

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Principal Facts for Gravity Profile Stations in the
Vicinity of Creede, Mineral County, Colorado

by

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards. Any use of trade names in this report is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

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DATA COLLECTION

A gravity survey was made in the vicinity of Creede, Colorado (fig. 1) in August, 1988 as part of the Deep Observation and Sampling of the Earth's Continental Crust, Inc. (DOSECC). Gravity observations were made using LaCoste and Romberg gravity meter G-551. The gravity stations were referenced to the U.S. Department of Defense (Defense Mapping Agency, 1974) base at Alamosa, Colorado (Appendix A). Gravity loops were started and closed daily by making repeat observations at a secondary base in Creede (Appendix B). Access to the survey area was by secondary roads and jeep trails.

ELEVATION CONTROL

The survey area is bounded approximately by latitudes $37^{\circ}48'N - 37^{\circ}58'N$ and longitudes $106^{\circ}53' - 107^{\circ}W$. One hundred-ten gravity stations were obtained. Station elevations were surveyed with a laser theodolite (accurate to the nearest tenth of a foot), or obtained from benchmarks and spot elevations on 1:24,000 USGS topographic maps. The greatest elevation uncertainty occurs at spot elevations, where the elevation uncertainty is assumed to be one-half the contour interval; thus on a map with 40-ft contour intervals, the maximum Bouguer and free-air correction error would be ± 1.2 mGals.

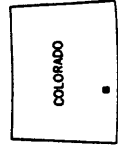
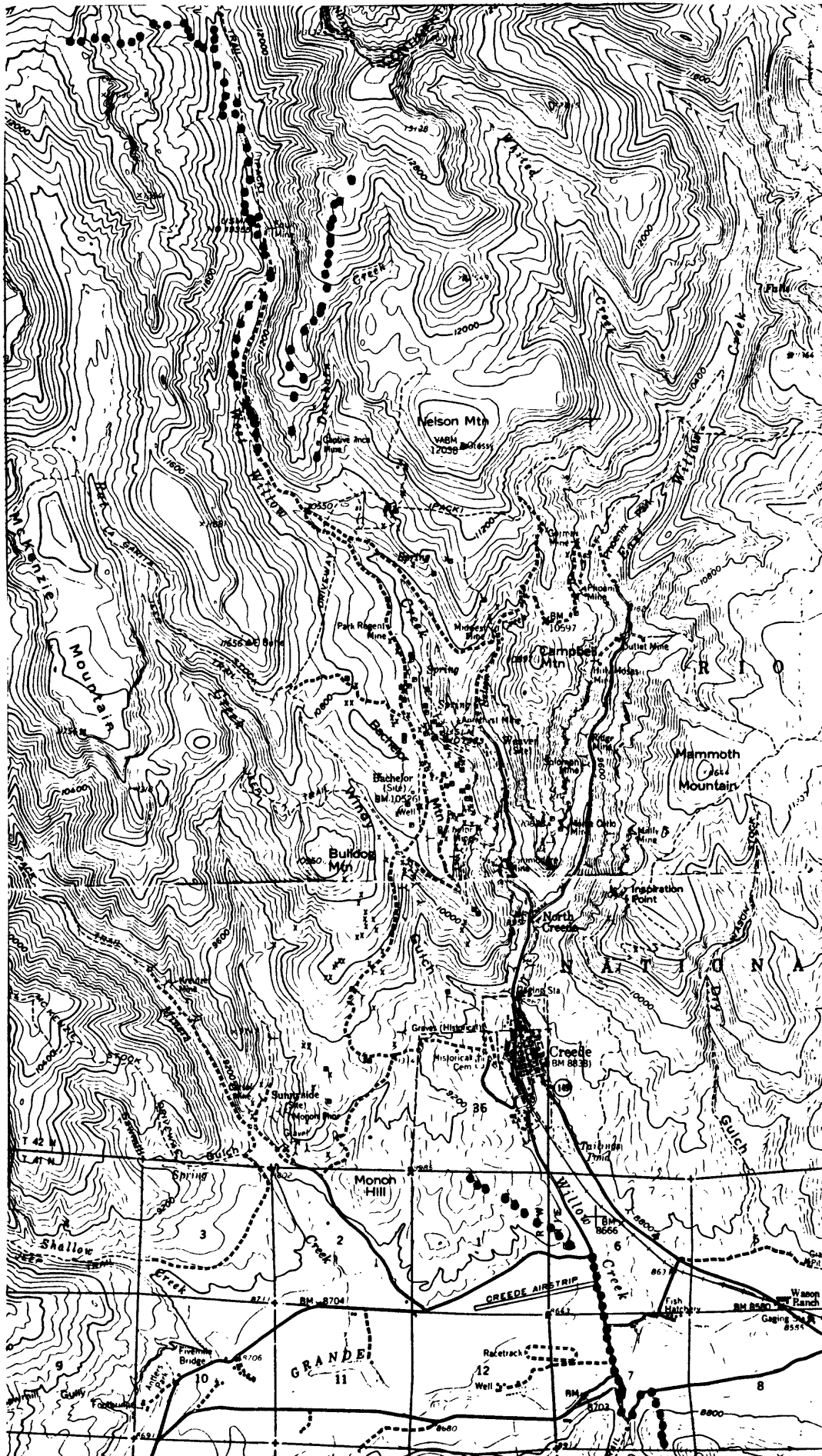
DATA REDUCTION

Computer programs existing on the USGS Branch of Geophysics Digital Equipment Corporation VAX 11 750 computer system were used to obtain principal facts and terrain-corrected gravity values. A program written by M. Webring and R. Wahl (USGS, 1984, unpub. program) was used to reduce gravity meter readings to observed gravity values by calculating and correcting for earth-

tide and linear meter drift. The theoretical gravity value was calculated using the 1967 formula of the Geodetic Reference System (International Association of Geodesy, 1971). Terrain corrections were computed using a program by R. H. Godson (USGS, 1978, unpub. program) correcting for the gravity effects of terrain from each station to a radius of 166.7 km using the method of Plouff (1977). Godson's program also calculates earth curvature corrections and complete (terrain corrected) Bouguer gravity anomaly values. For a complete description of gravity reduction equations and approximations used by the Branch of Geophysics see Cordell and others (1982). These computed terrain corrections use mean elevation digital data on a 15-second grid for corrections from 0.59 to 5 km, 1-minute terrain data for corrections from 5 to 21 km, and 3-minute terrain data for corrections from 21 to 166.7 km. Terrain located less than 0.59 km from a station may not be corrected for by the above procedure due to the coarseness of the terrain model. No additional terrain corrections were done on the present data set. A density of 2.67 g/cm^3 was used to calculate terrain corrections, giving one complete Bouguer gravity anomaly value for each station. The second complete Bouguer gravity anomaly value was calculated by using a reduction density of 2.45 g/cm^3 . The corrections and gravity anomaly values are listed in table 1.

37°55'

37°50'



Location



Location of Gravity Profiles

• Gravity Station

Figure 1.

Table 1: Principal Facts of Gravity Data

Explanation of headings

Identification

proj	Not used
sta-id	Gravity station identification number

Locations

latitude	North latitude in degrees, decimal minutes
longitude	West longitude in degrees, decimal minutes
ele	Station elevation in feet
st	State

Gravity

observed	Observed gravity in milligals
theoretical	Theoretical gravity in milligals

Corrections

Terrain	Terrain correction, 166.7 km radius, in milligals
Bouguer	Simple Bouguer slab correction in milligals
curv	Curvature correction in milligals
special	Not used

Anomalies

free-air	Free-air anomaly in milligals
complete-Bouguer	Complete Bouguer anomaly in milligals for designated densities d1 and d2
spec fields	Not used

CREED, COLORADO
AUGUST 1988
20-551

BOUGUER GRAVITY DATA

elev=f au=.01 srt=tme a-h i-x

STATION IDENTIFICATION proj sta-id	L O C A T I O N S		G R A V I T Y		C O R R F C T I O N S		A N O M A L I E S	
	LATITUDE deg min	LONGITUDE deg min	ELE min (in ft)	ST OBSERVED	TERRAIN ROUGHER CURV (d1=2.67)	SPECIAL	FREE AIR	COMPLETE-BOUGUER d1=2.67 d2=2.45 FIELDS
:R00	37 56.35	-106 57.72	11198.50	CO 978991.43	979986.77	0.00	57.18	-317.79 -286.89
:R01	37 56.51	-106 57.68	11195.00	CO 978991.89	979987.00	0.00	57.08	-316.49 -285.71
:R02	37 56.43	-106 57.72	11211.00	CO 978993.20	979986.88	0.00	60.01	-315.27 -284.35
:R03	37 56.62	-106 57.69	11230.20	CO 978990.01	979987.16	0.00	58.35	-315.90 -285.06
:R04	37 56.71	-106 57.71	11265.80	CO 978998.27	979987.29	0.00	59.82	-315.73 -284.79
:R05	37 56.83	-106 57.75	11309.80	CO 978986.34	979987.47	0.00	61.85	-315.76 -284.65
:R06	37 56.92	-106 57.80	11363.10	CO 978984.02	979987.55	0.00	64.41	-315.86 -284.53
:R07	37 56.31	-106 57.72	11222.70	CO 978990.33	979986.70	0.00	58.42	-317.89 -286.89
:R08	37 56.99	-106 57.79	11423.10	CO 978980.86	979987.70	0.00	66.77	-315.92 -284.39
:R09	37 56.91	-106 57.89	11349.80	CO 978984.91	979987.59	0.00	64.05	-316.03 -284.71
:R10	37 56.97	-106 57.89	11408.60	CO 978981.86	979987.67	0.00	66.44	-316.22 -284.69
:R11	37 57.03	-106 57.87	11420.80	CO 978981.35	979987.76	0.00	66.99	-315.38 -283.87
:R12	37 57.12	-106 57.89	11451.70	CO 978979.73	979987.85	0.00	68.13	-315.32 -283.72
:R13	37 57.23	-106 57.94	11455.00	CO 978979.19	979988.05	0.00	67.75	-314.98 -283.44
:R14	37 57.33	-106 57.96	11507.10	CO 978976.93	979988.20	0.00	70.23	-315.29 -283.52
:R15	37 57.45	-106 57.97	11565.60	CO 978973.91	979988.38	0.00	72.52	-316.11 -284.09
:R16	37 57.39	-106 57.97	11540.20	CO 978975.20	979988.28	0.00	71.53	-315.91 -283.99
:R17	37 57.49	-106 58.20	11901.30	CO 978954.23	979988.43	0.00	84.31	-318.18 -285.01
:R18	37 57.45	-106 58.17	11853.60	CO 978956.95	979988.38	0.00	82.62	-318.15 -285.12
:R19	37 57.41	-106 58.15	11822.30	CO 978959.17	979988.31	0.00	81.96	-317.64 -284.71
:R20	37 57.36	-106 58.10	11762.00	CO 978962.50	979988.24	0.00	79.65	-317.59 -284.86
:R21	37 57.34	-106 58.05	11667.50	CO 978968.09	979988.21	0.00	76.44	-316.82 -284.42
:R00	37 50.24	-106 55.98	9202.00	CO 979104.84	979977.84	0.00	-7.99	-319.06 -293.43
:R01	37 50.20	-106 55.92	9145.40	CO 979108.56	979977.76	0.00	-9.54	-319.07 -293.56
:R02	37 50.17	-106 55.86	9080.30	CO 979112.53	979977.73	0.00	-11.64	-319.17 -293.83
:R03	37 50.11	-106 55.71	9000.60	CO 979117.08	979977.65	0.00	-14.49	-319.38 -294.26
:R04	37 50.07	-106 55.63	8954.40	CO 979119.75	979977.59	0.00	-16.11	-319.41 -294.42
:R05	37 50.02	-106 55.55	8933.20	CO 979120.57	979977.52	0.00	-17.20	-319.75 -294.82
:R06	37 49.96	-106 55.46	8896.80	CO 979122.73	979977.43	0.00	-18.38	-319.63 -294.81
:R07	37 49.93	-106 55.35	8887.80	CO 979123.10	979977.39	0.00	-18.81	-319.68 -294.89
:R08	37 49.88	-106 55.28	8857.70	CO 979125.07	979977.31	0.00	-19.55	-319.40 -294.69
:R09	37 49.82	-106 55.20	8835.50	CO 979126.28	979977.23	0.00	-20.38	-319.44 -294.80
:R10	37 49.82	-106 55.19	8835.50	CO 979126.20	979977.23	0.00	-20.42	-319.50 -294.85
:R22	37 57.38	-106 59.10	12513.40	CO 978914.55	979988.27	0.00	102.27	-318.42 -283.76
:R23	37 57.38	-106 59.02	12416.80	CO 978920.77	979988.27	0.00	99.43	-319.03 -284.55
:R24	37 57.40	-106 58.82	12262.20	CO 978929.92	979988.30	0.00	94.03	-320.16 -286.03
:R25	37 57.38	-106 58.61	12103.00	CO 978940.82	979988.27	0.00	90.01	-319.06 -285.36
:R26	37 57.41	-106 58.55	12099.60	CO 978941.27	979988.31	0.00	90.10	-318.90 -285.20
:R27	37 57.48	-106 58.34	11977.10	CO 978949.24	979988.41	0.00	86.46	-318.64 -285.26
:R28	37 57.49	-106 58.44	11947.50	CO 978951.02	979988.43	0.00	85.45	-318.46 -285.18

BOUGUER GRAVITY DATA

CREED, COLORADO
AUGUST 1988
20-551

elev=f qu=.01 srt=tme a-h i-x

STATION IDENTIFICATION proj sta-id	L O C A T I O N S LATITUDE deg min deg	ELE (in ft)	ST OBSERVED	G R A V I T Y THEORETICAL	TERRAIN BOUGUER CURV (d1=2.67)	C O R P E C T I O N S SPECIAL	F R E E AIR	A N C M A L I E S COMPLETE-BOUGUER d1=2.67 d2=2.45	S P E C FIELDS
:715	37 55.91 -106 57.09	12135.50	CO	978932.28	979986.13	0.51 -413.91 -0.58	0.00	86.67 -319.32 -285.86	
:716	37 55.71 -106 57.12	11899.80	CO	978947.61	979985.83	6.80 -405.87 -0.66	0.00	80.16 -319.57 -286.64	
:717	37 55.67 -106 57.13	11875.00	CO	978948.86	979985.77	6.74 -405.02 -0.67	0.00	79.13 -319.52 -286.95	
:718	37 55.62 -106 57.18	11857.10	CO	978949.59	979985.70	7.14 -404.41 -0.68	0.00	78.27 -319.68 -286.89	
:719	37 55.56 -106 57.26	11832.00	CO	978950.91	979985.61	7.50 -403.56 -0.69	0.00	77.31 -319.44 -286.74	
:720	37 55.83 -106 57.08	12029.10	CO	978939.14	979986.01	7.67 -410.28 -0.62	0.00	83.65 -319.58 -286.35	
:911	37 49.09 -106 54.86	8611.00	CO	979142.72	979976.16	4.51 -293.70 -1.41	0.00	-23.97 -314.56 -290.62	
:912	37 49.74 -106 55.02	8657.00	CO	979137.52	979977.11	4.53 -295.27 -1.40	0.00	-25.79 -317.93 -293.85	
:913	37 49.68 -106 55.01	8651.00	CO	979138.05	979977.02	4.49 -295.06 -1.40	0.00	-25.74 -317.72 -293.66	
:914	37 49.62 -106 54.99	8645.20	CO	979138.43	979976.94	4.44 -294.86 -1.41	0.00	-25.82 -317.65 -293.60	
:915	37 49.55 -106 54.98	8636.50	CO	979139.10	979976.83	4.39 -294.57 -1.41	0.00	-25.85 -317.44 -293.41	
:916	37 49.50 -106 54.95	8634.80	CO	979139.39	979976.76	4.34 -294.51 -1.41	0.00	-25.65 -317.23 -293.20	
:917	37 49.43 -106 54.94	8628.00	CO	979139.88	979976.66	4.34 -294.28 -1.41	0.00	-25.70 -317.04 -293.04	
:918	37 49.36 -106 54.93	8623.60	CO	979140.06	979976.55	4.35 -294.13 -1.41	0.00	-25.83 -317.01 -293.02	
:919	37 49.28 -106 54.90	8617.00	CO	979140.74	979976.44	4.39 -293.90 -1.41	0.00	-25.65 -316.57 -292.60	
:920	37 49.23 -106 54.90	8616.80	CO	979140.83	979976.37	4.39 -293.89 -1.41	0.00	-25.52 -316.43 -292.46	
:921	37 49.15 -106 54.88	8617.60	CO	979141.39	979976.25	4.41 -293.92 -1.41	0.00	-24.76 -315.68 -291.71	
:922	37 49.02 -106 54.85	8600.80	CO	979143.78	979976.05	4.70 -293.35 -1.41	0.00	-23.75 -313.81 -289.91	
:923	37 48.96 -106 54.81	8610.40	CO	979143.97	979975.97	4.90 -293.68 -1.41	0.00	-22.58 -312.76 -288.85	
:925	37 48.75 -106 54.49	8850.80	CO	979131.60	979975.66	3.81 -301.88 -1.38	0.00	-12.06 -311.50 -286.83	
:926	37 48.68 -106 54.47	8898.20	CO	979129.02	979975.56	3.79 -303.49 -1.37	0.00	-10.08 -311.15 -286.35	
:927	37 48.57 -106 54.45	8932.00	CO	979126.81	979975.40	3.86 -304.64 -1.37	0.00	-8.95 -311.10 -286.21	
:924	37 48.62 -106 54.47	8944.80	CO	979126.20	979975.48	3.76 -305.08 -1.37	0.00	-8.44 -311.12 -286.18	
:928	37 48.89 -106 54.55	8722.10	CO	979138.35	979975.67	4.17 -297.49 -1.40	0.00	-17.60 -312.31 -288.03	
:929	37 48.82 -106 54.52	8774.10	CO	979135.62	979975.77	4.01 -295.26 -1.39	0.00	-15.35 -311.99 -287.54	
:930	37 48.89 -106 54.79	8637.80	CO	979143.22	979975.87	4.76 -294.61 -1.41	0.00	-20.65 -311.91 -287.91	
:931	37 48.87 -106 54.79	8653.40	CO	979142.34	979975.84	4.64 -295.14 -1.40	0.00	-20.03 -311.94 -287.89	
:932	37 48.76 -106 54.79	8695.00	CO	979140.37	979975.68	4.47 -296.56 -1.40	0.00	-17.94 -311.43 -287.25	
:933	37 48.75 -106 54.70	8706.30	CO	979139.65	979975.66	4.45 -296.95 -1.40	0.00	-17.58 -311.48 -287.26	
:934	37 48.87 -106 54.64	8733.50	CO	979137.84	979975.84	4.07 -297.87 -1.39	0.00	-17.01 -312.20 -287.88	

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[illegible]

:829	37	57.40	-106	58.91	12372.80	CO	978923.73	979888.30	5.21	-422.00	-0.50	0.00	98.22	-319.07	-284.69
:830	37	57.37	-106	58.70	12170.00	CO	978936.38	979986.26	4.38	-415.08	-0.57	0.00	93.87	-317.40	-283.51
:831	37	56.28	-106	57.62	11140.60	CO	978994.23	979986.66	9.12	-379.97	-0.90	0.00	54.64	-317.11	-286.48
:832	37	56.27	-106	57.68	11165.30	CO	978993.36	979986.65	8.27	-380.82	-0.89	0.00	56.11	-317.33	-286.56
:833	37	56.24	-106	57.67	11163.80	CO	978994.54	979986.60	8.20	-380.77	-0.89	0.00	57.20	-316.26	-285.49
:834	37	56.17	-106	57.62	11115.20	CO	978995.52	979986.50	8.81	-379.11	-0.91	0.00	53.72	-317.48	-286.90
:835	37	56.09	-106	57.58	11115.50	CO	978995.28	979986.38	8.17	-379.12	-0.91	0.00	53.62	-318.23	-287.59
:836	37	56.04	-106	57.57	11105.00	CO	978995.67	979986.31	7.78	-378.76	-0.91	0.00	53.10	-318.79	-288.15
:837	37	55.92	-106	57.52	11051.30	CO	978998.01	979986.13	7.65	-376.93	-0.92	0.00	50.57	-319.63	-289.13
:838	37	55.89	-106	57.52	11042.10	CO	978998.73	979986.05	7.70	-376.61	-0.93	0.00	50.46	-319.38	-288.90
:839	37	55.72	-106	57.69	10957.40	CO	979004.37	979985.84	7.61	-373.73	-0.95	0.00	48.40	-318.67	-288.42
:840	37	55.61	-106	57.76	10944.30	CO	979004.67	979985.68	7.30	-373.28	-0.95	0.00	47.64	-319.29	-289.06
:841	37	55.51	-106	57.79	10931.40	CO	979005.03	979985.54	6.77	-372.84	-0.96	0.00	46.93	-320.10	-289.86
:842	37	55.42	-106	57.80	10942.50	CO	979004.37	979985.41	6.14	-373.22	-0.95	0.00	47.44	-320.59	-290.27
:843	37	55.35	-106	57.83	10947.70	CO	979003.92	979985.30	5.90	-373.39	-0.95	0.00	47.58	-320.86	-290.51
:844	37	55.31	-106	57.83	10943.90	CO	979004.24	979985.24	5.89	-373.26	-0.95	0.00	47.61	-320.72	-290.37
:845	37	55.77	-106	57.58	10976.00	CO	979002.60	979985.92	8.05	-374.36	-0.95	0.00	48.31	-318.94	-288.68
:846	37	55.29	-106	57.81	10923.70	CO	979005.61	979985.21	6.12	-372.58	-0.96	0.00	47.10	-320.31	-290.04
:847	37	55.22	-106	57.79	10889.20	CO	979007.31	979985.11	6.47	-371.48	-0.97	0.00	45.67	-320.22	-290.07
:848	37	55.11	-106	57.72	10856.00	CO	979009.11	979984.95	6.54	-370.27	-0.98	0.00	44.51	-320.19	-290.14
:849	37	55.06	-106	57.69	10843.70	CO	979009.57	979984.88	6.44	-369.85	-0.98	0.00	43.89	-320.50	-290.48
:850	37	55.03	-106	57.67	10838.10	CO	979009.89	979984.84	6.28	-369.66	-0.98	0.00	43.73	-320.63	-290.61
:851	37	54.99	-106	57.65	10832.20	CO	979010.28	979984.77	6.11	-369.46	-0.98	0.00	43.63	-320.70	-290.68
:852	37	54.92	-106	57.64	10777.10	CO	979013.28	979984.67	6.78	-367.58	-1.00	0.00	41.55	-320.24	-290.43
:853	37	54.83	-106	57.63	10727.60	CO	979016.12	979984.55	7.26	-365.89	-1.01	0.00	39.86	-319.77	-290.1

References Cited

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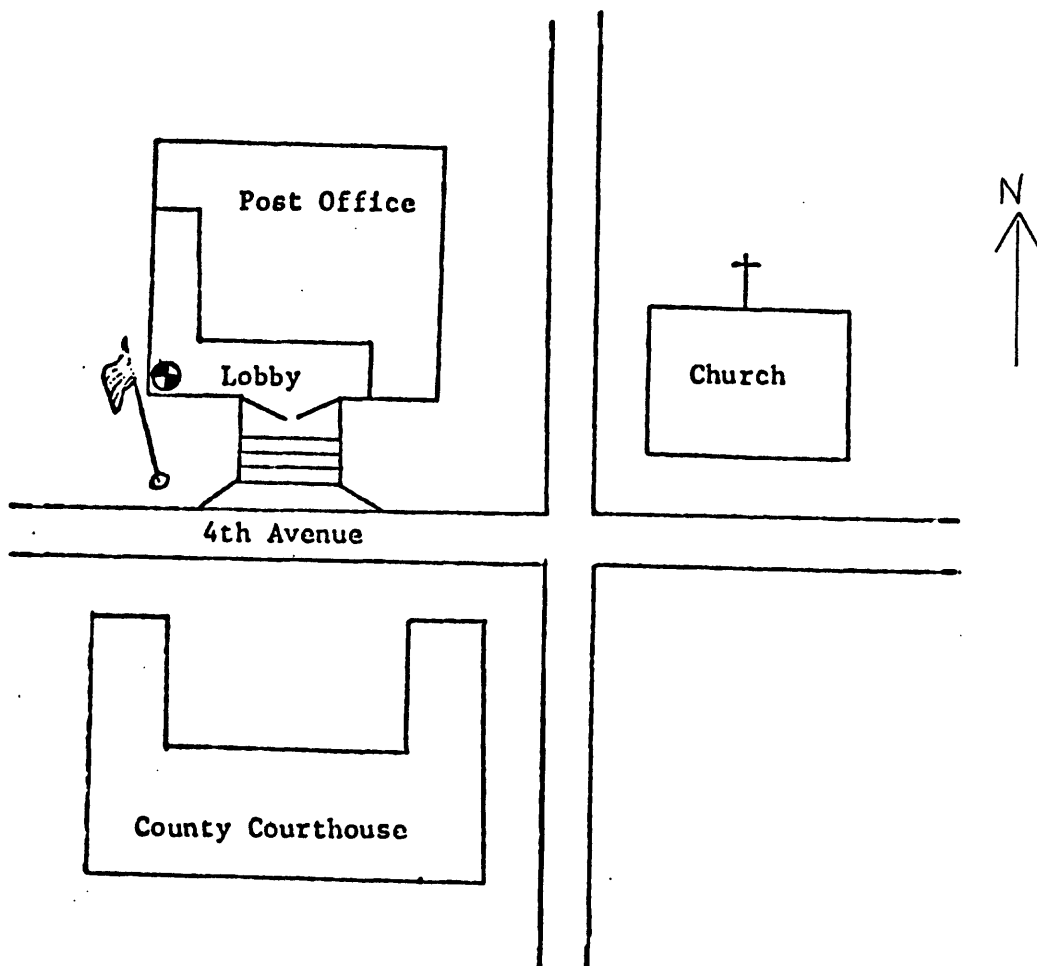
APPENDIX A

GRAVITY BASE STATION

LATITUDE 37° 28.21'N (1)		STATION DESIGNATION ALAMOSA	
LONGITUDE 105° 52.16'W (1)			
ELEVATION 2300.9 METERS (1)		COUNTRY/STATE USA/Colorado	
REFERENCE CODE NUMBERS		ADOPTED GRAVITY VALUE	
ACIC 4016-1		g = 979 234.98 mgals	
IGB 11975B			
		ESTIMATED ACCURACY	DATE
		± 0.1 mgals	MONTH/YEAR 1971

DESCRIPTION AND/OR SKETCH

The station is located at the Post Office in Alamosa, on the corner of San Juan Avenue and 4th Avenue, in the southwest corner of the Post Office lobby. It is marked with a USAF Gravity disc. (1)



(1)

REFERENCE SOURCE

9

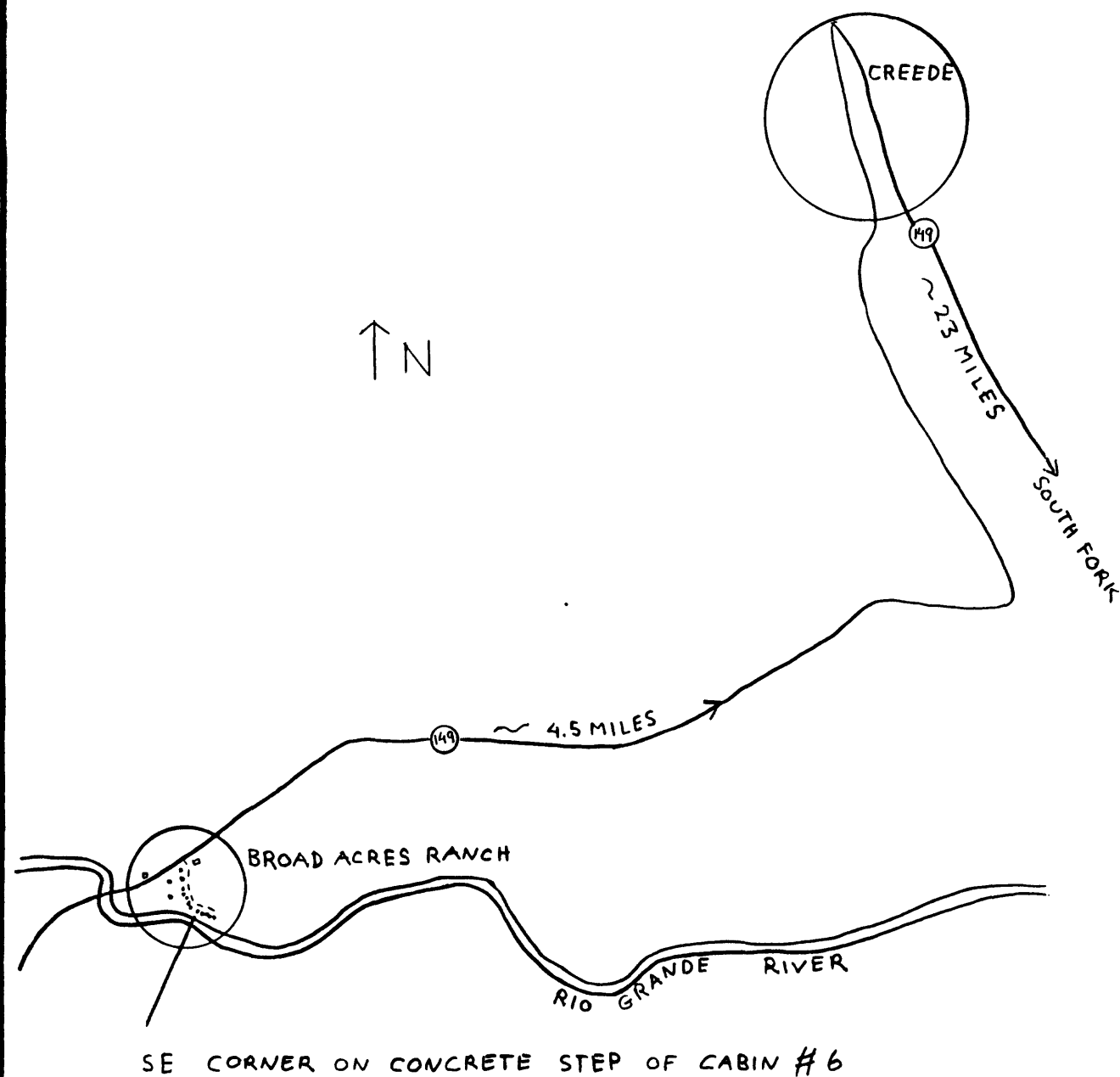
(1) 03405

APPENDIX B

SECONDARY GRAVITY BASE STATION

LATITUDE 37°48.98'N (1)		STATION DESIGNATION CREEDE	
LONGITUDE 106°57.86'W (1)			
ELEVATION 8689 ft METERS (1)		COUNTRY/STATE USA/Colorado	
REFERENCE CODE NUMBERS		ADOPTED GRAVITY VALUE	
		g = 979137.01 mgals	
		ESTIMATED ACCURACY	DATE
		± 0.1 mgals	MONTH/YEAR 5/1985

DESCRIPTION AND/OR SKETCH



REFERENCE SOURCE

10

(1)