



CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
<http://www.azgs.az.gov>
inquiries@azgs.az.gov

The following file is part of the Walter E. Heinrichs, Jr. Mining Collection

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

SEISMIC REFRACTION SURVEY

CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA

for

DEPT. OF THE ARMY
CORPS OF ENGINEERS
LOS ANGELES DISTRICT

**SEISMIC REFRACTION SURVEY
CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA**

For

**DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
LOS ANGELES DISTRICT**

17 - 18 MARCH, 1970

By

**HEINRICHS GEOEXPLORATION COMPANY
P.O. BOX 5964 - TUCSON, ARIZONA 85703
Phone: 623-0578 - Area Code: 602**

JOB # 505

TABLE OF CONTENTS

	Page
Index Map	
Special Provisions (Client's Assignment)	
Introduction-----	1
Procedure-----	2
Conclusions-----	3
Interpretation with time-distance curves and seismic velocity profiles-----	4
Plan Map	

GENERAL LOCATION
of
CAVE BUTTES DETENTION BASIN
for
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
ARIZONA



HEINRICHS GEOEXPLORATION COMPANY											
 GEOPHYSICAL ENGINEERS	<table border="0"> <tr> <td style="text-align: center;"><u>AUSTRALIA</u></td> <td style="text-align: center;"><u>U.S.A.</u></td> </tr> <tr> <td>(SYDNEY)</td> <td>Post Office Box 5671</td> </tr> <tr> <td>39 Hume Street</td> <td>Tucson, Arizona 85703</td> </tr> <tr> <td>Crows Nest, NSW</td> <td>Phone: (602) 623-0578</td> </tr> <tr> <td>Phone: 439-1793</td> <td>Cable: GEOEX, Tucson</td> </tr> </table>	<u>AUSTRALIA</u>	<u>U.S.A.</u>	(SYDNEY)	Post Office Box 5671	39 Hume Street	Tucson, Arizona 85703	Crows Nest, NSW	Phone: (602) 623-0578	Phone: 439-1793	Cable: GEOEX, Tucson
<u>AUSTRALIA</u>	<u>U.S.A.</u>										
(SYDNEY)	Post Office Box 5671										
39 Hume Street	Tucson, Arizona 85703										
Crows Nest, NSW	Phone: (602) 623-0578										
Phone: 439-1793	Cable: GEOEX, Tucson										

SPECIAL PROVISIONS

Seismic Refraction Survey

Cave Buttes, near Phoenix, Arizona

1. Scope of Work. The Contractor shall furnish all plant, labor, personnel, equipment, material and supplies to perform a seismic survey of designated areas at Cave Buttes Detention Basin, north of Phoenix, Arizona and furnish a report.
2. Purpose. To define the base of loose alluvium at the exploration site and determine seismic velocity of cemented materials to a maximum depth of 200 feet.
3. Specifications.
 - a. Profiling. The seismic refraction profiling is to be accomplished by using a multiple channel seismograph, explosive as an energy source, and geophone spacing adjusted for best definitions of the base of uncemented alluvium and determining seismic velocity of cemented materials to a maximum depth of 200 feet.
 - b. Report. A preliminary oral report shall be given in the field as soon as the required information is available. The written report, compiled from the profiling and interpretation, shall include seismic refraction sections, time distance profiles and written descriptions.
4. Contract Period. The work will commence on or about 10 March 1970 and the contract shall continue in force until the work is completed (approximately 30 calendar days) unless sooner terminated by the Government.
5. Mobilization and Demobilization. Mobilization and demobilization shall include moving all equipment and personnel to the job site and removing them upon completion of the work.
6. Quantities. The quantities, in linear feet, of profiling shown in the schedule are estimated only. Because of the exploratory nature of the work the estimated quantity may be increased or decreased.
7. Payment. Payment shall be made for actual quantities in linear feet profiled, in accordance with the unit prices listed. The actual amount of work performed will be determined and approved by the Government representative, who will be present at the job site to advise the Contractor during the course of work.
8. Location and Site Accessibility. The job site is located approximately fifteen (15) miles north of Phoenix, Arizona. Paved roads to within two miles of the site; graded roads, and desert trails suitable for two-wheel drive vehicles provide access to the site.

INTRODUCTION

At the request of Mr. R. Townsend of the Corps of Engineers, Los Angeles District, Heinrichs GEOEXploration Company conducted a seismic survey of the Cave Buttes Detention Basin near Phoenix, Arizona. Field work was done during 17-18 March 1970.

Heinrichs personnel involved in the field work were William Rasmussen, acting as Crew Chief, with Bruce Coons and William Pawelczyk as Technical Assistants. Interpretation, compilation and report by William Rasmussen assisted by the GEOEX Tucson staff.

Cooperation and assistance provided by Mr. Filmore Turner of the Corps of Engineers is most appreciated.

PROCEDURE

A seismic refraction survey utilizing the reverse shooting method was conducted with a total linear coverage of 9367 feet of which 200 feet was overlapping coverage. Eighteen time-distance curves were obtained in the field and used for interpretation. The survey gave excellent information from approximately 40 to 275 feet below surface. Extrapolation of available data made possible a reasonable estimate as to the composition of the top 40 feet of material.

Data were obtained utilizing an Electro-Technical Model ER 75-12 recording seismograph. The unit consists of twelve channels coupled to a cable that allowed a spacing of 50 feet between adjacent geophones. Permanent records were obtained on Polaroid photographic paper.

Four lines were surveyed; three of these consisted of two spreads each, with the other utilizing three spreads. Each spread or lay-out of geophones had a detonation at each end to produce data which would give an indication of the dip of the underlying stratified material.

Data are presented on time-distance curves as well as seismic refraction section sheets for each line. These follow the interpretation for each line.

CONCLUSIONS

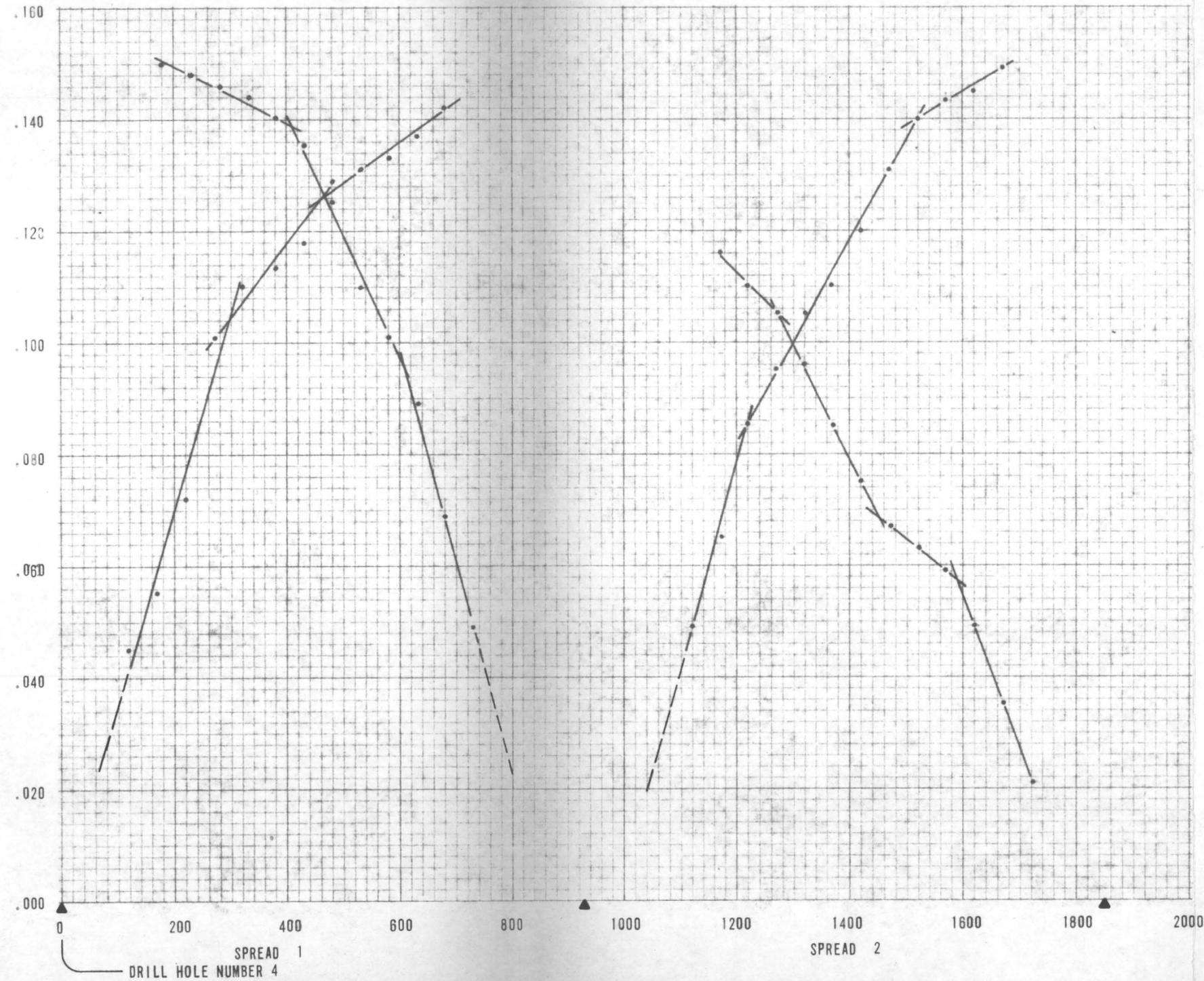
1. Line 1 appears to be composed of two layers with fairly unconsolidated material to a depth of approximately 200 feet, below which a highly consolidated material is encountered.
2. Line 2 appears to have a very shallow layer (probably within 40 feet of surface) overlying a well consolidated material which has an apparently higher consolidated material underlying it at the center of the line and at a depth of approximately 140 feet. This latter material has the same seismic velocity of propagation as the lower material on Line 1.
3. Line 3 crosses over material which is apparently faulted in several places. This line has a surface layer whose consolidation is higher than the other lines surveyed but does not have as high a velocity material at depth as does Lines 1 and 2.
4. Line 4 shows a fairly uniform two layer situation with the lower material having a seismic velocity approximately equal to the upper layer of Line 3.
5. Depth to well consolidated material on Line 1 appears to be fairly great compared to Line 2.
6. The proposed locations of the dikes shows the one related to Line 3 to be over a more consolidated, apparently faulted, material than the material beneath Line 4.

INTERPRETATION

Line 1

This line runs approximately east-west (see plan map). It begins on the west end with a three layer case where the top layer is a low speed cover (2900 ft/sec) to approximately 80 feet below surface. A material of apparent weak consolidation (5300 ft/sec) continues down to approximately 215 feet below surface where a highly consolidated material (16,700 ft/sec) is encountered. This general stratification continues throughout spread one and on to approximately the middle of spread two where the top two layers appear to merge into one with an escarpment or fault in the third layer bringing it up to a depth of approximately 92 feet with its seismic propagation velocity slightly lowered (11,000 ft/sec). It is covered by a material of weak consolidation (3700 ft/sec) at the eastern end of the line.

TIME-DISTANCE CURVES
of
LINE NUMBER 1
LOOKING NORTHERLY
CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA
for
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
by
HEINRICHS GEOEXPLORATION COMPANY



SHOT POINT ▲
HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = .020 SEC.

HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
geophysical engineers vancouver sydney

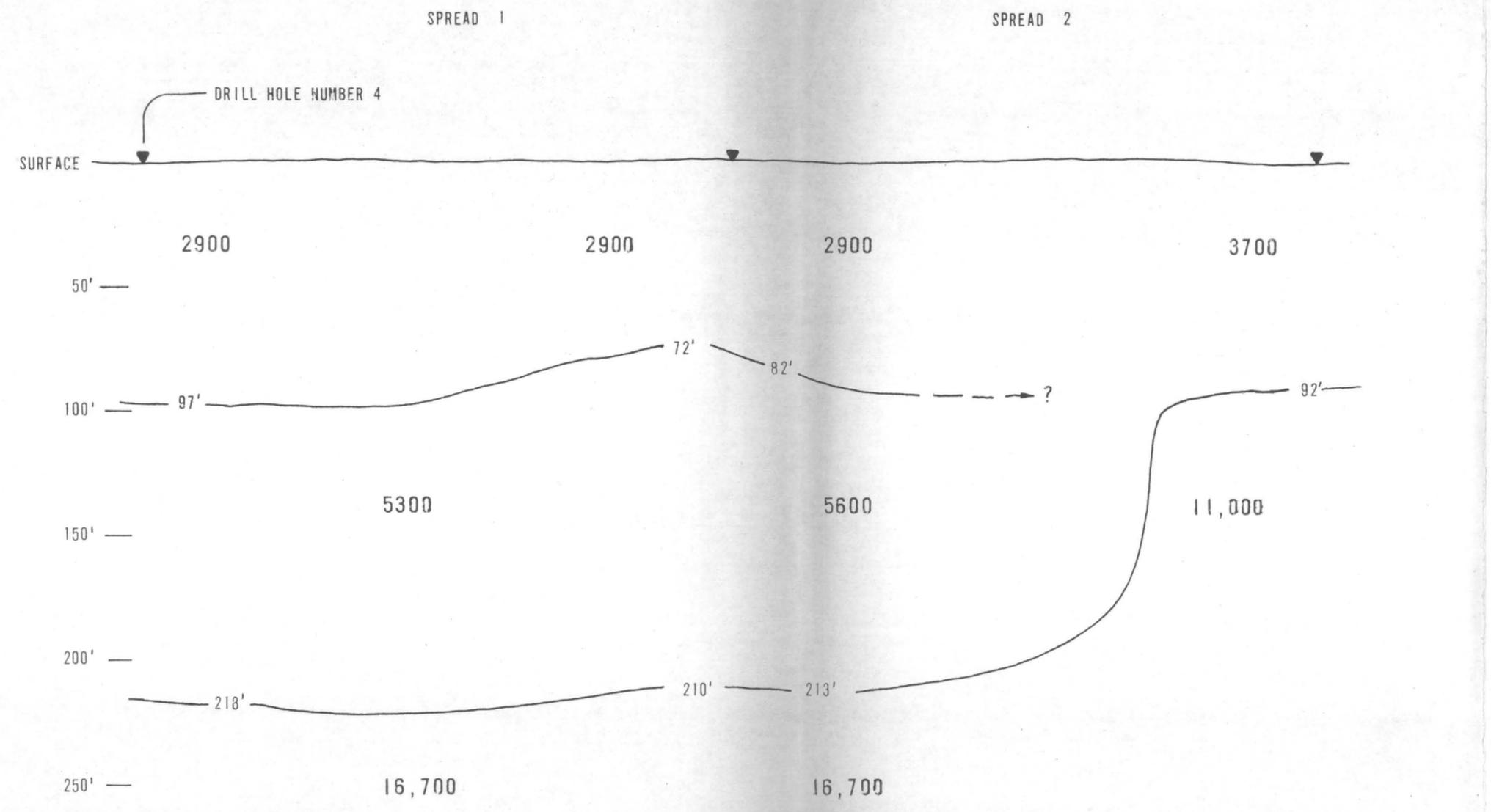
SEISMIC VELOCITY PROFILE

of
 LINE NUMBER 1
 CAVE BUTTES DETENTION BASIN
 MARICOPA COUNTY, ARIZONA

for
 DEPARTMENT OF THE ARMY
 CORPS OF ENGINEERS

by
 HEINRICHS GEOEXPLORATION COMPANY

NOTE: SURFACE NOT ADJUSTED FOR TOPOGRAPHIC RELIEF



HORIZONTAL SCALE: 1" = 200'
 VERTICAL SCALE: 1" = 50'

SEISMIC BOUNDARY AND CALCULATED DEPTH
 SEISMIC PROPAGATION VELOCITY (ft/sec)
 SEISMIC SHOT POINT

— 213'
 5600
 ▼

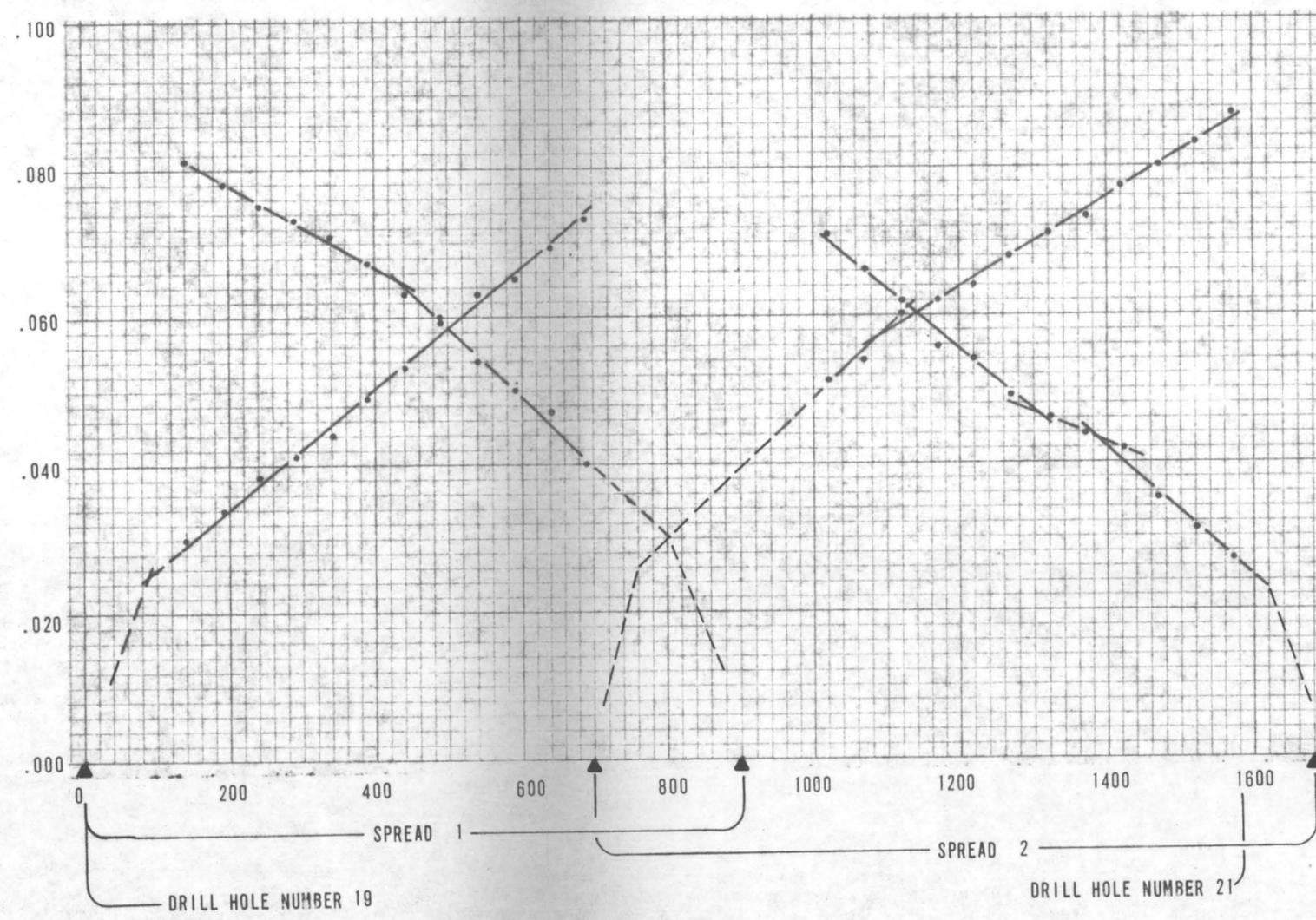
Handwritten signature

HEINRICHS GEOEXPLORATION COMPANY
 POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
 Phone: 602/623-0578 Cable: GEOEX, Tucson
 geophysical engineers vancouver sydney

Line 2

This line shows a weakly consolidated cover (4000 ft/sec) extending down to approximately 40 feet at its greatest depth. The velocity of this thin surface layer was taken from data on other lines. This was due to the fact that large lateral coverage and penetration were being achieved at the cost of detailed data of near-surface material. Below this material is a well consolidated one (10,000 - 12,500 ft/sec). This situation extends throughout both spreads with the occurrence of a more highly consolidated material (16,700 ft/sec) buried approximately 135 - 150 feet at the center of the line and extending laterally an unknown distance.

TIME-DISTANCE CURVES
of
LINE NUMBER 2
LOOKING NORTHERLY
CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA
for
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
by
HEINRICHS GEOEXPLORATION COMPANY



SHOT POINT ▲
HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = .020 SEC.

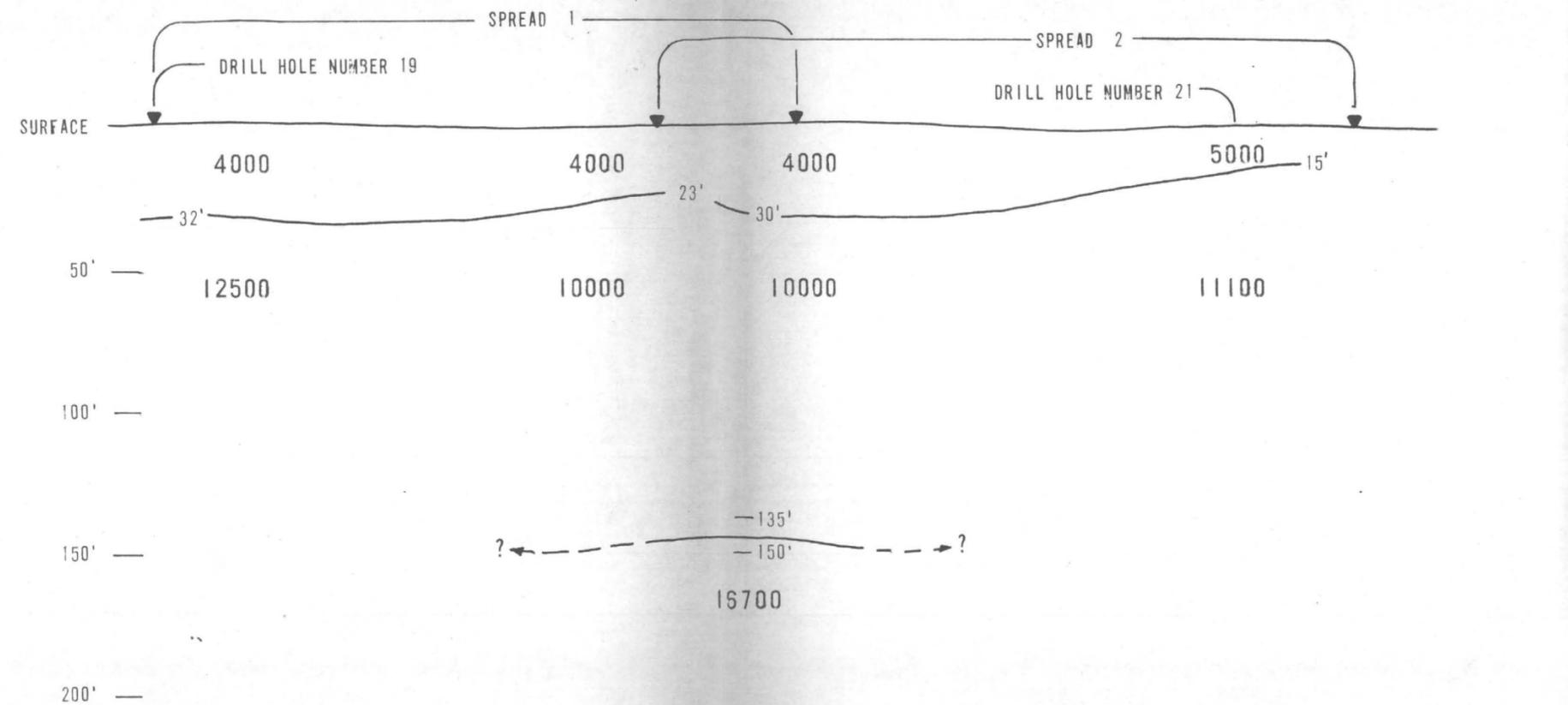
HEINRICHS GEOEXPLORATION COMPANY 505-70
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
geophysical engineers vancouver sydney

SEISMIC VELOCITY PROFILE
of
LINE NUMBER 2
CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA

for
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

by
HEINRICHS GEOEXPLORATION COMPANY

NOTE: SURFACE NOT ADJUSTED FOR TOPOGRAPHIC RELIEF



HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 50'

SEISMIC BOUNDARY AND CALCULATED DEPTH
SEISMIC PROPAGATION VELOCITY (ft/sec)
SEISMIC SHOT POINT

— 135'
4000
▼

HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
vancouver sydney
geophysical engineers

Line 3

This line appears somewhat complicated in structure. Beginning at the southeast end of the line there appears to be a two layer situation for most of spread 1. The upper material has a velocity of 5900 - 7100 ft/sec with the lower material being in the range 10,000 - 23,300 ft/sec. This lower material is encountered at the end of the line at a depth of approximately 86 feet and at the northwest end of spread one at approximately 155 feet. The lower material is probably a well consolidated rock. A fault appears to exist near the joining of spread one and two. Spread two shows a two layer situation in which the upper material again is in the range 6000 - 6700 ft/sec, while now the lower material is apparently less consolidated than spread one with a seismic velocity of propagation of 8000 - 8300 ft/sec and a depth of burial of approximately 53 feet on the southeast of spread two and 93 feet on the northwest end of this spread. There appears to be a sloping boundary toward surface from the end of spread two to the middle of spread three where a two layer case appears to merge into a one layer case. At the southeast beginning of spread three there is possibly a fault in the lower material which causes a lateral change in velocity of 8300 - 11,800 ft/sec, with a corresponding change in layer depth of 93 feet to 38 feet. Spread three then begins with a top layer of material whose seismic propagation velocity is 7000 ft/sec and then appears to merge into a single

layer case near the center of spread three whose material has a velocity of propagation of approximately 9000 ft/sec, and is thus apparently more consolidated than the upper material to the southeast. This material appears to be of an average consolidation (possibly fractured rock or caliche).

TIME-DISTANCE CURVES

of

LINE NUMBER 3

LOOKING SOUTHWESTERLY
CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA

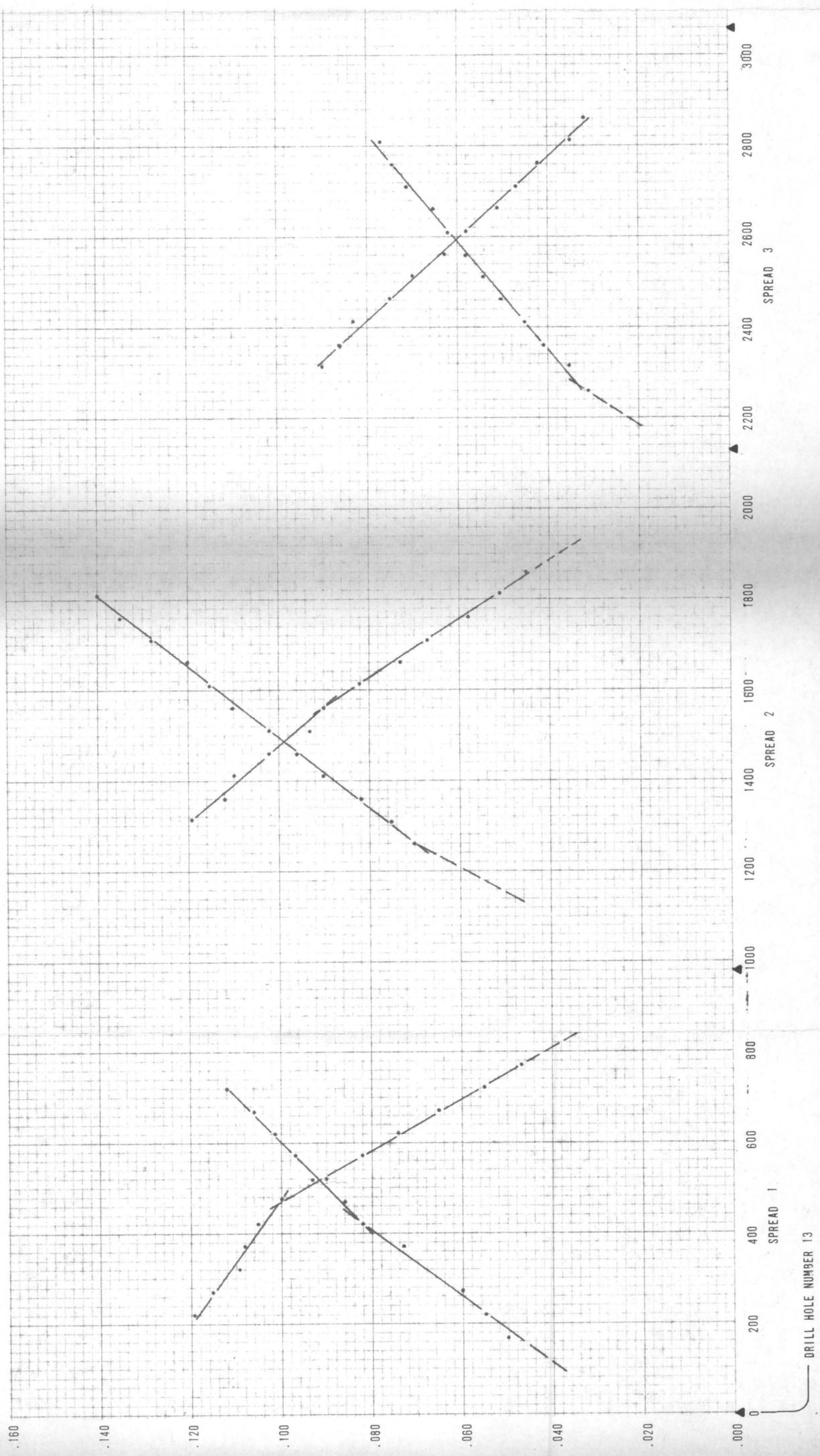
for

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

by

HEINRICHS GEODEXPLORATION COMPANY

SHOT POINT
HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = .020 SEC.

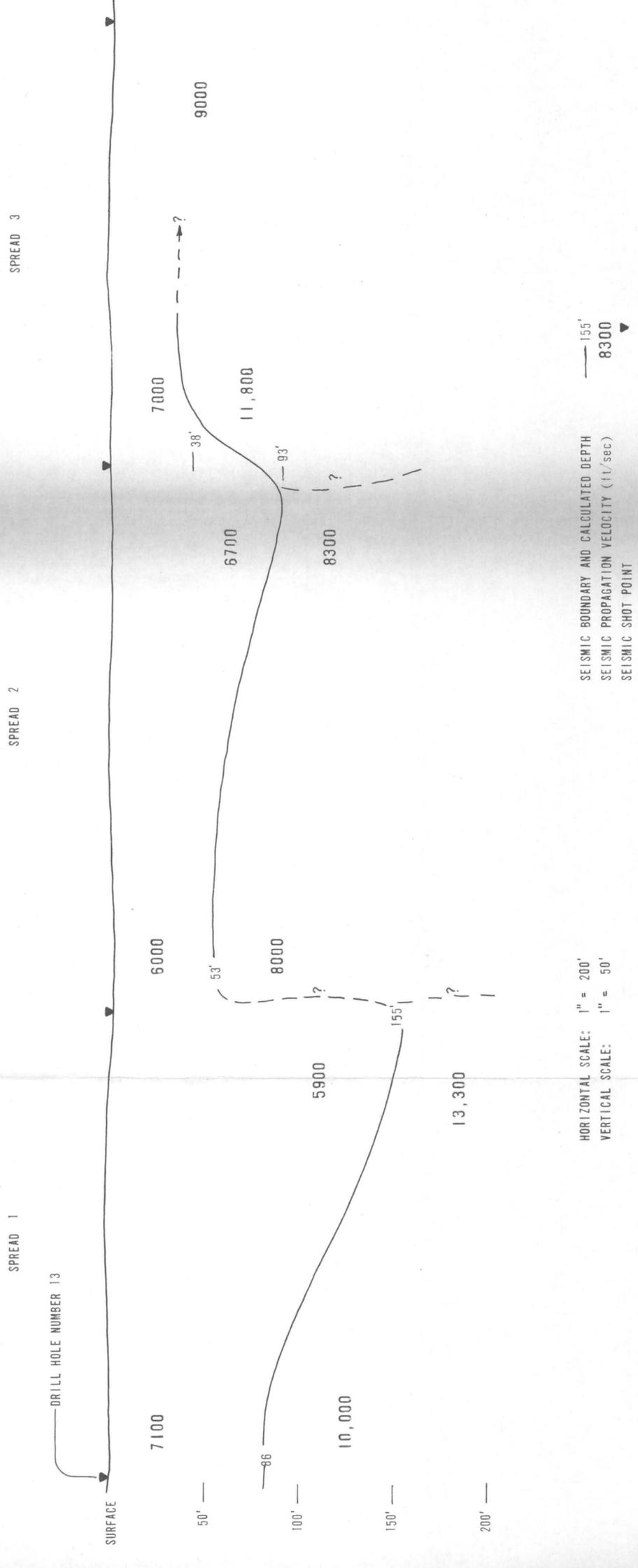


HEINRICHS
GEODEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0378 Cable: GEOEX, Tucson
vancouver
sydney
geophysical engineers

SEISMIC VELOCITY PROFILE

of
 LINE NUMBER 3
 CAVE BUTTES DETENTION BASIN
 MARICOPA COUNTY, ARIZONA
 for
 DEPARTMENT OF THE ARMY
 CORPS OF ENGINEERS
 by
 HEINRICHS GEOEXPLORATION COMPANY

NOTE: SURFACE NOT ADJUSTED FOR TOPOGRAPHIC RELIEF



HORIZONTAL SCALE: 1" = 200'
 VERTICAL SCALE: 1" = 50'

SEISMIC BOUNDARY AND CALCULATED DEPTH
 SEISMIC PROPAGATION VELOCITY (ft./sec)
 SEISMIC SHOT POINT

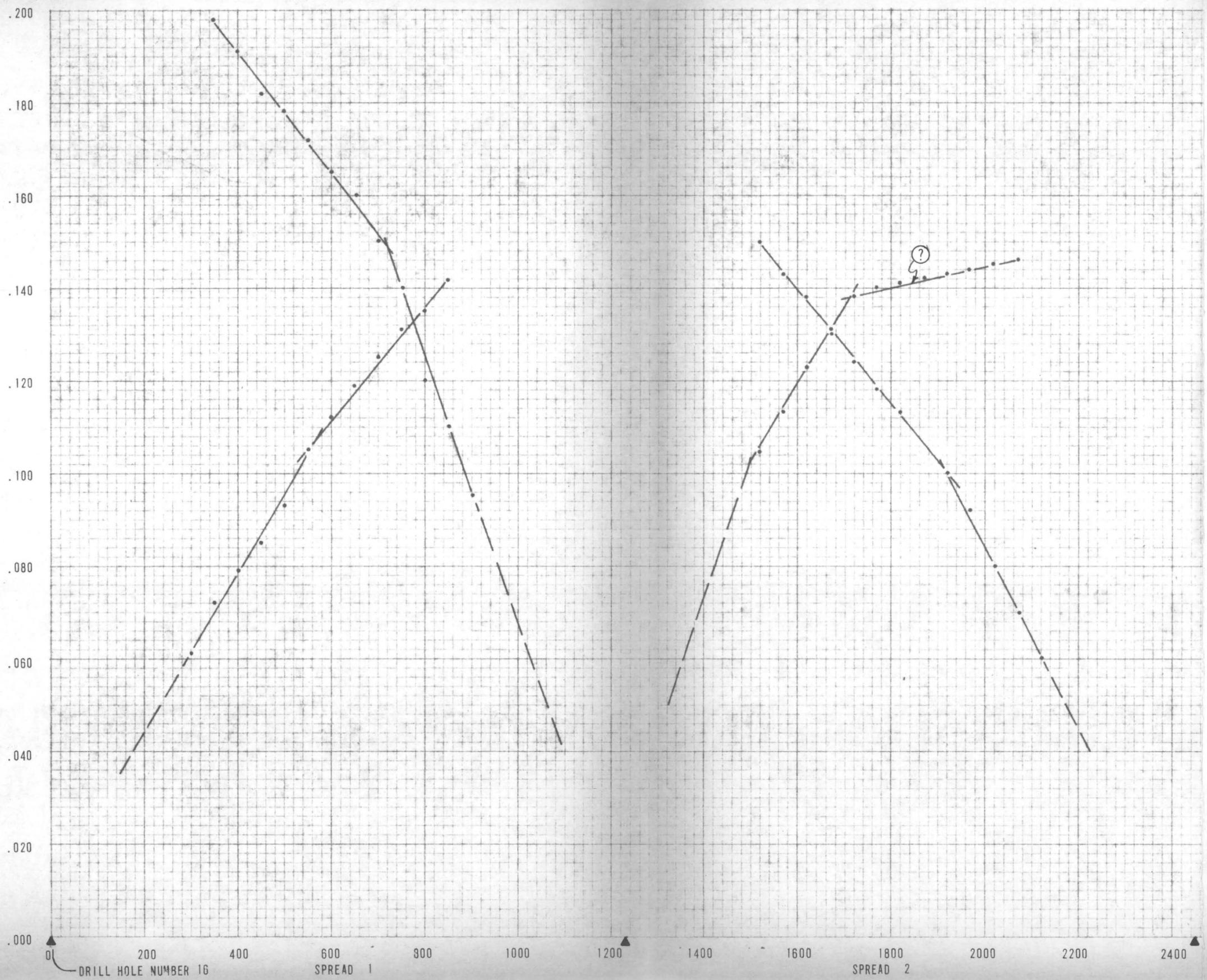
HEINRICHS
GEOEXPLORATION COMPANY
 POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
 Phone: 602/623-0578
 vancouver
 sydney
 geophysical engineers

Line 4

This line appears fairly constant in its being a two layer situation beneath its extent. The upper layer of material appears only slightly consolidated (3500 - 5900 ft/sec). The bottom material does not appear to be highly competent. The shot or record going NE on spread two of this line is in error for the returns of the last 8 geophones as a velocity of 50,000 ft/sec is implied. It appears from the record that the instrument was moved or hit at the midpoint of its recording cycle. This does not leave this spread without information as the reverse shot over it gives a profile consistent with the rest of the line. If the questionable trace above were thrown out then the depth to the interface at the center of the line is approximately 150 feet rather than the 130 feet given on the profile.

TIME-DISTANCE CURVES
of
LINE NUMBER 4
LOOKING NORTHWESTERLY
CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA
for
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
by
HEINRICHS GEOEXPLORATION COMPANY

SHOT POINT ▲
HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = .020 SEC.



HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
geophysical engineers vancouver sydney

SEISMIC VELOCITY PROFILE

of

LINE NUMBER 4

CAVE BUTTES DETENTION BASIN

MARICOPA COUNTY, ARIZONA

for

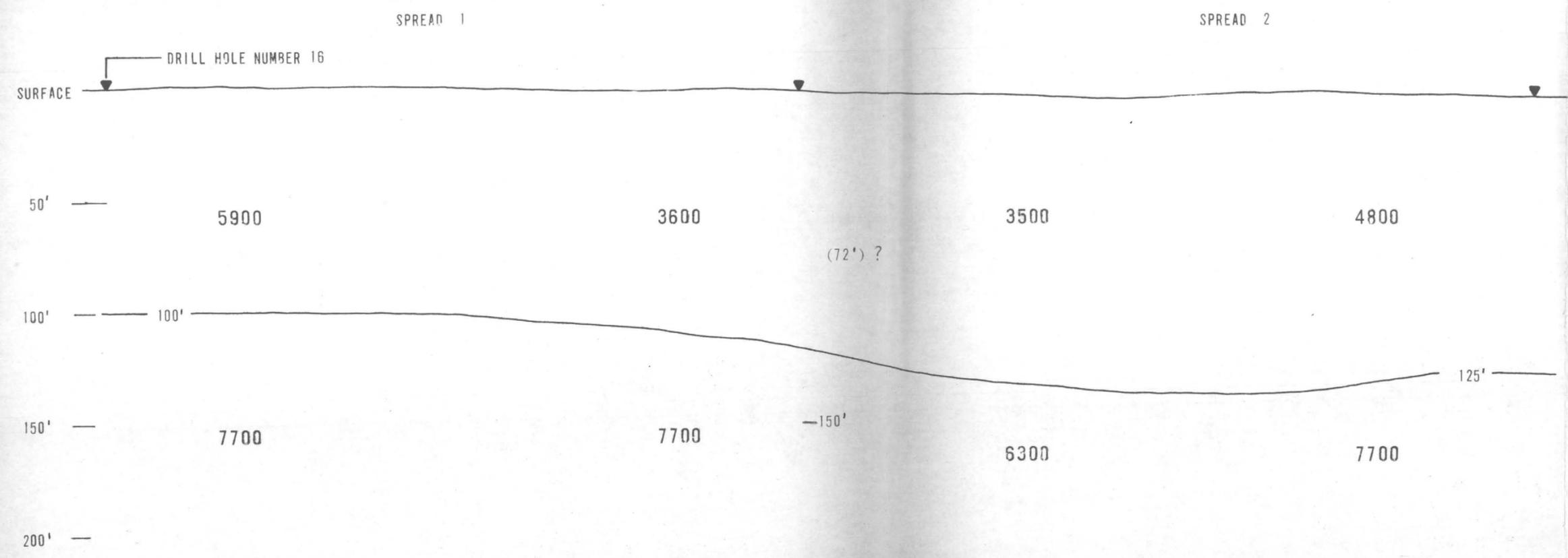
DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

by

HEINRICHS GEOEXPLORATION COMPANY

NOTE: SURFACE NOT ADJUSTED FOR TOPOGRAPHIC RELIEF



HORIZONTAL SCALE: 1" = 200'
 VERTICAL SCALE: 1" = 50'
 MARCH 1970

SEISMIC BOUNDARY AND CALCULATED DEPTH —125'
 SEISMIC PROPAGATION VELOCITY (ft/sec) 3500
 SEISMIC SHOT POINT ▼

HEINRICHS GEOEXPLORATION COMPANY
 POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
 Phone: 602 / 623-0578 Cable: GEOEX, Tucson
 geophysical engineers vancouver sydney

Respectfully submitted,

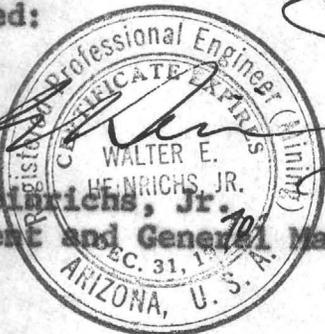
HEINRICHS GEOEXPLORATION COMPANY

W.O. Rasmussen

W.O. Rasmussen
Physicist

Approved:

W.E. Heinrichs, Jr.
W.E. Heinrichs, Jr.
President and General Manager



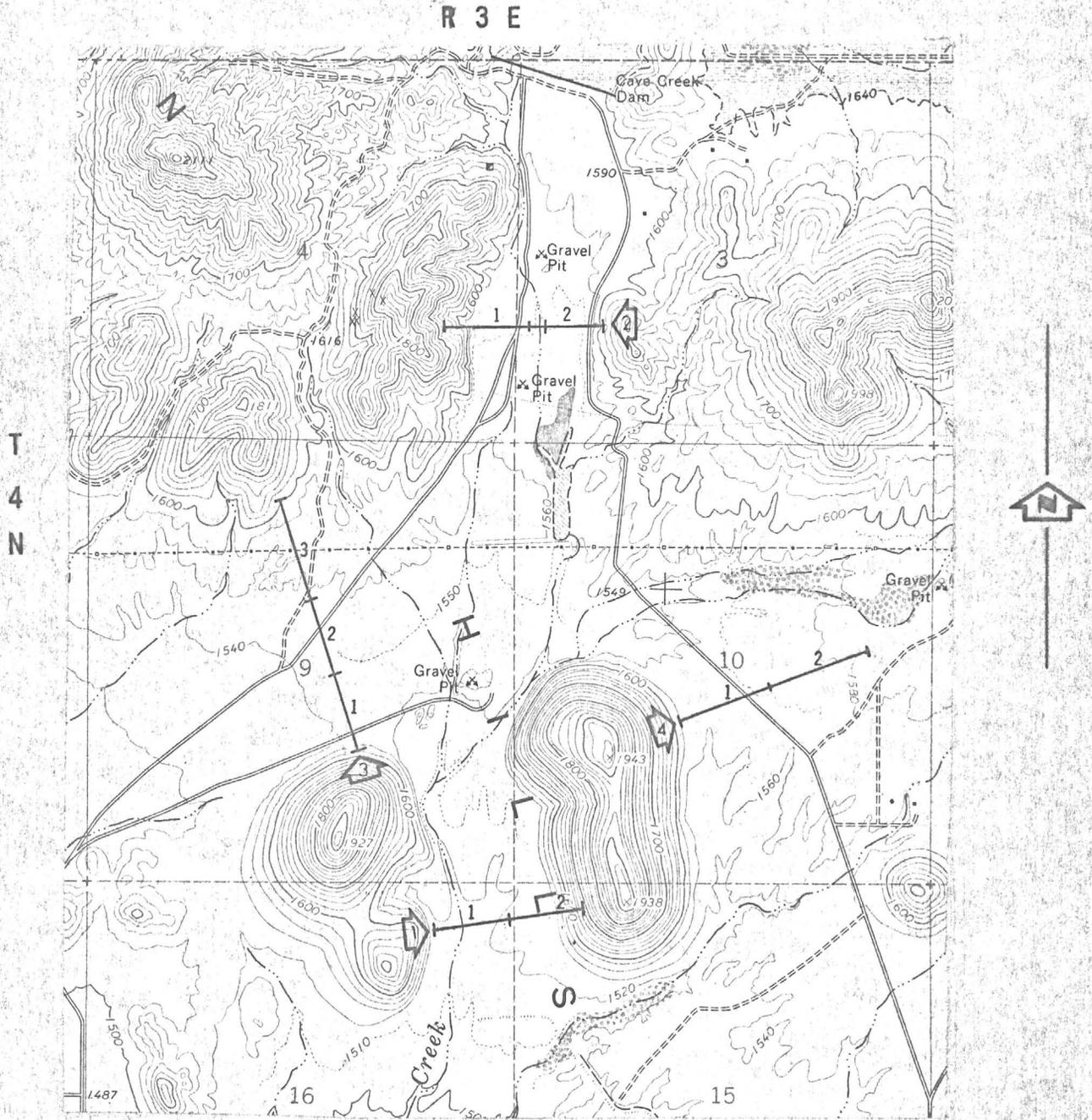
The seal is circular with the text "Professional Engineer" at the top, "REGISTERED" on the left, and "ARIZONA, U.S.A." at the bottom. Inside the seal, it says "WALTER E. HEINRICHS, JR." and "DEC. 31, 1970".

SEISMIC REFRACTION SURVEY LOCATION PLAN

of
CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA

for
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
by

HEINRICHS GEOEXPLORATION COMPANY



2 - SPREAD NUMBER
4 - LINE NUMBER

SEISMIC REFRACTION SURVEY
CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA

For

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
LOS ANGELES DISTRICT

17 - 18 MARCH, 1970

By

HEINRICHS GEOEXPLORATION COMPANY
P.O. BOX 5964 - TUCSON, ARIZONA 85703
Phone: 623-0578 - Area Code: 602

JOB # 505

TABLE OF CONTENTS

	Page
Index Map	
Special Provisions (Client's Assignment)	
Introduction-----	1
Procedure-----	2
Conclusions-----	3
Interpretation with time-distance curves and seismic velocity profiles-----	4
Plan Map	

SPECIAL PROVISIONS

Seismic Refraction Survey

Cave Buttes, near Phoenix, Arizona

1. Scope of Work. The Contractor shall furnish all plant, labor, personnel, equipment, material and supplies to perform a seismic survey of designated areas at Cave Buttes Detention Basin, north of Phoenix, Arizona and furnish a report.
2. Purpose. To define the base of loose alluvium at the exploration site and determine seismic velocity of cemented materials to a maximum depth of 200 feet.
3. Specifications.
 - a. Profiling. The seismic refraction profiling is to be accomplished by using a multiple channel seismograph, explosive as an energy source, and geophone spacing adjusted for best definitions of the base of uncemented alluvium and determining seismic velocity of cemented materials to a maximum depth of 200 feet.
 - b. Report. A preliminary oral report shall be given in the field as soon as the required information is available. The written report, compiled from the profiling and interpretation, shall include seismic refraction sections, time distance profiles and written descriptions.
4. Contract Period. The work will commence on or about 10 March 1970 and the contract shall continue in force until the work is completed (approximately 30 calendar days) unless sooner terminated by the Government.
5. Mobilization and Demobilization. Mobilization and demobilization shall include moving all equipment and personnel to the job site and removing them upon completion of the work.
6. Quantities. The quantities, in linear feet, of profiling shown in the schedule are estimated only. Because of the exploratory nature of the work the estimated quantity may be increased or decreased.
7. Payment. Payment shall be made for actual quantities in linear feet profiled, in accordance with the unit prices listed. The actual amount of work performed will be determined and approved by the Government representative, who will be present at the job site to advise the Contractor during the course of work.
8. Location and Site Accessibility. The job site is located approximately fifteen (15) miles north of Phoenix, Arizona. Paved roads to within two miles of the site; graded roads, and desert trails suitable for two-wheel drive vehicles provide access to the site.

INTRODUCTION

At the request of Mr. R. Townsend of the Corps of Engineers, Los Angeles District, Heinrichs GEOEXploration Company conducted a seismic survey of the Cave Buttes Detention Basin near Phoenix, Arizona. Field work was done during 17-18 March 1970.

Heinrichs personnel involved in the field work were William Rasmussen, acting as Crew Chief, with Bruce Coons and William Pawelczyk as Technical Assistants. Interpretation, compilation and report by William Rasmussen assisted by the GEOEX Tucson staff.

Cooperation and assistance provided by Mr. Filmore Turner of the Corps of Engineers is most appreciated.

PROCEDURE

A seismic refraction survey utilizing the reverse shooting method was conducted with a total linear coverage of 9367 feet of which 200 feet was overlapping coverage. Eighteen time-distance curves were obtained in the field and used for interpretation. The survey gave excellent information from approximately 40 to 275 feet below surface. Extrapolation of available data made possible a reasonable estimate as to the composition of the top 40 feet of material.

Data were obtained utilizing an Electro-Technical Model ER 75-12 recording seismograph. The unit consists of twelve channels coupled to a cable that allowed a spacing of 50 feet between adjacent geophones. Permanent records were obtained on Polaroid photographic paper.

Four lines were surveyed; three of these consisted of two spreads each, with the other utilizing three spreads. Each spread or lay-out of geophones had a detonation at each end to produce data which would give an indication of the dip of the underlying stratified material.

Data are presented on time-distance curves as well as seismic refraction section sheets for each line. These follow the interpretation for each line.

CONCLUSIONS

1. Line 1 appears to be composed of two layers with fairly unconsolidated material to a depth of approximately 200 feet, below which a highly consolidated material is encountered.
2. Line 2 appears to have a very shallow layer (probably within 40 feet of surface) overlying a well consolidated material which has an apparently higher consolidated material underlying it at the center of the line and at a depth of approximately 140 feet. This latter material has the same seismic velocity of propagation as the lower material on Line 1.
3. Line 3 crosses over material which is apparently faulted in several places. This line has a surface layer whose consolidation is higher than the other lines surveyed but does not have as high a velocity material at depth as does Lines 1 and 2.
4. Line 4 shows a fairly uniform two layer situation with the lower material having a seismic velocity approximately equal to the upper layer of Line 3.
5. Depth to well consolidated material on Line 1 appears to be fairly great compared to Line 2.
6. The proposed locations of the dikes shows the one related to Line 3 to be over a more consolidated, apparently faulted, material than the material beneath Line 4.

INTERPRETATION

Line 1

This line runs approximately east-west (see plan map). It begins on the west end with a three layer case where the top layer is a low speed cover (2900 ft/sec) to approximately 80 feet below surface. A material of apparent weak consolidation (5300 ft/sec) continues down to approximately 215 feet below surface where a highly consolidated material (16,700 ft/sec) is encountered. This general stratification continues throughout spread one and on to approximately the middle of spread two where the top two layers appear to merge into one with an escarpment or fault in the third layer bringing it up to a depth of approximately 92 feet with its seismic propagation velocity slightly lowered (11,000 ft/sec). It is covered by a material of weak consolidation (3700 ft/sec) at the eastern end of the line.

Line 2

This line shows a weakly consolidated cover (4000 ft/sec) extending down to approximately 40 feet at its greatest depth. The velocity of this thin surface layer was taken from data on other lines. This was due to the fact that large lateral coverage and penetration were being achieved at the cost of detailed data of near-surface material. Below this material is a well consolidated one (10,000 - 12,500 ft/sec). This situation extends throughout both spreads with the occurrence of a more highly consolidated material (16,700 ft/sec) buried approximately 135 - 150 feet at the center of the line and extending laterally an unknown distance.

Line 3

This line appears somewhat complicated in structure.

Beginning at the southeast end of the line there appears to be a two layer situation for most of spread 1. The upper material has a velocity of 5900 - 7100 ft/sec with the lower material being in the range 10,000 - 23,300 ft/sec. This lower material is encountered at the end of the line at a depth of approximately 86 feet and at the northwest end of spread one at approximately 155 feet. The lower material is probably a well consolidated rock. A fault appears to exist near the joining of spread one and two. Spread two shows a two layer situation in which the upper material again is in the range 6000 - 6700 ft/sec, while now the lower material is apparently less consolidated than spread one with a seismic velocity of propagation of 8000 - 8300 ft/sec and a depth of burial of approximately 53 feet on the southeast of spread two and 93 feet on the northwest end of this spread. There appears to be a sloping boundary toward surface from the end of spread two to the middle of spread three where a two layer case appears to merge into a one layer case. At the southeast beginning of spread three there is possibly a fault in the lower material which causes a lateral change in velocity of 8300 - 11,800 ft/sec, with a corresponding change in layer depth of 93 feet to 38 feet. Spread three then begins with a top layer of material whose seismic propagation velocity is 7000 ft/sec and then appears to merge into a single

layer case near the center of spread three whose material has a velocity of propagation of approximately 9000 ft/sec, and is thus apparently more consolidated than the upper material to the southeast. This material appears to be of an average consolidation (possibly fractured rock or caliche).

Line 4

This line appears fairly constant in its being a two layer situation beneath its extent. The upper layer of material appears only slightly consolidated (3500 - 5900 ft/sec). The bottom material does not appear to be highly competent. The shot or record going NE on spread two of this line is in error for the returns of the last 8 geophones as a velocity of 50,000 ft/sec is implied. It appears from the record that the instrument was moved or hit at the midpoint of its recording cycle. This does not leave this spread without information as the reverse shot over it gives a profile consistent with the rest of the line. If the questionable trace above were thrown out then the depth to the interface at the center of the line is approximately 150 feet rather than the 130 feet given on the profile.

Respectfully submitted,

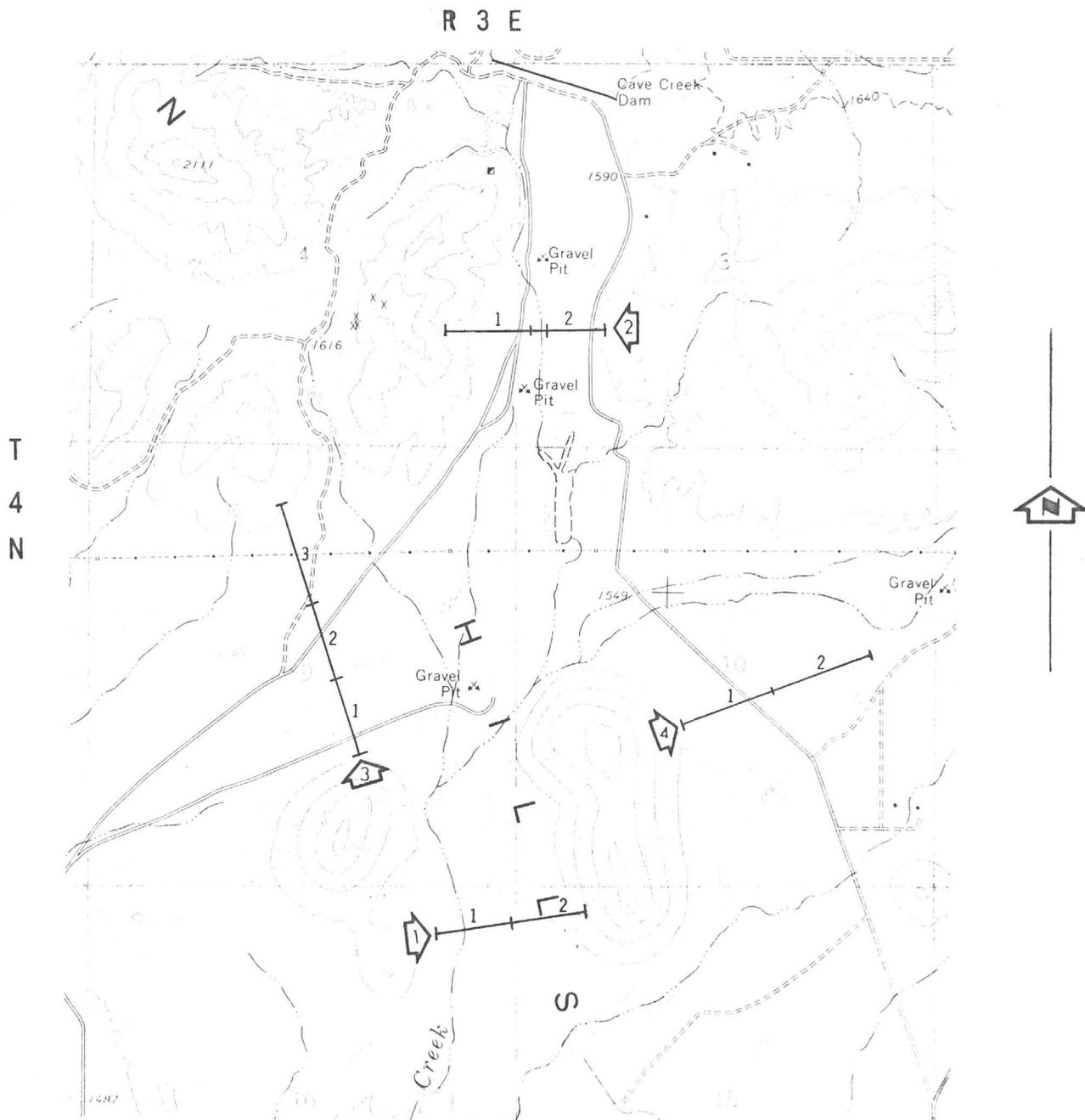
HEINRICHS GEOEXPLORATION COMPANY

**W.O. Rasmussen
Physicist**

Approved:

**W.E. Heinrichs, Jr.
President and General Manager**

SEISMIC REFRACTION SURVEY LOCATION PLAN
of
CAVE BUTTES DETENTION BASIN
MARICOPA COUNTY, ARIZONA
for
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
by
HEINRICHS GEOEXPLORATION COMPANY



2
—
⌘
4
 - SPREAD NUMBER
 LINE NUMBER

SPECIAL PROVISIONS

Seismic Refraction Survey

Cave Buttes, near Phoenix, Arizona

1. Scope of Work. The Contractor shall furnish all plant, labor, personnel, equipment, material and supplies to perform a seismic survey of designated areas at Cave Buttes Detention Basin, north of Phoenix, Arizona and furnish a report.
2. Purpose. To define the base of loose alluvium at the exploration site and determine seismic velocity of cemented materials to a maximum depth of 200 feet.
3. Specifications.
 - a. Profiling. The seismic refraction profiling is to be accomplished by using a multiple channel seismograph, explosive as an energy source, and geophone spacing adjusted for best definitions of the base of uncemented alluvium and determining seismic velocity of cemented materials to a maximum depth of 200 feet.
 - b. Report. A preliminary oral report shall be given in the field as soon as the required information is available. The written report, compiled from the profiling and interpretation, shall include seismic refraction sections, time distance profiles and written descriptions.
4. Contract Period. The work will commence on or about 10 March 1970 and the contract shall continue in force until the work is completed (approximately 30 calendar days) unless sooner terminated by the Government.
5. Mobilization and Demobilization. Mobilization and demobilization shall include moving all equipment and personnel to the job site and removing them upon completion of the work.
6. Quantities. The quantities, in linear feet, of profiling shown in the schedule are estimated only. Because of the exploratory nature of the work the estimated quantity may be increased or decreased.
7. Payment. Payment shall be made for actual quantities in linear feet profiled, in accordance with the unit prices listed. The actual amount of work performed will be determined and approved by the Government representative, who will be present at the job site to advise the Contractor during the course of work.
8. Location and Site Accessibility. The job site is located approximately fifteen (15) miles north of Phoenix, Arizona. Paved roads to within two miles of the site; graded roads, and desert trails suitable for two-wheel drive vehicles provide access to the site.

April, 1, 1970

Mr. R. Townsend (Rm. 6558)
Department of the Army
Los Angeles District
Corps of Engineers
P.O. Box 2711
Los Angeles, California 90053

Dear Sir:

Enclosed please find the original plus two copies of the report "Seismic Refraction Survey, Cave Buttes Detention Basin, Maricopa County, Arizona."

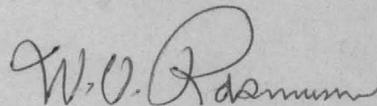
Sepias of the report will be sent should you desire them.

I hope the report meets with your approval.

We hope to be of service to you in the future in any geophysical problems which you might encounter.

All questions are welcome.

Sincerely yours,
HEINRICHS GEOEXPLORATION COMPANY



W.O. Rasmussen
Physicist

Enclosure:

<input checked="" type="checkbox"/> CHECKED BOX APPLIES	<input type="checkbox"/> ORDER FOR SUPPLIES OR SERVICES	<input type="checkbox"/> REQUEST FOR QUOTATIONS NO. RETURN COPY(IES) OF THIS QUOTE BY <small>(THIS IS NOT AN ORDER. See DD Form 1155r)</small>	PAGE 1 OF 1		
1. CONTRACT/PURCH ORDER NO. DACW09-70-M-1231	2. DELIVERY ORDER NO.	3. DATE OF ORDER 70 MAR 06 1744	4. REQUISITION/PURCH REQUEST NO.		
6. ISSUED BY: Department of The Army Los Angeles District Corps of Engineers	7. ADMINISTERED BY (if other than 6)	8. DELIVERY FOB <input type="checkbox"/> DEST <input checked="" type="checkbox"/> OTHER <small>(See Schedule if other)</small>	5. CERTIFIED FOR NATIONAL DEFENSE UNDER DMS REG 1 DO		
9. CONTRACTOR/QUOTER NAME AND ADDRESS Heinrich Geosexploration Co., Inc. Box 5671 Tucson, Arizona 85703	FACILITY CODE DW 971 TUCSON, ARIZONA 85703	10. DELIVER TO FOB POINT BY: on or about 10 March 1970	11. CHECK IF SMALL BUSINESS <input checked="" type="checkbox"/>		
14. ORDER FOR: DA, L.A. District, Corps of Engineers P.O. Box 2711 - Rm. 6558 (Townsend) Los Angeles, California 90053	15. PAYMENT WILL BE MADE BY: DA, Los Angeles District Corps of Engineers P.O. Box 2711 - ATTN: F&A Officer Los Angeles, California 90053	12. DISCOUNT TERMS 1% - 10 days 1/2% - 20 days	13. MAIL INVOICES TO: See Block 15		
16. TYPE OF ORDER DELIVERY <input type="checkbox"/> PURCHASE <input checked="" type="checkbox"/> This delivery order is subject to instructions contained on this side of form only and is issued on another Government agency or in accordance with and subject to terms and conditions of above numbered contract. Reference your Oral quote 6 March 1970 , furnish the following on terms specified herein, including, for U. S. purchases, General Provisions of Purchase Order on DD Form 1155r (EXCEPT CLAUSE NO. 13 APPLIES ONLY IF THIS BOX <input type="checkbox"/> IS CHECKED, AND NO. 15 IF THIS BOX <input type="checkbox"/> IS CHECKED); special provisions ; and delivery as indicated. This purchase is negotiated under authority of 10 USC 2304(a)(3) or as specified in the schedule if within the U. S., its possessions or Puerto Rico; if otherwise, under 2304(a)(6). <input type="checkbox"/> If checked, Additional General Provisions apply; Supplier shall sign "Acceptance" on DD Form 1155r and return copies.					
17. ACCOUNTING AND APPROPRIATION DATA/LOCAL USE 96x3122 Constr. Gen. 410A/30.111/60 I CERTIFY THAT THE AMOUNT OF \$ 2,400.00 HAS BEEN RESERVED IN THE COMMITMENT ACCOUNTS AND IS AVAILABLE FOR FUTURE OBLIGATIONS AGAINST THE FUNDS CITED. WRITTEN CERTIFICATION IS REQUIRED FOR UPWARD VARIATION IN TOTAL AMOUNT. <i>George A. Foerst</i> COR. GEORGE A. FOERST, FINANCE & ACCOUNTING OFFICER					
18. ITEM NO.	19. SCHEDULE OF SUPPLIES/SERVICES	20. QUANTITY ORDERED/ACCEPTED*	21. UNIT	22. UNIT PRICE	23. AMOUNT
1.	Perform multiple channel seismic refraction exploration at Cave Buttes Detention Basin, near Phoenix, Arizona, and furnish a report:				
1.	Mobilization and demobilization of personnel and equipment	1	Job	Lump Sum	\$ 800.00
2.	Seismic refraction profiling and interpretation	6,000 (estimated)	ft.	\$100.00 per 600 feet	1,000.00 (Estimated)
3.	Report	1	Job	Lump Sum	600.00
JOB SITE: Cave Buttes Detention Basin					
*If quantity accepted by the Government is same as quantity ordered, indicate by <input checked="" type="checkbox"/> mark. If different, enter actual quantity accepted below quantity ordered and encircle.		24. UNITED STATES OF AMERICA		25. TOTAL	\$2,400.00
26. QUANTITY IN COLUMN 20 HAS BEEN: <input type="checkbox"/> INSPECTED <input type="checkbox"/> RECEIVED <input type="checkbox"/> ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED		27. SHIP NO.		28. D. O. VOUCHER NO.	29. DIFFERENCES
DATE _____ SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE _____		<input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL		32. PAID BY	30. INITIALS
36. I certify this account is correct and proper for payment.		31. PAYMENT <input type="checkbox"/> COMPLETE <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL		33. AMOUNT VERIFIED CORRECT FOR	34. CHECK NUMBER
SIGNATURE AND TITLE OF CERTIFYING OFFICER _____		37. RECEIVED AT		35. BILL OF LADING NO.	38. RECEIVED BY
39. DATE RECEIVED		40. TOTAL CONTAINERS		41. S/R ACCOUNT NUMBER	42. S/R VOUCHER NO.

THIS PARAGRAPH APPLIES ONLY TO QUOTATIONS SUBMITTED: Supplies are of domestic origin unless otherwise indicated by quote. The Government reserves the right to consider quotations or modifications thereof received after the date indicated should such action be in the interest of the Government. This is a request for information and quotations furnished are not offers. When quoting, complete blocks 11, 12, 22, 23, 25. If you are unable to quote, please advise. This request does not commit the Government to pay any cost incurred in preparation or the submission of this quotation or to procure or contract for supplies or services.

GENERAL PROVISIONS

1. INSPECTION AND ACCEPTANCE - Inspection and acceptance will be at destination, unless otherwise provided. Until delivery and acceptance, and after any rejection, risk of loss will be on the contractor unless loss results from negligence of the Government.

2. VARIATION IN QUANTITY - No variation in the quantity of any item called for by this contract will be accepted unless such variation has been caused by conditions of loading, shipping, or packing, or allowances in manufacturing processes, and then only to the extent, if any, specified elsewhere in this contract.

3. PAYMENTS - Invoices shall be submitted in quadruplicate (one copy shall be marked "Original") unless otherwise specified, and shall contain the following information: Contract or Order number, Item number, contract description of supplies or services, sizes, quantities, unit prices and extended totals. Bill of lading number and weight of shipment will be shown for shipments on Government Bills of Lading. Unless otherwise specified, payment will be made on partial deliveries accepted by the Government when the amount due on such deliveries so warrants.

4. DISCOUNTS - Discount time will be computed from date of delivery at place of acceptance or from receipt of correct invoice at the office specified by the Government, whichever is later. Payment is made, for discount purposes, when check is mailed.

5. DISPUTES - (a) Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall mail or otherwise furnish a copy thereof to the Contractor. This decision shall be final and conclusive unless, within 30 days from the date of receipt of such copy, the Contractor mails or otherwise furnishes to the Contracting Officer a written appeal addressed to the Secretary. The decision of the Secretary or his duly authorized representative for the determination of such appeals shall be final and conclusive unless determined by a court of competent jurisdiction to have been fraudulent, or capricious, or arbitrary, or so grossly erroneous as necessarily to imply bad faith, or not supported by substantial evidence. The Contractor shall be afforded an opportunity to be heard and to offer evidence in support of his appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision. (b) This "Disputes" clause does not preclude consideration of law questions in connection with decisions provided for in (a) above, provided, that nothing in this contract shall be construed as making final the decision of any administrative official, representative, or board on a question of law.

6. FOREIGN SUPPLIES - This contract is subject to the Buy American Act (41 U.S.C. 10a-d) as implemented by Executive Order 10882 of December 17, 1954, and any restrictions in appropriation acts on the procurement of foreign supplies.

7. CONVICT LABOR - The Contractor agrees not to employ for work under this contract any person undergoing sentence of imprisonment at hard labor.

8. OFFICIALS NOT TO BENEFIT - No member of or Delegate to Congress or resident commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

9. COVENANT AGAINST CONTINGENT FEES - The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty the Government shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration or otherwise recover, the full amount of such commission, percentage, brokerage or contingent fee.

10. GRATUITIES - (a) The Government may, by written notice to the Contractor, terminate the right of the Contractor to proceed under this contract if it is found after notice and hearing, by the Secretary or his duly authorized representative, that gratuities (in the form of entertainment, gifts or otherwise) were offered or given by the Contractor, or any agent or representative of the Contractor, to any officer or employee of the Government with a view toward securing a contract or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performing of such contract, provided, that the existence of the facts upon which the Secretary or his duly authorized representative makes such findings shall be in issue and may be reviewed in any competent court. (b) In the event this contract is terminated as provided in paragraph (a) hereof the Government shall be entitled (i) to pursue the same remedies against the Contractor as it could pursue in the event of a breach of the contract by the Contractor and (ii) as a penalty in addition to any other damages to which it may be entitled by law to exemplary damages in an amount (as determined by the Secretary or his duly authorized representative) which shall be not less than three nor more than ten times the costs incurred by the Contractor in providing any such gratuities to any such officer or employee. (c) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

11. RENEGOTIATION - This contract, and any subcontract hereunder, is subject to the Renegotiation Act of 1951, as amended (50 U.S.C. App. 1211 et seq.) and shall be deemed to contain all the provisions required by Section 104 thereof, and is subject to any subsequent act of Congress providing for the renegotiation of contracts.

12. CONDITION FOR ASSIGNMENT - This Purchase Order may not be assigned pursuant to the Assignment of Claims Act of 1940, as amended (31 U.S.C. 203, 41 U.S.C. 15), unless or until the supplier has been requested and has accepted this order by executing the Acceptance hereon.

13. COMMERCIAL WARRANTY - The Contractor agrees that the supplies or services furnished under this contract shall be covered by the most favorable commercial warranties the contractor gives to any customer for such supplies or services and that the rights and remedies provided herein are in addition to and do not limit any rights afforded to the Government by any other clause of this contract.

14. PRIORITIES, ALLOCATIONS AND ALLOTMENTS DEFENSE MATERIALS SYSTEM - When the amount of the order is \$500 or more the Contractor shall follow the provisions of DMS Reg. 1 and all other applicable regulations and orders of the Business and Defense Services Administration in obtaining controlled materials and other products and materials needed to fill this order.

15. FAST PAYMENT PROCEDURE

a. GENERAL - This is a fast payment order. Invoices will be paid on the basis of the Contractor's certification thereon that articles listed on the order were delivered on a specified date to a post office, common carrier, or in shipment by other means, to the point of first receipt by the Government.

b. RESPONSIBILITY FOR SUPPLIES - Title to the supplies shall vest in the Government upon delivery to a post office or common carrier for shipment to the specified destination. If shipment is by means other than post office or common carrier, title to the supplies shall vest in the Government upon delivery to the point of first receipt by the Government. Notwithstanding any other provision of the purchase order, the Contractor shall assume all responsibility and risk of loss for supplies (i) not received at destination, (ii) damaged in transit, or (iii) not conforming to purchase requirements. The Contractor shall either replace, repair, or correct such supplies promptly at his expense, provided instructions to do so are furnished by the Contracting Officer within ninety (90) days from the date these supplies were delivered by the Contractor to a post office or common carrier. For supplies delivered by means other than post office or common carrier, such ninety (90) day period shall commence from the date these supplies were delivered to the point of first receipt by the Government.

c. PREPARATION OF INVOICE

(1) Upon delivery of supplies to a post office, common carrier, or in shipments by other means, the point of first receipt by the Government, the Contractor shall prepare an invoice in accordance with Clause 3 of the General Provisions of Purchase Order, except that invoices under a blanket purchase agreement shall be prepared in accordance with the provisions of the agreement. In shipments by either post office or common carrier, the Contractor shall either (A) cite on his invoice the date of shipment, name and address of post office or carrier, bill of lading number or other shipment document number, or (B) attach copies of such documents to his invoices as evidence of shipment. In the case of delivery by other than post office or common carrier, a receipted copy of the Contractor's delivery document shall be attached to the invoice as evidence of delivery. Regardless of delivery method the invoice shall include the following signed certification.

"I hereby certify that I did ship on (date) via the (method of shipment) or deliver on (date) in accordance with shipping instructions issued by the ordering officer, supplies in the quantities shown hereon and that such supplies are in the quantity and of the quality designated by the cited purchase order. This statement is furnished to support payment of invoice."

(2) If the purchase price excludes the cost of transportation, the Contractor shall enter the prepaid shipping cost on the invoice as a separate item. The cost of parcel post insurance will not be paid by the Government.

OUTER SHIPPING CONTAINERS SHALL BE MARKED "FAST PAY"

(This clause applies if this contract is for services and is not exempted by applicable regulations of the Department of Labor)

SERVICE CONTRACT ACT OF 1965 - The Contractor and any subcontractor hereunder shall pay all of their employees engaged in performing work on the contract not less than the minimum wage specified under Section 6(a)(1) of the Fair Labor Standards Act of 1938, as amended (\$1.25 per hour as of January 20, 1965) and are subject to the regulations of the Secretary of Labor thereunder (29 C.F.R. Part 4).

ADDITIONAL GENERAL PROVISIONS

17. CHANGES - The Contracting Officer may at any time, by a written order, and without notice to the sureties, make changes, within the general scope of this contract, in (i) drawings, designs, or specifications, where the supplies to be furnished are to be specially manufactured for the Government in accordance therewith; (ii) method of shipment or packing; and (iii) place of delivery. If any such change causes an increase or decrease in the cost of, or the time required for performance of this contract, whether changed or not changed by any such order, an equitable adjustment shall be made by written modification of this contract. Any claim by the Contractor for adjustment under this clause must be asserted within 30 days from the date of receipt by the Contractor of the notification of change provided that the Contracting Officer, if he decides that the facts justify such action, may receive and act upon any such claim if asserted prior to final payment, under this contract. Failure to agree to any adjustment shall be a dispute concerning a question of fact within the meaning of the clause of this contract entitled "Disputes." However, nothing in this clause shall excuse the Contractor from proceeding with the contract as changed.

18. TERMINATION FOR DEFAULT - The Contracting Officer, by written notice, may terminate this contract, in whole or in part, for failure of the Contractor to perform any of the provisions hereof. In such event, the contractor shall be liable for damages, including the excess cost of reprocurring similar supplies or services, provided that, if (i) it is determined for any reason that the Contractor was not in default or (ii) the Contractor's failure to perform is without his or his subcontractor's control, fault or negligence, the termination shall be deemed to be a termination for convenience under paragraph 19.

19. TERMINATION FOR CONVENIENCE - The Contracting Officer, by written notice, may terminate this contract, in whole or in part, when it is in the best interest of the Government. If this contract is for supplies and is so terminated, the Contractor shall be compensated in accordance with Section VIII of the Armed Services Procurement Regulation, in effect on this Contract's date. To the extent that this contract is for services and is so terminated, the Government shall be liable only for payment in accordance with the payment provisions of this contract for services rendered prior to the effective date of termination.

20. ASSIGNMENT OF CLAIMS - Claims for monies due or to become due under this contract shall be assigned only pursuant to the Assignment of Claims Act of 1940, as amended (31 U.S.C. 203, 41 U.S.C. 15). However, payments to an assignee of monies under this contract shall not, to the extent provided in said Act, as amended, be subject to reduction or set-off. (See clause 12)

ACCEPTANCE

The Contractor hereby accepts the offer represented by this numbered purchase order as it may previously have been or is now modified, subject to all of the terms and conditions set forth, and agrees to perform the same.

NAME OF CONTRACTOR

SIGNATURE

TYPED NAME AND TITLE

DATE SIGNED

REMARKS

1. REQUEST NO. _____ 2. DATE ISSUED **26 FEB 1970** 3. REQUISITION/PURCHASE REQUEST NO. **1744** 4. CERTIFIED FOR NATIONAL DEFENSE UNDER BDSA REG. 2 AND/OR DMS REG. 1 RATING: _____

5. ISSUED BY **DA, Los Angeles District, Corps of Engineers
 P.O. Box 2711 - SUPPLY DIVISION
 Los Angeles, California 90053**
L.R. Kraemer
 FOR INFORMATION CALL (Name and tel. no.) (No collect calls) **(213) 688-5675**

6. DELIVER BY (Date) **10 March 1970**

7. DELIVERY
 FOB DESTINATION
 OTHER (See Schedule)

8. TO NAME AND ADDRESS
 (Street, City, State and ZIP Code)
**Heinrich Geoexploration Co., Inc.
 Box 5671
 Tucson, Arizona 85703**

9. DESTINATION (Consignee and address including ZIP code)
JOB SITE: Cave Buttes Detention Basin, North of Phoenix, Arizona

**REPORT: Corps of Engineers
 P.O. Box 2711 - Rm. 6558
 Los Angeles, Calif. 90053**

10. PLEASE FURNISH QUOTATIONS TO THE ISSUING OFFICE ON OR BEFORE CLOSE OF BUSINESS **5 MAR 1970** (Date) SUPPLIES ARE OF DOMESTIC ORIGIN UNLESS OTHERWISE INDICATED BY QUOTER. THIS IS A REQUEST FOR INFORMATION, AND QUOTATIONS FURNISHED ARE NOT OFFERS. IF YOU ARE UNABLE TO QUOTE, PLEASE SO INDICATE ON THIS FORM AND RETURN IT. THIS REQUEST DOES NOT COMMIT THE GOVERNMENT TO PAY ANY COSTS INCURRED IN THE PREPARATION OR THE SUBMISSION OF THIS QUOTATION, OR TO PROCURE OR CONTRACT FOR SUPPLIES OR SERVICES.

SCHEDULE					
11. ITEM NO.	12. SUPPLIES/SERVICES	13. QUANTITY	14. UNIT	15. UNIT PRICE	16. AMOUNT
	Perform Seismic Refraction Survey at Cave Buttes, near Phoenix, Arizona and furnish a report, in accordance with attached specifications:				
1.	Mobilization and Demobilization	1	job	Lump sum	\$ <u>800.00</u>
2.	Seismic refraction profiling and interpretation	6,000 (Estimated)	ft.	<u>25⁰⁰/crush. + expenses</u>	\$ <u>2,000.00</u> (Estimated)
3.	Report	1	job	Lump Sum	\$ <u>600.00</u>
	TOTAL				\$ <u>2400.00</u>
	Describe equipment to be used: SIE-RS-4 Refraction system. Twelve Channels or Geo-Space, or Electro-Tech 12 channel.				
	Indicate recent experience in multiple channel seismic profiling: In 1969, 84 time distance curves derived from data using a twelve channel SIE-RS-4 refraction system. 26,400 linear feet of coverage was obtained with a geophone spacing of 50 feet for California Portland Cement Corp.				
	Prior to this numerous similar jobs on various damsites, highways and water problems in western U.S.A.				

17. PRICES QUOTED INCLUDE APPLICABLE FEDERAL, STATE, AND LOCAL TAXES.
 DISCOUNT FOR PROMPT PAYMENT 1 % 10 CALENDAR DAYS; 0.5 % 20 CALENDAR DAYS; **NET** % 30 CALENDAR DAYS; _____ % _____ CALENDAR DAYS.

NOTE: Reverse must also be completed by the quoter.

18. NAME AND ADDRESS OF QUOTER (Street, city, county, State, including ZIP Code) Heinrichs GEOEXploration Co. P.O.Box 5671, 808 W. Grant Road Tucson, Arizona 85703	19. SIGNATURE OF PERSON AUTHORIZED TO SIGN QUOTATION W. E. Heinrichs, Jr. President	20. DATE OF QUOTATION March 4, 1970
	21. SIGNER'S NAME AND TITLE (Type or print)	22. TELEPHONE NO. (Include area code) 602/623-0578

REPRESENTATIONS AND CERTIFICATIONS

The Quoter represents and certifies as part of his quotation that: (Check or complete all applicable boxes or blocks.)

1. SMALL BUSINESS:

He is, is not, a small business concern. A small business concern for the purpose of Government procurement is a concern, including its affiliates, which is independently owned and operated, is not dominant in the field of operation in which it is quoting on Government contracts, and can further qualify under the criteria concerning number of employees, average annual receipts, or other criteria, as prescribed by the Small Business Administration. (See Code of Federal Regulations, Title 13, Part 121, as amended, which contains detailed industry definitions and related procedures.) If the quoter is a small business concern and is not the manufacturer of the supplies offered, he also represents that all supplies to be furnished hereunder will, will not, be manufactured or produced by a small business concern in the United States, its possessions, or Puerto Rico.

2. REGULAR DEALER-MANUFACTURER (Applicable only to supply contracts exceeding \$10,000.)

He is a regular dealer in, manufacturer of, the supplies offered.

3. CERTIFICATION OF INDEPENDENT PRICE DETERMINATION (Applicable only to quotations in excess of \$2,500.)

(a) By submission of this quotation, the quoter certifies, and in the case of a joint quotation, each party thereto certifies as to its own organization, that in connection with this procurement:

(1) the prices in this quotation have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other quoter or with any competitor;

(2) unless otherwise required by law, the prices which have been quoted in this quotation have not been knowingly disclosed by the quoter and will not knowingly be disclosed by the quoter prior to opening in the case of an advertised procurement or prior to award in the case of a negotiated procurement, directly or indirectly to any other quoter or to any competitor; and

(3) no attempt has been made or will be made by the quoter to induce any other person or firm to submit or not to submit a quotation for the purpose of restricting competition.

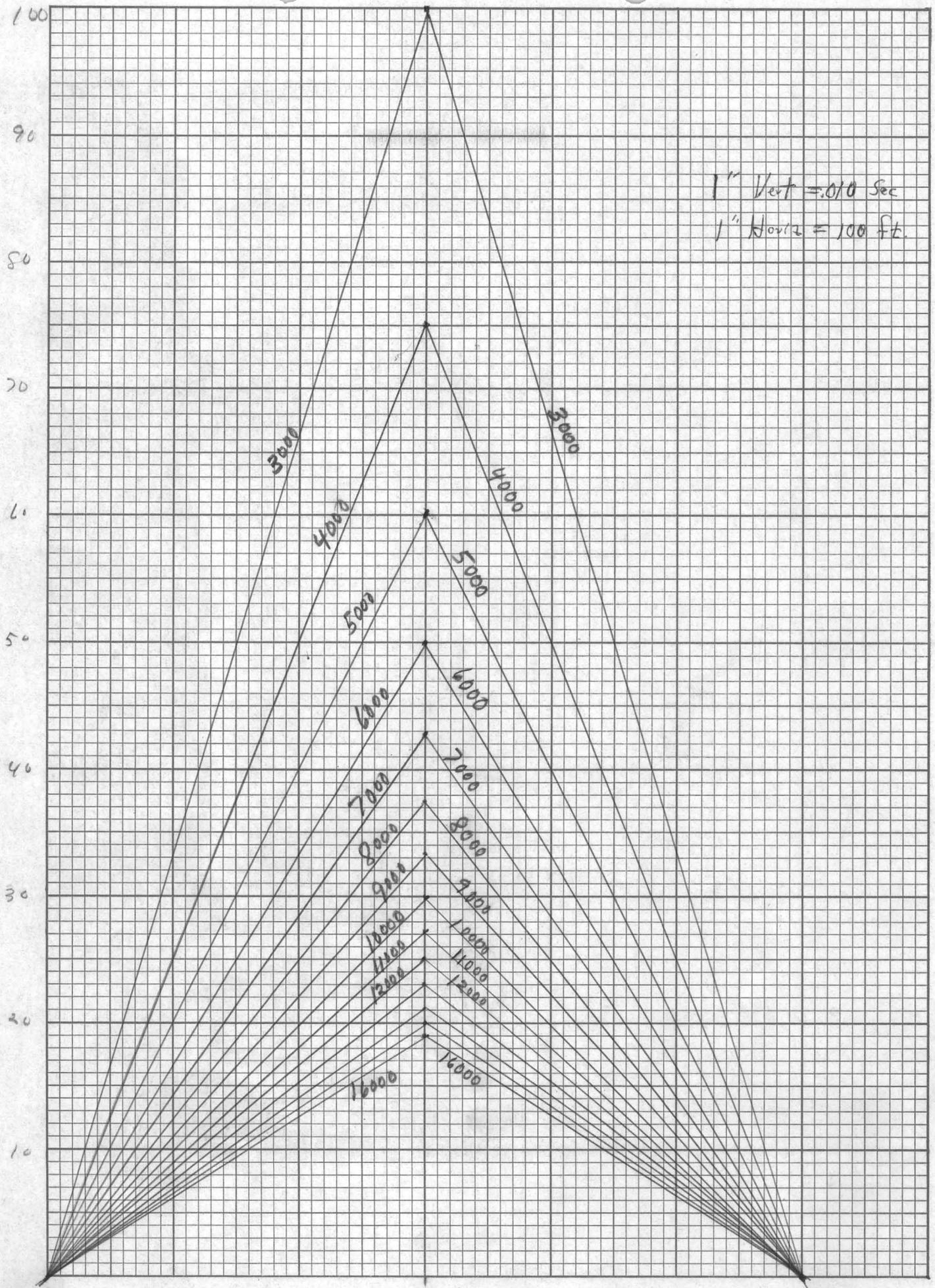
(b) Each person signing this quotation certifies that:

(1) he is the person in the quoter's organization responsible within that organization for the decision as to the prices being quoted herein and that he has not participated, and will not participate, in any action contrary to (a)(1) through (a)(3) above; or

(2)(i) He is not the person in the quoter's organization responsible within that organization for the decision as to the prices being quoted herein but that he has been authorized in writing to act as agent for the persons responsible for such decision in certifying that such persons have not participated, and will not participate, in any action contrary to (a)(1) through (a)(3) above, and as their agent does hereby so certify; and (ii) he has not participated, and will not participate, in any action contrary to (a)(1) through (a)(3) above.

(c) This certification is not applicable to a foreign quoter submitting a quotation for a contract which requires performance or delivery outside the United States, its possessions, and Puerto Rico.

(d) A quotation will not be considered for award where (a)(1), (a)(3), or (b) above, has been deleted or modified. Where (a)(2) above, has been deleted or modified, the quotation will not be considered for award unless the quoter furnishes with his quotation a signed statement which sets forth in detail the circumstances of the disclosure and the head of the Agency, or his designee, determines that such disclosure was not made for the purpose of restricting competition.



1" Vert = .010 Sec
1" Horiz = 100 Ft.

Line A going East

S. P. @ 322 - w. of #1

3/17/70

top
Bottle

3/23/70

3/23/70

1

3/23/20

3/23/70



3/18/70

Line 2

going East

S.P. @ 174 W of #1 Pline

S.P. @ F.A. #.4

3/17/70

Line 2 going East

SP @ 124' W of # show

ST. @ DV. #4

3/17/70

Paul

Line 2 going West
S.R. @ 195' E. of #1 3/10/70

End ?

Line 2 going West 3/12/20
S.P. @ 195' E. of #1 phone

2nd try

Line 1 going West
S.P. @ 115' E of #1

Bottom
3/17/20

S.P. @ D.N. 9

3/17/20

Line 1 going EAST
S.P. @ 190' W of #1

Bottom
Buttes

3/17/76

Line y Going North

S.P @ 330 ' S. of #1 phone

3/18/70

Line Y

going South

S.P. @ 288 - N of #1 phone

3/18/70

S.P. @ ~ 300' S.W. of D.N.#18

Line X going South

S.R @ 330 / N. of #1 phone

3/18/70

Good ?

Line X going South

S.P. @ 330' N₁₁ of #1 phone

2nd Try

3/18/70

Line X going North

Dike

S.P. @ 300 - S of #1 phone

S.P. @ #16 Drill Note

3/18/70

Line 8 going South

S.P. @ 205 - North of #1

S.P. in rock

3/18/70

Line 8 going North

S.P. @ 132' S. of #1 phone

3/18/70

#13 on

slight hill @

dwell pad location

Line B going South

S.P. @ 268 - N. of #1 phase

3/15/70



Line B going North

S. P. @ 278' S. of #1

Phone

3/18/70

Line & gang South

S.P. @ 210 - N of #1 drive.

3/18/20

Line 2 going N-West

C.P. @ 173 S.E. of #1

S.P. @ D.N. 13

3/18/70

Line B going west

S.P @ 209' E of #1 phone

3/17/70

top
Butter

Line B going East
S.P. @ 141' W. of #1

S.P. @ D. H. (19)

Base of Hill

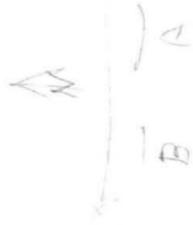
3/17/70

Top
Butte

Line A going West

S.P. @ 107' E of #1

#1 @ 5th. 21



3/17/20

Top
Butte

