CALIFORNIA

GEOGRAPHIC

COORDINATE

DATA BASE

(GCDB)

USERS'

GUIDE

Bureau of Land Management

California State Office
Branch of Cadastral Survey - GCDB Section
Sacramento, California
916-978-4340

GEOGRAPHIC COORDINATE DATA BASE USERS' GUIDE

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March 29, 2013

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INTRODUCTION

The Geographic Coordinate Data Base (GCDB) contains the geographic coordinates, and their associated attributes, for the Public Land Survey System (PLSS). Coordinates are available for all rectangular corners down to the 1/16 section corner level, and all special survey corners (meanders, mining claims, HES, etc).[1] It provides the foundation for the BLM's Automated Land and Mineral Record System (ALMRS) and will be useful to anyone trying to attach data to points on the earth's surface. These coordinates were calculated using the most recent survey information available for a township and control points from various sources. Two different software packages were used, PLSS Coordinate Computation System (PCCS) and GCDB Measurement Management (GMM). PCCS was used first, until May 1993. The file names for the two software packages are different but the contents are essentially the same.

The PCCS files have coordinates in Latitude/Longitude NAD 27, and Universal Transverse Mercator projection (UTMs - x,y in meters). State plane coordinates can be generated if needed. GMM files have coordinates in all three formats.

The files you will be most interested in will be:

PCCS - L06N08E, U06N08E, X06N08E

GMM - T03SR39E.LX, T03SR39E.UTM, T03SR39E.COR, T03SR39E.DXF, T03SR39E.PGC, T03SR39E.GEO, T03SR39E.TPR

Descriptions of some of the files are included for your information even though you won't be using them. (We know you'll be curious.)

You need to know how the point identification system works, the difference between the meaning of reliability in PCCS versus GMM, and some information on control points. These topics are discussed below.

The geographic coordinates and their associated products have NO LEGAL SIGNIFICANCE. They should be used for record keeping, mapping, graphics and planning purposes only.

We can't promise you that the data is flawless. Let us know if you find any problems. This will help us to improve the quality of the data base. If you have questions about anything, give us a call. We aim to please!

TOWNSHIP NAMING CONVENTIONS

BLM has various township naming conventions. They are listed below.

SURVEY PLATS/NOTES	GMM	PCCS L FILE	ALMRS DED*
T. 22 N., R. 1 W.	T22NR01W	L22N01W	0220N0010W
T. 14 N., R. 4 E.	T14NR04E	L14N04E	0140N0040E
T. 11-1/2 S., R. 6 W.	T112S06W	L11206W	0112S0060W
T. 12 N., R. 24-1/2 E.	T12N242E	L12N242E	0120N0242E

* *Data Element Dictionary*

---

[1]Townships with 26 or more Special Surveys may not have Special Surveys included, but will have the PLSS rectangular surveys included.

ERROR ELLIPSES (GMM) AND RELIABILITIES (PCCS)

In GMM, the error region (ellipse) is available, the first value is the (semi-major) axis of maximum error within the ellipse, and the second value is the (semi-minor) axis of minimum error within the ellipse. The values are in feet. The error ellipses are internal to that particular township only. See Appendix A. They are not a reflection of true (absolute) coordinate reliability but are relative to each other within a township reflecting the integrity of the survey information used.

In PCCS, the two values reflect the average and maximum reliability, in feet, for each point. These values are comparable from one township to another and are an estimate of the true positional reliability.

POINT IDENTIFICATION SYSTEM

Point IDs are used to show where in a township a point is located and generally what kind of point it is (i.e. township exterior, interior, offset, meander, tract, special survey, mile post). It is a 6 digit number composed of 2 parts, XxxYyy, related to the x,y axis. In Xxx or Yyy, X or Y is the line number and xx or yy is the number of chains[2*] from the section corner, going west to east and south to north. The diagrams on the next 2 pages show how the numbering scheme works.

Numbers greater than 700700 are reserved for the following special situations.

Xxx = 711 -799 Boundaries with Mileposts
800 -836 Meanders
837 -899 Tracts
900 -999 Mineral Surveys, Homestead Entries, etc.

Yyy Numbered sequentially along the survey in increments of 10. The prefix (Xxx) may be the same for all points in a similar survey.

In PCCS files, intersections of section lines and special survey lines will have two IDs, the "rectangular" (±4) and the segment identifier.

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[2] *Chains are a unit of measure used by surveyors. A regular section is 80 chains square. One chain equals 66 feet. One hundred links equal one chain.*

GCDB POINT IDENTIFICATION SCHEME

NOVEMBER 4, 1993

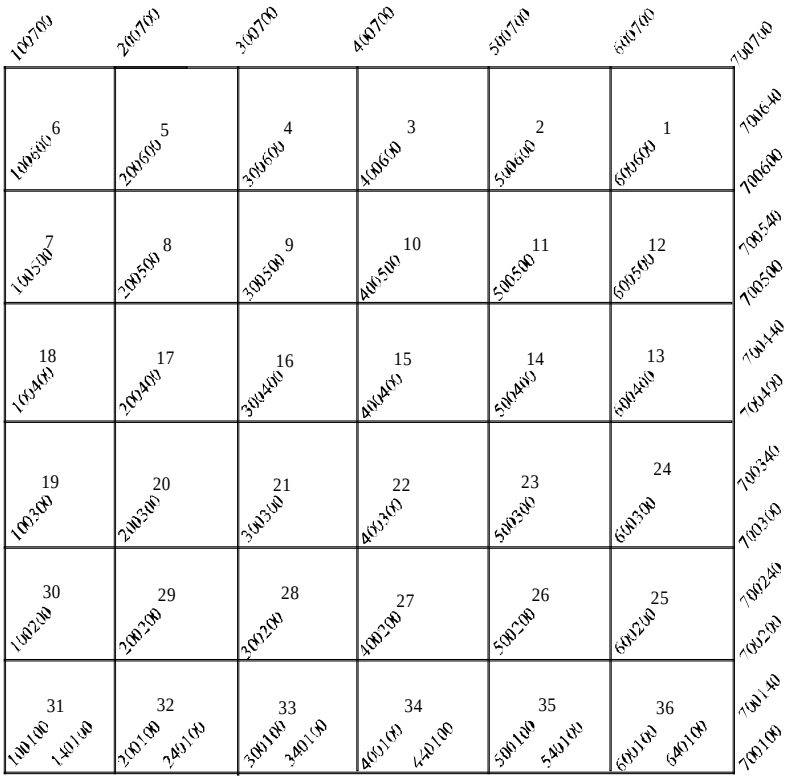
MEANING OF THE PREFIX (GENERALLY)

100 - 700 = RECTANGULAR SURVEY POINT

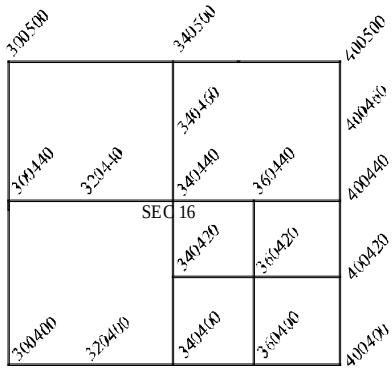
800 = MEANDERS

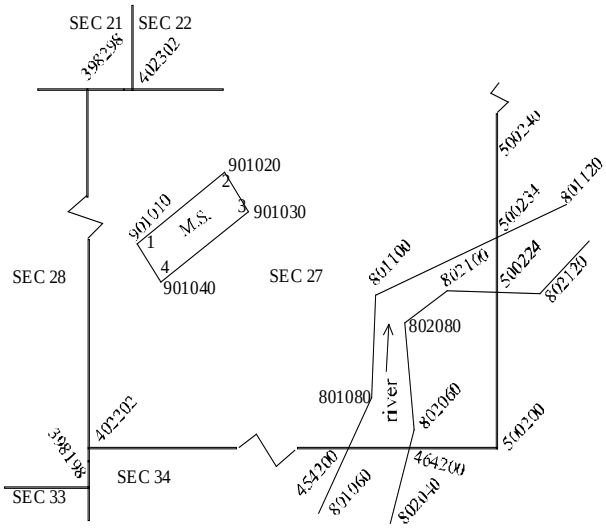
900 = MINERAL SURVEYS, HES, ETC.

For explanation of more complicated point ID situations contact the GCDB Section, Branch of Cadastral Surveys, California State Office, BLM

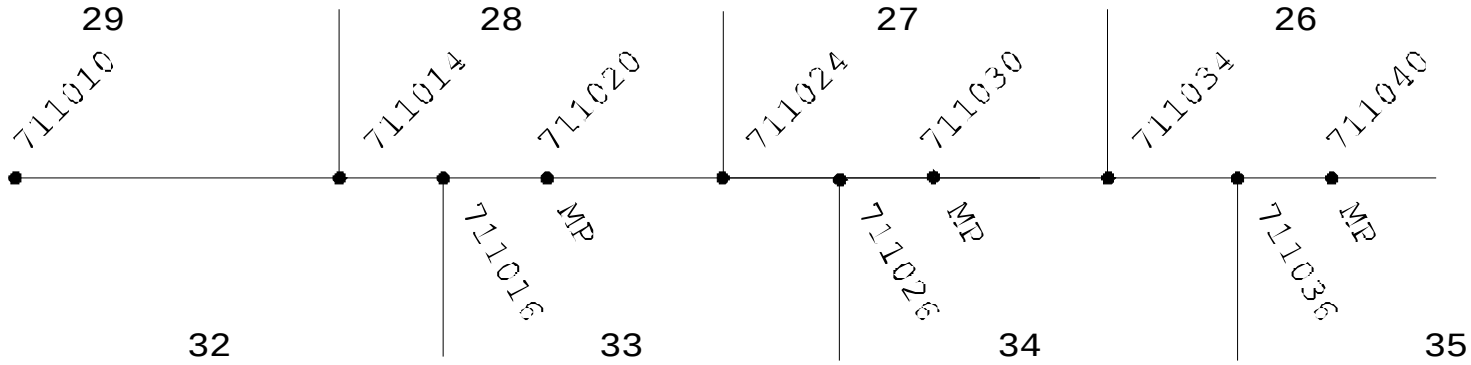


NO WARRANTY IS MADE BY THE BUREAU OF LAND MANAGEMENT
FOR USE OF THE DATA FOR PURPOSES NOT INTENDED BY BLM

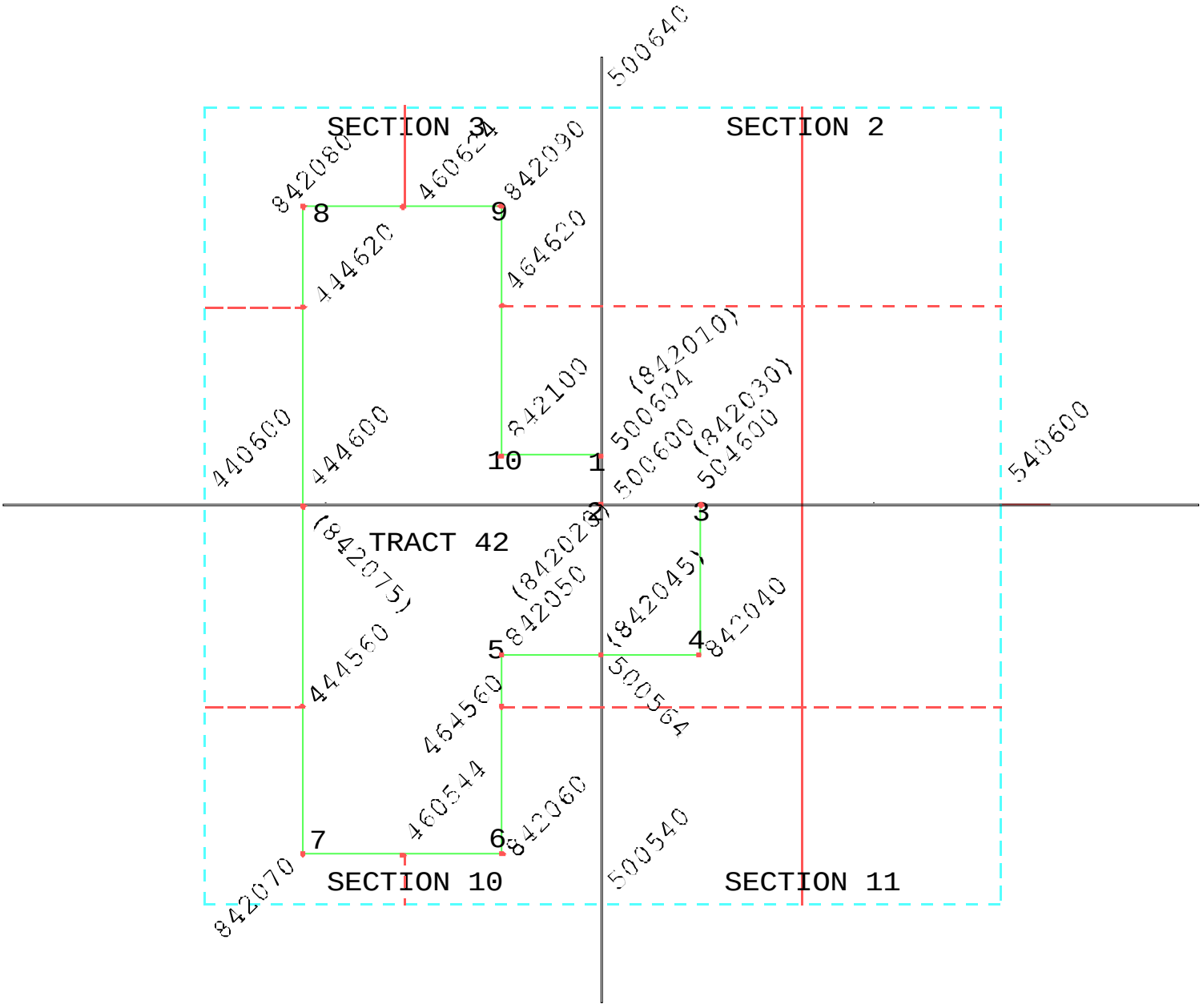




This sheet should accompany release of all GCDB data in ACCESS CATEGORY 2



Boundary or Milepost Survey



Special Survey Point Identifiers

SUMMARY
Point Identifier Standards

! Each XxxYyy has a prefix, Xxx, and a suffix, Yyy.

! X and Y start at 1 and increase by miles east or north.

! xx and yy increase by tens of chains within each mile.

! The one's place (Xx<u>x</u> or Yy<u>y</u>) is reserved for:

0 a rectangular corner point.

1,2,8 or 9 (∀1,∀2) offset corners in Township interior.

3 or 7 (∀3) offset corners on Township boundaries,

3,4,6 or 7 (∀3,∀4) intersection with special surveys.

5 for 1/256th corners

SUMMARY
Segment Identifiers

! For each XxxYyy, Xxx =

100 - 710	Rectangular
711 - 799	Boundaries with Mileposts
800 - 836	Meanders
837 - 899	Tracts
900 - 999	Mineral Surveys, Homestead Entries, etc.

! Yyy increments by tens, sequentially along the survey.

! Groups of similar surveys may have one segment identifier prefix.

CONTROL

Geographic control for GCDB is derived from a variety of sources, the various sources having a particular reliability. (e.g. Digitized points from USGS maps have a reliability of 40,40 (feet) whereas NGS first order points have reliabilities of 1,1 (foot).) The control points are handled differently by PCCS and GMM. In PCCS the control points are assigned a reliability and the values for latitude and longitude are held fixed during the computational process. In GMM the control points are not held fixed, but are assigned error estimates (weights), and allowed to adjust during the

adjustment process.

In GMM, the published values of control established by NGS and USGS are assigned error estimates of .001 feet, which is the most accurate the GMM software allows. In PCCS computed townships, the values for published control should be identical to the published values. For the townships computed using GMM the values should be the same to four decimal places. **YOU ARE ADVISED TO ALWAYS REFER TO THE PUBLISHED VALUES rather than using the value from the PCCS or GMM files**.

Many of the control points in GCDB are digitized values for PLSS corners shown as "found crosses" on USGS 7-1/2 minute quads. These digitized points are assigned a reliability of 40,40 (feet) in PCCS or GMM. PCCS will retain the digitized values during the computation process. GMM will not retain the digitized values, but will allow the digitized control to float and will adjust it.

GMM control is assigned an error estimate and provided to the computing surveyor, the estimate can only be changed where warranted. Some control is imported from adjacent townships to facilitate the merging of single township data sets during the regional adjustment. This type of control is given an error estimate of .001, .001 and is called Merge Control. For more information on control used during regional processing see page 13. On page 11 is a list of the control reliabilities you'll find in the data files and their possible sources.

We can provide more information on particular control points if you need it. We have a control data base (in ORACLE software) which contains the following information on each control point.

Point ID #, Station Name, Latitude & Longitude in NAD 27, Elevation in feet (not all points), NGS Order, which USGS Quad it's on, Source, Township, Range, Section, comments about what it is.

We can query on any of these fields to obtain data.

We also have a Plat and Special Survey data base (in ORACLE software) which contain the following information about Cadastral Plats.

Township, Range, BLM District, BLM Resource Area, Forest, Other (i.e. Indian Reservation, National Park, etc.), Surveyors, Survey Year, Survey Type, Number of sections, Comments

For Mineral Surveys, HES, etc we also have county, some acreage. Again, we can query on any of these fields.

Our **SUMMARY Report** includes all the above mentioned data for a particular township. See the example on page 12.

KEY TO RELIABILITY OF CONTROL POINTS

RELIABILITY[1]	SOURCE[2]	DESCRIPTION
(1,1)	NGS	From National Geodetic Survey (NGS) tape, 1st order.
(3,3)	NGS	From NGS Tape, 2nd order.
(10,10)	USGS	Supplemental Files, or source stated in comments
(1,1)	GPSF	Forest Service Global Positioning System (GPS)
(1,1)	USFS	Forest Service
(1,1)	G027	Canyon County GPS 1990 (027 is Data Element Dictionary (DED) code for C.Cnty)
(1,1)	GPSU	From USGS GPS Project
(1,1)	GPSB	BLM GPS
(1,1)	GPSP	Private GPS, D.Evans & Associates work for City of Coeur d' Alene 1988.
(10,10)	FSC	FS Plat conventional tie moving control to a section corner
(10,10)	BLMC	BLM Plat conventional tie moving control to a section corner
(16,16)	GPSB	BLM GPS done with PATHFINDER, good to 16 Feet
(25,25)	DOPU	USGS Doppler From USGS GPS Project
(25,25)	NGS	From NGS Tape
(25,25)	USGS	Supplemental files, USGS-GPS Project, or other
(40,40)	MCI	Digitized points (found corners) off USGS 7-1/2' quads.

[1] (10,10) the average and maximum error, in feet, of the point.

[2] Source is a code found in the control data base, not in the data files. If you need more information on a control point we can provide it.

Summary Report For T. 0360N, R. 0010E, 21 Principal Meridian

Task: 2 25-JUN-92
Complexity: 2

SURVEYOR	Year	Survey	Lotting	Source ID	#Sec	Comments
HOLMAN ET AL	1870	Original	Irregular			
MAGEE	1873	Dependent	Irregular			
BAKER	1882	Dependent	Irregular			
BERDAN	1882	Dependent	Irregular			
SANDOW	1882	Dependent	Irregular			
SANDOW	1882	Original	Irregular			
GLEAVES	1891	Dependent	Irregular			
GLEAVES	1891	Original	Irregular			
GLEAVES	1892	Dependent	Irregular			
DENT	1908	Dependent	Irregular			
DENT	1908	Original	Irregular			
ENGLISH	1922	Dependent	Irregular			
HIESTER ET AL	1938	Dependent	Irregular			
SYDLIK ET AL	1957	Dependent	Irregular			
HAMON ET AL	1983	Dependent	Irregular			

Special	Surveys	Sections	Number
Mineral	1	2	4547

Min Survey	Lode Name
4547	EXCELSIOR PLACER

Quad Name	ID #
Big Bend	41121-A8
Chalk Mountain	40121-H7
Roaring Creek	40121-H8
Skunk Ridge	41121-A7

Base Control Data in Township

Point	Latitude	Longitude	Source	Attribute
100100	405534.1387	1215435.8411	Dig 7.5 or Tie	Digtzd BLM method
100300	405719.0499	1215437.0445	Dig 7.5 or Tie	Digtzd BLM method
100440	405837.5472	1215437.8898	Dig 7.5 or Tie	Digtzd BLM method
100600	405958.0784	1215438.7778	Dig 7.5 or Tie	Digtzd BLM method
100700	410050.2440	1215438.5597	Dig 7.5 or Tie	Digtzd BLM method
200200	405624.9365	1215329.6398	Dig 7.5 or Tie	Digtzd BLM method
200300	405717.3398	1215329.6551	Dig 7.5 or Tie	Digtzd BLM method
200400	405812.0896	1215328.2236	Dig 7.5 or Tie	Digtzd BLM method
200640	410022.5311	1215329.0548	Dig 7.5 or Tie	Digtzd BLM method
300400	405811.9842	1215220.3723	Dig 7.5 or Tie	Digtzd BLM method
300700	410050.7404	1215219.3157	Dig 7.5 or Tie	Digtzd BLM method
400100	405532.9234	1215113.9848	Dig 7.5 or Tie	Digtzd BLM method

GMM REGIONAL ADJUSTMENT INFORMATION

The GMM software allows for the adjustment of blocks of townships. For administrative purposes these blocks are given the designation Txxa, where T = Task, xx = number of the task, and a = block of tps. within task. The number of townships in a block varies.

As of November 9, 1994, in order to maintain seamless edge match between blocks of townships the edges of blocks may be held rigid. This procedure will be changed in the future. As of July 16, 1995, edge match is accomplished by holding the edge of a buffer of townships fixed. Where buffer townships are one tier of previously processed townships, adjacent to the region being adjusted. The buffer townships are included in the adjustment, but the edge is held fixed with the adjacent townships that are also from the previous adjustment. See the diagram on page 14. For example, block 1 is adjusted first, block 2 is adjusted with one tier of from block 1 included and a fixed boundary. Block 3 is adjusted with one tier from block 1 (includes township that was adjusted with block 2) and a fixed boundary. Block D is adjusted with one tier from blocks 1, 2, and 3 and 2 fixed boundaries.

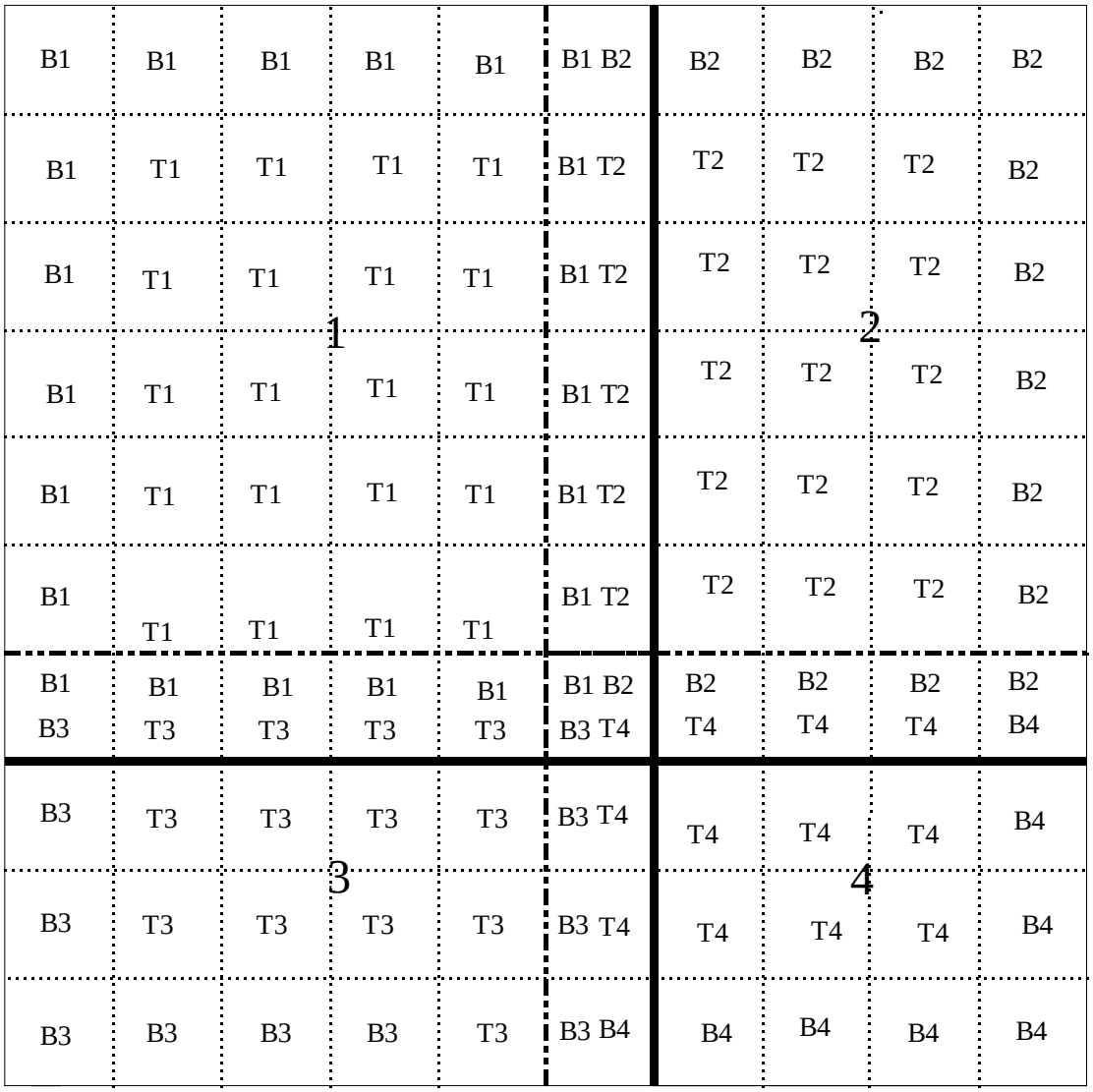
Many of the files for a regional adjustment are the same as those for a single township adjustment. These files do not exist for the regional adjustment: <block>.RAW, <block>.CON, <block>.SID, or any of the files relating to subdivision of sections. This is because the GMM software assembles the data for a block of townships, from the single township files into block files. After the regional adjustment is completed the GMM software is used to update the single township files with the regional adjustment data. A <block>.DXF file may exist which includes all the townships in a block, but without any section subdivision.

Merge Control Points

Control points imported as Merge Control are thrown out during the merging process. All other control points used in a regional adjustment, are the same control points as those used for the single township adjustment. Only the regionally adjusted coordinate are useful.

As of August 1, 1995, the following regions have protracted data included in them: TASK0, TASK1, TASK2, TASK3, TASK4 and TASK21. Some of TASK21 and most of TASK22 does not include protracted data. Task 23 does not include any protracted data. For information on what areas a task covers, or what the data exists, contact the California GCDB Data Steward.

Diagram Showing Block Adjustment Scheme



Denotes Block boundary

Denotes Fixed boundary

Tn = Target and Block No.
Bn = Buffer and BlockNo.

COMPARABLE FILES FOR PCCS AND GMM

PCCS	GMM
Bxxx N/A	none
Cxxx	xxx.CTL
Dxxx N/A	none
Fxxx N/A	none
Hxxx N/A	xxx.CON
Lxxx N/A	xxx.LX
Pxxx N/A	none
xxx.LL and xxx.QQ	xxx.LL and xxx.QQ
Rxxx	xxx.RAW
xxx.SCR	xxx.DXF
Uxxx N/A	xxx.UTM
Xxxx	xxx.PGC
Zxxx N/A	xxx.SID
none	xxx.COR
none	xxx.GEO
none	xxx.SD
none	xxx.SUB
none	xxx.INT
none	xxx.TPR or xxx.INR

Any files not shown are for use of the software and are only useful to the GCDB. PCCS files marked N/A are not available.

PCCS C36N01E

Geographic Coordinate File. Could be useful outside GCDB.

TWP 0360 RNG 0010 PM Mnt Diablo California(CA) DATE 05/01/92

ORIGIN	405834.0000	1215135.0000	4000.000	0	0	2000.0000	5000.0000
100100	405534.1387	1215435.8411	4000.000	40	40	1789.6264	4724.2048
100300	405719.0499	1215437.0445	4000.000	40	40	1788.3196	4885.1090
100440	405837.5472	1215437.8898	4000.000	40	40	1787.4067	5005.5022
100600	405958.0784	1215438.7778	4000.000	40	40	1786.4466	5129.0154
100700	410050.2440	1215438.5597	4000.000	40	40	1786.7468	5209.0231
200200	405624.9365	1215329.6398	4000.000	40	40	1866.6672	4802.0777
200300	405717.3398	1215329.6551	4000.000	40	40	1866.6787	4882.4492
200400	405812.0896	1215328.2236	4000.000	40	40	1868.3734	4966.4193
200640	410022.5311	1215329.0548	4000.000	40	40	1867.4797	5166.4808
300400	405811.9842	1215220.3723	4000.000	40	40	1947.2530	4966.2377
400100	405532.9234	1215113.9848	4000.000	40	40	2024.4472	4722.2813
400500	405903.7140	1215110.7006	4000.000	40	40	2028.2428	5045.5741
573700	410049.7263	1214857.5151	4000.000	40	40	2182.9608	5208.2126
600198	405624.8651	1214856.4271	4000.000	40	40	2184.4296	4801.9903
643100	405533.0275	1214817.0702	4000.000	40	40	2230.2540	4722.5126
700100	405532.9005	1214747.1030	4000.000	40	40	2265.1153	4722.3414
700113	405541.8552	1214747.7486	4000.000	100	100	2264.3544	4736.0747
683700	410050.0031	1214749.3533	4000.000	40	40	2262.1487	5208.6854
693700	410057.7226	1214749.3687	4000.000	40	40	2262.1223	5220.5250
700700	410057.7276	1214744.2319	4000.000	100	100	2268.0898	5220.5370
140700	410050.3760	1215403.6100	4000.000	10	10	1827.3502	5209.2041
404700	410049.6960	1215107.4800	4000.000	10	10	2031.9718	5208.1218
1	2		3	4	5	6	

1 - Point ID
2 - NAD 27 Latitude/Longitude. The decimal is located after the seconds.
3 - Project elevation in feet.
4 - Average Minimum Reliability in feet.
5 - Maximum Reliability in feet. (Control points have equal ave/max.)
6 - (X,Y) Cartesian tangent plane coordinates in chains unit. Origin is at Point ID 400400 or near the center of the township which is assigned a false departure of 2000 chs. and latitude of 5000 chs.

Description:
Contains all the available control for a township. Not all of the control will necessarily be used. The control resides in the GCDB Control Data Base.

PCCS R36N01E

Raw Data File. Only useful to GCDB.

```
  TWP 0360  RNG 0010  PM Mnt Diablo  California(CA)        DATE 05/01/92
999999
700100   700113   14.700  1     4400.  1908
700113   700120    5.360  1     5000.  1908
700120   700133   14.730  1     5000.  1908
700133   700140    5.330  1     5000.  1908
700140   700153   14.760  1     2500.  1908
700153   700160    5.345  1        0.  1908
700160   700193   14.730  1        0.  1908
700193   700200    5.375  1        0.  1908
700200   700213   14.700  1        0.  1892
700213   700220    5.300  1        0.  1892
700220   700240   20.000  1        0.  PROTRCTION
   and then further down in the file....

700100   667100   11.966  4   892800.  1908
667100   660100    8.319  4   892800.  1908
660100   643100   14.535  4   892800.  1908
643100   640100    5.750  4   894200.  1908
640100   623100   15.455  4   900000.  1908
623100   620100    3.985  4   900000.  1908
620100   603100   17.220  4   900000.  1908
603100   600100    2.780  4   900000.  1908
600100   563100   16.685  4   900000.  1892
563100   543100   19.465  4   900000.  1892
|-------------|   |----|  |   |-----|  |--|
       1             2    3      4       5
```

1 - From and to station Point IDs.
2 - Horizontal distance in chains.
3 - Bearing quadrant (1=NE, 2=SE, 3=SW, 4=NW)
4 - Bearing in degrees, minutes, and seconds. The decimal is located after the seconds. The first example shows 5 minutes, the last shows 90 degrees.
5 - Source Identifier number (SID) Each data source, whether it is an official cadastral survey plat, state or local survey plat, deeds, etc., utilized in generating coordinates for the GCDB, will be assigned a unique SID number.

Description:
This is the raw data on which PCCS performs it computations. It is abstracted from the survey records and entered into PCCS.

PCCS T06N08E.SCR

Script File. For use in AutoCAD.

```
layer
new
twp,sect,int,annot,points
color
magenta
twp
color
blue
sect
color
green
int
```

and further down in the file.....

```
layer
set
sect

pline
0.61534236000E+06,0.48512767700E+07
0.61533369000E+06,0.48516727400E+07
0.61532502000E+06,0.48520687000E+07
0.61531634000E+06,0.48524646700E+07
0.61530767000E+06,0.48528606400E+07
0.61530015000E+06,0.48532574500E+07
0.61529263000E+06,0.48536542700E+07
0.61528511000E+06,0.48540510800E+07
0.61527759000E+06,0.48544479000E+07
0.61527007000E+06,0.48548447100E+07
0.61526255000E+06,0.48552415200E+07
0.61525502000E+06,0.48556383400E+07
0.61524750000E+06,0.48560351500E+07
```

Description:
AutoCAD script files are created from PCCS Lxx files. They can then be brought into AutoCAD to generate a drawing of the township.

PCCS X36N01E

Geographic Coordinate File. Only useful to GCDB.

TWP 36N RNG 01E PM Mnt Diablo California(CA) DATE 06/11/92

ORIGIN	405834.0000	1215135.0000	4000.000	0	0	2000.0000	5000.0000
100100	405534.1387	1215435.8411	4000.000	40	40	1789.6264	4724.2048
100120	405547.2527	1215435.9914	4000.000	154	363	1789.4630	4744.3178
100140	405600.3666	1215436.1420	4000.000	153	363	1789.2996	4764.4309
100160	405613.4806	1215436.2923	4000.000	154	363	1789.1362	4784.5439
100200	405626.5944	1215436.4428	4000.000	153	363	1788.9729	4804.6570
100220	405639.7084	1215436.5932	4000.000	153	363	1788.8095	4824.7700
100240	405652.8222	1215436.7437	4000.000	153	363	1788.6461	4844.8830
100260	405705.9361	1215436.8940	4000.000	153	363	1788.4829	4864.9960
100300	405719.0499	1215437.0445	4000.000	40	40	1788.3196	4885.1090
100320	405732.1328	1215437.1853	4000.000	154	363	1788.1674	4905.1745
100340	405745.2157	1215437.3263	4000.000	153	363	1788.0152	4925.2401
100360	405758.2986	1215437.4671	4000.000	154	363	1787.8630	4945.3056
100400	405811.3815	1215437.6080	4000.000	153	363	1787.7109	4965.3712
100420	405824.4644	1215437.7488	4000.000	153	363	1787.5588	4985.4367
100440	405837.5472	1215437.8898	4000.000	40	40	1787.4067	5005.5022
100460	405850.9691	1215438.0377	4000.000	153	363	1787.2467	5026.0878
100500	405904.3910	1215438.1858	4000.000	153	363	1787.0866	5046.6733
100520	405917.8128	1215438.3338	4000.000	153	363	1786.9265	5067.2588
100540	405931.2347	1215438.4818	4000.000	153	363	1786.7665	5087.8443
100560	405944.6565	1215438.6298	4000.000	153	363	1786.6065	5108.4298
100600	405958.0784	1215438.7778	4000.000	40	40	1786.4466	5129.0154
100620	410011.3044	1215438.9352	4000.000	154	363	1786.2755	5149.3006
100640	410024.5305	1215439.0927	4000.000	12	35	1786.1045	5169.5859
100660	410037.3873	1215438.8262	4000.000	153	363	1786.4256	5189.3045
100700	410050.2440	1215438.5597	4000.000	40	40	1786.7468	5209.0231
113100	405534.0717	1215424.7054	4000.000	153	363	1802.5806	4724.0949
120100	405534.0374	1215419.0198	4000.000	153	363	1809.1947	4724.0387
120120	405547.0734	1215419.1658	4000.000	154	363	1809.0352	4744.0321
120140	405600.1087	1215419.3119	4000.000	154	363	1808.8757	4764.0246
120160	405613.1429	1215419.4582	4000.000	154	363	1808.7159	4784.0154
120200	405626.1765	1215419.6046	4000.000	158	429	1808.5562	4804.0053
120220	405639.2876	1215419.7086	4000.000	158	429	1808.4456	4824.1139
120240	405652.3983	1215419.8128	4000.000	158	429	1808.3351	4844.2220
120260	405705.5083	1215419.9168	4000.000	158	429	1808.2246	4864.3290
120300	405718.6179	1215420.0209	4000.000	158	429	1808.1142	4884.4355
120320	405731.8552	1215420.1064	4000.000	154	363	1808.0254	4904.7378
|----|	|----------|	|------|	|-|	|-|	|----------|	
1	2		3	4	5	6	

1 - Point ID
2 - NAD 27 Latitude/Longitude. The decimal is located after the seconds.
3 - Project elevation in feet.
4 - Average Minimum Reliability in feet.
5 - Maximum Reliability in feet. (Control points have equal ave/max.)
6 - (X,Y) Cartesian tangent plane coordinates in chains unit. Origin is at Point ID 400400 or a point near the center of the township which is assigned a false departure of 2000 chs. and latitude of 5000 chs.

Description:
Contains the above described values for every PCCS point in the township, including sixteenths and special surveys.

TABLE A

SOURCE AGENCY: (3-6 characters) Generally, this will be a three letter abbreviation for the agency which created the document. Below are some examples. If other agencies are needed, contact the BLM.

BLM	Bureau of Land Management - 1946 to present
GLO	General Land Office - pre 1946
BOR	Bureau of Reclamation
CGS	Coast and Geodetic Survey
NGS	National Geodetic Survey
USC&GS	US Coast & Geological Survey
USCE	US Corp of Engineers
USGS	US Geological Survey
USFS	US Forest Office
NPS	National Park Services
DMA	Defense Mapping Agency
FAA	Federal Aviation Administration
CALT	California Dept. of Transportation
NOAA	National Oceanic & Atmosphere Administration
LAWP	Los Angeles Water and Power
MWD	Metropolitan Water District
CAnn	Local Agency Codes for California from the Data Element Dictionary, Appendix A.

For countries other than the USA, use the first three letters.

TABLE B

SURVEY TYPE: (1 character) This attribute describes the method or procedure used to determine the measurement value for a line. It is possible that one .SID may relate to several of these survey types. Select the one that best describes the record.

A	LOCATION SURVEY	K	SUPPLEMENTAL PLAT
B	RETRACEMENT SURVEY	M	INTERNATIONAL BOUNDARY
C	CORRECTIVE RESURVEY	N	NO SURVEY PLAT, MAP ONLY
D	DEPENDENT RESURVEY	O	ORIGINAL SURVEY
E	ACQUIRED LANDS SURVEY	P	PROTRACTION DIAGRAM
F	OMITTED LANDS SURVEYS	Q	EXCHANGE SURVEY
I	INDEPENDENT RESURVEY	R	SEGREGATION SURVEY
J	OTHER	Z	UNKNOWN

GMM FILES T06SR20E.CON

Geographic Coordinate File. Only useful to GCDB.

```
 TWP 0060  RNG 0200  PM Mnt Diablo  California(CA)        DATE 11/29/93
ORIGIN    382203.0000 1194647.0000 7000.000   0    0  27
ORIGIN    382202.6809 1194650.6387 7000.000   0    0  83
ORIGIN    382202.3618 1194654.2775 7000.000   0    0  HP
100600    382307.7693 1194931.8103 7000.000  40   40  27
100600    382307.4504 1194935.4549 7000.000  40   40  83
100600    382307.1315 1194939.0996 7000.000  40   40  HP
400240    382018.8930 1194629.4619 7000.000  40   40  27
400240    382018.5756 1194633.0993 7000.000  40   40  83
400240    382018.2582 1194636.7368 7000.000  40   40  HP
540100    381904.3193 1194451.3239 7000.000  40   40  83
540100    381904.0026 1194454.9574 7000.000  40   40  HP
540100    381904.6360 1194447.6905 7000.000  40   40  27
700100    381902.9946 1194311.0783 7000.000 100  100  27
700100    381902.6791 1194314.7083 7000.000 100  100  83
700100    381902.3636 1194318.3384 7000.000 100  100  HP
710100    381902.9946 1194253.6955 7000.000 100  100  27
710100    381902.6793 1194257.3249 7000.000 100  100  83
710100    381902.3640 1194300.9544 7000.000 100  100  HP
|----|    |----------------------| |------|  |-----|  |-----------------|
  1                 2                 3        4               5
```

1 - Point ID
2 - NAD 27 Latitude/Longitude. The decimal is located after the seconds.
3 - Project elevation in feet.
4 - Error estimates in feet.
5 - 27 = NAD27
83 = NAD83
HP = HPGN

Description:
This file contains all the control used in the township.

GMM T06SR20E.CTL

Geographic Coordinate File. Only useful to GCDB.

```
 TWP 0060  RNG 0200  PM Mnt Diablo  California(CA)        DATE 11/29/93
ORIGIN    382203.0000 1194647.0000 4000.000   0    0  2000.0000 5000.0000
100100    381903.0022 1194947.6793 4000.000 283  283  1781.7713 4724.1200
100100    381903.0090 1194948.0308 4000.000 100  100  1781.3468 4724.1306
100600    382307.7693 1194931.8103 4000.000  40   40  1801.1243 5099.3422
100700    382359.9451 1194931.8103 4000.000 100  100  1801.1640 5179.3292
117100    381902.8935 1194930.9747 4000.000  57   57  1801.9475 4723.9429
117100    381902.9410 1194931.5416 4000.000 100  100  1801.2628 4724.0160
200640    382332.7680 1194828.7847 4000.000  40   40  1877.1887 5137.6354
240700    382400.8530 1194755.8351 4000.000  40   40  1916.9539 5180.6803
400240    382018.8930 1194629.4619 4000.000  40   40  2021.1768 4840.4027
540100    381904.6360 1194447.6905 4000.000  40   40  2144.1039 4726.5912
673700    382400.8530 1194308.4194 4000.000 100  100  2263.7064 5180.7585
700100    381902.9946 1194311.0783 4000.000 100  100  2260.7952 4724.1337
700700    382400.8530 1194303.3975 4000.000 100  100  2269.7651 5180.7625

|----|    |----------------------| |------|  |-----|  |-----------------|
  1                  2                3         4              5
```

1 - Point ID
2 - NAD 27 Latitude/Longitude. The decimal is located after the seconds.
3 - Project elevation in feet.
4 - Error estimates in feet.
5 - (X,Y) Cartesian tangent plane coordinates in chains unit. Origin is assigned a false departure of 2000 chs. and latitude of 5000 chs.

Description:
This is a backup control file. It contains all the control available in the township but does not include transferred points.

GMM T06SR20E.COR

Coordinate File. Useful to State Plane Coordinate users.

100100	2622610.193	244477.950
100200	2622538.727	249720.785
100300	2622665.686	254734.966
100320	2622710.389	255952.257
100340	2622755.095	257169.537
100363	2622799.793	258386.817
100383	2622844.492	259604.098
100400	2622863.104	260523.291
100403	2622860.824	260850.571
100423	2622922.320	262200.202
100443	2622983.814	263549.823
100463	2623045.306	264899.445
100500	2623043.731	265271.658
100513	2623059.312	266086.242
100540	2623094.754	267150.628
100560	2623130.200	268215.014
100600	2623165.641	269279.390
100640	2623044.672	271936.176
100660	2622998.748	273259.782
100700	2622952.826	274583.377
1	2	

1 - Point ID.
2 - State Plane Coordinates (x,y) easting & northing in feet and NAD 27.

Description:
These are the State Plane coordinates for the township. GMM does all its computations in SPCs and then converts them into UTMs and Lat/Long.

GMM T06SR20E.DXF

Line Data File for CAD (Computer Aided Design) packages and other software.
For CAD users.

```
  0
SECTION
  2
HEADER
  9
$ACADVER
  1
AC1004
  9
$INSBASE
 10
0.0
```

and then to the end of the file.....

```
  1
N90- 0W
 50
     0.13
  0
ENDSEC
  0
EOF
```

Description:
This drawing interchange file can be brought into many software packages to produce a drawing of the township.

Geographic Coordinate File. For those who need only latitude & longitude of points.

100100	38-19- 3.17160	119-49- 47.46953
100200	38-19- 55.00114	119-49- 46.79509
100300	38-20- 44.52412	119-49- 43.69914
100320	38-20- 56.54346	119-49- 42.77309
100340	38-21- 8.56279	119-49- 41.84701
100363	38-21- 20.58211	119-49- 40.92089
100383	38-21- 32.60141	119-49- 39.99472
100400	38-21- 41.68105	119-49- 39.48527
100403	38-21- 44.91592	119-49- 39.41571
100423	38-21- 58.23917	119-49- 38.23878
100443	38-22- 11.56242	119-49- 37.06179
100463	38-22- 24.88563	119-49- 35.88475
100500	38-22- 28.56438	119-49- 35.79272
100513	38-22- 36.61094	119-49- 35.35251
100540	38-22- 47.12141	119-49- 34.58787
100560	38-22- 57.63186	119-49- 33.82319
100600	38-23- 8.14230	119-49- 33.05850
100640	38-23- 34.42685	119-49- 33.77916
100660	38-23- 47.51830	119-49- 33.95818
100700	38-24- .60973	119-49- 34.13721
1	2	3

1 - Point ID
2 - NAD 27 Latitude
3 - NAD 27 Longitude

Description:
Latitude and Longitude in NAD 27 of the points.

GMM T06SR20E.LX

Geographic Coordinate Line File. For most Users.

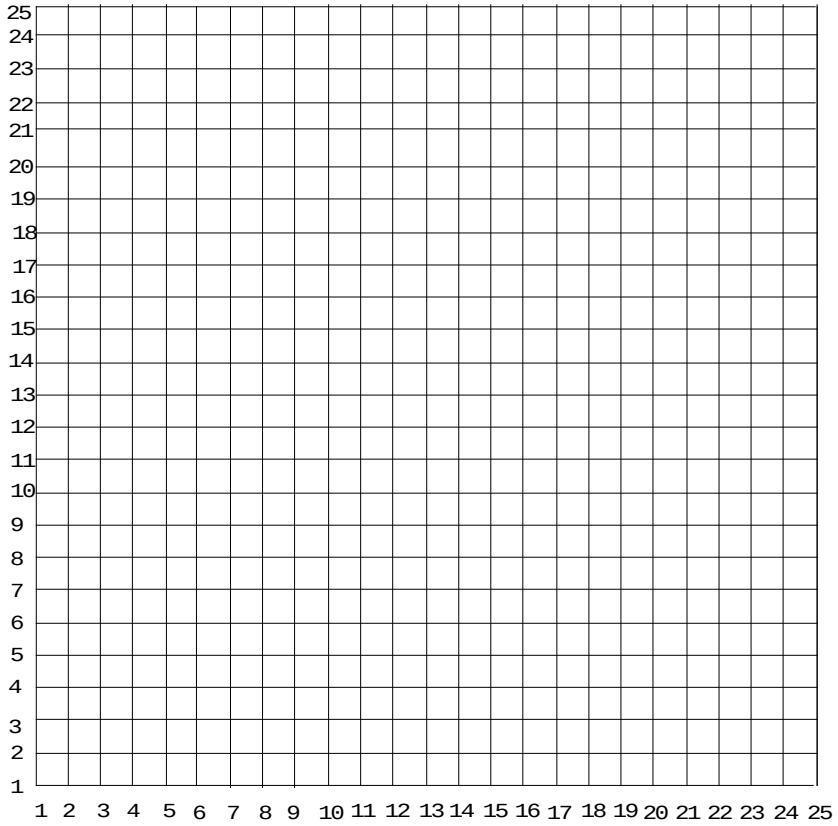
```
T06NR20E             MDM                  CA
ORIGIN    382203.0000 1194647.0000                    257142.504250042.92
100100 381903.1716 1194947.4695  7000.00  69   83  1 1 2  252591.89  4244632.03
100120 381916.1290 1194947.3009  7000.00  72  237  1 1 3  252608.23  4245031.38
100140 381929.0864 1194947.1323  7000.00  72  237  1 1 3  252624.57  4245430.73
100160 381942.0438 1194946.9637  7000.00  72  237  1 1 3  252640.91  4245830.08
100200 381955.0011 1194946.7951  7000.00  72  237  1 1 3  252657.25  4246229.43
100220 382007.3819 1194946.0211  7000.00  75  237  1 1 3  252687.75  4246610.55
100240 382019.7626 1194945.2471  7000.00  75  237  1 1 3  252718.25  4246991.67
100260 382032.1434 1194944.4731  7000.00  75  237  1 1 3  252748.74  4247372.79
100300 382044.5241 1194943.6991  7000.00  75  109  1 1 3  252779.24  4247753.91
100320 382056.5435 1194942.7731  7000.00 882  378  1 1 3  252813.08  4248123.78
100340 382108.5628 1194941.8470  7000.00 450 1789  1 1 3  252846.92  4248493.64
100363 382120.5821 1194940.9209  7000.00 436 1790  1 1 4  252880.77  4248863.51
100383 382132.6014 1194939.9947  7000.00 727  324  2 1 2  252914.61  4249233.37
100400 382141.6810 1194939.4853  7000.00 224  148  2 1 3  252935.56  4249512.92
100403 382144.9159 1194939.4157  7000.00 224  163  2 1 4  252940.31  4249612.60
100463 382224.8856 1194935.8847  7000.00 225  153  3 1 2  253063.79  4250842.24
100500 382228.5644 1194935.7927  7000.00 225  131  3 1 3  253069.50  4250955.59
100513 382236.6109 1194935.3525  7000.00 687  278  3 1 4  253087.78  4251203.33
100540 382247.1214 1194934.5879  7000.00 932  353  4 1 2  253116.27  4251526.80
100560 382257.6319 1194933.8232  7000.00 846  318  4 1 3  253144.76  4251850.27
100600 382308.1423 1194933.0585  7000.00  95   83  4 1 3  253173.25  4252173.74
100620 382321.2846 1194933.4188  7000.00  96  339  4 1 3  253176.93  4252579.19
100640 382334.4268 1194933.7792  7000.00  96  339  4 1 3  253180.60  4252984.63
100660 382347.5183 1194933.9582  7000.00  96  271  4 1 3  253188.64  4253388.38
100700 382400.6097 1194934.1372  7000.00  96   72  4 1 4  253196.67  4253792.12
|----| |----------------------|  |-----|  |-----|  | | |  |------------------|
   1              2                 3        4     5 6 7           8
```

1 - Point ID
2 - NAD 27 Latitude/Longitude. The decimal is located after the seconds.
3 - Project elevation in feet.
4 - Error error ellipse axis rounded to the nearest foot.
5 - Line number code - see Index diagram on page 13.
6 - Line type code - 0 = solid (continuous), 2 = dashed, 3 = centerline
7 - Line draw code - 1 = skip, 2 = pen down, 3 = draw, 4 = pen up
8 - Universal Transverse Mercator (UTM) coordinates in meters. Cartesian format - x,y.

Description:
This is a graphics line file. It can be imported into a GIS. Usually used to produce graphic displays of the data

xxx.LX (GMM) FILE INDEX DIAGRAM

This is the sequence of line information as it shows up in the Lxx file. It goes from South to North and then West to East.



GMM T06SR20E.PGC

Geographic Coordinate File. Only useful to GCDB.

```
T06NR20E             MDM                  CA
 ORIGIN    382203.0000 1194647.0000 7000.000   0    0  2000.0000 5000.0000
 100100    381903.1716 1194947.4695 7000.000  69   83
 100200    381955.0011 1194946.7951 7000.000  72  237
 100300    382044.5241 1194943.6991 7000.000  75  109
 100320    382056.5435 1194942.7731 7000.000 882  378
 100340    382108.5628 1194941.8470 7000.000 450 1789
 100363    382120.5821 1194940.9209 7000.000 436 1790
 100383    382132.6014 1194939.9947 7000.000 727  324
 100400    382141.6810 1194939.4853 7000.000 224  148
 100403    382144.9159 1194939.4157 7000.000 224  163
 100423    382158.2392 1194938.2388 7000.000 224  273
 100443    382211.5624 1194937.0618 7000.000 224  272
 100463    382224.8856 1194935.8847 7000.000 225  153
 100500    382228.5644 1194935.7927 7000.000 225  131
 100513    382236.6109 1194935.3525 7000.000 687  278
 100540    382247.1214 1194934.5879 7000.000 932  353
 100560    382257.6319 1194933.8232 7000.000 846  318
 100600    382308.1423 1194933.0585 7000.000  95   83
 100640    382334.4268 1194933.7792 7000.000  96  339
 100660    382347.5183 1194933.9582 7000.000  96  271
 100700    382400.6097 1194934.1372 7000.000  96   72
 |----|    |----------------------| |------|  |-----|  |-----------------|
   1                  2                 3        4               5
```

1 - Point ID
2 - NAD 27 Latitude/Longitude. The decimal is located after the seconds.
3 - Project elevation in feet.
4 - Error error ellipse axis rounded to the nearest foot.
5 - (X,Y) Cartesian tangent plane coordinates in chains unit. Origin is assigned a false departure of 2000 chs. and latitude of 5000 chs.

Description:
This is a geographic coordinate file used by GMM programs.

Raw Data File. Only useful to GCDB.

```
T06SR20E             MDM                 CA
999999
100100   100200   80.000  1         .0 1879WB
100200   100300   80.000  1         .0 1879WB
100300   100320   20.000  1         .0 A1879WB
100320   100340   20.000  1         .0 A1879WB
100340   100363   20.000  1         .0 A1879WB
100363   100383   20.000  1         .0 A1879WB
100383   100400   15.059  1         .0 A1879WB
100400   100403    4.941  1         .0 1879WB
```

and a little further down...

```
700100   657100   19.300  3   900000.0 1874SB
657100   637100   20.150  3   900000.0 1874SB
637100   617100   20.150  3   900000.0 1874SB
617100   600100   20.400  3   900000.0 1874SB
600100   577100     .091  3   900000.0 1874SB
577100   557100   20.492  3   900000.0 1874SB
557100   540100   19.417  3   900000.0 1874SB
540100   537100    1.075  3   890725.0 26RS084
```

and a little further down.....

```
240700   200700   40.000  3   900000.0 PROT122
200700   100700   80.000  3   900000.0 PROT122
400240   300240   79.000  4   874200.0 1981
200640   240640   40.000  1   900000.0 1879
240640   240700   40.000  1         .0 1879
999998
|-------------|   |----|  |   |------| |------|
       1            2     3       4        5
```

1 - From and to Point IDs.
2 - Distance, in chains, between the points.
3 - Bearing quadrant (1=NE, 2=SE, 3=SW, 4=NW)
4 - Bearing in degrees, minutes, and seconds. The decimal point is located after the seconds.
5 - Source Identifier number (SID). Each data source, whether it is an official cadastral survey plat, state or local survey plat, deeds, etc., utilized in generating coordinates for the GCDB, will be assigned a unique SID number. A SID with a letter prefix has augmented error estimates. A SID with a letter suffix denotes that there is more than one survey for the same year. A SID with boundary designations will have a NB, EB, SB or WB for a suffix.

Description:
This is the raw data on which GMM performs it computations. It is abstracted from the survey records and entered into GMM.

```
   GMM                              T06SR20E.SID

   Information File.  Only useful to GCDB.

S26RS084              .100   100.0    11.0   40.000   40.000
C CA109 1982 D
S1981                 .100   100.0    11.0   40.000   40.000
C BLM 13-DEC-1982 D JEPSON, WOODROW L.
S1928                 .100   333.3    31.0   40.000   40.000
C GLO 02-MAR-1932 D AVERILL, DUPREE R.
S1879                 .100 18000.0  4500.0   40.000   40.000
C GLO 21-JAN-1880 O ANDERSON, J.M.
S1874SB               .100  1000.0   300.0   40.000   40.000
C GLO 21-JAN-1880 O BENSON & GLOVER
SPROT122              .100   100.0  6300.0   40.000   40.000
C BLM 27-JAN-1970 P
S1879WB               .100  1562.5 18000.0   40.000   40.000
C GLO 21-JAN-1880 O ANDERSON, J.M.
S1879NB               .100  3125.0  3000.0   40.000   40.000
C GLO 21-JAN-1880 O ANDERSON, J.M.
SA1879WB              .100300000.0 28200.0   40.000   40.000
C GLO 21-JAN-1880 O ANDERSON, J.M.
SA1879                .100  1562.5 12000.0   40.000   40.000
C GLO 21-JAN-1880 O ANDERSON, J.M.
```

S1879	-	SID code (Year the survey was conducted if BLM/GLO) or For county records the code refers to the source documents book and page, where RS is Record of Survey or PM is Parcel Map or MP is Map Book, etc. So, 26RS084 refers to Book 26 of Records of Surveys beginning at page 84, for the county shown as the agency code on the first “C” (comment) line. In this case CA109 for Tuolumne Co.
0.100	-	Constant error estimate.
100.0	-	Distance error estimate in PPM (parts per million).
11.0	-	Error estimate in seconds.
40.000	-	These 2 fields are not used. The numbers are irrelevant.
C	-	Comment line.
GLO	-	Agency source code, See Table A on page 20.
10-OCT-1916	-	Date of approval of the SURVEY, put in by data abstractor.
O	-	Code for type of survey. See Table B on page 20.
Bardsley,HG	-	Name of Surveyor.

Description:
This file contains information about the surveys used for this township. It shows the SID number, survey source, date of survey, surveyor and some reliability values.

GMM T06SR20E.UTM

Geographic Coordinate File. Useful to UTM users.

```
 TWP 03S   RNG 39E   PM   Boise               Idaho(ID)   DATE 92/12/03
ORIGIN    430900.0000 1115300.0000  6107.00   0    0  428174.124777635.76
700100    430627.6337 1114932.5922  6107.00  22   22  432812.504772887.89
700117    430638.0782 1114932.5901  6107.00  22   21  432815.734773210.07
700120    430640.6688 1114932.5900  6107.00  22   21  432816.514773289.98
700137    430651.1165 1114932.5878  6107.00  21   21  432819.744773612.26
700140    430653.7038 1114932.5877  6107.00  21   21  432820.534773692.08
700157    430704.1548 1114932.5856  6107.00  21   21  432823.754774014.46
700160    430706.7389 1114932.5854  6107.00  21   21  432824.544774094.17
700197    430717.1931 1114932.5833  6107.00  20   20  432827.764774416.65
700200    430719.7739 1114932.5831  6107.00  20   20  432828.554774496.27
```

and further down in the file.....

```
100640    431114.6980 1115634.3899  6107.00   0    0  423378.514781843.65
100660    431127.7231 1115634.3490  6107.00   0    0  423383.964782245.44
100700    431144.1412 1115634.2974  6107.00   0    0  423390.834782751.89
640100    430627.6855 1115008.1917  6107.00  23   23  432007.884772897.46
540100    430627.7967 1115119.3741  6107.00  23   23  430399.024772917.11
440100    430627.9004 1115230.5835  6107.00  22   22  428789.554772936.92
340100    430627.9789 1115341.8584  6107.00  20   20  427178.594772956.35
240100    430628.0397 1115453.1879  6107.00  18   18  425566.394772975.63
140100    430628.1010 1115604.5570  6107.00   7    7  423953.304772995.31
120100    430628.1248 1115622.3762  6107.00   4    5  423550.554773000.55
|----|    |----------------------|  |-----|  |-----|  |-------||-------|
  1                  2                 3        4         5         6
```

1 - Point ID
2 - NAD 27 Latitude/Longitude. The decimal is located after the seconds.
3 - Project elevation in feet.
4 - Error error ellipse axis rounded to the nearest foot.
5 - Universal Transverse Mercator (UTM) coordinates in meters, x value.
6 - UTMs in meters, y value.

Description:
This file contains UTM coordinates for all the points in the township.

APPENDIX A - GMM Glossary

Observation - a fancy word for measurement

Simultaneous Solution - this means all coordinates are being solved for in one solution; In the compass rule process you must adjust one traverse into another traverse which is held as "fixed". This is not correct since the fixed traverse contains error.

System of Equations - in a least squares adjustment you solve an "n x n" system of equations each iteration where n equals the number of unknown quantities. In a 20 station traverse there are 40 unknowns (20 N, 20 E coordinates). This means a 40 equations, 40 unknowns system of equations must be solved. Even for a computer this is a slow process.

Bandwidth Optimization - There are many ways to speed up the solution of a system of equations and reduce the number of terms in the equations. Some methods other than bandwidth optimization include column profile minimization, Helmert blocking, and recursive partitioning. If a computer program does not use one of these methods the results will be produced very slowly. LSAQ uses a bandwidth optimization routine which has been extensively modified for better performance. For most survey networks the bandwidth will probably range from 5-30% of the total number of stations. This process enables more efficient solution of least squares problems, and especially allows "big" problems to be solved on a personal computer

Solution Convergence - the last iteration has insignificant updates and thus the solution terminates.

Solution Divergence - blunders or poor initial approximations will cause updates to grow as iterations proceed; This indicates something is wrong with the data, and it needs to be corrected.

Number of measurements - equals # of distances + number of angles + number of azimuths + number of control coordinates

Degrees of freedom - number of measurements minus number of unknowns; or the number of measurements beyond what is necessary to uniquely define coordinates for each station

Residual - the difference between a measurement and its computed quantity based on coordinates; It is how much the measurement adjusted.

Error estimate - A surveyor's error estimates of measurements assigns appropriate weighting of measurements in a least squares adjustment. An angle with an error estimate of 2 seconds will be treated as more weighted (stronger, less chance of

adjustment) than an angle with an error estimate of 10 seconds. This does not mean the angle with the smaller error estimate will always get a smaller adjustment since geometric constraints (such as sum of angles in a closed figure) also play a major role in dictating amount of adjustment. A distance error estimate is usually modeled by a constant plus a ppm addition to account for larger errors generally occurring in longer lines. An angle or azimuth error estimate is a function of the instrument's least count, the number of repetitions, the instrument operator's abilities, and the prevailing environmental conditions. Experience with instrumentation and the least squares adjustment will allow the surveyor to develop confidence in error estimation. Error estimating allows the simultaneous analysis of different measurement types (distances, angles, azimuths, control coordinates).

RMS error - root mean square error - it is the average of a series of residuals in which the sign of the residual is eliminated through summing squared residuals, dividing by the number of that type of measurement, then computed that value's square root.

Residual vs. error estimate - These quantities should be of approximately the same magnitude. Since measurements contain random error a plot of residuals should look like the "bell-shaped" curve from statistics which centers about zero. If residuals tend to be predominantly of one sign this means systematic error may exist. This would occur if your survey tied into two precise control coordinates and your EDM was measuring systematically long. All adjusted distances would be shorter than their measured values. It could also occur if horizontal angles were only measured in the direct position and a large horizontal collimation error existed. Residuals which are larger than three times their respective error estimate are generally considered suspect.

Standard error of unit weight - This is a number which tells you how well it appears you that you are estimating your measurement errors. It is generated by the summing the squares of all residuals divided by their error estimates. That quantity is divided by the degrees of freedom and the square root is taken. If a residual and error estimate are of the same magnitude note that the residual divided by the error estimate will generally produce a number close to one. The standard error of unit weight is a number that evaluates all residuals and corresponding error estimates. If the standard error of unit weight is near one (0.7-2.5) you are estimating your errors well. Uncorrected systematic errors, blunders, or generally poor measurements will result in larger residuals and thus a large standard error of unit weight. If you are pessimistic in error estimation or you have very few redundant measurements a very small standard error of unit weight will result.

Standard error of adjusted coordinates - these are the least squares error estimates of adjusting N,E coordinates. They are a function of proximity to existing control points. The statistical significance of these quantities is that if you went and made the same measurements with the same instrument using the same procedures, you would have a one sigma (68.3% confidence) chance of being within plus or minus the standard error

of the first solution's coordinate. It has nothing to do with additional traverse legs and readjustment, comparing to someone else's coordinates, or evaluating retracement evidence.

Error ellipses - It should be apparent that the reliability of a traverse point's position will not usually be the same in all directions. The position is generally stronger in the traverse direction, and weakest away from the traverse directions. The error region is an ellipse, defined by a radius (semi-major axis) of maximum error (SU), radius (semi-minor axis) of minimum error (SV), and the angle from north (positive clockwise) of the direction of maximum error (T). Since an error ellipse is two-dimensional, the one sigma error ellipse only denotes 35% confidence (roughly 68.3% squared). The same statistical significance reasoning for coordinate standard errors applies to error ellipses - it is an internal evaluation of your data and does not relate to external information such as other surveys or existing coordinates.

Robustness - This is a method of using least squares as a filtering mechanism for detection of blunders. Robustness averages the absolute value of a measurement's residual with its error estimate, and that average becomes the new error estimate in a readjustment. The measurements with large residuals get reassigned larger error estimates, and vice-versa. This enables the adjustment to be filtered to the suspect measurement. The success of robustness in blunder detection is a function of size of the blunder, number of blunders, and the geometry and redundancy of the traverse network.

NAD 27 - North American Datum of 1927 - a datum based on the Clarke Ellipsoid of 1866, and fixed position and orientation at Meade's Ranch in Kansas. Based upon this information latitudes and longitudes were calculated for all National Geodetic Survey control points based primarily on triangulation. The calculation involved a least squares adjustment by hand calculations!

NAD 83 - North American Datum of 1983 - a datum based on the GRS 80 Ellipsoid, and fixed position and orientation at the center of the earth. The measurements used in NAD 27, and additional measurements made by the National Geodetic Survey subsequent to 1927, were subjected to a least squares adjustment - this time using a computer. This results in a different latitude and longitude for a station when compared to its NAD 27 values, with the difference often amounting to hundreds of feet.

State Plane Coordinates - projections which uniquely relates a geodetic position (latitude, longitude) to a plane coordinate pair (N,E). The relation is truly a one-to-one correspondence; for a unique state plane coordinate pair there is only one latitude, longitude pair, and vice-versa. The two type of projections that exist are Lambert - a conic projection for states elongated east-west, and Mercator - a cylindrical projection for states elongated north-south. The size of a zone was limited by defining a a state plane distance will not differ from its geodetic counterpart by 1/10000 of the distance. Thus larger states are covered by more than zone.
NAD 27 state plane coordinates - These are based on zone constants which include

false northings and eastings so that negative coordinates do not result. The published units are U.S. Survey Feet.

NAD 83 state plane coordinates - These are based on different zone constants than NAD 27. The most notable change is that different values were assigned for false northings and eastings, and the coordinates published by NGS are in meters instead of U.S. Survey Feet. Even when converted to feet, NAD 83 coordinates look dramatically different than the NAD 27 coordinates for the same point because the false northings and eastings are different.