Technical Seminar
Kansas Water Well Association
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Highland Manor Inn - Great Bend, Kansas

The Land Classification System in Kansas and Its Use in Writing Descriptions of Well Locations

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On May 20, 1785, Congress passed an act providing for the subdivision of the public lands of the United States excepting, however, the 13 original states, Texas, Kentucky, Tennessee, North and South Carolina, Georgia, and parts of Ohio. Furthermore, the act provided for the subdividing of the public lands by a system of rectangular surveying (sections, townships, ranges) did not apply to the land north of the Ohio River and west of the Mississippi River that was privately owned at the time the territory became a part of the United States (Raymond, 1914, p. 277; also appendix). The standard United States land unit adopted is an area six by six miles consisting of 36 square miles. This unit is designated a United States, Congressional, or government standard township. It is not to be confused with the organized, civil, or municipal township which is a political unit and which always is designated by a name instead of by numbers. The civil township may be larger, smaller, or of the same size as the U.S. standard township. Each standard township is referred to two reference lines, a meridian and a parallel. In Kansas the reference meridian is known as the 6th Principal Meridian. It is a north-south line, longitude 97°23' west, passing through Wichita and Solomon. All standard land units are numbered, those east of this line are known as east ranges (R) and those west as west ranges. The easternmost range in Kansas is Range 25 East (R25E), whereas the westernmost one is Range 43 West (R43W) (Fig. 2). Both limiting ranges constitute fractional units. The 6th Principal Meridian also serves Nebraska, Colorado, Wyoming, and part of South Dakota (Fig. 1). All townships in the State are south townships and are referred for numbering to the 40th parallel which is the State line between Kansas and Nebraska and which also is used as the base line for land classification in Nebraska, Colorado, Wyoming, and a small part of South Dakota (Fig. 1).

Since the east and west boundaries of a standard township are meridian lines which converge when extended northward, townships normally diminish in size in that direction. In order to offset errors in area in the township, standard parallels or east-west correction lines at intervals of every five townships or every 30 miles were established across the State. There are six standard parallels or correction lines in Kansas (Fig. 2). Similarly, guide meridians spaced eight townships or 48 miles apart and extending in a north-south direction are established in the State. There is one guide meridian east of the 6th Principal Meridian and five west (Fig. 2).

The ideal U.S. standard township consists of 36 sections, each one of which is equal in area to one square mile or 640 acres. Sections are numbered as shown in Figure 3A. The first public lands in the U.S. to be subdivided into standard townships are in the northwestern projection of West Virginia. They were surveyed in 1786 and numbered as shown in Figure 3B. In surveying each standard township measurements normally begin at

the southeast corner and extend to the north and west. Accordingly, all errors in surveying are distributed in the northern and western tier of sections of each township. The accumulated errors occur in the northern and westernmost "fourties."

In Kansas a departure from the standard size of a section is found in the western tier of sections of Range 8 East. Some of these sections are more than 2.5 miles wide and contain more than 1,600 acres. In these wide sections the method of subdivision is shown in Figure 3C.*

*The preceeding discussion is adopted from an article by Walter H. Shoewe entitled The Geography of Kansas, Part I, Political Geography, published in the Transactions of the Kansas Academy of Science, Vol. 51, No. 3, September, 1948.

Definition - Map: A representation (usually flat) of the surface of the earth, or a part of it.

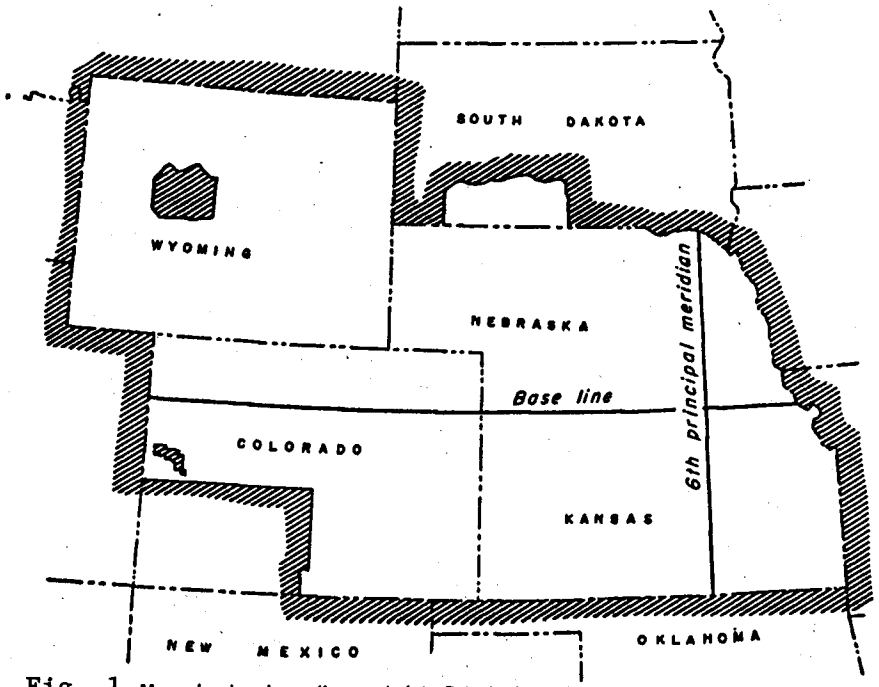


Fig. 1 Map showing base line and 6th Principal Meridian and the States governed thereby in land classification.
(From: Shoewe, W.H., 1948, The Geography of Kansas, Part 1)

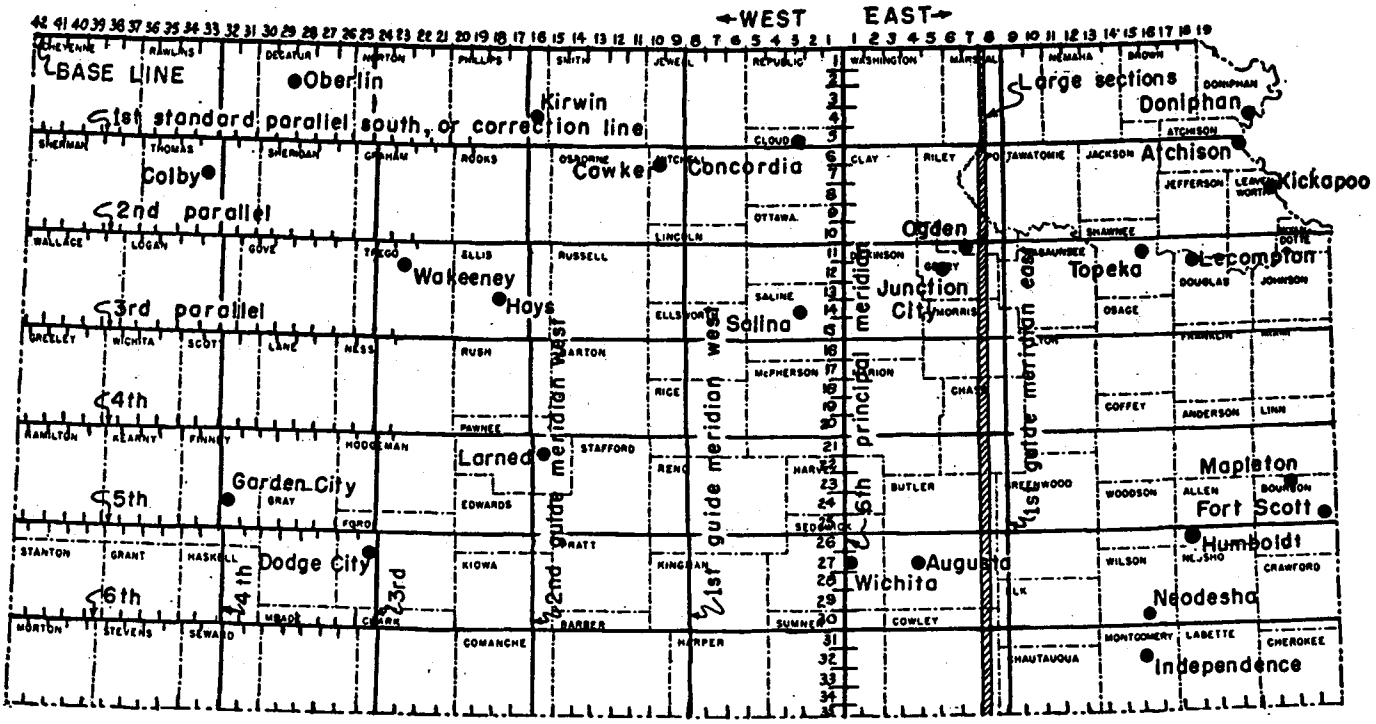


Fig. 2 Map of Kansas showing land classification base line, 6th Principal Meridian, standard parallels or correction lines, guide meridians, number of townships and ranges, strip of oversized sections in Range 8 East, and former U.S. Land Offices. (Figure 3 shows numbering for these abnormally large sections in Range 8 East).

(From: Shoewe, W.H., 1948, The Geography of Kansas, Part 1)

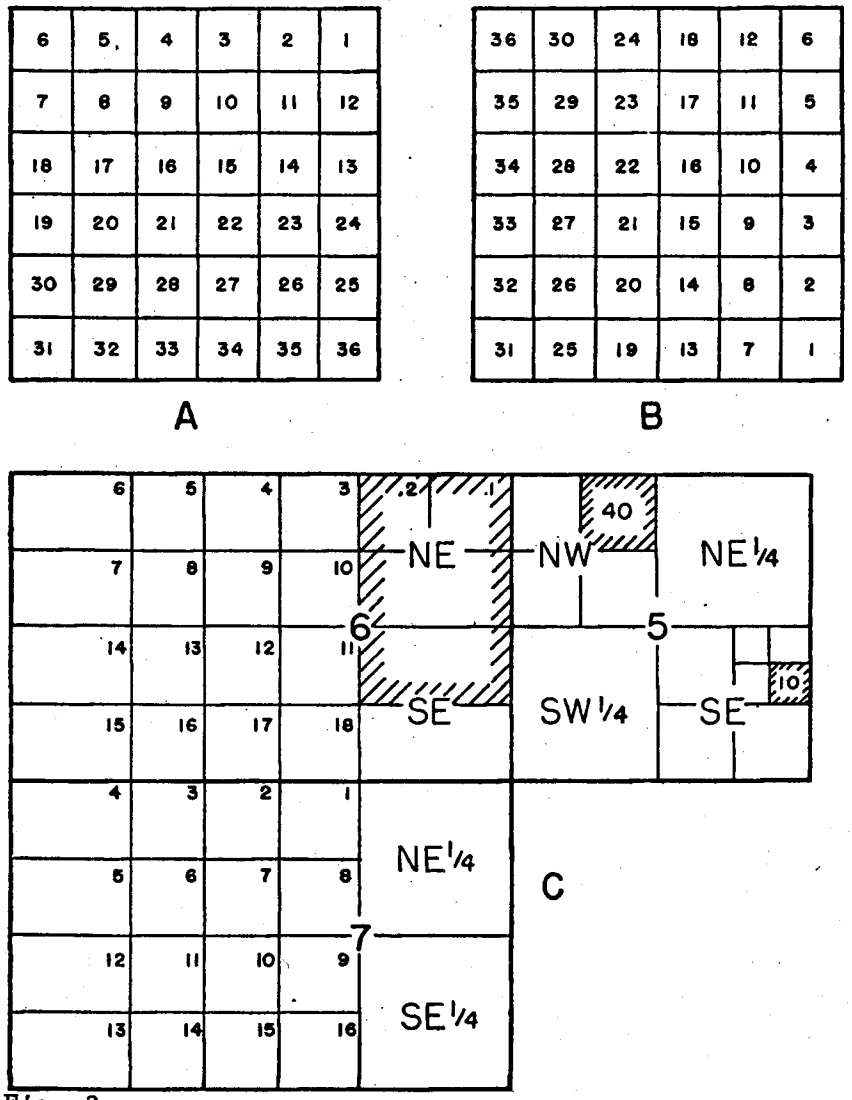


Fig. 3 (A)Conventional system of numbering sections of a township.
(B) Original numbering system in 1786.
(C) Sections 5, 6, and 7, T. 6 S., R. 8 E., Pottawatomie County, showing division of sections 6 and 7 into lots and systems of numbering of the abnormally oversized sections in Range 8 East. The number and area of lots vary in different counties. (Numbers 1 through 18 are lot numbers. Each lot in the western tier is more than 40 acres in area. Section 5 is of standard size, 1x1 mile).

(From: Shoewe, W.H., 1948, The Geography of Kansas, Part 1)

Procedure for Determining Legal Locations from Maps

1. In describing a well location, first identify the section the well is located in and record. Normally, the section number is shown in the center of the section if all sides of the section are shown on the map.

2. Look along the right or left map edges to determine the proper township number and record. In Kansas, all township numbers are south since the base line they are numbered from is the north boundary of Kansas.

3. Look along the top or bottom of the map to determine the proper range number, east or west, and record. Remember east ranges are located east of the 6th Principal Meridian, a north-south line through Wichita and Solomon, Kansas. East ranges are numbered from 1 to 25 eastward from the 6th Principal Meridian. West ranges are numbered from 1 to 43 westward from the 6th Principal Merician.

4. Next, determine which quarter of the section the well location is in by drawing a vertical line and a horizontal line through the center of the section. This divides the 640-acre section into 160-acre quarters NE, NW, SW, and SE.

5. Next, take the 160-acre tract in which the well is located and repeat the quartering by drawing a vertical line and a horizontal line through the center of the 160-acre square dividing it into four quarters of 40 acres each, a NE, NW, SW and SE quarter of the 160-acre quarter of the section.

6. Repeat again to divide the 40-acre tract in which the well is located to determine the 10-acre tract.

The sequence of writing the legal description thus becomes:

6th	5th	4th	1st	2nd	3rd
_____¼	_____¼	_____¼	sec___	T___S	R___E/W
10 acre	40 acre	160 acre			

Problem Exercises

Using: Great Bend Quadrangle 7.5-Minute Series

1. Describe the location of a well to be drilled 1.95 miles south and 0.1 mile west of the intersection of U.S. 56 and U.S. 281 and about 100 feet north of the radio tower.

_____¼ _____¼ _____¼ sec_____, T____S, R_____E/W

2. Describe the legal location of wells A, B, C and D shown on the accompanying map to the nearest 40-acre tract (quarter, quarter section) or 10-acre tract (quarter, quarter, quarter) if possible.

A. _____¼ _____¼ _____¼ sec_____ T____S, R_____E/W

B. _____¼ _____¼ _____¼ sec_____ T____S, R_____E/W

C. _____¼ _____¼ _____¼ sec_____ T____S, R_____E/W

D. _____¼ _____¼ _____¼ sec_____ T____S, R_____E/W

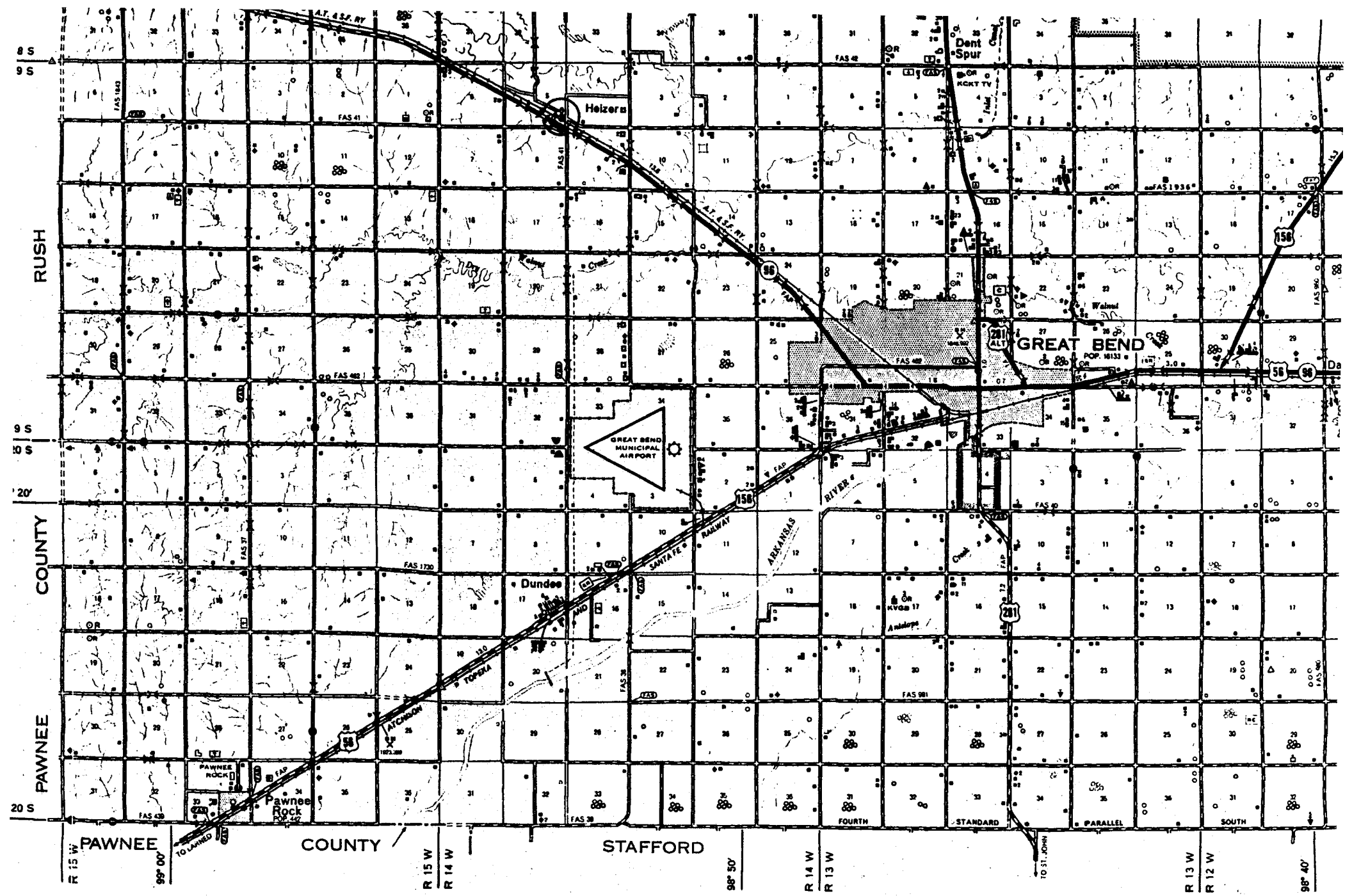
Using: Barton County, Kansas ½-inch Per Mile Highway Base Map

1. Describe location of a well drilled at the southeast corner of the cemetary .25 mile east, then 2.6 mile north from the center of Pawnee Rock (town)

_____¼ _____¼ _____¼ sec_____ T_____S, R_____E/W

2. Describe location of a well about 2 miles south of Heizer then 0.4 mile east of section corner and 100 feet north of E-W roadway.

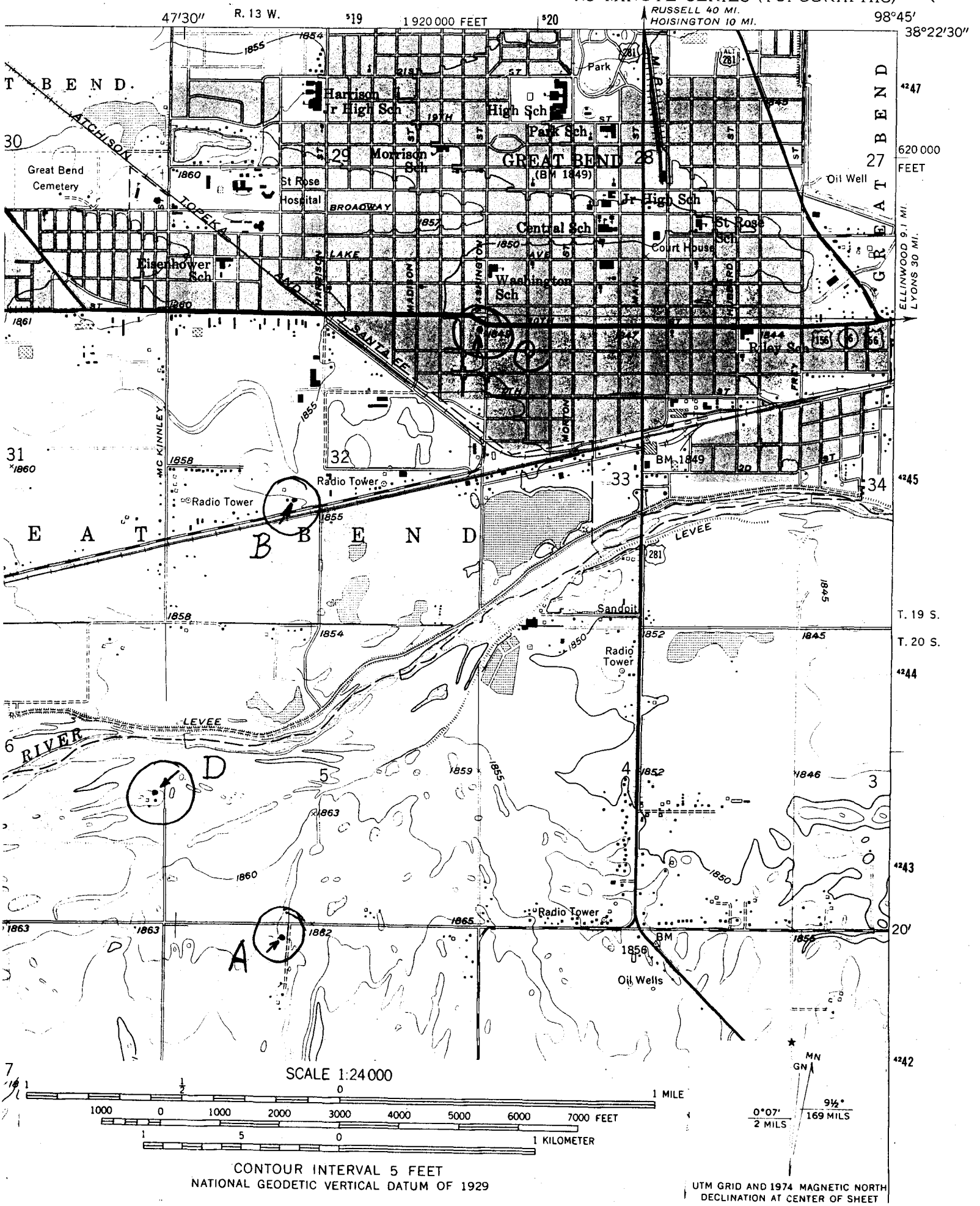
_____¼ _____¼ _____¼ sec_____ T_____S, R_____E/W

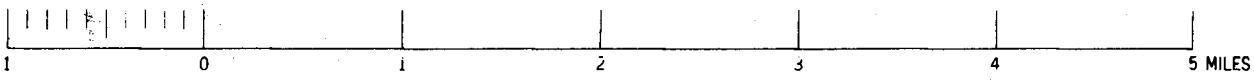


KANSAS STATE PRINTING PLANT

GREAT BEND QUADRANGLE
KANSAS
7.5 MINUTE SERIES (TOPOGRAPHIC)

6260 I NW
(ELLINWOOD)





MILE SCALE 1:62 500

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

TOPOGRAPHIC MAP INFORMATION AND SYMBOLS MARCH 1978

QUADRANGLE MAPS AND SERIES

Quadrangle maps cover four-sided areas bounded by parallels of latitude and meridians of longitude. Quadrangle size is given in minutes or degrees.
Map series are groups of maps that conform to established specifications for size, scale, content, and other elements.
Map scale is the relationship between distance on a map and the corresponding distance on the ground.
Map scale is expressed as a numerical ratio and shown graphically by bar scales marked in feet, miles, and kilometers.

NATIONAL TOPOGRAPHIC MAPS

Series	Scale	1 inch represents	1 centimeter represents	Standard quadrangle size (latitude-longitude)	Quadrangle area (square miles)
7½-minute	1:24,000	2,000 feet	240 meters	7½×7½ min.	49 to 70
7½×15-minute	1:25,000	about 2,083 feet	250 meters	7½×15 min.	98 to 140
Puerto Rico 7½-minute	1:20,000	about 1,667 feet	200 meters	7½×7½ min.	71
15-minute	1:62,500	nearly 1 mile	625 meters	15×15 min.	197 to 282
Alaska 1:63,360	1:63,360	1 mile	nearly 634 meters	15×20 to 36 min.	207 to 281
Intermediate	1:100,000	nearly 1.6 miles	1 kilometer	30×60 min.	1568 to 2240
U. S. 1:250,000	1:250,000	nearly 4 miles	2.5 kilometers	1°×2° or 3°	4,580 to 8,669
U. S. 1:1,000,000	1:1,000,000	nearly 16 miles	10 kilometers	4°×6°	73,734 to 102,759
Antarctica 1:250,000	1:250,000	nearly 4 miles	2.5 kilometers	1°×3° to 15°	4,089 to 8,336
Antarctica 1:500,000	1:500,000	nearly 8 miles	5 kilometers	2°×7½°	28,174 to 30,462

CONTOUR LINES SHOW LAND SHAPES AND ELEVATION

The shape of the land, portrayed by contours, is the distinctive characteristic of topographic maps.
Contours are imaginary lines following the ground surface at a constant elevation above or below sea level.
Contour interval is the elevation difference represented by adjacent contour lines on maps.
Contour intervals depend on ground slope and map scale. Small contour intervals are used for flat areas; larger intervals are used for mountainous terrain.
Supplementary dotted contours, at less than the regular interval, are used in selected flat areas.
Index contours are heavier than others and most have elevation figures.
Relief shading, an overprint giving a three-dimensional impression, is used on selected maps.
Orthophotomaps, which depict terrain and other map features by color-enhanced photographic images, are available for selected areas.

COLORS DISTINGUISH KINDS OF MAP FEATURES

Black is used for manmade or cultural features, such as roads, buildings, names, and boundaries.
Blue is used for water or hydrographic features, such as lakes, rivers, canals, glaciers, and swamps.
Brown is used for relief or hypsographic features—land shapes portrayed by contour lines.
Green is used for woodland cover, with patterns to show scrub, vineyards, or orchards.
Red emphasizes important roads and is used to show public land subdivision lines, land grants, and fence and field lines.
Red tint indicates urban areas, in which only landmark buildings are shown.
Purple is used to show office revision from aerial photographs. The changes are not field checked.

INDEXES SHOW PUBLISHED TOPOGRAPHIC MAPS

Indexes for each State, Puerto Rico and the Virgin Islands of the United States, Guam, American Samoa, and Antarctica show available published maps. Index maps show quadrangle location, name, and survey date. Listed also are special maps and sheets, with prices, map dealers, Federal distribution centers, and map reference libraries, and instructions for ordering maps. Indexes and a booklet describing topographic maps are available free on request.

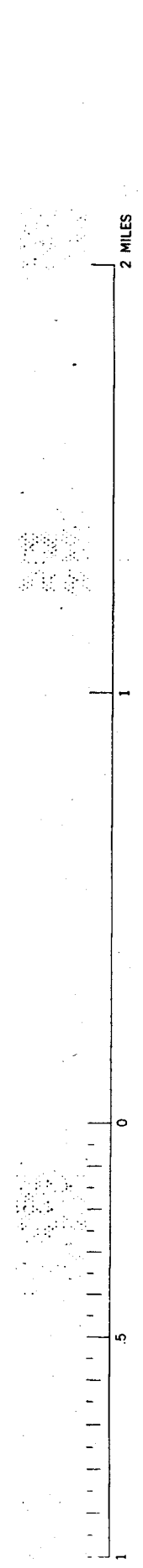
HOW MAPS CAN BE OBTAINED

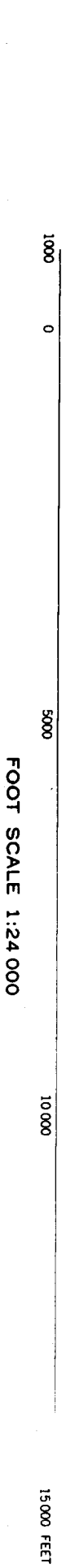
Mail orders for maps of areas east of the Mississippi River, including Minnesota, Puerto Rico, the Virgin Islands of the United States, and Antarctica should be addressed to the Branch of Distribution, U. S. Geological Survey, 1200 South Eads Street, Arlington, Virginia 22202. Maps of areas west of the Mississippi River, including Alaska, Hawaii, Louisiana, American Samoa, and Guam should be ordered from the Branch of Distribution, U. S. Geological Survey, Box 25286, Federal Center, Denver, Colorado 80225. A single order combining both eastern and western maps may be placed with either office. Residents of Alaska may order Alaska maps or an index for Alaska from the Distribution Section, U. S. Geological Survey, Federal Building-Box 12, 101 Twelfth Avenue, Fairbanks, Alaska 99701. Order by map name, State, and series. On an order amounting to $300 or more at the list price, a 30-percent discount is allowed. No other discount is applicable. Prepayment is required and must accompany each order. Payment may be made by money order or check payable to the U. S. Geological Survey. Your ZIP code is required.

Sales counters are maintained in the following U. S. Geological Survey offices, where maps of the area may be purchased in person: 1200 South Eads Street, Arlington, Va.; Room 1028, General Services Administration Building, 19th & F Streets NW, Washington, D. C.; 1400 Independence Road, Rolla, Mo.; 345 Middlefield Road, Menlo Park, Calif.; Room 7638, Federal Building, 300 North Los Angeles Street, Los Angeles, Calif.; Room 504, Custom House, 555 Battery Street, San Francisco, Calif.; Building 41, Federal Center, Denver, Colo.; Room 1012, Federal Building, 1961 Stout Street, Denver Colo.; Room 1C45, Federal Building, 1100 Commerce Street, Dallas, Texas; Room 8105, Federal Building, 125 South State Street, Salt Lake City, Utah; Room 1C402, National Center, 12201 Sunrise Valley Drive, Reston, Va.; Room 678, U. S. Court House, West 920 Riverside Avenue, Spokane, Wash.; Room 108, Skyline Building, 508 Second Avenue, Anchorage, Alaska; and Federal Building, 101 Twelfth Avenue, Fairbanks, Alaska.

Commercial dealers sell U. S. Geological Survey maps at their own prices. Names and addresses of dealers are listed in each State index.

INTERIOR—GEOLOGICAL SURVEY RESTON, VIRGINIA—1978





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TOPOGRAPHIC MAP SYMBOLS

VARIATIONS WILL BE FOUND ON OLDER MAPS

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- Road under construction, alinement known
- Proposed road
- Dual highway, dividing strip 25 feet or less
- Dual highway, dividing strip exceeding 25 feet
- Trail

- Railroad: single track and multiple track
- Railroads in juxtaposition
- Narrow gage: single track and multiple track
- Railroad in street and carline
- Bridge: road and railroad
- Drawbridge: road and railroad
- Footbridge
- Tunnel: road and railroad
- Overpass and underpass
- Small masonry or concrete dam
- Dam with lock
- Dam with road
- Canal with lock

- Buildings (dwelling, place of employment, etc.)
- School, church, and cemetery — Cem
- Buildings (barn, warehouse, etc.)
- Power transmission line with located metal tower
- Telephone line, pipeline, etc. (labeled as to type)
- Wells other than water (labeled as to type) — Oil — Gas
- Tanks: oil, water, etc. (labeled only if water) — Water
- Located or landmark object; windmill
- Open pit, mine, or quarry; prospect
- Shaft and tunnel entrance

- Horizontal and vertical control station:
  - Tablet, spirit level elevation — BM △5653
  - Other recoverable mark, spirit level elevation — △5455
- Horizontal control station: tablet, vertical angle elevation — VABM △ *95/9*
  - Any recoverable mark, vertical angle or checked elevation — *△3775*
- Vertical control station: tablet, spirit level elevation — BM × 957
  - Other recoverable mark, spirit level elevation — ×954
- Spot elevation — × *7369* × *7369*
- Water elevation — *670*

- Boundaries: National
  - State
  - County, parish, municipio
  - Civil township, precinct, town, barrio
  - Incorporated city, village, town, hamlet
  - Reservation, National or State
  - Small park, cemetery, airport, etc.
  - Land grant
- Township or range line, United States land survey
- Township or range line, approximate location
- Section line, United States land survey
- Section line, approximate location
- Township line, not United States land survey
- Section line, not United States land survey
- Found corner: section and closing
- Boundary monument: land grant and other
- Fence or field line

- Index contour
- Intermediate contour
- Supplementary contour
- Depression contours
- Fill
- Cut
- Levee
- Levee with road
- Mine dump
- Wash
- Tailings
- Tailings pond
- Shifting sand or dunes
- Intricate surface
- Sand area
- Gravel beach

- Perennial streams
- Intermittent streams
- Elevated aqueduct
- Aqueduct tunnel
- Water well and spring
- Glacier
- Small rapids
- Small falls
- Large rapids
- Large falls
- Intermittent lake
- Dry lake bed
- Foreshore flat
- Rock or coral reef
- Sounding, depth curve — 10
- Piling or dolphin
- Exposed wreck
- Sunken wreck
- Rock, bare or awash; dangerous to navigation

- Marsh (swamp)
- Submerged marsh
- Wooded marsh
- Mangrove
- Woods or brushwood
- Orchard
- Vineyard
- Scrub
- Land subject to controlled inundation
- Urban area