

U.S. Department of the Interior
Geological Survey

Gravity base stations in the
Kalispell 1° x 2° quadrangle, Montana

Viki Bankey and M.D. Kleinkopf

Open-File 85-109

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This report describes 13 gravity base stations set by the U.S. Geological Survey (USGS) in the Kalispell, Montana, 1° x 2° quadrangle. Each USGS gravity base is referenced or updated to the International Gravity Standardization Net of 1971 (IGSN-71). Most of these bases were tied to one of the U.S. Department of Defense (DOD) gravity bases, although some bases were tied to secondary USGS bases previously tied to the Kalispell DOD base. The DOD base in the Kalispell quadrangle is at Kalispell airport. Secondary bases were tied two or more times to ensure accuracy, and the average value of these ties is used as the observed gravity value.

Many of the gravity bases are set at bench marks. Those that are not are given estimated elevations based on contours interpolation from 1:24,000 or 1:62,500 scale topographic maps. These elevations are noted by the letters "est", which signifies an estimated elevation for that gravity base station.

These base description sketches are not drawn to scale and should be used with topographic maps.

SELECTED REFERENCES

Defense Mapping Agency Aerospace Center, 1974, World Relative Gravity Reference Network, North America, Part 2: DMAAC Reference Publication 25, with supplement updating gravity values to the International Gravity Standardization Net 1971, 1635 p.

International Association of Geodesy, 1967, Geodetic Reference System, 1967, International Association of Geodesy Special Publication 3, 74 p.

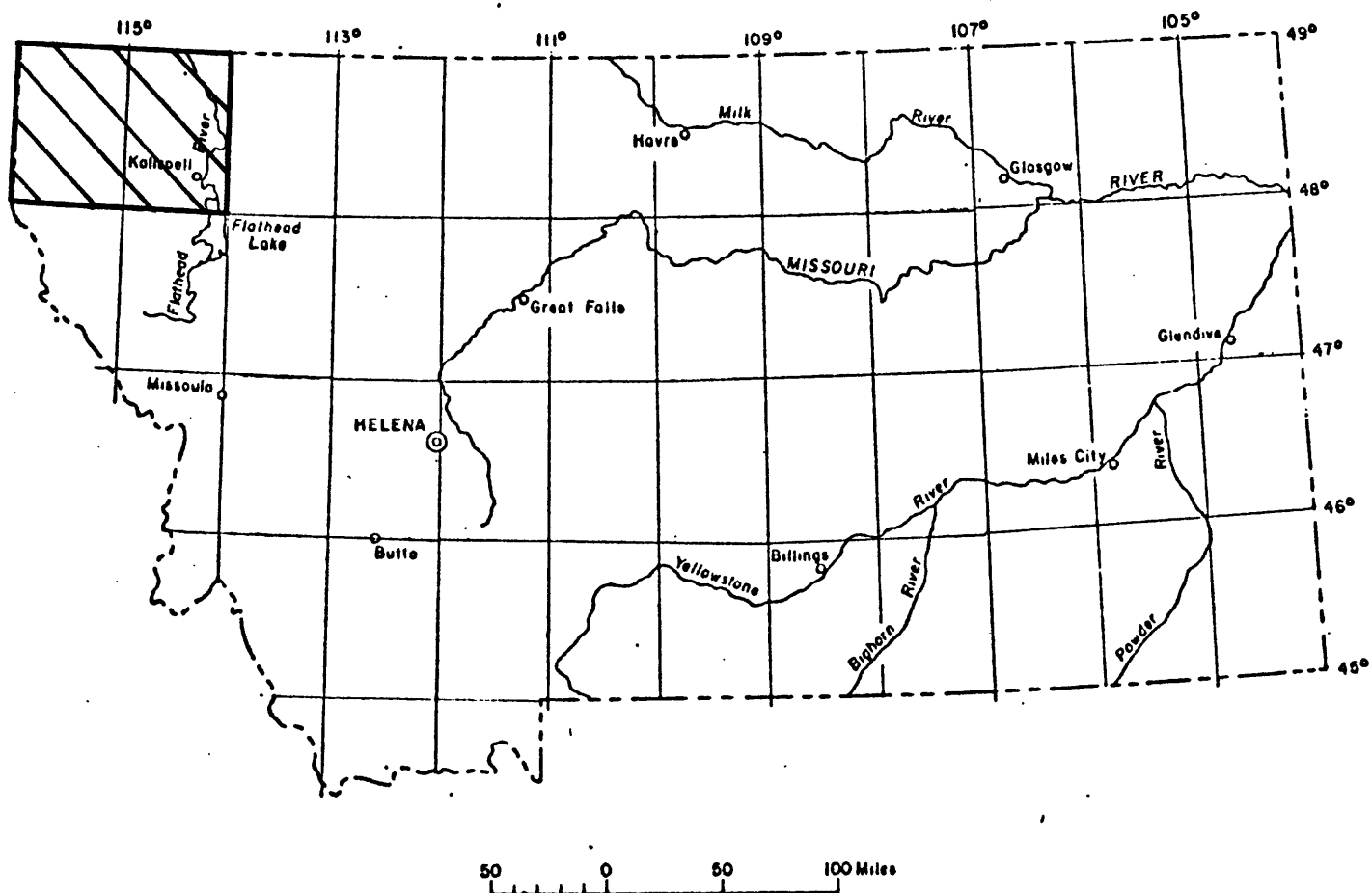


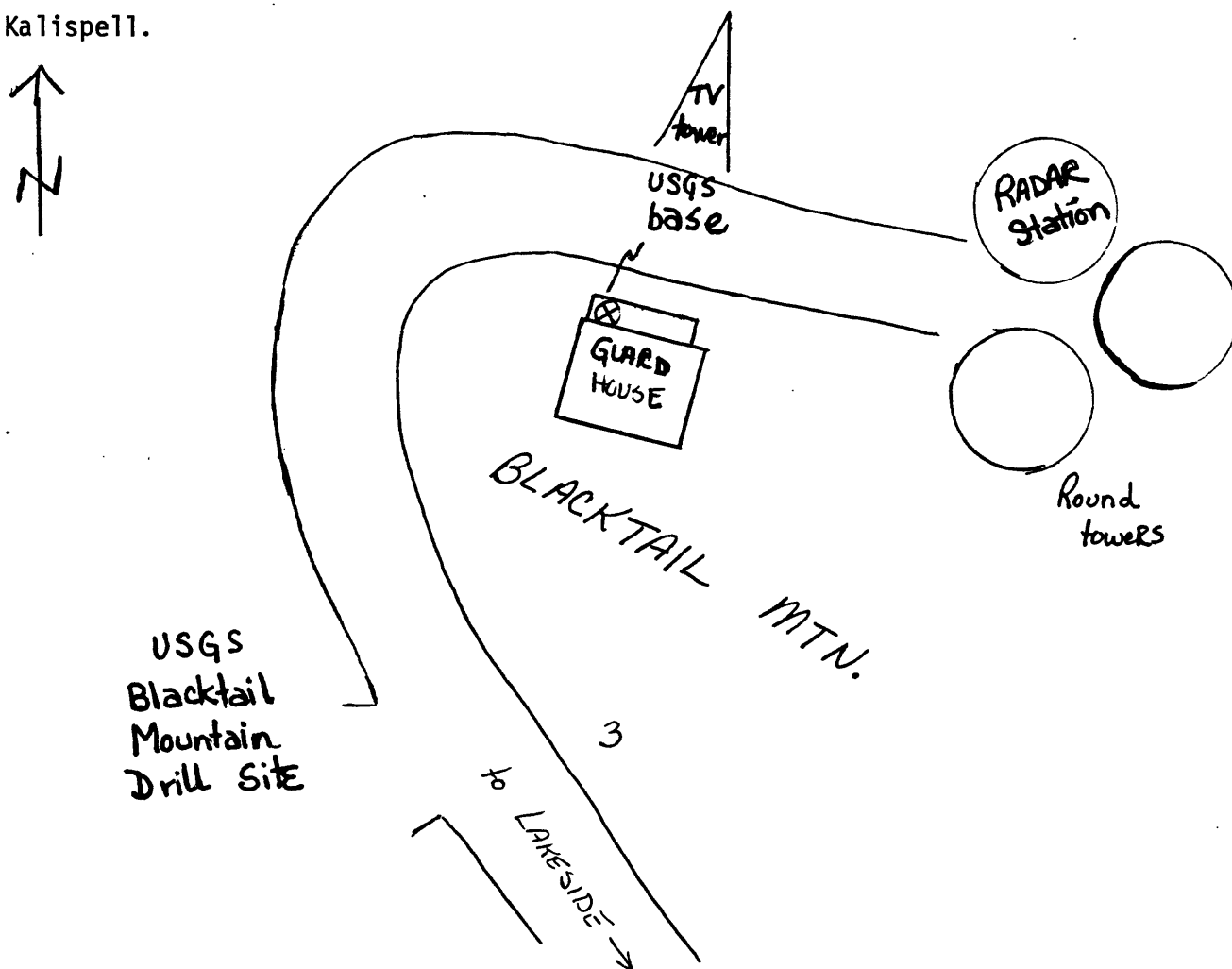
Figure 1--Location map of the Kalispell 1° x 2° quadrangle, Montana.

U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY		STATION DESIGNATION		OBSERVED GRAVITY
Montana		Blacktail Mountain		980343.71 mgals
NEAREST TOWN		LONGITUDE		LATITUDE
Lakeside		114° 21.96'		48° 00.78'
ELEVATION		TOPOGRAPHIC MAP(S)		
6650 ft (2026.9 m) est		Lion Mountain 1:24,000 , Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
7/11/78	Kleinkopf/Brickey	G-235	Kalispell Airport (DOD)	980567.39 mgals

DESCRIPTION/SKETCH

Read at northwest corner of guard house on cement slab, located at entrance to Blacktail Mountain Radar Station, opposite TV tower station, KCFW, Channel 9, Kalispell.

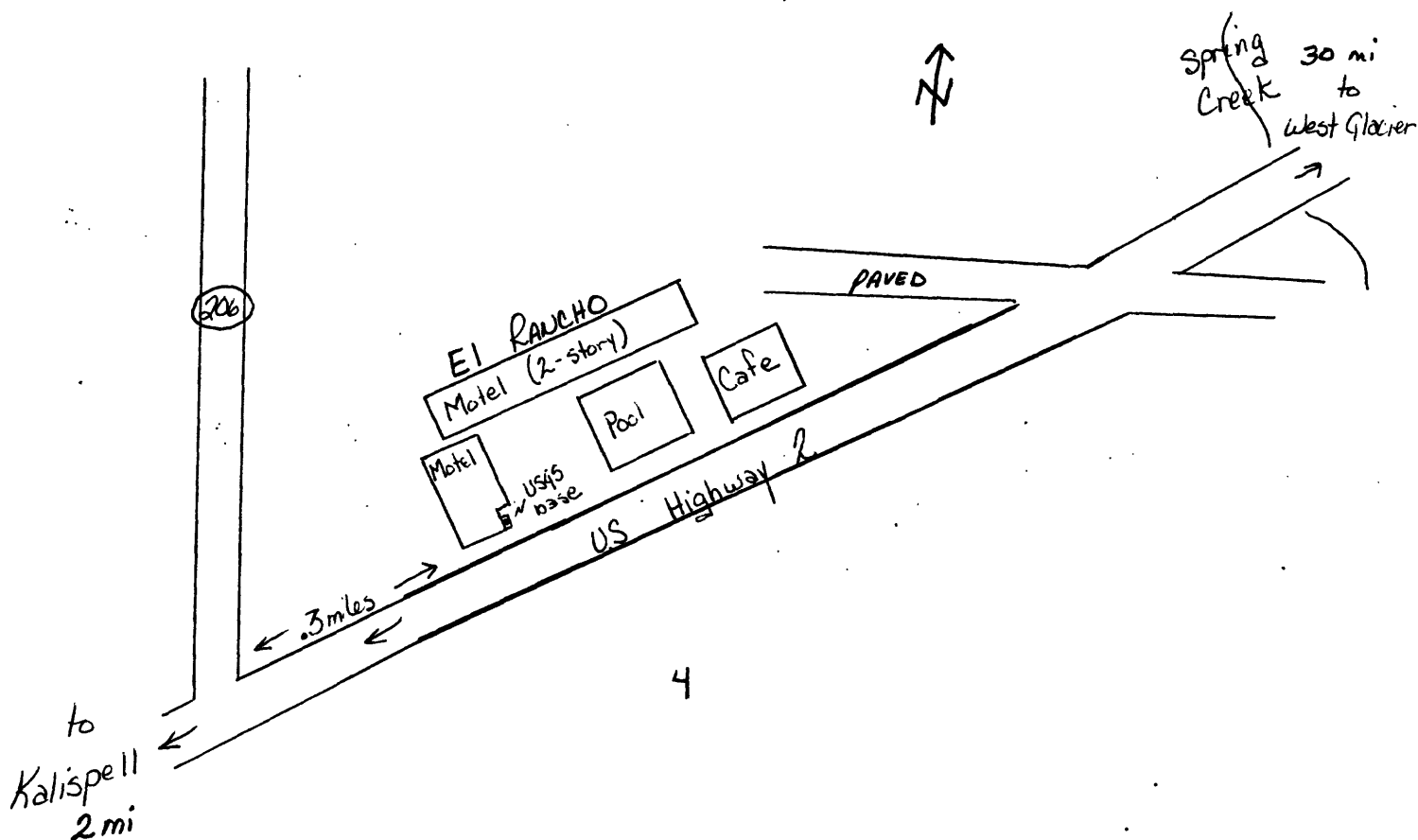


U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY Montana		STATION DESIGNATION El Rancho Motel		OBSERVED GRAVITY 980571.48 mgals
NEAREST TOWN Kalispell (Evergreen)		LONGITUDE 114° 16.09'		LATITUDE 48° 13.09'
ELEVATION 2916 ft (888.8 m) est.		TOPOGRAPHIC MAP(S) Kalispell 1:24,000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
9/81	Bankey	G-24	Kalispell Airport DOD	980567.39 mgals

DESCRIPTION/SKETCH

The El Rancho Motel and Cafe is located east of Kalispell, in the town of Evergreen, on Highway 2. The USGS base is read on a cement step near a pop machine at the southeast corner of the single-story motel building.

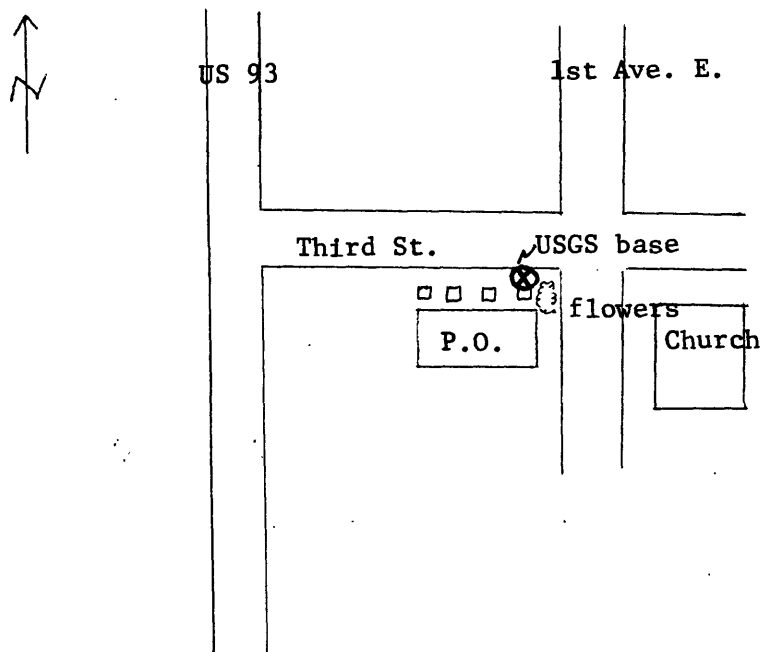


U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY Montana		STATION DESIGNATION Eureka Post Office		OBSERVED GRAVITY 980660.70 mgals
NEAREST TOWN Eureka		LONGITUDE 115° 03.07'		LATITUDE 48° 52.85'
ELEVATION 2580 ft (786.4 m) est.		TOPOGRAPHIC MAP(S) Eureka North 1:24000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
8/25/78	Howard/Kleinkopf	G-235	Kalispell DOD	980567.39 mgals

DESCRIPTION/SKETCH

Meter read on concrete sidewalk in front of eastern-most of 4 brick pillars, in front of the Eureka Post Office, located on the corner of 1st Ave. E. and 3rd Street.

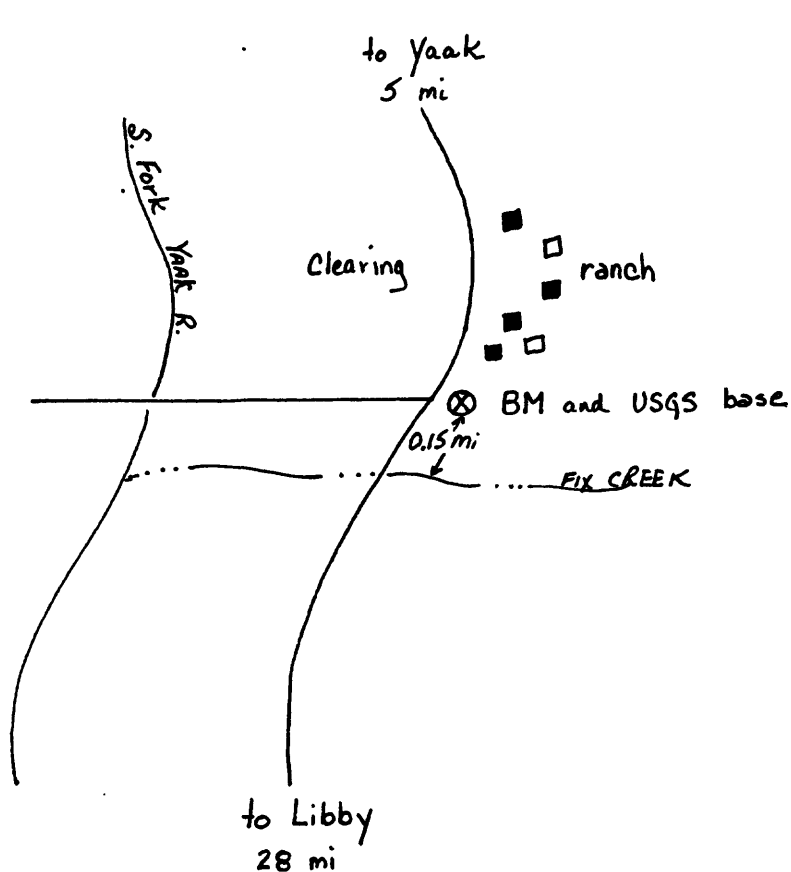


GRAVITY BASE STATION
U.S. GEOLOGICAL SURVEY

STATE/COUNTRY Montana		STATION DESIGNATION Fix Creek (KS50)		OBSERVED GRAVITY 980622.27 mgals
NEAREST TOWN Yaak.		LONGITUDE 115° 39.37'		LATITUDE 48° 46.37'
ELEVATION 3460' (1054.6 m)		TOPOGRAPHIC MAP(S) Yaak 1:24,000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
7/77	Kleinkopf	E-134	Libby P.O.	980652.62 mgals

DESCRIPTION/SKETCH

Fix Creek base is read over USGS Benchmark 17RHM on the east side of a blacktop road approximately 5 miles south of Yaak village and 0.15 mi. north of Fix Creek.

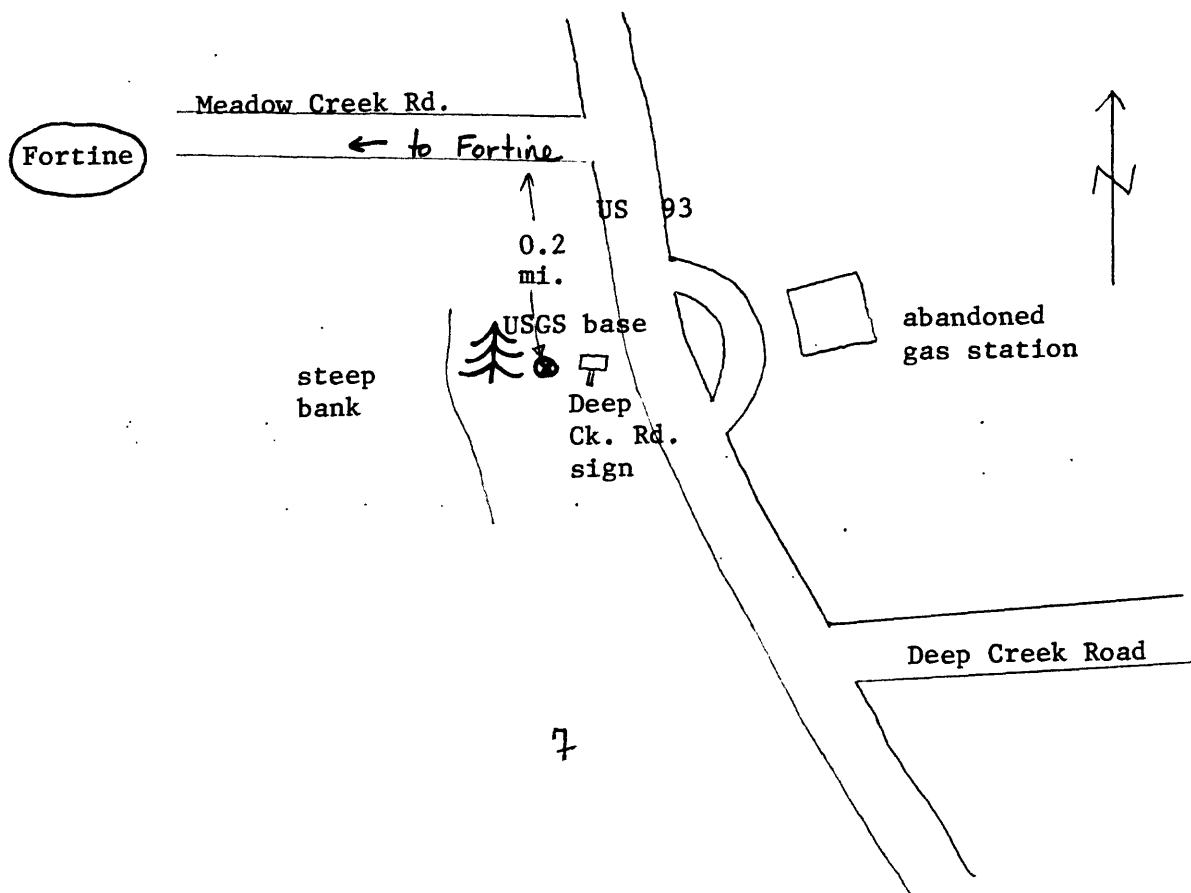


U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY Montana		STATION DESIGNATION Fortine		OBSERVED GRAVITY 980611.96 mgals.
NEAREST TOWN Fortine		LONGITUDE 114° 53.62'		LATITUDE 48° 45.75'
ELEVATION 2965 ft (903.7 m)		TOPOGRAPHIC MAP(S) Fortine 1:24,000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
8/25/78	Howard/Kleinkopf	G-235	Kalispell DOD	980567.39 mgals.

DESCRIPTION/SKETCH

Meter read over USC & GS benchmark "Fortine", located 0.2 mi southeast of the Fortine turn-off, along the west side of US 93 and across road from abandoned service station. Benchmark is on a small knoll.

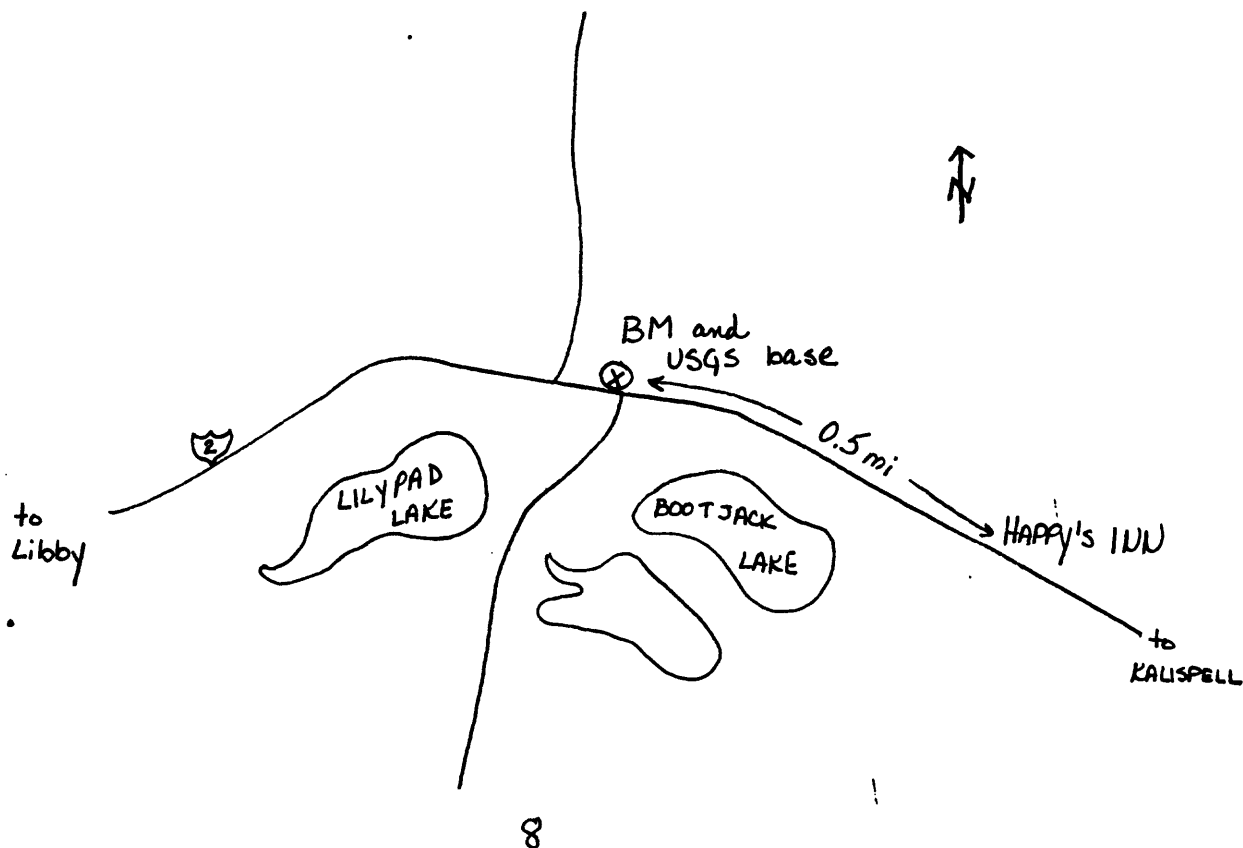


GRAVITY BASE STATION
U.S. GEOLOGICAL SURVEY

STATE/COUNTRY Montana		STATION DESIGNATION Happy's Inn		OBSERVED GRAVITY 980552.87 mgals
NEAREST TOWN Happy's Inn		LONGITUDE 115° 09.23'		LATITUDE 48° 05.21'
ELEVATION 3394 ft (1034.5 m)		TOPOGRAPHIC MAP(S) Loon Lake 1:24,000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
7/77	Kleinkopf	E-134	Kalispell DOD	980567.39 mgals

DESCRIPTION/SKETCH

The Happy's Inn gravity base station is set at the base of a benchmark post, labeled Montana State Highway #FAP580, located on the north side of US Highway 2 about 0.5 mi northwest of Happy's Inn.



APPENDIX 3

GRAVITY BASE STATION

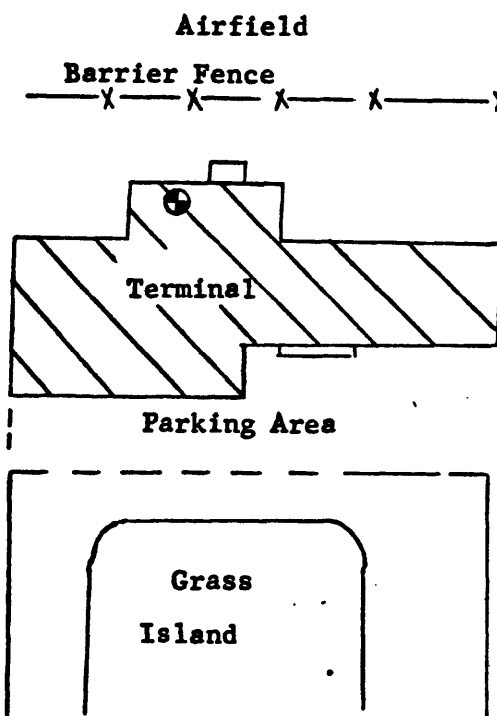
LATITUDE $48^{\circ} 18.50' N$ (1)		STATION DESIGNATION KALISPELL DOD	
LONGITUDE $111^{\circ} 15.00' W$ (1)			
ELEVATION 905.6 m (2970') (1)		COUNTRY/STATE USA/Montana	
REFERENCE CODE NUMBERS		ADOPTED GRAVITY VALUE	
ACIC 0111-0		$g = 980\ 567.39$ mgals	
IGC 15684 J			
WA 32			
		ESTIMATED ACCURACY	DATE
Tape maps: 1:24,000 - Rose Crossing and Colombia Falls South		± 0.1 mgals	MONTH/YEAR 10 / 1971

DESCRIPTION AND/OR SKETCH

Station is located at the Flathead Airport,* six miles north of Kalispell, Mont., on the west side of St.Hwy. #206, inside the airport lobby, on the floor, at the west side of the entrance to the apron and loading area.

* 1984 topo maps call it

GLACIER PARK INTERNATIONAL AIRPORT



REFERENCE SOURCE

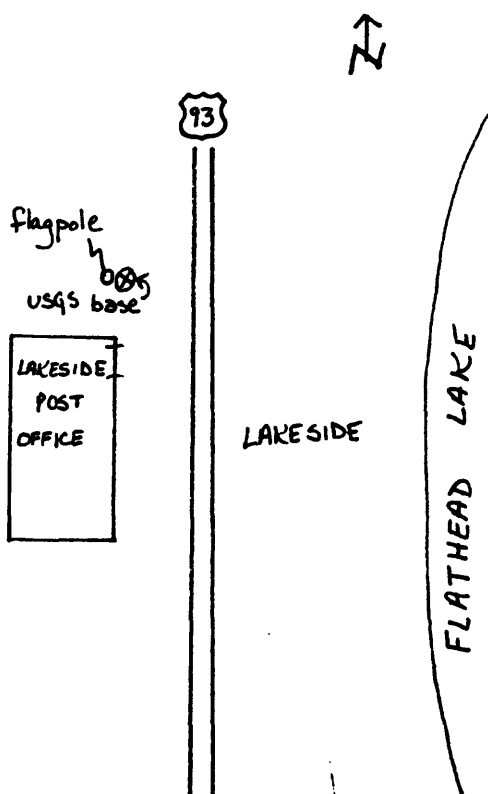
(1) 01355 (2) 05100

GRAVITY BASE STATION
U.S. GEOLOGICAL SURVEY

STATE/COUNTRY		STATION DESIGNATION		OBSERVED GRAVITY
Montana		Lakeside Post Office		980572.93 mgals
NEAREST TOWN		LONGITUDE		LATITUDE
Lakeside		114° 13.42'		48° 01.18'
ELEVATION		TOPOGRAPHIC MAP(S)		
2910 ft (887.1 m) est		Lakeside 1:24,000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
7/78	Brickey	G-235	Kalispell Airport	980567.39 mgals

DESCRIPTION/SKETCH

Base was read at base of flagpole, highway side, on cement slab about 3 meters north of the main entrance to the post office.

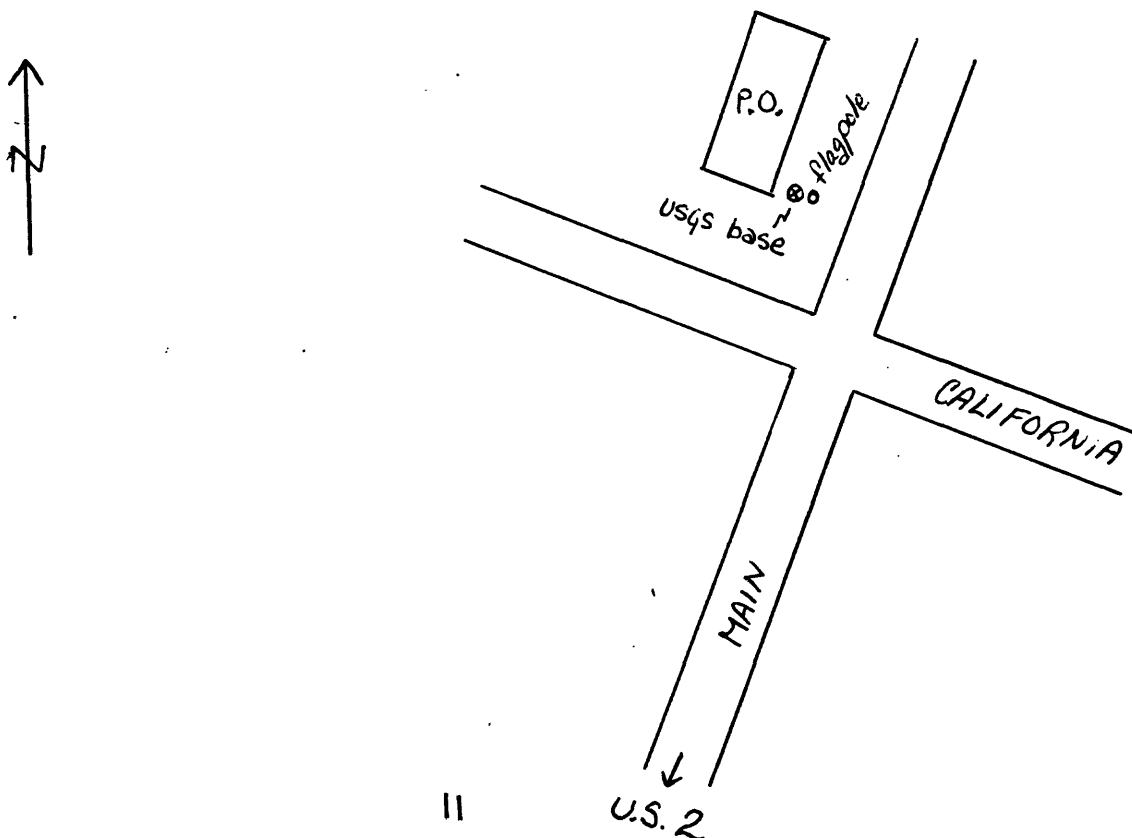


U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY		STATION DESIGNATION		OBSERVED GRAVITY
Montana		Libby Post Office		980652.62 mgals
NEAREST TOWN		LONGITUDE		LATITUDE
Libby		115° 30.77'		48° 23.50'
ELEVATION		TOPOGRAPHIC MAP(S)		
2080 ft (634.0 m) est.		Libby 1:24,000 , Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
8/26/78	Kleinkopf	G-235	Kalispell Airport (DOD)	980567.39 mgals

DESCRIPTION/SKETCH

Reading was at west base of flag pole, near the front door of the Post Office which is located at the corner of Main and California Ave. in Libby, Montana.

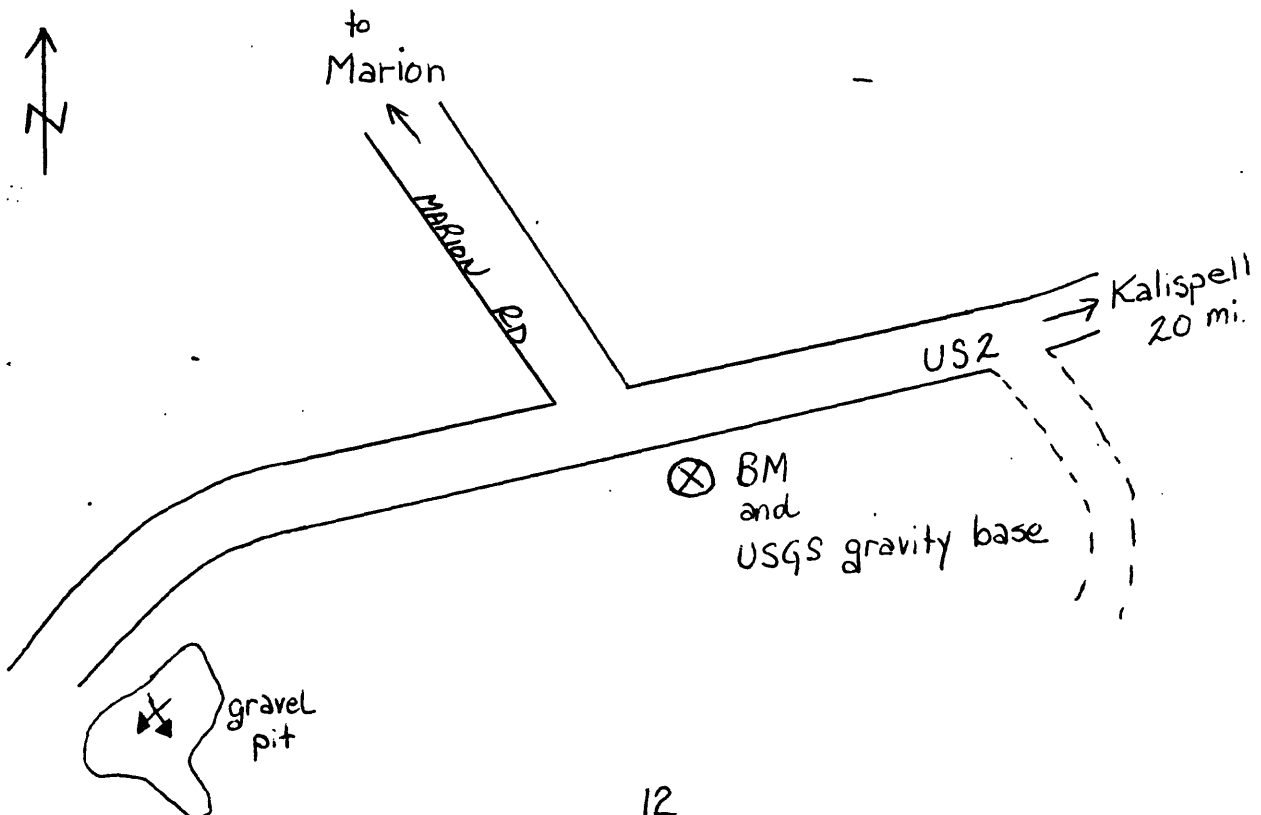


**U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION**

STATE/COUNTRY		STATION DESIGNATION		OBSERVED GRAVITY
Montana .		Marion		980528.28 mgals.
NEAREST TOWN		LONGITUDE		LATITUDE
Marion		114° 38.82'		48° 05.94'
ELEVATION		TOPOGRAPHIC MAP(S)		
3938 ft (1200.3 m)		Marion 1:24,000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
8-26-78	Kleinkopf	G-235	Kalispell Airport DOD	980567.39 mgals

DESCRIPTION/SKETCH

USGS base is located at USC&GS Benchmark G381 (1952) , located on the southeast corner of US Highway 2 and Marion Road. BM is set in concrete in the ditch.

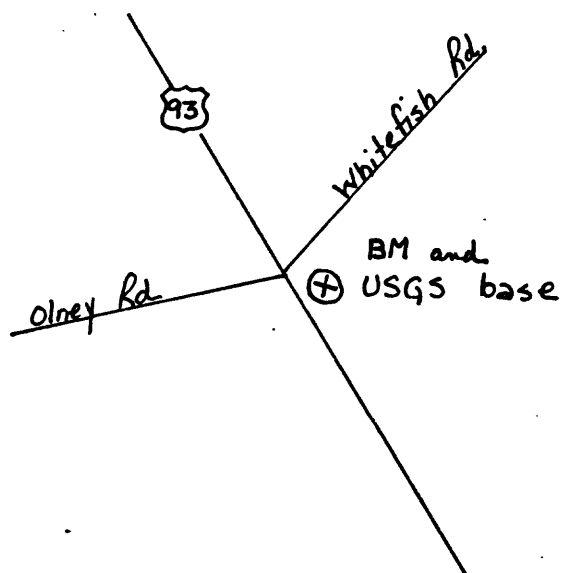


U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY		STATION DESIGNATION		OBSERVED GRAVITY
Montana		Olney		980591.82 mgals
NEAREST TOWN		LONGITUDE		LATITUDE
Olney		114° 34.33'		48° 33.19'
ELEVATION		TOPOGRAPHIC MAP(S)		
3181 ft (969.6 m)		Kalispell 1:250,000, Olney 1:24,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
8/25/78	Howard/Kleinkopf	G-235	Kalispell Airport (DOD)	980567.39 mgals

DESCRIPTION/SKETCH

Base is 0.3 m west of Montana State Highway BM, labeled Dept 3M "3180.89" - located on a brass plate atop a concrete post. Located at Junction of US 93 and Olney Road-Whitefish Road; at southeast corner of intersection.

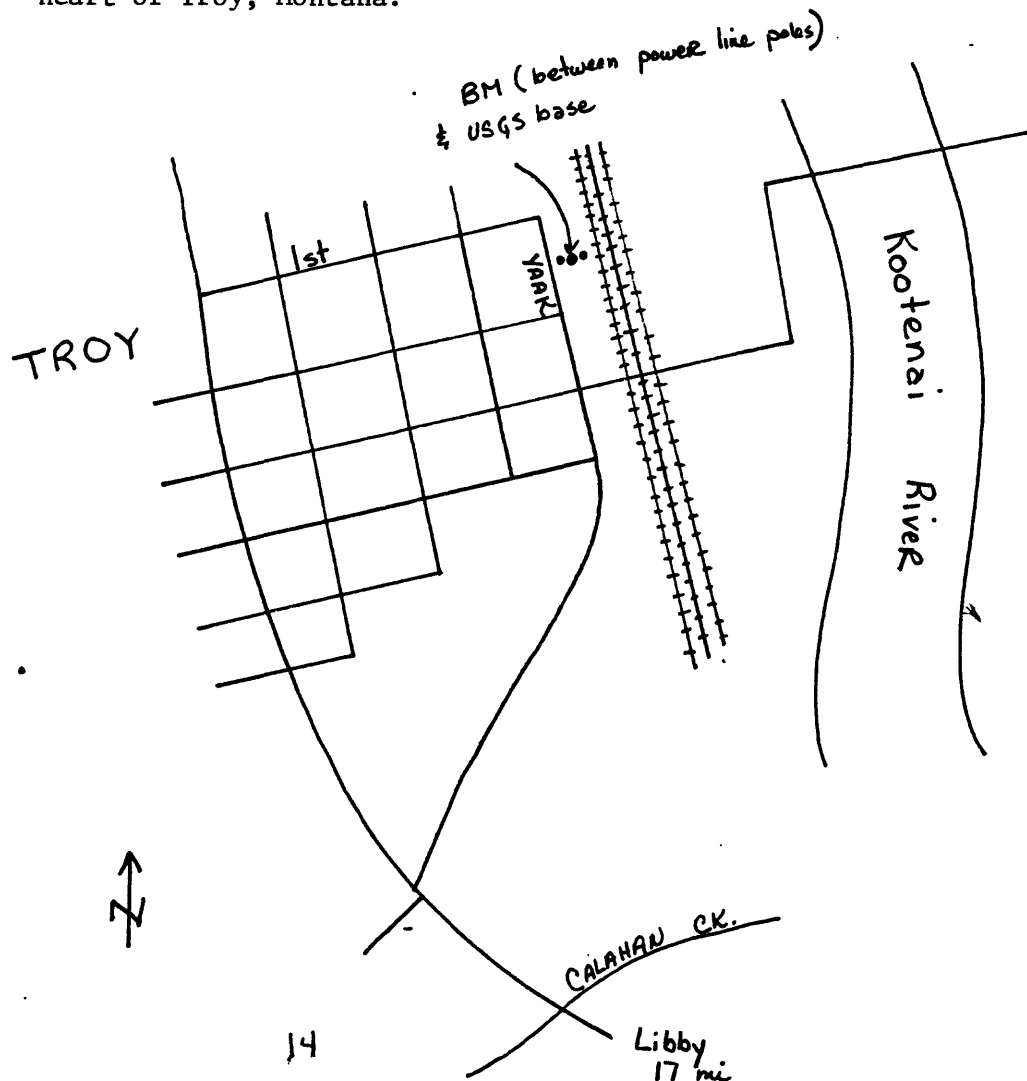


GRAVITY BASE STATION
U.S. GEOLOGICAL SURVEY

STATE/COUNTRY Montana		STATION DESIGNATION Troy		OBSERVED GRAVITY 980674.61 mgals
NEAREST TOWN Troy		LONGITUDE 115° 53.40'		LATITUDE 48° 27.73'
ELEVATION 1888' (575.46 m)		TOPOGRAPHIC MAP(S) Troy 1:24,000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
7/77	Kleinkopf	E-134	Libby P.O.	980652.62 mgals

DESCRIPTION/SKETCH

Meter read at USGS Bench mark K-5 (1929), located west of the Burlington Northern railroad tracks near 1st and Yaak St. in the heart of Troy, Montana.

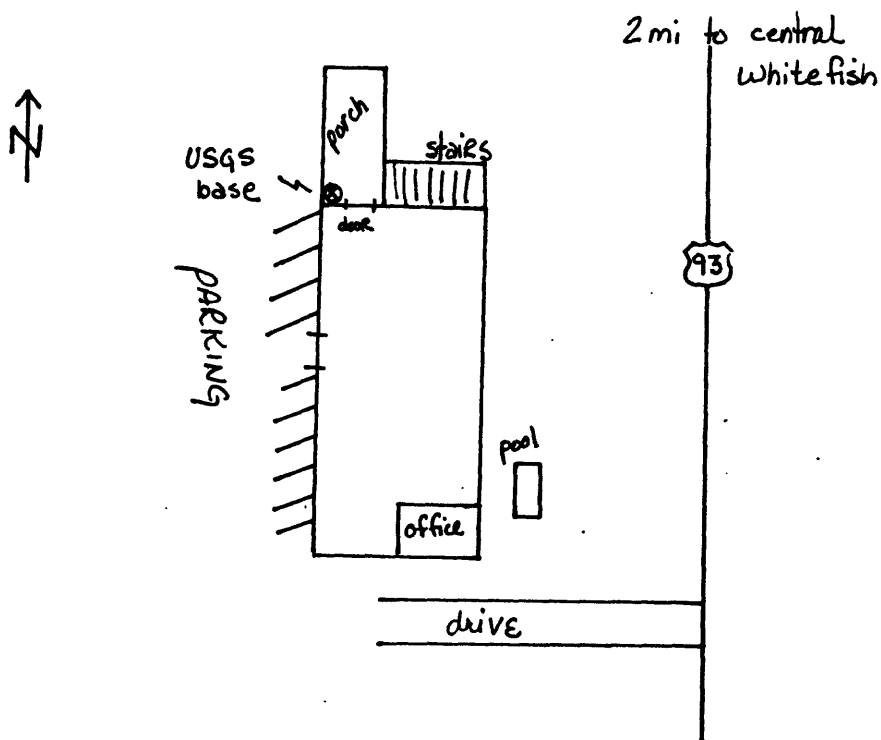


U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY Montana		STATION DESIGNATION Valley Inn Motel, Whitefish		OBSERVED GRAVITY 980584.36 mgals
NEAREST TOWN Whitefish		LONGITUDE 114° 20.05'		LATITUDE 48° 23.75'
ELEVATION 3040 ft (926.6 m) est.		TOPOGRAPHIC MAP(S) Whitefish 1:24,000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
Aug 1983	Bankey	G-550	Kalispell DOD	980567.39 mgals

DESCRIPTION/SKETCH

The USGS gravity base at the Valley Inn is located 2 mi south of the center of Whitefish, Montana. The base is located at the northwest corner of the Valley Inn Motel, on the concrete porch next to the door and near the stairs outside the building. The Valley Inn is located on the west side of Highway 93.



GRAVITY BASE STATION
U.S. GEOLOGICAL SURVEY

STATE/COUNTRY Montana		STATION DESIGNATION Yaak Signpost		OBSERVED GRAVITY 980658.10 mgals
NEAREST TOWN Yaak		LONGITUDE 115° 42.39'		LATITUDE 48° 49.94'
ELEVATION 2953' (900.07 m) est.		TOPOGRAPHIC MAP(S) Yaak 1:24,000 Kalispell 1:250,000		
DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
8/80	Kleinkopf	G-328	Libby P.O.	980652.62 mgals

DESCRIPTION/SKETCH

Yaak Signpost Gravity base is located 2 ft south of the eastern base of the road sign at the intersection of the two main (and only) roads in Yaak, Montana.

