

FC
USGS
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Memo
NV
Persh. &
Churchill Co.
5/23/78

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MAY 30 1978



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Area Geothermal Supervisor's Office
Conservation Division, MS 92
345 Middlefield Road
Menlo Park, CA 94025

St. Ross
- This is a new
company or we. Note
for case studies?

MAY 23 1978

Memorandum

To: Interested Parties
From: Area Geothermal Supervisor
Subject: Plan of Operation, Southland Royalty Company, Federal Leases
N-8392, N-8395, N-8489, N-8491, N-9861, N-10706, N-11583,
N-17283, N-17285, Dixie Valley KGRA, Pershing & Churchill
Counties, NV
Ref: 1760 (2403-01a) N-8392 (POO for EA #111-8)

Southland Royalty Company has submitted a Plan of Operation in accordance with 30 CFR 270.34 to drill 11 geothermal exploratory wells to depths of 2590+ meters (8500+ feet). A copy of the Plan of Operation is attached for your review and files.

An Environmental Analysis (EA#111-8) will be prepared by the Office of the Area Geothermal Supervisor for the proposed action. You are invited to participate in a field inspection to be conducted by Mr. Bernard Moroz, Reno, NV District Geothermal Supervisor, USGS, on June 8, 1978. Participants are asked to meet at the Frenchman Cafe approximately 30 miles east of Fallon, NV, on U.S. 50 at 10:00 am.

Parties planning to attend should notify the Reno District Geothermal Supervisor by June 1, 1978 ((702)784-5676, FTS 470-5676). Those parties responding will be notified in the event of postponement or cancellation.

All comments concerning the proposed action must be received no later than June 17, 1978 by:

Area Geothermal Supervisor
USGS, Conservation Division
345 Middlefield Rd., MS92
Menlo Park, CA 94025
(415) 323-8111 X2848 FTS 467-2848

We urge you to send written comments and suggestions and will appreciate hearing from you even if you are of the opinion that the existing regulations, lease terms, and operational orders provide adequate environmental protection. All comments will be given serious consideration in the preparation of the environmental analysis and any subsequent conditions of approval.

UNIVERSITY OF UTAH
RESEARCH INSTITUTE
EARTH SCIENCE LAB.

The Area Geothermal Supervisor's Office does not send draft Environmental Analyses (EA's) to interested parties for review for work proposed by lessees under these circumstances. Certain parties, however, such as the surface managing agency, the lessee, GEAP, and USFWS will receive a copy of the completed EA. Other interested parties will not receive a copy of the final EA unless such parties comment on the proposed action in writing or request a copy of the particular EA pursuant to the Freedom of Information Act. Copies of Environmental Analyses are available for inspection during normal business hours at the Area Geothermal Supervisor's Office, the Reno District Geothermal Supervisor's Office, the appropriate BLM District Manager's Office, the Nevada State Director, BLM, Office, and the U.S. Forest Service Offices, per the attached list.

Reid T Stone

Enclosures

INTERESTED PARTIES

Southland Royalty Company

Plan of Operation - 11-8500'± Exploratory Wells
Federal Leases N-8392, N-8395, N-8489, N-8491, N-9861,
N-10706, N-11583, N-17283, N-17285
Dixie Valley KGRA,
Chruchill & Pershing Counties, NV

USGS-Conservation Division
Conservation Manager, Western Region
Attn: Environmental Staff
345 Middlefield Road, MS 80
Menlo Park, CA 94025
(415) 323-8111, Ext. 2093
FTS: 467-2093

District Geothermal Supervisor
USGS - Conservation Division
Kietzke Plaza, Bldg. D, Suite 137
4600 Kietzke Lane
Reno, Nevada 89502
Attn: Bernie Moroz
(702) 784-5676
FTS: 470-5676

USGS-Conservation Division
Area Geologist, Pacific Area
Attn: Henry Cullins
345 Middlefield Road, MS 80
Menlo Park, CA 94025
(415) 323-8111, Ext. 2053
FTS: 467-2053

Geothermal Environmental Advisory Panel
Attn: Max Crittenden
345 Middlefield Road, MS 75
Menlo Park, CA 94025
(415) 323-8111, Ext. 2317
FTS: 467-2317

U.S. Bureau of Land Management
Nevada State Director
Federal Bldg., Room 3008
300 Booth Street
Reno, NV 89502
(702) 784-5451
FTS: 598-5451

U.S. Bureau of Land Management
Winnemucca District Manager
Attn: Chester Conard
P.O. Box 71
Winnemucca, NV 89445
(702) 623-3676
FTS: 470-5423

U.S. Bureau of Land Management
Carson City District Manager
Attn: Don Pomi
1050 E. William Street, Suite 335
Carson City, NV 89701
(702) 882-1631
FTS: 470-5911 ask for 882-1631

U.S. Bureau of Land Management
Geothermal Specialist
Attn: Ted Holland
Denver Federal Center, Bldg. 50 (D-310)
Denver, CO 80225
(303) 234-5098
FTS: 234-5098

U.S. Fish and Wildlife Service
Office of Biological Services
Geothermal Advisor, Region 1
Attn: L.A. Mehrhoff
4620 Overland Road, Room 210
Boise, ID 83705
(208) 834-1931
FTS: 554-1931

U.S. Fish and Wildlife Service
Attn: Felix Smith
2800 Cottage Way, Room E-2727
Sacramento, CA 95825
(916) 484-4731
FTS: 468-4731

U.S. Bureau of Reclamation
Attn: Lloyd Osbourne
P.O. Box 640
Carson City, NV 89701
(702) 882-3436

Planning Director, Pershing County
Attn: E.L. Spencer
Route 1, Box 71-D
Lovelock, NV 89419
(702) 273-2636

Phillips Petroleum Company
Attn: R. T. Forest
Energy Minerals Division
P.O. Box 10566
Reno, NV 89510
(702) 786-2273

Phillips Petroleum Company
Attn: R.L. Wright
P.O. Box 752
Del Mar, CA 92014
(714) 755-0131

San Diego Gas & Electric Co.
Attn: Larry Grogan/J.M. Nugent
P.O. Box 1831
San Diego, CA 92112
(714) 232-4252, Ext. 1715/1903

Sunoco Energy Development Co.
Attn: C.T. Clark, Jr.
12700 Park Central Pl., Suite 1500
Dallas, TX 75251
(214) 233-2600, Ext. 515

Shell Oil Company
Attn: F.W. Nantker
196 South Fir Street
Ventura, CA 93001
(805) 648-2751

California Energy Company
Attn: Paul Storm
P.O. Box 3909
Santa Rosa, CA 95402
(707) 526-1000

Lawrence Livermore Laboratory
Attn: Dave Snoeberger
Box 808, Mail Code L-523
Livermore, CA 94550
(415) 447-1100
FTS: 457-5501

Mr. Clyde E. Kuhn
2207 Carroll St., Apt. 3
Oakland, CA 94606
(415) 451-3714

GeothermEx, Inc.
Attn: James B. Koenig
901 Mendocino Ave.
Berkeley, CA 94707
(415) 524-9242

Getty Oil Company
Attn: Dan W. Sparks
P.O. Box 5237
Bakersfield, CA 93308
(805) 399-2961

Chevron USA, Inc.
Attn: J.G. Turner
P.O. Box 3722
San Francisco, CA 94119
(415) 894-2726

Gulf Mineral Resources Co.
Exploration Department
Attn: Glen E. Campbell
1720 South Bellaire Street
Denver, CO 80222
(303) 758-1700

Republic Geothermal, Inc.
Attn: Dwight Carey
P.O. Box 3388
Santa Fe Springs, CA 90670
(213) 945-3661

Republic Geothermal, Inc.
Attn: Jim Sheidenberger
2544 Cleveland Ave.
Santa Rosa, CA 95401
(707) 527-7755

Exploration Geologists of Nevada
Attn: Ralph D. Mulhollen
P.O. Box 3043
Reno, NV 89505
(702) 972-6791

Geothermal Power Corporation
Attn: Frank G. Metcalfe
P.O. Box 1186
Novato, CA 94947
(415) 897-7833

ICF, Inc.
Attn: Doug Fried
1990 M Street, NW
Washington, D.C. 20036
(202) 785-3440

Union Oil Company of California
Geothermal Division
Attn: Neil J. Stefanides
Union Oil Center, Box 7600
Los Angeles, CA 90051
(213) 486-7740

Dresser Industries
MAGCOBAR Division
Attn: Jim Fox
475 17th Street, Suite 1600
Denver, CO 80202

Occidental Geothermal, Inc.
Attn: B.J. Wyant
5000 Stockdale Highway
Bakersfield, CA 93309
(805) 327-7351

AMAX Exploration
Attn: Larry Hall
4704 Harlan Street
Denver, CO 80212
(303) 433-6151

Thermal Power Company
Attn: K.R. Davis
601 California Street
San Francisco, CA 94108
(415) 981-5700

Energy and Natural Resources Consultants
Attn: Richard Jodry
P.O. Box 941
Richardson, Texas 75080
(214) 238-9554

Univ. of Utah Research Institute
Attn: Phillip Wright
391 Chipeta Way
Salt Lake City, UT 84108
(801) 581-5226

Anadarko Production Company
Attn: John Syptak
P.O. Box 1330
Houston, Texas 77001
(713) 526-5421

Hydro-Search, Inc.
Attn: Virgil Wilhite
333 Flint St.
Reno, NV 89501
(702) 322-4173

Mr. Jack McNamara
Law Center, Room 422
University of Southern California
Los Angeles, CA 90007
(213) 741-7569

Magma Power Company
Attn: Richard Foss
631 S. Witmer Street
Los Angeles, CA 90017
(213) 483-2285

Magma Electric Company
Attn: Tom Hinrichs
P.O. Box 2082
Escondido, CA 92025
(714) 743-7008

Aminoil USA, Inc.
P.O. Box 11279
Santa Rosa, CA 95406
(707) 527-5333

Geothermal Resources Council
Attn: Mr. David Anderson
P.O. Box 1033
Davis, CA 95616
(916) 758-2360

U.S. Department of Energy
Nevada Operations Office
Attn: J.O. Cummings
P.O. Box 14100
Las Vegas, NV 89114
(702) 734-3591
FTS: 598-3591

U.S. Department of Energy
Div. of Geothermal Energy, 3rd Floor
Attn: Jack Sailsburg
20 Massachusetts Ave. NW
Washington, D.C. 20545
(202) 376-4914
FTS: 376-4914

U.S. Environmental Protection Agency
Environmental Monitoring and Support
Attn: Michael O'Connell
P.O. Box 15027
Las Vegas, NV 89114
(702) 736-2969
FTS: 595-2969

State of Nevada
Department of Energy
1050 E. William, Suite 405
Carson City, NV 89701
(702) 885-5157

State of Nevada
Department of Human Resources
Capitol Complex
1209 Johnson Street
Carson City, NV 89710
(702) 885-4730

State of Nevada
Division of Water Resources
Attn: Roland Westergard
201 S. Fall Street, Capitol Complex
Carson City, NV 89710
(702) 885-4380

State of Nevada
Division of State Lands
201 S. Fall Street, Capitol Complex
Room 338
Carson City, NV 89710
(702) 885-4363

State of Nevada
Environmental Protection Services
Attn: Wendell McCurry/Vern Ross
201 S. Fall St., Capitol Complex
Carson City, NV 89710
(702) 885-4670

State of Nevada
Nevada Dept. of Fish & Game
Attn: Dale Lockhard
P.O. Box 10678
Reno, NV 89510
(702) 784-6214

State of Nevada
Nevada Dept. of Fish & Game
Attn: Ray Corlett, Regional Manager
380 West B Street
Fallon, NV 89406
(702) 423-3171

State of Nevada
Nevada State Museum
Attn: Mary Rusco, Archaeologist
600 N. Carson Street
Carson City, NV 89701
(702) 885-4819

State of Nevada
Div. of Historic Preservation &
Archeology
Attn: Kimberly Wood, SHPO
201 South Fall St. Capitol Complex
Carson City, NV 89701
(702) 885-5138

State of Nevada
Planning Coordinator
Attn: Bruce Arkell
Capitol Plaza
Carson City, Nevada 89701
(702) 885-4865

Churchill County Commissioner
Attn: Beale E. "Skip" Cann, Chairman
Churchill County Courthouse
Fallon, NV 89406
(702) 423-4092

VTN

Attn: Mr. Dick Hallett
2301 Campus Dr.
P.O. Box C-19529
Irvine, CA 92713
(714) 833-2450

Geothermal Services, Inc.
Attn: Steve Quiett
10072 Willow Creek Road
San Diego, CA 92131
(714) 566-4520

Earth Science Laboratory
Attn: Phillip M. Wright
University of Utah Research Institute
Research Park
391 Chipeta Way
Salt Lake City, UT 84108
(801) 581-5226

Mr. Warren M. Woodward
125 Drew Drive
Reno, NV 89502
(702) 825-3079

Southland Royalty Company
1600 First National Building
Fort Worth, TX 76102
(817) 336-9801

Republic Geothermal, Inc.
Attn: Dwight Carey
P.O. Box 3388
Santa Fe Springs, CA 90670
(213) 945-3661

Republic Geothermal, Inc.
Attn: Jim Sheidenberger
2544 Cleveland Ave.
Santa Rosa, Ca 95401
(707) 527-7755

bcc: Reading File 101-02

Subject File 1760 N-8392 POO for EA #111-8

(ENV - Dave Fach

(ENG

OPE

BDeTar

Plan of Operations
per CFR 270.34

The plan is to drill eleven exploratory wells in Dixie Valley, Nevada, to a depth of up to 8,500 feet each.

- a) The locations to the nearest quarter section are shown on the attached map. A schematic of the general layout of mud tanks, pits, racks, etc. is included with the drilling plan. After on site review with the BLM area representative the exact locations will be staked and surveyed and the exact orientation of pits, tanks, etc. will be provided for each well location.
- b) Existing and planned access roads are shown on the enclosed map.
- c) Location and source of water supply and road building materials are addressed in the drilling plans.
- d) The camp will be established to take advantage of existing concrete pads at the Dixie Site (see enclosed map).
- e) There are no other areas of potential surface disturbance.
- f) The topographic features and drainage patterns are evident on the enclosed map.
- g) Methods of disposing of waste materials are discussed in the environmental section and drilling plans. (attached)
- h) Methods used to protect the environment are discussed in the environmental section (attached).
- i) This is hopefully covered in the attached material, but the operator will be happy to provide any other information requested by the Supervisor.
- j) Monthly progress reports will be provided in writing. Daily calls will be made to the District Supervisor to advise of well status, plans to test blowout preventers or cement jobs, or other pertinent information.
- k) The operator anticipates a significant lag between the completion of exploratory wells and installation of production equipment. The operator therefore considers it premature to monitor for baseline environmental data prior to the determination that there is, in fact, a commercially viable resource in Dixie Valley, Nevada.

Plugging and Abandonment Procedure

In the even this well is a dry hole, or when this well is depleted, the following procedure will be followed:

1. Run drill pipe with 7 5/8" bit and clean out to 8500'.
2. Run drill pipe with retainer, set retainer at 7900', fill hole section 7900' - 8500' with 190 sacks cement, pull out of retainer, spot 32 sacks cement in casing, filling casing from 7900' to 7800'. Wait on cement 8 hours, test plug by setting drill pipe weight of 15,000 pounds on top of plug.
3. Fill hole from 7800' to ground level with 9.5# drilling mud.
4. Set 14 sack cement plug at 6' to 50'
5. Cut off 20", 16", and 8 5/8" casing 6' below ground level, weld on a steel plate 20" in diameter and fill cellar.
6. Restore the well site to the satisfactions of the Bureau of Land Management personnel.

Drilling and Completion Procedure (in brief)

1. Drill 24" hole to 50', run 20" casing, cement 0' to 50'.
2. Drill 18 5/8" hole to 1300', run 16" casing, cement 0' to 1300', install casing head and blowout preventers.
3. Drill 10 5/8" hole to 3,000', if lost circulation occurs, ream hole to 13 3/4", run 11 3/4" casing, cement 0' to 1300'.
4. Drill 10 5/8" hole to 8,000', run 8 5/8" casing, cement 0' to 8,000'.
5. Drill 7 5/8" hole from 8,000' to 8,500', fill hole with water, lay down drill pipe, remove blowout preventers, move off rotary rig.

Drilling and Completion Procedure (in detail)

1. Move in and rig up rotary tools. Drill 24" hole to 50' using a fresh water gel mud. Run 20' 94# H-40 casing to 50' and cement with 96 sacks. If cement fails to circulate or falls down the annulus after cementing, wait on cement 8 hours, run 1" pipe into the annulus to top of cement and recement through the 1" pipe, bringing the top of cement to ground level. Wait on cement 12 hours

In as much as Southland Royalty Company has drilled four geothermal test wells in this immediate area to depths below 1300' without encountering water, air, steam, oil or gas flows, we request that the requirement of a blowout preventer on this string of casing be waived and that we be allowed to set surface casing before installing a blowout preventer.

2. Drill 18 5/8" hole to 1300' using a fresh water gel mud. Run electric logs from 50' to 1300'. Run 16" 75# K-55 casing to 1300' and cement with 1225 sacks. If cement fails to circulate or falls down the annulus after cementing, wait on cement 8 hours, run 1" pipe into the annulus to top of cement and recement through the 1" pipe, bringing the top of cement to ground level. Wait on cement 12 hours.

Install a 16" 2000 psi working pressure casing head with 2 - 2" side outlets on the 16" casing at ground level. Install a 2" 2000 psi working pressure valve on one casing head outlet, then connect the valve to the mud pump and use this opening as a kill line if needed. Install 2 - 2" 2000 psi working pressure valves in series on the other casing head outlet, then connect these valves to the mud pits for use as a blowdown line if needed. Install a 16" 2000 psi working pressure drilling spool with 2 - 2" side outlets on the 16" casing head. Install a 2" 2000 psi working pressure valve on one

drilling spool outlet, then connect the valve to the mud pump and use this opening as a fillup line. Install a 2" 2000 psi working pressure valve to the other drilling spool outlet, this valve will be retained for reserve use. Install a manual and remotely controlled hydraulically operated double ram blowout preventer rated at 2000 psi working pressure on the 16" drilling spool. Install an expansion-type blowout preventer rated at 2000 psi working pressure on the 16" double ram blowout preventer. All of this well head equipment will have a bore larger than 14" in order to allow passage of 13 3/4" drilling tools. After nipping up this equipment, test the blowout preventers, valves and casing to 2000 psi. The blowout preventers will be pressure tested not less than once each week, alternating the control stations. The blowout preventers will be tested for operating ability not less than once each day. Prior to drilling out cement, the drill string will be equipped with a kelly cock installed between the kelly and the swivel. A full opening drill string safety valve will be kept on the rig floor and ready for use at all times.

3. Drill 10 5/8" hole to 3000' or through volcanic beds using a 9.5 pound per gallon fresh water based gel-chemical mud. If no lost circulation zones have been encountered, continue drilling 10 5/8" hole to 5000'. If severe lost circulation occurs while drilling the 1300' - 3000' interval, ream the hole to 13 3/4", run electric logs, run 11 3/4" 54# K-55 casing to 3000' and cement with 1700 sacks. If cement fails to circulate or falls down the annulus after cementing wait on cement 8 hours, run 1" pipe into the annulus to top of cement and recement through the 1" pipe, bringing the top of cement to ground level. Wait on cement 12 hours.

Install 11 3/4" x 16" casing slips and packing in the 16" casing head. Install a 16" x 16" 2000 psi working pressure casing spool with 2" side outlets on the 16" casing head. Install a 2" 2000 psi working pressure valve on one casing spool outlet, then connect the valve to the mud pump and use this opening as a kill line if needed.

Install 2 - 2" 2000 psi working pressure valves in series in the other casing spool outlet, then connect these valves to the mud pits for use on a blowdown line if needed. Install a 16" 2000 psi working pressure drilling spool with 2 - 2" side outlets on the 16" casing spool. Install a 2" 2000 psi working pressure valve on one drilling spool outlet, then connect the valve to the mud pump and use this opening as a fillup line. Install a 2" 2000 psi working pressure valve on the other drilling spool outlet; this valve will be retained for reserve use. Install a manual and remotely controlled hydraulically - operated double ram blowout preventer rated at 2000 psi working pressure on the 16" drilling spool. Install an expansion - type blowout preventer rated at 2000 psi working pressure on the 16" double ram blowout preventer. All of this equipment will have a bore larger than 10 3/4" in order to allow passage of 10 5/8" drilling tools.

After nipping up this equipment, test the blowout preventers, valves and casing to 2000 psi. The blowout preventer will be pressure tested not less than once each week, alternating the control stations. The blowout preventer will be tested for operating ability not less than once each day. Prior to drilling out cement, the drill string will be equipped with a kelly cock installed between the kelly and the swivel. A full opening drill string safety valve will be kept on the rig floor and ready for use at all time.

4. Drill 10 5/8" hole to 8000' using a 9.5 pound per gallon fresh water based gel-chemical mud. Run electric logs. Run 8 5/8" 36# Buttress casing to 8000' and cement with 2100 sacks of a high temperature admix cement. This casing string will be composed of 6000' of 36# K-55 casing (top portion) and 2000' of 36# N-80 casing (bottom portion). Cementing will be accomplished by running drill pipe inside the casing to a stab-in float collar positioned one joint above the casing guide shoe and pumping cement through the drill pipe and up the annulus outside the 8 5/8" casing to the surface.

A wiper plug will then be pumped through the drill pipe. In the event circulation is lost while cementing and cement does not reach ground level, a wiper plug will be pumped through the drill pipe, the drill pipe pulled, a temperature survey will be run to locate the cement top, the casing will be perforated at the cement top, a cement retainer will be placed above the perforations and the casing will be again cemented. If necessary, this process will be repeated until a continuous column of cement exists from ground level to the casing shoe. After waiting on cement 12 hours, all retainers placed in the casing will be drilled out and the perforations tested to 2000 psi to assure the perforations are well cemented.

5. Drill 7 5/8" hole to 8500' using a 9.5 pound per gallon fresh water based chemical mud. Run electric logs. Run a drill stem test if feasible, setting packers in 8 5/8" casing. Displace mud in hole with fresh water. Lay down drill pipe. Shut in well at 10" master valve. Remove rotating head, expansion type blowout preventer, double ram blowout preventer, drilling spool and all mud lines. Install a second 10" 2000 psi working pressure valve to be used as a production valve. Move off the rotary drilling rig. Allow well to flow fresh water to pits. Begin production testing for pressure, volume, temperature and quality.

6. In the event severe lost circulation occurs while drilling the hole section 3000' to 8000' and it is necessary to case off these lost circulation zones, an 8 5/8" 36# N-80 liner will be run and cemented from 2700' to setting depth, then 7 5/8" hole will be drilled to 8000' where a string of 7" 23# N-80 Buttress casing will be run and cemented, using the techniques described in step 4 above. The hole section 8000' - 8500' will then be drilled with a 6" bit and the completion technique described in step 5 above will be applied.

In addition to drilling and completion procedure:

1. Condition hole and mud before pulling drill pipe to change bits, log or run casing.
2. Keep hole full while pulling drill pipe.
3. Check mud qualities daily, keep mud testing equipment on location at all times.
4. Equipment pits with a high-low level indicator but both visual and audial warning devices.
5. Equip mud system with a degasser and desilter.
6. Equip mud system with temperature monitors to read and record mud temperatures going into and coming out of hole at intervals of 30' or less.
7. A hydrogen sulfide indicator and alarm will be installed on the rig floor while drilling from 1300' to T.D.
8. A member of the rig crew or the tool pusher will monitor activity on the rig floor at all times while drilling and completing this well.
9. Weight material of quantity needed to raise the weight of the mud system 2 pounds per gallon will be maintained at the well site while drilling the interval 1300' - 8500'.
10. Deviation surveys will be made at intervals of 500 feet or less.
11. In addition to blowout preventer specifications listed in the drilling procedure, the following procedures will be observed:

- A. Packing elements and ram rubbers will be of high temperature resistant materials.
- B. The hydraulic actuators for opening and closing the ram type and expansion type blowout preventers will be located at the drillers station and at a point on ground level 50' or more from the well bore.
- C. The blowdown line connecting the well head and the mud pits will be equipped with steel or ceramic chokes and valves. The line will be anchored at all bends and at the end.
- D. A blowout prevention drill will be conducted weekly for each drilling crew. During this drill, the expansion-type blowout preventer and pipe rams will be operated, using both control station actuators. All crew personnel will participate in these drills. The result of these drills will be entered in the drillers log book. Flange bolts will be inspected for tightness as a part of this drill.
- E. Blind rams in blowout preventers will be checked for operation or each trip.
- F. The expansion-type blowout preventer and pipe ram elements of ram type blowout preventers will be checked daily for operation.

Casing Design Safety Factors:

20" 94#, set at 50', using 9.5# maximum mud weight.

Collapse REQ = 25	Rating = 520	SF = 20.8
Tension REQ = 4700	Rating = 487,000	SF = 103.6
Burst REQ = 25	Rating = 1400	SF = 56.0

16" 75#, set at 1300', using 9.5# maximum mud weight

Collapse REQ = 642	Rating = 1020	SF = 1.6
Tension REQ = 97,500	Rating = 662,000	SF = 6.8
Burst REQ = 642	Rating = 2400	SF = 3.7

11 3/4" 54#, set at 3000', using 9.5# maximum mud weight

Collapse REQ = 1482	Rating = 2280	SF = 1.5
Tension REQ = 162,000	Rating = 593,000	SF = 3.7
Burst REQ = 1482	Rating = 3300	SF = 2.2

8 5/8" 36# N-80 Buttress 6000' to 8000', using 9.5# maximum mud weight

Collapse REQ = 3952	Rating = 4270	SF 1.08
Tension REQ = 72,000	Rating = 1,034,000	SF 14.36
Burst REQ = 3952	Rating = 5900	SF 1.49

8 5/8" 36# K-55 Buttress 0' - 6000', using 9.5 # maximum mud weight

Collapse REQ = 2964	Rating = 3420	SF = 1.15
Tension REQ = 288,000	Rating = 981,000	SF = 3.40
Burst REQ = 2964	Rating = 4100	SF = 1.38

7" 23# N-80 Buttress 0' - 8000', using 9.5# maximum mud weight

Collapse REQ = 3952	Rating = 4070	SF = 1.03
Tension REQ = 184,000	Rating = 666,000	SF = 3.62
Burst REQ = 3952	Rating = 5800	SF = 1.46

BLOWOUT PREVENTION PROGRAM

As detailed in the Drilling and Completion Procedure our blowout prevention program consists of three phases: blowout prevention containment devices (blowout preventers, rotating head and master gate), blowout warning devices (pit level alarm, degasser, temperature monitor), and blowout control drills for crew members.

The containment devices will be equipped with high temperature resistant packing elements and ram rubbers. All of the containment devices used will be rated and tested to 2000 psi. All of the containment devices will be installed and used above ground level so that any leaks will be visible and accessible for repair. As outlined in the Drilling Procedure, blowout preventers will be pressure tested when installed; then pressure tested not less than once each week; and again pressure tested if any of the equipment is removed or if any seals are broken for any reason. The equipment will be tested for operating ability not less than once each day.

The warning device in use on this well will consist of a pit level alarm rigged to actuate both an audio and visual warning in event the level of fluids in the mud pits increases or decreases. The warning device will be located on the rig floor near the drillers station. In addition to mud level monitoring, mud temperatures will be monitored and recorded, which will also serve as a warning device as temperatures increase.

Blowout control drills for crew members will be conducted not less than once each week and will consist of two phases: acquainting every crew member with blowout prevention equipment and controls; and schooling drillers and tool pushers with kick control techniques and calculations. Kick control procedures and worksheets for calculations will be maintained on the rig floor at all times after drilling surface hole.

A blowout contingency plan in detail will also be placed in a conspicuous place near the rig floor and will concern actions to be taken after kick control procedures are begun. This plan will consist of three main thrusts; containmnet of well fluids, insulation of the public from danger and cleanup measures.

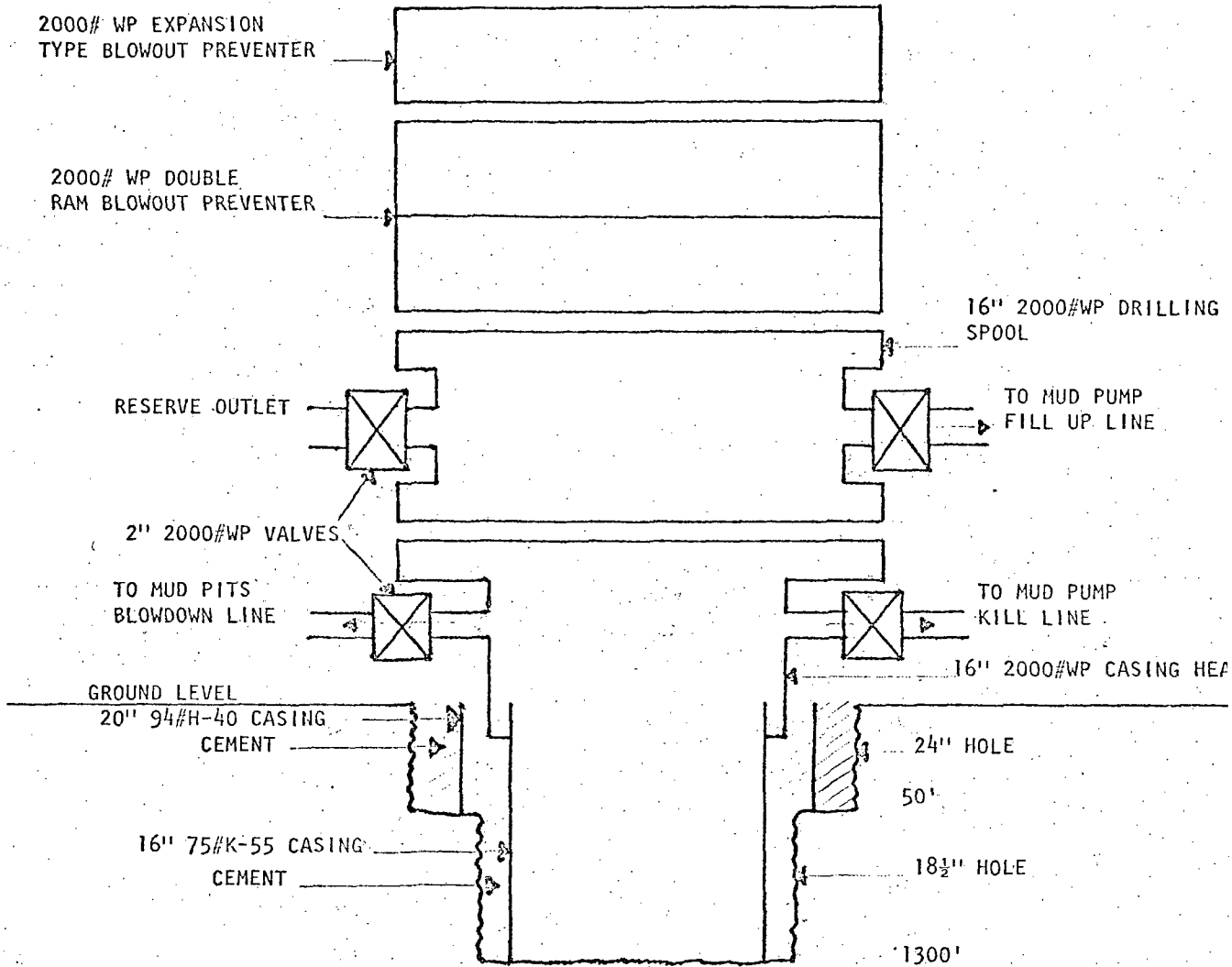
The reserve pit built on the well site will at all times be capable of handling several thousand barrels of well fluids in addition to drilling fluids discarded as normal operating procedure. If this pit should prove to be inadequate for fluid containment, additional earthen pits will be made to hold well fluids.

The access road to the well site will be equipped with signs warning the general public of possible danger and advising unauthorized personnel to stay away from the well site at all times. In the event a well kick occurs or high temperatures are encountered, the access road will be blockaded to further restrict visitors. If any fluids are being produced by the well, either water, steam or gas, the road will be blockaded and manned to prevent entry by the general public. In the event gas, oil or corrosive waters are produced by the well and are being airborne away from the well site and access road to other public roadways, these roadways will be blockaded and manned to warn the general public of danger.

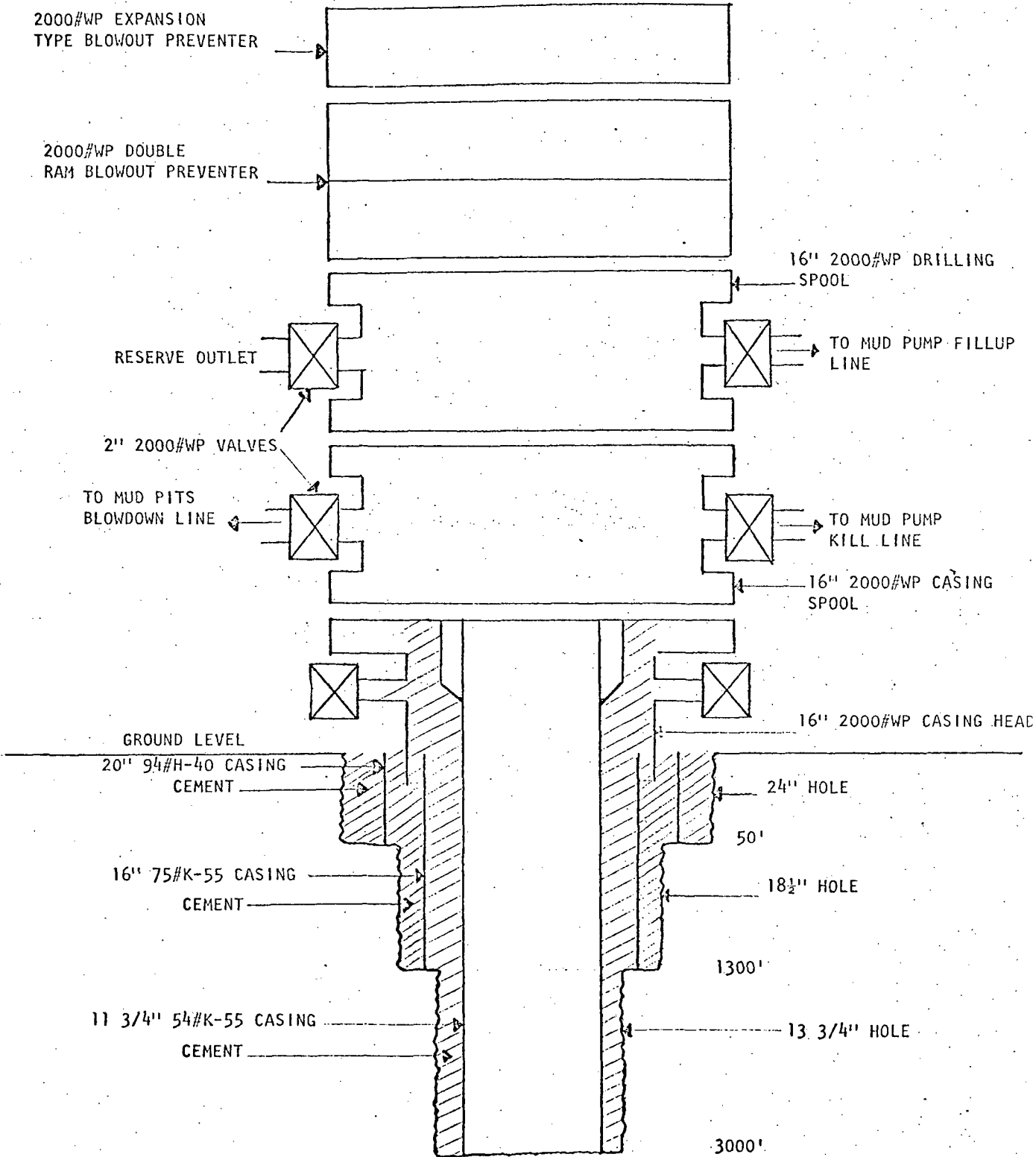
In the event oil or corrosive water should be produced by this well, these fluids will be confined to the drill site and either transported to a disposal site or buried at the well site when the well site is restored.

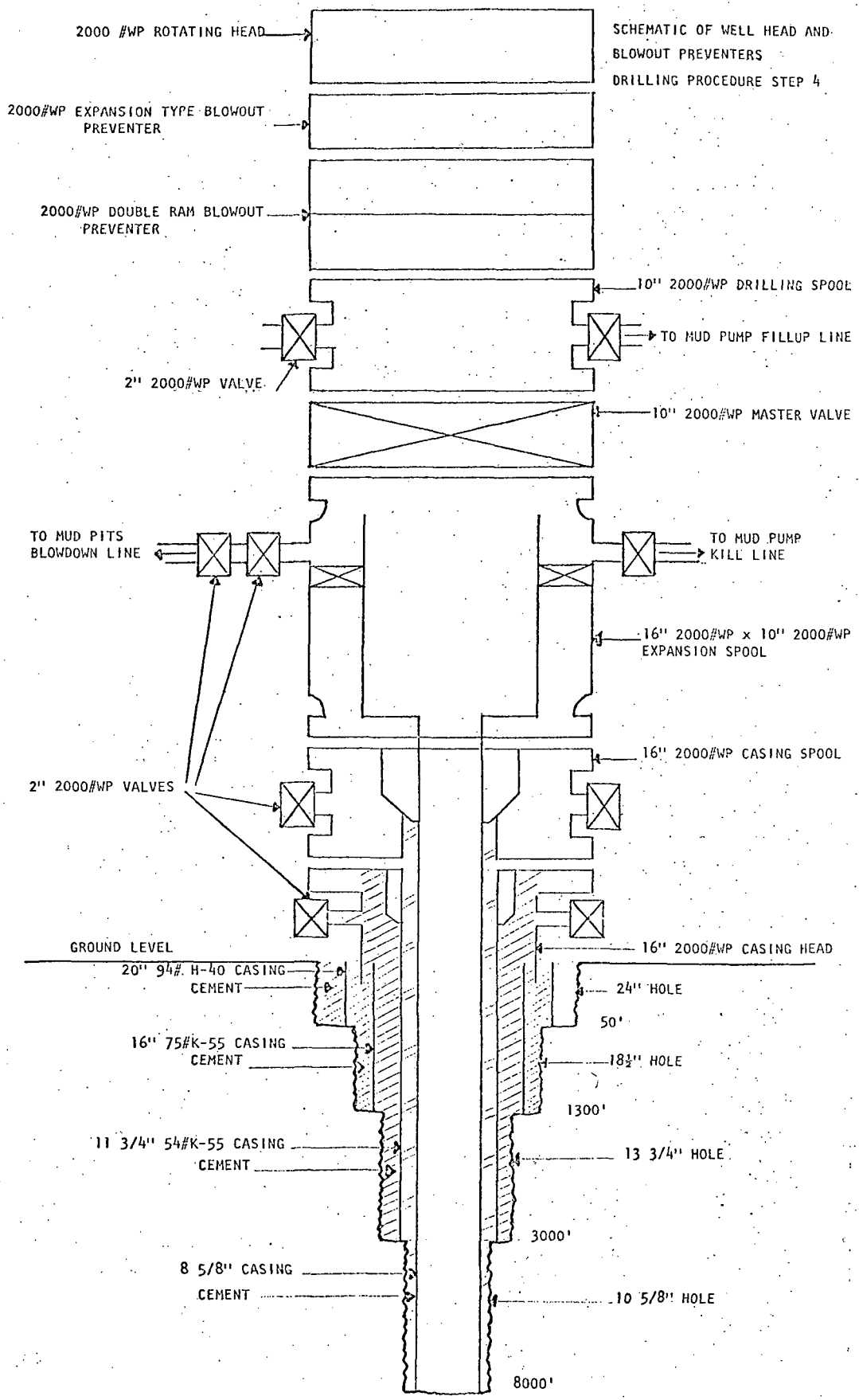
SCHEMATIC OF WELL HEAD AND BLOWOUT PREVENTERS

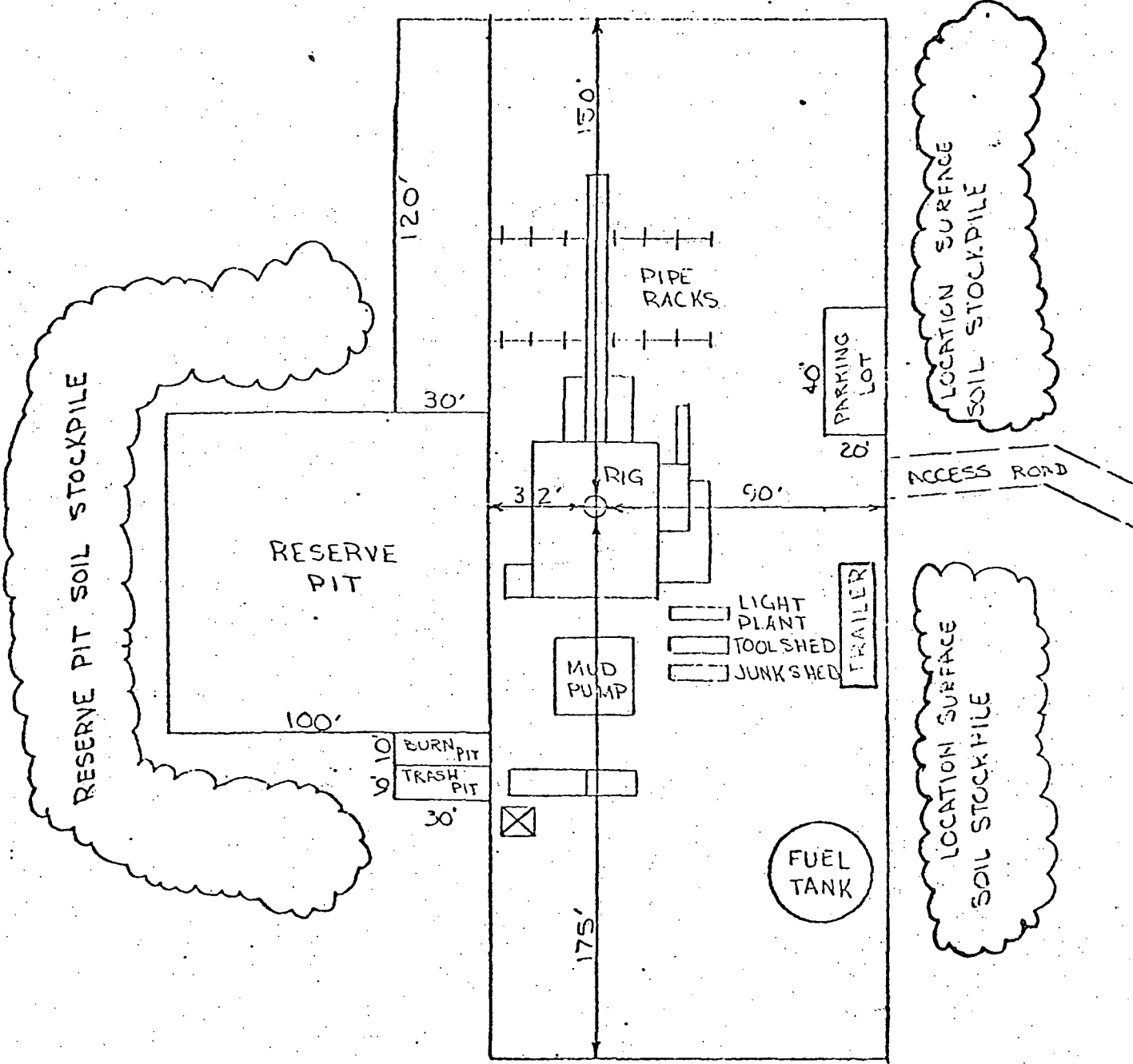
DRILLING PROCEDURE STEP 2



SCHEMATIC OF WELL HEAD AND BLOWOUT PREVENTERS
 DRILLING PROCEDURE STEP 3 (If Necessary)







Lessors Intentions with Respect to
GRO Order #4

1. Aesthetics - Due to the remoteness of the location and lack of traffic, lessee does not consider the aesthetic impact of the drill site and rig to be significant. In the event production is obtained, suitable design and landscape techniques for the mitigation of aesthetic disturbances will be included in the production plan.
2. Land Use and Reclamation - The drill site will be graded and contoured to approximate its pre-drilling condition. Disturbed surfaces will be reseeded or revegetated according to local BLM recommendations. The area surrounding the drill site will be maintained in a safe and orderly condition and all operations will be conducted in a workmanlike manner. All supplies, equipment and scrap will be removed in a timely and orderly fashion.
3. Public Access - The public will have free access to all parts of the lease except the drill site. Warning signs will be posted about the drill site and it will be fenced to keep out livestock and wildlife.
4. Recreation - The only apparent recreational values of the lease are for dune buggies in the Humbolt Salt Flat or for hiking in the foothills. The drillsite should not interfere with either of these activities.
5. Slope Stability and Erosion Control - The drillsite is located to avoid continual erosional problems on the lease. Severe erosional problems are

encountered in the foothills surrounding the Humbolt Salt Flat as all drainage from the surrounding mountains flows into the Flat. There is no natural drainage out of the Flat, as it is the lowest area in northern Nevada. Large alluvial fans exist at the entrances to every canyon.

During drilling a diversionary dike will be constructed uphill from the drill site to keep sediments from being washed out of the pits and to prevent erosion of the drill pad. If a productive resource is found, a program for contouring the terrain and stabilizing the soil adjacent to production facilities will be included in the production plan.

6. Biota - The lessee does not know of any endangered species of flora or fauna on its lease, or on the proposed drill site. If evidence of any such species is provided to the Supervisor by recognized experts, the lessee will consult with the Supervisor and recognized experts to determine what reasonable mitigating measures may be taken to minimize or prevent any adverse effect which would result from drilling this well or could reasonably be expected to result from future production facilities if this well proves that a commercially viable resource exists on the lease.

7. Cultural Resources Preservation - The lessee believes there are no significant archaeological, historical, cultural, paleontological, or unique geologic sites on any of its leases in Dixie Valley. The Dixie Site may be considered an archaeological site, but in the opinion of the lessee it is not significant. Nevertheless, the lessee does not intend to drill within 2,500 feet of the Dixie Site.

8. Subsidence and Seismicity - Benchmarks already exist approximately every

mile along the road through the lessee's leases in Dixie Valley. In the opinion of the lessee, these benchmarks should be adequate to determine if any subsidence occurs while the well is being tested. If a commercially viable resource is discovered, the lessee would include plans for surveying in the area, establishing additional benchmarks and installing seismographs as part of the production plan.

Reservoir pressure and temperature data will be reported on Form 9-330C within 30 days after completion of measurements conducted to obtain this data. Initial and subsequent production test data including steam/water ratio, surface pressure and temperature, quality and quantity of well effluent will be filed with the Supervisor on Form 9-330C within 30 days after the well is completed.

9. Pollution, Waste Disposal and Fire Prevention - The lessee intends to comply with all applicable Federal, State and local standards with respect to control of all forms of air, land, water and noise pollution, including the control of erosion and the disposal of liquid, solid and gaseous wastes. While waste is being burned, and at all other times while lessee is conducting operations on the lease, fire prevention equipment will be strategically located and in working order.

A. (1) Liquid Disposal - It is the intent of the lessor to dispose of well effluent in a plastic lined pit while the well is being tested. If tests indicate the only significant contaminant contained in the effluent is heat, the lessee intends to hold such effluents until they have cooled to less than 100^o F and then release them from the pit so they can join surface waters collecting in the Humbolt Salt

Flat. If tests indicate harmful dissolved solids are contained in the well effluent, the fluids will be held in the pit to evaporate. Drilling fluids, if toxic, will be left in the mud pits to evaporate and the residue will be removed before the pits are refilled.

(2) Solid Waste Disposal - The lessee intends to burn a paper, wood and other easily ignited waste, use acid toilets or portable toilets for human waste, and bury or haul away all other waste or refuse generated in connection with the lessees operations. Burial of waste will not occur without the prior consent of the local BLM representative.

(3) Air Quality - Noncondensable gases will be vented into the atmosphere during well testing so long as they do not exceed Federal, State or regional air pollution standards. If special exceptions are required in order to test the well, copies of permits issued by the appropriate agency and reports required thereunder will be submitted to the Supervisor. Once the nature of the reservoir is known, appropriate measures to control release of non-condensable gases will be included in the production plan.

(4) Pits and Sumps - Pits and sumps will be plastic lined and any harmful chemicals or precipitates will be removed before backfilling. Contents of pits and sumps will not be allowed to contaminate ground waters (there are no lakes or streams). The pits and sumps locations, as well as the rest of the drill site, will be restored to a near natural state as soon as well testing and pit evaporation are completed. As noted in item 3, the well site will be fenced to keep out wildlife and livestock. Surface reclamation will be as noted in item 2.

(5) Production Facilities Maintenance - Will be addressed in the production plan, if this well proves there is a commercially viable resource on the lease.

B. Inspection & Reports

(1) Drilling facilities will be inspected daily by the lessee to insure that failures or malfunctions which could lead to pollution are prevented.

(2) Any pollution incident which should occur will be reported orally within 18 hours to the Geothermal District Supervisor and will be followed within 30 days by a written report stating the cause and corrective action taken.

C. Injection - The lessee does not anticipate any injection unless a commercially viable resource is discovered by this well. If injection is required in conjunction with production, it will be covered in the production plan.

10. Water Quality - The lessee intends to comply with State and local as well as Federal water quality standards. The lessee will file, in duplicate, a detailed water analysis report within 30 days after completion and annually thereafter including a determination of arsenic, boron, radioactive content and radioactivity of produced fluids.

11. Noise Abatement - The lessee does not expect noise to be a problem for anyone but its own personnel due to the lack of habitation in the area of the well site. Nevertheless, the noise level will not exceed 65 db(A) within 0.8 km (one-half mile) from the source on or near the drill site. Due to the location, lessee does not intend to measure noise levels if all equipment used on the lease has mufflers that reduce noise to acceptable levels, unless the Supervisor stipulates that such measurements shall be made despite the lack of habitation in the area.

WELL	COUNTY	LOCATION
SRC 1	Pershing Churchill	NW $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 28, T25N - R37E, Approximately .35 Mi. NE of BM 3450 and .65 Mi. SE of BM 3458
SRC 2	"	SE $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 31, T25N - R37E, Approximately 1.35 Mi. Due North of BM 3489 and 1.00 Mi. W.SW of BM 3454
SRC 3	"	NE $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 16, T24N - R36E, Approximately .71 Mi. Due West of BM 3441 and .43 Mi. Due North of BM 3439
SRC 4	"	SE $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 22, T24N - R36E, Approximately 1.57 Mi. Due East of BM 3454 and 1.14 Mi. SE of BM 3439
SRC 5	"	SE $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 21, T24N - R36E, Approximately .64 Mi. S.SW of BM 3439 and .50 Mi. E.NE of BM 3454
SRC 6	"	NW $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 31, T24N - R36E, Approximately .86 Mi. E.SE of BM 3420 and .75 Mi. S.SW of BM 3460
SRC 7	"	SE $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 4, T23N - R36E, Approximately 3.50 Mi. Due South of BM 3439 and 3.79 Mi. E.NE. of BM 3484
SRC 8	"	SW $\frac{1}{4}$, SW $\frac{1}{4}$ SEC. 6, T23N - R36E, Approximately 1.07 Mi. SE of BM 3503 and 1.28 Mi. E.NE of BM 3484
SRC 9	"	NW $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 2, T23N - R35E, Approximately .71 Mi. S.SW of BM 3503 and .36 Mi. N.NW of BM 3484
SRC 10	"	NW $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 14, T23N - R35E, Approximately .43 Mi. N.NE of BM 3411 and .57 Mi. S.SW of BM 3419
SRC 11	"	SE $\frac{1}{4}$, SE $\frac{1}{4}$ SEC. 23, T23N - R35E, Approximately .36 Mi. SE of BM 3408 and 1.00 Mi. NE of BM 3403

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1. TYPE OF WORK
 DRILL DEEPEN PLUG BACK
 b. TYPE OF WELL
 OIL WELL GAS WELL OTHER Geothermal SINGLE ZONE MULTIPLE ZONE

2. NAME OF OPERATOR
 Southland Royalty Company

3. ADDRESS OF OPERATOR
 1000 Fort Worth Club Tower, Fort Worth, Texas 76102

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements.)*
 At surface
 See attached list
 At proposed prod. zone

14. DISTANCE IN MILES AND DIRECTION FROM NEAREST TOWN OR POST OFFICE*

15. DISTANCE FROM PROPOSED*
 LOCATION TO NEAREST
 PROPERTY OR LEASE LINE, FT.
 (Also to nearest d.i.g. unit line, if any)

16. NO. OF ACRES IN LEASE
 640

17. NO. OF ACRES ASSIGNED
 TO THIS WELL
 40

18. DISTANCE FROM PROPOSED LOCATION*
 TO NEAREST WELL, DRILLING, COMPLETED,
 OR APPLIED FOR, ON THIS LEASE, FT.

19. PROPOSED DEPTH
 8500'

20. ROTARY OR CABLE TOOLS
 Rotary

21. ELEVATIONS (Show whether DF, RT, GR, etc.)

22. APPROX. DATE WORK WILL START*

5. LEASE DESIGNATION AND SERIAL NO.
 6. IF INDIAN, ALLOTTEE OR TRIBE NAME
 7. UNIT AGREEMENT NAME
 8. FARM OR LEASE NAME
 9. WELL NO.
 10. FIELD AND POOL, OR WILDCAT
 Wildcat
 11. SEC., T., R., M., OR BLK.
 AND SURVEY OR AREA
 12. COUNTY OR PARISH
 Churchill
 13. STATE
 Nevada

PROPOSED CASING AND CEMENTING PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	QUANTITY OF CEMENT
24"	20"	94	50'	96
18 5/8"	16"	75	1300'	1225
13 3/4"	* 11 3/4"	54	3000'	1700
10 5/8"	8 5/8"	36	8000'	2100

This casing will be run only if lost circulation occurs while drilling from 1300' to 3000'.

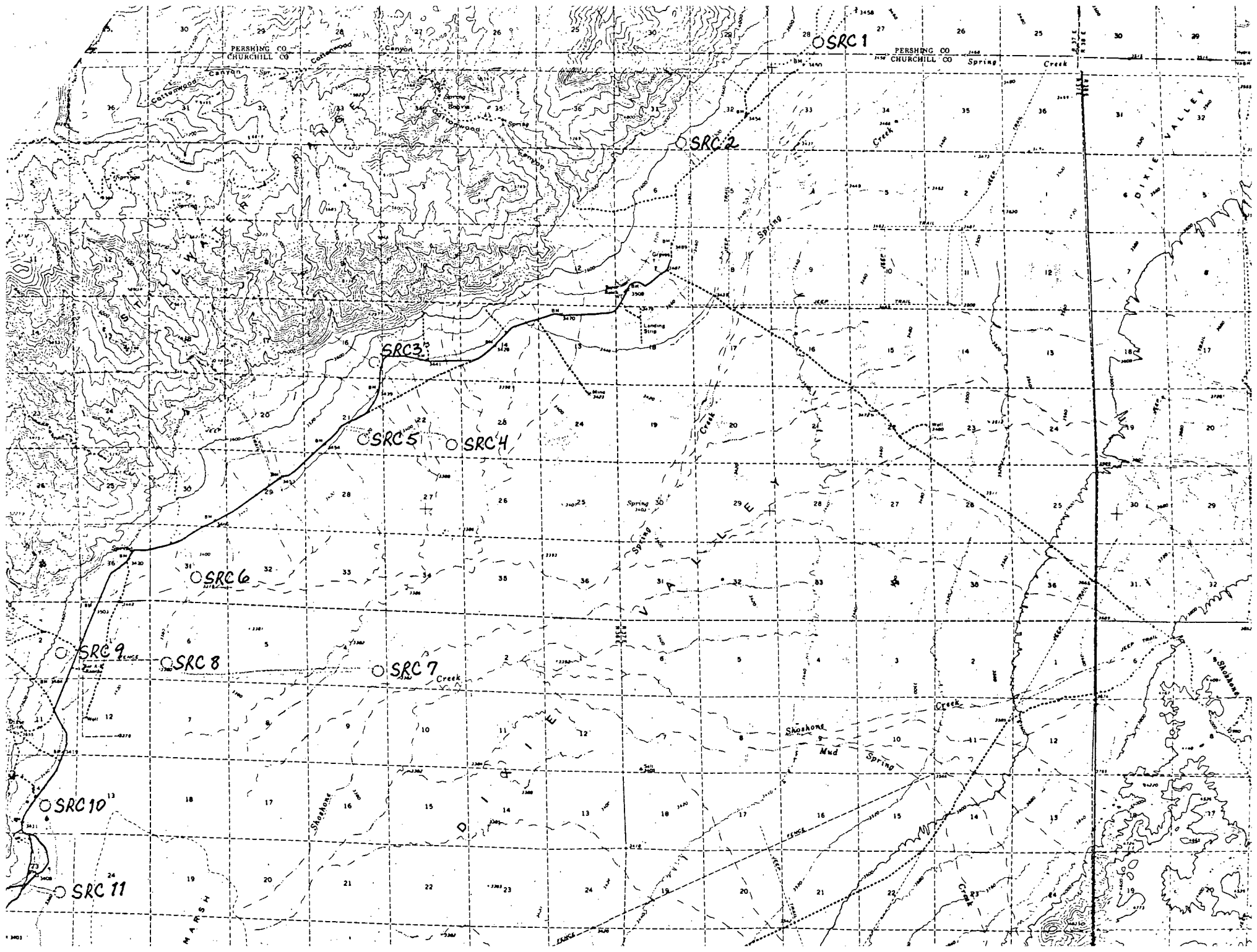
CASING DESIGN SAFETY FACTORS:

- 20" 94# Collapse = 20.8, Tension = 103.6, Burst = 56.0
- 16" 75# Collapse = 1.6, Tension = 6.8, Burst = 3.7
- 11 3/4" 54# Collapse = 1.5, Tension = 3.7, Burst = 2.2
- 8 5/8" 36# N-80 Collapse = 1.08, Tension = 14.36, Burst = 1.49
- 8 5/8" 36# K-55 Collapse = 1.15, Tension = 3.40, Burst = 1.38
- 7" 23# N-80 Collapse = 1.03, Tension = 3.62, Burst = 1.46

8. ABOVE SPACE DESCRIBE PROPOSED PROGRAM: If proposal is to deepen or plug back, give data on present productive zone and proposed new productive zone. If proposal is to drill or deepen directionally, give pertinent data on subsurface locations and measured and true vertical depths. Give blowout preventer program, if any.

SIGNED *James L. ...* TITLE District Manager DATE 5/12/78
 (This space for Federal or State office use)

PERMIT NO. _____ APPROVAL DATE _____
 APPROVED BY _____ TITLE _____ DATE _____
 CONDITIONS OF APPROVAL, IF ANY:



SRC 1

SRC 2

SRC 3

SRC 5

SRC 4

SRC 6

SRC 9

SRC 8

SRC 7

SRC 10

SRC 11