GL02374

Southland Royalty Company

June 4, 1979

Mr. Bill Haskins
Haskins-Pfeiffer
1449 Denver Club Building
Denver, CO 80202

Dear Mr. Haskins:

Attached is the information provided by the Department of Energy for the seismic survey that they propose in Dixie Valley, Nevada. I am also enclosing a map of the area indicating the suggested locations of the seismic lines.

I will be talking with the Department of Energy later today to see if they have a written indication of what geological information they hope to obtain from this survey. I will forward this information or ask them to forward it to you directly in the near future.

The one thing I failed to mention on the phone is that they must have the funds committed to this project prior to September 30, and their hope is that the final report can be done by then.

Please advise me as soon as you can on what your total price would be to supervise this survey and to provide a completed interpretation of the data.

Sincerely yours,

Jere Denton
District Manager
Natural Resources

JD/ji
attachment

cc Howard Ross, Univ. of Utah ✓
Joe Fiore, DOE, Nevada

RECOMMENDATIONS: SURVEY PARAMETERS

Barring very special conditions unique to a particular area, the panel of consultants feels that future surveys specified by DOE to contractors should meet the following general design parameters for the field procedures:

VIBROSEIS or dynamite source
2400% coverage
110' group spacing
12 geophones/group minimum
*12-60 Hz sweeps
*16 sweeps minimum
*10-20 sec sweeps
4 sec records, minimum

*VIBROSEIS crew

Processing is the key to success in the complex problem of geothermal seismic data, and a knowledgeable seismologist must interact with those doing the processing. The minimal product from the survey must be processing through migration with the

standard processing package, but with particular attention to the velocities determined and used in the migration routine. Static corrections must be treated with special care. The expenditure for data processing in a geothermal survey will be a relatively larger fraction of total cost than it is for reflection surveys in petroleum exploration.

It is vital to seismic exploration technology to evaluate the effectiveness of imaging techniques in reservoir detection, and in such surveys the following field parameters should be specified as general guidelines:

6 x 8 array, regularly spaced (48 channels minimum)
110' intervals
18 element geophone cross (4.5 Hz)
location approx. 0.5-1.0 mi from surface point above expected reservoir
large dynamic range recording system (80 dB+)

Such a modification, termed FKI here (for frequency-wavenumber imaging), should be incorporated in a CDP survey in instances where we have a great deal of other geological/geophysical data, where interference from cultural sources (drilling, traffic, towns & industry) is very low, and, particularly, if we have evidence for seismic activity near the potential reservoir, though this last requirement should not preclude such a survey if the other two conditions are satisfied. The DOE program can make a substantial contribution by encouraging a few FKI surveys in appropriate situations as add-ons to CDP surveys. As an add-on such a survey is quite inexpensive.

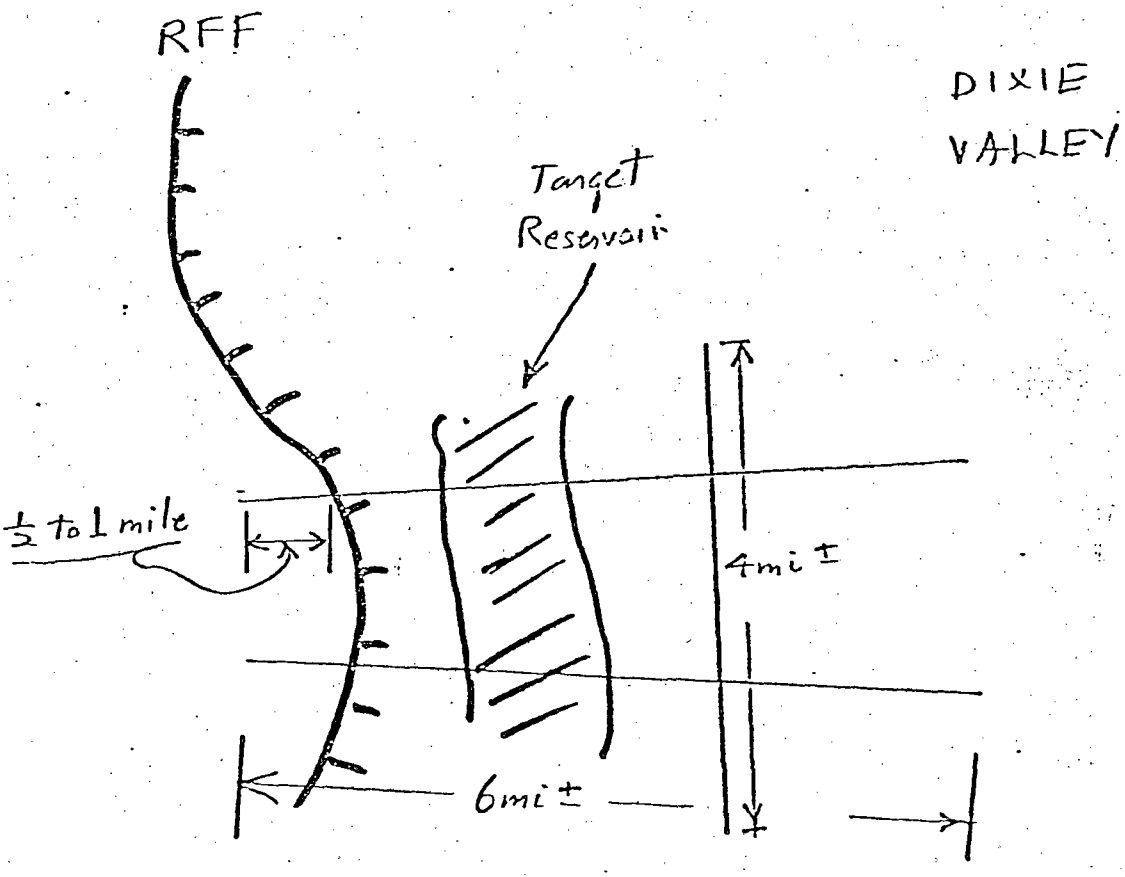
Details of the line or array geometry in a survey will naturally depend on the particular site, although some general guidelines should be followed. These are based on the goal of the DOE stimulation being demonstrating utility of the methods, or lack of utility, in specific cases. Demonstration implies mapping capabilities for structure and faulting down to at least 4000', in the vicinity of the suspected reservoir. Consequently, dense coverage is not needed. In most Basin & Range cases, three lines at most should suffice, with a total coverage of less than 20 line miles. Evaluation of the FKI process requires only one setup at a prospect--spectacular results will insure subsequent evaluation and DOE will have accomplished its goal.

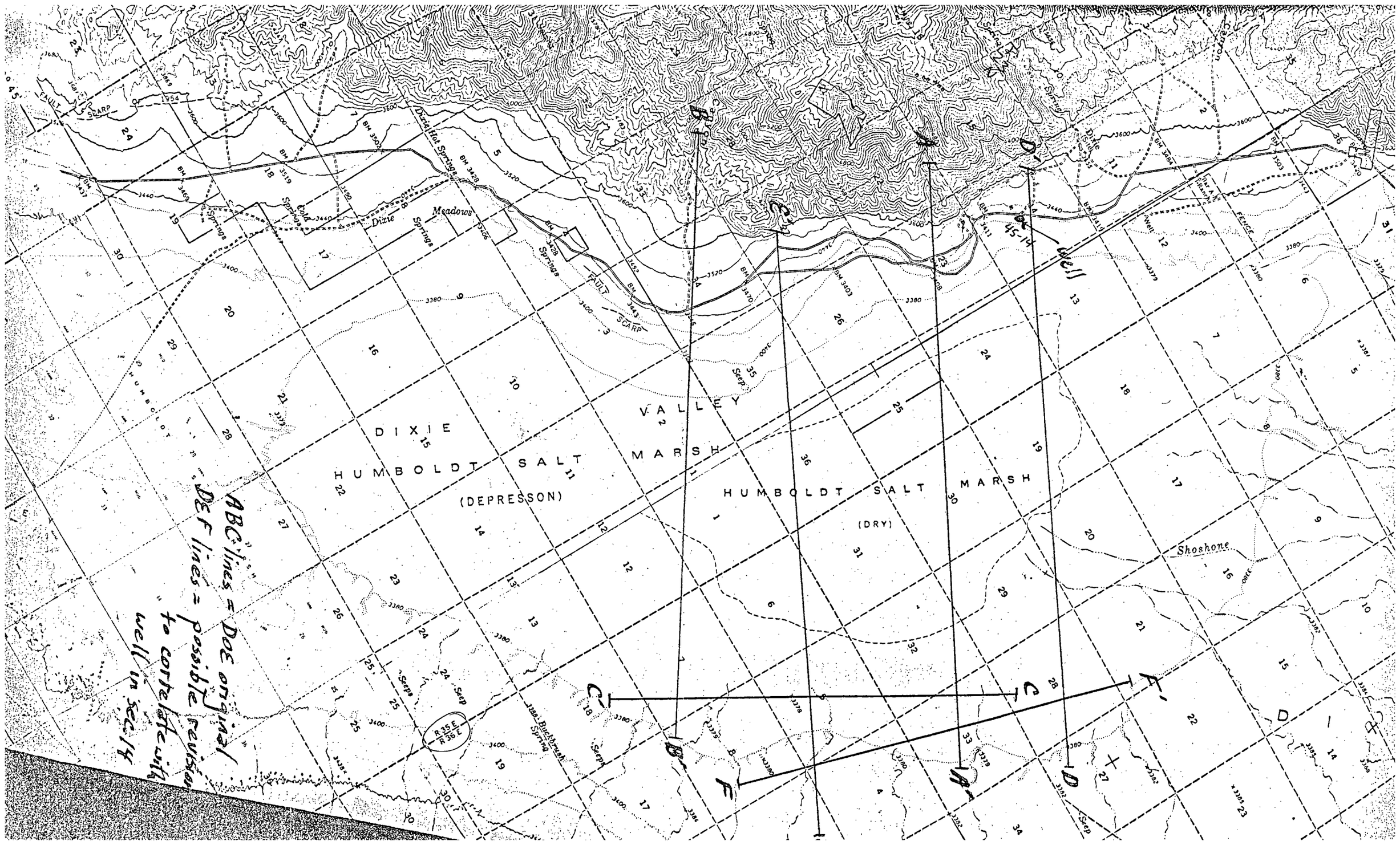
Cost estimations:

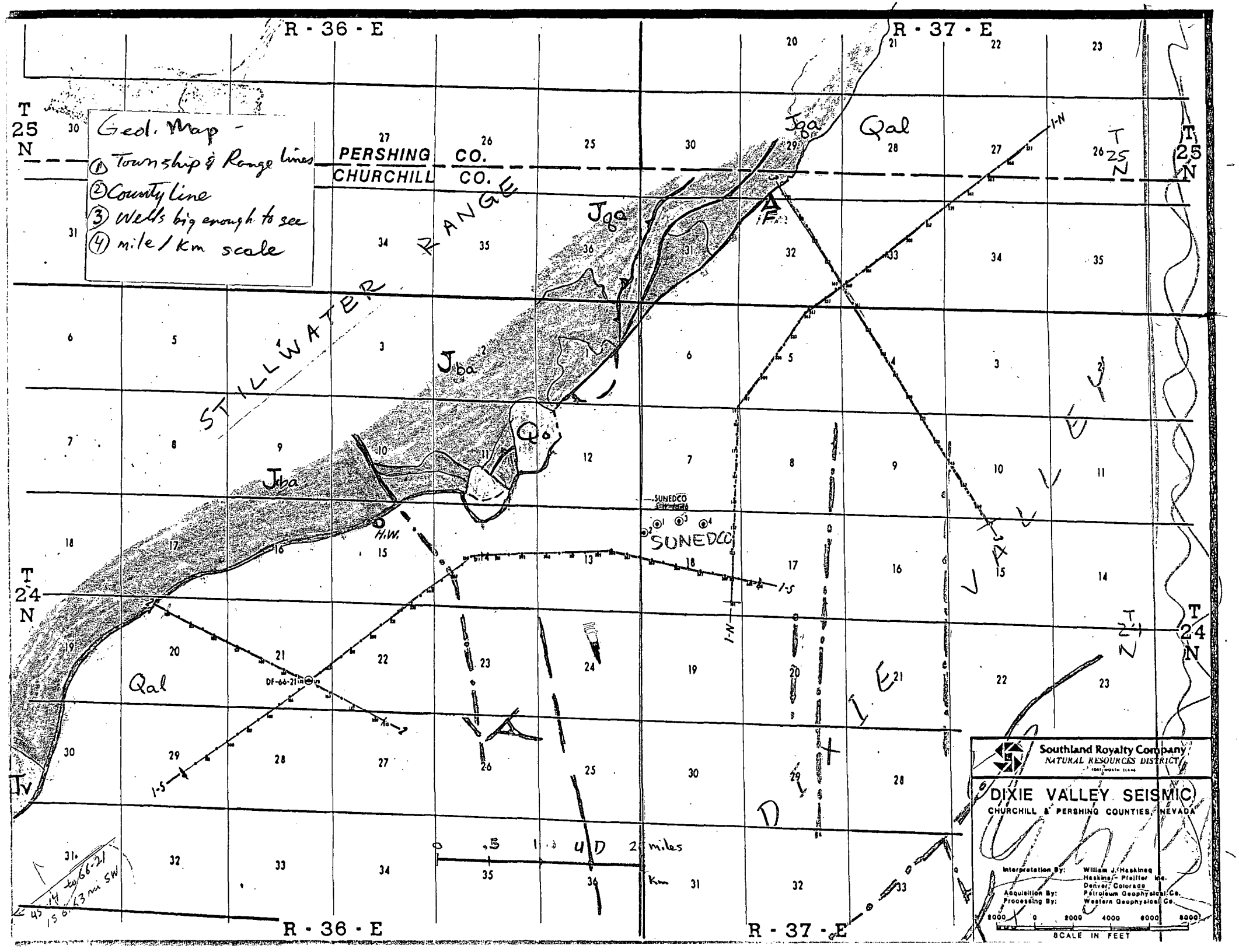
CDP Profiling. The above specifications of 48 points/mile will allow 1.5 to 2 miles per day, at best, for a cost, at $7500 per day (including processing), of $60K-90K for a typical 3-line (two @ 6 mi, crossed by a 4 mi line), 16 mile survey.

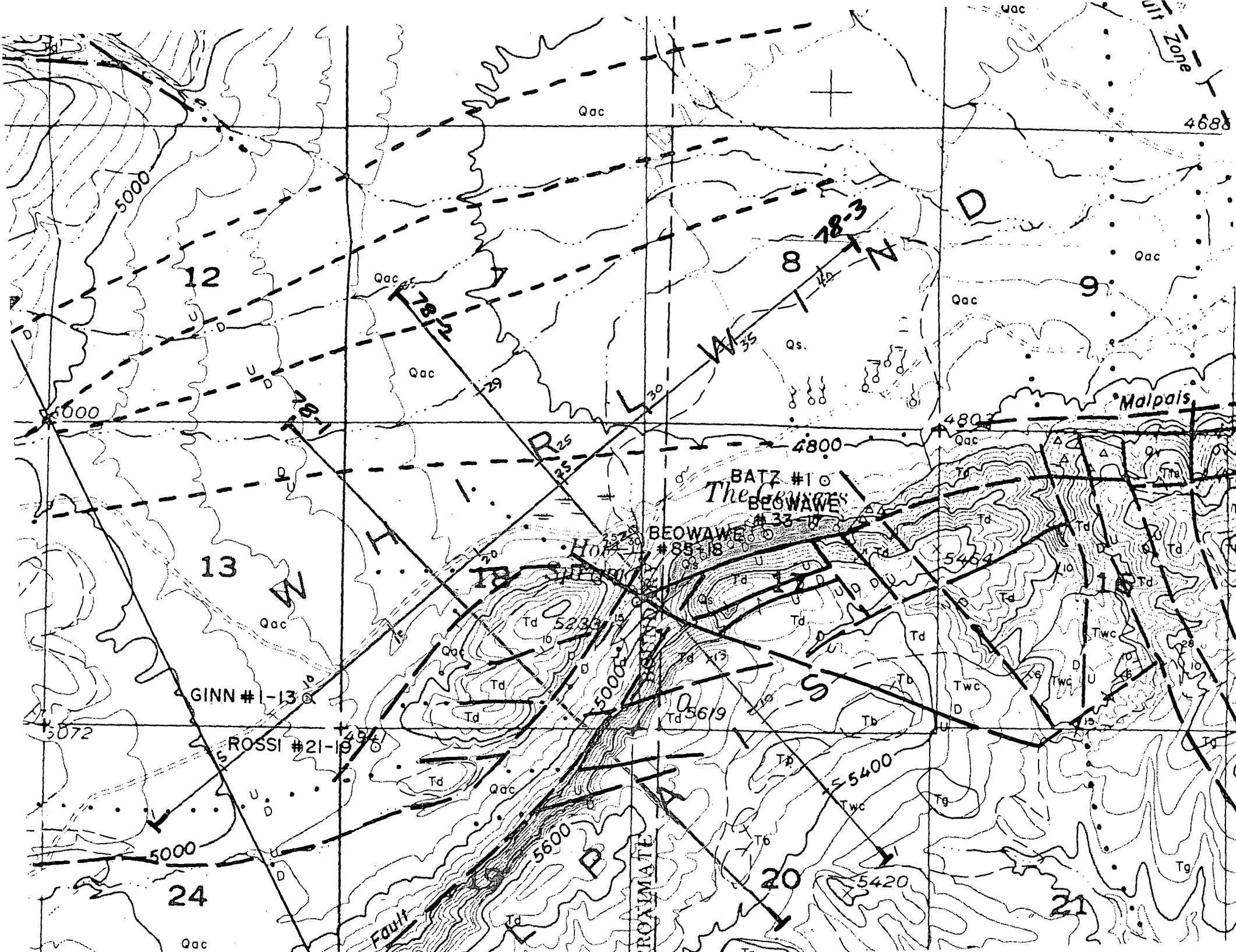
FKI Surveying. As an add-on, this aspect of the field effort amounts to no more than one day's work, and consequently will add less than $10K to the total survey cost.

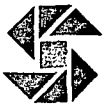
2. Dixie Valley. This prospect received high priority because of its status as a high potential area based on much existing data, including the reported dry steam found in the Sun well. It offers also the opportunity for a full case history on a classical RFF type structure, a situation promising adequate seismic data on the basis of results at San Emidio and Leach (see p. 3). The field geometry sketched below represents that typically required in the RFF situation. It is important that both dip lines be shot and that they be tied by the cross line, in order that mapping quality and consistency can be ascertained and so that the data can be compared to well data. The importance of acquiring all the lines is emphasized here because the lease situation looks messy, and the tendency may grow to compromise the survey. Under no circumstances should the proposed survey be reduced to less than two lines, one down-dip and a cross line in the valley east of the RFF. The details of the survey are to be as specified above for CDP profiling. FKI is not recommended for Dixie Valley at this time because of interference considerations from wells. In all, the recommendation is for two 6-mile lines spaced 2 miles apart and crossed by a 4-mile line on their eastern segments.




DIXIE
HUMBOLDT SALT
(DEPRESSON)
VALLEY
MARSH
HUMBOLDT SALT MARSH
(DRY)
Dixie Hot Springs
Dixie Meadows
Cold Springs
Dixie Springs
Shoshone
Buckbrush Spring
Seep
Fault
Scarp
Well
45-14
ABC lines = DOE original
DEF lines = possible revision
to correlate with
well in sec 14


R - 36 - E
R - 37 - E
T 25 N
T 24 N
PERSHING CO.
CHURCHILL CO.
Geol. Map -
① Township & Range lines
② County line
③ Wells big enough to see
④ mile / Km scale
STILLWATER RANGE
DIXIE VALLEY
Jba
Jga
Qal
Qo
SUNEDCO
H.W.
DF-66-21
I-5
I-N
0 .5 1 0 2 miles
0 1 2 3 4 5 Km
to 66-21 14 4.3 mi SW
Southland Royalty Company
NATURAL RESOURCES DISTRICT
DIXIE VALLEY SEISMIC
CHURCHILL & PERSHING COUNTIES, NEVADA
Interpretation By: William J. Haskins
Haskins - Pfeiffer Inc.
Denver, Colorado
Acquisition By: Petroleum Geophysical Co.
Processing By: Western Geophysical Co.
8000 0 2000 4000 6000 8000
SCALE IN FEET


Qac
Qs.
Malpais
BATZ #1
BEOWAWE #33-18
BEOWAWE #85-18
GINN #1-13
ROSSI #21-19
Fault
APPROXIMATE
5000
4800
5400
5600
5420
5464
5236
5619
5072
12
13
24
8
9
20
21
18-3
18-2
18-1
Td
Twc
Tg
Tb



Southland Royalty Company

May 30, 1980

Mr. Joe Fiore
Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, Nevada 89114

Dear Mr. Fiore:

This letter is to update you on the Dixie Valley, Nevada seismic program being conducted by Southland Royalty Company.

Haskins-Pfeiffer contacted Southland and indicated they are going to begin processing the data today. We discussed the following processing parameters to be used:

5"/second horizontal scale
16 trace/inch vertical scale
Flatten the data to 3,300' reference surface
Correctional velocity of 6,000'/second to be used

Discussions with Amoco Production Company of Denver indicated that the data should not be heavily "band-filtered" on the high end as a distinct loss of resolution of faults occurs. The sections also show a high degree of "ringing" in the presentation when this occurs.

Western Geophysical will be doing the processing. The first QC sections will be available in ten days to two weeks. After a review of the QC sections, processing to refine the data will be taken to filter and migrate the data into final form.

The seismic crew has completed approximately eighteen miles of seismic lines in Dixie Valley. A bend was caused in the section in T24N, R37E near Lamb's Ranch due to large boulders being present. The Carson City BLM office was reluctant to allow this area to be bulldozed to remove the boulders and permit the equipment to pass.

1000 FORT WORTH CLUB TOWER (817) 390-9200 FORT WORTH, TEXAS 76102

If you have any questions concerning the above data, please feel free to contact our office.

Sincerely yours,

Dennis S. McMurdie
Geothermal Geologist
Natural Resources Department

DSM/dcs

cc: Howard P. Ross
University of Utah Research Institute

Jere Denton, District Manager
Natural Resources Department
Southland Royalty Company

Southland Royalty Company

October 24, 1980

Mr. Joe Fiore
Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, Nevada 89114

Dear Joe:

Enclosed is the report on the seismic survey conducted in Dixie Valley.

Sincerely yours,

Jere Denton
District Manager
Natural Resources District

JD/dcs

Enclosure

cc: Howard P. Ross

Received _____, 1980

By _____

Southland Royalty Company

May 8, 1980

Mr. Joe Fiore
Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, Nevada 89114

Dear Joe:

Attached is the seismic layout which I described to you on the phone before my recent trip to Washington. As you can see, the basic northeast southwest trending line would intersect Dixie Federal 66-21, pass just west of the Sun wells, and just to the east of the Senator Fumaroles. The southern most northwest southeast trending line would also intersect Dixie Federal 66-21 and presumably intersect the basin bounding fault on the west side of Dixie Valley. This line is unfortunately only two miles long because of the Humboldt Salt Marsh. The northern most of the northwest southeast trending lines would intersect the location of temperature gradient hole SR-3 on which DOE will receive downhole information, will intersect the northeast southwest trending line and would presumably intersect the basin bounding fault as well.

In addition to the information which I am enclosing, I should mention that based on Southland's single level aeromagnetic survey over this area it would appear that the long seismic line would start on the southwest end in a horst block, would cross a small graben, return to a horst block on which the Sun discovery wells are drilled, cross another graben, and end up on a horst block.

I believe this program would allow us to not only intersect the basin bounding fault with subsurface control from our deep well, which was the initial objective of the program, but also give us some idea what is the source for the Sun production and the Senator Fumaroles.

This program as is presently laid out should be capable of being conducted without special equipment that would have been necessary if the survey had been done in closer proximity to the Humboldt Salt Marsh.

1000 FORT WORTH CLUB TOWER (817) 390-9200 FORT WORTH, TEXAS 76102

If this proposal is acceptable to you, I would appreciate a contract modification being made so that I can proceed in securing a geophysical contractor.

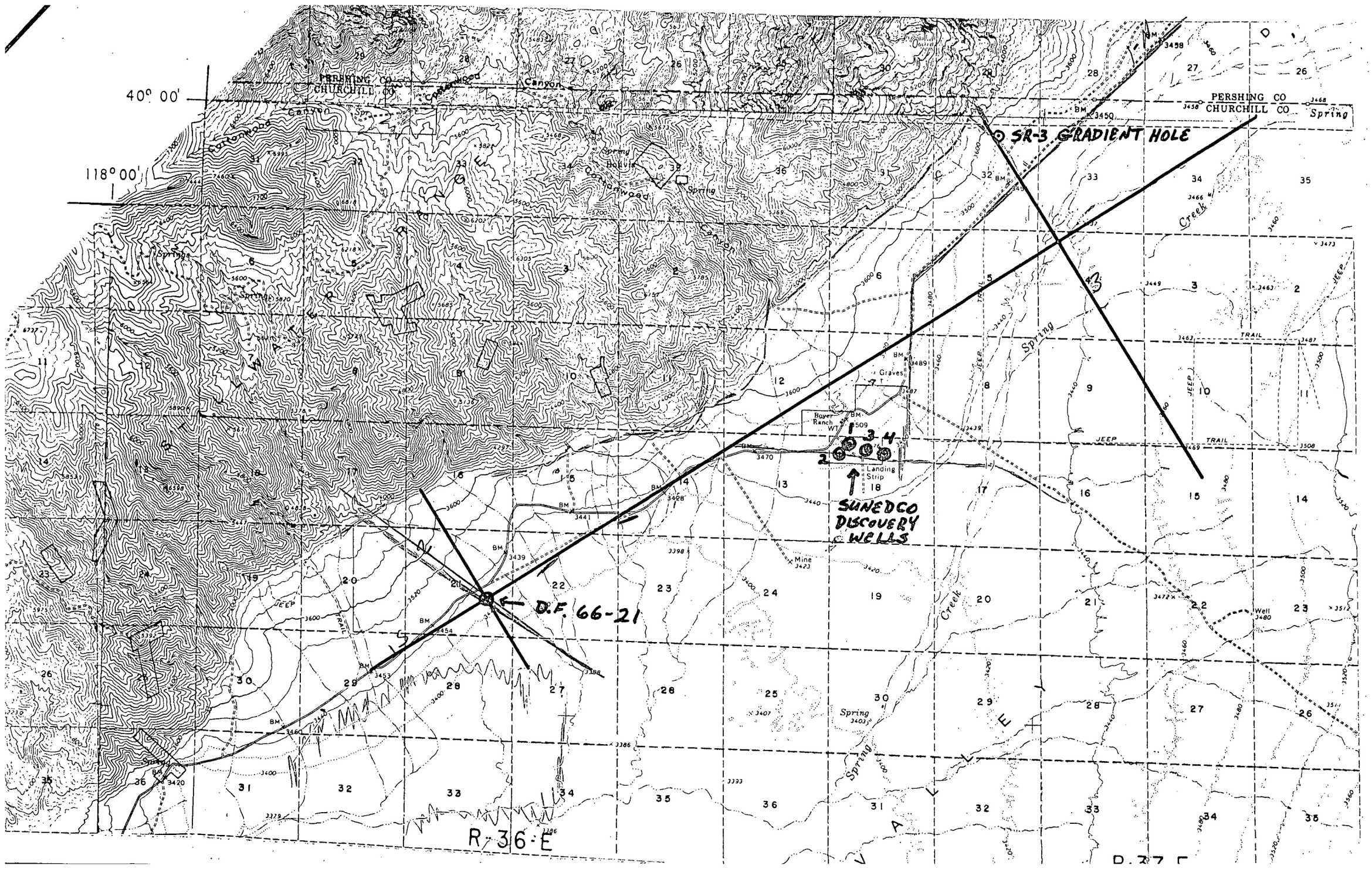
Sincerely yours,

Jere Denton
District Manager
Natural Resources Department

JD/dcs

Attachment

cc: Howard Ross
University of Utah Research Institute


40° 00'
118° 00'
PERSHING CO
CHURCHILL CO
Cottonwood Canyon
Spring
SR-3 GRADIENT HOLE
SUNEDCO DISCOVERY WELLS
D.F. 66-21
Buena Vista Valley
Graves
Boyer Ranch
Landing Strip
Mine
Well
JEEP TRAIL
R. 36 E
R. 37 E

Southland Royalty Company

March 6, 1980

ACTION EAD
INFO
R. F.
AMA
AM. & C
AMD

Mr. Jim Cotter
Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, Nevada 89114

Dear Mr. Cotter:

Attached you will find a report from the Mackay Minerals Research Institute regarding its subcontract with Southland Royalty for work in Dixie Valley, Nevada. This report covers the events from December 1 through the end of February and discusses problems which have resulted in the delay of the delivery of the original report and will apparently delay delivery of the supplemental contract report. I believe that a sincere effort is being made to come up with the best possible reports and that in the long run this is more important than adhering to a precise time schedule. Nevertheless, I have repeatedly stressed the importance of timeliness to this technical group.

I should also like to report that drilling of the first of the two 1,500' temperature gradient holes under our contract was completed on February 14. This hole was located in T25N R37E, in the NW/4 of Section 32 near the Senator Fumaroles. The first logging of this well has been completed and the temperature at 1,470' was 198°F. It is currently anticipated that two more holes will be drilled by Southland in this part of the valley before the rig is moved to the east side of the valley to commence the second hole under the DOE contract. The reason for this is largely related to the timing of decisions which will be made about the Clan Alpine Mountain Wilderness status. It is currently expected that some decision on this area may be forthcoming approximately May 1.

I have received Joe Fiore's memo dated March 3 with respect to the supplemental contract for the reflection seismic survey. All three of the attached options, ignore the fact that line "B" which is the northeast/southwest trending line, cannot be performed because the Humboldt Salt Marsh intrudes into the area with its closest proximity to the old Stillwater Fault being in Section 26, T24N R35E. Thus, that segment of line "B" running from approximately the east edge of Section 1, T23N R35E to the western edge of Section 28, T24N R37E would encounter the problems which have already been discussed. We are presently reviewing internally the possibility of running the northeast/southwest trending line to the north from Dixie Federal 66-21 across lands in the vicinity of the Sun Oil geothermal discovery and into the vicinity of the

Ltr. 175744

Senator Fumaroles. We would then contemplate another tie-line running from the mountains to the valley in approximately the vicinity of the Senator Fumaroles., It appears that a crew may be available to perform the work this summer.

This week Southland was able to trade some information to Amoco for seismic data they have in the valley. We will have to evaluate seismic quality as a function of the shot parameters which were used by them. Once this is done, we should be able to advise you further as to the viability of this project.

Sincerely yours,

Jere Denton
District Manager
Natural Resources Department

SOUTHLAND ROYALTY COMPANY

JD/dcs

Attachment

primacord

Southland Royalty Company

February 6, 1980

Joseph N. Fiore
Project Engineer
Geothermal Branch
Energy Applications Division
Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, Nevada 89114

Dear Joe:

I have received your memo of January 28th, with respect to drill hole access for experimental seismic measurements. I would very much appreciate it if you would ask the USC investigators to contact me.

I, also, talked this morning with the geophysical contractor in Denver. He indicated that they have a quote from CGG, but that it seems extremely high. He is wondering if primacord would be an acceptable alternative. He believes there is a type of plow available from Ditch-Witch which could be used for plowing the primacord in to a depth of approximately 30 inches. He believes this would leave some air blast problem but, that it would be minimal.

Howard, Is this viable alternative for reflection seismic at Dixie Valley? JN 2/11/80

I would appreciate it if you would discuss the primacord alternative with Howard Ross or the Idaho lab people. Short of that, it appears that additional funding would be necessary to proceed with the CGG bid.

How much?

Sincerely,

Jere Denton

Jere Denton
District Manager
Natural Resources Department

SOUTHLAND ROYALTY COMPANY

JD/rr

1) move lines away from marsh NG
2) primacord
3) couple w. McCoy Amax refl. seismic
4) deobligate funds

ACTION EAD
INFO
RF
AMA
AMS & C ✓
AMD

2/13/80 J.D.

CGG BID — BUGGY MOUNTED DRILL + DYN SOURCE

48 TRACE CURVE VS 96 TRACE CURVE DOUBLES NO. OF HOLES

$900 ± /day drill cost

$40 - 80 K for drilling

$ 4,000 for shooting /mile

MOB/DEMOB etc

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
420 CHIPETA WAY, SUITE 120
SALT LAKE CITY, UTAH 84108
TELEPHONE 801-581-5283

Feb. 22, 1980

Mr. Joseph N. Fiore
DOE/NV
P.O. Box 14100
Las Vegas, Nevada 89114

Dear Joe,

Enclosed are two copies of a map showing 3 options for the reflection seismic survey at Dixie Valley. I still favor a dynamite or vibroseis survey to primacord because the aim of the Exploration Technology and Industry Coupled programs is to obtain useful, state-of-the art data. It therefore seems better to shift line locations somewhat to avoid the salt marsh and problem areas if this can be done without too much sacrafice, and without added cost.

The primacord results are difficult to predict. Sometimes good results are obtained in marsh environments but there are two major concerns: 1) surface waves which could result in a high noise level for 0 – 0.4 sec. 2) getting enough energy into the alluvium to get good reflections to depths of 4000-6000'. There are also environmental concerns.

I suggest we recommend a dynamite source reflection survey with conventional vehicles and drill rigs if the options shown can be completed. If the work cannot be completed by Sept. 1980 perhaps the DOE funds for this work should be deobligated in favor of other exploration survey requests already made to DOE/NV.

Regards,

Howard

encl.

DIXIE VALLEY - REFL. SEISMIC 2-21-80

Stan Laster - called him Feb 21 @ 11:45

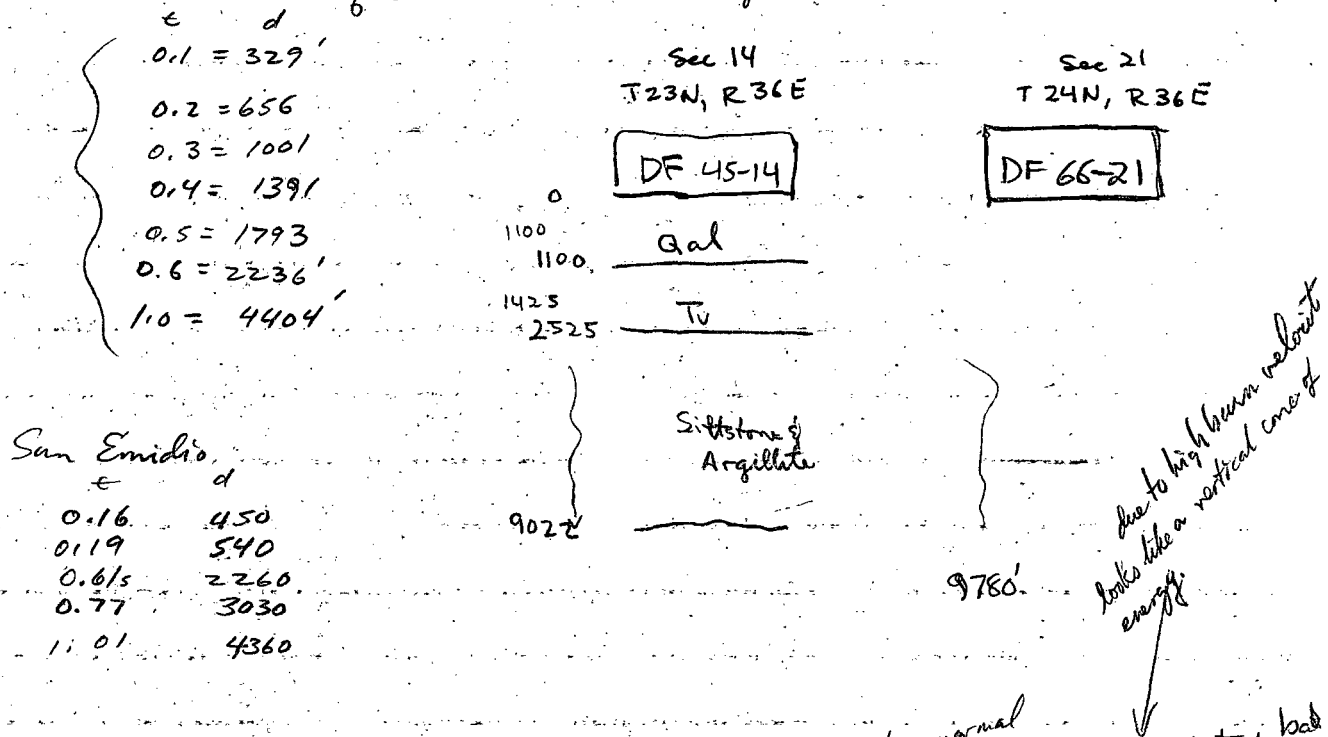
Primacord - normally used in West Texas, desert sand type environments - know of little use in marsh environments - normally used where cost effective by trench digger - back hoe equip -

a) yes, surface noise could be a real problem; testing and selection of right burn velocity rate might over come this

V_{gal} = 4000'/sec ;
- 500' = 0.25 sec
- 1000' 2 way @ 4000'/sec = 0.5 sec
- 2000' 2 way @ " = 1 sec
- 3000' 2 way @ " = 1.5 sec
- 4000' 2 way @ 4000'/sec = 2 sec

Soda Lake V_{gal} = 6000 - 7500'/sec for 1st @ 0.6 sec

t	d
0.1	= 329'
0.2	= 656
0.3	= 1001
0.4	= 1391
0.5	= 1793
0.6	= 2236'
1.0	= 4404'



San Emidio

t	d
0.16	450
0.19	540
0.61s	2260
0.77	3030
1.01	4360

STAN LASTER

Primacord has been used in marshes - smaller charges than normal - surface waves group length; energy limited though, and would likely be lost in near surface alluvial layers

{Hill A.F.B. Hole #2.?} 3260' 40°C - tight, drilled w. mud
65°C/km grad.

MAR 3 1980

Mr. Jere Denton, District Manager
Natural Resources Department
Southland Royalty Company
1000 Ft. Worth Club Tower
Ft. Worth, Texas 76102

Dear Mr. Denton:

DIXIE VALLEY, REFLECTION SEISMIC SURVEY

We have reviewed the CGG bid for the subject survey and concur with your determination that the proposed costs are unreasonably high. Additional funds to supplement the $110,000 currently authorized under the subject contract are not available. If funds were available, it is doubtful whether the Government could justify additional expenditures for the work in light of the apparent unreasonableness of the proposed costs.

The University of Utah Research Institute (UURI) has reviewed the alternate primacord method and does not recommend its use because of (1) surface waves which could result in excessive noise levels, and (2) inability to transfer enough energy through the alluvium for adequate reflections from beyond 4,000 ft. UURI has suggested alternate locations for the reflection seismic survey to avoid the salt marsh, thus allowing the use of conventional dynamite source or Vibroseis techniques. A map showing the alternate locations as options 1-3 is attached for your review. If these options still present the same problem, perhaps you can suggest an additional option for final consideration.

In the interest of the Exploration Technology Program objectives, it is desirable to complete the seismic work by September 30, 1980. If, in your analyses, such is not possible in light of the technical and cost considerations associated with the subject survey, the Government will consider utilizing the currently obligated funds for other work.

We appreciate your efforts in attempting to resolve the problems associated with the proposed seismic work and will await your response prior to initiating any contractual actions.

Sincerely,

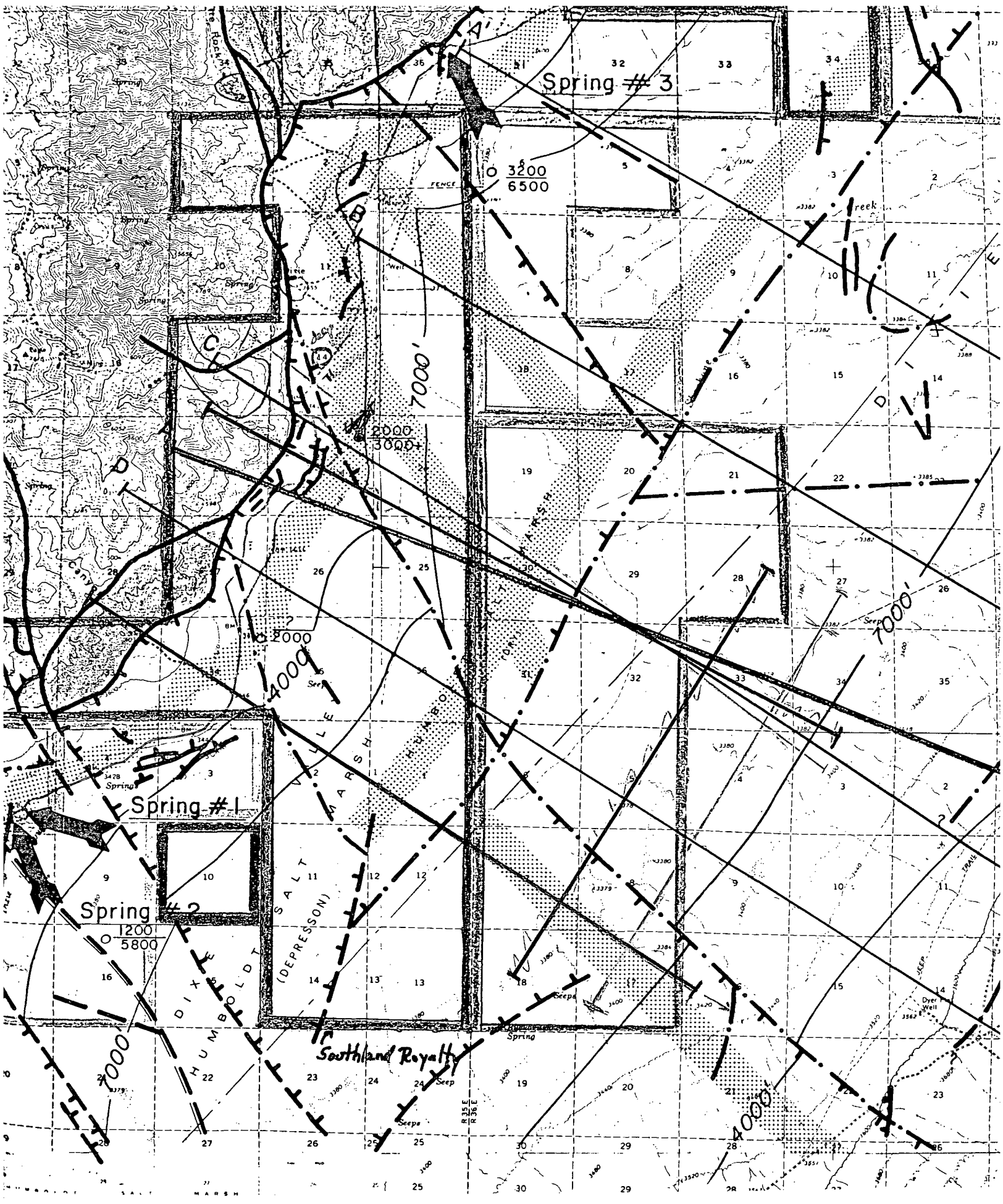
Original Signed by
J. N. FIORE

Joseph N. Fiore, Project Engineer
Geothermal Branch
Energy Applications Division

EAD:JNF-252

Enclosure:
As stated

cc w/o encl:
R. A. Gray, DGE, HQ, RA-233, MS-3344
Dr. H. P. Ross, UURI, Salt Lake City, UT



R 35 E

R 36 E

changes suggested by Judy & Dennis 4 25 79

SUGGESTED REFLECTION SEISMIC LINE LOCATION
DIXIE VALLEY, NEVADA

Southland Royalty Company

July 24, 1979

Mr. Joe Fiore
Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, Nevada 89114

Dear Joe:

Enclosed is a map showing the seismic profile lines I outlined to you on the phone. I have shown the lines in red on the aeromagnetic map based on the second multi-level aeromagnetic survey. I have put green circles on the map at each point where the proposed seismic lines cross, what are believed to be fault lines based on this aeromagnetic survey. I have also indicated that the seismic lines will intersect both of the deep geothermal test wells being drilled under the DOE Cost Sharing Program. It may also be of interest for you to know that the north end of the long seismic line will also, by coincidence, intersect a Republic Geothermal gradient hole which was drilled to approximately 1,800' and which was very warm. We have traded Republic for the information from this well and they have indicated that we may use the data in discussions with University of Nevada but we may not release the data in any part of the geothermal case study on Dixie Valley.

Your comments, and Howard's, on this approach would be most appreciated. After a fair amount of internal review, it appears to us to be the best program for cutting the northeast trending faults and their offsets and intersecting the well bores, while at the same time, recognizing the inherent constraint of the Humboldt Salt Marsh.

Best regards,

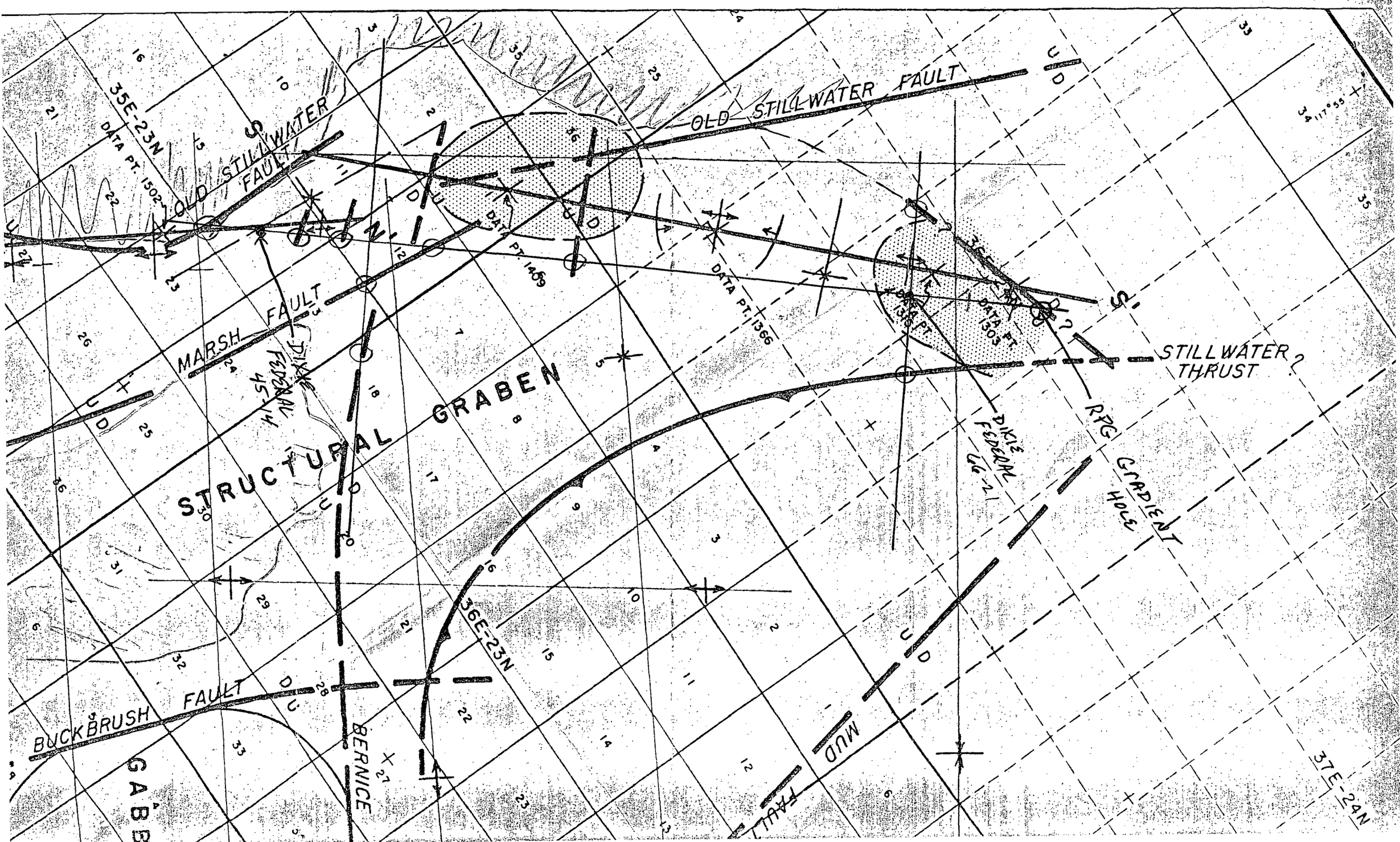
Jere Denton

Jere Denton

District Manager
Natural Resources
SOUTHLAND ROYALTY COMPANY

JD/ji
cc Howard Ross, Univ. of Utah

1000 FORT WORTH CLUB TOWER (817) 390-9200 FORT WORTH, TEXAS 76102


OLD STILLWATER FAULT
OLD STILLWATER FAULT
MARSH FAULT
FEDERAL 45-14
DIKE
STRUCTURAL GRABEN
BUCKBRUSH FAULT
BERNICE
GABB
MUD FAULT
STILLWATER THRUST
RPG GRADIENT HOLE
DIKIE FEDERAL 66-21
DATA PT. 1502
DATA PT. 1469
DATA PT. 1366
DATA PT. 1354
DATA PT. 1303
35E-23N
36E-23N
37E-24N
117°55'
34

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
420 CHIPETA WAY, SUITE 120
SALT LAKE CITY, UTAH 84108
TELEPHONE 801-581-5283

September 7, 1979

Mr. Joseph N. Fiore
U.S. Dept. of Energy/NVO
P.O. Box 14100
Las Vegas, Nevada 89114

Dear Joe;

Enclosed is the only "hard" cost information on these geophysical survey costs that I've been able to develop on short notice. The local manager for Scintrex, Inc. is away for a week but may call back with verbal quotes I can transmit to you later.

It is our experience and a general feeling in the mining industry that Mining Geophysical Surveys of Tucson is the most efficient, best quality resistivity/IP contractor. I believe the Terra physics group is well regarded by industry for self-potential work. I will try to supplement the enclosed information by telephone next week.

Regards,

Howard

Howard P. Ross
Project Manager

HPR/hmb

Enclosure

Electrical Resistivity Survey Costs - dipole-dipole

1) Mining Geophysical Surveys, Inc., Tucson, Arizona
   Actual survey costs, Cove Fort-Sulphurdale, September 1978
   6 lines 1000 foot dipoles, read to n=6&7; 1 line=2.65 line miles
   (IP readings included on 1 1/2 lines, probably added 1000 to survey cost)
   Total Cost = $9,881.42 for actual 19.7 line miles
   -Mobilization - Demobilization from Tucson to Cove Fort, Utah =$480.00
   -Estimated cost per line mile, 1000 foot dipoles = $477.23

2) Applied Geophysics, Inc. Salt Lake City, Utah
   Verbal cost information from Harold Dallon, Sept. 7, 1979 - as a rough cost estimate; 5-man crew cost.
   Two to four days per line, conventional seven spread, 1000 foot dipoles. May not be able to read n=5,6 with their 7.5 Kw transmitter.
   1 line = 2.65 line miles; $750-$1000/day
   Thus $1500-4000/line = $566 to $1,509 per line mile
   -Mobilization/demobilization to Lovelock, Nev. from SLC = $600.
   -Estimated cost per line mile, 1000 foot dipoles = $566-1,509.

3) Scintrex, Inc., Salt Lake City, Utah
   Verbal estimate Jack C. Webster Sept. 14, 1979
   Crew cost $700-750/day for 1000' d-d; avg. 1 mile/day; 2-3 days per line.
   -Thus estimated cost per ~~day~~ line mile, 1000 foot dipoles = $700-750.
   -Mobilization/demobilization to Lovelock, Nev. from SLC = $800 each way.

Self Potential Survey Costs

1) AMAX Exploration Inc., Tuscarora and McCoy proposals
   May 1978
   112 line miles (=180 line-km) @100-200 meter spacing estimated 1200 readings at $16,000.
   -Estimated cost $142.86 per line mile, @10.7 readings/mile average
   -Mobilization costs included in above or borne by AMAX.

2) Terraphysics, Richmond, CA.
   Beowawe, Nevada survey for Chevron, 1977
   30 line miles @100m spacing plus fill in @25m at a total cost of $16,297.
   -Estimated line mile cost $543.23
   -Mobilization/demobilization included in above.

3) Applied Geophysics, Inc., Salt Lake City, Utah
   Verbal cost information from Harold Dallon, Sept. 7, 1979
   rough cost estimate; 2-man crew
   Estimate based on one-half crew costs for a resistivity/IP crew, thus $375-$500 per day; for 40 line miles at a spacing of 500 feet, about 425 readings or 11 per line mile Dallon estimates 1 1/2miles per day: This is slow for 11 stations/mile!
   -Estimated line mile cost $187.50 to $333.33
   -Mobilization/demobilization cost to Lovelock from SLC = $600.

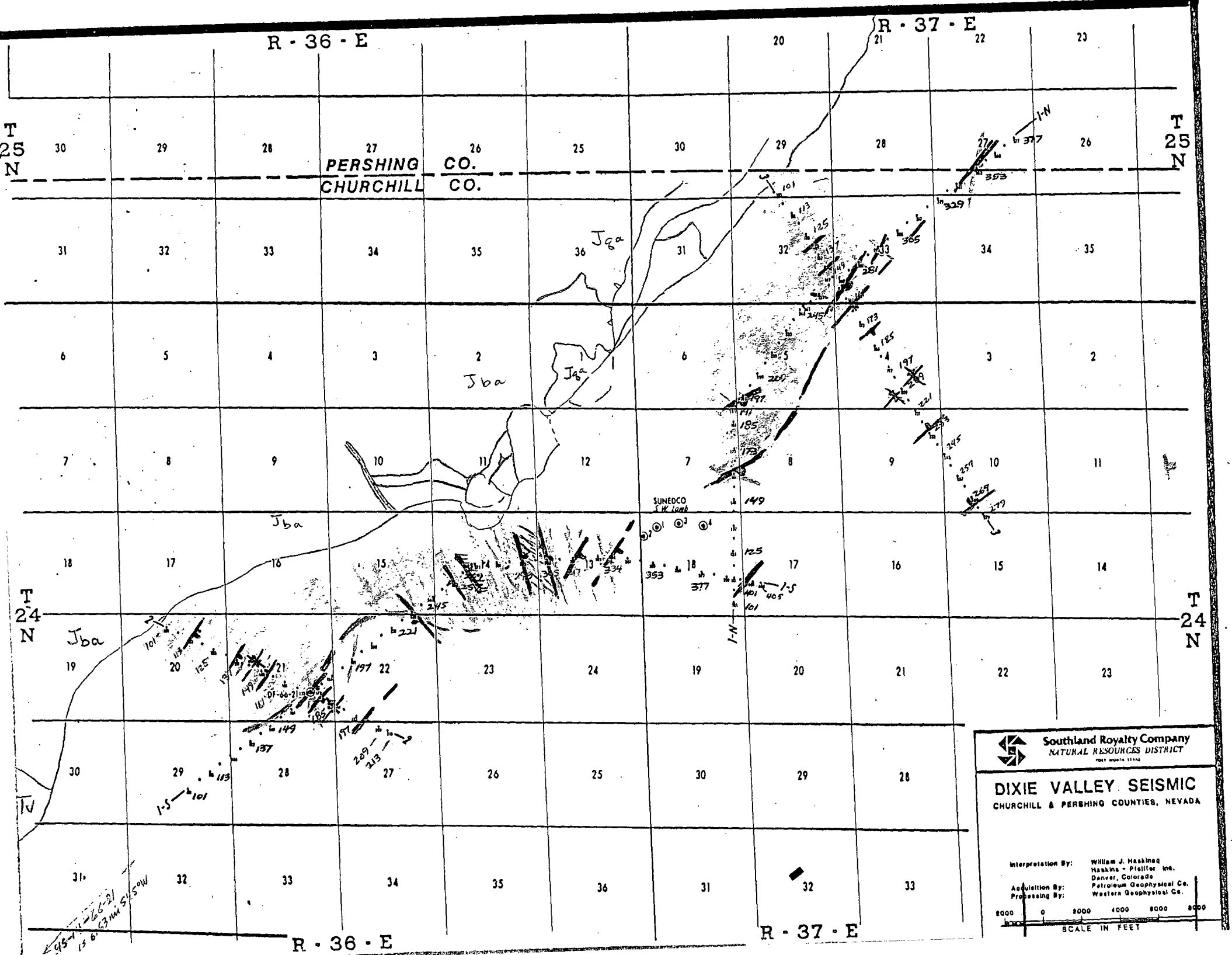
4) Scintrex, Inc., Salt Lake City

Verbal estimate from Jack C. Webster, Sept. 14, 1979

Two man crew at $350-$400 per day; 1.5-2.0 miles per day at 300 to 500 foot station spacing.

-Estimated line mile cost =$175-$266.

-Mobilization/demobilization cost to Lovelock from SLC = $400 each way.


R - 36 - E
R - 37 - E
T 25 N
T 24 N
PERSHING CO.
CHURCHILL CO.
Jba
Jga
SUNEDCO
S.W. Lamb
1-N
1-S
R - 36 - E
R - 37 - E
Southland Royalty Company
NATURAL RESOURCES DISTRICT
FORT WORTH, TEXAS
DIXIE VALLEY SEISMIC
CHURCHILL & PERSHING COUNTIES, NEVADA
Interpretation By: William J. Haskinaq
Haskins - Pfeiffer Inc.
Denver, Colorado
Acquisition By: Petroleum Geophysical Co.
Processing By: Western Geophysical Co.
SCALE IN FEET

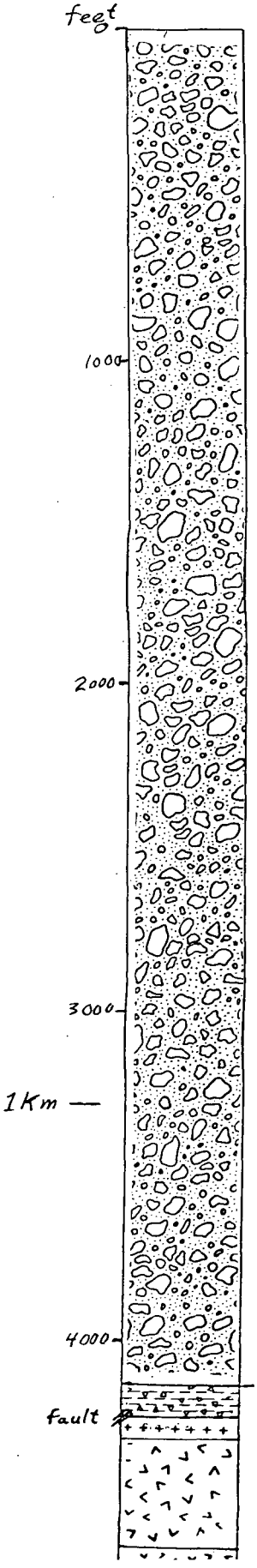
.00 Scale

DIXIE FEDERAL 66-21

GENERALIZED LITHOLOGIC LOG

by

Bruce Sibbett



0-4130' Alluvium, coarse gravel, poor sorting, subrounded to angular pebbles to cobbles of mixed igneous lithologies, mostly felsite clast from andesite to latite lava flows. A few clast of diorite, mudstone and tuff also present.

Matrix material poorly represented in cuttings but is fine sand to silt and mudstone with calcite cement.

The degree of lithification not easily determined from cuttings. Probably grading to conglomerate with depth, but generally breaks around clast and matrix mostly disaggregated by drilling.

Clast are variably altered, generally alteration appears to pre-date deposition. Limonite staining present through entire alluvial section.
Hematite staining, and chlorite most abundant near the top of the alluvium (140-500').

A few chips of specular hematite, probably detrital, are present in the alluvium.

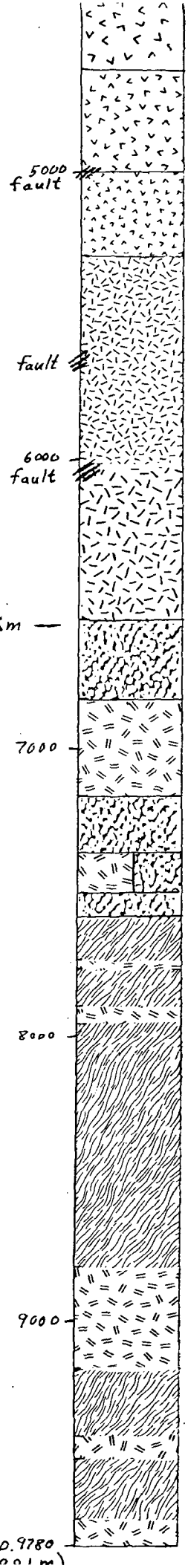
No notiable marker horizons evident.

The conglomerate may grade to a volcanoclastic sequence in the lower part.

4130-4230 Clay, pink to red, probably altered tuff. Non-bedded with white flecks & splotches which may be altered feldspars or zeolites.

4230-4300 Granitic, possible dike.

4300-4640 Mixed volcanic lithologies with andesitic to rhyolitic fraction and clay (alt tuff), hematite.



4300-4640 Mixed volcanic lithologies with andesitic to rhyolitic fraction and clay (alt tuff), hematite. May be flows or volcanic breccia, prob. Tertiary.

4640-5000 Basalt to andesite lava flows or intrusives. No vesicles or flow texture evident. Cement and LCM suggest major lost cir. Zone, probable fault.

5000-5250 Dacite to Latite? Black specks in a white matrix.

5300-6020 Biotite Monzonite light gray, 1 mm ave crystal size. K-feldspar more than plagioclase, biotite ~ 6% chlorite ~4% (alt. bio.) epidote 2-3%, hornblende 1-2%, opaques ~2%, magnetite present. Chlorite and epidote most abundant 5600'-6200' Quartz veinlets & aplike dikes 5600'-5800'. May be Tertiary or part of Jurassic lopolith.

6020-6560' Biotite Quartz Monzonite, same as monzonite above except contains ~20% quartz, and the feldspars are harder to distinguish. The alteration is the same as above and traces of pyrite are present.

6560-6830' Sandstone to quartzite. of fine to v. fine quartz sand, white, well sorted, calcite & quartz cement. Probably the arenite which is spacially associated with the Jurassic lopolith. Intrusive contacts.

6830'-7160' Biotite Diorite, ½ mm ave. crystal size. The mafics (~15%) are totally altered to chlorite + calcite. Part of Jurassic Humboldt lopolith.

7160'-7360' Quartzite, white, well sorted, v.f. grained.

7360-7500' Diorite and Quartzite mixed. Diorite deutericly alt.

7500-7590 Quartzite, white, well sort. Diorite dike at lower contact.

7590-9780' Slate, calcareous with micaeous sheen, fine, even texture with very poorly developed cleavage or foliation. Color is medium gray to light grayish green.

The slate is probably the Jurassic Auld Lang Syne Group. The thickness of this unit is uncertain but several thousands of feet.

Diorite dikes or sills occur in the slate as indicated. All of the diorite is very similar to the diorite described above at 6830'. The alteration is deuteric and uniform.

8810-9110'

SAN EMIDIO SEISMIC

Chevron Resources was one of the first companies to integrate the reflection seismic method into their geothermal exploration program. After completing gravity, electrical and other surface surveys, thermal gradient drilling, and the 4013 foot Kosmos 1-8 well, Chevron contracted Western Geophysical for a 2.1 line mile, high resolution seismic survey.

The survey included three east-west lines, the longest being 5600 feet in length crossing Kosmos 1-8, the main interpretative line of this study. Two lines 2000 feet long were completed ½ and 1.0 miles further south. A dynamite source, 5-20 pounds, was used; 14 hydrophones at depths of 18 feet in holes 33 feet apart provided the receiving array. The 700% stacked sections show many thin reflecting horizons in the lake beds and Tertiary sediments and a strong band of reflected energy at about 1.0 sec (4313 feet) probably the top of Tertiary volcanics extending east from Kosmos 1-8; few coherent reflections are observed on the eastern 1/3 of the profile, i.e. after crossing one or more basin and range faults.

Chevron contracted United Geophysical Corp. to complete a second reflection seismic survey of 10 line miles in October 1977, prior to drilling the second deep well test (Kosmos 1-9). Three east-west lines one mile apart and one north-south line, all approximately 2.5 miles long, were completed. Conventional split-spreads with 100 foot group interval and a dynamite source of 1-10 pounds were used to obtain 1200% CDP coverage. The southernmost line of this survey is shown on the right.

Good reflection gravity is evident to 1.2 seconds, approximately 5500 feet deep. Several of the more continuous reflections are shown in yellow. These correspond to variations in lake bed lithology at the top, Tertiary sediments (0.3-0.6 sec), and volcanics at greater depth. No coherent reflections represent the eastern portion of the section where dipping metasediments occur at shallow depth.

The high angle red lines shown on the slide are inferred to be basin and range faults. They terminate several coherent reflections, and can generally be traced from section to section (along a northerly trend). A major interpreted fault projects to the surface where alteration is mapped at the surface.

Limited velocity control has delayed our time-to-depth conversion of the seismic data. The utility of the method in this geologic environment, where one is seeking a fault or fracture zone reservoir, is clearly demonstrated.

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