U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

PRINCIPAL FACTS AND FIELD DATA FOR GRAVITY DATA IN AND ADJACENT TO THE RENO 1° × 2° QUADRANGLE, NEVADA AND CALIFORNIA

By

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94-006-A Documentation (paper copy)
94-006-B Digital gravity data (diskette)

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CONTENTS

TABLES

ILLUSTRATIONS

INTRODUCTION

The diskette for Part B includes a "README" file that explains the format and contents of the diskette. The 3 ½-inch diskette (double-sided, high-density) contains files of principal facts and files of available field observations for all data discussed in this report. Records in files with principal facts (file names with a suffix of **.ICE** if data are located in the Reno quadrangle or **ICE.** if located outside the quadrangle) include unique station names, geographic coordinates, elevations, values of observed gravity, accuracy codes, free air gravity anomalies, dates of last observation, inner terrain corrections, total terrain corrections, outer radii of inner terrain corrections, Bouguer gravity anomalies, values of isostatic residual gravity, and base station names. Files with field observations (file names with a suffix of **.FLD**) include station names, dates, times, readings, elevations, and, for data I collected, accuracy codes, closein terrain corrections, and map designations. File names are indicated by bold print in the following discussion.

The initial accomplishment of this study was to assemble a data base of 2,194 unique data points in the Reno 1° x 2° quadrangle, Nevada (between lat 39° and 40° N. and between long 118° and 120° W.). This data set was supplemented with existing data extending to about 5 minutes of latitude and longitude beyond the edges of the quadrangle so that Bouguer gravity anomaly, isostatic residual (fig. 1), and derivative maps were prepared and subsequently were interpreted as part of a geologic assessment of the mineral resources of the Reno quadrangle (Plouff, 1992; John and others, 1993). Four data points were added and 30 data points were modified after the original compilation. Another product of this study is to release in digital format principal facts for these data, principal facts for previously unpublished data in adjacent areas, and records of field observations.

COMPILATION METHODS

Essential steps to assure quality during the compilation of existing gravity data were to delete duplicate data, to correct or delete erroneous data, and to evaluate the accuracy of the accepted data. Duplicate data could not be easily identified when previous compilers modified values of observed gravity, modified locations, or copied earlier data into their sets and then applied different station numbers. The pattern of two sets of sequence numbers at associated data points often could be easily recognized except in cases where a later compiler modified locations or sorted data points by their latitude and then replaced original station numbers with numerical sequence numbers. Station names and elevations initially were computer-plotted near data points on a 15-minute topographic map in the northeast corner of the quadrangle or on 7 ½-minute topographic maps in the rest of the quadrangle. Data points were discarded if uncertain locations and consequent errors of elevations or terrain corrections could not be reconciled by modifying their locations or elevations. If a data point from a data set with less accurate values apparently was either copied into another set or was duplicated by a nearby observation from another data set, the less accurate data point was discarded unless the less accurate data point was closely surrounded only by data points of the less accurate data set. Preference also was given to data with available field notes and readings.

Lists of station names, locations, and elevations were keyed to a 5-digit, map-based arrangement so that, despite duplication or complexity of numbering or map-naming schemes, stations to be evaluated could be readily identified. Data points that had the same station names as other data points or had no station name, which occurred in subsets of data from the Defense Mapping Agency gravity library, were assigned unique station names. Data points located near spot elevations or bench marks, near cultural features such as roads or marked section corners, or arranged along regularly-spaced lines or grids generally were accepted with minor modifications. Data points with locations that markedly disagreed with topography or culture and data points too closely spaced for uncertainties of their locations or consequent uncertainties of terrain corrections were discarded or were selectively--one of three closely spaced points, for example--retained. The last criterion for identifying data points to be rejected, corrected, or accepted was to look for conspicuous disagreements (forming one-station "bullseye" shapes on contour plots of gravity anomalies) between the terrain-corrected Bouguer gravity anomaly of the data point and anomalies at adjacent points. Coded descriptions (table 3), elevation accuracy codes (table 4), and location accuracy codes (table 5) for all data points were expressed by 3-digit accuracy codes. The accuracy of observed gravity was estimated for most data points (table 6).

OBSERVED GRAVITY

The datum of observed gravity for data points listed in this report is the International Gravity Standardization Net of 1971 (IGSN-71) described by Morelli (1974). Two primary gravity base stations in the Reno 1° by 2° quadrangle listed by the Defense Mapping Agency as part of a worldwide gravity network (Jablonski, 1974) are located at Reno

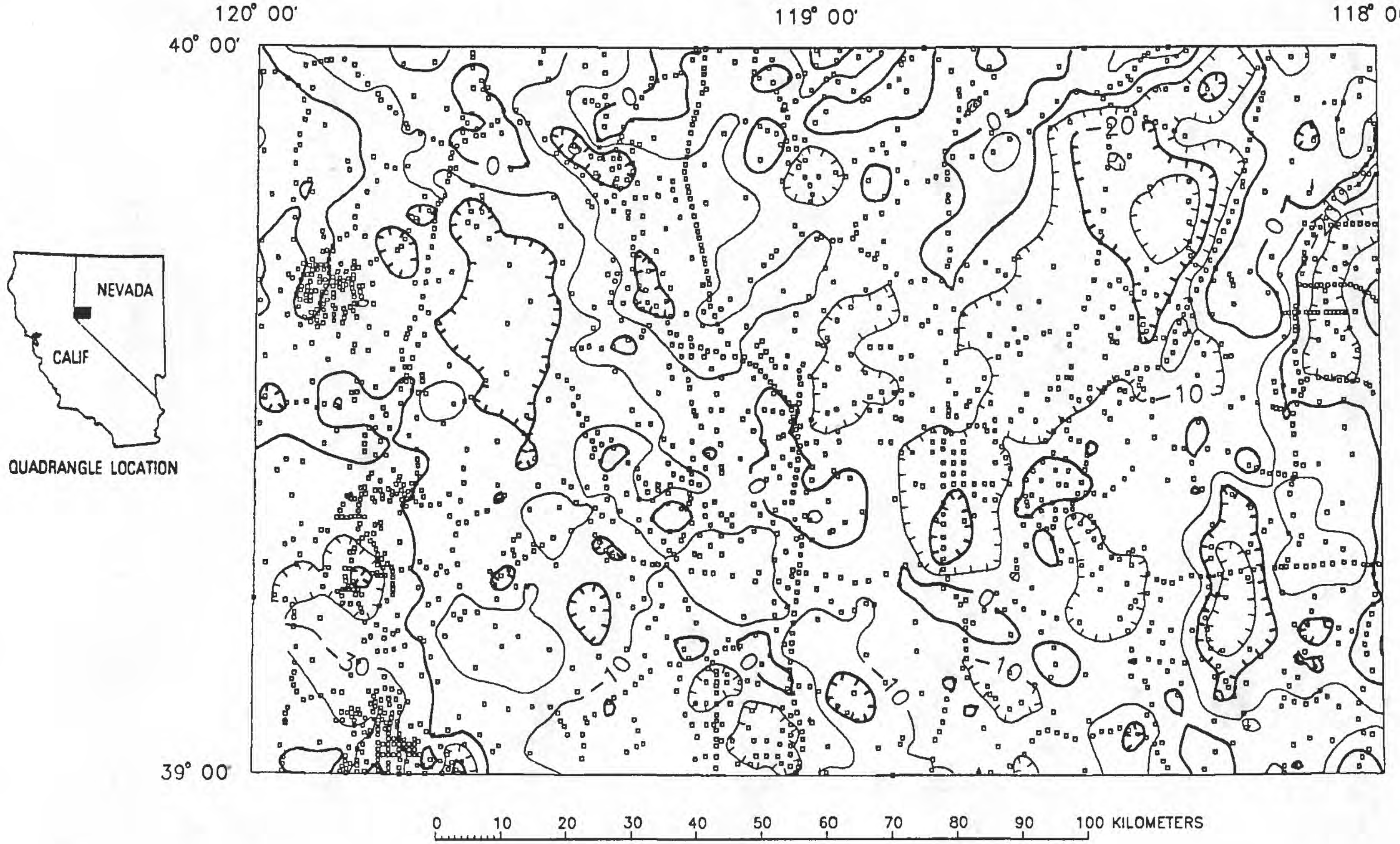

Figure 1. Isostatic residual gravity map of the Reno quadrangle. Hachures indicate closed gravity low. Contour interval, 10 mGal. See text for explanation of parameters.

("RENOA") and Fallon ("FALLA"), Nevada. Values of observed gravity at auxiliary base stations (table 1) were established by direct ties to the primary base stations during the current studies or, for previously established data, by evaluating combinations of ties among different sets of gravity data. The accuracy of observed gravity relative to primary base stations is about 0.05 mGal for field data collected during the present study. To achieve consistency of observed gravity among data sets, constant datum shifts to values of observed gravity were applied to data sets, if observations apparently at the same locations in other established data sets indicated consistent differences of observed gravity. Errors of observed gravity are primarily caused by lack of precision of gravity meter calibration, lack of ties to common base stations with the same datums, and non-linear instrument drift rates. Gravity changes associated with changes such as subsidence, shifts of water table, or earthquake fracturing during intervals between repeated measurements are assumed to be small compared to 0.1 mGal typically expected for the best accuracy of gravity anomalies.

ELEVATIONS

Elevation errors generally are the largest source of error in calculating Bouguer gravity anomalies. An elevation error of 0.3 m generates an error of 0.05 mGal for the Bouguer gravity anomaly. Elevation errors attributed to inaccuracies as large as 3 m (corresponding to 0.6 mGal for the Bouguer gravity anomaly), for example, is associated with some photogrammetric or altimetric elevations but is acceptable when applied to the present application of interpreting regional gravity maps with contour intervals of 5 mGal. An error of 0.6 mGal, however, would be unacceptable if gravity stations are closely spaced and local anomalies are to be interpreted. The greatest limitation to efficiency and consequent productivity in obtaining regional gravity data coverage is the limited availablity on topographic maps of photogrammetrically determined spot elevations along numerous roads without benchmarks, in contrast to ubiqitous spot elevations on less accessible hilltops. Hilltops also are less desirable station locations because the effects of terrain correction and internal density distribution--for an extreme example, cinder cones-- are difficult to analyze.

In addition to establishing gravity stations near points of known or interpolated elevations on USGS topographic maps, closely-spaced gravity stations were collected during the present study at surveyed elevations near footings of power poles along the Los Angeles Department of Water and Power DC powerline (A.A. Galindo, written commun., 1985), which crosses between the north and south edges of the Reno 1° x 2° quadrangle. Location maps and local topographic maps along the powerline also were obtained. The elevation of Pyramid Lake was obtained from the Water Resources Division of the U.S. Geological Survey in Carson City, Nevada (Alex Pupacko, written commun., 1988). The elevation of the water surface at the Lahontan Reservoir was obtained in the field from an employee of the Truckee Water Company.

TERRAIN CORRECTIONS

Gravity terrain corrections are the gravity effect of departures of the Earth's surface from a horizontal plane that passes through the station when calculated near the gravity station or departures from a spherical cap at farther distances, for example, beyond 8,440 m (Swick, 1942, p. 68). Topographic information needed to calculate the innermost part of of a terrain correction, the part of topography not resolvable at the scale of topographic maps, must be obtained in the field. Terrain corrections were estimated in the field to distances of 53 and 68 m, respectively, for data collected for the present study and for the study of magmatic-arc terrane. The remaining part of the inner terrain correction was estimated to distances of 895 and 590 m, respectively, by evaluating elevations and slopes within compartments bounded by radial lines and circles on transparent templates (Hammer, 1939; Swick, 1942; Campbell, 1980; Spielman and Ponce, 1984). Because of low accuracy needed for contouring gravity anomalies at an interval of 5 mGal and at a scale of 1:250,000, the time to calculate inner terrain corrections for the remaining stations of this regional survey was minimized by estimating inner terrain corrections, including an approximation of the innermost part, by estimating terrain corrections in 14 cells to a distance of 500 m. The number of stations that were corrected manually for the effect of terrain to distances of 500, 590, and 895 m were 1719, 17, and 462, respectively. Total inner terrain corrections range to 5.0, 0.4, and 1.5 mGal, respectively, and have average values and associated standard deviations of 0.2±0.5, 0.2±0.1, and 0.1±0.2 mGal, respectively.

Terrain corrections, including the effect of the Earth's curvature, were determined in the remaining distance to 166.7 km by using a computer program that incorporates a model of average elevations digitized at intervals of 15 seconds, 1 minute, and 3 minutes (Plouff, 1977; Godson and Plouff, 1988). The terrain model (modified from a model available from the National Geophysical Data Center in Boulder, Colorado) was derived from digitization of topographic maps at scales of 1:250,000. The accuracy of the digital model was evaluated by contouring the difference between station elevations and linearly interpolated elevations of the terrain model. After correction for erroneous station elevations, elevation differences were attributed to low vertical and horizontal accuracy of topography mapped at a scale of 1:250,000. The quality of the terrain model is good, inasmuch as only 61 accepted gravity data points, especially including points along ridge tops, have elevation differences that exceed the 200-ft contour interval of topography mapped at a scale of 1:250,000. The error of gravity anomalies associated with the error of digital terrain model was minimized because the innermost parts of all terrain corrections were estimated manually to distances of at least 500 m from data points on topographic maps at the largest available map scales of 1:24,000 and 1:62,500.

GRAVITY ANOMALIES

Theoretical values of gravity at sea level were calculated as a function of latitude by using the Geodetic Reference System 1967 formula (GRS-67) for normal gravity on the spheroid (International Association of Geodesy, 1971, p. 60). The theoretical value of gravity was adjusted to the elevations of data points by using Swick's (1942, p.65) standard formula for the free-air correction. Free-air gravity anomalies were calculated at the data points by subtracting the theoretical gravity values from the observed gravity values. Complete Bouguer anomalies were calculated by taking into account the effect of the mass of rocks with assumed average densities of 2.67 g/cm^3 between the station and sea level (Bouguer correction), the Earth's-curvature, and departures of topography from the station elevation (terrain correction). Oliver (1980, p. 50) listed the formulas used by the U.S. Geological Survey to calculate gravity corrections.

The effect of isostatic compensation was estimated by using the method of Jachens and Roberts (1981). The gravity effect of Airy-Heiskanen type of compensation (Heiskanen and Vening Meinesz, 1958, p. 135-137) was calculated for each data point by summing the gravity effects of mass deficiencies of volume elements ("roots") of crustal density that penetrate into denser rocks beneath the base of the normal crust to compensate for overlying elements that consist of rock above sea level. The same 3-minute digitization of topography applied to gravity terrain corrections provided model elements to 166.7 km from each data point. Assumed isostatic parameters are 25 km for the thickness of normal crust, 2.67 g/cm^3 for the average density of rocks above sea level, and 0.4 g/cm^3 for the contrast in density between the lower crust and the upper mantle. Assumptions are that compensation can occur locally, that the mass and lateral dimensions of the compensating volume element at the base of the crust are the same as the volume element of topography at the surface, and that the mass of the volume element at the base of the crust can be treated as though it is concentrated along a centered vertical line element. The consequent height of the volume element at the base of the crust is ratio of 2.67/0.4 times that of the topographic element. The effect of the Earth's curvature was not taken into account for the isostatic correction, so that an exact join could be made with the previously published gravity map of the Walker Lake 1° x 2° quadrangle to the south (Plouff, 1982; 1987). Adjusting elevations of elements of the isostatic model for the effect of the Earth's curvature would add 0.7 mGal to the value calculated for isostatic residual gravity at the lowest data point (1,030 m above sea level) and would add 1.0 mGal at the highest data point (3,285 m) in the quadrangle. Gravity values for isostatic compensation of the mass above sea level beyond 166.7 km were interpolated from maps by Karki and others (1961), which applied an assumed normal crustal thickness of 30 km. Different kinds of compensating models and different parameters probably would result in gravity datum shifts and gradual changes of values with distance, and, therefore, would not cause significant changes of the anomaly pattern on the isostatic residual gravity map (fig. 1).

DATA COLLECTED SINCE 1987 BY U.S. GEOLOGICAL SURVEY

Study of magmatic arcs (D.A. Ponce)

A total of 17 gravity stations were established during July, 1990, in the Reno 1° x 2° quadrangle as part of a USGS study of magmatic arcs by D.A. Ponce (file **RPONCE.ICE**). Eight gravity stations were established to the south of the quadrangle as part of the same study (file **WPONCICE.**). Ties were made to the primary base station in Reno ("RENOA") (table 1) and to an auxiliary base station in Fernley, Nevada ("FERNW"). J.M. Glen assisted in the field.

Conterminous U.S. Mineral Appraisal and study of Pyramid Lake Indian Reservation

A total of 338 gravity stations, including two auxiliary base stations ("FALLW" and "FERNW") (table 1), were established during 1987 and 1988 in the Reno 1° x 2° quadrangle as part of the present study, and 85 gravity stations, including one auxiliary base station ("NIXNS"), were established as part of a study of the Pyramid Lake Indian Reservation (file **RPLOUFF.ICE**). A total of 40 gravity stations were established in the Lovelock 1° by 2° quadrangle to the north of Reno quadrangle as part of the study of the Pyramid Lake Indian Reservation (file **LVBIAICE.**). Field data are in files **R8717PL.FLD, R878PL.FLD, R88PL.FLD,** and **R938PL.FLD.** Calibration tables for the gravity meters used are in files **G17B.CAL** and **G8B.CAL.** Methods described by Barnes and others (1969) were used to apply a corrective multiplicative factor to calibration values tabulated by the gravity meter manufacturer. After correction for tidal effects, the range of diurnal instrument drift, which includes the effect of uncertainty of repeating gravity readings, exceeded 0.1 mGal only for one datum shift ("tare") of 0.15 mGal between base station readings before and after two readings at station "P 90."

PREVIOUS DATA COMPILED OR COLLECTED BY U.S. GEOLOGICAL SURVEY

Compilation of Walker Lake 1° by 2° quadrangle

A total of 192 data points were obtained from the compilation by Plouff (1982) associated with previous studies in and adjacent to the Walker Lake 1° x 2° quadrangle to the south of the Reno quadrangle (file **RWALKER.ICE**). Principal facts for the remaining 3,479 data points for the study of the Walker Lake quadrangle is in file **WALKICE.** Field data collected by the USGS as part of the study of the Walker Lake quadrangle, including small sets of data in the adjacent Mariposa, Reno, Sacramento, and San Jose 1° x 2° quadrangles, are in files **W7879PL.FLD, W80PL.FLD, WR78VAN.FLD,** and **WSJSTUOL.FLD.** Field data from M.W. Reynolds (written commun., 1978), the University of California at Berkeley, were re-reduced to be compatible with other data (**WREYNOLD.FLD**). Calibration tables for the gravity meters used are in files **G17B.CAL, G8B.CAL,** and **G244.CAL.**

A total of 61 data points were obtained from data collected near Yerington, Nevada, under the supervision of J.W. Erwin (1970) of the Nevada Division of Mines and Geology (NDMG). Although all except one ("VIRGC") of the 61 data points are included in the Defense Mapping Agency (DMA) Gravity Library (National Geophysical Data Center, 1984, source #3048), these data, including 16 data points not included by Plouff (1982, p. 11 and 64-65), were re-reduced so that the effects of Earth tides, ties to data points from later gravity surveys, and the publication of later topographic maps could be utilized (**WRERWIN.FLD**). The field data include values for gravity meter calibration. Arbitrarily unique station names were assigned to data points, which were blank or referred to sections, townships, and ranges on source compilation sheets. The accuracy of observed gravity for this set of data is about 0.5 mGal, with better accuracy at data points where observations were repeated. After nominally correcting for datum shifts, the average difference between values of observed gravity calculated for 21 data points reported by Peterson (1975) apparently at the same locations is 0.07±0.39 mGal. The largest change of station elevation due to revision of an earlier 15-minute topographic map was an increase of 22 ft at station "MAP Y112."

A total of 124 data points were obtained from a study of the thickness of fill in Carson Valley by D.K. Maurer of the Water Resources Division of USGS (WRD) in Carson City, Nevada (Plouff, 1982, p. 15-16). WRD stations were tied to the Defense Mapping Agency base station at the Douglas County Airport ("AMIND"). Ties to WRD stations in the Walker Lake quadrangle indicate that the accuracy of observed gravity for this set of WRD data exceeds 0.2 mGal.

Data collected by R.R. Wahl

R.R. Wahl of the USGS collected gravity data in 1961 along a seismic profile between Eureka and Fallon, Nevada, including 15 stations in the Reno 1° x 2° quadrangle (file **EFSEIS.ICE**). The field data are in file **RW61.FLD** and the associated instrument calibration data are in file **G8A.CAL.** A total of 410 data points were obtained from data collected by R.R. Wahl in 1963-1964, and 65 data points were obtained from data collected by D.L. Peterson in 1975 for a study of Carson Sink (Wahl and Peterson, 1976) (file **RWAHL.ICE**). Most of the data were obtained in digital format from sources 2149 and 2235, respectively, in the DMA Gravity Library. The field data are in files **RW63.FLD** and **RW64.FLD**, and the associated instrument calibration factor is in file **E340.CAL.**

A constant 14.42 mGal was subtracted by the DMA from unpublished values of observed gravity (R.R. Wahl, written commun., 1988) for data in DMA source 2149. A constant 14.58 mGal, the same datum shift applied to essentially all USGS data submitted to DMA for data collected in California, was subtracted by the DMA from values published by Wahl and Peterson (1976) to obtain values of observed gravity in DMA source 2235. Values of observed gravity for Wahl data were adjusted to include a tie I made in 1993 between the DMA primary base, "FALLA", at the Fallon airport and the site of Wahl's primary base station, "SFALL", (R.R. Wahl, written commun., 1988). A constant 0.25 mGal was added to DMA values of observed gravity to account for the difference between the 1993 value at "SFALL" (979,725.33

mGal) and its counterpart "BM F" (979,725.08 mGal) in DMA source 2149. Inasmuch as the value at "SFALL" (or "FALL") was listed as 979,739.50 mGal by Wahl and Peterson (1976), the DMA equivalent value of base station "SFALL" in DMA source 2235 would be 979,724.92 mGal. Therefore, 0.41 (=14.58-14.42+0.25) mGal was added to values of observed gravity for data in DMA source 2235. A comparable suggested datum shift of 0.40±0.11 mGal at "SFALL" was obtained from a best fit of observed gravity for my 1987-1988 ties to 22 other 1963-1964 Wahl stations.

An observed-gravity datum shift of 14.17 mGal was applied to principal facts for 172 data points listed by Wahl and Peterson (1976), which were not included in DMA source 2235. Field data obtained from R.R. Wahl (written commun., 1988) for gravity data collected in 1961-1964 were typed into computer files. Inasmuch as details of data analysis, including possible later ties, are not known to me, the field data were not reduced to revise values of observed gravity but were used to evaluate the accuracy of data located in the Reno quadrangle and to identify values that might significantly differ from the published values. For example, four presumed mis-readings of 100 dial units and one mis-reading of 300 dial units were corrected before the 1976 publication. Comparisons with values of observed gravity at data points common to other gravity surveys indicated that the instrument multiplicative factor shown on the data sheets for Worden gravity meter readings was correct to within 0.8%. Instrument drift curves indicated that the Worden gravity meter E340 used in 1963-1964 had high drift rates between resets of 1.1 mGal/day for 27 days in 1963 and 1.45 mGal/day for 16 days in 1964.

Locations of data points that did not agree with described locations were re-digitized by using current topographic maps. Many locations for data collected in 1961 could not be corrected, because field notes referred to seismometer locations rather than specific landmarks, and elevations were of poor quality, inasmuch as altimetry without temperature data was relied upon. Odometer readings astutely recorded on field sheets for short intervals in 1963 and 1964 proved useful to correctly locate data points on present maps. An estimated 7% correction for odometer error was applied in 1964.

Geothermal studies

A total of 79 data points were obtained from geothermal studies by the U.S. Geological Survey near Salt Wells Basin (Peterson and Kaufmann, 1977), Steamboat Hills, and Wabuska (Peterson, 1975) (file **RGEOTH.ICE**). The data were obtained in digital format from DMA sources 4935, 4832, and 4832, respectively (National Geophysical Data Center, 1984). Constants of 13.90, 13.75, and 13.75, respectively, were subtracted by the DMA from the published values to convert to the IGSN-71 datum. Ten ties to nearly coincident data points from other surveys indicate that the values of observed gravity for the Salt Wells Basin survey agree to 0.03±0.16 mGal. Based on six apparent ties to stations from data points of a gravity survey by Thompson and Sandberg (1958) (R.W. Tabor, written commun., 1976), 0.8±0.2 mGal possibly still should be added to the values of observed gravity for the Steamboat Hills survey. Based on ten apparent ties, an associated standard deviation of 0.2 mGal is too high to substantiate the need to add 0.2 mGal to values of observed gravity for the Wabuska survey. The maximum value of combined instrument and tidal drift reported for the Salt Wells Basin survey was 0.4 mGal in four hours (Peterson and Kaufmann, 1977, p. 2).

Most locations were re-digitized on 7 1/2-minute topographic maps published after the field data were collected. The largest location change was 0.12 minute at Steamboat Hills station SB48. Two potentially useful data points to the north of Wabuska were discarded because their computer plotted locations in moderately rugged topography are doubtful. The DMA version of the elevation at station SW43 is 244 m (800 ft) too low (3095 rather than 3895 ft) probably as a consequence of poor reproducibility of computer printout in the report by Peterson and Kaufmann (1977).

Washoe Valley (R.W. Tabor)

A total of 58 data points were obtained from R.W. Tabor (written commun., 1976; Tabor and others, 1983) (file **RTABOR.ICE**). Principal facts for 11 data points ("UN" prefices) were printed on computer output sheets from R.W. Tabor and were obtained in digital format from Saltus (1988). Base stations, to which these data were tied, were not identified, but ties of these and other data on the computer printouts indicated that a constant of 14.56±0.2 mGal should be subtracted to convert from the apparent Behrendt and Woollard (1961) or Chapman (1966) observed-gravity datum to that of IGSN-71. Janell Edman made gravity observations at 43 sites in 1974 ("ET" prefices) and Stephen Ellen made gravity observations at four sites in 1975 ("EL" prefices) under the supervision of R.W. Tabor. The "EL" data were not included in gravity anomaly maps published by Plouff (1992) but have a negligible effect on the shapes of the contours and consequent interpretation. An accuracy of 0.2 mGal was assigned to non-repeated stations collected in 1974, inasmuch as available field sheets only indicate base ties to an arbitrary base at the University of Nevada in Reno campus the day before field work and twice daily ties to a motel room during the survey. Comparisons of observed gravity for seven data points repeated by other surveys indicate a good standard deviation of 0.08 mGal. Gravity observations were tied to base station "CH351" of the California base station network (Chapman, 1966) for data collected by Stephen Ellen.

Regional aquifer studies

The Water Resources Division (WRD) of the U.S. Geological Survey collected and interpreted gravity data in basins and valleys in the Reno 1° x 2° quadrangle. Data collected for the study of Carson Valley were discussed in a previous section as an extension of data collected in the adjacent Walker Lake 1° x 2° quadrangle. Principal facts for 184 data points were obtained from D.H. Schaefer (written commun., 1986) (file **RENOWRD.ICE**). The study of Lemmon Valley includes 103 data points tied to base station "CH351" in Carson City of the California base station network (Chapman, 1966). The study of Dixie Valley (Schaefer and others, 1984) includes 65 data points tied to a local base station "TRLRB" and thence to a primary base station "FALLA" of the Defense Mapping Agency. The study of Galena Creek basin includes 16 data points tied to base station "CH351" in Carson City (Katzer and others, 1984).

A constant observed-gravity datum shift of 13.70 mGal was subtracted by the Defense Mapping Agency when the WRD gravity data were added to the Gravity Library, apparently to account for the local difference between DMA base station descriptions referred to the U.S. National Gravity Base Net datum (NGBN) (Schwimmer and Rice, 1969) and IGSN-71. For compatibility with the observed gravity at other data points, 0.20 mGal was subtracted from DMA values for data collected for the study of Dixie Valley. For compatibility with the observed gravity at other data points, an additional 0.70 mGal was subtracted from data collected for the study of Lemmon Valley. No ties were available to possibly adjust the observed-gravity datum for the study of Galena Creek basin.

DATA COLLECTED BY G.A. THOMPSON AND C.H. SANDBERG

Principal facts for 69 data points from the gravity survey by Thompson and Sandberg (1958) were printed on computer output sheets from R.W. Tabor (written commun., 1976) and were obtained in digital format from Saltus (1988) (file **RTHOMP.ICE**). For compatibility with values of observed gravity at six data points from other surveys, 0.50 mGal was subtracted from Saltus' values. Inasmuch as the base stations, to which the values of observed gravity originally were tied, were at two pendulum stations (Thompson and Sandberg, 1958, p. 1270) and Tabor's (written commun., 1976) ties were related to values of Bouguer gravity anomalies, a standard deviation of 0.27 mGal for the six apparently repeated observations provided a sufficiently accurate basis for changing the observed-gravity datum.

DATA COLLECTED BY J.I. GIMLETT

Gravity data for 107 data points from a study of Warm Springs Valley by Gimlett (1967) were obtained in digital format from DMA source 2649 (National Geophysical Data Center, 1984) (file **RGIMLETT.ICE**). The error of observed gravity was estimated as 0.15 mGal relative to a base station at the University of Nevada campus in Reno (Gimlett, 1967, p. 16). A constant 0.55 mGal was subtracted from the DMA values of observed gravity based on four direct ties (0.53±0.04) and 12 ties to other surveys (0.64±0.12).

DATA COLLECTED BY A.H. COGBILL, JR.

A.H. Cogbill, Jr. (1979) collected gravity data in an extensive region of western Nevada as part of a study of regional crustal structure. Principal facts and gravity station descriptions were obtained from Cogbill (written communs., 1987, 1988) for gravity data collected in the Reno 1° x 2° quadrangle. Data were obtained in digital format for 17 data points accepted from DMA source 4999 (National Geophysical Data Center, 1984) (file **RCOGBILL.ICE**). A constant 0.10 mGal was added to Cogbill's values of observed gravity based on determining an average difference of 0.15±0.21 mGal relative to other surveys for eight ties to other gravity stations of Cogbill's data set. Elevations for 8 of the 17 data points were determined by altimetric methods ("A" in station name), but these data were needed to fill gaps in data coverage. Thirty three data points were discarded because their locations or elevations could not be reconciled on current maps at scales of 1:24,000 or their locations were redundant to other surveys.

COMPILATION BY THE UNIVERSITY OF NEVADA

Erwin (1982) published a list of principal facts for 1,708 data points, including 31 redundant and one mis-located data point, in or along the edge of the Reno 1° x 2° quadrangle. A preliminary version of these data and principal facts for an additional 129 data points previously were obtained by the U.S. Geological Survey from J.W. Erwin (written commun., 1976) as part of a cooperative arrangement to compute digital gravity terrain corrections (Plouff, 1977). The combination of these two data sets comprise DMA source 5069 (National Geophysical Data Center, 1984), which consists of 1,672 data points. The DMA subtracted 13.75 mGal from Erwin's (1982) values of observed gravity to convert from the U.S. National Gravity Base Net datum to the IGSN-71 datum. I added 0.10 mGal to the DMA version of Erwin's values of observed gravity based on determining an average difference of 0.2±0.2 mGal relative to other surveys for 22 ties to other gravity stations of Erwin's data set. The full 0.2-mGal difference was not added, inasmuch as the data set consists of numerous unknown subsets and covers a large region.

A total of 123 data points from J.W. Erwin (file **RERWIN.ICE**) were not included in other data sets discussed in this report. A prefix of "E" before the 4-digit station numbers was used to identify this data set. An additional letter "E" replaced the first digit of three 8-digit station names to symbolize that those station elevations were changed by 2 m (6 ft) or more. A suffix of "B" after stations E1768 and E1773 indicates that their locations needed to be changed by more than 2 km so that spot elevations associated with the data points would be correctly located. Principal facts were not found for about 50 data points shown on the gravity anomaly map by Erwin and Berg (1977) in significant gaps among other data points in the present report.

COMPILATION BY DEFENSE MAPPING AGENCY

A total of 4,194 data points were obtained from the Defense Mapping Agency (DMA) Gravity Library (National Geophysical Data Center, 1984) (table 2). Ten subsets of the DMA data were extracted from the initial digital data set and are discussed in other sections of this report. A total of 1,484 data points coincided with other data points of the DMA data set. Most of 445 data points located between 0.01 and 0.1 minute of longitude and latitude from other data points of the DMA data set were duplicate points. Subsets with source numbers 2381, 2733, 3502, 3507, and 3598 were excluded (table 1) because they do not form useful clusters with ties to other stations, and sources for their elevations and reliabilities of their local gravity base stations are doubtful. A total of 437 data points (file **RENODMA.ICE**) that were not rejected as doubtful, redundant, or part of a separately discussed set remain from the initial data set. Minor changes of these data were made to correct locations, elevations, and values of observed gravity. A data point (source 5144, sequence number 5635) near an island in Pyramid Lake, which was retained in other data sets, was not preserved by re-locating it at a benchmark 1° 0.00' eastward, because another data point (S0170 from R.R. Wahl) with an observed gravity value of 0.2 mGal lower at the same elevation is there.

Eight-digit station names were created for data points by appending their 4-digit sequence numbers to their 4-digit source codes that identify the data contributor. For ease of recognizing data sources and reducing the number of characters for plotting, many source codes were replaced by a single right-adjusted alphabetical character in the station name (table 2). Station names generally were retained in their original form, but a prefix, "E," was substituted in column 1 of the station name for 24 data points, for which DMA elevations were corrected by 2 m (6 ft) or more. Arbitrary station names were assigned to data points in sources 1083 and 6206, inasmuch as all data points within those subsets had the same sequence numbers--"000 " and "4055," respectively. The leftmost, less-varying four characters of station names, which simply may confirm the source or general location, often appeared in DMA subsets as sequence numbers rather than the rightmost four characters for station names with more than 4 digits, which were submitted to the DMA library.

If standard deviations were sufficiently small, constant values of observed gravity based on ties to USGS observations or to data points from other sets were added as datum shifts to improve overall compatibility. Computer analysis of the 1,484 coincident pairs of data points indicated that most of the duplicate stations are in source 5069, Erwin's (1982) compilation, as verified by the occurrence of only two average differences of observed gravity and one standard deviation that exceed 0.1 mGal for 24 DMA subsets, from which Erwin's data points apparently were derived.

FILES WITH PRINCIPAL FACTS

Principal facts for each data point consist of a record of 80 columns in diskette files of Part B. The record format is the same as previous releases from the U.S. Geological Survey in Menlo Park, Calif. (for example, Plouff, 1977, p. 14), which is specified in the **README.** file on the diskette. Unique station names consist of 8 or less characters. Decimal points are excluded. Locations are in geographic coordinates expressed in degrees and minutes to the nearest 0.01 minute. Elevations are expressed to 0.1 ft. Values of observed gravity are expressed to 0.01 mGal. Although values of terrain corrections (inner and total), free air anomalies, complete Bouguer anomalies, and isostatic residual gravity are expressed to 0.01 mGal, most of those values are accurate to no better than 0.1 mGal.

A 4-digit code symbolizes the type of location (table 3) and the estimated accuracies of elevation (table 4), location (table 5), and, if available, the value of observed gravity (table 6) at each data point. Elevation errors of 0.02 mGal/m, as applied to the Bouguer gravity anomaly, are the largest potential source of error. The accuracy of observed gravity depends on the type of gravity meter used, the magnitude of drift, and the number and quality of repeat readings. The accuracy of observed gravity was left blank in the principal-facts tables unless the field data were available or the type of gravity meter was known. The radius, to which inner terrain corrections are carried, is specified by a one-digit code. The 5-digit name of the base station, to which the station was tied, is included if available; therefore, if the value of observed gravity at a base station is improved, correcting the observed gravity at stations tied to that base is a simple computer process. Dates (month-day-year), year of publication reference, or a range of years when the last gravity observation was made are specified, if available, in columns previously allocated to the simple Bouguer anomaly.

The following statistical information summarizes the principal facts for the 2,198 gravity stations in the Reno 1° x 2° quadrangle. Elevations range from 1,030 to 3,285 m above sea level with an average elevation of 1,409±252 m, where the last number indicates standard deviation. Values of observed gravity range from 979,236 to 979,799 mGal with an average of 979,673±70 mGal. Free-air gravity anomalies range from -80 to +178 mGal with an average of -13± 28 mGal. Total terrain corrections range to 39.7 mGal with an average of 1.7±2.8 mGal. Complete Bouguer gravity anomalies range from -215 to -134 mGal with an average of -172±15 mGal. Values of isostatic residual gravity (fig. 1) range from -44 to +16 mGal with an average of -13±11 mGal. The ability to detect local gravity anomalies within the regional background has been improved by estimating the effect of isostatic compensation, as indicated by the reduction of the standard deviation by 4 mGal between Bouguer gravity anomalies and values for the isostatic residual gravity.

FILES WITH FIELD DATA

Formats for field data files are specified in detail in the **README.** file on the diskette in Part B. Files of field observations with suffices **.FLD** include gravity meter names, the last five digits of 8-digit station names, dates, times, Greenwich corrections, readings, and comments. For data collected or processed after 1983, the files also may include flags for repeated readings at data points from other surveys, station elevations, elevation units, the first three digits of the accuracy code, a field terrain correction to 53 m (175 ft), and a 5-digit code for the topographic map. Files for gravity meter calibrations with suffices **.CAL**, which cover the range of field readings, include a multiplication factor, available circular error corrections (gravity meter 17B only), and a series of dial readings to the nearest 100 units with associated milligal-equivalent values and interval factors. Components of **.FLD** file names include the first letter of the name of 1° by 2° quadrangle, an abbreviation of the supervisor's name, the number of the gravity meter, the time of the year for correction of times to greeenwich (D for Daylight Saving and S for Standard Time), and the last digit of the year.

Field data I collected as part of the study of the Tonopah 1° by 2° quadrangle Plouff (1990) are in file **TPLF84.FLD**. Data collected under the supervision of D.B. Snyder in the Tonopah quadrangle are in files **TONOBASE.FLD, TSN177D0.FLD, TSN177D1.FLD, TSN177D2.FLD, TSN177S0.FLD, TSNY161B.FLD, TSNY17B1.FLD, TSNY17B2.FLD, TSNY1920.FLD, TSNY6142.FLD**, and **TSNY8B83.FLD**. Data collected under the supervision of D.L. Healey in the Tonopah quadrangle are in files **THL134D.FLD, THL134S.FLD, THL444D.FLD, THL1444S.FLD**, and **THL772.FLD**. Data collected under the supervision of M.W. Reynolds of the University of California at Berkely in the Walker Lake 1° x 2° quadrangle is in file **WREYNOLD.FLD**. Names of party chiefs and field assistants are listed to the extent available as comments in field data files.

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Table 1.--Base station descriptions and values

The following list provides available latitudes, longitudes, values of observed gravity in milligals, elevations in feet (as on diskette), and observers' descriptions of locations. The number in parentheses after the 5-digit base station name indicates the number of stations known to be tied to that base station. The following abbreviations are used: BM, level line bench mark; CGS, bench mark established by the U.S. Coast and Geodetic Survey (now the National Geodetic Survey); E, N, S, and W are compass directions east, north, south, and west, respectively; CL, centerline; Hwy, highway; and Vee, outward direction along the bisector of angle between adjacent roads of a road intersection. "Secondary base" indicates that the station was repeated but the value of observed gravity is not as accurate as bases of the network, to which the auxiliary base station was tied. Base stations were not identified for 642 data points.

Primary base stations established by the Defense Mapping Agency in Reno quadrangle

RENOA (59) 39° 32.38' 119° 48.79' 4560 ft 979,674.65 mGal

At the campus of the University of Nevada in Reno--designated "ACIC 0454-1" and "IGC 12099B." On concrete floor at corner in wall under stairway; inside and 1 m S of doorway below ground level at SE entrance to W wing of James G. Scrugham Building. Entrance is about 20 m NW of stairs leading down from parking lot. Elevation from contour interpolation may be lower.

FALLA (52) 39° 29.73' 119° 45.38' 3963 ft 979,730.77 mGal

At the Fallon Airport (about 1.5 mi N of Fallon, Nev.)--designated "ACIC 2351-1" and "IGB 12098J." On concrete porch; NW corner of porch; at SW corner of southmost (administration) building. Epoxy remains from former metal disk (1993). Elevation estimated relative to benchmark shown less than 200 m away on topographic map.

Base stations occupied for this study

FALLW (112) 39° 28.55' 118° 47.97' 3969.8 ft 979,725.23 mGal

Easily accessible location near the west edge of Fallon, Nev. Sidewalk CL; CL about 4x4x4-ft green metal box; 11 ft N of N edge of driveway to motel to S; 28 ft S of SE entrance to drivein restaurant; 25 ft E of Allen Road CL; about 175 ft S of U.S. Hwy 50 CL. Accuracy 0.03 mGal relative to FALLA. 11 readings at site.

FERNW (304) 39° 36.67' 119° 15.86' 4140.4 ft 979,716.38 mGal

Easily accessible location S of exit from Interstate 80 near the west edge of Fernley, Nev. 1 ft S of Stop sign in S road Vee; 23 ft W of U.S. Hwy 95A CL; about 200 ft S of road to W; about 500 ft S railroad crossing. Accuracy 0.03 mGal relative to RENOA. 36 readings at site.

NIXNS (0)   39° 49.22'   119° 21.67'   3952.0 ft   979,736.46 mGal

Secondary base station. On USGS BM 3HJH; about 90 ft E of road junction; about 1 mi S of Nixon, Nev. Accuracy 0.03 mGal relative to RENOA and FERNW. 14 readings at site.

Base stations for data collected by R.R. Wahl

AUSTN (2)

Base station from Mabey (1960) network. Near CGS BM A384; near end of Nevada Hwy 8A at junction with U.S. Hwy 50; about 1 mi NW of courthouse at Austin, Nev. Gravity datum established by ties to other data points of set.

SFALL (371)   39° 28.29'   118° 45.97'   3956 ft   979,725.33 mGal

Near east edge of Fallon, Nev. 1993 description. 2 ft S of witness post for destroyed BM Q47; 3 ft S of fence; 24 ft W of SE fence corner of "State of Nevada Maintenance shops"; 30 ft N of street CL. Slight depression at BM location. Accuracy 0.03 mGal relative to FALLA.

SFERN (117)   39° 36.22'   119° 13.66'   4145 ft   979,715.38 mGal

East edge of Fernley, Nev. 15 ft W of Hwy signpost to Lovelock; S side of U.S. Hwy 50A; SW corner of U.S. Hwy 95A. Not recoverable due to road and sign changes. Apparent reference to spot elevation on 15' quadrangle.

Base stations for data collected near the edge of the Walker Lake quadrangle

The following base stations were described by Plouff (1982), with page numbers indicated in square brackets: YERRI (17) [34]; AMIND (125) [32]; Y 77 (19) [35]; Y 37 (3) [35]; Y 36 (1) [35]; Y 71 (15) [35]; R242 (2) [30]; P192 (2) [34]; PB 3 (3) [34]; and VB 1 (2) [32]. The description for station Y 48 (15) [34], however, should be revised to:

Y 48   39° 08.33'   119° 10.80'   4299 ft   979,659.88 mGal

NVBM repeat station "28-15-25." Near destroyed Vertical Angle BM shown on superseded 15' Wabuska map.

Base stations for regional aquifer studies and studies of Washoe Valley

TRLRB (64)   39° 42.50'   118° 06.96'   3424 ft   979,751.88 mGal

Secondary base station for Dixie Valley survey. Arbitrary location of trailer near well and ranch may not be registered correctly to current topographic map.

DIXIE 1 (0)   39° 40.45'   118° 08.55'   3482 ft   979,751.22 mGal

Secondary base station for Dixie Valley survey. Near BM and main road junction.

CH351 (123)   39° 10.13'   119° 45.96'   4685 ft   979,619.21 mGal

Carson City. Base station at edge of California base station network (Chapman, 1966, P. 49). Identified as "26650351" in file **RENODMA.ICE**. On brick sidewalk; 0.7 ft below CGS BM G-323 on NW corner of Civic Auditorium-Library Building; SE corner of Carson and Ann Streets. Value of observed gravity may be 0.04 mGal higher (written commun., S.L. Robbins, 1971, p. 80)

Other base stations

MYSTC (41)   39° 27.1'   5152 ft   979,630.0 mGal

Thompson (1959, p. 228) published this value for U.S. Coast and Geodetic Survey pendulum station 1044 at Mystic, California (Duerksen, 1949, p. 183), but the location and observed-gravity datum adjustment to IGSN-71 is not known. The accuracy of pendulum observations probably is not better than 2 mGal,

NBM (107)   39° 32.4'   119° 48.8'   4540 ft

Base station for data in file **RGIMLETT.ICE**. Gimlett (1967, p. 16) described his primary base station as "a convenient location in front of the Nevada Bureau of Mines Building" at the campus of the University of Nevada at Reno. Coordinates and elevation estimated. Gravity datum established by ties to other data points of set.

Table 2.--Sources of data from Defense Mapping Agency Gravity Library.

[Pre, letter in column 3 or 4 of station name, which replaces source code. Code, 4-digit code associated with source of gravity data. IN, initial number of data points. FN, final number of data points in file **RENODMA.ICE**. DG, value of observed gravity that was added (in 0.01-mGal units) for reconciliation with other values in this report; V, more than one value. DMA, Defense Mapping Agency, Topographic Command or Geodetic Survey Squadron at Cheyenne, Wyo. UNR, University of Nevada at Reno. USGS, U.S. Geological Survey. UW, University of Wisconsin.]

Pre	Code	IN	FN	DG	Contributor, description, notes
	483	76	41	30	Stanford University, 1954, G.A. Thompson.
	1083	32	7	20	National Gravimeter Base Network, NOAA.
	2149	41	0	25	USGS, Eureka-Fallon profile, 1963. See R.R. Wahl study.
B	2179	160	60	0	USGS, Basin and Range (Mabey, 1960)
	2235	376	0	45	USGS, Carson Sink, Nevada. See R.R. Wahl study.
	2293	16	9		USGS, Sierra Nevada, 1961.
	2381	1	0		DMA, California and other U.S. data, 1963, NAVOCEANO.
	2649	156	0	-55	Stanford University, Warm Springs Valley, 1965. See Gimlett data.
	2665	3	2		California Division of Mines and Geology bases, 1965, R.H. Chapman.
	2733	1	0		DMA, Gravity base net and excenters, 1967.
Y	3048	54	0	20	UNR, Yerington area, 1967 (Erwin, 1970). See Walker Lake study.
	3260	17	16	0	USGS Walker Lake and adjacent quadrangles, 1969, W.L. Rambo.
	3502	8	0		UW, Trip AD, Series PI, 1954, R. Pemberton.
	3507	7	0		UW, Trip AI, Series M, 1955, J. Mack and R.M. Iverson.
	3598	17	0		UW, Trip ZZ, Sereis NI, 1953, N.A. Ostenso.
G	3667	4	1	0	USGS, Susanville quadrangle, California, 1971, S.L. Robbins.
	4099	4	2	0	DMA, North-south profiles, 1967, HIG.
	4832	95	0	16	USGS, Wabuska 75-668, 1976, D.L. Peterson. See geothermal studies.
	4838	1	0		USGS, Walker Lake quadrangle, 1976, D.L. Healey.
	4935	45	0	10	USGS, Churchill County, Peterson and Kaufman. See geothermal studies.
	4960	1	1		USGS, Chico quadrangle, 1977, C.W. Roberts.
	4999	50	0	20	Northwestern University, Western Nevada, 1976. See A.H. Cogbill, Jr.
	5068	2	0		UNR, Millett quadrangle, 1978, J.W. Erwin.
	5069	1672	0	10	UNR, Reno quadrangle, 1978, J.W. Erwin. See UNR compilation.
F	5116	93	44	-10	DMA, Nevada, 1968
Q	5130	94	48	-10	DMA, Nevada, 1969
H	5144	281	150	0	DMA, Nevada, 1971
X	5163	52	51	0	DMA, Nevada, 1972
	5171	3	0		DMA, Nevada, 1972
	5271	1	0		DMA, Whirlwind Valleys, Nevada, 1979
	5675	5	0		USGS, Nevada and California, 1980.
	5788	234	0	V	USGS, Washoe County, 1979, Schaefer and Maurer. See Walker Lake study.
	5962	568	0		USGS, Basin and Range, D. Schaefer. See aquifer studies.
	6206	24	5	30	Hawaiian Institute of Geophysics, National Geodetic Survey, U.S.

Table 3.--Location description codes (digit one) in Reno quadrangle

[Num, total number of gravity stations for which code was used.]

Code	Num	Explanation
B	23	On level-line bench mark or other permanent mark incorporated into U.S. Geological Survey vertical control system, including National Geodetic Survey bench marks.
N	575	Near or possibly on level-line bench mark of U.S. Geological Survey system.
H	62	Near or possibly on vertical-angle bench mark.
D	80	Near assumed location of any of the above marks that was destroyed or not found.
P	90	Near surveyed elevation not printed on topographic map.
X	23	Near well-defined marks such as wells, windmills, microwave towers, or section corners.
F	28	Near location with or without a mark, at which a surveyed elevation is shown on a published topographic map.
G	866	Near location (on a manuscript or published map) at which a spot elevation is determined by photogrammetry; near doubtful F-location. Printed in brown or with lettet "T" appended.
T	4	Elevation based on photogrammetry done by by U.S. Geological Survey; or spot elevation not printed on published topographic map.
K	20	Spot elevation based on photogrammetry determined by other organizations.
R	1	Near spillway or stream gaging station or water level; usually tied to surveyed elevation.
W	19	Edge of lake, canal, or reservoir; interpolated elevation or elevation given for water or dam at unknown height relative to present level.
A	72	Elevation determined by using altimetry with unknown accuracy.
C	67	Elevation determined by topographic contour interpolation.
2	51	Along regularly spaced profile of stations; elevation source is unknown.
3	207	Near road or section line; elevation source is unknown.
U	10	Not near road or other landmark; elevation source is unknown.

Table 4.--Codes for elevation accuracy (digit two) in Reno quadrangle

[Num, total number of stations for which code was used. AC, accuracy in meters. BOU, corresponding accuracy of the Bouguer gravity anomaly, in milligals, assuming 0.02 mGal/m. Uncertainty of horizontal location tends to degrade elevation accuracy.]

Code	Num	AC	BOU	Examples
1	13	0.05	0.01	On or tied to level-line bench mark by surveying.
2	37	0.15	0.03	Elevation difference hand-leveled to nearby bench mark; elevation recorded to nearest foot.
3	341	0.3	0.06	Near bench mark.
4	297	0.6	0.12	On or near vertical-angle bench mark; flat area near level-line bench mark that was not found.
5	315	1.5	0.3	Near surveyed elevation on topographic map; elevation from map with 10-ft contour interval
6	583	3.0	0.6	Photogrammetric elevation or contour interpolation on map with 20-ft contour interval.
7	500	6.0	1.2	Uncertain location of photogrammetric spot elevation.
8	109	15.0	3.0	Contour interpolation along road or stream on map with 80-ft contour interval; doubtful combination of elevation and horizontal location.
9	3	30.0	6.0	Location where original elevation was that of a spot elevation on a different hillcrest.

Table 5.--Codes for horizontal location accuracy (digit 3) in Reno quadrangle

[Num, total number of stations for which code was used. AC, accuracy in meters. BOU, corresponding accuracy of the Bouguer gravity anomaly, in milligals. Error of Bouguer gravity anomaly is based on assumption that all location error is along the north component of direction.]

Code	Num	AC	BOU	Examples
1	10	13	0.01	Near vertical-angle bench mark. No information was available to show how close to the mapped location were 41 stations with location code "H".
2	389	25	0.02	Near permanent mark on map such as bench mark, section corner, or well.
3	815	65	0.05	Road intersection or stream fork.
4	595	130	0.1	Broad road curve or gentle hillcrest.
5	282	250	0.2	Location depends on odometer measurement over interval greater than 1 mi, or other estimate. Map location of surveyed station that differs by up to 840 ft from previously published location.
6	63	650	0.5	Location approximately agrees with elevation but is located 0.5 mi from a likely landmark.
7	39	1,300	1.0	No likely landmark within 1 mile.
8	5	2,500	2.0	Original location changed by 1 to 2 mi, to agree with location of the given elevation.

Table 6.--Codes for accuracy of observed gravity (digit four) in Reno quadrangle

[Num, total number of stations for which code was used. AC, accuracy of observed gravity in milligals. Accuracy primarily reflects accuracy of tie to base station, to which station was tied, and secondarily depends on accuracy of observed gravity at the base station.]

Code	Num	AC	Examples
1	5	0.01	Base station established with LaCoste and Romberg gravity meter.
2	5	0.02	Station established with multiple ties of high precision.
3	10	0.05	Repeated readings with LaCoste and Romberg gravity meter.
4	729	0.1	One reading with LaCoste and Romberg gravity meter.
5	366	0.2	Single tide-corrected reading with Worden gravity meter with good drift characteristics.
6	548	0.5	Value is average of two observations that are 1.0 mGal apart; uncertain datum shift.
7	32	1.0	Single reading of Worden gravity meter with doubtful drift characteristics.
8	1	2.0	Value is average of two observations that are 3.2 mGal apart.
	502		Type of gravity meter and quality of base station ties are unknown.