DOE/ID/12079--109

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RESULTS OF A DETAILED GRAVITY SURVEY IN THE ALAMOSA AREA, ALAMOSA COUNTY, COLORADO

by

Claron E. Mackelprang

September, 1983

Work performed under Contract Number DE-AC07-80ID12079

DISCLAIMER

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ESL-126

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Earth Science Laboratory
University of Utah Research Institute
420 Chipeta Way, Suite 120
Salt Lake City, Utah 84108

Prepared for U.S. Department of Energy
Division of Geothermal Energy

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ILLUSTRATIONS

ABSTRACT

A total of 322 stations, centered on the City of Alamosa, were surveyed with a gravimeter during September, 1981. These data have shown the Alamosa horst to have an irregular top. This irregularity is thought to be caused by paleovalleys and/or down-dropped fault blocks within the Precambrian horst. The City of Alamosa lies directly over a local gravity low. Volcanic rocks within this low may contain a reservoir for geothermal fluids, as yet unsubstantiated by drilling. Thermal fluids are thought to enter the Alamosa area via aquifers from the west (San Juan Mountains) and/or from the Rio Grande Rift zone with the fluids rising along fractures within and bordering the horst. The most favorable drilling targets appear to be either near the center of the local gravity low or in the fracture zone at the edges of the inferred down-dropped fault blocks.

INTRODUCTION

At the request of DOE/DGE Idaho Operations Office the Earth Science Laboratory/University of Utah Research Institute (ESL/UURI) undertook a detailed gravity survey of a 200 square mile area centered on the City of Alamosa, Colorado. Low temperature (90-110°F) geothermal fluids are currently being used by several businesses in or near Alamosa. These include direct heating of motels, shopping malls and public swimming pools.

The City of Alamosa, through participation in the DOE/DGE User-Coupled Drilling Program, had contracted to drill for thermal fluids which would be used for district heating and industrial processing. A drill site had been selected and drilling scheduled but prior to its commencement, ESL received the request from DOE/DGE Idaho Operations Office to perform a gravity survey. This gravity survey was to provide additional data which would aid in the selection of a drill site within the area most promising for thermal fluids.

A meeting was held with the drilling contractor, Dr. Jay Kunze of Energy Services Inc., Idaho Falls, Idaho, immediately following the field survey. A rough copy of the Bouguer gravity map was presented and its general implications were discussed. Unfortunately, the initial drill site was drilled irrespective of the gravity results.

GENERAL GEOLOGY

The generalized geology of the Alamosa area presented in this report is, for the most part, a summary of Colorado Geological Survey Special Publication 17 by Dr. Richard L. Burroughs (1981).

The City of Alamosa is located at the south-central end of an intermontane structural depression. This valley is approximately 40 miles wide and 70 miles long (Figure 1) and is designated the Alamosa Basin. Trending north-south through the center of the Alamosa Basin is a buried bedrock horst. The City of Alamosa lies directly above this horst which consists of Precambrian rocks and has been penetrated at a depth of about 5400 feet by a drill test located roughly 10 miles north of town in the CSESW Sec. 16, T.29N., R.10W.

Additional drilling still further to the north of town has shown that the two grabens formed on either side of the Alamosa Horst (Plate I) have developed at different times geologically and to significantly different depths. The Baca Graben which formed to the east of Alamosa has an accumulation of valley fill estimated to be at least 19,000 feet thick. This graben was well formed prior to the late Eocene. The Monte Vista Graben formed west of the horst during the Pre-Miocene and has accumulated about 10,000 feet of material which contains ash-flow tuffs and volcanoclastics from the San Juan volcanic field still further to the west. These volcanics are not thought to extend, in any significant thickness, across the Alamosa Horst nor are they present in the Baca Graben to the east.

Gravity Data

The gravity data in the Alamosa Basin prior to the ESL survey consisted, in part, of USGS data presented on Map GP-895 by Behrendt and Gajwa (1974); a Masters Thesis, University of Texas at El Paso (Davis, 1979) which included approximately 3500 stations from the files of the Department of Defense gravity library; and recent unpublished data from the Colorado School of Mines. With the exception of the Colorado School of Mines data, these gravity

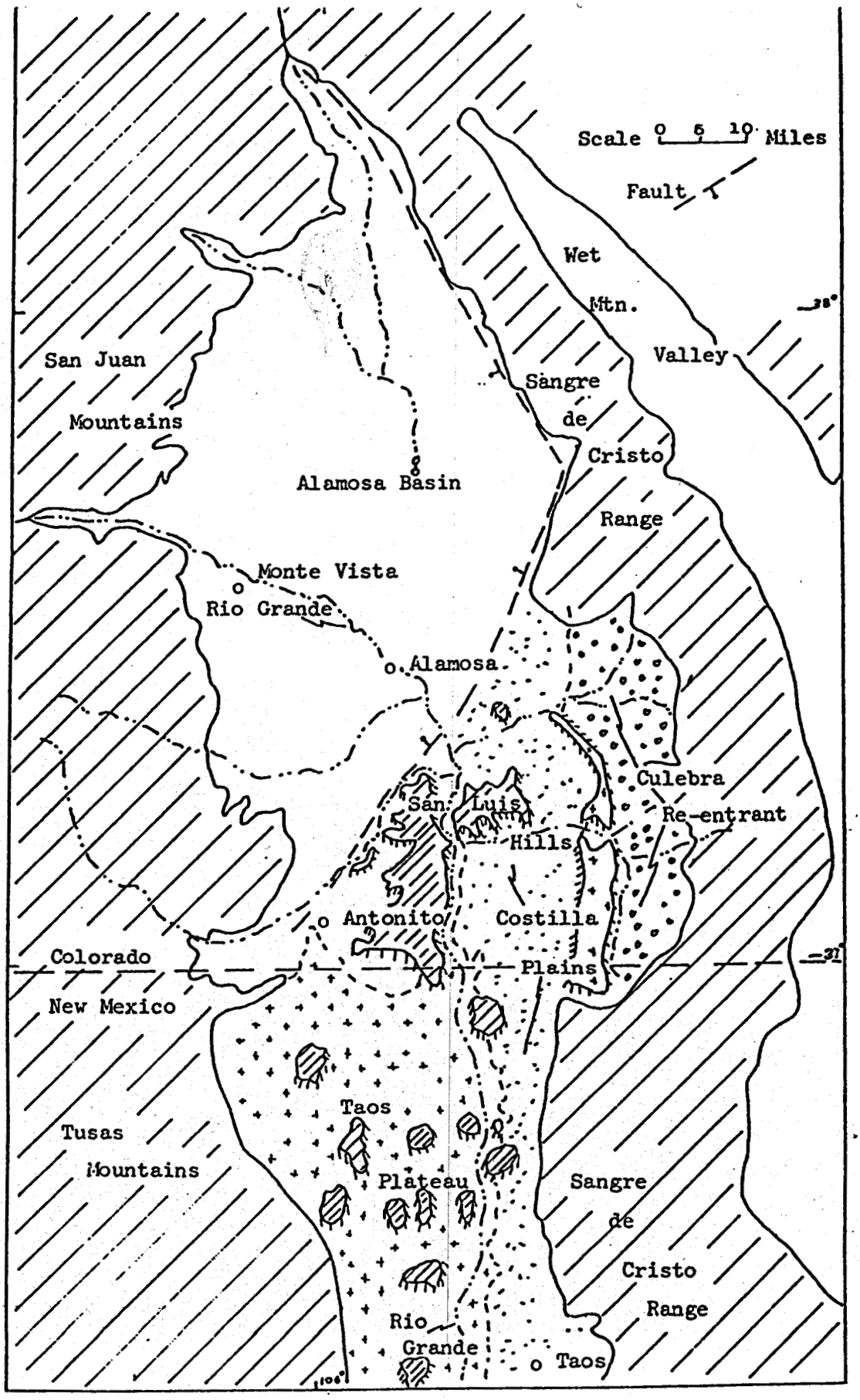

Figure 1. Physiographic subdivisions San Luis basin (modified after Upson, 1939).

data are of a regional nature with stations being occupied generally at two mile spacings wherever possible, and at benchmarks, road intersections, section corners etc. where photogrammetric elevations are available.

Survey Procedure

The ESL survey was restricted to roads covering a 200 square mile area centered on the city of Alamosa. Stations were located at points with photogrammetric elevations, i.e. benchmarks, road junctions, section corners whenever possible at 0.25, 0.5 and 1.0 mile intervals radiating outward from town. Because the topography is so uniform within the survey area, elevations of other stations were picked from their locations on topographic maps.

Stations were acquired in a looping method, each loop being of approximately three hours duration. Base readings were taken at the start and completion of each loop. The initial base was the USAF station located in the SW corner of the Old Post Office building on the corner of San Juan and 4th Avenues. An alternate base station was set at benchmark H364 located on the east side of the intersection of State Avenue and 17th Street.

The Bouguer gravity was computed using standard data reduction techniques. The adopted gravity value for the Post Office base station was 979.23498 gals which was determined using the Geodetic Reference System (GRS), 1967 (Woollard, 1979).

Survey Results

The results of the survey are presented as the Simple Bouguer Gravity Map (Plate II). The long profile trending into Alamosa from the Northwest, consisting of stations numbered 2001 to 2060 and 1801 to 1822, was provided by

Dr. Ralph C. Holmer of the Colorado School of Mines. This profile indicates the western edge of the Alamosa horst as a steep local gradient which is superimposed upon a strong regional gravity gradient. The regional trend undoubtedly continues westward into the thick volcanic section comprising the San Juan volcanic field. The gravity profile across the horst indicates that the city of Alamosa sets on a gravity low. The Colorado School of Mines data did not define the eastern edge of the Alamosa Horst. This profile was therefore extended an additional four miles to the east by ESL. The eastern edge of the horst appears to be located approximately one mile east of the point where the School of Mines profile ended, (at station 1822). While the ESL extension did not completely cross the Baca graben, sufficient data were acquired to indicate this graben is likely formed from several down-faulted blocks.

Three gravity highs, separate and distinct from each other, were delineated within the limits of this survey. These occur to the northwest, northeast and south of town and border the local gravity low at Alamosa. This low is centered roughly midway between main street (Highway 160) and the airport. The low is localized within the horst and is of 1.0 to 1.5 mgals amplitude. An east-west trending "trough" suggests continuity with both the Monte Vista and Baca grabens. Another "trough" extends northward from town and it is these "troughs" that separate the gravity highs from each other. These "troughs" then form an inverted "T" ($\perp$) with the low on the horst being at their junction.

Model Results

The gravity data presented on Plate II were interpreted in terms of subsurface structure by computing two and one-half dimensional and three-

dimensional models using algorithms modified at ESL. The resultant models, shown as Plate III to Plate V, are excellent fits to the Bouguer gravity data. Interpretational ambiguities include the density, depth of burial and thickness of the various rocks units, and these result in a non-unique interpretation of the gravity data.

In computing the three-dimensional model, rectangular prisms of varying dimensions and density are combined to approximate irregularities in the subsurface bedrock. The parameters for the model determined to be a "best fit" to the Bouguer gravity map are listed in Appendix A.

The model on Plate III suggests the two northern gravity highs are caused by Precambrian rocks occurring at depths between 4,750 feet and 5,600 feet. The gravity low between the northern highs is formed in the model by placing a down-dropped block at a depth of 5,600 feet. This block has an inferred section of volcaniclastics 600 feet thick above the Precambrian rocks. The gravity low upon which Alamosa is located was modeled with two down-dropped blocks. The first, centered on the low, has inferred volcaniclastics, 1400 feet thick, in the depth interval of 5,600 feet to 7,000 feet. The second, which forces an eastward elongation of the low, has inferred volcaniclastics, 900 feet thick, in the depth interval of 5,600 feet to 6,500 feet. Finally, the gravity high to the south of town was modeled with Precambrian rocks at a depth of 5,000 feet.

Plates IV and V show model results using a $2\frac{1}{2}$ - dimensional algorithm originally developed by the USGS (Cady, 1977). This algorithm is $2\frac{1}{2}$ - dimensional in that it allows for polygons of finite rather than infinite width.

Two profiles, labeled B-B' and D-D', were computed as north-south and east-west profiles, respectively, across the survey area (Plate II). Geologic control for these profiles is taken from Plate I of Burroughs, 1981. This geologic cross-section crosses the Alamosa horst to the north of the survey area and utilizes deep drill hole data for control.

GEOLOGIC IMPLICATIONS

Obviously the top of the Alamosa horst is very irregular, the most likely cause being structural deformation (faulting) of the horst itself due to rifting. Based upon the picture presented by the ESL Bouguer gravity map and the computer models, it is hypothesized that the "troughs" define down-faulted blocks within the horst. The gravity highs are more stable portions of the horst and the local gravity low centered on Alamosa is possibly due to an intersection of east-west and north trending fault sets which may have caused a small block to be down-dropped a few hundred feet.

Cuttings from the drill hole recently completed for the City of Alamosa show the presence of a significant thickness of Oligocene (?) volcaniclastics filling in the "troughs". These volcaniclastics were encountered at a depth of approximately 5,300 feet and continued until the Precambrian was intersected at 6,370 feet (J. Zeisloft, pers. comm.). This drill hole was located on the southwest flank of the local gravity low; hence, a thicker section of volcaniclastics probably exists within the center of the gravity low.

It is not known if volcaniclastic rocks cap Precambrian basement beneath the gravity highs. Conceivably the volcaniclastics could have formed a blanket over Precambrian highs and these volcaniclastics were subsequently

eroded during the Late Eocene. It is also possible that the gravity highs are indicative of Precambrian rocks without associated volcanic cover as assumed by the 3-D model. In any event, the recent drill-hole has shown the presence of the volcaniclastics within the local gravity low and these very probably extend throughout the postulated "troughs".

EXPLORATION TARGET

Burroughs (1981) has mentioned the presence of paleovalleys and/or down-dropped blocks along the Alamosa horst and has discussed their importance to the discovery of geothermal fluids. The detailed gravity survey completed by ESL has further indicated what appears to be paleovalleys and/or down-dropped blocks within the Alamosa horst. These appear to traverse the crest of the horst in a north and east-west direction and could allow for communication of water between the Monte Vista and Baca grabens. The hole drilled by Energy Services, Inc. has shown the presence of at least 1,060 feet of volcaniclastics upon the Alamosa horst near the airport. Since these rocks comprise part of what is called the "confined aquifer" there appears to be adequate reservoir potential for ponded geothermal fluids particularly within the areas of the down-dropped blocks.

The source of the thermal waters within the Alamosa area is not known. The area is part of the Rio Grande Rift zone so deep circulation of meteoric waters is possible. These heated fluids would likely rise along the border faults of the Alamosa horst and could conceivably filter through the horst along the fractures of the down-dropped blocks. Alternatively, thermal waters could be moving laterally away from a heat source in the San Juan volcanic field and into the Alamosa area as postulated by Burroughs (1981). Certainly the high heat flow measurements (2.85 + 0.65 HFU) in the San Juan volcanic

field support the presence of a buried heat source. The eastward dip of the volcanic rocks within the Monte Vista graben would place the Alamosa area down dip and along the hydrologic gradient.

Regardless of the thermal fluid source, it is still possible to formulate an exploration target in the Alamosa area. If the volcanics form a reservoir for thermal fluids, then an area such as the local gravity low centered on Alamosa would likely have a thicker volcanic section and hence a greater chance for development of a sizable reservoir. Not all volcanic flows have the same texture or, more importantly, the same porosity and permeability. A drill-hole centered on the gravity low would likely intersect the greatest thickness of volcaniclastics and thus increase the odds for a productive well.

Since fluids might be flowing along fractures as well as through aquifers, an alternative drill location could test a major fracture zone. While the major bounding faults to the Alamosa horst can not be overlooked as potential targets, a better area might be found on the horst itself along one of the borders to the postulated down-faulted blocks. An area could be identified where two or more of these blocks and/or faults intersect. Such an area may exist along the northern side of the local gravity low. It would be necessary to better define the edges of any down-faulted blocks before drilling in this area. This cannot be done with additional gravity data but may be achieved with a reflection seismic survey. This could be quite expensive ($20,000 to $40,000) but it would still be less costly than drilling a "dry" hole.

ACKNOWLEDGEMENTS

Special thanks are given to Dr. Ralph C. Holmer of the Colorado School of Mines for his time spent in discussing the geophysical data in the Alamosa Area and for permission to use the gravity data acquired by the School of Mines along Highway 160. Thanks are also given to Bear Creek Mining Company in Tucson, Arizona for their generous loan of a gravimeter.

REFERENCES

Behrendt, John C., and Bajwa, LaCretia Y., 1974, Bouguer Gravity Map of Colorado, Geophysical Investigations Map GP-895.

Burroughs, Richard L., 1981, A Summary of the Geology of the San Luis Basin, Colorado-New Mexico with emphasis on the Geothermal Potential for the Monte Vista Graben. Colorado Geological Survey Special Publication 18. 35 pp.

Davis, Gene Howell, 1979, A Gravity Study of the San Luis Basin, Colorado. Thesis, Master of Science, University of Texas at El Paso.

Woollard, G. P., 1979, The New Gravity System--Changes in international gravity base values and anomaly values. Geophysics, v. 44, no. 8, p. 1352-1366.

APPENDIX A

Project name: Alamosa Area, Colorado
Gravity Survey

Model: 3-D Gravity Model

Units in Feet

PRISM	X1	X2	Y1	Y2	D1	D2	DC
1	-85000.	100000.	-85000.	265000.	0.	20000.	-0.83
2	-21120.	-2640.	10560.	27984.	5000.	5200.	0.83
3	-12144.	-7392.	20000.	25000.	4900.	5200.	0.83
4	15840.	24816.	10000.	15840.	4500.	5200.	0.83
5	8448.	21120.	29568.	32736.	4750.	5200.	0.83
6	21120.	24816.	15840.	40000.	5000.	5200.	0.83
7	18480.	31680.	-18480.	-7392.	5400.	5600.	0.83
8	-13728.	-2640.	-18480.	-5280.	5300.	5600.	0.83
9	-26400.	52800.	-85000.	-18480.	5000.	20000.	0.83
10	-2640.	8448.	-10560.	6500.	5600.	7000.	-0.45
11	8448.	18480.	-10560.	2112.	5600.	6500.	-0.45
12	31680.	52800.	-18480.	265000.	7000.	20000.	0.83
13	-26400.	31680.	-18480.	47520.	5600.	20000.	0.83
14	-85000.	-26400.	-85000.	265000.	5600.	8000.	0.63
15	-26500.	31680.	47520.	265000.	5400.	20000.	0.83
16	-2640.	8448.	6500.	47520.	5600.	6200.	-0.45
17	-85000.	-26400.	-85000.	265000.	8000.	10000.	0.35
18	75000.	100000.	-85000.	265000.	12500.	20000.	0.83
19	52800.	75000.	-85000.	265000.	10000.	20000.	0.83
20	-85000.	-26400.	-85000.	265000.	10000.	20000.	0.83
21	-26400.	-2640.	6500.	40000.	5200.	5600.	0.83
22	8448.	31680.	6500.	40000.	5200.	5600.	0.83

Grid Parameters
Gravity Model
Number of Grid Points in X Direction: 19
Number of Grid Points in Y Direction: 15
Grid Spacing in Feet: 5280.00
X Offset in Feet: 0.00
Y Offset in Feet: 0.00

APPENDIX B

PRINCIPAL FACTORS FOR GRAVITY STATIONS

AMPAD · EFFICIENCY LINE® 22-210

DATE : Sept. 3, 1981

AREA : ALAMOSA, COLO.

METER CONSTANT : K = 0.099946 mg/DD

Pg. 1

note: Elev. picked from Topo. sheet.

	1 STA.	2 TIME	3 READ.	4 ELEV.	5 LAT.	6 LONG.	7 G obs.	8 G theo.	9 B.G. mg	10 REMARKS	12 G theo.	13 B.G simple
							IGF (1930)				GRS (1967)	
BASE * 1	USAF Sta.	0854	498.8	7548.9'	37°28.21'	105°52.02'	979.23498	979.95783	-269.99	in SW Ltr dlf P.O.	979.94572	-257.
2	1	0915	480.5	7536	26.62	51.84	.23313	.95552	-270.3	@ night HSGS	.94341	-258.
3	2	0925	484.7	7535	27.27	51.88	.23354	.95646	-270.9	BM J306 @ Cr 17th and State	.94436	-258.
BASE * 4	USAF Sta.	0950	499.3				979.23498			BM H364		
5	2	1000	486.7	7535			.23373		-270.6			-258
6	1	1010	484.4	7536			.23352		-269.9			-257
BASE * 7	USAF Sta.	1030	498.8				979.23498					
8	2	1053	490.4	7535			.23416		-270.3			-258
9	3	1100	488.4	7536	32° 27.28'	105° 52.18'	979.23296	979.95648	-270.4		.94437	-258
10	4	1105	489.1	7537	27.28	52.48	.23403	.95648	-270.3		.94437	-258.
11	5	1109	487.4	7536	27.04	52.47	.23387	.95613	-270.2		.94402	-258.
12	6	1115	485.6	7536	26.84	52.47	.23369	.95584	-270.1		.94373	-257.
13	7	1118	487.5	7537	26.65	52.47	.23388	.95556	-269.5		.94346	-257.
14	8	1124	486.7	7536	26.43	52.46	.23381	.95524	-269.3		.94314	-257.
15	9	1136	483.3	7534	26.22	52.46	.23348	.95494	-269.5		.94283	-257.
16	10	1142	485.2	7533	25.99	52.46	.23367	.95461	-269.0		.94249	-255.
17	11	1147	484.4	7532	25.76	52.45	.23359	.95427	-268.8		.94216	-256.
18	12	1156	484.4	7536	27.04	52.18	.23360	.95613	-270.4		.94402	-258.
19	13	1200	483.8	7536	27.05	51.90	.23354	.95614	-270.5		.94404	-258.
20	14	1203	482.3	7536	26.82	51.90	.23340	.95581	-270.3		.94370	-258
21	1	1206	481.4	7536			.23331	.95552	-270.1	BG is Average of 3 BASE TIES		-258.
22	2	1212	486.9	7535			.23386	.95646	-270.6			-258.
23	15	1218	493.4	7538	27.74	51.90	.23452	.95715	-270.4		.94504	-258.
BASE * 24	USAF Sta.	1225	498.0				979.23498					
25	16	1320	492.9	7538	27.74	52.18	.23463	.95715	-270.3		.94504	-258
26	17	1326	487.7	7537	27.51	52.18	.23413	.95681	-270.5		.94471	-258.
27	18	1331	487.0	7536	27.50	51.90	.23407	.95680	-270.6		.94469	-258.
28	19	1334	488.9	7537	27.61	51.70	.23427	.95696	-270.5		.94485	-258.
29	20	1339	494.8	7538	27.87	51.70	.23488	.95734	-270.3		.94523	-258.
30	21	1343	494.8	7536	27.80	51.41	.23489	.95723	-270.3		.94513	-258.
31	22	1347	492.5	7536	27.58	51.40	.23467	.95691	-270.2		.94481	-258.

AMPAC EFFICIENCY LINE® 22-210

DATE: Sept. 3, 1981

AREA: ALAMOSA, COLO.

K = 0.099946 mg/00

	[1] STA.	[2] Time	[3] READ.	[4] ELEV.	[5] LAT.	[6] LONG.	[7] Gobs.	[8] Gtheo.	[9] B.G. mg	[10] REMARKS	[11] Gtheo (1967)	[12] NEW SIMPLE BG
1	23	1351	489.6	7534	37° 27.38'	105° 51.40'	979.23439	979.95662	-270.3		979.94452	-258.
2	24	1354	487.4	7534	27.21	51.40	.23418	.95638	-270.2		.94427	-258.
3	25	1358	486.9	7534	27.05	51.40	.23414	.95614	-270.0		.94404	-257.
4	26	1402	484.5	7534	27.05	51.61	.23392	.95614	-270.3		.94404	-258.
BASE * 5	2	1407	483.4	7535			979.23382	Gobs value average of 4 readings				-258.
6	27	1416	488.2	7536	27.33	51.10	.23427	.95655	-270.2		.94444	-258.
7	28	1420	487.3	7532	27.17	50.90	.23416	.95632	-270.3		.94421	-258
8	29	1424	486.8	7531	27.06	50.62	.23410	.95616	-270.3		.94405	-258.
9	30	1427	483.8	7532	26.83	50.60	.23379	.95583	-270.2		.94372	-258.
10	31	1430	483.4	7532	26.62	50.58	.23374	.95552	-269.9		.94341	-257.
11	32	1434	482.4	7533	26.43	50.38	.23363	.95524	-269.7		.94314	-257.
12	33	1439	480.1	7529	26.21	50.31	.23338	.95493	-269.9		.94281	-257.8
13	34	1442	482.2	7528	26.00	50.31	.23358	.95462	-269.4		.94251	-257.
14	35	1445	480.4	7527	25.79	50.30	.23339	.95432	-269.4		.94220	-257.
15	36	1458	485.0	7526	25.77	49.75	.23380	.95429	-269.0		.94218	-256.
16	37	1455	487.9	7526	25.78	49.21	.23410	.95430	-268.7		.94219	-256.
17	38	1504	488.8	7524	25.34	49.21	.23416	.95366	-268.1		.94155	-256
18	39	1507	490.6	7522	24.91	49.20	.23433	.95304	-267.5		.94092	-255.
19	40	1512	487.2	7525	24.48	49.20	.23397	.95242	-267.0		.94030	-254.
20	41	1518	488.5	7523	24.05	49.20	.23408	.95179	-266.4		.93967	-254.
21	42	1521	484.0	7524	23.57	49.20	.23362	.95110	-266.1		.93898	-254.
22	43	1526	477.7	7526	23.13	49.19	.23247	.95046	-266.0		.93834	-253.
BASE * 23	2	1555	487.2				979.23382					
24	44	1607	484.0	7531	25.39	52.45	.23348	.95374	-268.5		.94162	-256
25	45	1612	484.0	7533	24.91	52.44	.23347	.95304	-267.7		.94092	-255
26	46	1620	481.1	7535	24.47	52.43	.23317	.95240	-267.2		.94028	-255.
27	47	1625	479.6	7540	24.03	52.43	.23301	.95177	-266.4		.93964	-254.
28	48	1630	479.7	7538	23.58	52.42	.23301	.95111	-265.9		.93899	-253.
29	49	1634	485.6	7537	23.14	52.42	.23359	.95047	-264.7	Rain	.93835	-252.
30	50	1640	484.8	7540	22.70	52.47	.23350	.94984	-264.0		.93771	-251.
BASE * 31	2	1651	488.2	7535			979.23382					

AMPAD EFFICIENCY LINE® 22-210

DATE: 9/4/81

AREA: ALAMOSA, Colo.

K = 0.099946 mg/dd

GRS (HM) * NE

	1 STA	2 TIME	3 READ.	4 Elev.	5 LAT.	6 LONG.	7 Gobs.	8 Gthee.	9 BG	10 REMARKS	12 Gthee	13 SIMPLE BG
BASE * 1	2	0905	520.3		37°	105°	979.23382	979.			979.	
2	51	0915	519.8	7540	28.12	50.95	.23575	.95770	-269.6		.94559	-257.
3	52	0928	521.5	7533	27.74	49.98	.23590	.95715	-269.3		.94504	-257.
4	53	0934	529.4	7533	28.18	50.22	.23668	.95778	-269.2		.94568	-257.
5	54	0937	526.9	7534	27.97	50.22	.23643	.95748	-269.1		.94538	-257.
6	55	0943	526.9	7532	27.90	49.67	.23642	.95738	-269.1		.94527	-257.
7	56	0947	526.5	7534	27.84	49.23	.23637	.95729	-269.0		.94519	-256.
8	57	0953	535.0	7535	28.17	49.23	.23721	.95777	-268.5	REPORTED EARTHQUAKE	.94567	-256.
9	58	0959	552.4	7536	28.62	49.22	.23894	.95842	-267.4	5.8 Magnitude	.94632	-255.
10	59	1015	557.2	7535	28.85	49.22	.23939	.95876	-267.3		.94666	-255.
11	60	1020	557.2	7534	28.72	49.01	.23938	.95857	-267.2	LA. AREA	.94647	-255.
12	61	1024	555.8	7531	28.61	48.87	.23924	.95841	-267.4	shakey readings	.94631	-255.
13	62	1028	555.8	7531	28.61	48.62	.23923	.95841	-267.4		.94631	-255.
14	63	1032	557.3	7532	28.61	48.37	.23937	.95841	-267.2		.94631	-255.
15	64	1035	561.7	7531	28.61	48.15	.23981	.95841	-266.8		.94631	-254.
16	65	1040	564.7	7531	28.61	47.92	.24010	.95841	-266.5		.94631	-254.
BASE * 17	2	1100	502.2				979.23382					
18	66	1113	548.5	7530	28.18	48.15	.23845	.95778	-267.6		.94568	-255.
19	67	1117	539.2	7529	27.96	48.15	.23752	.95747	-268.3		.94536	-256.
20	68	1123	531.7	7530	27.75	48.14	.23677	.95716	-268.7		.94506	-256.
21	69	1128	524.2	7528	27.53	48.14	.23602	.95684	-269.2		.94473	-257.
22	70	1132	517.2	7529	27.31	48.14	.23532	.95652	-269.5		.94441	-257.
23	71	1136	512.8	7527	27.10	48.13	.23488	.95622	-269.8		.94411	-257.
24	72	1140	510.8	7525	26.87	48.13	.23468	.95588	-269.8		.94378	-257.
25	73	1144	510.6	7525	26.66	48.13	.23466	.95558	-269.5		.94347	-257.
26	74	1148	508.3	7524	26.44	48.12	.23443	.95526	-269.5		.94315	-257.
27	75	1154	504.8	7524	26.66	47.58	.23407	.95558	-270.1		.94347	-258.
28	76	1158	503.3	7523	26.67	47.03	.23392	.95559	-270.4		.94348	-258.
29	77	1207	501.1	7527	27.72	47.87	.23370	.95712	-271.9		.94501	-259.
30	78	1211	526.0	7526	27.69	47.60	.23619	.95707	-269.4		.94497	-257.
31	79	1215	519.3	7526	27.66	47.33	.23552	.95703	-270.0		.94492	-257.

AMPAD EFFICIENCY LINE # 22-210

DATE : 9/4/81

AREA : ALAMOSA, COLO.

K = 0.099946 mg/oo

Pg. 4

	1 STA.	2 TIME	3 READ.	4 Elev.	5 LAT.	6 LONG.	7 Gobs.	8 Gtheo.	9 BG.	10	REMARKS	12 G theo (1967)	13 BG simple
1	80	1218	514.4	7525	37° 27.65'	105° 47.06	979.23503	979.95702	-270.6			979.94491	-258.
2	81	1223	527.2	7527	27.98	47.06	.23631	.95750	-269.6			.94539	-257.
3	82	1228	532.7	7529	28.19	47.06	.23686	.95780	-269.3			.94569	-257.
BASE * 4	2	1242	502.3				979.23382						
BASE * 5	2	1338	501.4				979.23382						
6	83	1350	521.9	7544	28.28	52.43	.23590	.95793	-269.5			.94583	-257.
7	84	1355	520.6	7544	28.28	52.18	.23579	.95793	-269.6			.94583	-257.
8	85	1359	517.7	7544	28.28	51.90	.23551	.95793	-269.9			.94583	-257.
9	86	1404	524.9	7543	28.45	51.87	.23624	.95818	-269.4			.94609	-257.
10	87	1407	531.1	7539	28.61	51.96	.23687	.95841	-269.3			.94631	-257.
11	88	1411	538.1	7540	28.81	52.00	.23758	.95870	-268.8			.94660	-256.
12	89	1413	537.2	7540	29.00	52.18	.23750	.95898	-269.2			.94687	-257.
13	90	1417	545.4	7544	29.30	52.18	.23833	.95941	-268.5			.94731	-256.
14	91	1420	543.7	7542	29.26	51.84	.23816	.95935	-268.7			.94725	-256.
15	92	1425	546.6	7543	29.27	51.42	.23847	.95937	-268.4			.94727	-256.
16	93	1429	542.3	7541	29.00	51.41	.23805	.95898	-268.5			.94687	-256.
17	94	1432	537.3	7540	28.81	51.41	.23758	.95870	-268.8			.94660	-256.
18	95	1438	529.2	7540	28.60	51.42	.23677	.95840	-269.3			.94629	-257.
19	96	1449	547.0	7529	28.62	47.06	.23857	.95842	-268.2			.94632	-256.
20	97	1453	555.0	7527	28.85	47.06	.23939	.95876	-267.8			.94666	-255.
21	98	1457	561.6	7527	29.06	47.06	.24006	.95906	-267.5			.94696	-255.
22	99	1501	569.6	7527	29.29	47.06	.24087	.95940	-267.0			.94730	-254.
23	100	1504	578.4	7528	29.29	47.33	.24175	.95940	-266.0			.94730	-253.
24	101	1507	584.2	7529	29.28	47.60	.24234	.95938	-265.4			.94728	-253.
25	102	1512	585.6	7531	29.28	47.87	.24250	.95938	-265.1			.94728	-253.
26	103	1515	584.2	7531	29.28	48.14	.24236	.95938	-265.2			.94728	-253.
27	104	1518	580.3	7532	29.27	48.41	.24198	.95937	-265.5			.94727	-253.
28	105	1522	580.3	7533	29.27	48.68	.24199	.95937	-265.5			.94727	-253.
29	106	1525	579.3	7534	29.27	48.95	.24190	.95937	-265.5			.94727	-253.
30	107	1528	577.6	7534	29.27	49.23	.24174	.95937	-265.7			.94727	-253.
31	108	1533	567.1	7534	29.05	49.22	.24071	.95905	-266.4			.94695	-254.
BASE *	2	1544	497.9				979.23382						

AMPAD EFFICIENCY LINE® 22-210

DATE: 9/4/81 Pg. 5

AREA: Alamosa, Co/O.

K = 0.099946 mg/100

	1 Sta.	2 TIME	3 READ.	4 Elev.	5 Lat.	6 Long.	7 Gobs.	8 Gtheo.	9 BG	10	11 Remarks	12 CRS (1967) Gtheo	13 New SIMPLE BG
1	109	1600	540.7	7537	37°28.83'	105°51.00'	979.23811	979.95873	-268.5			979.94663	-256.
2	110	1607	532.8	7537	28.61	50.98	.23732	.95841	-268.9			.94631	-256.
3	111	1612	542.7	7535	28.84	50.67	.23832	.95874	-268.4			.94664	-256.
4	112	1622	550.7	7540	29.28	51.05	.23912	.95938	-267.9			.94728	-255.
5	113	1626	557.7	7539	29.27	50.72	.23983	.95937	-267.3			.94727	-255.
6	114	1631	563.8	7538	29.27	50.32	.24044	.95937	-266.7			.94727	-254.
7	115	1634	569.3	7535	29.27	49.98	.24099	.95937	-266.4			.94727	-254.
8	116	1637	572.8	7535	29.27	49.64	.24134	.95937	-266.0			.94727	-253.
9	117	1643	592.7	7534	29.56	49.23	.24334	.95979	-264.5			.94769	-252.
10	118	1649	604.6	7534	29.86	49.23	.24453	.96022	-263.7			.94813	-251.
11	119	1705	549.8	7544	29.71	51.41	.23906	.96001	-268.4			.94791	-256.
12	120	1713	545.9	7542	29.47	51.41	.23868	.95966	-268.5			.94756	-256.
BASE * 13	2	1724	497.2				979.23382						
14													
15													
16													
17													
18													
19													
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22													
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AMPAD · EFFICIENCY LINE® 22-210

DATE: 9/5/81 Pg. 6

AREA: Alamosa, Co/o.

K = 0.099946 mg/100

	1 STA.	2 TIME	3 READ.	4 Elev.	5 LAT.	6 LONG	7 Gobs.	8 Gthco.	9 BG.	10	11 REMARKS	GRS (1967) 12 Gthco	13 SIMPLE BG
BASE * 1	2	0849	500.3		37°	105°	979.23382	979.				979.	
2	121	0855	509.0	7538	27.74'	52.50'	.23466	.95715	-270.3			.94504	-258
3	122	0906	507.2	7538	27.50	52.53	.23443	.95680	-270.2			.94469	-258.
4	123	0910	507.3	7538	27.22	52.68	.23442	.95639	-269.8			.94428	-257.
5	124	0915	507.1	7538	26.97	52.82	.23438	.95603	-269.4			.94392	-257.
6	125	0918	510.8	7539	26.66	52.98	.23473	.95558	-268.6			.94347	-256.
7	126	0921	510.8	7539	26.66	53.25	.23472	.95558	-268.6			.94347	-256.
8	127	0925	514.5	7540	26.65	53.58	.23507	.95556	-268.2			.94346	-256.
9	128	0933	508.8	7539	27.51	52.75	.23446	.95681	-270.1			.94471	-258
10	129	0938	508.8	7539	27.51	53.03	.23444	.95681	-270.1			.94471	-258.
11	130	0941	513.8	7540	27.51	53.34	.23493	.95681	-269.6			.94471	-257.
12	131	0945	515.8	7542	27.51	53.60	.23511	.95681	-269.3			.94471	-257.
13	132	0951	515.8	7544	27.70	53.60	.23508	.95709	-269.4			.94498	-257.
14	133	0954	520.0	7546	27.88	53.60	.23548	.95735	-269.2			.94524	-257.
15	134	0958	527.0	7546	28.07	53.60	.23617	.95763	-268.8			.94552	-256.
16	135	1002	531.0	7544	28.28	53.60	.23655	.95793	-268.8			.94583	-256.
17	136	1006	522.6	7544	27.89	53.30	.23569	.95736	-269.1			.94526	-257.
18	137	1009	519.4	7540	27.89	53.00	.23535	.95736	-269.7			.94526	-257.
19	138	1013	518.7	7538	27.89	52.79	.23527	.95736	-269.9			.94526	-257.
BASE * 20	2	1040	505.5				979.23382						
21	139	1050	530.2	7542	28.38	52.77	.23630	.95808	-269.3			.94597	-257.
22	140	1055	537.9	7544	28.53	53.18	.23707	.95829	-268.7			.94619	-256.
23	141	1100	538.9	7543	28.66	53.10	.23717	.95848	-268.8			.94638	-256.
24	142	1103	541.8	7543	28.73	52.77	.23746	.95858	-268.6			.94648	-256.
25	143	1107	547.4	7543	28.95	52.95	.23803	.95890	-268.4			.94680	-256.
26	144	1112	547.0	7544	28.81	53.25	.23799	.95870	-268.1			.94660	-256.
27	145	1116	548.5	7546	28.80	53.58	.23814	.95868	-267.9			.94658	-255.
28	146	1122	548.5	7548	28.81	54.69	.23815	.95870	-267.7			.94660	-255.
29	147	1125	547.8	7552	28.81	54.97	.23808	.95870	-267.6			.94660	-255.
30	148	1129	545.1	7554	28.81	55.24	.23781	.95870	-267.7			.94660	-255
31	149	1133	543.1	7556	28.82	55.52	.23761	.95871	-267.8			.94661	-255.
	150	1135	541.1	7557	28.82	55.80	.23742	.95871	-267.9			.94661	-255.

AMPAD EFFICIENCY LINE® 22-210

DATE: 9/5/81

AREA: Alamosa, Co/o-

K = 0.099946 mg/oo

	1 STA.	2 TIME	3 READ.	4 Elev.	5 LAT.	6 LONG:	7 Gobs.	8 Gtheo.	9 BG	10	REMARKS	GRS (1967) 12 Gtheo	NEW SIMPLE 13 BG
1	151	1140	549.2	7557	37° 29.03'	105° 55.80'	.23823	979.95902	-267.4			979.94692	-255
2	152	1145	553.9	7558	29.25	55.80	.23870	.95934	-267.2			.94724	-255
3	153	1151	549.0	7561	29.25	56.34	.23822	.95934	-267.6			.94724	-255
4	154	1156	537.0	7562	29.25	56.87	.23702	.95934	-268.7			.94724	-256
5	155	1202	546.0	7563	29.52	56.88	.23792	.95973	-268.1		RAIN!	.94763	-256
BASE * 6	2	1250	504.6				979.23382						
BASE * 7	2	1457	504.0				979.23382						
8	156	1512	536.0	7555	28.39	54.69	.23700	.95808	-267.9			.94599	-255
9	157	1517	537.8	7550	28.38	54.35	.23717	.95808	-268.0			.94597	-255
10	158	1520	535.5	7552	28.38	54.02	.23694	.95808	-268.1			.94597	-256
11	159	1525	535.2	7561	28.38	54.95	.23690	.95808	-267.6			.94597	-255
12	160	1529	533.1	7551	28.38	55.25	.23668	.95808	-268.4			.94597	-256
13	161	1532	532.5	7552	28.38	55.52	.23662	.95808	-268.4			.94597	-256
14	162	1536	525.2	7554	28.39	55.79	.23589	.95809	-269.0			.94599	-256
15	163	1539	534.5	7554	28.60	55.79	.23681	.95840	-268.4			.94629	-256
16	164	1543	520.4	7555	28.17	55.78	.23540	.95777	-269.1			.94567	-257
17	165	1550	516.0	7553	27.95	55.78	.23495	.95745	-269.4			.94535	-257
18	166	1553	512.4	7551	27.73	55.77	.23458	.95713	-269.6			.94503	-257
19	167	1556	506.6	7552	27.50	55.77	.23400	.95680	-269.8			.94469	-257
20	168	1602	505.8	7552	27.28	55.76	.23391	.95648	-269.5			.94437	-257
21	169	1605	499.5	7552	27.10	55.76	.23328	.95622	-269.9			.94411	-257
22	170	1608	488.8	7563	26.87	55.76	.23220	.95588	-270.0			.94378	-257
23	171	1612	493.6	7555	26.68	55.75	.23268	.95561	-269.7			.94350	-257
24	172	1618	493.6	7546	26.24	55.68	.23267	.95497	-269.6			.94286	-257
25	173	1622	486.2	7553	25.80	55.68	.23193	.95433	-269.3			.94222	-257
26	174	1625	486.2	7549	25.80	55.13	.23192	.95433	-269.5			.94222	-257
27	175	1628	496.3	7543	25.79	54.65	.23293	.95432	-268.9			.94220	-256
28	176	1632	501.4	7539	25.79	54.07	.23343	.95432	-268.6			.94220	-256
29	177	1636	505.5	7536	25.78	53.55	.23384	.95430	-268.4			.94219	-256
30	178	1640	505.5	7533	25.77	53.00	.23383	.95429	-268.6			.94218	-256
BASE * 31	2	1647	505.5				979.23382						
	179	1658	513.3	7542	27.50	53.87	.23460	.95680	-269.8			.94469	-257

AMPAD · EFFICIENCY LINE® 22-210

DATE: 9/5/81

AREA: ALAMOSA, Colo.

K = 0.099946 mgl/00

	1 STA.	2 Time	3 READ.	4 Elev.	5 LAT.	6 LONG.	7 Gobs.	8 Gthco.	9 BG	10	11 REMARKS	12 Gthco GRS (1967)	13 Simpl. BG
1	180	1703	514.7	7544	37° 27.50	105°54.13'	.23475	979.95680	-269.5			979.94469	-257
2	181	1706	514.1	7546	27.50	54.40	.23469	.95680	-269.4			.94469	-257
3	182	1710	511.2	7548	27.50	54.67	.23440	.95680	-269.6			.94469	-257.
4	183	1713	510.9	7548	27.50	54.96	.23437	.95680	-269.6			.94469	-257.
5	184	1717	506.8	7552	27.50	55.23	.23396	.95680	-269.8			.94469	-257.
6	185	1720	509.8	7551	27.50	55.50	.23427	.95680	-269.5			.94469	-257.
BASE #7	2	1730	505.3				979.23382						
8													
9													
10													
11													
12													
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AMPAD EFFICIENCY LINE® 22-210

DATE: 9/6/81

AREA: ALAMOSA, Colo.

K = 0.099946 mg/OD

	1 STA.	2 TIME	3 READ.	4 Elev.	5 LAT.	6 LONG.	7 Gobs.	8 Gtheo.	9 BG	10	11 REMARKS	12 Gtheo (1967) & new	13 SIMPLR BG
BASE #1	2	1226	515.5		37°	105°	979.23382	979.				979.	
2	1822	1241	652.5	7531	28.67'	47.06'	.23749	.95850	-269.2	RCH's station		.94639	-257.
3	186	1245	534.8	7527	28.42	46.52	.23572	.95813	-270.9			.94603	-258.
4	187	1249	511.9	7528	28.43	45.97	.23342	.95815	-273.1			.94605	-261.
5	188	1254	486.3	7526	28.44	45.41	.23085	.95816	-275.8	Heavy Traffic		.94606	-263.
6	189	1259	466.8	7526	28.45	44.87	.22890	.95818	-277.8	along Hiway		.94607	-265.
7	190	1303	447.4	7534	28.47	44.33	.22695	.95821	-279.3			.94610	-267.
8	191	1306	432.9	7535	28.48	43.76	.22549	.95822	-280.1			.94612	-268.
9	192	1310	417.9	7538	28.48	43.22	.22399	.95822	-281.4			.94612	-269.
10	193	1313	396.3	7553	28.48	42.67	.22182	.95822	-284.5			.94612	-271.
11	194	1322	422.5	7524	29.32	44.87	.22992	.95944	-278.1			.94734	-266
12	195	1327	502.2	7525	29.30	45.45	.23238	.95941	-275.6			.94731	-263.
13	196	1330	530.5	7524	29.30	45.97	.23521	.95941	-272.8			.94731	-260
14	197	1335	559.5	7524	29.30	46.52	.23810	.95941	-269.9			.94731	-257.
15	198	1340	592.8	7528	29.72	47.05	.24142	.96002	-267.0			.94792	-254.
16	199	1343	596.1	7533	30.17	47.05'	.24174	.96067	-267.0			.94858	-254.
17	200	1347	600.6	7531	30.61	47.05	.24218	.96131	-267.3			.94922	-255.
18	201	1354	612.5	7531	30.17	47.31	.24336	.96067	-265.5			.94858	-253.
19	202	1358	622.0	7531	30.17	47.58	.24439	.96067	-264.5			.94858	-252.
20	203	1400	626.3	7532	30.16	47.87	.24473	.96066	-264.1			.94856	-252.
21	204	1407	628.3	7533	30.16	48.16	.24492	.96066	-263.8			.94856	-251.
22	205	1411	630.1	7533	30.16	48.42	.24509	.96066	-263.7			.94856	-251.
23	206	1414	630.1	7534	30.16	48.69	.24509	.96066	-263.6			.94856	-251.
24	207	1418	631.2	7536	30.16	48.96	.24519	.96066	-263.4			.94856	-251.
25	208	1421	627.4	7537	30.16	49.24	.24480	.96066	-263.7			.94856	-251.
26	209	1425	623.7	7537	30.60	49.24	.24443	.96130	-264.7			.94920	-252
27	210	1430	621.5	7538	30.16	49.50	.24420	.96066	-264.2			.94856	-252
28	211	1435	614.0	7538	30.16	49.76	.24344	.96066	-265.0			.94856	-252
29	212	1438	606.7	7539	30.16	50.04	.24271	.96066	-265.7			.94856	-253
30	213	1441	598.5	7539	30.16	50.32	.24188	.96066	-266.5			.94856	-254.
31	214	1446	595.9	7539	30.15	50.60	.24161	.96064	-266.8			.94855	-254.
	215	1447	591.9	7542	30.15	50.87	.24121	.96064	-267.0			.94855	-254.

AMPAC EFFICIENCY LINE® 22-210

DATE: 9/6/81

AREA: ALAMOSA, COLO.

K = 0.099946 mg/100

B. 10

	1 STA.	2 TIME	3 READ	4 Elev.	5 LAT.	6 LONG.	7 Gobs.	8 Gtheo	9 BG	10 REMARKS		GRS(All) 12 Gtheo	New 13 SIMPLE BG
1	216	1451	587.2	7542	37° 30.15'	105° 51.16'	.24073	979.96064	-267.9			979.94855	-255.
2	217	1455	581.0	7546	30.15	51.41	.24011	.96064	-267.8			.94855	-255.
BASE #3	2	1507	518.3				979.23382						
4	218	1523	587.7	7546	30.59	51.42	.24079	.96128	-267.8			.94919	-255.
5	219	1530	593.0	7546	31.01	51.43	.24134	.96189	-267.9			.94980	-255.
6	220	1534	602.7	7543	31.02	50.87	.24232	.96191	-267.1			.94981	-255.
7	221	1538	609.7	7542	31.02	50.33	.24303	.96191	-266.4			.94981	-254.
8	222	1542	618.8	7540	31.02	49.79	.24395	.96191	-265.6			.94981	-253
9	223	1545	628.7	7539	31.02	49.25	.24494	.96191	-264.7			.94981	-252.
10	224	1550	636.6	7536	31.03	48.69	.24575	.96192	-264.1			.94983	-252
11	225	1554	639.7	7533	31.03	48.15	.24606	.96192	-263.9			.94983	-251.
12	226	1558	634.6	7531	31.03	47.60	.24556	.96192	-264.6			.94983	-252.
13	227	1602	606.2	7531	31.04	47.05	.24274	.96194	-267.4			.94984	-255.
14	228	1607	581.7	7526	31.04	46.50	.24030	.96194	-270.1			.94984	-258.
15	229	1610	551.2	7529	31.04	45.94	.23726	.96194	-273.0			.94984	-260.
16	230	1614	528.8	7526	31.05	45.40	.23503	.96195	-275.4			.94986	-263.
17	231	1618	555.5	7524	31.47	45.95	.23771	.96256	-273.5			.95047	-261.
18	232	1623	562.3	7526	31.90	45.96	.23840	.96318	-273.3			.95109	-261.
19	233	1627	570.0	7527	32.33	45.98	.23918	.96381	-273.1			.95172	-261.
20	234	1631	577.1	7527	32.77	46.00	.23990	.96445	-273.0			.95236	-260
21	235	1635	538.9	7529	32.78	45.38	.23609	.96446	-276.7			.95238	-264.
22	236	1641	612.5	7529	32.77	46.55	.24346	.96445	-269.3			.95236	-257.
23	237	1645	642.3	7533	32.76	47.09	.24645	.96443	-266.1			.95235	-254
24	238	1650	665.4	7533	32.77	47.66	.24877	.96445	-263.8			.95236	-251.
25	239	1653	667.4	7537	32.77	48.19	.24897	.96445	-263.3			.95236	-251.
26	240	1657	667.4	7537	32.78	48.74	.24898	.96446	-263.3			.95238	-251.
27	241	1700	661.9	7539	32.77	49.28	.24844	.96445	-263.7			.95236	-251.
28	242	1704	658.0	7541	32.77	49.82	.24806	.96445	-264.0			.95238	-251.
29	243	1708	646.3	7543	32.76	50.35	.24690	.96443	-265.0			.95235	-252.
30	244	1712	636.5	7543	32.33	50.35	.24593	.96381	-265.4			.95172	-253
31	245	1716	623.9	7543	31.90	50.35	.24468	.96318	-266.0			.95109	-253.
	246	1721	614.0	7541	31.46	50.33	.24370	.96255	-266.5			.95045	-254

AMPAG · EFFICIENCY LINE® 22-210

DATE: 9/7 - 9/8/81 Pg. 11

AREA: ALAMOSA, COLO.

K = 0.099946 mg/oo

	1 STA.	2 TIME	3 READ.	4 Elev.	5 LAT.	6 LONG.	7 Gobs.	8 Gtheo.	9 BG	10 REMARKS	GRS (1967) 12 Gtheo	13 Simple BG
1	247	1727	631.4	7534	37 31.46'	105° 49.25'	979.24545	979.96255	-265.1		979.95045	-253
2	248	1731	638.7	7538	31.91	49.26	.24619	.96320	-264.8		.95111	-252.
3	249	1735	649.3	7539	32.34	49.28	.24726	.96382	-2643		.95174	-252
4	250	1741	634.0	7544	32.77	50.90	.24575	.96445	-266.1		.95236	-254.
5	251	1746	622.7	7549	32.77	51.44	.24463	.96445	-266.9		.95236	-254.
6	252	1750	613.7	7549	32.34	51.45	.24374	.96382	-267.2		.95174	-255.
7	253	1753	604.2	7548	31.90	51.45	.24280	.96318	-267.6		.95109	-255
8	254	1757	594.2	7549	31.46	51.45	.24181	.96255	-267.9		.95045	-255
BASE * 9	2	1813	513.9				979.23382					
BASE * 10	2	0926	516.2				979.23382			9/8/81		
11	255	0944	562.3	7554	29.25	54.69	.23892	.95934	-267.2		.94724	-253
12	256	0947	572.8	7552	29.47	54.69	.23947	.95966	-267.1		.94756	-255
13	257	0951	577.0	7554	29.67	54.68	.23988	.95995	-266.9		.94785	-254.
14	258	0954	582.5	7552	29.89	54.68	.24043	.96027	-266.8		.94817	-254.
15	259	0958	591.9	7552	30.13	54.68	.24137	.96062	-266.2		.94852	-254.
16	260	1002	581.4	7557	29.69	55.77	.24032	.95998	-266.3		.94788	-254.
17	261	1011	586.2	7559	29.96	55.76	.24079	.96037	-266.1		.94827	-254.
18	262	1022	571.4	7567	30.13	56.87	.23931	.96062	-267.4		.94852	-255.
19	263	1026	579.3	7567	30.56	56.87	.24010	.96124	-267.2		.94914	-255
20	264	1030	585.6	7568	31.00	56.88	.24072	.96188	-267.1		.94979	-255.
21	265	1035	588.2	7572	31.56	57.05	.24098	.96269	-267.5		.95060	-255.
22	266	1044	584.7	7573	31.87	57.33	.24063	.96314	-268.2		.95105	-256.
23	267	1049	575.3	7576	31.86	57.89	.23969	.96313	-268.9		.95104	-256.
24	268	1054	566.5	7577	31.43	57.92	.23880	.96250	-269.1		.95041	-257.
25	269	1058	560.1	7574	31.00	57.91	.23816	.96188	-269.3		.94979	-257.
26	270	1103	559.7	7581	31.85	58.43	.23812	.96311	-270.2		.95102	-258
27	271	1106	546.2	7585	31.85	59.00	.23677	.96311	-271.3		.95102	-259.
28	272	1110	542.9	7582	31.41	59.00	.23644	.96247	-271.2		.95038	-259.
BASE * 29	2	1126	516.8				979.23382					
30	273	1146	564.0	7544	29.45	52.47	.23852	.95963	-268.5		.94753	-256.
31	274	1151	571.7	7546	29.68	52.65	.23928	.95996	-268.0		.94786	-255.
	275	1154	575.3	7548	29.91	52.77	.23964	.96030	-267.8		.94820	-255.

AMPAD · EFFICIENCY LINE® 22-210

DATE: 9/8/81

AREA: ALAMOSA, COLO.

K = 0.099946 mg/DD

	1 STA.	2 TIME	3 READ.	4 Elev.	5 LAT.	6 LONG.	Gobs.	Gtheo.	9 BG	10 REMARKS		CRS (1967) Gtheo	NE. SIMPLE 13 BG
1	276	1207	577.7	7549	37°30.14'	105°52.80'	979.23986	979.96063	-267.9			979.94853	-255
2	277	1212	590.7	7549	30.57	52.80	.24116	.96125	-267.2			.94915	-255
3	278	1217	608.3	7552	30.57	53.63	.24291	.96125	-265.3			.94915	-253
4	279	1221	614.1	7553	31.00	53.64	.24349	.96188	-265.3			.94979	-253
5	280	1225	604.0	7550	31.00	53.07	.24247	.96188	-266.5			.94979	-254
6	281	1231	595.5	7548	31.01	52.51	.24162	.96189	-267.5			.94980	-255
7	282	1235	605.8	7549	31.44	52.52	.24264	.96252	-267.0			.95042	-254
8	283	1239	612.4	7549	31.88	52.52	.24330	.96316	-267.0			.95107	-254
9	284	1243	616.9	7551	32.32	52.52	.24374	.96380	-267.1			.95171	-255
10	285	1248	616.9	7552	32.75	52.53	.24374	.96442	-267.6			.95233	-255
11	286	1252	621.8	7554	32.74	53.10	.24422	.96441	-267.0			.95232	-254
12	287	1255	621.8	7555	32.68	53.64	.24422	.96432	-266.9			.95223	-254
13	288	1259	624.1	7556	32.28	53.64	.24444	.96374	-266.0			.95165	-253
14	289	1302	622.3	7555	31.87	53.65	.24426	.96314	-265.6			.95105	-253
15	290	1306	619.5	7554	31.44	53.64	.24398	.96252	-265.4			.95042	-253
BASE * 16	2	1327	518.1				979.23382						
17	291	1343	617.4	7553	31.00	54.17	.24376	.96188	-265.0			.94979	-252
18	292	1347	617.4	7556	31.00	54.70	.24376	.96188	-264.8			.94979	-252
19	293	1351	626.8	7556	31.42	54.70	.24470	.96249	-264.5			.95040	-252
20	294	1354	626.8	7560	31.85	54.71	.24470	.96311	-264.9			.95102	-252
21	295	1358	626.8	7562	31.84	55.17	.24471	.96310	-264.7			.95101	-252
22	296	1403	618.8	7565	31.82	55.71	.24391	.96307	-265.3			.95098	-253
23	297	1406	616.0	7566	32.27	55.70	.24363	.96372	-266.2			.95163	-254
24	298	1409	612.8	7566	32.71	55.70	.24332	.96436	-267.1			.95227	-255
25	299	1412	616.2	7565	33.14	55.70	.24366	.96499	-267.5			.95290	-255
26	300	1415	616.2	7568	33.58	55.70	.24366	.96562	-267.9			.95354	-255
27	301	1421	627.9	7561	33.60	53.63	.24483	.96565	-267.2			.95357	-255
28	302	1424	623.0	7558	33.17	53.64	.24435	.96503	-267.3			.95294	-255
BASE * 29	2	1500	517.4				979.23382						
30	303	1511	512.8	7556	27.51	56.32	.23340	.95681	-270.1			.94471	-258
31	304	1516	503.9	7557	27.52	56.87	.23251	.95683	-271.0			.94472	-258
	305	1519	496.5	7558	27.52	57.35	.23181	.95683	-271.6			.94472	-259.5

AMPAD EFFICIENCY LINE® 22-210

DATE: 9/8/81

AREA: ALAMOSA, COLO.

K = 0.099946 mgl/00

	[1] STA.	[2] TIME	[3] READ.	[4] Elev.	[5] LAT.	[6] LONG.	[7] Gobs.	[8] Gtheo	[9] BG	[10] REMARKS		GRS (1967) Gtheo.	new SIMPLE BG
1	306	1523	486.2	7562	32° 27.52	105° 57.89	979.23089	979.95683	-272.4			979.94472	-260.
2	307	1527	476.7	7567	27.52	58.44	.22986	.95683	-273.0			.94472	-260.
3	308	1530	458.8	7570	27.52	59.01	.22808	.95683	-274.6			.94472	-262.
4	309	1534	453.9	7569	27.52	59.55	.22761	.95683	-275.1			.94472	-263.
5	310	1545	488.5	7553	25.80	56.22	.23111	.95433	-270.1			.94222	-258.
6	311	1549	485.0	7561	25.80	56.78	.23077	.95433	-270.0			.94222	-257.
7	312	1552	476.2	7564	25.79	57.32	.22991	.95432	-270.6			.94220	-258.
8	313	1556	466.3	7568	25.78	57.89	.22893	.95430	-271.4			.94219	-259.
9	314	1559	453.9	7567	25.78	58.45	.22770	.95430	-272.6			.94219	-260.
10	315	1603	443.1	7571	25.78	59.02	.22664	.95430	-273.5			.94219	-261.4
11	316	1607	431.9	7578	25.77	59.58	.22554	.95429	-274.1			.94218	-262.
12	317	1615	425.6	7576	24.00	59.00	.22494	.95172	-272.3			.93960	-260.
13	318	1620	453.6	7568	24.00	57.90	.22776	.95172	-269.9			.93960	-257.
14	319	1624	471.0	7561	24.00	56.78	.22951	.95172	-268.6			.93960	-256.
15	320	1629	475.3	7555	24.02	55.70	.22996	.95175	-268.6			.93963	-256
16	321	1633	484.2	7551	24.02	5464	.23087	.95175	-267.9			.93963	-255.
17	322	1637	497.9	7545	24.23	53.52	.23225	.95205	-267.2			.93994	-255.
BASE * 18	2	1650	513.1				979.23382						
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													

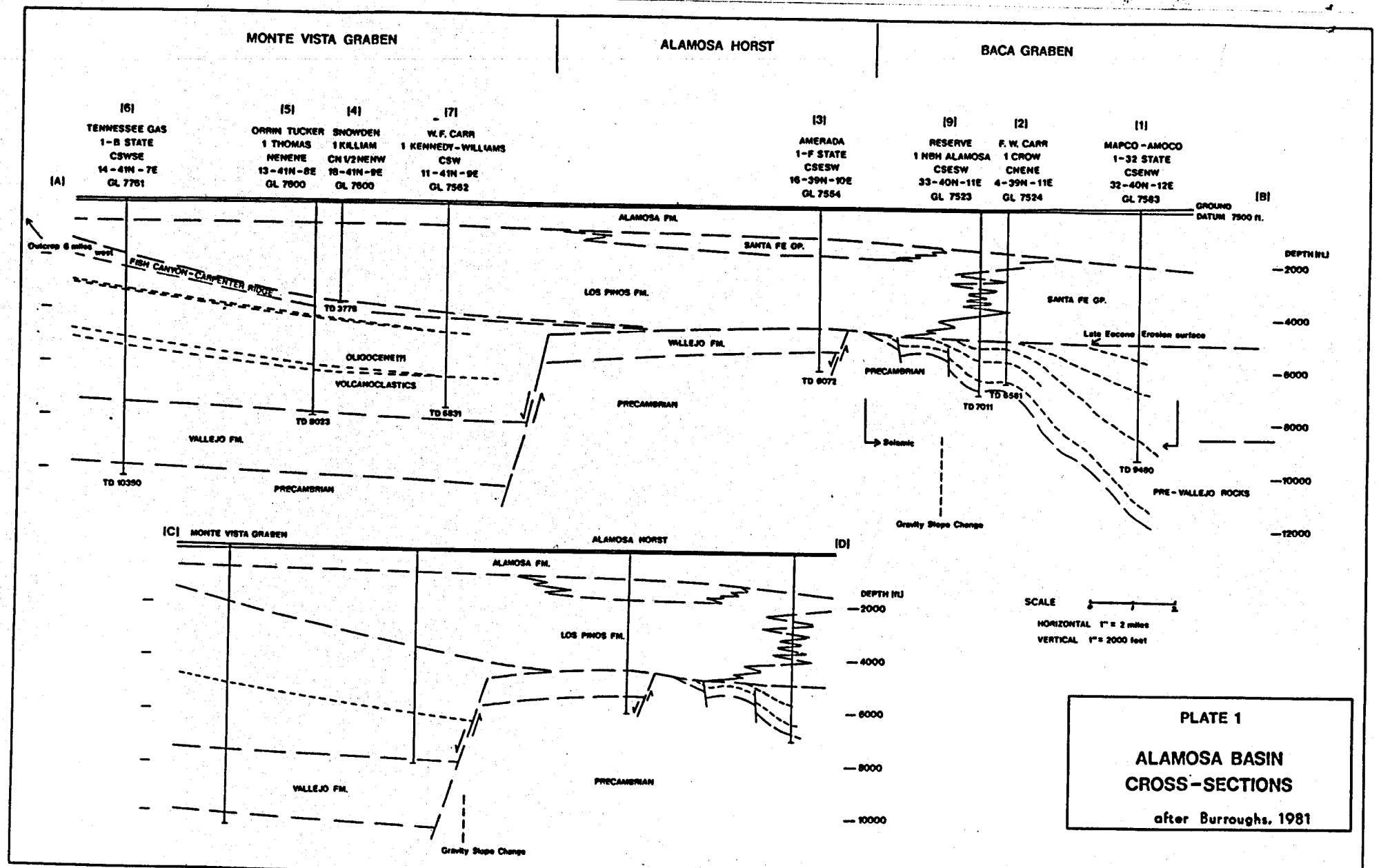
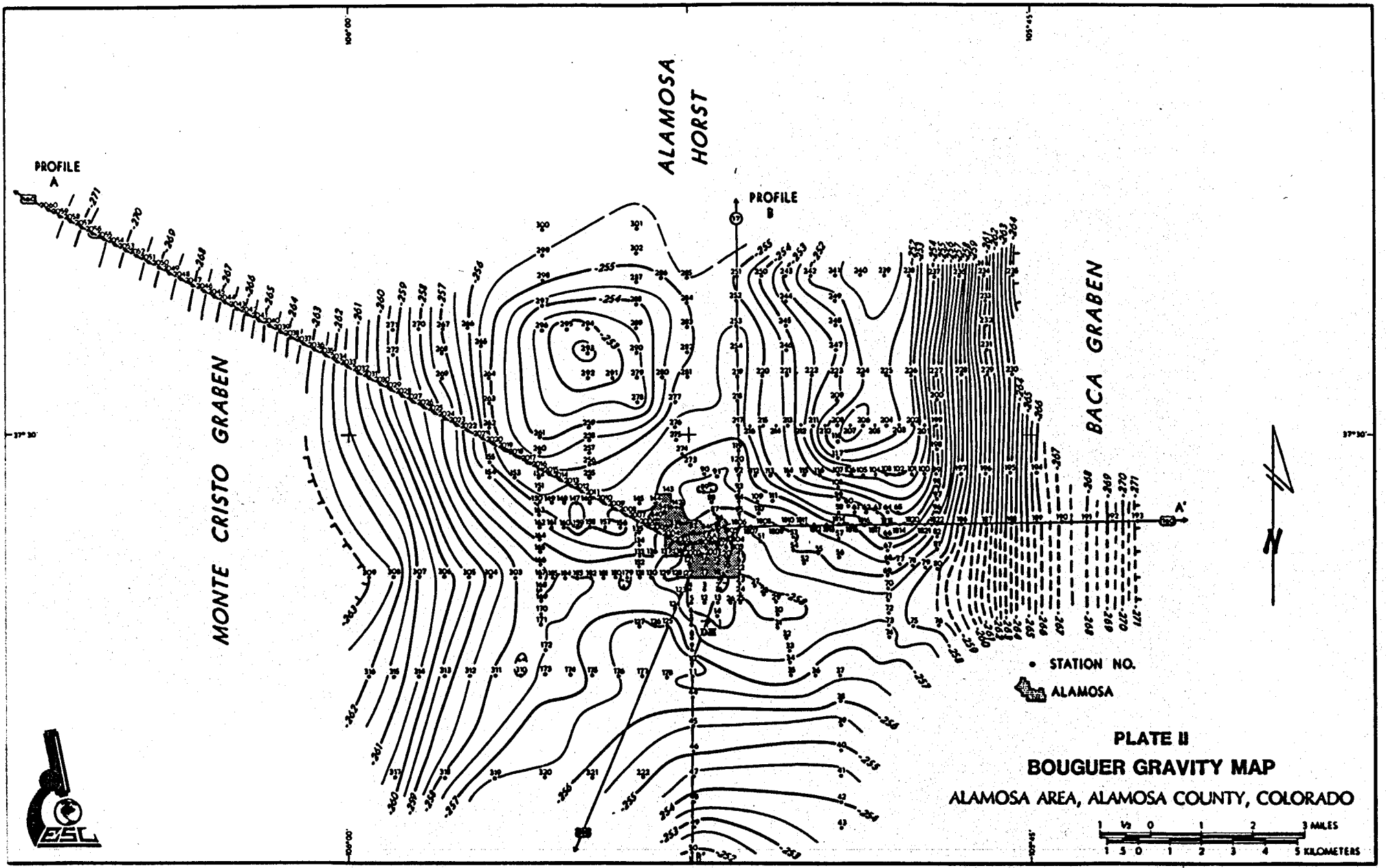
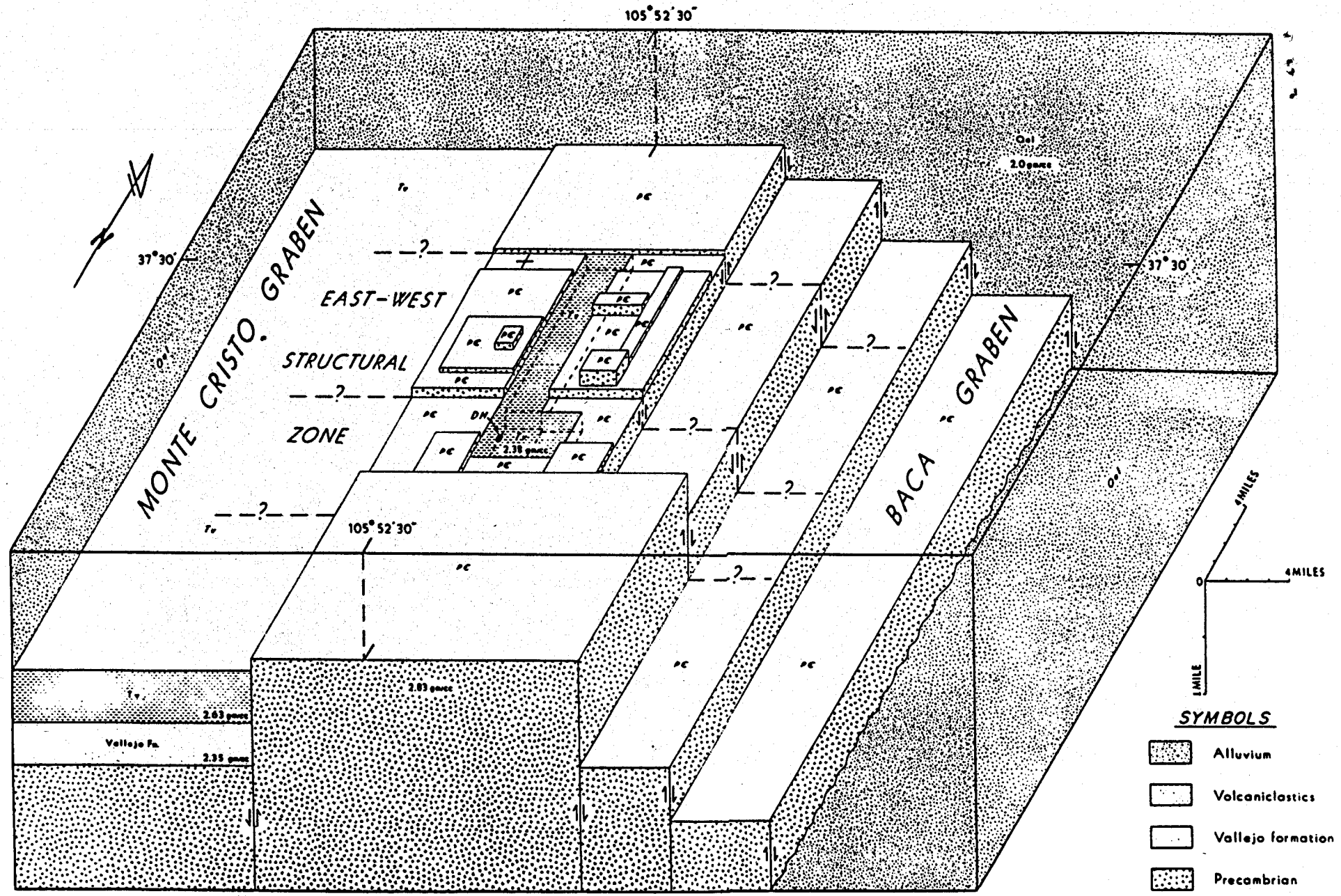


PLATE 1

ALAMOSA BASIN CROSS-SECTIONS

after Burroughs, 1981

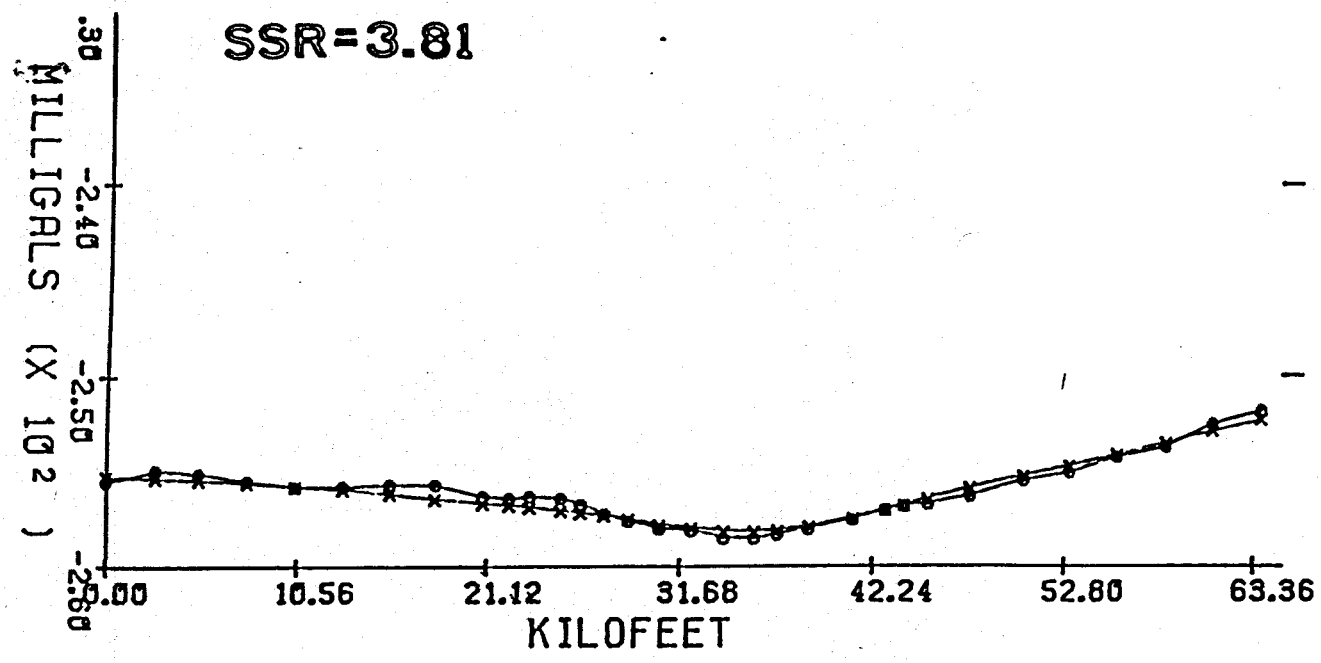

ALAMOSA HORST
MONTE CRISTO GRABEN
BACA GRABEN
PROFILE A
PROFILE B
A
A'
B
B'
N
• STATION NO.
ALAMOSA
PLATE II
BOUGUER GRAVITY MAP
ALAMOSA AREA, ALAMOSA COUNTY, COLORADO
1 ½ 0 1 2 3 MILES
1 5 0 1 2 3 4 5 KILOMETERS



3-D GRAVITY MODEL SCHEMATIC

ALAMOSA AREA, ALAMOSA COUNTY, COLORADO

PLATE III



OBSERVED= ⊙
CALCULATED= X

POLYGON NO.	DENSITY CONTRAST
1	-0.43000
2	-0.33000

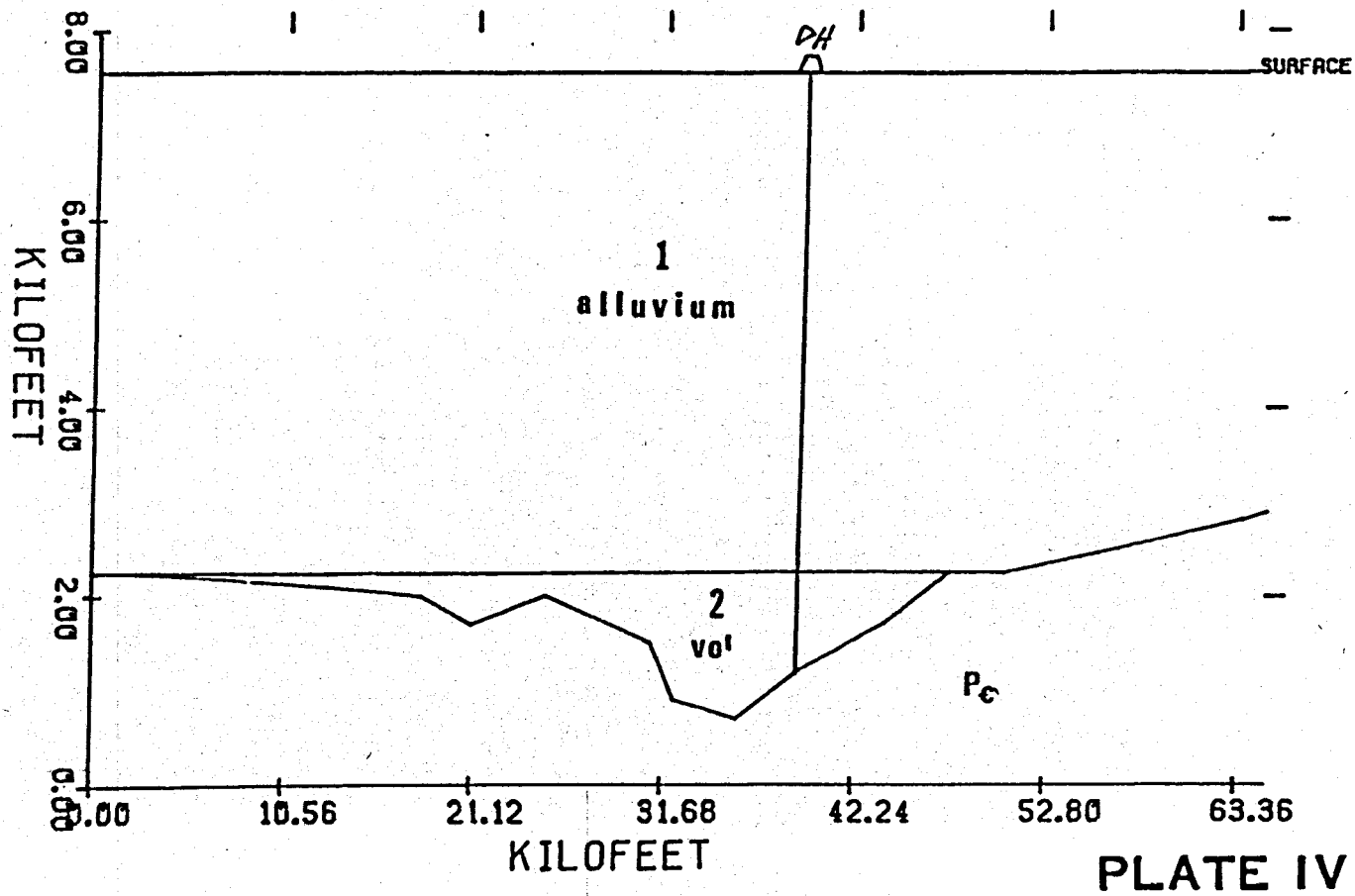
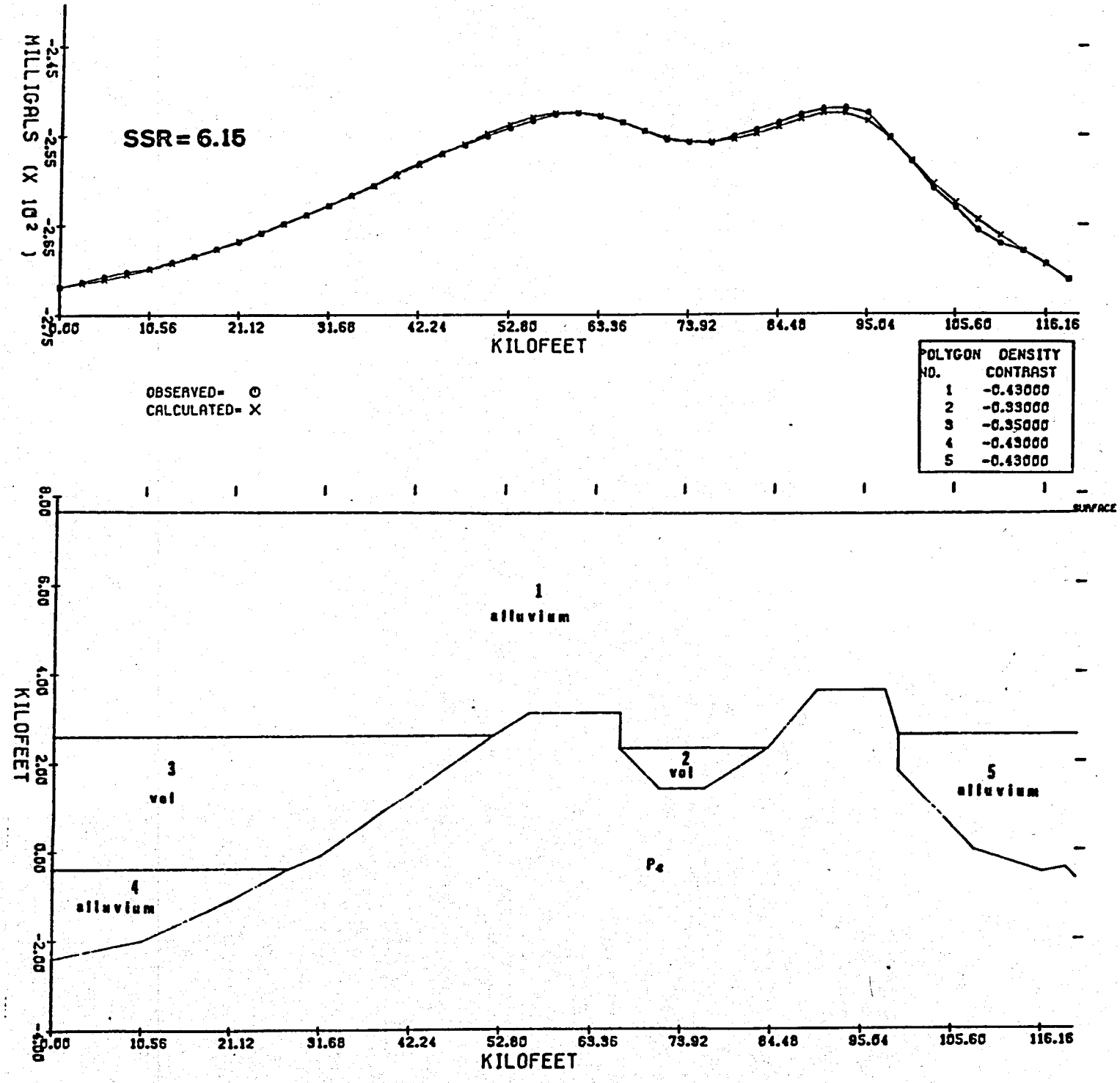


PLATE IV

ALAMOSA GRAVITY PROFILE B-B'



ALAMOSA GRAVITY PROFILE D-D'

PLATE V