REPORT
GEOTECHNICAL CONSULTATION
RHSU WELL #27.3
MILLFORD, UTAH
FOR PHILLIPS PETROLEUM

[redacted]

CONSULTING ENGINEERS
658 Bair Island Road • Redwood City, California 94063-2777 415-367-9510

October 16, 1985
Our Job Number 1855-H

Phillips Petroleum
655 East, 4500 South
Salt Lake City, Utah 84107

Attention: Thomas Turner
Development & Operations Director

Gentlemen:

This letter submits three copies of our report titled "Report, Geotechnical Consultation, RHSU Well #27-3, Milford, Utah, For Phillips Petroleum". This report supplements and modifies the hand-written report which we submitted to you on September 17, 1985. Since the hand-written report was dated September 17, 1985, this report discusses conditions, future plans and proposed remedial measures as of that date. The report contains no discussions on events at the site subsequent to September 17th.

We appreciate the opportunity to have been of service to Phillips Petroleum on this project.

Sincerely,

Chris Jennings RSC

CHRIS JENNINGS
Project Engineer

CJ/RSC/cb
R-5/Let1855-H

COOPER ENGINEERS, INC.
(415) 367-9510

REPORT
GEOTECHNICAL CONSULTATION
RHSU WELL #27-3
MILFORD, UTAH
FOR PHILLIPS PETROLEUM

INTRODUCTION

This report presents the results of our geotechnical consultation on certain effects of the blowout of steam well RHSU Well #27-3, which is located in Beaver County, Utah. We understand that the blowout occured mid-morning on September 9, 1985. It evidenced itself in the form of a small fissure and three vents, or blowholes, which appeared at the well pad surface. The largest of the blowholes emitted substantial volumes of steam, gas, and surficial (alluvial) debris. The volume of debris was estimated at approximately forty-five cubic yards. Cold water was pumped into the well in order to control the blow. Control was achieved within six hours. To maintain control of the well, cold water pumping continued during the course of this study. In order to investigate the cause for the blowout and to determine and implement remedial measures to preserve the production capabilities of the well, it is intended to re-drill the well boring. The drilling start up is scheduled for Tuesday, September 17, 1985.

The well pad, measuring approximately 400' x 450', was constructed over two years ago. Since the initial well drilling, the pad was regraded to drain. Regrading included the in-filling of the original waste sump. Construction consisted primarily of minor cuts and fills, all on the order of 5 to 8 feet. The general site topography is illustrated on the attached Plate 1, Location of Seismic and Self Potential Survey Lines. The regional topography is gently sloping from east to west at an approximately 6:1 to 8:1 (horizontal:vertical) gradient. A sixty-foot-high separator is currently located near the well head.

PURPOSE AND SCOPE OF SERVICES

Because of the evident damage created by the blowout and the unknown nature and extent of the subsurface fissure(s) there was concern over the structural integrity of the materials underlying the existing pad. We were requested on Wednesday afternoon, September 11, 1985, to determine a safe location for the steam well drilling rig and to calculate allowable bearing pressures for the rig's foundation. This information was to be provided without delaying the scheduled start-up date for the drilling. In order to provide this information, we completed the following scope of services:

1. Reviewed the available site information. This included oral histories of the blowout, a site grading map (this forms the basis of several of the attached plates) and the steam well survey log.
2. Conducted self potential and near-surface (30-foot depth) seismic refraction surveys in the well head and blowout vicinities.
3. Drilled and logged three borings in the vicinity of the in-filled sump and well head. Sampling was done with a standard penetrometer.
4. Excavated two test pits in the in-filled sump area. Two nuclear guage moisture-density determinations were made at various depths during each of the excavations.
5. Performed one maximum dry density test (ASTM Test Method D1557-78).
6. Performed engineering and geophysical analyses.
7. Presented the results of our work in the form of a hand-written report and attachments early Tuesday, September 17, 1985.
8. Presented a "clean" copy of the same results in this report.

The intent of our services was to locate a safe area(s) where the drill rig and its associated ancillary facilities could set up without producing or experiencing distress due to any subsurface material inconsistancies caused by the blowout. Additionally, we were to determine the bearing capacity at this location(s).

FIELD INVESTIGATION AND DISCUSSION

The field investigation was performed in two phases. The individual aspects and intent of each are further discussed below. Briefly, however, the purpose of the geophysical survey, consisting of a grid of self potential and seismic refraction lines, was to provide a broad-area survey of the site and to roughly trace the location of the subsurface material inconsistancies produced by the blowout and therefrom determine a "safe" area for the drill rig. The locations of the survey lines are indicated on Plate 1, Location of Seismic and Self Potential Lines. The intent of the further "intrusive," exploratory work, (borings and test pits) was to supplement the surveys, confirm that the identified area was consistent, and to provide information which would permit a rough determination of the bearing capacity of the area. The boring and test pit locations are shown on Plate 2, Locations of Borings and Test Pits.

GEOPHYSICAL SURVEY

Purpose

Two geophysical methods were used in the vicinity of the blowout and immediately adjacent areas. The methods included self potential (SP) and seismic refraction surveys.

The overall purpose of these surveys was to provide a broad scale investigation of the blowout area and to aid in locating the test borings and test pits. This included defining anomalous or inconsistent zones which could be related to void developments, weak areas, steam cavities, etc.

SP and Seismic Refraction Surveys

The SP method, which is sensitive to changes in temperature and/or fluid flow or migration, was used to survey for inconsistency in the subsurface conditions in the blowout area and vicinity. The seismic refraction method is sensitive to differences in density or compaction as well as saturation.

The SP survey was conducted along T traverses that were spaced approximately 25 feet apart. Three of these traverses were oriented E-W, the remaining were N-S. Measurements were taken at 25-foot intervals along each traverse. These measurements were plotted and contoured to define the SP variations as an equipotential map. This map is illustrated on Plate 3A, SP Contour Map.

Two seismic refraction lines, oriented N-S, were located near the well head. One line was located 15 feet to the west and the other 15 feet to the east of the well. A third line was located over the old sump area and test boring location. Each line consisted of 12 geophones spaced 5 to 10 feet apart with shot points at each end and in the center. The seismic data was plotted as travel time versus distance graphs to determine the seismic layer velocities and depths. The seismic line time-distance histories are plotted on Plates 3B and 3C, Time-Distance Plots.

Results

The SP results are shown on the attached map (Plate 3-A) The values range from -179 millivolts (mv) at the well head to over +100mv at the old sump area to the west. Generally, this strong gradient trends approximately E-W and is, likely, regional in nature. This gradient is influenced by a linear low anomaly that is associated with the effects of the well and generally trends to the southeast. The axis of the anomaly is in alignment with the blow out hole and the well. The low negative values north of the well are probably caused by the nearby facilities. To the east, the SP values are generally flat.

Since the low negative anomaly trends in the same general orientation from the well as the blow out holes, it appears that it may be caused by the structural consequence of the recent blowout; i.e. steam conduit(s) originating at the well. An alternative explanation is that the anomaly defines a feature or condition that the escaping steam subsequently followed. The former seems more reasonable. This observation is reinforced by the fact that, while sounding the blowout hole, heat was detected at a depth of 40 feet below the surface (SP is sensitive to heat and fluid flow).

The two seismic refraction lines in the vicinity of this anomaly indicate that the seismic velocity of the material within, approximately 30 feet of the ground surface ranges between 1500 to 2000 feet per second (fps). Across the sump area, a velocity layer from 10 to 15 feet thick with a velocity of 1500 fps overlies 2200 fps material. The upper layer is probably fill material.

Generally, the seismic velocities are typical for dry to moist coarse grained material that is medium dense. These results imply that there are not any major inconsistencies, such as large voids, in the upper 30 feet of the subsurface material, apart from those created by the blowout holes.

Test Borings

Three borings were drilled to depths ranging from 17½ feet to 29½ feet. One boring was located in the middle of the in-filled waste sump, and two were drilled in the immediate vicinity of the well head. These latter borings were located in the area identified by the geophysical survey as likely "safe" for the positioning of a steam well rig. The locations of the borings are illustrated on Plate 2, Locations of Borings and Test Pits. The materials encountered are described on Plates 4A through 4D, Boring Logs.

The purpose of Borings 2 and 3 was to provide a check on the geophysical survey and to generate data which could be used to compute bearing capacities of the underlying subsurface materials. The intent of Boring 1 was to determine the adequacy of the initial sump construction, the relative compaction of sump backfill and, again, to provide parameters for bearing capacity analyses.

The materials encountered were largely silty sands and poorly-graded medium sands. All are the product of alluvial deposition of the severely weathered underlying bedrock as evidenced in the nearby rocky peaks. The sands consist primarily of quartz and feldspar clasts. Their densities range from dense to very dense with the exception of some of the in-filled sump material which is medium dense. The borings appear to confirm what the geophysical data indicates regarding the apparent consistency of materials underlying the western portion of the site.

Test Pits

The test pits were intended to provide further information regarding the adequacy of the waste sump backfill. The materials encountered in the test pits are illustrated on Plate 5, Test Pit Logs. The system used to classify the soils encountered in the borings and test pits is presented on Plate 6, Method of Soil Classification. In order to determine the relative degree of compaction obtained in infilling the waste sump, a representative bulk sample of the materials encountered in the test pits was taken and subjected to maximum dry density testing. The results are presented on Plate 7, Compaction Test Data. Two field density tests were performed at various depths in each pit, the results of which are presented on Plate 8, Summary of Field Density Tests. These results, when compared against the maximum dry density test results, and the blow counts obtained in sampling boring 1, indicate that only moderate compaction was achieved while in-filling the waste sump.

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations presented herein are based on the available data, the proposed construction, and on our interpretation of the existing geotechnical conditions. On this basis, it is our opinion that the erection of a steam well drilling rig on-site is geotechnically feasible, provided that the recommendations presented herein are followed.

Our conclusions and recommendations are presented below on an item by item basis.

1. Based on the investigation performed and described herein, it appears that the substantial fissure(s) is limited to a single radial arm (in plan) extending from the well head in a southeasterly direction to and, perhaps, slightly beyond the largest evident blowhole.

2. The largest blowhole extends nearly vertically from the surface to at least 40 feet. At 40 feet there is an apparent obstruction. The blow hole nearest the well head is obstructed at 4½ feet - likely due to caving. Based on the limited extent and breadth of our surveys, there are no apparent signs of a large near-surface void or radially oriented fissures.

3. The portion of the pad to the west of the well head appears to be composed of consistent material which does not exhibit any signs of voids, fissures or cracking. It appears to represent, with the exception noted below, a safe, competent area upon which the drill could be founded. Allowable bearing capacities are presented below.

4. The in-filled waste sump represents a minor constraint to the site development. Portions of the sump fill and portions of the original berm are only moderately compacted. The upper 2 to 3 feet of the sump materials are well-compacted; however, the approximately 5 to 7 feet of underlying fill soils are somewhat less dense, inconsistantly compacted, and could be subject to some further settlement with loading. This would become very evident if any planned gradings were to remove the top "cap" soils. Any structure straddling firm native soils and the less dense fill would be subject to the effects of differential settlement. Calculation of the magnitude of such settlement exceeds the scope of this report; however, we estimate that it may be on the order of several inches. Short of measures involving reconstructing this area with compacted fill (minimum 90% relative dry density) under engineering observation, or sub-excavation; we recommend not locating critical structures in this area.

5. Recommended bearing capacity values within the areas investigated:

Western Site Portion	4 ksf dead loads 5 ksf dead + live 6 ksf total design
* In-filled Sump Area	1.5 ksf dead loads 2 ksf dead + live 3 ksf total design

   * If the sump area is reconstructed as indicated above, the higher values for the western site portion could be used.

6. Because of the inherent uncertainty in an investigation of this sort, we recommend the drill rig matting layout illustrated on Plate 9. This layout provides a larger bearing surface and, consequently, produces lower bearing pressures. Should any void develop to the east of the well head, this configuration should enable the matting to straddle it and, thus, still provide adequate support for the rig. The layout will not infringe far enough on the in-filled sump to subject it to significant differential settlement.

7. We recommend, in order to avoid all possible contact with the subsurface inconsistancies associated with the blowout, that the planned baker tanks (for the drilling wastes sump) be situated at least 60 feet south of the well head. If so located, bearing capacity values of 4 ksf, 5 ksf and 6 ksf, dead, dead + live and total design loads, respectively, may be used.

8. From a geotechnical engineering perspective, we recommend that the blow holes be filled prior to moving on the drilling rig.

9. If any excavations are planned, we recommend that, in the native soil, temporary construction slopes be no steeper than 1:1 (horizontal to vertical) and in fill 1.5:1.

10. If any site grading is to be done, we recommend that the appropriate Phillips Petroleum Standards be followed; however, instead of specifying performance standards, prescriptive standards, which can be checked, should be employed.

CLOSURE

Our conclusions and recommendations are based on largely empirical test methods and a very quick investigation, results interpretation, and analyses. The relative degrees of accuracy and conservatism of our recommendations reflect this. We wish to emphasize that no lab testing was done and, consequently, some discrepancies may become evident between the actual conditions and those which we have interpreted. The boring logs and test pits are also not necessarily representative of subsurface material at other locations or times.

We appreciate the opportunity to have been of service to Phillips Petroleum Company in this project. If you have any questions, please contact us.

The following plates are attached and complete this report:

Plate 1	Locations of Seismic and Self Potential Survey Lines
Plate 2	Locations of Borings and Test Pits
Plate 3A	SP Contour Map
Plates 3B and 3C	Time – Distance Plots
Plates 4A through 4D	Boring Logs
Plate 5	Test Pit Logs
Plate 6	Method of Soil Classification
Plate 7	Compaction Test Data
Plate 8	Summary of Field Density Tests
Plate 9	Recommended Drill Rig Matting Layout

Yours very truly,

COOPER ENGINEERS, INC.

Chris Jennings RSC

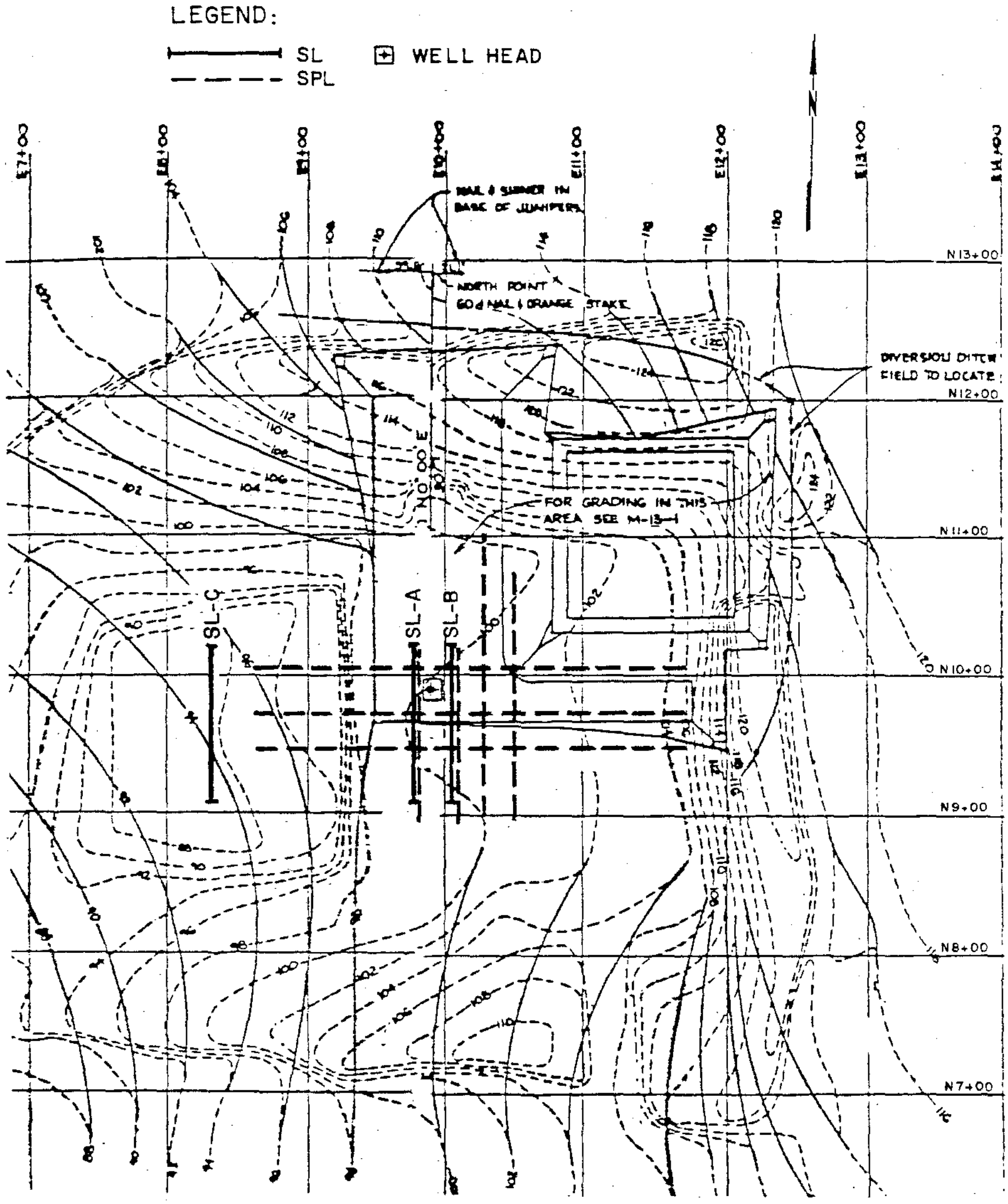
CHRIS JENNINGS
Civil Engineer 39,634 CA

CJ/RSC/cb
R-3/REP1855-H

(3 copies submitted)

[redacted]

PLATE I



Revisions:
By ______ Date ______
By ______ Date
MILFORD, UTAH
Location
PHILLIPS PETROLEUM
Name
By ______ Date CJ 9-20-85
Checked By ______
Job Number 1855-H

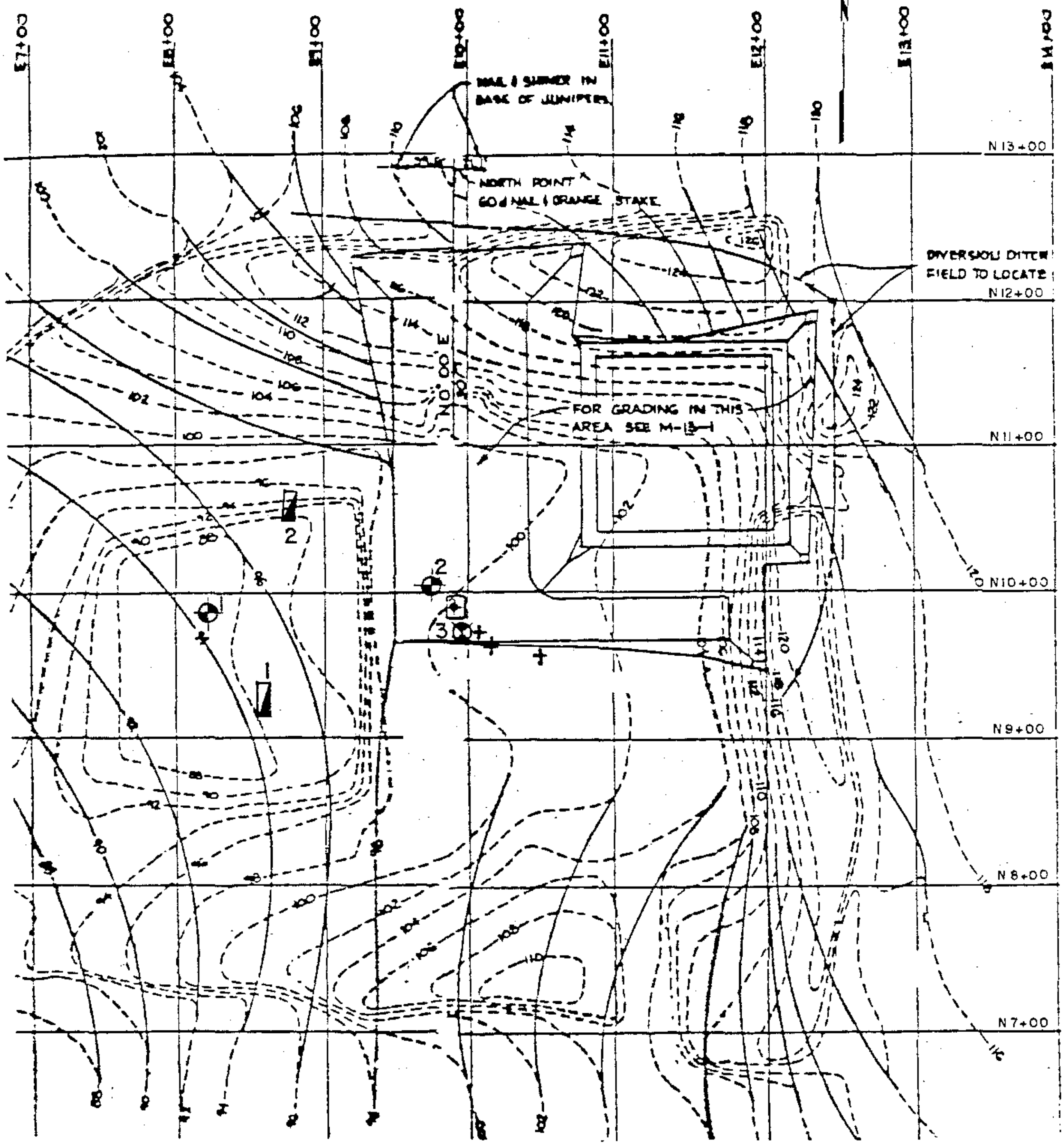
LCATIONS OF SEISMIC & SELF POTENTIAL SURVEY LINES

SCALE: 1" = 100'

PLATE 2

LEGEND:

- BORING
- WELL HEAD
- TEST PIT
- + BLOW OUT HOLE



Revisions: By ____ Date ____
By ____ Date ____
Location MILFORD, UTAH
Name PHILLIPS PETROLEUM
By ____ Date 9-20-82
Checked By ____
Job Number 1855-H

LOCATIONS OF BORINGS AND TEST PITS

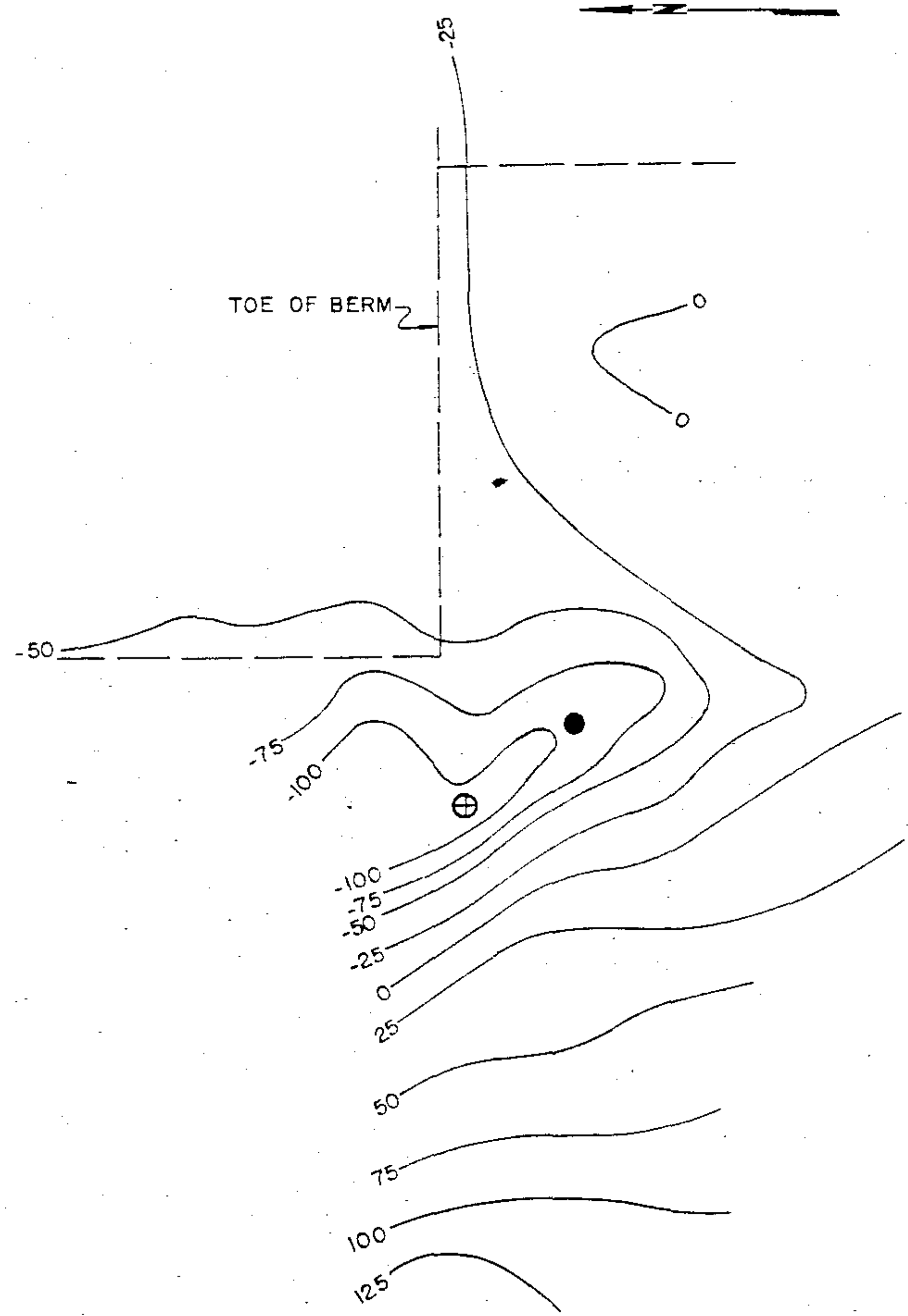
SCALE: 1" = 100'

LEGEND:

⊕ WELL

● BLOW OUT HOLE

50 ——— SP CONTOUR LINES (VALUES IN MILLIVOLTS)



SP CONTOUR MAP

SCALE: 1" = 50'

Revisions:
By ______ Date ______
By ______ Date ______
Location MILFORD, UTAH

By ______ Date ______
Checked By ______ Name PHILLIPS PETROLEUM
Job Number 1855-H

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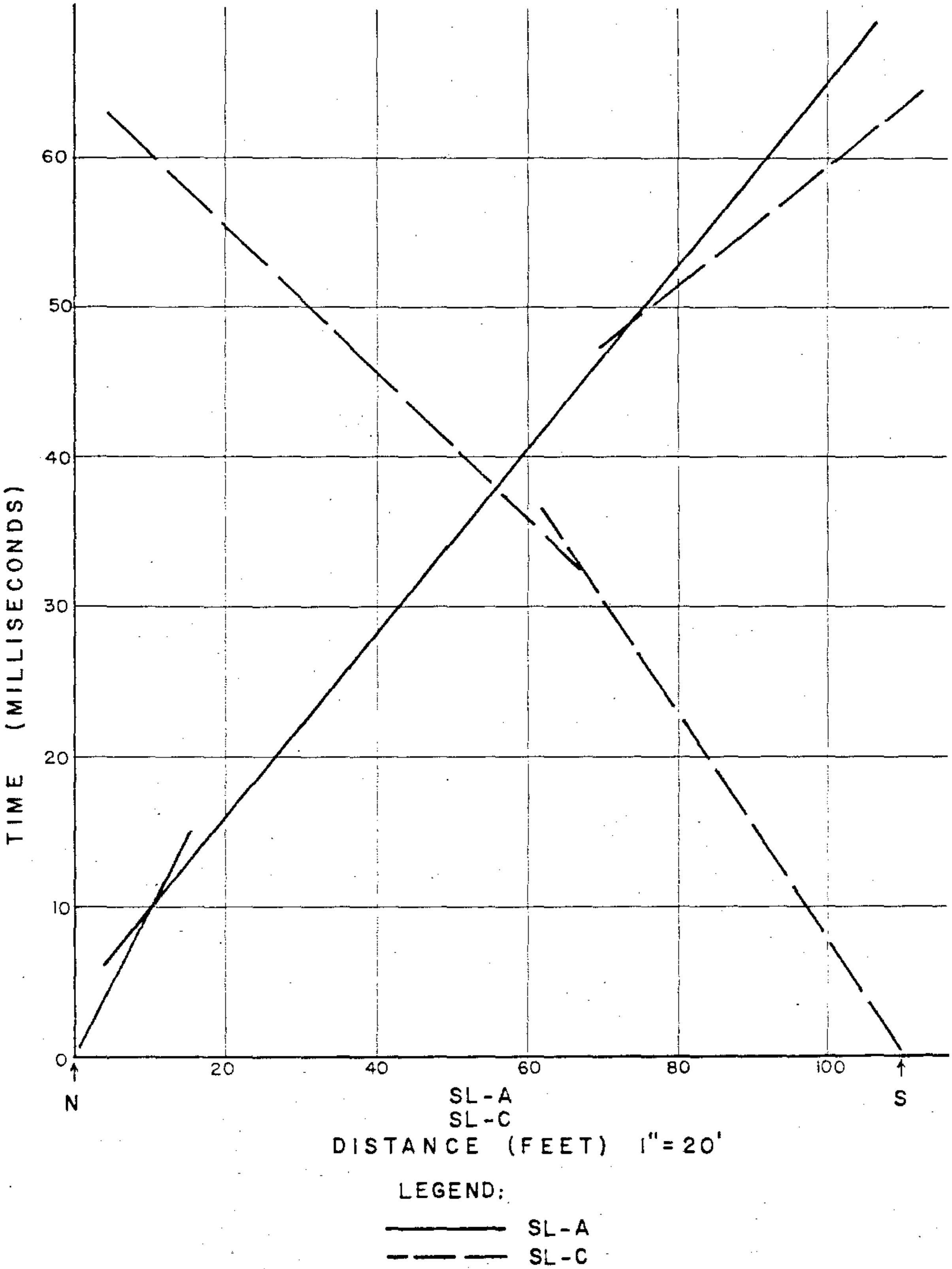
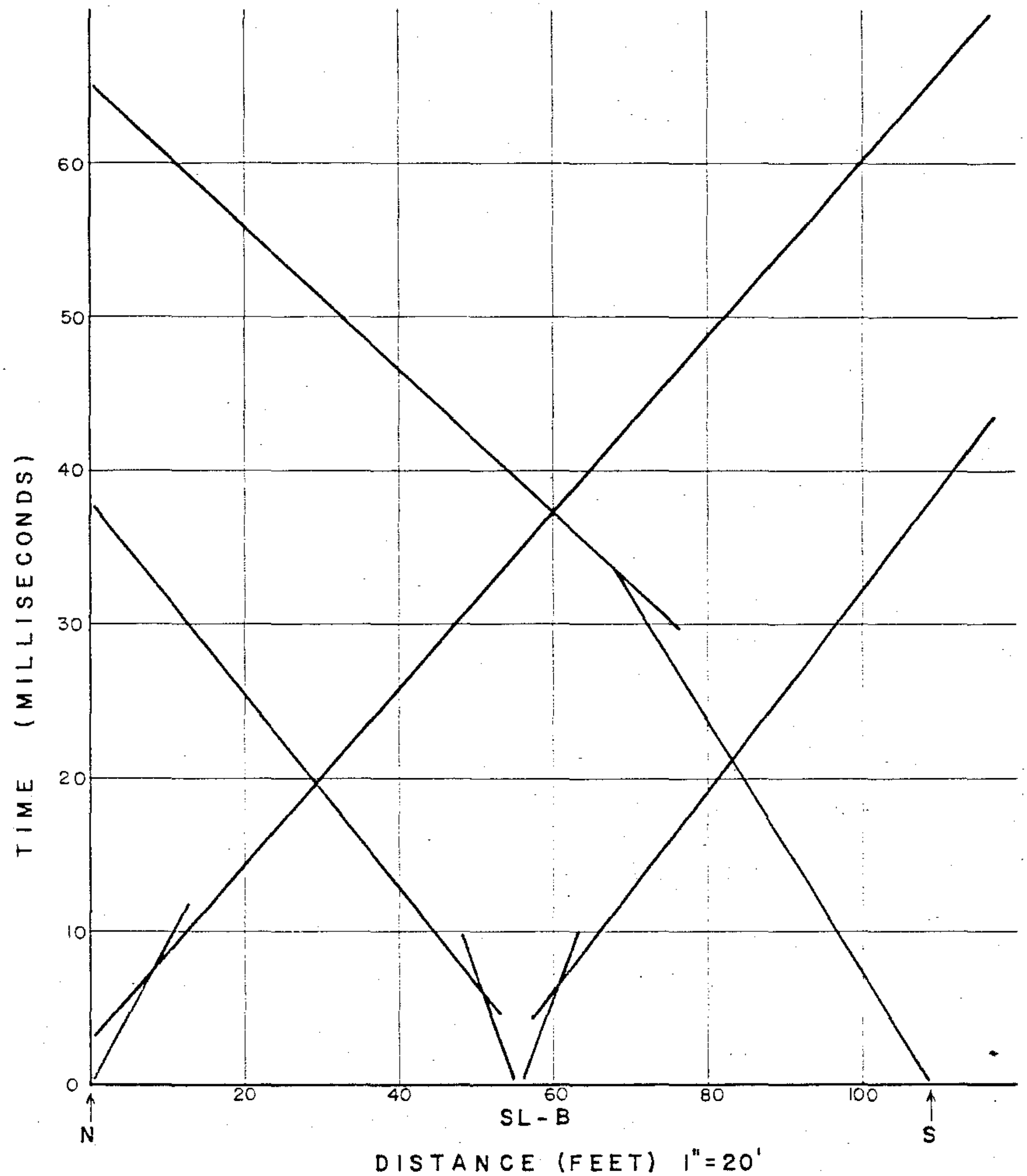


SEISMIC SURVEY
TIME-DISTANCE PLOT

By ______ Date ______
Checked By Cil Date 9-20-56
Job Number 1855-H Name PHILLIPS PETROLEUM Location MILFORD, UTAH

Revisions:
By ______ Date ______
By ______ Date ______

PLATE 3C



SEISMIC SURVEY
TIME - DISTANCE PLOT

By ______ Date ______
Checked By ______ Date 7-20-66
Job Number 1855-H Name PHILLIPS PETROLEUM Location MILFORD, UTAH
Revisions:
By ______ Date ______
By ______ Date ______

PLATE 4-A

Job Name: Phillips Petroleum
Location: Roosevelt Hot Springs, Utah
Date drilled: 9/16/85

Job Number: 1855-H
Boring Number: 1
Elevation of Boring: 11.6 feet

Percent Fines (-#200)	Liquid Limit %	Plasticity Index	Type Strngth Test	Test Surch. Press. psf	Test Moist. Cont. %	Shear Strngth psf	Natural Moist. Cont. %	Dry Density pcf	Sampler Type-Blows/Foot	Feet	Visual Classification
										1	[SM] Brownish-gray silty sand (dense, dry)
									34	2	[SM] Dark brown silty sand w/trace clay (dense, dry to moist)
										3	
										4	(lens bentonite treated soil at 3.0 to 3.4)
									29	5	(grades moist to very moist)
										6	FILL
										7	(grades coarse grained, loose to medium dense and with more
									9	8	clay)
										9	[SC] Brown clayey sand with silt (medium dense, very moist)
										10	
									9	11	LINER?
										12	
										13	(silt lens 12.5 to 13.0) [SM] /[SP] Brownish-gray silty sand - decomposed granite, few fines (dense, moist)
									20	14	
										15	
										16	
									32	17	

FIELD NOTES:

1. The borings were drilled on September 16, 1985 with truck-mounted, power-driven, 8-inch-diameter, hollow-stem auger equipment.

2. The following symbol, N-☒, denotes a standard penetration test. The number recorded for N is the penetration resistance: blows required to drive a standard 2-inch-diameter sampler for 12 inches (from 6 to 18) inches below the bottom of the boring with a 140-pound hammer free-falling 30 inches.

3. Boring elevations are relative to the elevation of the top of the well head cellar (assumed = 10.0 feet).

4. Groundwater was not encountered in any of the borings.

Job Name: Phillips Petroleum
Location: Roosevelt Hot Springs, Utah
Date drilled: 9/16/85

Job Number: 1855-H
Boring Number: 2
Elevation of Boring: 10.0 feet

Percent Fines (-#200)	Liquid Limit %	Plasticity Index	Type Strngth Test	Test Surch. Press. psf	Test Moist. Cont. %	Shear Strngth psf	Natural Moist. Cont. %	Dry Density pcf	Sampler Type-Blows/Foot	Feet	Visual Classification
										1	[SM] /[SP] Yellowish-brown silty sand (dense to very dense, dry) completely weathered granite
									60	2	
										3	(grades with few fines to SP) small rx at 3.5, sub-angular quartz clast
									27	4	
										5	
										6	(grades moist and dense)
										7	
									24	8	(grades reddish brown with trace clay, dry)
										9	(grading yellowish-brown)
										10	(grades with few fines, occasional quartz and feldspar clasts, subangular to subrounded)
										11	
									32	12	
										13	
										14	
										15	
										16	
										17	
									26	18	[ML] Brown gravelly silt (stiff, dry to moist) sub-rounded gravels to 1/2" diameter

Job Name: Phillips Petroleum
Location: Roosevelt Hot Springs, Utah
Date drilled: 9/16/85

Job Number: 1855-H
Boring Number: 3
Elevation of Boring: 9.6 feet

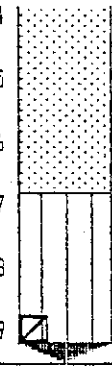
Percent Fines (-#200)	Liquid Limit %	Plasticity Index	Type Strngth Test	Test Surch. Press. psf	Test Moist. Cont. %	Shear Strngth psf	Natural Moist. Cont. %	Dry Density pcf	Sampler Type-Blows/Foot	Feet	Visual Classification
									38	1	[SM] Brown silty sand (dense, dry) decomposed granite
										2	
										3	
									31	4	grades yellowish-brown with few fines, subangular quartz and feldspar clasts to 1/2" diameter
										5	
										6	[SP] Yellowish-brown medium sand with trace gravels (very dense, dry to moist)
										7	
									30	8	
										9	
										10	(grades with more moisture to moist)
										11	
									33	12	consistant drilling
										13	
										14	
										15	(grades with more fines)
										16	
										17	consistant drilling
										18	
									53	19	(grades to very dense)
										20	
										21	
										22	(consistant drilling, dense to very dense, dry to moist)
										23	

Log Continued on Next Page

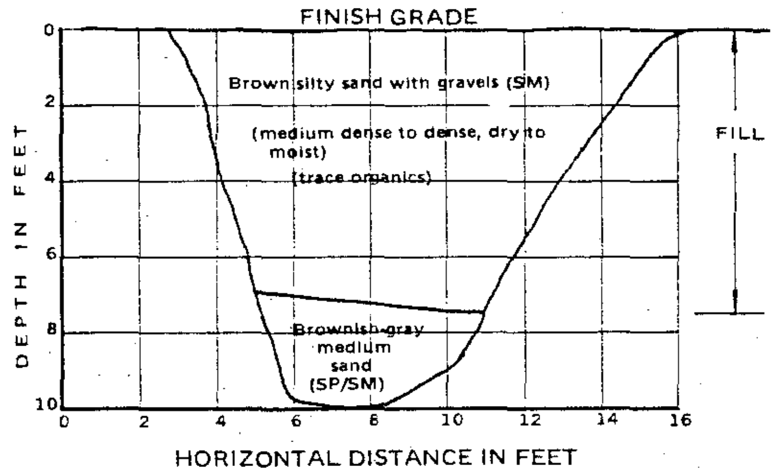
Job Name: Phillips Petroleum
Location: Roosevelt Hot Springs, Utah
Date drilled: 9/16/85

Job Number: 1855-H
Boring Number: 3
Elevation of Boring: 9.6 feet

Percent Fines (-#200)	Liquid Limit %	Plasticity Index	Type Strngth Test	Test Surch. Press. psf	Test Moist. Cont. %	Shear Strngth psf	Natural Moist. Cont. %	Dry Density pcf	Sampler Type-Blows/Foot	Feet	Visual Classification
										24	
										25	Gravel lens at 25.0 to 25.5 subrounded, approx. 1-inch nominal diameter
										26	
										27	[ML] Reddish-brown clayey silt (stiff to very stiff, moist)
										28	
									24	29	



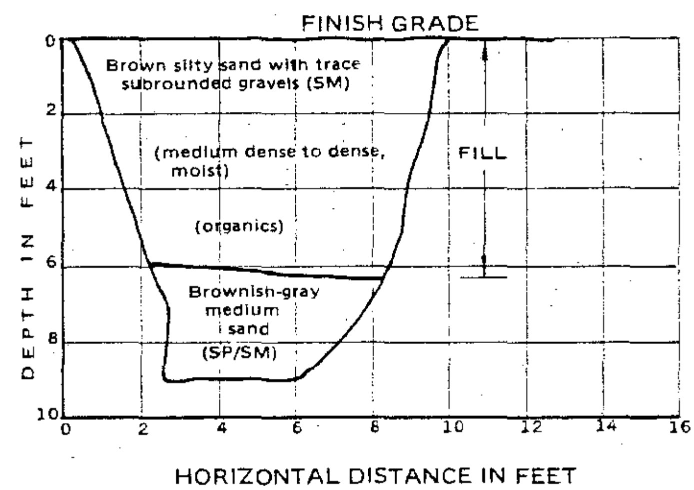
TEST PIT NO. 1



Field Density Test No. 1 @ 2 feet 90% compaction @8% moisture content

Field Density Test No. 2 @ 5 feet 90% compaction @ 10% moisture content

TEST PIT NO. 2



Field Density Test No. 3 @ 4 feet 89% compaction @ 11% moisture content

Field Density Test No. 4 @ 6 feet 87% compaction @ 11% moisture content

FIELD NOTES:

1. The test pits were excavated on September 15, 1985 with a backhoe.
2. The field density tests were performed with a nuclear guage.
3. The test pits were backfilled with compacted on-site material.
4. No groundwater was encountered.
5. No caving.

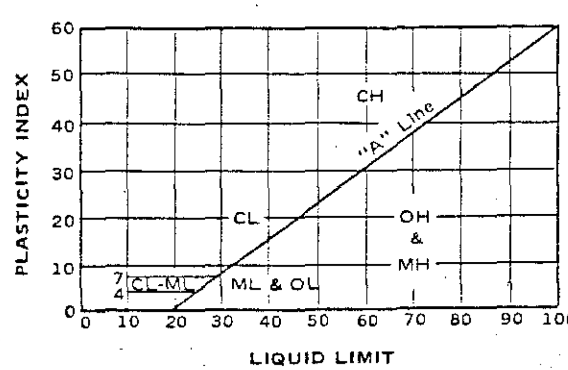
By EE Date 9/15/85
Checked By CJ 9/27/85
Job Number 1855-11 Name Phillips Petroleum
Location Milford, Utah
Revisions:
By ______ Date ______
By ______ Date ______

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than ½ of soil > no. 200 sieve size)	GRAVELS (More than ½ of coarse fraction > no. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than ½ of coarse fraction < no. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (More than ½ of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

CLASSIFICATION CHART
(Unified Soil Classification System)

CLASSIFICATION	RANGE OF GRAIN SIZES U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.76
coarse	3" to ¾"	76.2 to 19.1
fine	¾" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

GRAIN SIZE CHART

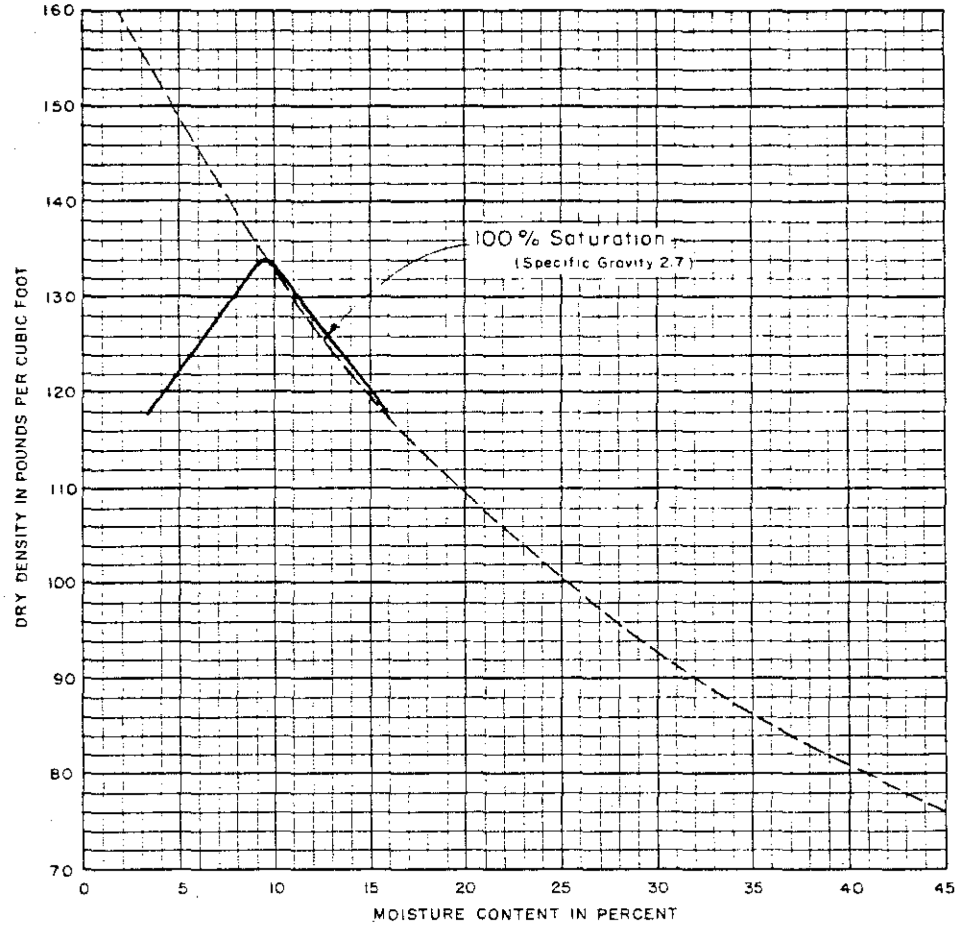


PLASTICITY CHART

METHOD OF SOIL CLASSIFICATION

Revisions:
By_______ Date_______
By_______ Date_______
Location Milford, Utah

By_______ Date_______
Checked By_______
Job Number 1855-H Name Phillips Petroleum



COMPACTION METHOD:

- ☐ ASTM D 698 (OR AASHO T 99)
- ☒ ASTM D 1557 (OR AASHO T 180)
- ☐ CALIF. 216
- ☐ OTHER ____________

LEGEND	————		
BORING or SAMPLE NUMBER	Test Pit Number 1		
DEPTH (FEET)	2 - 4		
SOIL DESCRIPTION	Brown silty sand with trace gravels (SM)		
SOURCE OF MATERIAL	Sump Fill		
USE OF MATERIAL	Fill		

OPTIMUM MOISTURE CONTENT (%)	9.5		
MAXIMUM DRY DENSITY (PCF)	134		

COMPACTION TEST DATA

Drawn By FF Date 9/15/85
Checked By CJ Date 9/27/85

Job Number 1855-11 Client Phillips Petroleum
Location Milford, Utah
Cross Reference Job Number ____________

Job Number 1855-H Client Phillips Petroleum
Location Milford, Utah

Prepared by FR Date 9/15/85
Checked by CJ Date 9/23/85

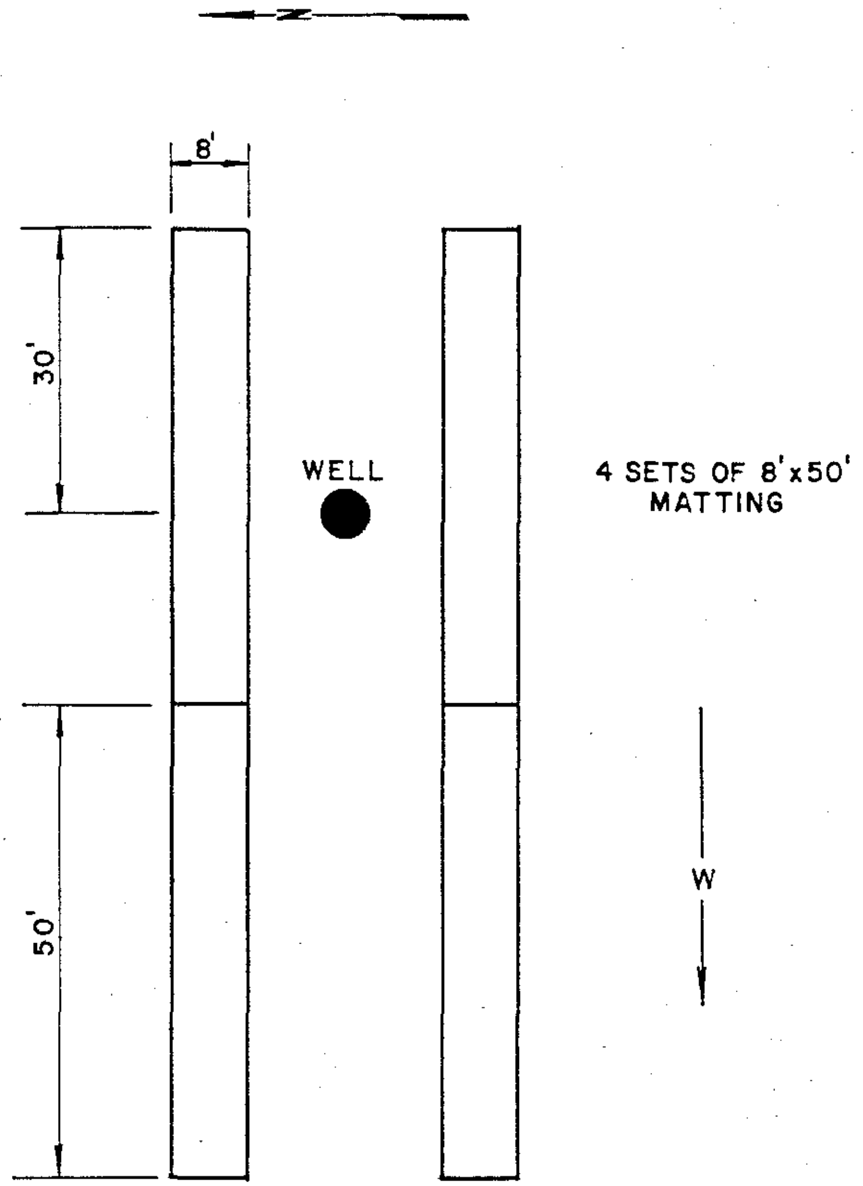
SUMMARY OF FIELD DENSITY TESTS

TEST NO.	DATE	LOCATION	DEPTH BELOW FINAL GRADE (FEET)	ELEVATION (FEET)	TEST NO	MOISTURE CONTENT (PERCENT)	DRY DENSITY (LBS/CU FT)	PERCENT COMPACTION	PERCENT COMPACTION SPECIFIED	REMARKS
1	9/15/85	Sump fill, TP#1	2		101	8	120	90		
2	9/15/85	Sump fill, TP#1	5		101	10	120	90		
3	9/15/85	Sump fill, TP#2	4		101	11	119	89		
4	9/15/85	Sump fill, TP#2	6		101	11	117	87		

COMPACTION TEST NUMBER	101		
METHOD OF COMPACTION	ASTM 1557		
OPTIMUM MOISTURE CONTENT (PERCENT)	9½		
MAXIMUM DRY DENSITY (LBS/CU FT)	134		

SPECIAL NOTES:

By ______ Date ______
Checked By ______
Job Number 1855-H Name PHILLIPS PETROLEUM Location MILFORD, UTAH
Revisions:
By ______ Date ______
By ______ Date ______



RECCOMMENDED DRILL RIG MATTING LAYOUT

SCALE: 1" = 20'