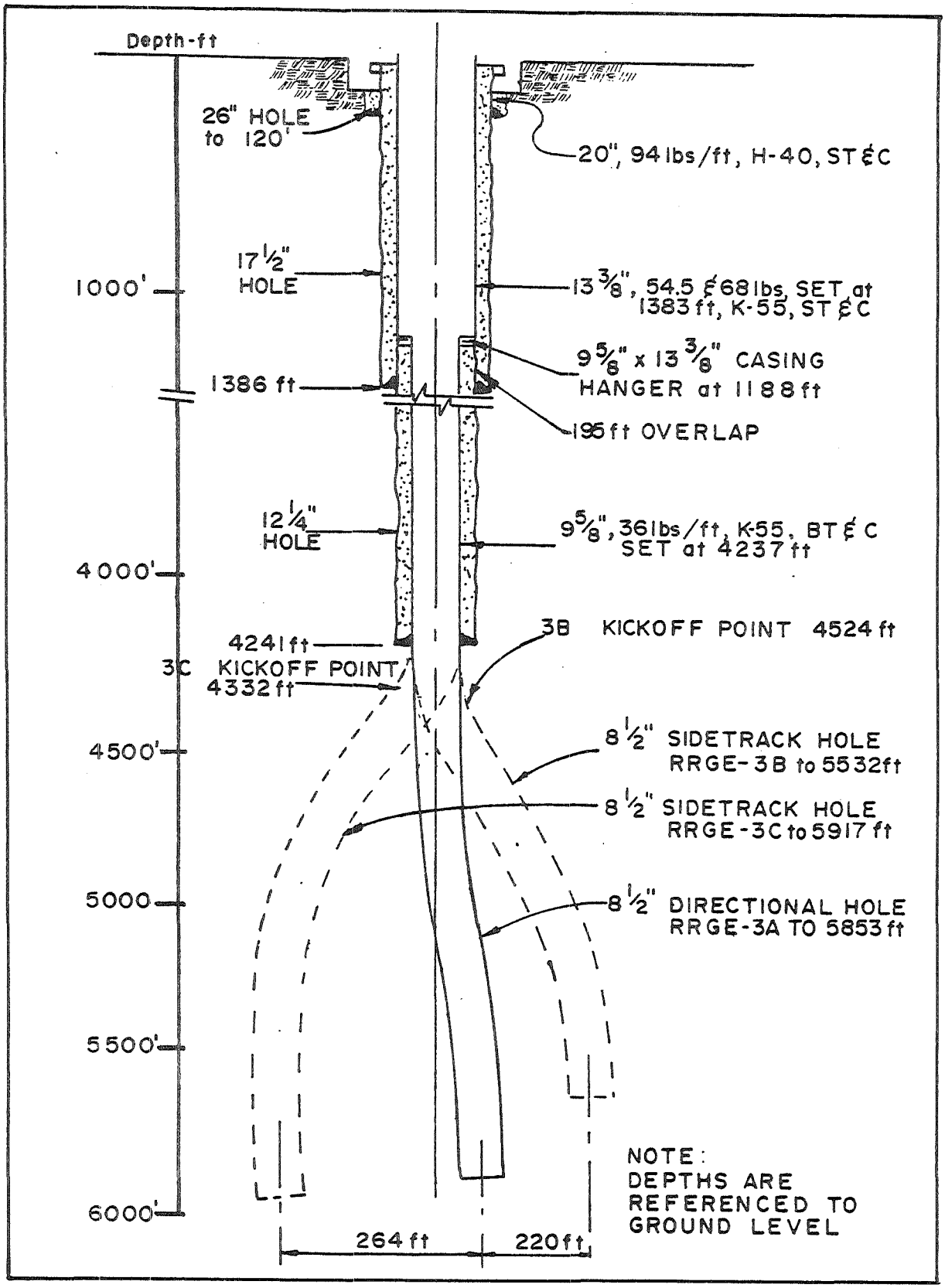


Figure 4. Subsurface Well Status

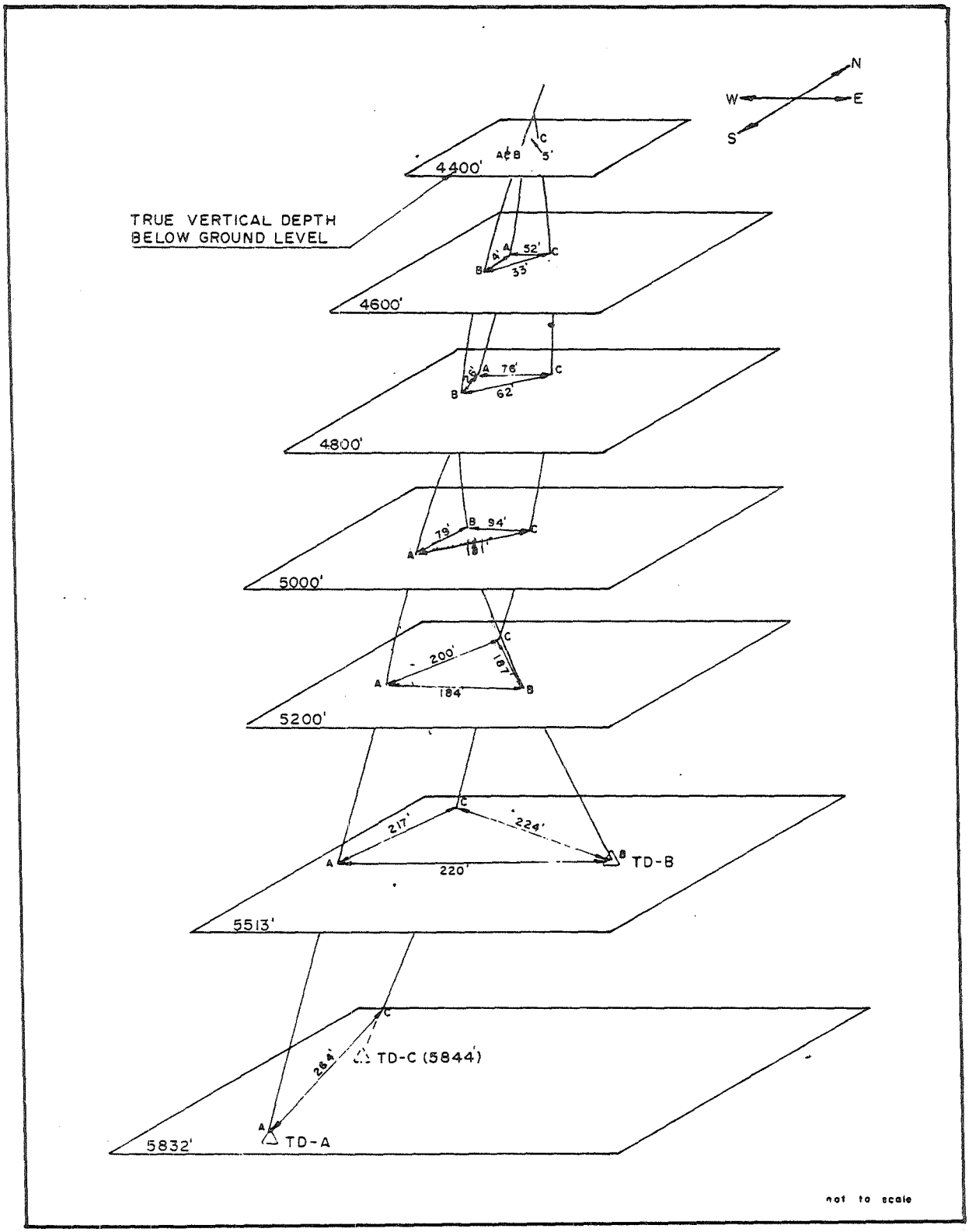


Figure 5. RRGE-3 Hole Relationship, Depth vs Horizontal Separation

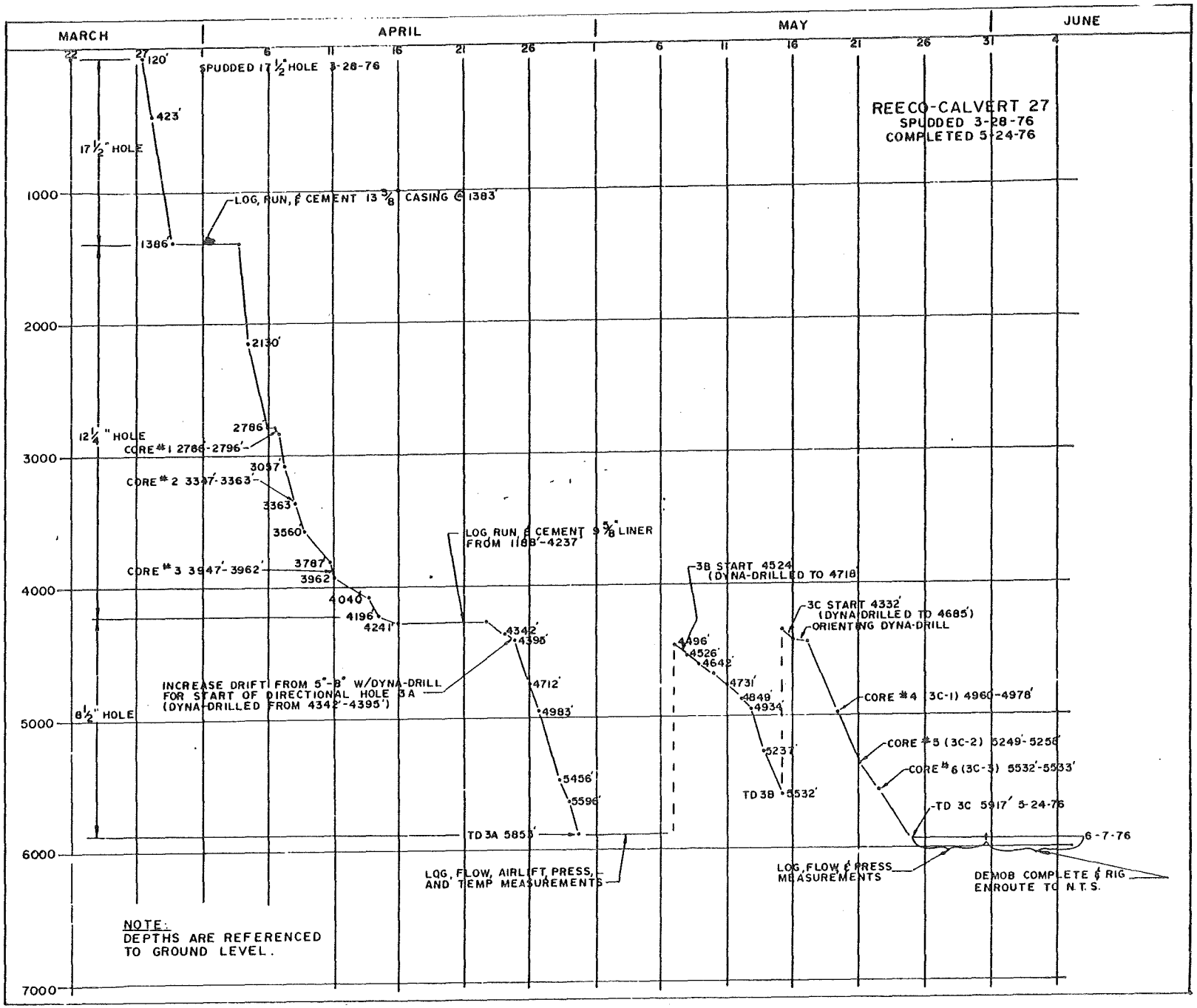


Figure 6. Drilling and Operations Summary

then used to complete the second 8-1/2-inch hole to a total depth of 5,532 feet. The horizontal separation between this leg (RRGE-3B) and the first directional leg (RRGE-3A) was 220 feet.

The final directional leg, RRGE-3C, was kicked off at 4,332 feet. A drift angle of approximately 12° was established before conventional drilling resumed and the 8-1/2-inch hole was completed at a total depth of 5,917 feet on May 24, 1976. See Figure 5 for the relationships between the three directional legs (3A, 3B, and 3C). Three cores were taken during this interval.

The drill rig was maintained in an active status for five days during logging and flow testing operations. Rig demobilization back to the ERDA Nevada Test Site (NTS) commenced on May 30, 1976. See Figure 6 for the Drilling and Operations Summary.

A summary of the daily drilling reports from mobilization through rig-down is presented as Appendix A.

2. SURFACE AND CONTAINMENT EQUIPMENT AND SERVICES

2.1 Containment Equipment - Surface Hole

Containment equipment used for the drilling of the 17-1/2-inch hole, from the bottom of the conductor pipe (120 feet) to the intermediate casing setting depth (1,383 feet), was limited to a 20-inch Shaffer single gate blow out preventer bolted between the casing head and the drilling nipple.

2.2 Containment Equipment - Production Hole

After the 13-3/8-inch intermediate casing was set and cemented, the following containment stack (listed in order of position above the casing head) was installed and used for the remainder of the drilling operation:

a. W-K-M Brewster double-flanged expansion spool, 20-inch x 12-inch.

b. W-K-M Brewster double-flanged gate valve, 12-inch.

c. Double-flanged flow spool with one 8-inch flanged outlet.

d. Cameron single gate blow out preventer, 12-inch.

e. Hydril Type GK blow out preventer, 12-inch.

f. Grant rotating head, 12-inch, high temperature model. This unit is manufactured for geothermal drilling operations.

2.3 Flow Testing Equipment

All flow testing of the well (as directed by INEL) was accomplished through the 8-inch flow line connected to the flow spool in the containment stack.

2.4 Wellhead

The Brewster expansion spool and gate valve were left on the casing head and the rest of the containment stack was removed for return with the drill rig to the Nevada Test Site.

2.5 Drilling Recorder

A Geolograph drilling recorder was used on the drill rig while drilling from 120 feet to total depth. This multi-pen recorder continuously indicated and recorded depth, penetration rate, bit weight, and pump pressure. A mud pit level recorder was added after setting the intermediate casing, and was used to total depth on RRGE-3A.

3. DOWNHOLE EQUIPMENT AND SERVICES

3.1 Intermediate Casing

Thirty-five joints of 13-3/8-inch, K-55, ST&C casing totaling 1,410.24 feet was set at 1,383 feet (GL). The top 2 joints and the bottom 21 joints were 68 lb/ft. The intervening joints were 54.5 lb/ft. See Appendix D for detailed Casing Record. A float collar was positioned one joint (40 feet) above the float shoe. Centralizers were positioned on the collar of every third joint of casing except joint No. 1 (the bottom joint) where it was located in the middle. All casing ends were threaded and joined with couplings. A casing crew using the "JAM" (Joint Analyzed Make-Up) system was employed to run the 13-3/8-inch casing.

3.2 Production Liner

Seventy-five joints of 9-5/8-inch, K-55, 36 lb/ft, BT&C casing totaling 3,048.91 feet were hung from a liner hanger inside the 13-3/8-inch casing. The top of the liner hanger was set at 1,188 feet leaving an overlap of 195 feet between the 13-3/8-inch casing and the 9-5/8-inch casing. See Appendix D for detailed Casing Record. The shoe of the 9-5/8-inch liner was set at 4,237 feet. A float collar was positioned one joint (40 feet) above the float shoe. Centralizers were placed on the collar of every third joint except joint No. 1 where it was located in the middle. All casing ends were threaded and joined with couplings. A casing crew using the "JAM" (Joint Analyzed Make-Up) system was employed to run the 9-5/8-inch casing.

3.3 Liner Hanger

The liner hanger for the 9-5/8-inch production liner was a Baash-Ross plain type with fluted cones and circulating ports. The ports were designed to facilitate a remedial cement job if required.

3.4 Drill Bit Summary

The 26-inch conductor hole was drilled to 120 feet with a "rathole" drill rig by an INEL subcontractor. Bit type was not recorded by REECo.

A 17-1/2-inch hole was drilled from 120 feet to 1,386 feet with one 17-1/2-inch mill tooth bit in 28 hours.

A 12-1/4-inch hole was drilled from 1,386 feet to 4,241 feet in 99-1/2 rotating hours. Five 12-1/4-inch mill tooth bits were used, two of which were re-run. Each bit averaged 852 feet. Three 8-1/2-inch cores were taken in this interval, using the same diamond core bit.

An 8-1/2-inch hole was drilled from the bottom of the liner to 5,853 feet in 79-1/4 hours. The first 101 feet were drilled with a mill tooth bit. Four button bits were used to drill the remaining 1,511 feet. A Dyna-Drill was used to increase drift angle in the interval from 4,342 feet to 4,395 feet. This hole was designated RRGE-3A.

The hole was sidetracked at 4,524 feet and directionally drilled to 5,532 feet in 62 hours rotating time. Seven bits were used: six 8-1/2-inch button bits, and one 8-1/2-inch mill tooth. The mill tooth bit was used to ream the dog legs produced by directional drilling. This hole was designated RRGE-3B.

A second 8-1/2-inch sidetrack hole was kicked off at 4,332 feet and drilled to 5,917 feet in 110-1/4 rotating hours, including the time required to ream the dog legs and core intervals. Seven bits were used: six 8-1/2-inch button bits and one re-run mill tooth bit. Three cores were taken in this sidetrack using two 8-1/2-inch diamond core bits. This hole was designated RRGE-3C. See Appendix B for the Bit Record.

3.5 Coring

Six 4-inch O.D. cores were taken using a 6-3/4-inch by 30 foot core barrel. Three cores were taken while drilling the 12-1/4-inch hole for the production liner and three were taken in the final sidetrack hole, RRGE-3C. Water was used as the drilling fluid for all cores. Three 8-1/2-inch diamond core bits, Christensen type MC20, were used.

CORING OPERATIONS
RRGE-3

Core Run	Core Bit	Interval From	Interval To	Core Recovery (ft)	Core Recovery %
1	1	2,786	2,796	10	100
2	1	3,347	3,363	3.5	22
3 (RRGE-3C)	1	3,947	3,962	15	100
4	2	4,958	4,978	20	100
5	3	5,249	5,258	6	67
6	2	5,532	5,533	1	100

3.6 Directional Drilling

A unique feature of RRGE-3 Well was the directional drilling of three holes into the resource production zone from a common well bore below the 9-5/8-inch liner. The objective of using this method was to maximize resource production derived from the investment in drilling, casing, and cementing to the production liner setting point. See Figure 7 for a summary of directional drilling surveys.

Cement plugs could not be set at the kickoff points for sidetracks 3B and 3C because this would seal off further production from the plugged legs. Therefore, a drift angle exceeding 8° was accumulated in directional hole 3A in the first 300 feet below the bottom of the production liner. Sidetrack holes 3B and 3C were kicked off from the low side of this 300 foot interval, with the second sidetrack being kicked off higher than the first.

This approach necessitated that all logging be accomplished for each leg before proceeding to the next because there was no way to control reentry into any but the last sidetrack drilled. The procedure proved successful. No significant difficulties were encountered in reentering the correct sidetrack when tripping or logging.

3.7 Drilling Fluid

A fresh water base gel mud was used to drill the 17-1/2-inch hole from 120 feet to 1,386 feet. Mud weight was 9 lb/gal, and viscosity was 45 sec/1000 cc.

All drilling below the 17-1/2-inch hole and all coring was performed with fresh water.

A lost circulation zone was encountered at 1,930 feet.

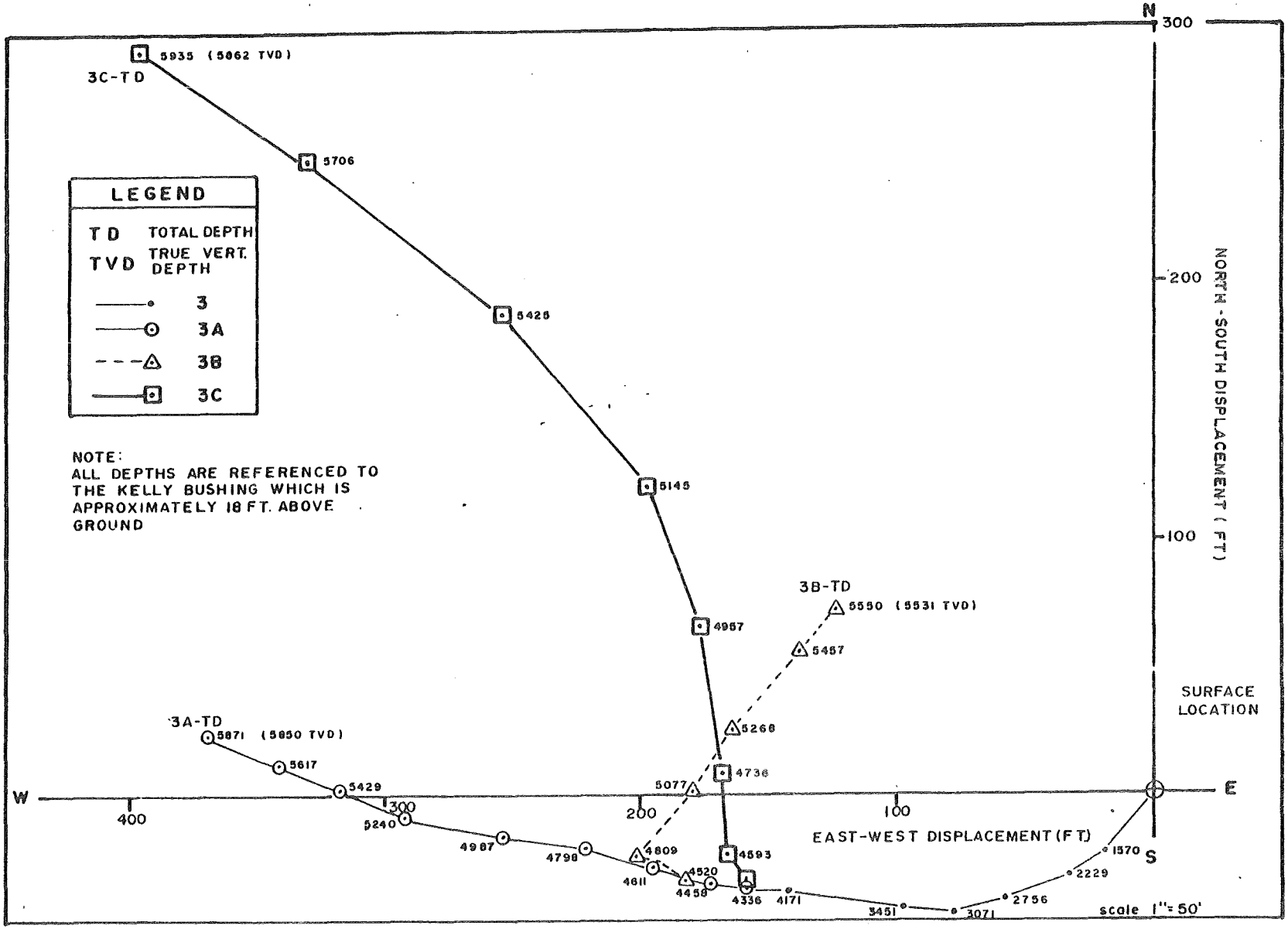


Figure 7. RRGE-3 Directional Survey Summary

3.8 Samples and Mud Logging Service

A mud logging service was employed to monitor drilling fluid and cutting returns. The service was used in drilling from approximately 1,400 feet to total depth on RRGE-3A and 3B and to about 5,620 feet on RRGE-3C. This service monitored fluid temperatures (in and out), hydrogen sulfide and hydrocarbons. Lithological characteristics were also determined from the analysis of drill cuttings.

3.9 Formation Tops

Analysis of drilling fluid returns indicated the following approximate formation tops:

Formation	Depth (ft) from Ground Level		
	RRGE-3A	RRGE-3B	RRGE-3C
Alluvium	0	---	---
Raft River	520	---	---
Salt Lake	1,270	---	---
Metamorphosed Zone	5,300	5,340	5,400
Elba Quartzite	5,780	5,530	5,495
Quartz Monzonite	5,842	---	5,900

(Formation data provided by INEL.)

3.10 Logging

The logging program conducted in RRGE-3 was as follows:

Log Run No.	Type Log	Date Log Run	Logged Interval (From)	(To)	Total Footage Logged
	17-1/2-inch open hole:				
1	Caliper	03-30-76	36	1,391	1,355
2	Dual induction focused with linear correlation	03-30-76	122	1,392	1,270
3	Temperature	03-30-76	7	1,394	1,387
	12-1/4-inch open hole:				
4	Caliper	04-17-76	1,385	4,209	2,824
5	Dual induction focused with linear correlation	04-17-76	1,385	4,209	2,824
6	Compensated neutron with gamma ray	04-17-76	1,385	4,209	2,824
7	Compensated densilog with gamma ray and caliper	04-17-76	1,384	4,209	2,825
8	BHC Acoustilog with gamma ray and caliper	04-18-76	1,385	4,201	2,816
	9-5/8-inch liner:				
9	Acoustic cement bond	04-20-76	1,206	2,396	1,190
10	Acoustic cement bond	04-23-76	1,150	4,226	3,076
	8-1/2-inch open hole:				
11	Acoustilog with gamma ray and caliper	05-01-76	4,247	5,856	1,609
12	Temperature	05-01-76	0	5,868	5,868
13	Compensated neutron with gamma ray	05-01-76	4,200	5,863	1,663
14	Dual induction focused with linear correlation	05-02-76	4,247	5,863	1,616
15	Compensated densilog with gamma ray and caliper	05-03-76	4,247	5,863	1,616
16	Temperature	05-03-76	0	5,865	5,865

Note: Logged interval measurements determined from ground level.

3.11 Cementing

Intermediate Casing. The 13-3/8-inch intermediate casing was cemented in one stage through the float shoe at 1,383 feet with 500 sacks of Class "G" cement, containing one cubic foot of perlite per sack, 35 percent silica flour, two percent gel, and three percent Calcium Chloride. Slurry weight was 12.4 lbs. per gallon and yield was 2.59 cubic feet per sack. This was followed by 250 sacks of 50-50 Pozmix with 35 percent silica flour and two percent Calcium Cloride. Slurry weight was 15.9 lbs. per gallon and yield was 1.5 cubic feet per sack. The stage was tailed in with 200 sacks of Class "G" cement with 35 percent silica flour. Slurry weight was 15.7 lbs. per gallon and yield was 1.55 cubic feet per sack. Total volume of slurry was 353 barrels (1,980 cubic feet). Good circulation was maintained throughout the operation and cement returns were obtained at the surface.

Production Liner. The 9-5/8-inch production liner was cemented in two stages: Stage No. 1 was pumped through the float shoe at 4,241 feet placing cement up to approximately 2,400 feet in the annulus, and Stage No. 2 was squeezed through ports in the liner hanger at 1,188 feet filling the annulus from 2,400 feet to the hanger.

The intent of the initial (Stage No. 1) cementing operation was to place cement throughout the entire liner interval in a single operation. But, with the failure of the cement to rise above approximately 2,400 feet in the annular space, a remedial (Stage No. 2) cementing operation was required.

The Stage No. 1 cement slurry consisted of the following: 1) a lead volume of 1,290 sacks of Class "G" cement containing two percent gel, 35 percent silica flour, one cubic foot of perlite per sack, 0.75 percent CFR2, and 0.2 percent HR-4. Slurry weight was 12.4 lbs. per gallon and yield was 2.59 cubic feet per sack. Lead slurry volume was 3,341 cubic feet (595 barrels); 2) a tail volume of 100 sacks of Class "G" cement containing 35 percent silica flour, 0.75 percent CFR2 and 0.2 percent HR-4. Slurry weight was 15.7 lbs. per gallon and yield was 1.55 cubic feet per sack. Tail slurry volume was 155 cubic feet (28 barrels).

The lead and tail slurry total volume of 3,496 cubic feet (623 barrels) was mixed and pumped down the "run in" drill pipe string and displacement with water was commenced. After approximately 100 barrels had been displaced the cementing pressures increased to 1,600 psi and the snubbing lines (chains) holding the drill pipe in the hole failed and the pipe rose approximately two feet. Pumping pressure was released and the pipe returned to its original position. Further attempts to displace the cement proved unsuccessful and the operation was discontinued with cement remaining in the 9-5/8-inch liner from 4,241 feet to 2,421 feet. Stage No. 1 was calculated to have risen in the annulus to about 2,400 feet or approximately 1,200 feet below the liner hanger.

The Stage No. 2 cementing slurry consisted of a lead volume of 400 sacks of Class "G" cement containing two percent gel, 35 percent silica flour, one cubic foot of perlite per sack and two percent Calcium Chloride. Slurry weight was 12.4 lbs. per gallon and yield was 2.59 cubic feet per sack.

Lead slurry volume was 1,039 cubic feet (184 barrels). The tail volume consisted of 180 sacks of Class "G" cement containing 35 percent silica flour for a weight of 15.7 lbs. per gallon and yield of 1.55 cubic feet per sack. Tail slurry volume was 279 cubic feet (50 barrels).

A packer was run on drill pipe and set at 1,100 feet (100 feet above the liner hanger). The total lead and tail slurry volume of 1,318 cubic feet (234 barrels) was mixed and pumped down the drill pipe with the well on a vacuum. After displacing cement with 18 barrels of water, pressure began building and rose to 1,000 psi with 21 barrels of water pumped. After pumping 22 barrels of water, displacement was stopped with the well holding 1,200 psi. The packer was released and reverse circulation established. No cement was circulated out. The packer was reset and 200 psi placed on the drill pipe.

A 70 foot plug of cement above the hanger was drilled out and a satisfactory cement job was verified with a subsequent cement bond log.

COMPLETION REPORT
RRGE-3, 1977
[IDO 10069]

Appendix A

DAILY DRILLING REPORTS

RRGE-3 - DAILY DRILLING REPORTS

March 22, 1976	Rigged up with 3 crews, 10 hours. Set mud pits. Set and leveled subbase. Rigged down and loaded drill pipe and equipment at RRGE-2.
March 23, 1976	Rigged up with 3 crews, 10-1/2 hours. Loaded derrick at RRGE-2 and moved to RRGE-3. Set derrick, drawworks motor and pump motors on subbase. Loaded 9-5/8-inch casing and equipment at RRGE-2.
March 24, 1976	Rigged up with 3 crews, 10-1/2 hours, using crane to hang dog house stand, floor extension, and derrick board. Strung drilling line. Loaded equipment and 13-3/8-inch casing at RRGE-2.
March 25, 1976	Rigged up with 3 crews, 9-1/2 hours. Raised derrick at 2:45 p.m. Connected electric and water lines. Worked on mud pumps and engine compound. Relocated equipment.
March 26, 1976	Rigged up with 3 crews, 10 hours. Set in floor plates and set up wind walls and hand rails. Connected cellar jet and set trash pump by reserve pit.
March 27, 1976	Rigged up with 3 crews, 9-1/2 hours. Nipped up to casing head with 20-inch gate valve. Connected flow line. Set in rathole and mousehole. Unloaded subs and drill collars from RRGE-2. Replaced piston rubbers in pumps No. 1 and No. 2.
March 28, 1976	Rigged up with 2 crews, 6-1/2 hours. Picked up 17-1/2-inch bit and drilled out cement in conductor casing from 58 to 120 feet in 6-1/4 hours. Cleaned mud tanks and mixed mud. Drilled 17-1/2-inch hole 120 to 153 feet, 1-3/4 hours.
March 29, 1976	Began 3-shift, 24-hour operation. Drilled 17-1/2-inch hole 153 to 1,003 feet in 17-3/4 hours. Survey at 846 feet, 0° 35 minutes. Repaired sandline clutch, No. 1 pump engine and 2-inch mudline, serviced and inspected rig, and unplugged jet in shale pit, 4 hours.
March 30, 1976	Drilled 17-1/2-inch hole 1,003 to 1,404 feet in 8-1/2 hours. Circulated and conditioned hole for logging. Survey at 1,311 feet, 1° 10 minutes. Ran temperature survey log (158°), dual induction log, and caliper log, 7-1/4 hours. Picked up 17-1/2-inch reamer and bit No. 1, a 17-1/2-inch Security type S3SJ mill tooth.

NOTE: Depths throughout this section are referenced to the Rotary Kelly Bushing which is 18 feet above ground level.

RRGE-3 - DAILY DRILLING REPORTS

March 31, 1976 — Tripped in hole and circulated to condition hole for casing, 4 hours. Tripped out and laid down 6-5/8-inch drill pipe and 11-inch drill collars. Stood 8-inch drill collars in the derrick. Set tools out and cleaned up floor to run casing. Ran 35 joints of 13-3/8-inch K-55, ST&C, Range 3 casing totaling 1,410.24 feet set at 1,401 feet KB (1,383 GL). Rigged up cement head and circulated the hole. Cemented Stage No. 1 with 353 barrels of slurry displaced with 200 barrels of water. Left 50 feet of cement in the casing above the float collar.

April 1, 1976 — Cement in place at 12:32 a.m. WOC 23-1/2 hours. Flushed cement out of BOP. Cleaned out flowline and shale shaker. Jetted and cleaned all pits. Rigged down Halliburton. Installed 8-inch valve in flowline. Cut off 20-inch casing including casing head and set out of cellar.

April 2, 1976 — Welders worked on 20-inch casing head, 24 hours. 13-3/8-inch casing not centered in 20-inch casing. Welded 3-inch plate to 13-3/8-inch casing and welded 20-inch casing with casing head on plate with 13-3/8-inch casing centered. Crews assisted welders, worked on 17-1/2-inch stabilizers, set 4-1/2-inch drill pipe and 8-inch drill collars on racks, and set accumulator in place.

April 3, 1976 — Welders finished welding casing head on casing. Nippled up BOP. Connected flow line. Connected accumulator to BOP. Measured and calipered drill collars, reamers, and cross-over subs. Pressured up on BOP. Set in floor and rotary table. Picked up 12-1/4-inch drilling assembly and tripped in with bit No. 2, a 12-1/4-inch Reed type Y13J mill tooth.

April 4, 1976 — Tagged top of cement at 1,286 feet. Drilled out cement to 1,390 feet. Closed pipe rams and pressure tested casing to 350 psi. Eight-inch flange on flow spool below BOP leaked fluid. Replaced flange and pressured up to 350 psi for 15 minutes. Drilled out cement plug and shoe to 1,401 feet. Drilled 12-1/4-inch hole to 1,869 feet, 12 hours. Survey at 1,570 feet, 2° .05 minutes S42°W.

April 5, 1976 — Drilled 12-1/4-inch hole 1,869 to 2,211 feet in 1-1/2 hours, and tripped for new bit. Tripped in with bit No. 3, a 12-1/4-inch Reed type Y13J mill tooth and drilled to 2,500 feet in 8 hours. Replaced air throttle on No. 2 pump. Survey at 2,357 feet, 2° 30 minutes S77°W.

April 6, 1976

Drilled 12-1/4-inch hole 2,500 to 2,804 in 14-1/4 hours and circulated for core No. 1. Tripped out with bit No. 3 and laid down two string reamers and one 8-inch drill collar. Serviced core barrel. Survey at 2,756 feet, 3° 15 minutes S75°W.

April 7, 1976

Tripped in hole with core barrel and an 8-1/2-inch Christensen diamond core bit. Cored from 2,804 feet to 2,814 feet. Tripped out with core No. 1 and recovered a full core (10 feet). Removed diamond bit from core barrel, serviced and laid down, 1 hour. Ran temperature log for 2-1/2 hours (Bottom hole temperature - 174°F) jetted and cleaned mud pits, serviced drawworks engines and air compressors in 2-1/2 hours. Tripped in with bit No. 4, a 12-1/4-inch Reed Y13J. Picked up two stabilizers and one bottom hole reamer, 2 hours. Reamed core hole from 2,804 feet to 2,814 feet in 1 hour and continued drilling to 2,900 feet in 7-1/2 hours. Conducted directional survey at 2,859 feet, 3° 30 minutes, S69°W.

April 8, 1976

Drilled a 12-1/4-inch hole from 2,900 feet to 3,365 feet in 15-1/2 hours. Connected 8-inch discharge line on flash tank. Tripped out of hole, laid down 2 stabilizers and picked up and serviced core barrel, 4 hours. Conducted directional survey at 3,196 feet, 3° 20 minutes, S84°W.

April 9, 1976

Tripped in hole for core run No. 2 and cored from 3,365 feet to 3,381 feet in 3-1/2 hours. Tripped out with core No. 2, (3-1/2 foot recovery). Removed diamond bit from core barrel, serviced barrel and laid down. Installed a 3-1/2-inch orifice in 8-inch flow line. Ran temperature log for 3-1/2 hours. (Bottom hole temperature was recorded at 161°F.) Serviced engines on mud pump No. 1 and ran 2-inch line from well to water tank. Connected air compressor to mud line and ran 3 stands of drill pipe in hole open-ended. Blew water out of the hole with drill pipe at 279 feet and well started flowing. Pulled out and rigged up lubricator to run temperature log. Ran temperature log for 2 hours. Picked up stabilizers and tripped in hole with bit No. 5, a 12-1/4-inch Reed Y13J. Broke circulation. Cleaned out fill from 3,330 feet to 3,365 feet in 1/2 hour. Reamed core hole to 3,381 feet in 1/2 hour and continued drilling to 3,428 feet in 2 hours. Conducted directional survey at 3,325 feet, 2° 20 minutes, N89°W.

RRGE 3 - DAILY DRILLING REPORTS

April 10, 1976

Drilled 12-1/4-inch hole from 3,428 feet to 3,436 feet and lost circulation. Filled mud tanks and circulated out sand at 3,436 feet in 2 hours. Continued drilling to 3,451 feet in 2-3/4 hours and conducted directional survey at 3,451 feet, 3° 15 minutes, N70°W. Had 40 feet of fill in hole after survey and no returns to the surface. Pumped water down the hole and washed out fill with partial returns. Drilled from 3,451 feet to 3,578 feet in 3 hours. Returns were being lost to the formation @ 550 gpm. Conducted directional survey at 3,570 feet, 3° 20 minutes, N88°W. Had 35 feet of fill after survey. Washed out fill and continued drilling 12-1/4-inch hole from 3,578 feet to 3,805 feet in 8-3/4 hours. Circulated to condition hole, surveyed at 3,733 feet and tripped out of hole with bit No. 5. Filled hole and kept full with mud pump. Hole was taking fluid at the rate of 160 gpm. Shut down pump after 45 minutes and fluid level dropped to 28 feet (GL). Rigged up and ran temperature survey for 1-3/4 hours.

April 11, 1976

Removed 3-3/8-inch orifice from 8-inch flow line. Rigged down temperature survey at 1:00 a.m. (Temperature was recorded at 144°F). Fluid level checked at 28 feet (GL). Tripped in hole with 5 stands of open-ended drill pipe to a depth of 504 feet and blew water out of hole for 2 hours. Turned off air - well not flowing. Continued blowing water out until 6:00 a.m. Pulled out of hole with well flowing @ 198 gpm. Rigged up and ran temperature survey and flowed well for 6 hours. (Flow-rate estimated @ 225 gpm and temperature recorded at 191°F.) Ran in 17 joints of drill pipe open-ended and took orifice out of 8-inch flow line. Blew water out with drill pipe at 527 feet for 3-1/4 hours. (Flow-rate with air injection estimated @ 800 gpm and temperature recorded at 220°F.) Changed orifice in 8-inch flow line to 5-3/8-inch. Water flow with air injection recorded @ 1,050 gpm. Rigged up and ran temperature survey for 3-1/4 hours. Flow-rate without air injection was 310 gpm and bottom hole temperature was recorded at 242°F. Tripped in with a re-run of bit No. 5, cleaned out 5 feet of fill and drilled a 12-1/4-inch hole from 3,805 feet to 3,808 feet in 2-3/4 hours.

April 12, 1976

Drilled 12-1/4-inch hole from 3,808 feet to 3,965 feet in 5-1/4 hours. Began losing water and after 1 hour of drilling ran out of water. Pulled up one stand and filled mud tanks. Also set in and hooked up a trash pump from the reserve pit to the mud tanks to supply water. Ran back in (45 feet of fill). Washed out fill, circulated and conditioned hole for core run No. 3. Repaired mud line, 1/2 hour. Continued circulating hole for 1-1/4 hours. Conducted directional survey at 3,911 feet, 3° 40 minutes, N86°W. Tripped out and laid down 2 stabilizers. Removed junk sub and picked up core barrel. Made up diamond core bit on barrel and tripped in hole. Circulated before coring and cored from 3,965 feet to 3,980 feet in 2 hours. Tripped out with core barrel, dumped core No. 2 and laid core barrel down, 2 hours. Had a full 15 foot recovery. Tripped in hole with 5 stands of 4-1/4-inch drill pipe. Began air injection flow test at 10:30 p.m.

April 13, 1976

Completed air injection flow test at 3:30 a.m. Pulled out drill pipe. Rigged up 4-1/2-inch I.F. lubricator and INEL logging truck. Ran temperature survey while flowing well for 4 hours. Temperature log not working properly. Ran temperature survey again for 1 hour. Ran five stands of drill pipe in hole. Conducted air injection flow test with free flowing well for 6-1/4 hours. Changed rotating rubber and tripped out of hole with drill pipe, 1 hour. Conducted temperature survey using Amerada temperature bomb, with well flowing, for 2 hours. (Bottom hole temperature recorded at 239°F.) Attempted to repair INEL logging truck for 4 hours. Connected mud line and pumped cool water down hole while preparing to go in hole with bit No. 6, a 12-1/4-inch Reed S21GJ.

April 14, 1976

Picked up tools and pumped cold water down hot hole for 1 hour. Stopped while tripping in hole to pump water and cool the hole. Fill tagged at 3,895 feet (70 feet of fill). Washed out fill and reamed core hole from 3,965 feet to 3,980 feet in 3/4 hour. Drilled 12-1/4-inch hole from 3,980 feet to 4,058 feet. Lost circulation while drilling at 4,027 feet. Tried unsuccessfully to get full returns to the surface for 1-1/2 hours. Circulated for 1/2 hour. Made short trip and tagged top of fill at 3,968 feet. Circulated and washed hole to bottom. Returns increased from 20 percent to 75 percent, from 3,968 feet to 4,058 feet. Continued drilling 12-1/4-inch hole to 4,214 feet, 7-1/4 hours. Circulated and conditioned hole for 1-1/2 hours. Conducted directional survey at 4,171 feet, 4° 15 minutes, N70°W. Started out of hole.

April 15, 1976

Tripped out of hole, logged and flowed hole for 1-1/2 hours. Ran in five stands of drill pipe to air flow hole. Conducted air flow test at 500 feet for 4 hours. Pulled out and rigged up to log. Ran temperature survey with the INEL logging truck. Log not operating properly - worked on logging unit for 1-1/2 hours. Ran temperature survey using Amerada bomb for 2-1/4 hours. Ran one stand of drill pipe in hole and the temperature tool malfunctioned. Waited on orders for 3/4 hour. Ran 4 more stands of drill pipe in hole (total of 5) and conducted air flow test for 4-1/4 hours. Conducted air flow test with air injection - 1/2 hour. Pulled drill pipe out of hole and rigged up to run temperature survey, 1/2 hour. Ran INEL electrical temperature survey, 2-1/2 hours. (Bottom hole temperature recorded at 230°F.) Conducted Amerada temperature survey for 4-1/2 hours.

April 16, 1976

Rigged down Amerada temperature bomb. Lost the probe in mousehole. Pulled mousehole, recovered probe and replaced mousehole, 1 hour. Waited on orders for 1 hour. Pumped in hole for 1-1/2 hours. Picked up tools and tripped in hole with re-run of bit No. 6, a 12-1/4-inch Reed S21GJ. Fill tagged at 4,124 feet. Cleaned and circulated out fill from 4,124 feet to 4,214 feet in 2-1/2 hours. Drilled 12-1/4-inch hole from 4,214 feet to 4,259 feet in 3-1/4 hours. Circulated for samples at 4,259 feet - 1-3/4 hours. Circulated and conditioned hole to log for 6-1/2 hours. Conducted directional survey at 4,217 feet, 4° 20 minutes, N86°W. Started to trip out of hole.

April 17, 1976

Finished tripping out of hole. Waited on service contractor logging unit for 1-3/4 hours. Rigged up and ran caliper log and tagged fill at 4,209 feet. (No results on first run). Ran caliper log again to 4,212 feet (GL). Ran dual induction log to 4,212 feet (GL). Ran acoustic sonic log. Worked on density tool, 2-1/4 hours. (4,212 feet (GL) temperature was recorded at a high of 168°F and at a low of 130°F). Ran Densilog and caliper log to 4,212 feet (GL). Ran neutron log to 4,210 feet. Total logging time, 16-3/4 hours.

April 18, 1976

Waited on caliper tool for 1 hour. Conducted an unsuccessful sonic log run. Worked on sonic tool and temperature tool for 3-3/4 hours. Ran sonic tool and tagged fill at 4,209 feet (GL). Ran acoustilog and caliper log to 4,209 feet (GL). Rigged down logging equipment, 3/4 hour. Made up bit and reamer and tripped in hole with a re-run of bit No. 6. Circulated and conditioned hole to run casing for 3-1/2 hours. Tripped out of hole. Cleaned off rig floor while waiting on casing crew. Rigged up casing crew equipment and JAM system, 2-1/4 hours. Began running 9-5/8-inch casing.

April 19, 1976

Ran 75 joints of 9-5/8-inch K55, 36 lb/ft casing in 5-1/2 hours. Made up Baash-Ross liner hanger and setting tool on 4-1/2-inch drill pipe. Tripped in hole with 9-5/8-inch casing and liner hanger. Tagged fill at 4,227 feet. Circulated out fill for 2 hours. Set liner hanger at 1,206 feet (KB). Casing shoe was set at 4,255 feet (KB). Total 9-5/8-inch casing set was 3,049 feet including 7.6 foot liner hanger. Pumped 50 barrels of gel ahead and cemented Stage No. 1 with 3,496 cu/ft of cement. Dropped plug and started displacement. Could not complete displacement due to pressure increase. Tripped out of hole and laid down liner running tools. WOC and laid down 8-inch collars - 2 hours. Ran temperature survey for 2-1/2 hours. Replaced flange on flow line with the welder. Picked up 6-inch drill collars, near bit reamer and 8-1/2-inch bit.

April 20, 1976

WOC and ran 18 stands of pipe and 9 drill collars in hole, 1 hour. Picked up kelly, closed rams and pumped 360 barrels of water through the drill pipe. (Well head pressure recorded at 75 psi.) Ran five more stands of drill pipe in hole and tagged cement at 2,421 feet (KB). Tripped out of hole. Rigged up tools for service contractor logging unit. Ran acoustic cement bond log at 2,397 feet (GL) for 3-3/4 hours. Checked cement inside 9-5/8-inch casing. No cement was found outside of casing. Rigged loggers down and WOC for 6-3/4 hours. Made up RTTS packer and tripped in hole with 12 stands of drill pipe. Set double packer on 11th stand at 1,100 feet in 13-3/8-inch casing and pressurized to 200 psi.

April 21, 1976

Cemented Stage No. 2 through ports and the liner hanger with 1,318 cu/ft of cement in one stage, WOC for 8 hours. Tripped out and broke down the RTTS packer. Picked up tools and tripped in with re-run bit No. 6, 12-1/4 Reed S21GJ, tagging cement at 1,142 feet. Drilled out cement from 1,142 feet to 1,203 feet in 13-3/8-inch casing, 2 hours. Tripped out of hole to change bits. Tripped in hole with bit No. 7, an 8-1/2-inch Hughes OWVJ. Drilled out cement (top plug) in the 13-3/8-inch casing from 1,203 feet to 1,276 feet. Ran in hole to 1,357 feet and conducted pressure test on casing. Casing held 300 psi for 30 minutes. Ran in and tagged top of cement at 2,421 feet. Drilled out cement (bottom plug) in 9-5/8-inch casing from 2,421 feet to 2,679 feet in 5 hours.

April 22, 1976

Drilled cement out of 9-5/8-inch casing with 8-1/2-inch bit from 2,679 feet to 3,374 feet in 10-3/4 hours. Bit torqued up as if drilling on junk. Tripped out to inspect bit and discovered broken teeth. Tripped in with bit No. 8, an 8-1/2-inch, Hughes OWVJ. Filled drill pipe and drilled by junk. Continued drilling cement out of 9-5/8-inch liner from 3,374 feet to 3,740 feet in 6-1/2 hours.

RRGE 3 - DAILY DRILLING REPORTS

April 23, 1976 — Drilled cement out of 9-5/8-inch casing from 3,740 feet to 4,245 feet in 6-1/2 hours. Circulated hole for 1 hour and started trip out. Rigged up and conducted pressure test (pressure held at 300 psi for 15 minutes.) Finished tripping out to log. Rigged up service contractor logging unit and ran acoustic cement bond log, 5 hours. Installed new wash pipe and packing in swivel. Tripped in hole with re-run of bit No. 8, an 8-1/2-inch, Hughes OWVJ and filled drill pipe with water.

April 24, 1976 — Drilled from 4,245 feet through cement and guide shoe at 4,255 feet and continued drilling to 4,360 feet in 6-3/4 hours. Circulated and conditioned hole for sidetrack, 4-3/4 hours. Tripped out of the hole and waited on directional drilling supervisor and tools for 8 hours. Tripped in hole with directional drilling tools and bit No. 9, an 8-1/2-inch Smith F4.

April 25, 1976 — (RRGE-3A) Completed trip in hole with directional tools. Worked on survey instruments for 1-1/2 hours. Oriented Dyna-Drill with 5 runs from 4,360 feet to 4,381 feet, 1-3/4 hours. Filled drill pipe with water. Conducted directional survey at 4,350 feet, 5° 45 minutes, N87°W. Drilled an 8-1/2-inch hole from 4,381 feet to 4,413 feet with Dyna-Drill for 3/4 hours. Tripped out of hole to change drilling assemblies. Tripped in hole with bit No. 10, an 8-1/2-inch Smith F4. Laid 2 joints of 4-1/2-inch drill pipe down to ream. Reamed 8-1/2-inch hole from 4,360 feet to 4,413 feet in 1 hour. Continued drilling to 4,565 feet in 8 hours. Conducted directional surveys at 4,458 feet, 8° 45 minutes, N79°W and at 4,520 feet, 8° 45 minutes, N80°W.

April 26, 1976 — (RRGE-3A) Drilled an 8-1/2-inch hole from 4,565 feet to 5,001 feet in 15-1/4 hours. Circulated hole for 1/4 hour, and tripped out for temperature log. Conducted directional surveys at 4,611 feet, 8° 15 minutes, N67°W; 4,674 feet, 8° 5 minutes N63°W; 4,736 feet, 8° 15 minutes, N75°W; 4,798 feet, 9° minutes, N89°W; 4,861 feet, 10° 0 minutes, N75°W and at 4,924 feet, 9° 45 minutes, N79°W.

April 27, 1976 — (RRGE-3A) Ran temperature logs at 4,600 feet - 181°F, 4,700 feet - 194°F, 4,750 feet - 199°F and 4,800 feet - 203°F in 3 hours. Instrument stopped working at 4,800 feet. Ran Amerada temperature bomb for 2-1/2 hours. Rigged down temperature log and checked drill pipe float. Tripped in hole with bit No. 11, an 8-1/2-inch Smith F5. Filled drill pipe with water and drilled from 5,001 feet to 5,345 feet in 10-1/2 hours. Conducted directional surveys at 4,987 feet, 10° 5 minutes, N87°W; 5,050 feet, 9° 20 minutes, N77°W; 5,114 feet, 8° 50 minutes N80°W; 5,176 feet, 8° 20 minutes, N82°W and at 5,240 feet, 9° 0 minutes, N79°W.

RRGE 3 - DAILY DRILLING REPORTS

April 28, 1976	(RRGE-3A) Drilled an 8-1/2-inch hole from 5,345 feet to 5,597 feet in 16-3/4 hours. Circulated for survey and tripped out of hole with bit No. 11. Rigged up and ran INEL temperature probe which stopped working at 206 feet. Rigged up and ran Amerada temperature bomb, 2-1/2 hours.
April 29, 1976	(RRGE-3A) Continued running Amerada temperature bomb for 1-1/2 hours. (Bottom hole temperature was recorded at maximum thermometer reading - 285°F.) Tripped in hole with bit No. 12, an 8-1/2-inch, Security H88F in 2-1/2 hours. Reamed hole from 5,567 feet to 5,597 feet in 2-1/4 hours. Continued drilling from 5,597 feet to 5,825 feet in 16-1/4 hours. Conducted directional surveys at 5,617 feet, 7° 10 minutes, N72°W; 5,680 feet, 7° 0 minutes, N65°W and at 5,742 feet, 6° 55 minutes, N68°W.
April 30, 1976	(RRGE-3A) Drilled an 8-1/2-inch hole from 5,825 feet to 5,871 feet in 5-1/2 hours. Conducted directional survey at 5,810 feet, 6° 45 minutes, N65°W. Circulated hole for 1/4 hour and tripped out of hole for a bit, an airlift run and a temperature survey. Left 3 cutters in hole. Changed stripper rubber in rotating head, ran 3 stands of 4-1/2-inch drill pipe along with one 8-1/2-inch float sub in hole and rigged up the air compressor, 2 hours. Conducted flow test with air lift at 280 feet. Tried to run stand No. 4 in hole. Hole would not unload at 400 feet. Tripped out of hole with 4-1/2-inch drill pipe to run temperature survey, 5 hours. Ran Amerada bomb to total depth, 2 hours. (Open flow recorded with Amerada in hole was 50 gpm.) Rigged down Amerada bomb, ran 3 stands of pipe in hole, ran flow test with air and picked up stand No. 4. Laid down 2 singles and began unloading hole at 353 feet with a 500 gpm rate of flow. Pulled out of hole to rig up and run Amerada temperature bomb.
May 1, 1976	(RRGE-3A) Continued running Amerada temperature bomb for 1-1/2 hours. Well started flowing at 1:30 a.m. Checked flow temperature of well while waiting on the service contractors logging unit for 1/2 hour. Rigged up logging unit and worked on temperature tool for 2 hours. Conducted an open hole and cased hole temperature log for 4 hours, a neutron log, 2 density logs (neither of which worked), an acoustilog and a caliper log in 8 hours. Ran a neutron log for 8 hours.

RRGE 3 - DAILY DRILLING REPORTS

May 2, 1976	(RRGE-3A) Ran density log for 5-1/2 hours. (Tool malfunctioned.) Ran dual induction log for 1-3/4 hours. Rigged down service contractors logging unit. Ran 3 stands of 4-1/2-inch drill pipe in hole and began flow test with air injection. Pulled out of hole and rigged up INEL logging truck. Ran temperature log at 5,400 feet. (Temperature was recorded at 280°F.) Tripped in hole with 3 stands of 4-1/2-inch drill pipe open-ended. Air lifted water out of hole with air compressor for 1/2 hour. Gauged water rise inside casing with probe at intervals of 10 feet from 168 feet to the surface for 2-1/2 hours. (Free-flow rate was recorded @ 248 gpm at 168 feet.) Air lifted water with air compressor for 6 hours.
May 3, 1976	(RRGE-3A) Continued air lifting water out of hole for 7 hours. Pulled 3 stands out of hole and rigged up service contractors logging unit. Ran open hole and cased hole temperature log for 8 hours. (Bottom hole temperature was recorded at 295°F.) Well had stopped flowing but began Artesian flow at 5:30 p.m. Made up density tool on service contractors logging unit. Ran Densilog and caliper log for 2-1/2 hours. Continued flowing well @ 47 gpm for 2-3/4 hours. Ran 3 stands in hole and picked up kelly. Continued air lifting water out of hole for 3/4 hour.
May 4, 1976	(RRGE-3A) Air lifted water out of 9-5/8-inch casing for 8 hours. Conducted flow test with air injection for 1-1/2 hours. Gauged water rise from 193 feet to the surface for 6-1/2 hours. (Flow-rate was recorded @ 378 gpm at 193 feet.) Ran quartz pressure probe to 4,450 feet and took readings while well flowed for 8 hours. Free flow rate at surface was recorded @ 60 gpm, well-head pressure was 20 psi, pressure at 4,550 feet was 1,874 psi and the temperature at 4,550 feet was recorded at 283°F.
May 5, 1976	(RRGE-3A) Ran quartz temperature and pressure probe with well shut in and pipe rams closed for 16 hours. Ran 3 stands of drill pipe in hole and continued running quartz temperature and pressure probe at 4,550 feet with rams closed for 8 hours. Final pressure was recorded at 1,920 psi, well-head pressure was 24.5 psi, flow-rate was recorded @ 100 gpm and temperature was 283°F. Started flashing at 6:00 p.m.

RRGE 3 - DAILY DRILLING REPORTS

May 6, 1976

(RRGE-3A) Placed choke in 8-inch flow line and flowed well through separator for 1 hour. Continued flowing well with quartz temperature and pressure probe in hole at 4,550 feet (with well shut in) for 15 hours. Ran 3 stands of drill pipe in hole and continued logging in hole for 3 hours. Cooled hole for 1/4 hour. Pulled quartz probe out of hole. Injected cool water in hole through drill pipe for 3/4 hour. Connected air compressor and air lifted water out of hole with drill pipe at 278 feet for 2 hours.

May 7, 1976

(RRGE-3A) Continued air lifting water out of casing for 7 hours then cut air off and allowed well to free flow through separator for 1 hour. Gauged hole with water separator for 3 hours. Pulled out of hole. Picked up Dyna-Drill and tools and laid down string stabilizer - 1-1/2 hours. Tripped in hole to 4,550 feet with bit No. 13, an 8-1/2-inch Hughes J88. Filled drill pipe with water and surveyed to orient Dyna-Drill. Tried to sidetrack (with Dynaflex) from 4,515 feet to 4,544 feet. Dyna-Drill not operating properly so started out of hole, 4-1/2 hours. Pulled one single and two stands and laid them down. On the third stand out, the pipe became stuck in tight hole (38-2/3 stands on hook).

May 8, 1976

(RRGE-3B) Worked stuck pipe at 4,247 feet for 1 hour. Broke kelly and one single of pipe out at A-frame, 4 hours. Used kelly bushing to drive pipe back which freed pipe. Tried to get kelly bushing in rotary table. Pipe went down but would not pull up. Worked stuck pipe at 4,259 feet for 4-1/2 hours until it became free at 10:30 a.m. Chained drill pipe out of hole and laid down tools, 2-1/2 hours. Dynaflex tool plug had blown out. Picked up Dyna-Drill and orienting sub and tested same for 1-1/2 hours. Tripped in hole with bit No. 14, an 8-1/2-inch, Smith F4. Oriented Dyna-Drill for 3/4 hour. While trying to sidetrack from 4,545 feet to 4,565 feet, fell off of shoulder. Drilled seven passes from 4,532 feet to 4,542 feet to build sidetrack shoulder - no shoulder - 3-1/2 hours. Drilled two passes from 4,540 feet to 4,545 feet to build sidetrack shoulder, 1-1/2 hours.

May 9, 1976

(RRGE-3B) Kicked off at 4,542 feet and drilled 8-1/2-inch sidetrack (RRGE-3B) to 4,599 feet in 6 hours. Tripped out of hole for new bit. Serviced rig and Dyna-Drill (rubber in bit). Tripped in hole with bit No. 15, an 8-1/2-inch Smith F5. Surveyed to orient Dyna-Drill, 1 hour. Dyna-Drill would not work. Tripped out of hole and changed out Dyna-Drill, 4-1/2 hours. Tripped in and checked new Dyna-Drill. Oriented Dyna-Drill and filled drill pipe with water. Drilled 8-1/2-inch hole from 4,599 feet to 4,604 feet in 1-1/4 hours. Conducted directional surveys at 4,517 feet, 8° 30 minutes, N75°W and 4,549 feet, 8° 0 minutes, N77°W.

RRGE 3 - DAILY DRILLING REPORTS

May 10, 1976

(RRGE-3B) Drilled 8-1/2-inch hole from 4,604 feet to 4,736 feet in 10 hours. Tripped out, checked Dyna-Drill and kick sub, 3-3/4 hours. Laid down Dyna-Drill and picked up bottom hole reamer and two string stabilizers. Tripped in hole with bit No. 16, an 8-1/2-inch Hughes OWVJ, 3 hours. Conducted directional surveys at 4,579 feet, 7° 0 minutes, N79°W; 4,621 feet, 4° 30 minutes, N87°W; 4,652 feet, 1° 30 minutes, N52°W and 4,684 feet, 3° 0 minutes, N83°W.

May 11, 1976

(RRGE-3B) Reamed out sidetrack hole from 4,530 feet to 4,736 feet in 3-1/2 hours and drilled 8-1/2-inch hole from 4,736 feet to 4,749 feet in 1/2 hour. Circulated hole and surveyed for 1 hour. Tripped out of hole. Tripped in hole with bit No. 17, an 8-1/2-inch Smith F5. Surveyed to orient Dyna-Drill at 4,448 feet for 1 hour. Ran in and tagged fill at 4,744 feet. Washed out fill, circulated to cool Dyna-Drill for 1/2 hour, then surveyed to orient Dyna-Drill. Drilled 8-1/2-inch hole from 4,749 feet to 4,860 feet in 3-1/4 hours. Circulated hole for 1-1/2 hours. Conducted directional surveys at 4,700 feet, 2° 30 minutes, N73°W; 4,746 feet, 3° 30 minutes, N37°W; 4,777 feet, 3° 45 minutes, N17°W and 4,809 feet, 3° 45 minutes, N11°E.

May 12, 1976

(RRGE-3B) Drilled 8-1/2-inch hole from 4,860 feet to 4,867 feet in 2 hours. Tripped out of hole and laid down Dyna-Drill. Picked up reamer and stabilizer and tripped in hole with a re-run of bit No. 16, an 8-1/2-inch Hughes OWVJ. Reamed Dyna-Drill hole to 4,867 feet in 3/4 hour and circulated hole for 1/2 hour. Surveyed and tripped out for Dyna-Drill. Picked up Dyna-Drill and tools and tested Dyna-Drill for 1 hour. Tripped in hole with bit No. 18, an 8-1/2-inch Hughes X55R, to 4,490 feet in 2 hours. Filled drill pipe with water to cool Dyna-Drill for survey. Drilled from 4,867 feet to 4,914 feet in 4 hours, then circulated and cooled hole for 3/4 hour. Conducted directional surveys at 4,850 feet, 6° 15 minutes, N38°E and 4,870 feet, 6° 45 minutes, N44°E.

May 13, 1976

(RRGE-3B) Drilled 8-1/2-inch hole from 4,914 feet to 4,952 feet in 1-3/4 hours. Tripped out and checked Dyna-Drill. Went in hole open-ended with one 6-inch drill collar, 8 joints of 4-1/2-inch drill pipe and rigged up to airlift. Conducted flow test for 5 hours. Ran water locater for 1 hour then pulled out of hole and picked up reamer and stabilizers. Tripped in hole with bit No. 19, an 8-1/2-inch Hughes J77 and reamed directional hole to 4,952 feet in 2 hours. Drilled 8-1/2-inch hole from 4,952 feet to 5,080 feet in 5 hours. Installed new rotating rubber and conducted directional surveys at 4,903 feet, 7° 30 minutes, N62°E; 4,953 feet, 7° 45 minutes, N43°E and 5,026 feet, 8° 0 minutes, N34°E.

RRGE 3 - DAILY DRILLING REPORTS

May 14, 1976	(RRGE-3B) Drilled 8-1/2-inch hole from 5,080 feet to 5,550 feet in 17-3/4 hours. Changed rotating rubber. Checked flow line and circulated and conditioned hole for 3/4 hour. Conducted directional surveys at 5,079 feet, 8° 35 minutes, N37°E; 5,142 feet, 8° 45 minutes, N27°E; 5,205 feet, 8° 15 minutes, N35°E; 5,268 feet 10° 0 minutes, N37°E; 5,330 feet, 11° 15 minutes, N40°E; 5,394 feet, 13° 15 minutes, N38°E and at 5,457 feet, 13° 45 minutes, N50°E.
May 15, 1976	(RRGE-3B) Circulated for bottom hole samples, 1/2 hour. Tripped out of hole. Ran 3 stands of pipe in the hole open-ended and rigged up to airlift. Checked free flow before starting air injection (free flow rate was recorded @ 100 gpm) and conducted air lift flow test for 4 hours. Pulled out of hole and picked up directional drilling assembly to sidetrack. Tripped in hole with bit No. 20, an 8-1/2-inch Hughes J22, and circulated to cool Dyna-Drill. Surveyed to orient Dyna-Drill for 4 hours. Kicked off at 4,350 feet and drilled 8-1/2-inch hole to 4,395 feet in 7-1/2 hours (RRGE-3C).
May 16, 1976	(RRGE-3C) Drilled 8-1/2-inch hole from 4,395 feet to 4,478 feet in 4-3/4 hours. Tripped out of hole. Rig mechanic worked on the sand line clutch for 3/4 hour. Picked up reamer assembly and tripped in hole with a re-run of bit No. 7, an 8-1/2-inch Hughes OWVJ. Reamed Dyna-Drill hole from 4,350 feet to 4,478 feet in 2 hours. Tripped out of hole and picked up Dyna-Drill. Made up and checked Dyna-Drill then tripped in hole with bit No. 21, an 8-1/2-inch Hughes J-22. Circulated hole to cool Dyna-Drill for 1/4 hour before conducting two orientation surveys. Attempted to get Dyna-Drill to operate properly for 1-3/4 hours then tripped out of hole. Conducted directional surveys at 4,376 feet, 4° 15 minutes, N88°W; 4,407 feet, 1° 45 minutes, N85°W and at 4,440 feet, 1° 30 minutes, N34°W.
May 17, 1976	(RRGE-3C) Laid down Dyna-Drill No. 65034 and picked up Dyna-drill No. 65622. Pumped cold water down hole and changed rotating rubber. Tripped in hole and pumped cold water to cool hole for 2 hours. Finished tripping in hole to kick off point. Pumped cold water in hole and down the drill pipe for 1/2 hour. Surveyed to orient Dyna-Drill and get back in hole No. 3C. Drilled 8-1/2-inch hole from 4,478 feet to 4,703 feet in 8-1/4 hours. Circulated hole for survey, 1/4 hour. Conducted directional surveys at 4,470 feet, 2° 30 minutes, N18°W; 4,500 feet, 4° 0 minutes, N; 4,530 feet, 5° 30 minutes, N7°W; 4,562 feet, 7° 30 minutes, N7°W; 4,593 feet, 9° 0 minutes, N5°W and 4,625 feet, 10° 30 minutes, N5°W.

RRGE 3 - DAILY DRILLING REPORTS

May 18, 1976 — (RRGE-3C) Tripped out and laid down Dyna-Drill. Tripped in with bit No. 22, an 8-1/2-inch Hughes J77, and reamed from 4,478 feet to 4,703 feet in 1-1/2 hours. Drilled 8-1/2-inch hole from 4,703 feet to 4,944 feet in 17 hours. Conducted directional surveys at 4,673 feet, 13° 0 minutes, N9°W; 4,736 feet, 14° 45 minutes, N5°E; 4,831 feet, 15° 15 minutes, N10°W and at 4,894 feet, 15° 45 minutes, N10°W.

May 19, 1976 — (RRGE-3C) Drilled 8-1/2-inch hole from 4,944 feet to 4,976 feet in 2 hours. Circulated and conditioned hole for core run, 2 hours. Tripped out of hole and picked up core barrel. Serviced rig and pumped cool water down hole for 1 hour. Tripped in hole with core barrel and an 8-1/2-inch Christensen diamond core bit for core run No. 4. Changed rotating rubber while welding stand pipe. Circulated out 5 feet of fill and cored from 4,976 feet to 4,996 feet in 2-1/2 hours. Tripped out with core and laid down core and core barrel. Recovered 20 feet of core. Pumped water in hole to cool well. Tripped in hole with a re-run of bit No. 22, an 8-1/2-inch Hughes J77, reamed core hole from 4,976 feet to 4,996 feet and drilled to 5,007 feet in 3-3/4 hours.

May 20, 1976 — (RRGE-3C) Drilled 8-1/2-inch hole from 5,007 feet to 5,267 feet in 10 hours. Circulated hole for core run, 1-1/2 hours. Tripped out of hole and picked up coring assembly. Tripped in hole with core barrel and an 8-1/2-inch Christensen diamond core bit for core run No. 5. Jammed while coring from 5,267 feet to 5,276 feet. Started trip out of hole with core No. 5.

May 21, 1976 — (RRGE-3C) Finished trip out of hole. Laid core barrel down and recovered core (6 feet). Tripped in hole with bit No. 23, an 8-1/2-inch Hughes J77, and reamed core hole from 5,267 feet to 5,276 feet in 2-1/2 hours. Drilled from 5,276 feet to 5,550 feet in 15-3/4 hours, then circulated and conditioned hole for core run No. 6. Conducted directional surveys at 5,331 feet, 18° 45 minutes, N37°W and at 5,425 feet, 19° 5 minutes, N41°W.

May 22, 1976 — (RRGE-3C) Circulated and conditioned hole for core run, 1/2 hour. Tripped out of hole and pumped cool water in hole for 3 hours. Picked up core barrel, serviced same and tripped in hole with core barrel and an 8-1/2-inch Christensen diamond core bit. Filled drill pipe with water for 1/4 hour. Cored from 5,550 feet to 5,551 feet in 2-1/4 hours. Tripped out of hole with core No. 6 (1 foot core recovered). Dressed two string stabilizers and one reamer for 2-1/2 hours. Started to trip in hole with bit No. 24, an 8-1/2-inch Smith F7. Stopped to cool hole. Finished trip in hole, reamed core hole from 5,550 feet to 5,551 feet and drilled same diameter hole from 5,551 feet to 5,615 feet in 7 hours. Conducted directional survey at 5,519 feet, 19° 15 minutes, N51°W.

May 23, 1976

(RRGE-3C) Drilled 8-1/2-inch hole from 5,615 feet to 5,704 feet in 11-1/2 hours. Tripped out with bit No. 24. Installed new rollers and load pins on bottom hole reamer. Cooled hole for 1/4 hour. Tripped in hole with bit No. 25, an 8-1/2-inch Hughes J88, reamed out of gauge hole from 5,694 feet to 5,704 feet and continued drilling from 5,704 feet to 5,720 feet in 7-1/4 hours. Conducted directional survey at 5,615 feet, 19° 15 minutes, N51°W.

May 24, 1976

(RRGE-3C) Drilled 8-1/2-inch hole from 5,720 feet to 5,935 feet in 21-1/2 hours. Serviced rig and repaired stand pipe. Circulated hole at total depth for 1/2 hour. Conducted directional surveys at 5,706 feet, 20° 30 minutes, N58°W and at 5,803 feet, 20° 15 minutes, N59°W.

May 25, 1976

Continued circulating hole for 1-1/2 hours then pulled 20 stands of pipe in derrick in 1/2 hour. Laid down 108 joints of 4-1/2-inch drill pipe, a 6 inch drill collar and replaced rotating stripper rubber in 6 hours. Finished laying down drill collars and cooled hole, 2 hours. Loaded out 1 bottom hole reamer, 2 stabilizers and 1 Monel drill collar. Rigged up and ran temperature log, 4 hours (not working). Ran Amerada temperature bomb for 2 hours. Recorded bottom hole temperature of 298°F. Flowed hole for 1/2 hour. Closed in well pressure recorded at 100 psi. Picked up one joint of 4-1/2-inch drill pipe and one blank lifting sub. Closed pipe rams and flowed well for 6 hours. Measured maximum flow of 800 gpm. Conducted directional survey at 5,895 feet, 22° 45 minutes, N60°W.

Results of well flow through separator tank were recorded as follows:

Time	Differential Pressure (psi)	Flow Rate (gpm)
6:00 p.m.	13.1	785
6:05 p.m.	13.7	802

Well was closed in with readings recorded as follows:

Time	Pressure (psi)
6:30 p.m.	90
7:00 p.m.	105
9:00 p.m.	105

RRGE 3 - DAILY DRILLING REPORTS

May 25, 1976

Well was opened and flowed through the 8-inch flow line and readings recorded as follows:

Time	Temperature (°F)	Well-head pressure (psi)
9:00 p.m.	264	12
9:30 p.m.	269	25
10:30 p.m.	260	24
11:30 p.m.	258	24
12:00 p.m.	258	24

May 26, 1976

Performed drill rig watch and flow tested well for 8-1/4 hours. Closed in well. Recorded temperature at 222°F and pressure at 65 psi, 2-1/4 hours. Continued flowing well at 350 gpm with 20 psi back pressure for 1/2 hour, then stopped to cool hole with 200 barrels of water and install rotating rubber. Ran 13 stands of drill pipe in hole and picked up kelly. Flowed well at about 150 gpm with 35 psi back pressure and recorded the temperature at 278°F. Air lifted water out of hole at 1,222 feet through drill pipe for 4 hours. Closed in hole and had Ø pressure on well head from 5:30 p.m. to 6:45 p.m. Pressure gradually increased from 1 psi at 6:45 p.m. to 34 psi at 10:45 p.m. Opened hole at 10:45 p.m. for 1 hour. Temperature recorded at 260°F and pressure at 10 psi. Closed hole temperature was recorded at 250°F and pressure at 45 psi. Started water injection test.

May 27, 1976

Performed drill rig watch and flowed well for 7 hours. Closed in hole and injected water to cool hole for 1 hour. Laid down 60 joints of 4-1/2-inch drill pipe and closed well. Removed tools and subs from rig floor, jetted cellar and mud pits, rigged up INEL logging truck and loaded out 3 trucks with drill pipe. Rigged up INEL pressure and temperature probe and ran in hole to 100 feet. Probe malfunctioned. Pulled probe out, closed master gate and worked on probe for 2 hours. Ran probe down hole (inoperative). Pulled probe and closed master gate.

May 28, 1976

Worked on probe and ran in hole, 5 hours. Pulled probe, closed master gate and worked on probe, 3 hours. Loaded out pipe trailer with 80 joints of 4-1/2-inch drill pipe. Ran temperature and pressure survey log. Rigged down engine shed, removed pump motors and rigged down mud pits. Conducted INEL (step) flow test for 2-1/2 hours. Increased flow to 306 gpm at 6:30 p.m. and continued taking readings for 5-1/2 hours.

Five men on day shift, one man on swing and one man on grave.

May 29, 1976

Conducted flow test at constant discharge rate for 6-1/2 hours. Closed well in for 1-1/2 hours. Well head pressure recorded at 42 psi. Ran temperature and pressure log. Loaded out truck with 80 joints of 4-1/2-inch drill pipe (load No. 5) and set out equipment, mud pump and water tank. Loaded mud tanks with water hoses, water lines and suction hose. Performed drill rig watch, removed flow line from Grant rotating head, unbolted Cameron BOP and Hydril, and worked at unbolting Grant rotating head.

Five men on day shift, one man on swing and one man on grave.

May 30, 1976

Performed drill rig watch and removed Grant rotating head, 8 hours. Loaded out 3 trucks with 4-1/2-inch drill pipe, drill collars and miscellaneous equipment. Removed windwall from rig floor. Removed rotary table, BOP, mousehole and rathole. Moved equipment from rig with forklift.

Five men on day shift, one man on swing and one man on grave.

May 31, 1976

Performed drill rig watch and moved mud tank. Removed all flood lights from subbase and stored in dog house. Loaded out 1 truck with 4-1/2-inch drill pipe and miscellaneous junk pipe (load No. 9). Rigged down and lowered mast on stand at 3:15 p.m. Removed boards from under subbase and stacked in yard. Separated electrical lines at each section of derrick, and stored supplies in dog house for move.

Five men on day shift, one man on swing and one man on grave.

June 1, 1976

Performed drill rig watch. Picked up boards around location and stored supplies in dog house. Unstrung crown and blocks and rolled up lines in derrick. Unbolted drilling engines, drawworks and compounds and broke out equipment in the subbase. Moved and set out equipment with forklift and loaded out truck for NTS. Cleaned up location and set equipment in dog house.

Five men on day shift, one man on swing and one man on grave.

RRGE 3 - DAILY DRILLING REPORTS

June 2, 1976

Performed drill rig watch and cleaned location. Removed derrick from rig floor with crane and set on ground. Removed drawworks motors from subbase. Rigged motor subbase down. Loaded out mudpits with floor plates, catwalks, subs, tongs and tools. Removed discharge fittings and suction hose from trash pump. Lowered walkways around subbase.

Five men on day shift, one man on swing and one man on grave.

June 3, 1976

Performed rig watch. Loaded out the crane and forklift. Set drawworks from subbase onto truck and took A-frame down. Rigged down and set out subbase. Loaded out trucks on RRGE-1 location to RRGE-3 and NTS. Loaded out 9 trucks to NTS with 41 joints of 4-1/2-inch drill pipe, 12 joints of 6-5/8-inch drill pipe, 1 joint of 6-5/8-inch twist off pipe, 1 E-Z torque, 1 kelly shuck, 1 joint 20-inch (junk) casing, 1 joint 24-inch (junk) casing, 1 joint of 8-1/2-inch (junk) washover pipe and one 2-inch pump.

Five men on day shift, one man on swing and one man on grave.

June 4, 1976

Performed rig watch. Continued rigging down on day and swing shifts. Took derrick apart, loaded out trucks and cleaned up location. Moved subbase from hole so INEL could rig up to log. Stacked up INEL equipment on one side of the location.

Five men on day shift, one man on swing and one man on grave.

June 5, 1976

Performed drill rig watch. Loaded out 6 trucks and cleaned location. Helped INEL install head and lubricator for logs on swing shift.

Five men on day shift, one man on swing and one man on grave.

June 6, 1976

Performed drill rig watch. Cleaned up dog house and picked up tools. Loaded out 7 trucks for NTS. Removed head frame from forklift and loaded out. Placed 2 orifices in 8-inch flow line for INEL. Helped INEL run temperature and pressure log in hole on swing shift.

Five men on day shift, one man on swing and one man on grave.

June 7, 1976

Ran INEL temperature and pressure survey on hole at 5,800 feet for 2 hours then took down rig signs and cleaned the forklift for 6 hours. Cleaned up location. Rig down completed.

Appendix B
BIT RECORD

RRGE-3
BIT RECORD

RRGE-3A

CORE NO.	BIT NO.	SIZE	MAKE	TYPE	DEPTH OUT	FOOTAGE	HOURS	PENETRATION FT/HR	WEIGHT 1000 LBS	RPM	PUMP PRESSURE	S.P.M.	REMARKS
	1	17-1/2"	Security	S3SJ	1,404	1,266	28	45.21	15	60	1,150	65	Drilled with mud (wt. 9, vis 45, W.L. 11) to 1,404'. Set 13-3/8" casing at 1,401'. Below 1,404' water was used as the drilling fluid.
	2	12-1/4"	Reed	Y13J	2,211	807	19-1/2	41.38	5/10	60	1,150	65	
	3	12-1/4"	Reed	Y13J	2,804	593	22-1/4	26.65	5	60	1,200	65	
#1	#1	8-1/2"	CDP	MC20	2,814	10	1-1/4	8.00	15	24	450	30	Recovered 10'.
	4	12-1/4"	Reed	Y13J	3,365	551	23	23.96	5/10	60	1,200	65	Reamed core hole from 2,804' to 2,814'.
#2	RR#1	8-1/2"	CDP	MC20	3,381	16	1-1/2	10.67	10	36	400	28	Recovered 3-1/2'.
	5	12-1/4"	Reed	Y13J	3,805	424	16	26.50	10	60	1,200	65	Reamed core hole from 3,365' to 3,381'.
	RR5	12-1/4"	Reed	Y13J	3,965	160	5-3/4	27.83	10	60	1,300	65	
#3	RR#1	8-1/2"	CDP	MC20	3,980	15	1-1/4	12.00	10	28	1,100	30	Recovered 15'.
	6	12-1/4"	Reed	S21GJ	4,214	234	9-3/4	24.00	15	60	1,500	65	Reamed core hole from 3,965' to 3,980'.
	RR6	12-1/4"	Reed	S21GJ	4,259	45	3-1/4	13.85	15	60	1,500	65	Set 9-5/8" liner at 4,255'. Top of liner hanger at 1,206'. Cemented Stage #1 through casing shoe.
	7	8-1/2"	HTC	OWV-J									Tagged cement inside 9-5/8" liner at 2,421' and trip out. Set packer at 1,100' and cemented Stage #2 through ports in liner hanger.
	RR6	12-1/4"	Reed	S21GJ									Drilled out cement inside 13-3/8" casing from 1,142' to 1,203'.
	7	8-1/2"	HTC	OWV-J									Drilled out cement from 1,203' to 1,276' and from 2,421' to 3,374'.
	8	8-1/2"	HTC	OWV-J									Drilled out cement from 3,374' to 4,245'.
	RR8	8-1/2"	HTC	OWV-J	4,360	101	5-1/4	19.24	10	60	1,500	65	Drilled out cement and casing shoe from 4,245' to 4,259'.
	9	8-1/2"	Smith	F4	4,413	53	2	26.50	3	Dyna Drill	1,000	44	
	10	8-1/2"	Smith	F4	5,001	588	23-1/2	25.02	15	60	1,500	65	
	11	8-1/2"	Smith	F5	5,597	596	26-1/4	22.70	35	40	1,700	60	
	12	8-1/2"	Security	H88F	5,871	274	22-1/4	12.31	35	40	1,700	60	Total depth for RRGE-3A. All cones missing from bit.

RRGE-3B

	13	8-1/2"	HTC	J88	4,544	0	4	-----	1	Dyna Drill	1,250	60	Attempted to sidetrack.
	14	8-1/2"	Smith	F4	4,599	57	11-1/2	4.96	2	Dyna Drill	1,250	60	Sidetracked at 4,542'.
	15	8-1/2"	Smith	F5	4,736	137	11-1/4	12.18	10/15	Dyna Drill	1,250	60	
	16	8-1/2"	HTC	OWV-J	4,749	13	4	3.25		50	1,000	60	Reamed Dyna Drill hole from 4,542' to 4,736' in 3-1/2 hours.
	17	8-1/2"	Smith	F5	4,867	118	5-1/2	21.45	1/8	Dyna Drill	1,200	58	
	RR16	8-1/2"	HTC	OWV-J	4,867	0	3/4	-----		60	1,000	60	Reamed Dyna Drill hole from 4,736' to 4,867'.
	18	8-1/2"	HTC	X55R	4,952	85	5-3/4	14.78	10	Dyna Drill	1,000	45	
	19	8-1/2"	HTC	J77	5,550	598	22-3/4	26.29	30	45	1,450	60	Total depth for RRGE-3B.

RRGE-3C

	20	8-1/2"	HTC	J22	4,478	128	12-1/2	10.24		Dyna Drill	700	42	Sidetracked at 4,350'.
	RR7	8-1/2"	HTC	OWV-J	4,478	0	2	-----	0/10	40	800	60	Reamed Dyna Drill hole from 4,350' to 4,478'.
	21	8-1/2"	HTC	J22	4,703	225	8	28.13	5	Dyna Drill	1,300	42	
	22	8-1/2"	HTC	J77	4,976	273	19	14.37	35	45	1,500	60	
#4	#2	8-1/2"	CDP	MC20	4,996	20	2-1/2	8.00	25	34	800	28	Recovered 20'.
	RR22	8-1/2"	HTC	J77	5,267	271	11	24.69	35	45	1,500	60	Reamed core hole from 4,976' to 4,996'.
#5	#3	8-1/2"	CDP	MC20	5,276	9	2-1/4	4.00	30	30	800	28	Recovered 6'.
	23	8-1/2"	HTC	J77	5,550	274	15-3/4	17.40	30	45	1,400	60	Reamed core hole from 5,267' to 5,276'.
#6	RR#2	8-1/2"	CDP	MC20	5,551	1	2-1/4	.44	30	40	1,400	36	Recovered 1'.
	24	8-1/2"	Smith	F7	5,704	153	18-1/2	8.27	35	45	1,500	60	Reamed core hole from 5,550' to 5,551'.
	25	8-1/2"	HTC	J88	5,935	231	23-1/2	9.83	35	45	1,500	60	Total depth for RRGE-3C.

NOTE: Depths are referenced to the Rotary Kelly Bushing which is 18 feet above ground level.

Appendix C

DIRECTIONAL DRILLING SURVEY SUMMARY

RRGE-3A
DIRECTIONAL DRILLING SURVEY SUMMARY

Measured Depth	Course Length	Drift Angle	Vertical Depth	True Vertical Depth	Course Deviation	Course Direction	Course Coordinates North	Course Coordinates South	Course Coordinates East	Course Coordinates West	Total Coordinates North	Total Coordinates South	Total Coordinates East	Total Coordinates West
246	246	0°30'	245.99	245.99	2.15	S42°W	-	1.60	-	1.44	-	1.60	-	1.44
339	93	0°45'	92.99	338.98	1.22	S42°W	-	0.90	-	0.82	-	2.51	-	2.26
475	136	0°45'	135.99	474.97	1.78	S42°W	-	1.32	-	1.19	-	3.82	-	3.45
567	92	0°30'	92.00	566.97	0.80	S42°W	-	0.59	-	0.54	-	4.41	-	3.99
660	93	0°45'	92.99	659.96	1.22	S42°W	-	0.91	-	0.82	-	5.32	-	4.81
742	82	0°30'	82.00	741.96	0.72	S42°W	-	0.54	-	0.48	-	5.86	-	5.29
846	104	0°35'	103.99	845.95	1.06	S42°W	-	0.79	-	0.71	-	6.65	-	6.00
961	115	0°55'	114.99	960.94	1.84	S42°W	-	1.37	-	1.23	-	8.02	-	7.23
1,085	124	1°15'	123.97	1,084.91	2.71	S42°W	-	2.01	-	1.81	-	10.03	-	9.04
1,176	91	1°30'	90.97	1,175.88	2.38	S42°W	-	1.77	-	1.59	-	11.80	-	10.63
1,311	135	1°10'	134.97	1,310.85	2.75	S42°W	-	2.04	-	1.84	-	13.84	-	12.47
1,445	134	2°10'	133.90	1,444.75	5.07	S42°W	-	3.77	-	3.39	-	17.61	-	15.86
1,570	125	2°05'	124.92	1,569.67	4.54	S42°W	-	3.37	-	3.04	-	20.98	-	18.90
1,740	170	0°30'	169.99	1,739.66	1.48	N53°W	0.89	-	-	1.18	-	20.09	-	20.08
1,899	159	2°00'	158.90	1,898.56	5.55	S23°W	-	5.11	-	2.17	-	25.20	-	22.25
2,022	123	2°00'	122.93	2,021.49	4.29	S38°W	-	3.38	-	2.64	-	28.58	-	24.89
2,148	126	1°35'	125.95	2,147.44	3.48	S55°W	-	2.00	-	2.85	-	30.58	-	27.74
2,224	76	2°45'	75.91	2,223.35	3.65	S72°W	-	1.13	-	3.47	-	31.71	-	31.21
2,357	133	2°30'	132.87	2,356.22	5.80	S77°W	-	1.30	-	5.65	-	33.01	-	38.86
2,474	117	3°05'	116.83	2,473.05	6.29	S75°W	-	1.63	-	6.08	-	34.64	-	42.94
2,600	126	3°45'	125.73	2,598.78	8.24	S81°W	-	1.29	-	8.14	-	35.93	-	51.08
2,660	60	3°15'	59.90	2,658.68	3.40	S45°W	-	2.40	-	2.40	-	38.33	-	53.48
2,756	96	3°15'	95.85	2,754.53	5.44	S75°W	-	1.41	-	5.25	-	39.74	-	58.73
2,859	103	3°30'	102.81	2,857.34	6.29	S69°W	-	2.25	-	5.87	-	41.99	-	64.60
2,946	87	3°30'	86.84	2,944.18	5.31	S69°W	-	1.90	-	4.96	-	43.89	-	69.56
3,072	126	3°30'	125.76	3,069.94	7.69	S74°W	-	2.12	-	7.39	-	46.01	-	76.95
3,196	124	3°20'	123.79	3,193.73	7.21	S84°W	-	0.75	-	7.17	-	36.76	-	84.12
3,325	129	2°20'	128.89	3,322.62	5.25	N89°W	0.09	-	-	5.25	-	46.67	-	89.37
3,451	126	3°15'	125.80	3,448.42	7.14	N70°W	2.44	-	-	6.71	-	44.23	-	96.08
3,570	119	3°20'	118.80	3,567.22	6.91	N88°W	0.24	-	-	6.92	-	43.99	-	103.00
3,733	163	3°45'	162.65	3,729.87	10.66	S81°W	-	1.67	-	10.53	-	45.66	-	113.53
3,911	178	3°40'	177.64	3,907.51	11.38	N86°W	0.79	-	-	11.35	-	44.87	-	124.88
4,171	260	4°15'	259.29	4,166.80	19.27	N70°W	6.59	-	-	18.11	-	38.28	-	142.99
4,217	46	4°20'	45.87	4,212.67	3.48	N86°W	0.24	-	-	3.47	-	38.04	-	146.46
4,318	101	5°30'	100.54	4,313.21	9.68	N87°W	0.51	-	-	9.67	-	37.53	-	156.13
4,336	18	5°45'	17.91	4,331.12	1.80	N87°W	0.09	-	-	1.80	-	37.44	-	157.93
	60	6°30'	59.61		6.79	N83.5°W	0.77	-	-	6.75	-	-	-	-
4,396		7°15'		4,390.73		N80°W	-	-	-	-	-	36.67	-	164.68
	62	8°00'	61.40		8.63	N78°W	1.79	-	-	8.44	-	-	-	-
4,458		8°45'		4,452.13		N76°W	-	-	-	-	-	34.88	-	173.12
	62	8°45'	61.28		9.43	N78°W	1.96	-	-	9.22	-	-	-	-
4,520		8°45'		4,513.41		N80°W	-	-	-	-	-	32.92	-	182.34

NOTE: Depths throughout this section are referenced to the Rotary Kelly Bushing which is 18 feet above ground level.

RRGE-3A
DIRECTIONAL DRILLING SURVEY SUMMARY

Measured Depth	Course Length	Drift Angle	Vertical Depth	True Vertical Depth	Course Deviation	Course Direction	Course Coordinates North	Course Coordinates South	Course Coordinates East	Course Coordinates West	Total Coordinates North	Total Coordinates South	Total Coordinates East	Total Coordinates West
											-	-	-	-
	91	8°30'	90.00		13.45	N73.5°W	3.82	-	-	12.90	-	29.10	-	195.24
4,611		8°15'		4,603.41		N67°W	-	-	-	-	-	-	-	-
	63	8°10'	62.36		8.95	N65°W	3.78	-	-	8.11	-	25.32	-	203.35
4,674		8°05'		4,665.77		N63°W	-	-	-	-	-	-	-	-
	62	8°10'	61.37		8.81	N69°W	3.16	-	-	8.22	-	22.16	-	211.57
4,736		8°15'		4,727.14		N75°W	-	-	-	-	-	-	-	-
	62	8°42'	61.29		9.38	N82°W	1.31	-	-	9.29	-	20.85	-	220.86
4,798		9°10'		4,788.43		N89°W	-	-	-	-	-	-	-	-
	63	9°35'	62.12		10.49	N82°W	1.46	-	-	10.39	-	19.39	-	231.25
4,861		10°00'		4,850.55		N75°W	-	-	-	-	-	-	-	-
	63	9°52'	62.07		10.80	N77°W	2.43	-	-	10.52	-	16.96	-	241.77
4,924		9°45'		4,912.62		N79°W	-	-	-	-	-	-	-	-
	63	9°55'	62.06		10.85	N83°W	1.32	-	-	10.77	-	15.64	-	252.54
4,987		10°05'		4,974.68		N87°W	-	-	-	-	-	-	-	-
	63	9°42'	62.10		10.61	N82°W	1.48	-	-	10.51	-	14.16	-	263.05
5,050		9°20'		5,036.78		N77°W	-	-	-	-	-	-	-	-
	64	9°05'	63.20		10.10	N78.5°W	2.02	-	-	9.90	-	12.14	-	272.95
5,114		8°50'		5,099.98		N80°W	-	-	-	-	-	-	-	-
	62	8°35'	61.31		9.25	N81°W	1.45	-	-	9.14	-	10.69	-	282.09
5,176		8°20'		5,161.29		N82°W	-	-	-	-	-	-	-	-
	64	8°40'	63.27		9.64	N80.5W	1.59	-	-	9.51	-	9.10	-	291.60
5,240		9°00'		5,224.56		N79°W	-	-	-	-	-	-	-	-
	64	8°52'	63.24		9.86	N70.5°W	3.29	-	-	9.29	-	5.81	-	300.89
5,304		8°45'		5,287.80		N62°W	-	-	-	-	-	-	-	-
	63	8°22'	62.33		9.19	N62.5°W	4.24	-	-	8.15	-	1.57	-	309.04
5,367		8°00'		5,350.13		N63°W	-	-	-	-	-	-	-	-
	62	8°00'	61.40		8.63	N70°W	2.95	-	-	8.11	1.38	-	-	317.15
5,429		8°00'		5,411.53		N77°W	-	-	-	-	-	-	-	-
	63	8°00'	62.39		8.77	N73°W	2.56	-	-	8.39	3.94	-	-	325.54
5,492		8°00'		5,473.92		N69°W	-	-	-	-	-	-	-	-
	63	8°00'	62.39		8.77	N68°W	3.29	-	-	8.13	7.23	-	-	333.67
5,555		8°00'		5,536.31		N67°W	-	-	-	-	-	-	-	-
	62	7°35'	61.46		8.31	N69.5°W	2.91	-	-	7.78	10.14	-	-	341.45
5,617		7°10'		5,597.77		N72°W	-	-	-	-	-	-	-	-
	63	7°05'	62.52		7.77	N68.5°W	2.85	-	-	7.23	12.99	-	-	348.68
5,680		7°00'		5,660.29		N65°W	-	-	-	-	-	-	-	-
	62	6°57'	61.54		7.50	N66.5°W	2.99	-	-	6.88	15.98	-	-	355.56
5,742		6°55'		5,721.83		N68°W	-	-	-	-	-	-	-	-
	68	6°50'	67.52		8.09	N66.5°W	3.23	-	-	7.42	19.21	-	-	362.98
5,810		6°45'		5,789.35		N65°W	-	-	-	-	-	-	-	-
	61	6°45'	60.58		7.17	N65°W	3.03	-	-	6.50	22.24	-	-	369.48
5,871		6°45'		5,849.93		N65°W	-	-	-	-				

RRGE-3B
DIRECTIONAL DRILLING SURVEY SUMMARY

Measured Depth	Course Length	Drift Angle	Vertical Depth	True Vertical Depth	Course Deviation	Course Direction	Course Coordinates North	Course Coordinates South	Course Coordinates East	Course Coordinates West	Total Coordinates North	Total Coordinates South	Total Coordinates East	Total Coordinates West
4,520		8°45'		4,513.41		N80°W	-	-	-	-	-	32.92	-	182.34
	29	8°45'	28.66		4.41	N79°W	0.84	-	-	4.33	-	-	-	-
4,549		8°45'		4,542.07		N78°W	-	-	-	-	-	32.08	-	186.67
	30	7°52'	29.72		4.11	N78.5°W	0.82	-	-	4.03	-	-	-	-
4,579		7°00'		4,571.79		N79°W	-	-	-	-	-	31.26	-	190.70
	42	5°45'	41.79		4.21	N83°W	0.51	-	-	4.18	-	-	-	-
4,621		4°30'		4,613.58		N87°W	-	-	-	-	-	30.75	-	194.88
	31	3°00'	30.96		1.62	N69.5°W	0.57	-	-	1.52	-	-	-	-
4,652		1°30'		4,644.54		N52°W	-	-	-	-	-	30.18	-	196.40
	32	2°15'	31.98		1.26	N67.5°W	0.48	-	-	1.16	-	-	-	-
4,684		3°00'		4,676.52		N83°W	-	-	-	-	-	29.70	-	197.56
	16	2°45'	15.98		0.77	N78°W	0.16	-	-	0.75	-	-	-	-
4,700		2°30'		4,692.50		N73°W	-	-	-	-	-	29.54	-	198.31
	31	2°45'	30.96		1.49	N62.5°W	0.69	-	-	1.32	-	-	-	-
4,731		3°00'		4,723.46		N52°W	-	-	-	-	-	28.85	-	199.63
	15	3°15'	14.98		0.85	N44.5°W	0.61	-	-	0.60	-	-	-	-
4.746		3°30'		4,738.44		N37°W	-	-	-	-	-	28.24	-	200.23
	31	3°37'	30.94		1.96	N27°W	1.75	-	-	0.89	-	-	-	-
4,777		3°45'		4,769.38		N17°W	-	-	-	-	-	26.49	-	201.12
	32	3°45'	31.93		2.09	N03°W	2.09	-	-	0.11	-	-	-	-
4,809		3°45'		4,801.31		N11°E	-	-	-	-	-	24.40	-	201.23
	41	5°00'	40.84		3.57	N24.5°E	3.25	-	1.48	-	-	-	-	-
4,850		6°15'		4,842.15		N38°E	-	-	-	-	-	21.15	-	199.75
	20	6°30'	19.87		2.26	N41°E	1.71	-	1.48	-	-	-	-	-
4,870		6°45'		4,862.02		N44°E	-	-	-	-	-	19.44	-	198.27
	33	7°07'	32.75		4.09	N53°E	2.46	-	3.27	-	-	-	-	-
4,903		7°30'		4,894.77		N62°E	-	-	-	-	-	16.98	-	195.00
	50	7°37'	49.56		6.63	N52.5°E	4.04	-	5.26	-	-	-	-	-
4,953		7°45'		4,944.33		N43°E	-	-	-	-	-	12.94	-	189.74
	73	7°52'	72.31		9.99	N38.5°E	7.82	-	6.22	-	-	-	-	-
5,026		8°00'		5,016.64		N34°E	-	-	-	-	-	5.12	-	183.52
	53	8°18'	52.45		7.65	N35.5°E	6.23	-	4.44	-	-	-	-	-
5,079		8°35'		5,069.09		N37°E	-	-	-	-	1.11	-	-	179.08
	63	8°40'	62.28		9.49	N32°E	8.05	-	5.03	-	-	-	-	-
5,142		8°45'		5,131.37		N27°E	-	-	-	-	9.16	-	-	174.05
	63	8°30'	62.31		9.31	N31°E	7.98	-	4.80	-	-	-	-	-
5,205		8°15'		5,193.68		N35°E	-	-	-	-	17.14	-	-	169.25
	63	9°07'	62.20		9.98	N36°E	8.07	-	5.87	-	-	-	-	-
5,268		10°00'		5,255.88		N37°E	-	-	-	-	25.21	-	-	163.38
	62	10°37'	60.94		11.42	N38.5°E	8.94	-	7.11	-	-	-	-	-
5,330		11°15'		5,316.82		N40°E	-	-	-	-	34.15	-	-	156.27
	64	12°15'	62.48		13.58	N39°E	10.55	-	8.55	-	-	-	-	-
5,394		13°15'		5,379.30		N38°E	-	-	-	-	44.70	-	-	147.72
	63	13°30'	61.26		14.71	N44°E	10.58	-	10.22	-	-	-	-	-
5,457		13°45'		5,440.56		N50°E	-	-	-	-	55.28	-	-	137.50
	93	13°52'	90.29		22.29	N40.5°E	16.95	-	14.48	-	-	-	-	-
5,550		14°00'		5,530.85		N31°E	-	-	-	-	72.23	-	-	123.02

RRGE-3C
DIRECTIONAL DRILLING SURVEY SUMMARY

Measured Depth	Course Length	Drift Angle	Vertical Depth	True Vertical Depth	Course Deviation	Course Direction	Course Coordinates North	Course Coordinates South	Course Coordinates East	Course Coordinates West	Total Coordinates North	Total Coordinates South	Total Coordinates East	Total Coordinates West
						N87°W	-	-	-	-	-	37.44	-	157.93
4,336		5°45'		4,331.12										
	40	5°00'	39.85		3.49	N87.5°W	0.15	-	-	3.49	-	-	-	-
4,376		4°15'		4,370.97		N88°W	-	-	-	-	-	37.29	-	161.42
	31	3°00'	30.96		1.62	N86.5°W	0.10	-	-	1.62	-	-	-	-
4,407		1°45'		4,401.93		N85°W	-	-	-	-	-	37.19	-	163.04
	33	1°37'	32.99		0.93	N59.5°W	0.47	-	-	0.80	-	-	-	-
4,440		1°30'		4,434.92		N34°W	-	-	-	-	-	36.72	-	163.84
	30	2°00'	29.98		1.05	N26°W	0.94	-	-	0.46	-	-	-	-
4,470		2°30'		4,464.90		N18°W	-	-	-	-	-	35.78	-	164.30
	30	3°15'	29.95		1.70	N09°W	1.68	-	-	0.27	-	-	-	-
4,500		4°00'		4,494.85		N0°W	-	-	-	-	-	34.10	-	164.57
	30	4°45'	29.90		2.48	N03.5°W	2.48	-	-	0.15	-	-	-	-
4,530		5°30'		4,524.75		N07°W	-	-	-	-	-	31.62	-	164.72
	32	6°30'	31.79		3.62	N07°W	3.59	-	-	0.44	-	-	-	-
4,562		7°30'		4,556.54		N07°W	-	-	-	-	-	28.03	-	165.16
	31	8°15'	30.68		4.45	N06°W	4.43	-	-	0.47	-	-	-	-
4,593		9°00'		4,587.22		N05°W	-	-	-	-	-	23.60	-	165.63
	32	9°45'	31.54		5.42	N05°W	5.40	-	-	0.47	-	-	-	-
4,625		10°30'		4,618.76		N05°W	-	-	-	-	-	18.20	-	166.10
	32	11°22'	31.37		6.31	N05°W	6.29	-	-	0.55	-	-	-	-
4,657		12°15'		4,650.13		N05°W	-	-	-	-	-	11.91	-	166.65
	16	12°37'	15.61		3.49	N07°W	3.46	-	-	0.42	-	-	-	-
4,673		13°00'		4,665.74		N09°W	-	-	-	-	-	8.45	-	167.07
	63	13°52'	61.16		15.10	N02°W	15.09	-	-	0.53	-	-	-	-
4,736		14°45'		4,726.90		N05°E	-	-	-	-	6.64	-	-	167.60
	95	15°00'	91.76		24.59	N02.5°W	24.57	-	-	1.07	-	-	-	-
4,831		15°15'		4,818.66		N10°W	-	-	-	-	31.21	-	-	168.67
	63	15°30'	60.71		16.84	N10°W	16.58	-	-	2.92	-	-	-	-
4,894		15°45'		4,879.37		N10°W	-	-	-	-	47.79	-	-	171.59
	63	16°22'	60.45		17.75	N11.5W	17.39	-	-	3.54	-	-	-	-
4,957		17°00'		4,939.82		N13°W	-	-	-	-	65.18	-	-	175.13
	100	17°30'	95.37		30.07	N13°W	29.30	-	-	6.76	-	-	-	-
5,057		18°00'		5,035.19		N13°W	-	-	-	-	94.48	-	-	181.89
	88	18°30'	83.45		27.92	N21.5°W	25.98	-	-	10.23	-	-	-	-
5,145		19°00'		5,118.64		N30°W	-	-	-	-	120.46	-	-	192.12
	92	19°00'	86.99		29.95	N41.5°W	22.43	-	-	19.85	-	-	-	-
5,237		19°00'		5,205.63		N53°W	-	-	-	-	140.31	-	-	211.97
	94	18°53'	88.94		30.42	N45°W	21.51	-	-	21.51	-	-	-	-
5,331		18°45'		5,294.57		N37°W	-	-	-	-	161.82	-	-	233.48
	94	18°55'	88.92		30.47	N39°W	23.68	-	-	19.18	-	-	-	-
5,425		19°05'		5,383.49		N41°W	-	-	-	-	185.50	-	-	252.66
	94	19°10'	88.79		30.86	N46°W	21.44	-	-	22.20	-	-	-	-
5,519		19°15'		5,472.28		N51°W	-	-	-	-	206.94	-	-	274.86
	93	19°15'	87.80		30.66	N51°W	19.29	-	-	23.83	-	-	-	-
5,612		19°15'		5,560.08		N51"W	-	-	-	-	226.23	-	-	298.69
	94	19°52'	88.41		31.94	N54.5°W	18.55	-	-	26.00	-	-	-	-
5,706		20°30'		5,648.49		N58°W	-	-	-	-	244.78	-	-	324.69
	97	20°22'	90.94		33.76	N58.5°W	17.64	-	-	28.79	-	-	-	-
5,803		20°15'		5,739.43		N59°W	-	-	-	-	262.42	-	-	353.48
	132	21°30'	122.82		48.38	N59.5°W	24.55	-	-	41.69	-	-	-	-
5,935		22°45'		5,862.25		N60°W	-	-	-	-	286.97	-	-	395.17

Appendix D
CASING RECORD

RRGE-3

CASING RECORD

INTERMEDIATE CASING - 13-3/8-INCH O.D., K-55

Date Installed - March 31, 1976

Joint No.	Weight	Measured Length (ft.)	Cumulative Length (ft.)	Remarks
		2.72	2.72	Float Shoe
1	68 lb/ft	39.98	42.70	Centralizer (Middle of Joint)
		2.00	44.70	Float Collar
2	68 lb/ft	40.17	84.87	
3	68 lb/ft	36.50	121.37	Centralizer
4	68 lb/ft	40.11	161.48	
5	68 lb/ft	41.12	202.60	Cement Basket
6	68 lb/ft	38.80	241.40	Centralizer
7	68 lb/ft	37.63	279.03	
8	68 lb/ft	40.96	319.99	
9	68 lb/ft	39.78	359.77	Centralizer
10	68 lb/ft	41.32	401.09	
11	68 lb/ft	40.32	441.41	
12	68 lb/ft	41.78	483.19	Centralizer
13	68 lb/ft	40.06	523.25	
14	68 lb/ft	38.97	562.22	
15	68 lb/ft	40.16	602.38	Centralizer
16	68 lb/ft	39.04	641.42	
17	68 lb/ft	38.12	679.54	
18	68 lb/ft	40.90	720.44	Centralizer
19	68 lb/ft	40.20	760.64	
20	68 lb/ft	40.96	801.60	
21	68 lb/ft	40.45	842.05	Centralizer
22	54.5 lb/ft	41.56	883.61	Cement Basket
23	54.5 lb/ft	41.06	924.67	
24	54.5 lb/ft	41.64	966.31	Centralizer
25	54.5 lb/ft	42.09	1,008.40	
26	54.5 lb/ft	38.00	1,046.40	
27	54.5 lb/ft	39.16	1,085.56	Centralizer
28	54.5 lb/ft	41.29	1,126.85	
29	54.5 lb/ft	41.58	1,168.43	Cement Basket
30	54.5 lb/ft	38.89	1,207.32	Centralizer
31	54.5 lb/ft	41.67	1,248.99	
32	54.5 lb/ft	38.41	1,287.40	
33	54.5 lb/ft	40.57	1,327.97	Centralizer
34	68 lb/ft	41.05	1,369.02	
35	68 lb/ft	41.22	1,410.24	

Total Casing Length - 1,410.24 feet

Casing Setting Depth - 1,383 feet (G.L.)

RRGE-3
CASING RECORD
PRODUCTION LINER - 9-5/8-INCH O.D., K-55, 36 LB/FT.
Date Installed - April 19, 1976

Joint No.	Measured Length (ft.)	Cumulative Length (ft.)	Remarks
	1.50		Float Shoe
1	41.05	42.55	Centralizer (Middle of Joint)
	.90	43.45	Float Collar
2	39.91	83.36	
3	37.44	120.80	Centralizer
4	41.73	162.53	
5	40.21	202.74	
6	41.07	243.81	Centralizer
7	39.10	282.91	
8	40.72	323.63	
9	41.33	364.96	Centralizer
10	40.56	405.52	
11	40.97	446.49	
12	40.54	487.03	Centralizer
13	40.54	527.57	
14	40.13	567.70	
15	40.81	608.51	Centralizer
16	40.93	649.44	
17	40.19	689.63	
18	40.44	730.07	Centralizer
19	39.95	770.02	
20	41.19	811.21	
21	39.72	850.93	Centralizer
22	40.93	891.86	
23	40.91	932.77	
24	40.49	973.26	Centralizer
25	40.69	1,013.95	
26	39.58	1,053.53	
27	39.72	1,093.25	Centralizer
28	40.96	1,134.21	
29	40.72	1,174.93	
30	40.74	1,215.67	Centralizer
31	40.75	1,256.42	
32	41.03	1,297.45	
33	40.57	1,338.02	Centralizer
34	38.11	1,376.13	
35	40.48	1,416.61	
36	40.63	1,457.24	Centralizer
37	40.58	1,497.82	
38	39.91	1,537.73	
39	40.63	1,578.36	Centralizer
40	39.88	1,618.24	

RRGE-3
CASING RECORD
PRODUCTION LINER - 9-5/8-INCH O.D., K-55, 36 LB/FT.
Date Installed - April 19, 1976

Joint No.	Measured Length (ft.)	Cumulative Length (ft.)	Remarks
41	40.57	1,658.81	
42	40.67	1,699.48	Centralizer
43	40.84	1,740.32	
44	40.51	1,780.83	
45	39.44	1,820.27	Centralizer
46	40.30	1,860.57	
47	40.55	1,901.12	
48	41.33	1,942.45	Centralizer
49	39.47	1,981.92	
50	40.47	2,022.39	
51	41.56	2,063.95	Centralizer
52	40.73	2,104.68	
53	40.99	2,145.67	
54	40.83	2,186.50	Centralizer
55	40.83	2,227.33	
56	40.87	2,268.20	
57	41.55	2,309.75	Centralizer
58	40.93	2,350.68	
59	40.72	2,391.40	
60	41.00	2,432.40	Centralizer
61	41.48	2,473.88	
62	40.80	2,514.68	
63	40.32	2,555.00	Centralizer
64	40.57	2,595.57	
65	40.21	2,635.78	
66	40.49	2,676.27	Centralizer
67	40.69	2,716.96	
68	37.52	2,754.48	
69	39.50	2,793.98	Centralizer
70	40.60	2,834.58	
71	40.12	2,874.70	
72	42.45	2,917.15	Centralizer
73	41.27	2,958.42	
74	41.49	2,999.91	Centralizer
75	41.40	3,041.31	
	7.60	3,048.91	Liner Hanger

Total Casing Length - 3,048.91 feet

Liner set at 4,237 feet (G.L.). Top of Liner hung at 1,188 feet (G.L.).

Appendix E

CROSS REFERENCE

GROUND LEVEL TO KELLY BUSHING

CROSS REFERENCE: GROUND LEVEL TO KELLY BUSHING (in feet)

	GL	KB
Surface casing set at	120	138
Top of Raft River formation	520	538
Top of production liner	1,188	1,206
Top of Salt Lake formation	1,270	1,288
Intermediate casing set at	1,383	1,401
17-1/2-inch hole drilled to	1,386	1,404
Core #1 from	2,786	2,804
to	2,796	2,814
Core #2 from	3,347	3,365
to	3,363	3,381
Core #3 from	3,947	3,965
to	3,962	3,980
Production liner set at	4,237	4,255
12-1/4-inch hole drilled to	4,241	4,259
RRGE-3C kickoff point	4,332	4,350
RRGE-3B kickoff point	4,524	4,542
Core #4 from	4,958	4,976
to	4,978	4,996
Core #5 from	5,249	5,267
to	5,258	5,276
Top of Metamorphosed Zone - RRGE-3A	5,300	5,318
Top of Metamorphosed Zone - RRGE-3B	5,340	5,358
Top of Metamorphosed Zone - RRGE-3C	5,400	5,418
Top of Elba Quartzite formation - RRGE-3C	5,495	5,513
Top of Elba Quartzite formation - RRGE-3B	5,530	5,548
RRGE-3B total depth	5,532	5,550
Core #6 from	5,532	5,550
to	5,533	5,551
Top of Elba Quartzite formation - RRGE-3A	5,780	5,798
Top of Quartz Monzonite formation - RRGE-3A	5,842	5,860
RRGE-3A total depth	5,853	5,871
Top of Quartz Monzonite formation - RRGE-3C	5,900	5,918
RRGE-3C total depth	5,917	5,935

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