CHANNEL-BED DEGRADATION IN MAJOR OKLAHOMA STREAMS

VOLUME IV of V: CANADIAN RIVER

Final Report
ODOT Item Number 2191

by

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15. Abstract

The purpose of this research is to analyze the flowline data and relate it to the degradation of the river bed at bridge locations in the river. This information may then be used to replace or rehabilitate those bridges that experienced severe degradation.

This report evaluates channel degradation in 409.76-mile reach of Canadian River in Oklahoma. In this study, the 409.76 mile river length is divided into two Reaches: Reach 1- river station (RS1) to Eufaula Dam, and Reach 2- Eufaula Lake Dam to RS18. The flowlines of Canadian River in Oklahoma were observed for a long period. In Reach-1, RS 14 shows the maximum degradation of 17.60 feet in 19 years from 1985 to 2004. On the other hand, maximum channel aggradation of 3.00 feet is observed at RS 17 in the Eufaula Lake. It was also found that the river station 18, 8.86 mile downstream of the Eufaula Dam, has experienced the degradation of 3.5 feet in 6 years from 1983 to 1989.

River station (RS) 7 at U.S. 81, river station 12 at S.H. 3W, and river station 14 at U.S. 283 has experienced 12.05, 10.00, and 17.6 feet of degradation respectively. Degradations in these bridges are experienced in 45, 34, and 19 years respectively. Therefore, RS 7 (Bridge Key b13537), RS 12 (Bridge Key b14520), and RS 14 (Bridge Key b22420) are determined as critical and recommended for rehabilitation or replacement in the replacement cycle. A detailed hydraulic and geotechnical analysis should be performed before reconstruction.

It is recommended that degradation of tributaries is evaluated to determine the structures where flowline is severely degrading in Canadian River basin.

17. Key Words
Degradation, Canadian River, Dam, and flowlines

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I. INTRODUCTION

Natural alluvial rivers generally do not exist in equilibrium. The fluvial process in an alluvial river is a dynamic process, a function of flow and sediment regimes interacting with the physiographic features and vegetative cover of the landscape (Ward and Standford 2006). Streams are not inherently unstable but they are often out of equilibrium due to imposed conditions. Man made activities and natural events are the major factors which disturb the stability of a river, causing high sediment load, high slope, relatively coarse grain size, high lateral mobility rate, and multi-thread, braided stream. If the streambed is eroded, resulting in a low bed elevation it is called “degradation” and if bed elevation is elevated due to an accumulation of sediment it is called “aggradation”.

A river channel is considered stable if the streambed does not change its dimension, pattern and profile over a relatively long river reach and long period of time. If the hydraulic, hydrologic, and sedimentological characteristics of the alluvial rivers are altered naturally or by human interference, the river will adjust dynamically and geometrically as the fluvial system seeks to establish a state of equilibrium. The river equilibrium concept was explained by Macklin (1948) as the “graded” river in which channel size, cross-sectional shape, and slope are adjusted to the quantities of sediment and water transported so that the river bed neither degrades nor aggrades.

Human activities such as construction of reservoir are major factors in changing in river equilibrium. When the sediment transport is interrupted by a dam, the flow may become sediment-starved and prone to erode the channel

bed and banks, producing channel incision, and coarsening of bed material (Kondolf 2004).

The purpose of this research is to analyze the flowline data and relate it to the degradation of the river bed at different bridge locations in the river. This information may then be used to replace or rehabilitate those bridges that experienced severe degradation.

II. STUDY AREA

The Canadian River is the largest tributary of the Arkansas River. The 906 mile long Canadian River, also known as South Canadian River starts in Colorado and travels through New Mexico, the Texas Panhandle, and most of Oklahoma. The river flows south through New Mexico and then turns east, crossing the Texas Panhandle into Oklahoma. The river's only major tributary is the North Canadian River, which runs almost parallel to the Canadian river in Oklahoma. The tributary joins the Canadian river at Eufaula in eastern Oklahoma to form the Eufaula Reservoir.

In Oklahoma Canadian River flows through eighteen counties: Roger Mills, Ellis, Dewey, Custer, Blaine, Caddo, Canadian, Grady, McClain, Cleveland, Pottawatomie, Pontotoc, Seminole, Hughes, Pittsburg, McIntosh, Haskell, and Muskogee. The focus of this study is the 409.76 mile reach of Canadian River from its crossing at US highway 283 in Roger Mills County of Oklahoma to the State Highway 2 in Haskell County of Oklahoma (Fig. 1). The Canadian river in the study reach is characterized as just a slow trickle bounded by red mud flats and quicksand. When sufficient rain has fallen, however the river can carry substantial amounts of water. The channel slope averages about 4.85 feet per mile. Throughout the study area, the Canadian River is impounded at one reservoir: Eufaula Lake.

Eufaula Dam is located on the Canadian river, approximately 12 miles east of Eufaula in McIntosh County, Oklahoma (Austin & Thomas 2006). The dam is 0.605 miles long and located 8.86 miles upstream from RS 18 at the

crossing of S.H. 2 on the Haskell Channel. The lake has a drainage area of 47,522 square miles and surface area of 159.37 square miles. The shore length of lake is over 600 miles. The lake is owned and operated by the U.S. Army Crops of Engineers (Wikipedia).

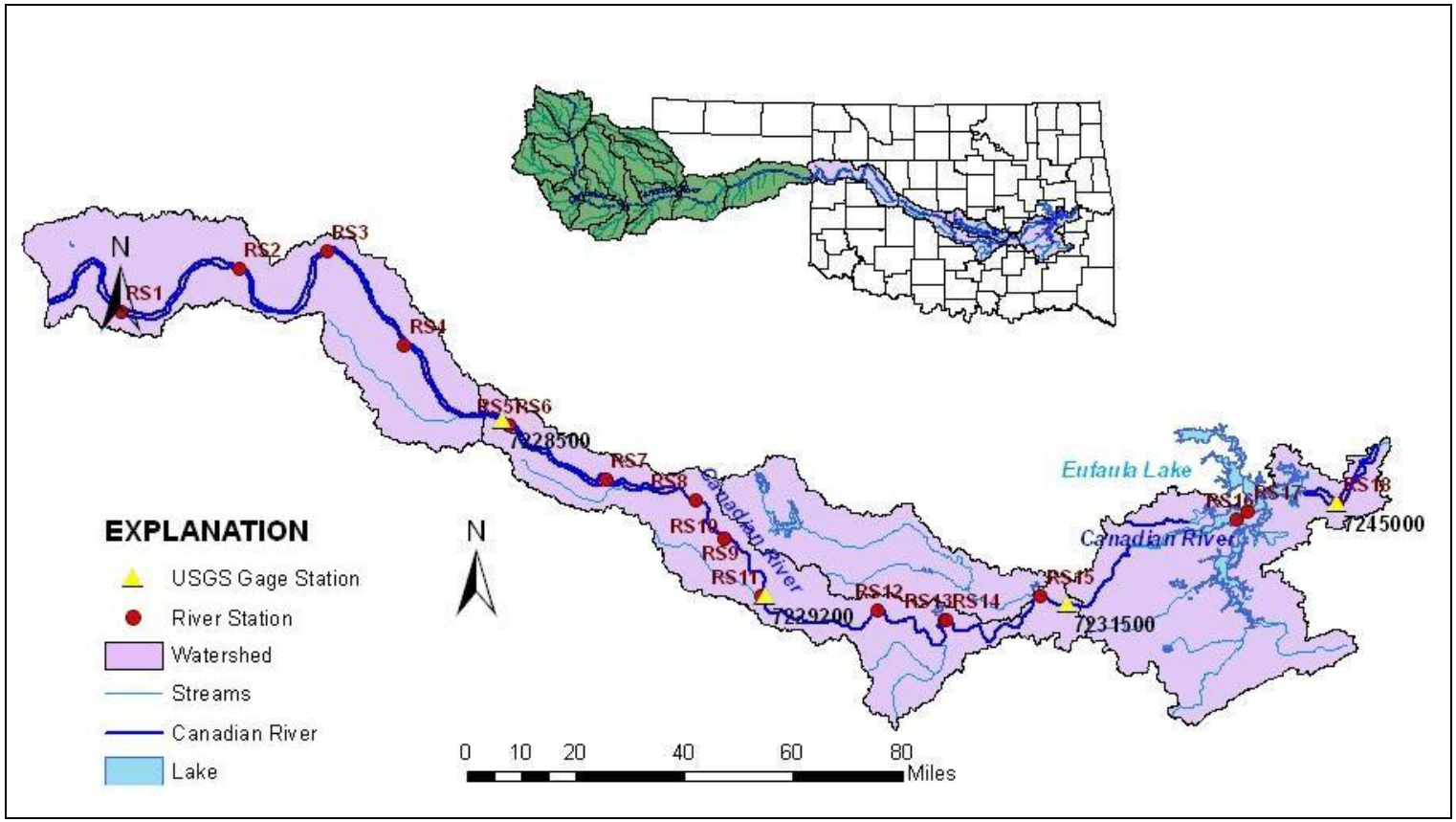


Figure 1. Location of Study points in Canadian River, and USGS gage stations

III. HYDROLOGY

The physical characteristics of the stream such as channel bed degradation, stream widening, deposition of channel bars, shifting flowline, and stream bank erosion depends on the hydrology of the stream. According to Doyle (2003), “channels formed in fine alluvial material that is easily eroded and transported out of the system with little downstream aggradation will respond to disturbance by lateral adjustments.” As the stream profile degrades, the stream tries to widen to accommodate higher flows, as stream bank erosions increase along with increases in sediment loads. Flow measurement of the stream is one of the fundamental tasks in accessing surface hydrology. USGS stream flow gage stations have been studied in the study reach. Currently there are six USGS gaging stations among which only four have the peak stream flow data (Fig.1). The descriptions of USGS gage stations are explained in table 1, below.

Table 1. Description of USGS gage stations

Data Locations and descriptions	Data Available
USGS 07228500 Canadian River at Bridgeport, OK Caddo County, Oklahoma Hydrologic Unit Code 11090202 Latitude 35°32'37", Longitude 98°19'03" NAD27 Drainage area 25,276 square miles Contributing drainage area 20,475 square miles Gage datum 1,360.00 feet above sea level NGVD29	1914-2005
USGS 07229200 Canadian River at Purcell, OK Cleveland County, Oklahoma Hydrologic Unit Code 11090202 Latitude 35°00'50", Longitude 97°20'50" NAD27 Drainage area 25,939 square miles Contributing drainage area 21,138 square miles Gage datum 1,017.14 feet above sea level NGVD29	1980-2005
USGS 07231500 Canadian River at Calvin, OK Hughes County, Oklahoma Hydrologic Unit Code 11090202 Latitude 34°58'40", Longitude 96°14'36" NAD27 Drainage area 27,952 square miles Contributing drainage area 23,151 square miles Gage datum 682.72 feet above sea level NGVD29	1906-2005
USGS 07245000 Canadian River near Whitefield, OK Haskell County, Oklahoma Hydrologic Unit Code 11090204 Latitude 35°15'50", Longitude 95°14'21" NAD27 Drainage area 47,576 square miles Contributing drainage area 37,876 square miles Gage datum 473.16 feet above sea level NGVD29	1939-2005

Annual peak discharge is the annual instantaneous maximum discharge. Human land use practices such as agriculture and forest clearing also impact fluvial geomorphic system. In addition to this, channel changes are vary through time, depending on the timing of floods and droughts. Annual peak discharges plots were downloaded from USGS gaging stations to evaluate the historical flood occurrences. In October 1904, a particularly unusual flood event occurred in Canadian River flood plain. Rains in eastern New Mexico provided the water for this dramatic flood that occurred under clear Oklahoma skies. An eighteen-to twenty-foot high wall of water devastated the flood plain from October 1 to 4 (Johnson, 2003). USGS peak stream flow record of 281,000cfs in Whitefield OK (Fig. 5) mimics the flood of 1943 and USGS peak stream flow record of 150,000 cfs (Fig. 2) mimics the flood of 1948. In 1950 USGS gage stations at Calving OK (Fig. 3) and Whitefield OK (Fig.5) recorded peak flows of 174,000 cfs and 256,000 cfs respectively. A peak stream flow of 102,000cfs in Purcell OK (Fig. 3) is due to the flood in 1987.

Table 2. Peak flows recorded at USGS gauge stations

Locations	Peak flows (cfs)	Year
Bridgeport	150,000	Jun. 23, 1948
Purcell	102,000	May 29, 1987
Calvin	174,000	May 11, 1950
Whitefield	281,000 256,000	May 10, 1943 May 11, 1950

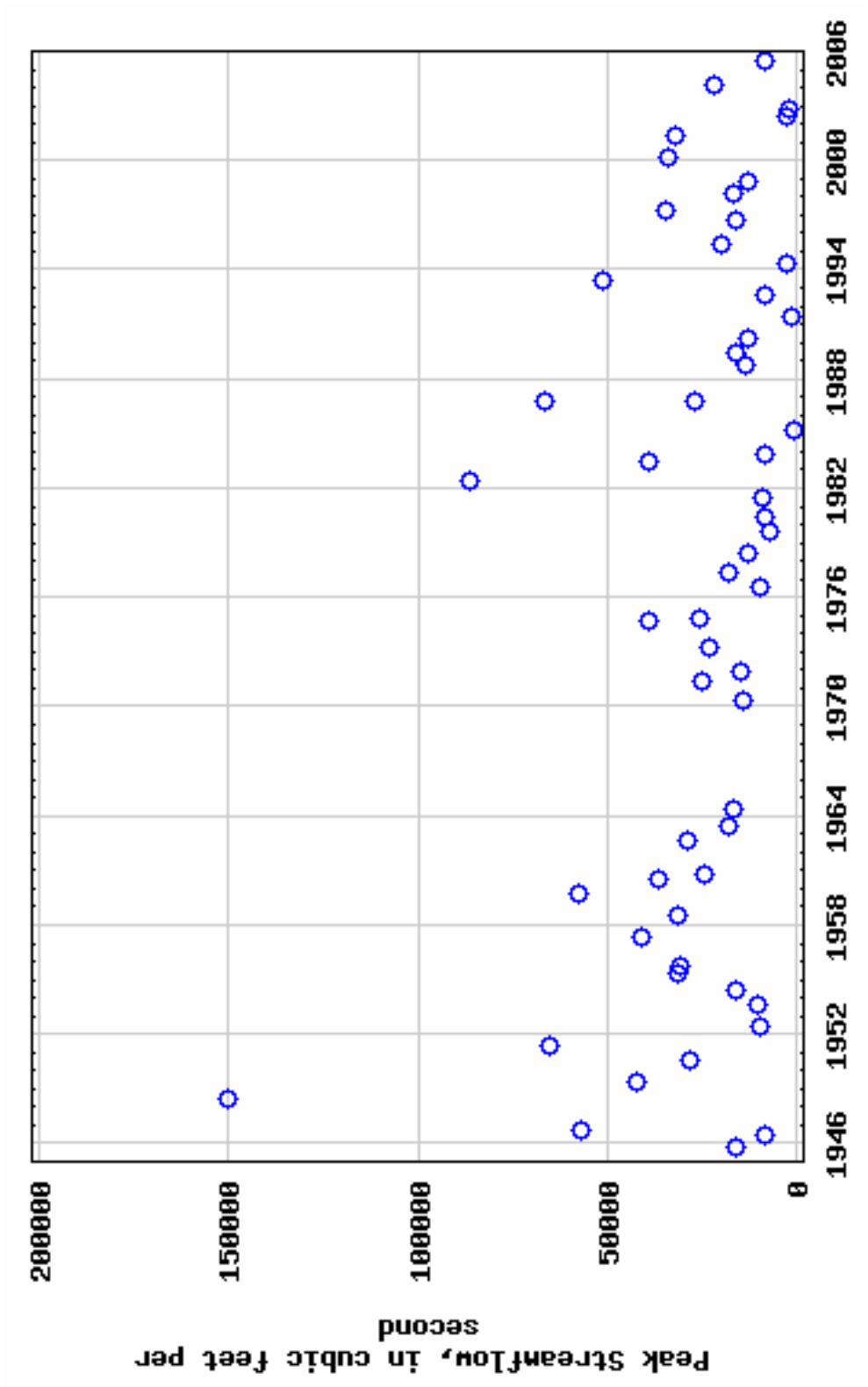


Figure 2. Annual peak streamflow in Canadian River at Bridgeport (USGS 07228500), OK

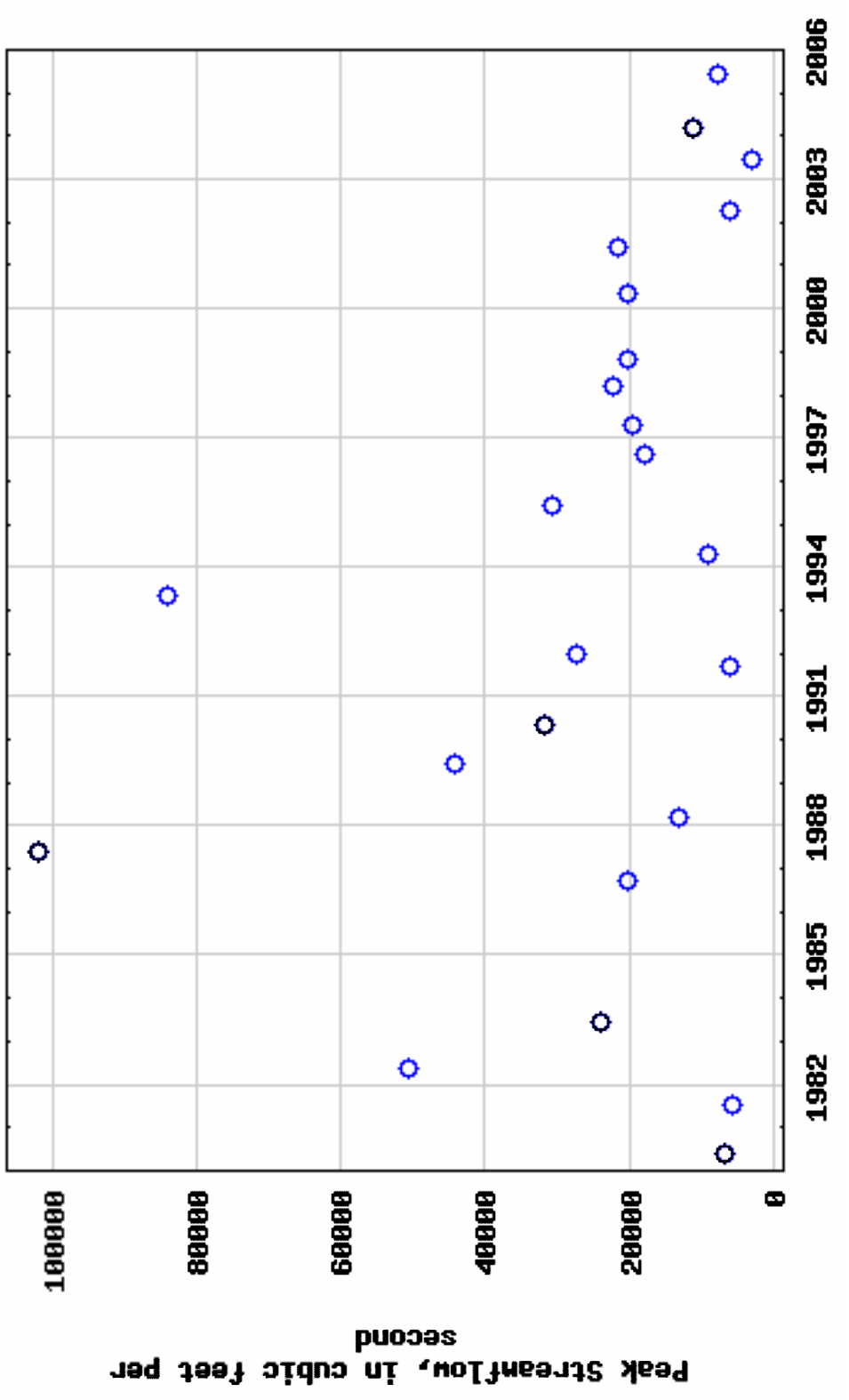


Figure 3. Annual peak streamflow in Canadian River at Purcell (USGS 07229200), OK

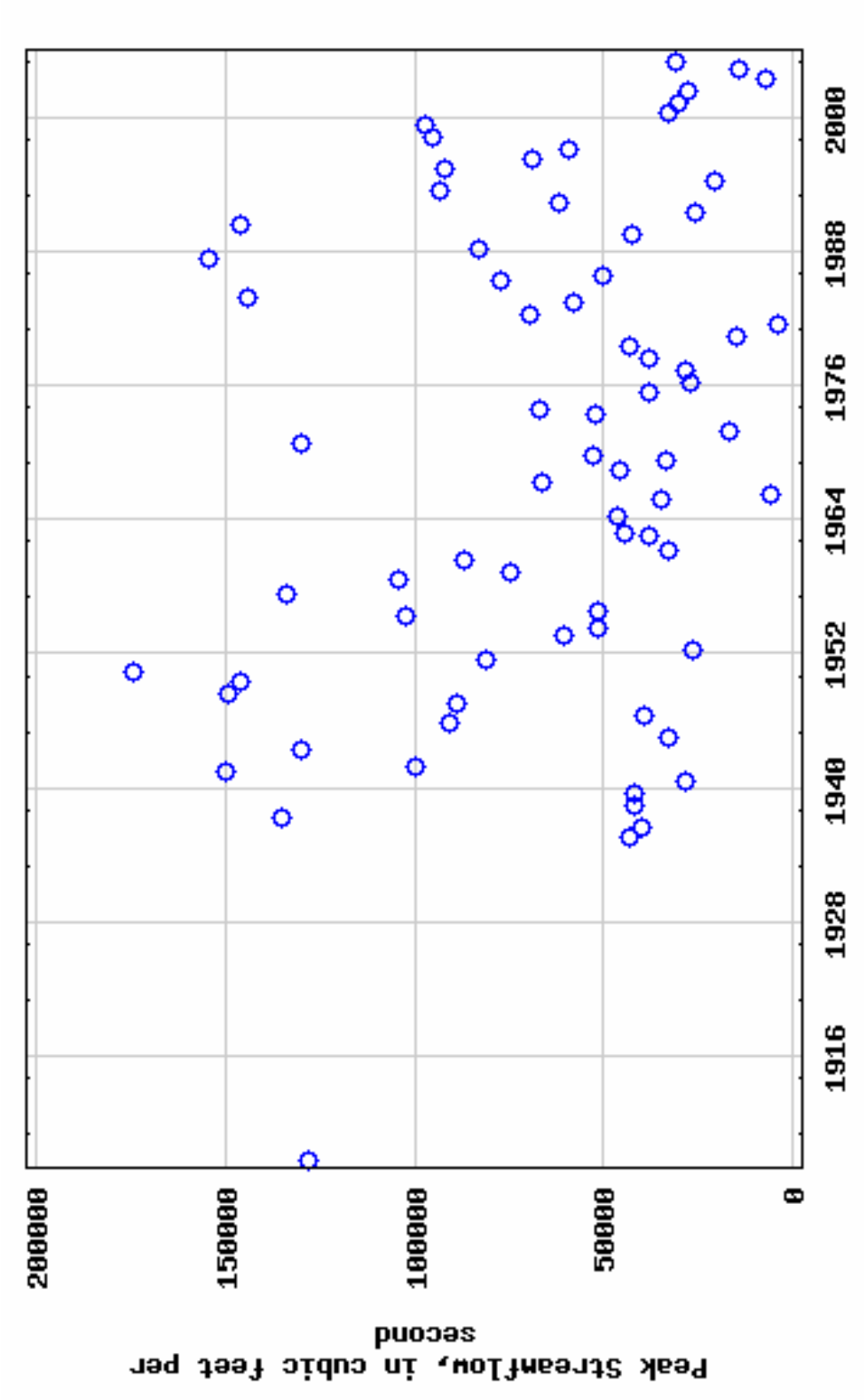


Figure 4. Annual peak streamflow in Canadian River at Calvin (USGS 07231500), OK

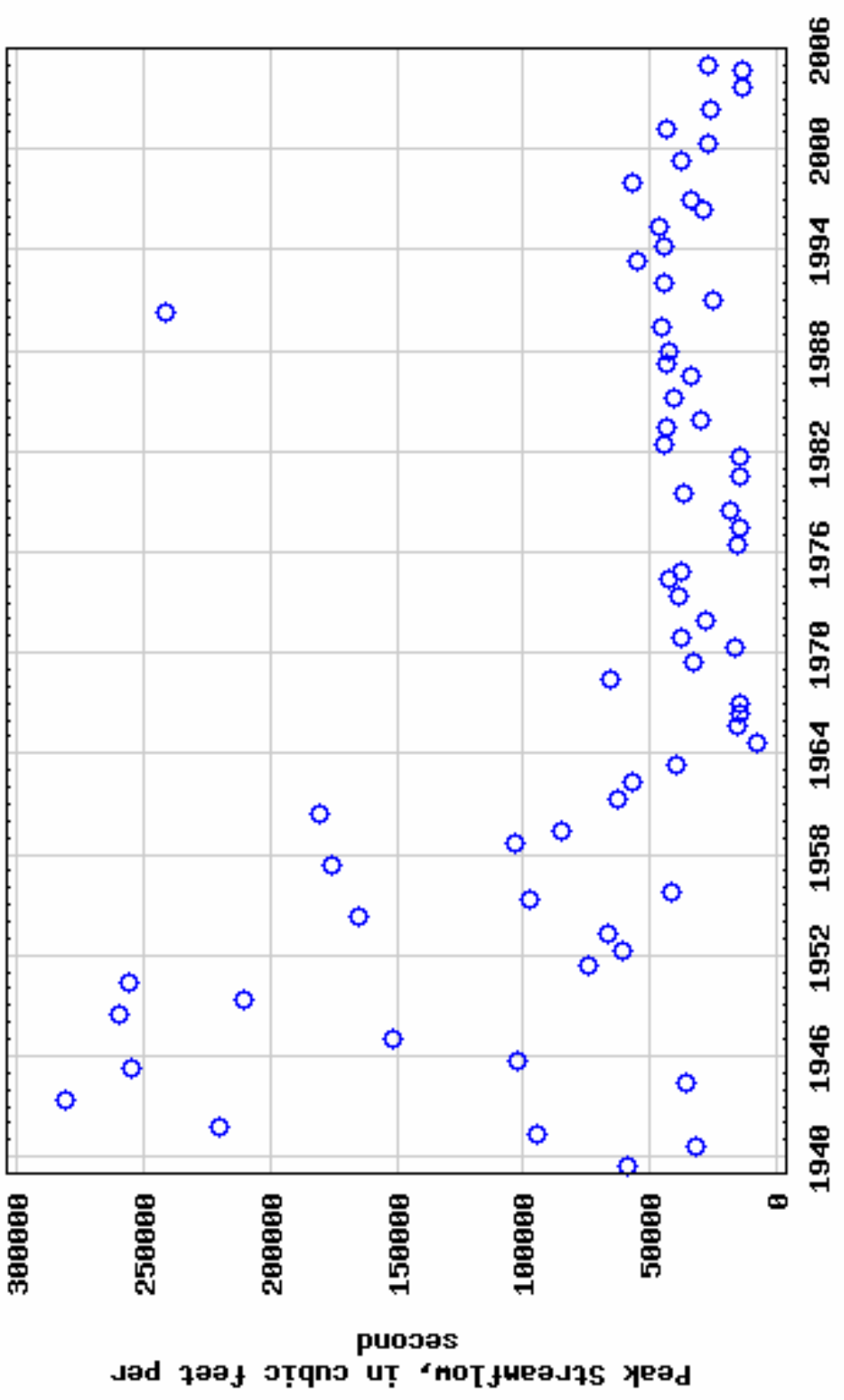


Figure 5. Annual peak streamflow in Canadian River at Whitefield (USGS 07245000), OK

Gilvier (1999) studied a number of areas in which fluvial geomorphology is directly relevant and beneficial to river engineering. These are when:

1. River channel functions as a three dimensional form with longitudinal, transverse, and vertical dimensions (x,y,z-directions) involving changes in morphology and amount of water and sediment.
2. The river system functions in response to water and sediment coming from the upstream watersheds.
3. The planform of a river normally varies through time, but the dynamics of natural channel adjustment varies between and along rivers.
4. The geomorphic stability of a river system is disturbed by activities such as river training, removing riparian vegetation, land use, and climatic change etc.

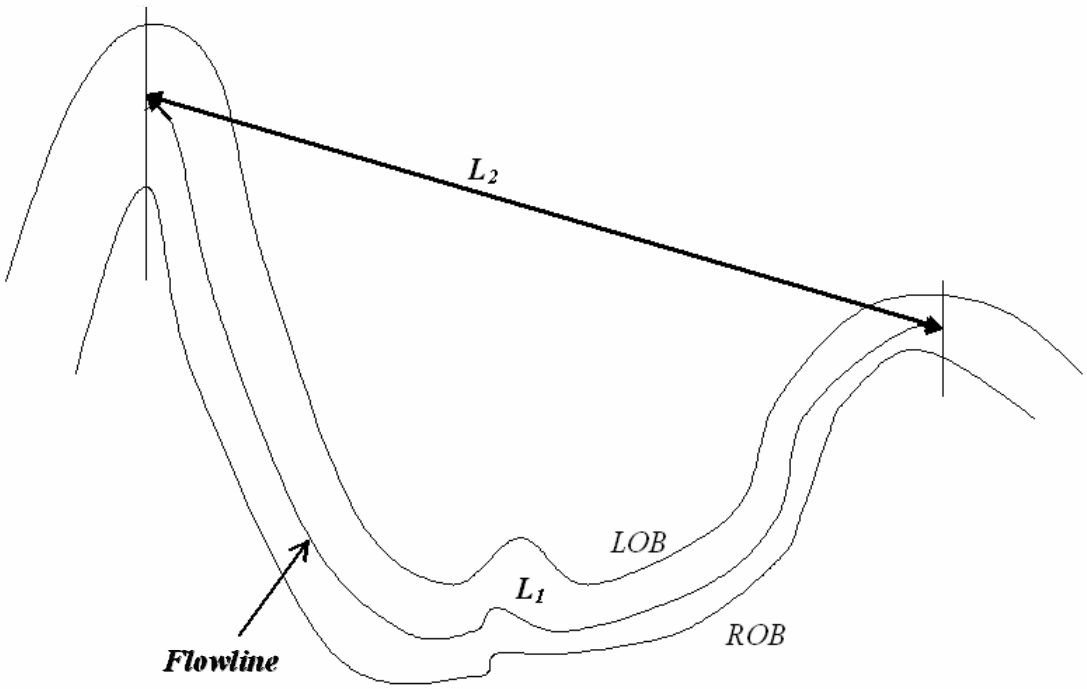
In this study, the 409.76 mile river length is divided into 2 Reaches: Reach 1- RS1 to Eufaula Lake Dam, and Reach 2- Eufaula Lake Dam to RS18. Data collection at each site included channel gradient, cross-sectional geometry, and bed material composition. Channel gradient from one river station to another was calculated arithmetically and taken mean for each study reach. River meandering between each river stations was determined by calculating sinuosity as shown in River meandering between two successive river stations was determined by calculating sinuosity as shown in Figure 6 using Geographic Information System (GIS), to examine the downstream effects of dams in meandering channels.

Sinuosity is defined as a ratio of total length between two river stations along the flowline to shortest length of the channel.

The Canadian River in Oklahoma is characterized as a less meandering, steep slope river. Reach-1 in the study area is found to be more meandering than Reach-2 whereas the slope of the river increases in Reach-2 in comparison to Reach-1 (Table 2). Longitudinal and vertical changes of river channel were also studied and will be discussed separately in another chapter.

Table 2. Sinuosity and slope study of Canadian River

Study of reach				Study of River Stations		
Reach	Location	Reach slope	Reach Sinuosity	River Stations	Slope	Sinuosity
1	RS 1(b21132) to Eufaula Lake Dam	3.83	1.60	RS 1 to RS 2	5.36	1.33
				RS 2 to RS 3	4.52	1.88
				RS 3 to RS 4	4.99	1.18
				RS 4 to RS 5	4.24	1.37
				RS 5 to RS 6	0.00	0.00
				RS 6 to RS 7	3.84	1.43
				RS 7 to RS 8	3.18	1.28
				RS 8 to RS 9	4.46	1.30
				RS 9 to RS 10	0.00	1.17
				RS 10 to RS 11	3.86	1.35
				RS 11 to RS 12	4.14	1.40
				RS 12 to RS 13	2.77	1.95
				RS 13 to RS 14	0.00	1.05
				RS 14 to RS 15	2.14	1.62
				RS 15 to RS 16	2.94	1.35
				RS 16 to RS 17	4.97	1.26
2	Eufaula Lake Dam to RS 18 (b20578)	3.98	1.18	RS 17 to RS 18	3.98	1.32



$$Sinuosity = \frac{Flowline \quad Length(L_1)}{Shortest \quad Length(L_2)}$$

Figure 6. Schematic diagram of sinuosity of natural channels

IV. ANALYSIS OF CROSS-SECTIONAL GEOMETRY

Field data measured for a long period of time by Oklahoma Department of Transportation were examined in this study. Throughout the study reach, 18 River Stations (RS) were selected: RS 1 to Eufaula Lake Dam in Reach 1, and Eufaula Lake Dam to RS 18 in Reach 2. Twelve out of eighteen river stations have data on cross-section geometry. These river stations are measured in bridge crossings.

In Reach 1, RS 1 shows the maximum aggradation of 1.8 feet from 1985 to 1989. The bridge at this river station was constructed in 1985 and the resultant aggradation on the river bed is possibly due to the ongoing stabilization process at the newly excavated bed. The observed data shows that at RS 3 (Fig. 8) at the crossing of U.S. 183, the river bed is most stable. However, the flowline has shifted from the right to the middle. The bed material at RS 3 is characterized as Sand to Soft Red Bed. RS 4 (Fig. 9) at the crossing of S.H. 33 has the slight aggradaion of about 0.5 feet in 8 years. Along the river length of 151.75 miles between RS 5 to RS 14, the channel bed shows a degradation ranging from 1.4 to 17.6 feet. At RS 7 (Fig.12) at the crossing of I-40, a degradation of 12.05 feet is observed from year 1955 to 2000. Flowline at this river station is narrower and deeper; however its position has not shifted in 45 years. RS 9 and RS 10 on interstate highway I-35 show the maximum degradation of 10.25 feet over 4 and 6 years respectively. The bed material at RS 11 and RS 12 is characterized as sandy clay.

RS 11 (Fig.13) at the crossing of US-77, shows a degradation of 4 feet in 63 years. The channel at this river station is being incisive at the middle. At RS12 (Fig.14) at the crossing of SH-3W, a degradation of 10 feet is shown from 1959 to 1993, primarily at the right side of the river. Data at RS 14 at the crossing of U.S.283, shows the degradation of 17.6 feet from 1985 to 2004. RS 15 (Fig.15) at the crossing of S.H. 48, has a slight aggradation of about 0.2 feet in 20 years. At this river station, the flowline has shifted from right to the left. RS 16 at the crossing of U.S.69, and RS 17 at the crossing of S.H. 9, are located within Eufaula Lake. In RS 16, (Fig.16) a degradation of 2.5 feet is observed in 33 years. Data shows that the river section at this river station has widened since 1987, which mimics the flood of 1987. RS 17 is 8.86 miles upstream of the Eufaula Lake Dam. At this river station, an aggradation of 3 feet was observed from 1962 to 1993. The Eufaula Dam construction was completed in 1963 and resultant aggradation is due to the Eufaula Dam, which has completely interrupted the motion of sediment.

Reach-2 extends from the Eufaula Lake Dam location to the RS 18 (Fig.17) at the crossing of S.H. 2 on the Haskell Channel, which is the last river station of the study area. The observed data shows that a degradation of 3.5 feet was occurred in RS 18 from 1983 to 1989. The bed material at this river station is characterized as sand and gray shale.

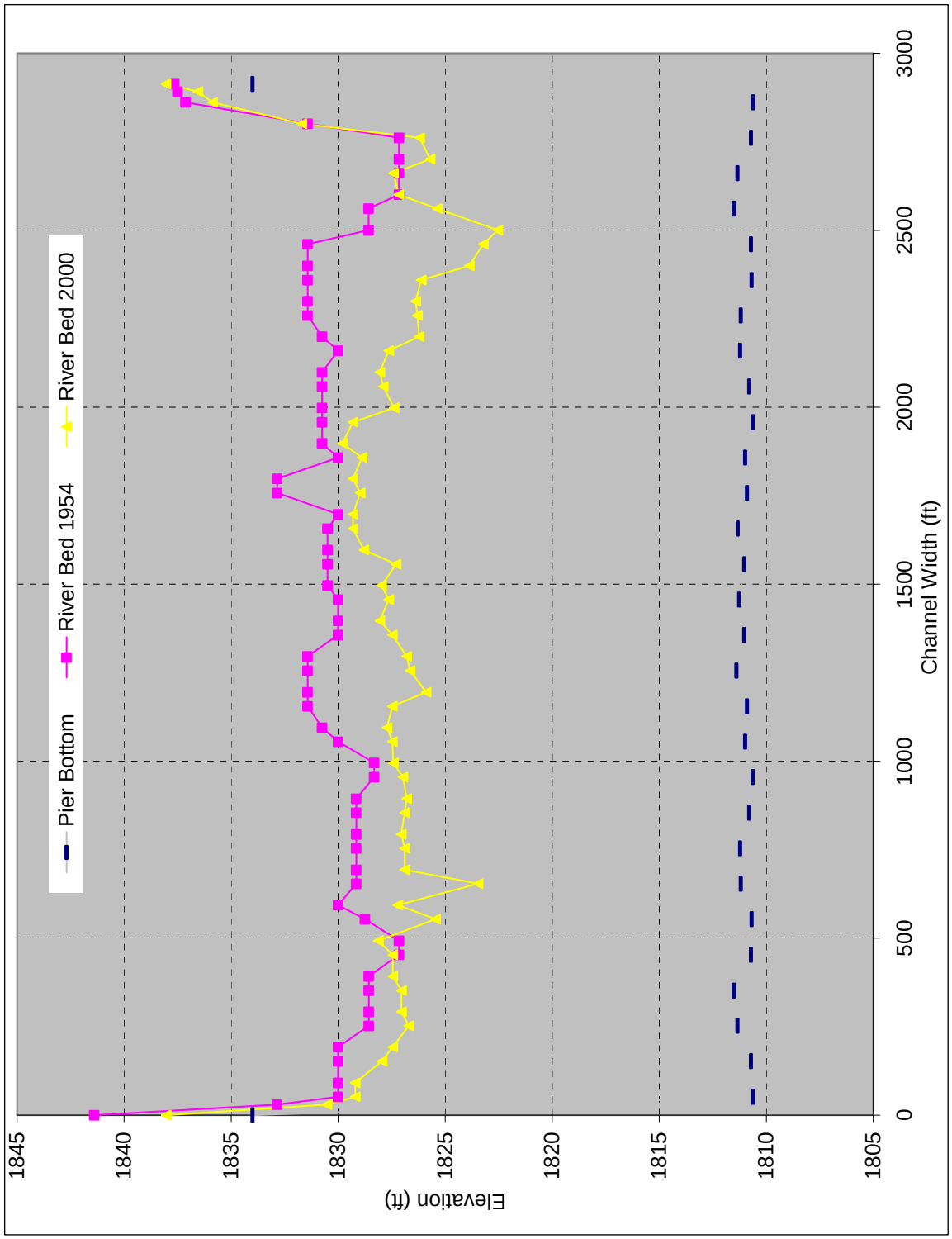


Figure 7. Cross-section at bridge (Key No. 13240 and RS 2) on SH 34, Canadian River, OK

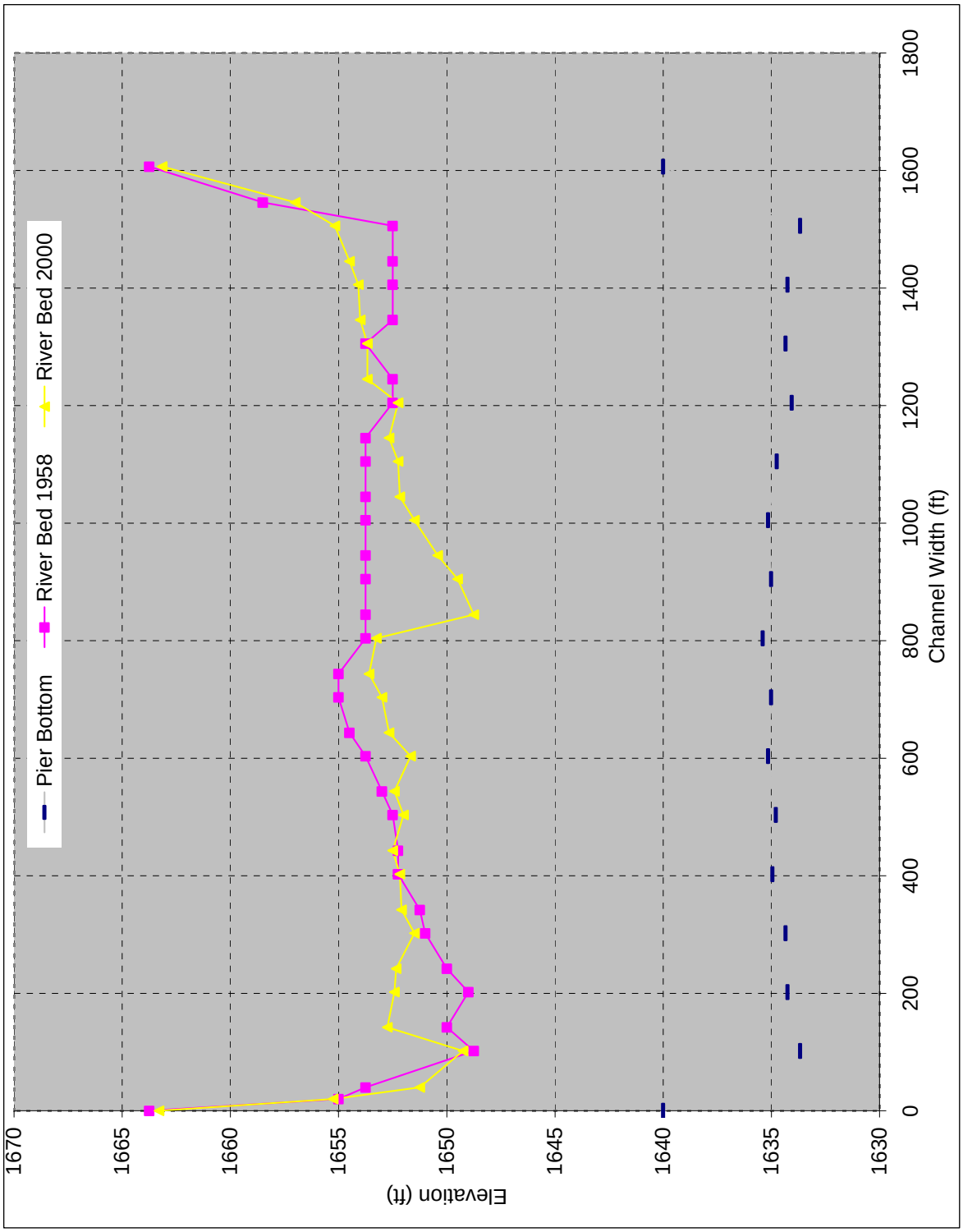


Figure 8. Cross-section at bridge (Key No. 14214 and RS 3) on US 183, Canadian River, OK

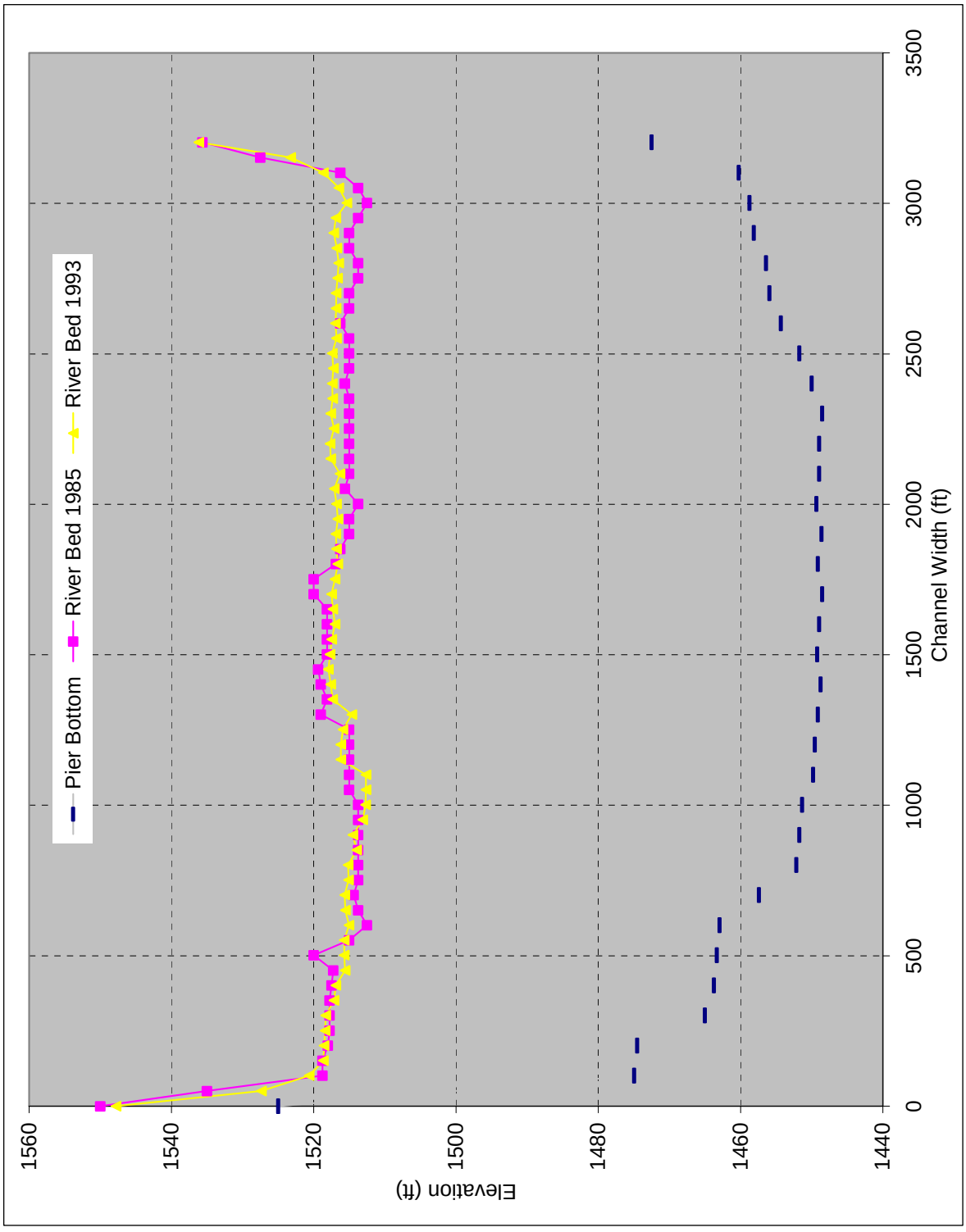


Figure 9. Cross-section at bridge (Key No. 21131 and RS 4) on SH 33, Canadian River, OK

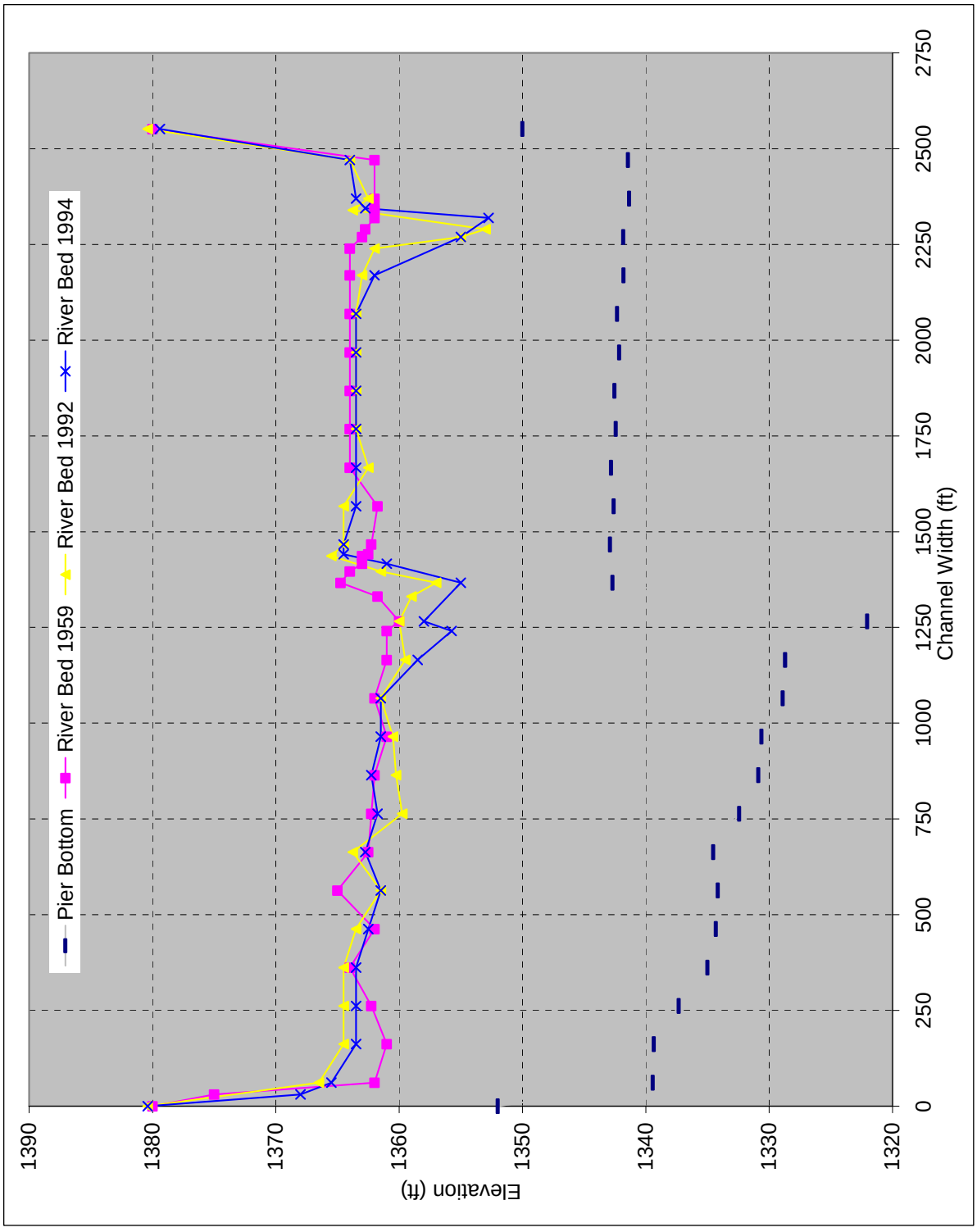


Figure 10. Cross-section at bridge (Key No. 14522 and RS 5) on I-40, Canadian River, OK

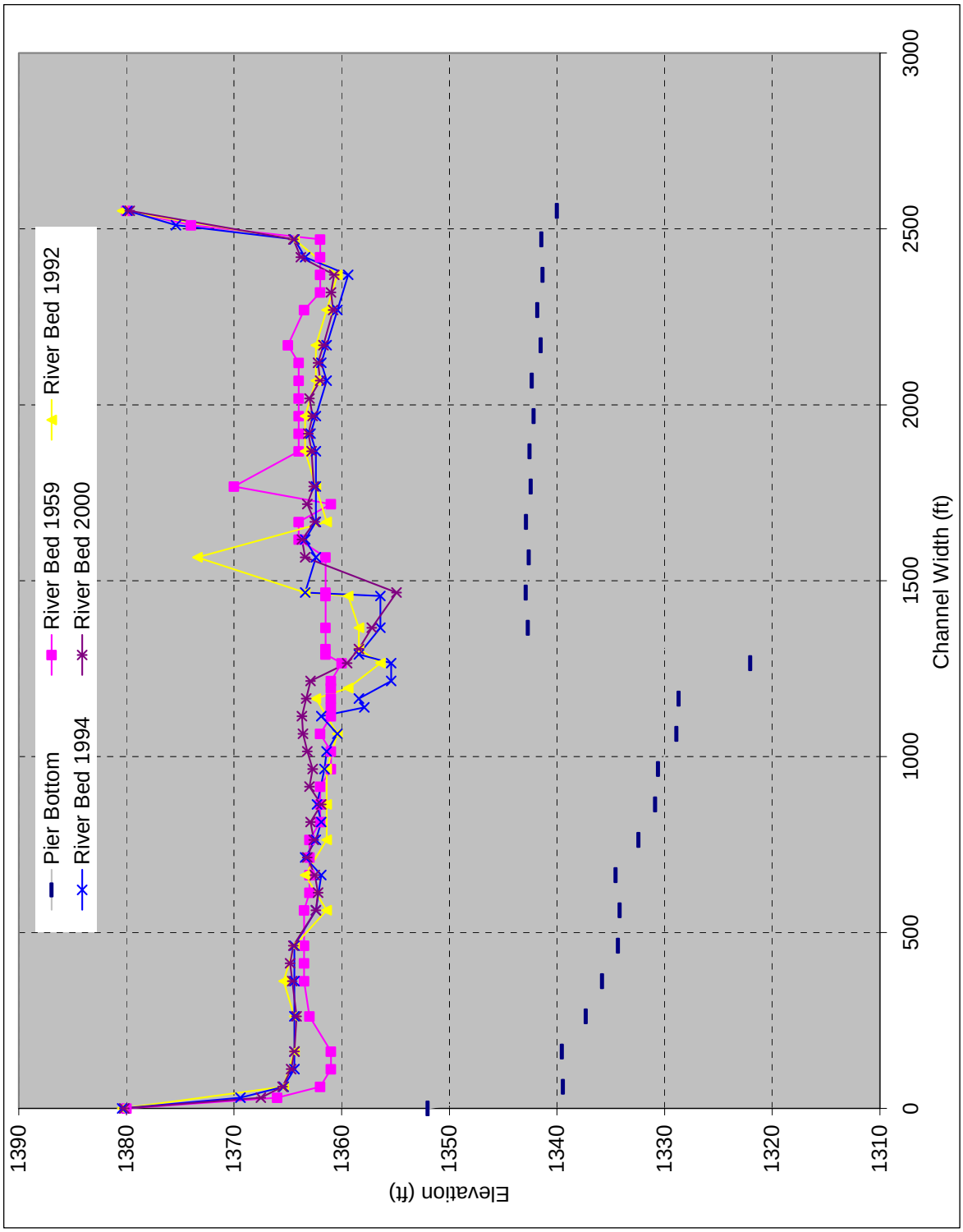


Figure 11. Cross-section at bridge (Key No. 14521 and RS 6) on I-40, Canadian River, OK

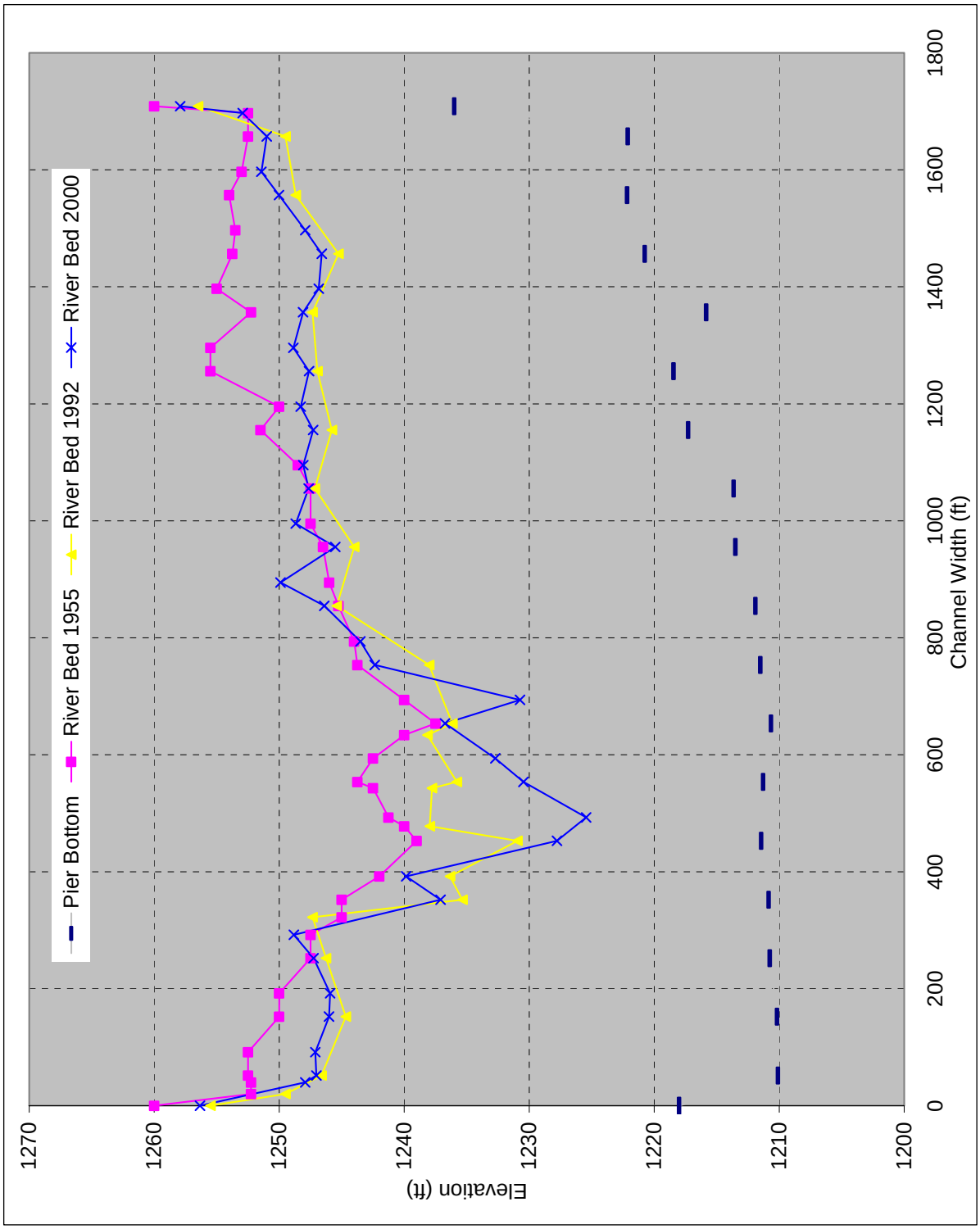


Figure 12. Cross-section at bridge (Key No. 13537 and RS 7) on US-81, Canadian River, OK

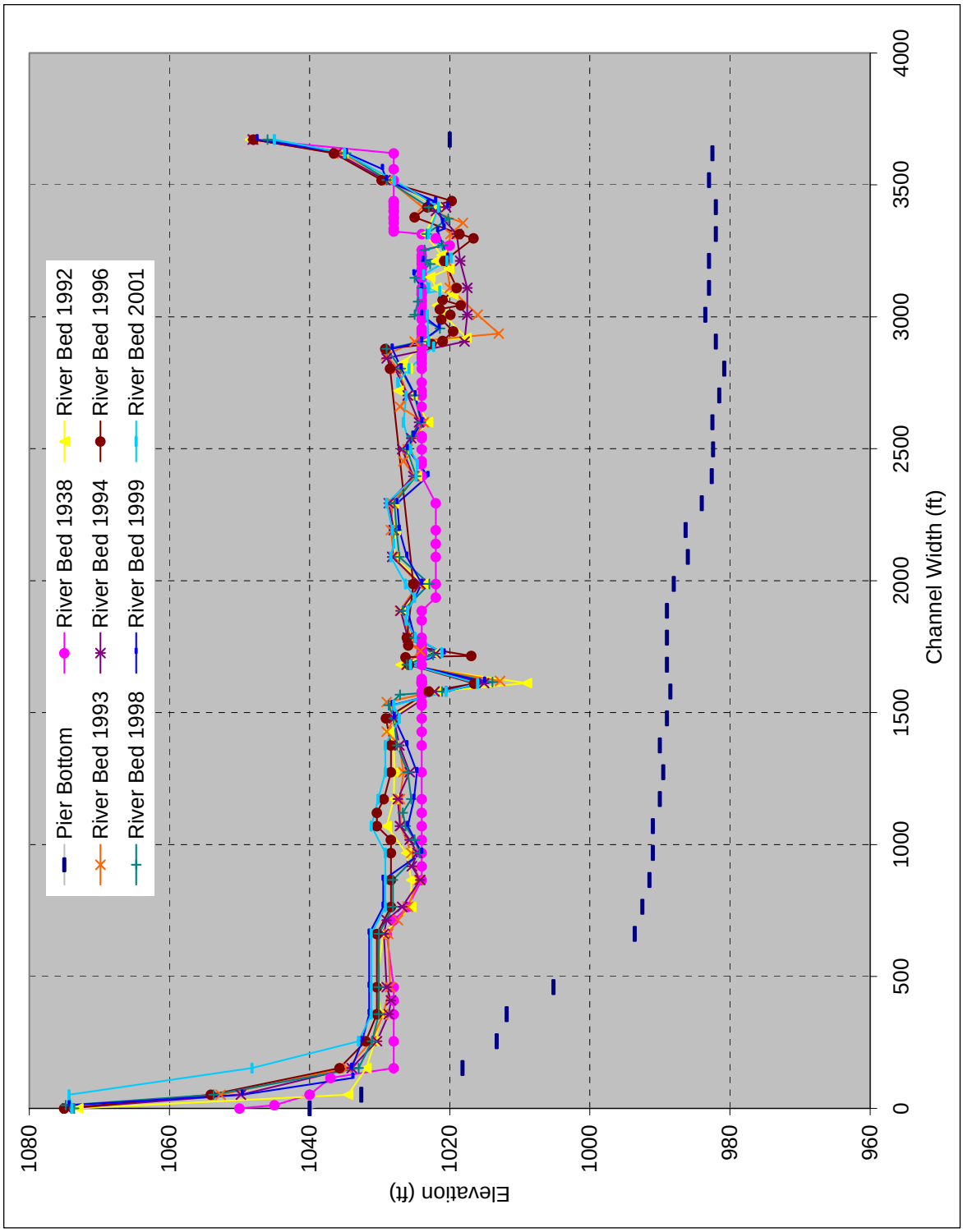


Figure 13. Cross-section at bridge (Key No. 06593 and RS 11) on US-77, Canadian River,

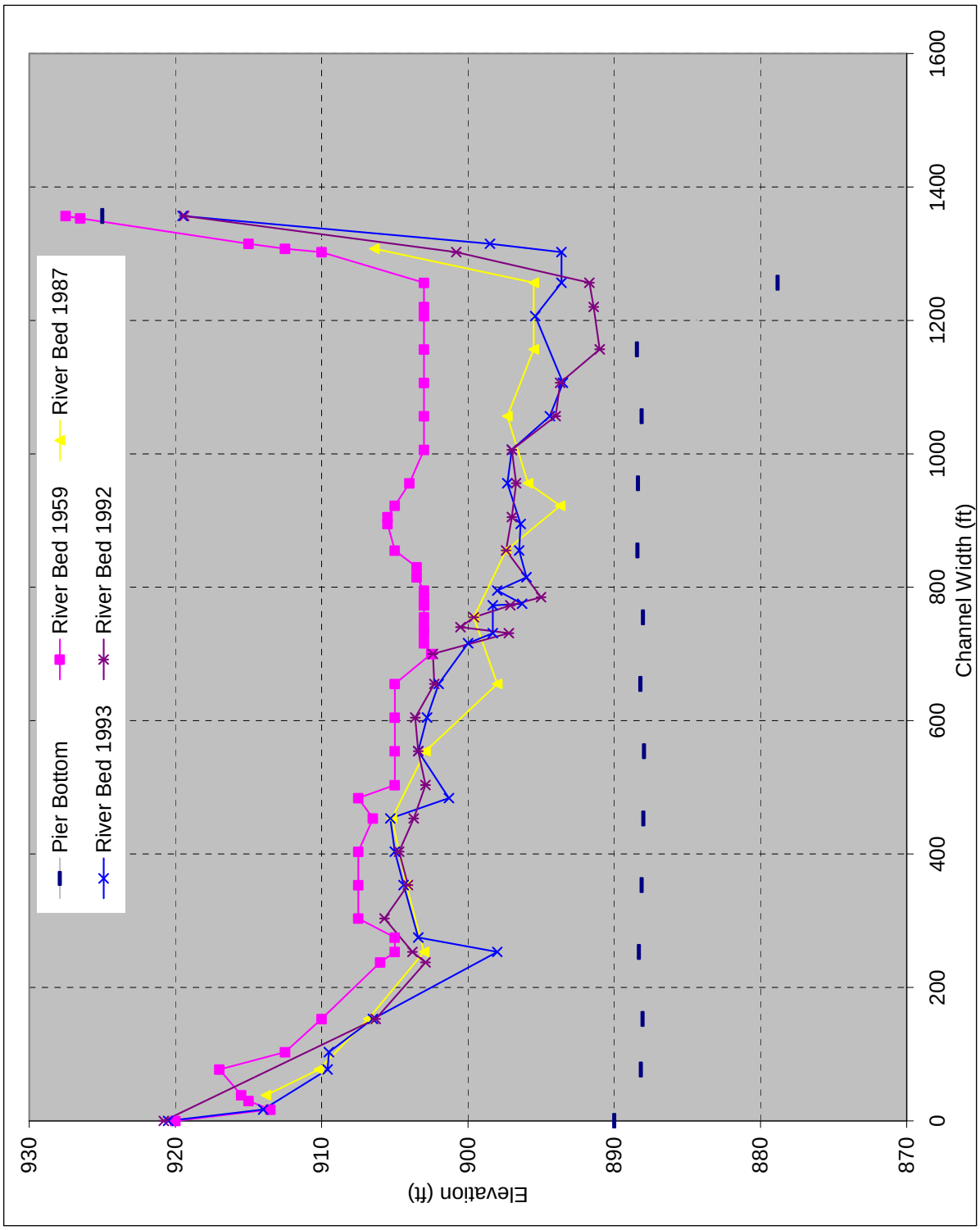


Figure 14. Cross-section at bridge (Key No. 14520 and RS 12) on SH-3W, Canadian River, OK

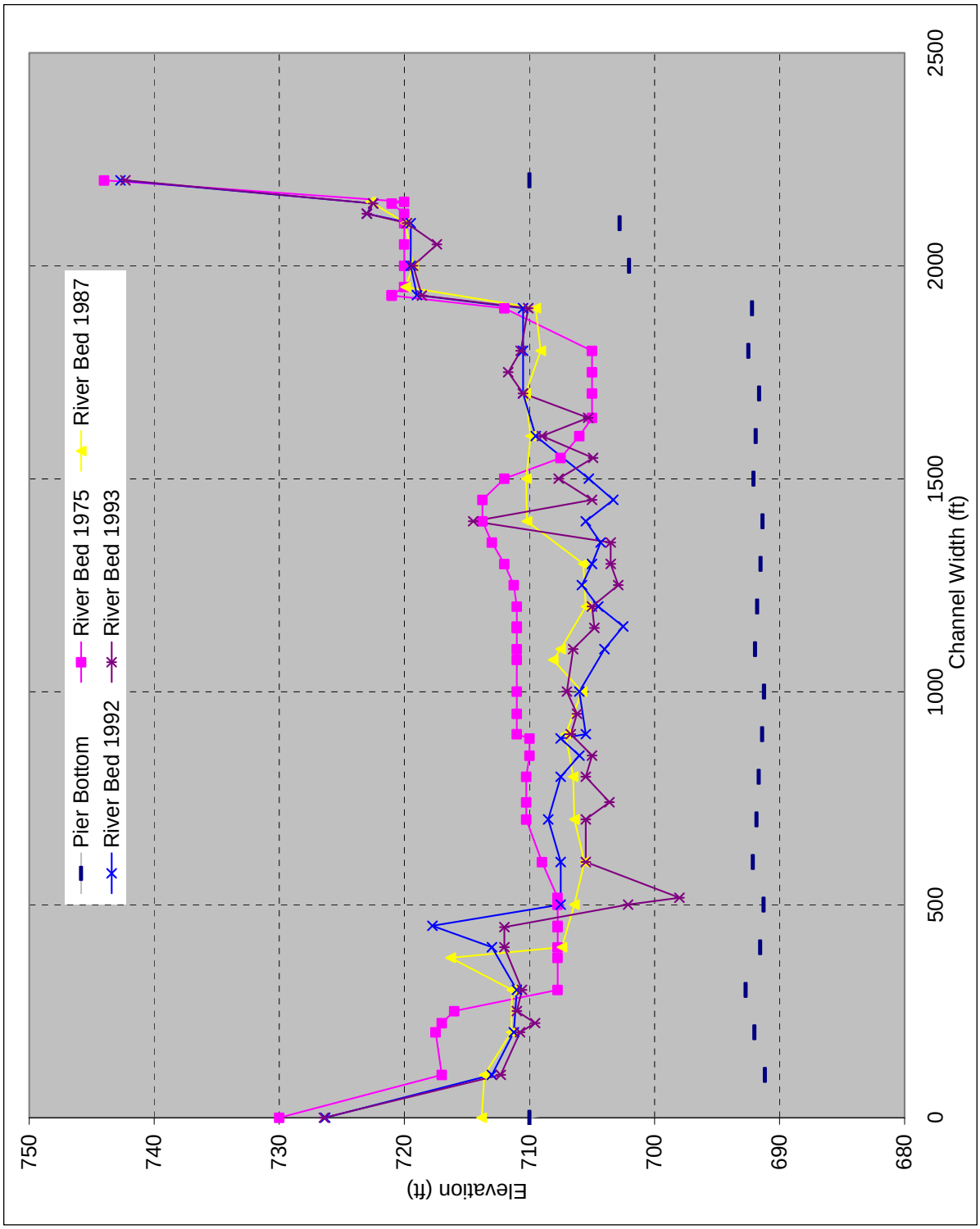


Figure 15. Cross-section at bridge (Key No. 19113 and RS 15) on SH-48, Canadian River, OK

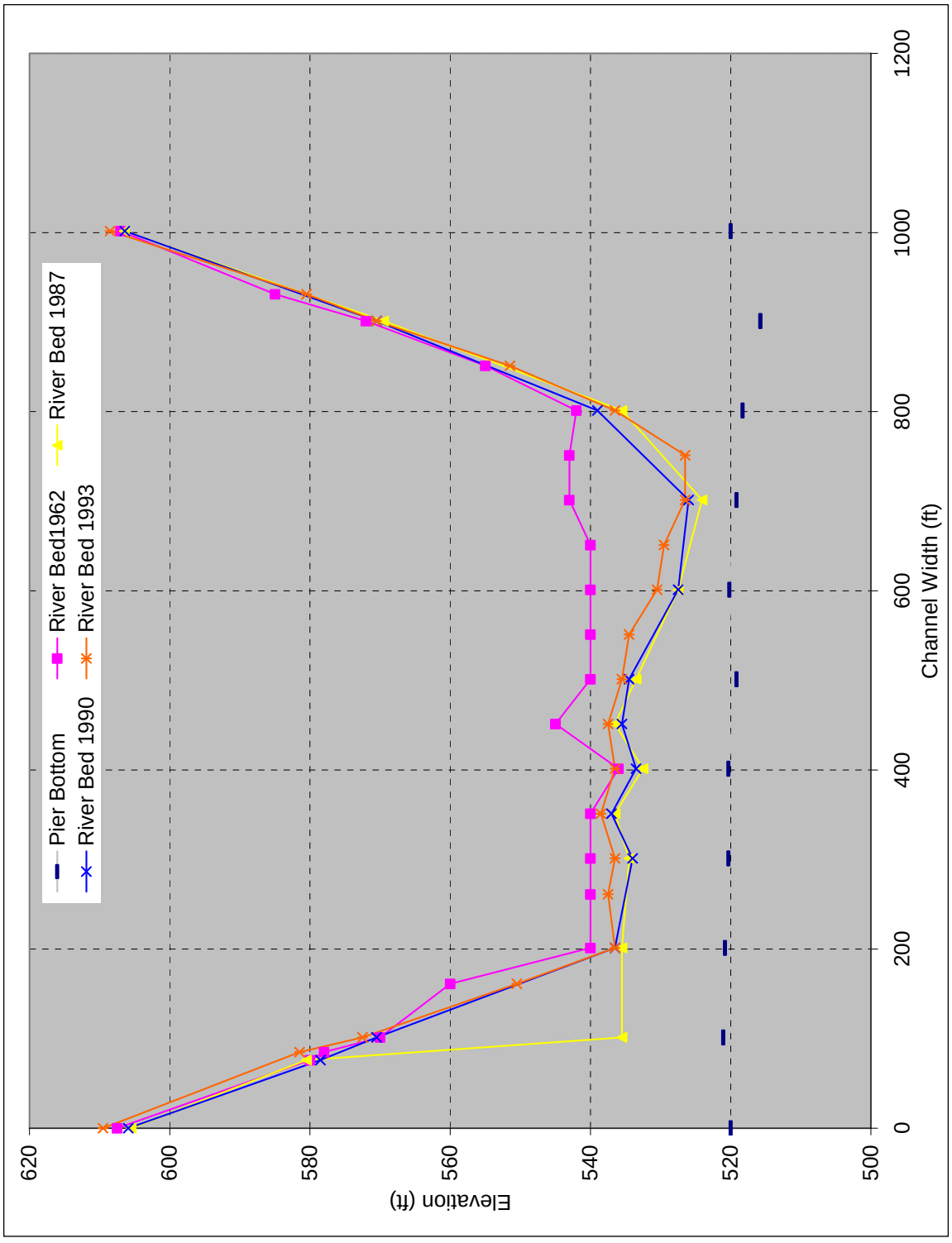


Figure 16. Cross-section at bridge (Key No. 15586 and RS 16) on US-69, Canadian River, OK

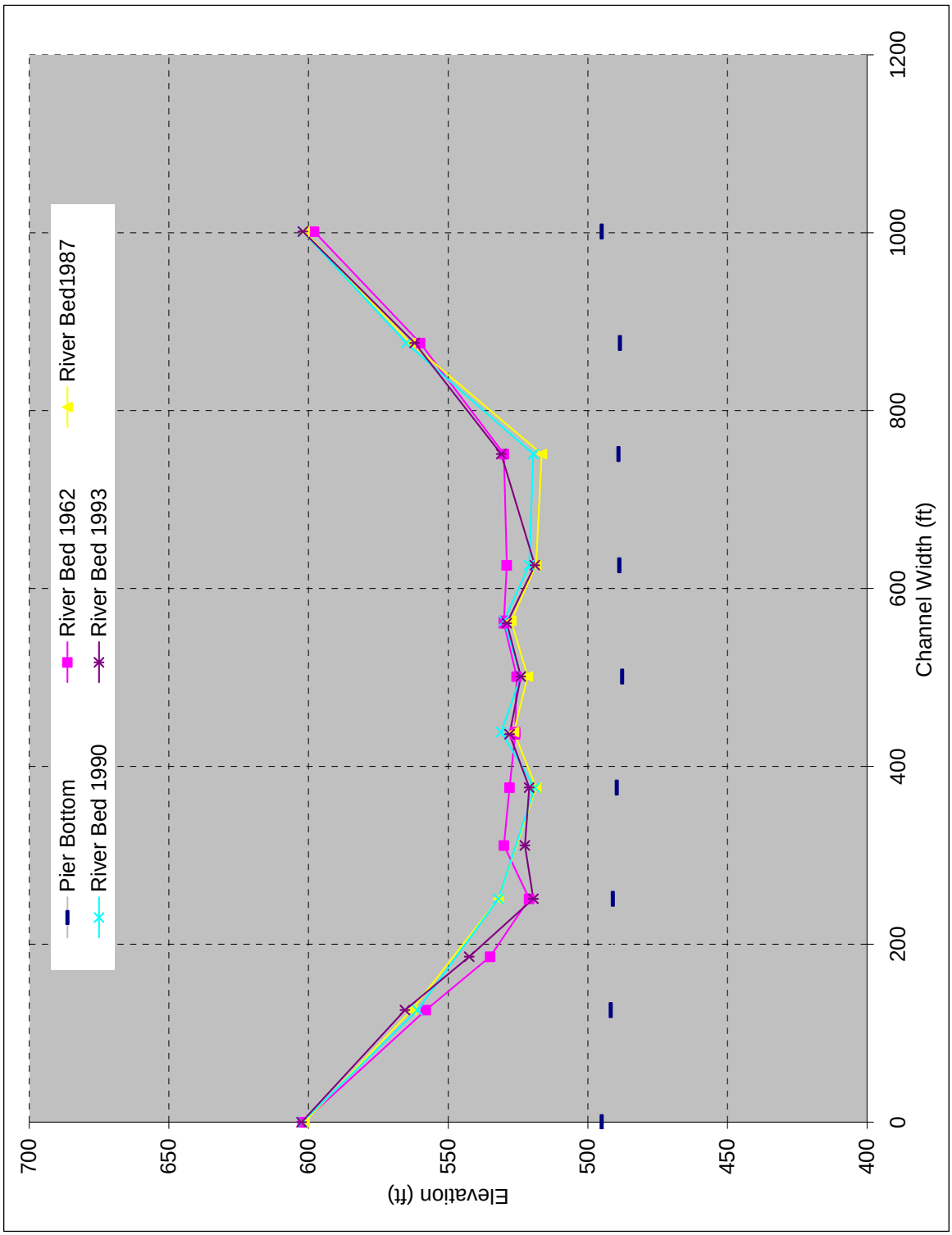


Figure 17. Cross-section at bridge (Key No. 15587 and RS 17) on SH- 9, Canadian River, OK

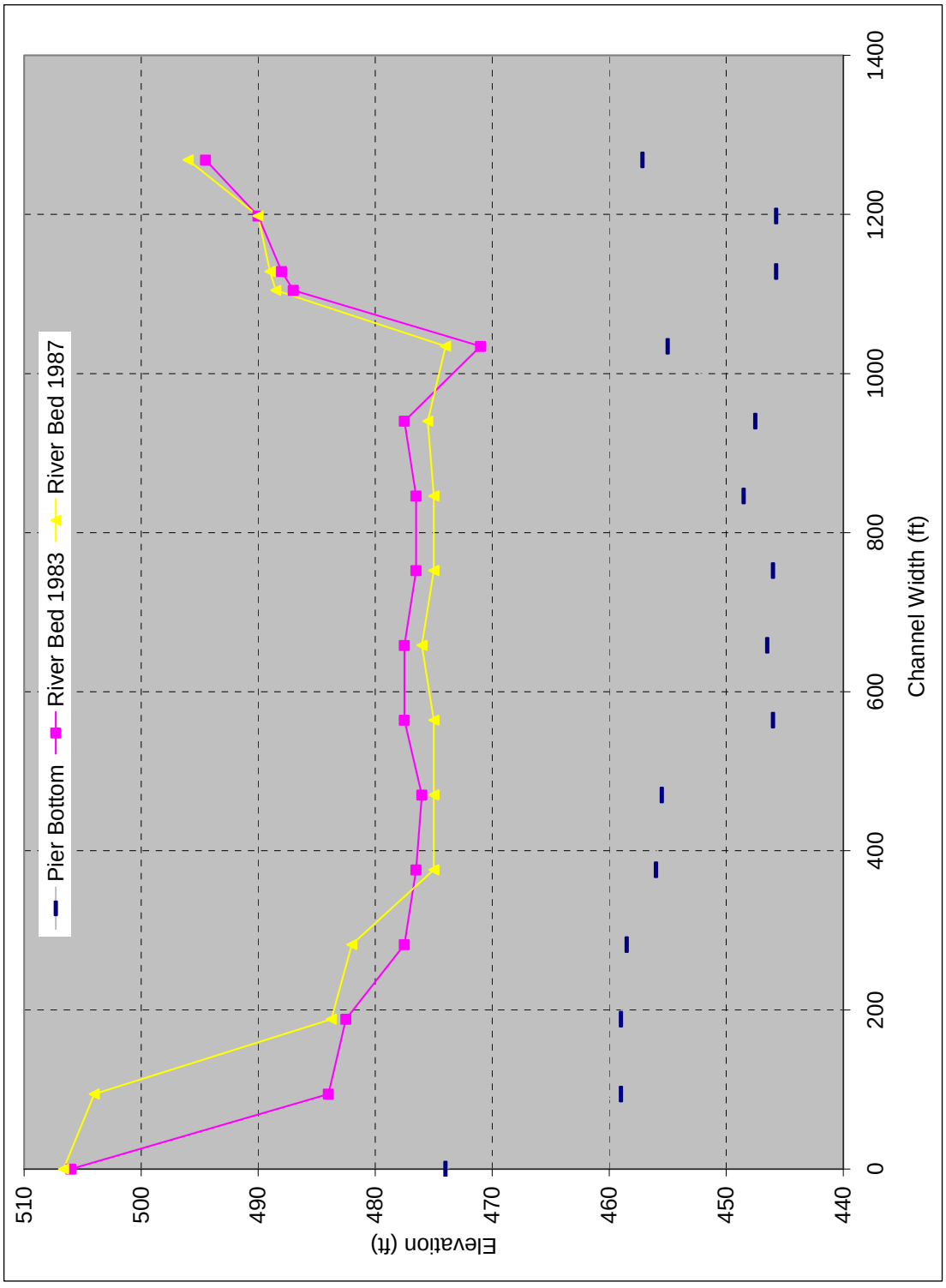


Figure 18. Cross-section at bridge (Key No. 20578 and RS 18) on SH-2, Canadian River, OK

V. ANALYSIS OF FLOWLINE PROFILE

The rate of channel-bed elevation change was estimated as the net difference in channel-bed elevation between the starting and ending dates divided by the total duration of time between the two dates (Table 3). The trend line of bed-elevation changes (Fig.19) was plotted for study Reach 1, upstream of Eufaula Lake Dam and Reach 2, downstream of Eufaula Lake Dam. The best fit line for the stream bed elevation change rate (Fig. 20) is also plotted.

Flowlines at each river station were interpolated for 5 year intervals (Table 4) and the longitudinal profile of flowlines were then plotted in Microsoft Excel (Fig. 19). Twenty five miles of river reach is plotted separately in each sheet for evaluating channel-bed elevation changes (Fig. 22-38). The study of river-bed elevation change elucidates that the Canadian River is not constantly degrading between RS 5 to RS 14 above the Eufaula Lake dam. RS 10 located at I-35, has experienced the highest 2.56feet/year of channel-bed degradation rate in the Canadian River, Oklahoma. Below the Eufaula Lake Dam, channel bed elevation data is available for only one river station (RS 18) and it shows a degradation of 3.5 feet from 1983 to 1989.

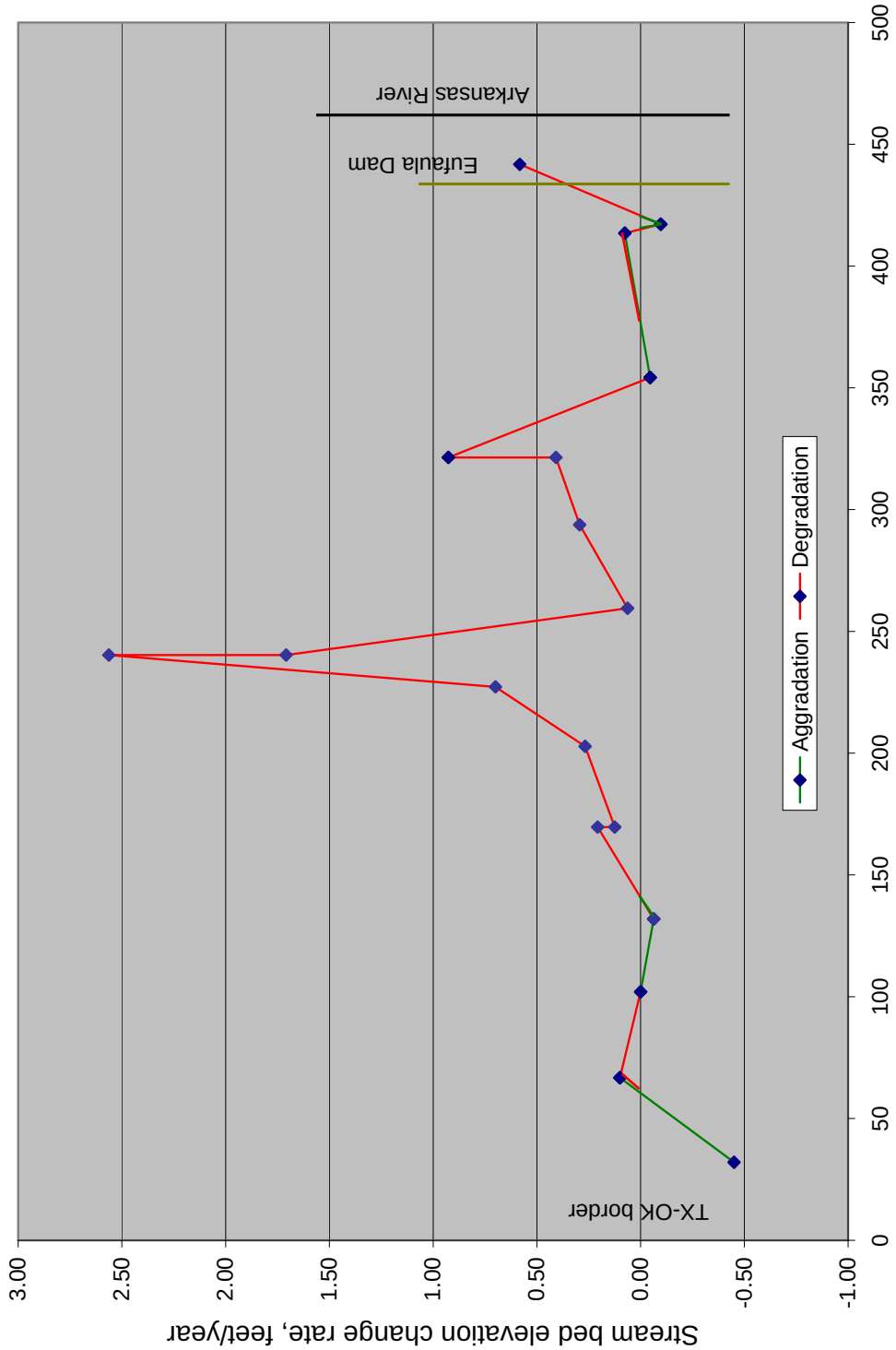


Figure 19. Trend line of stream-bed elevation changes

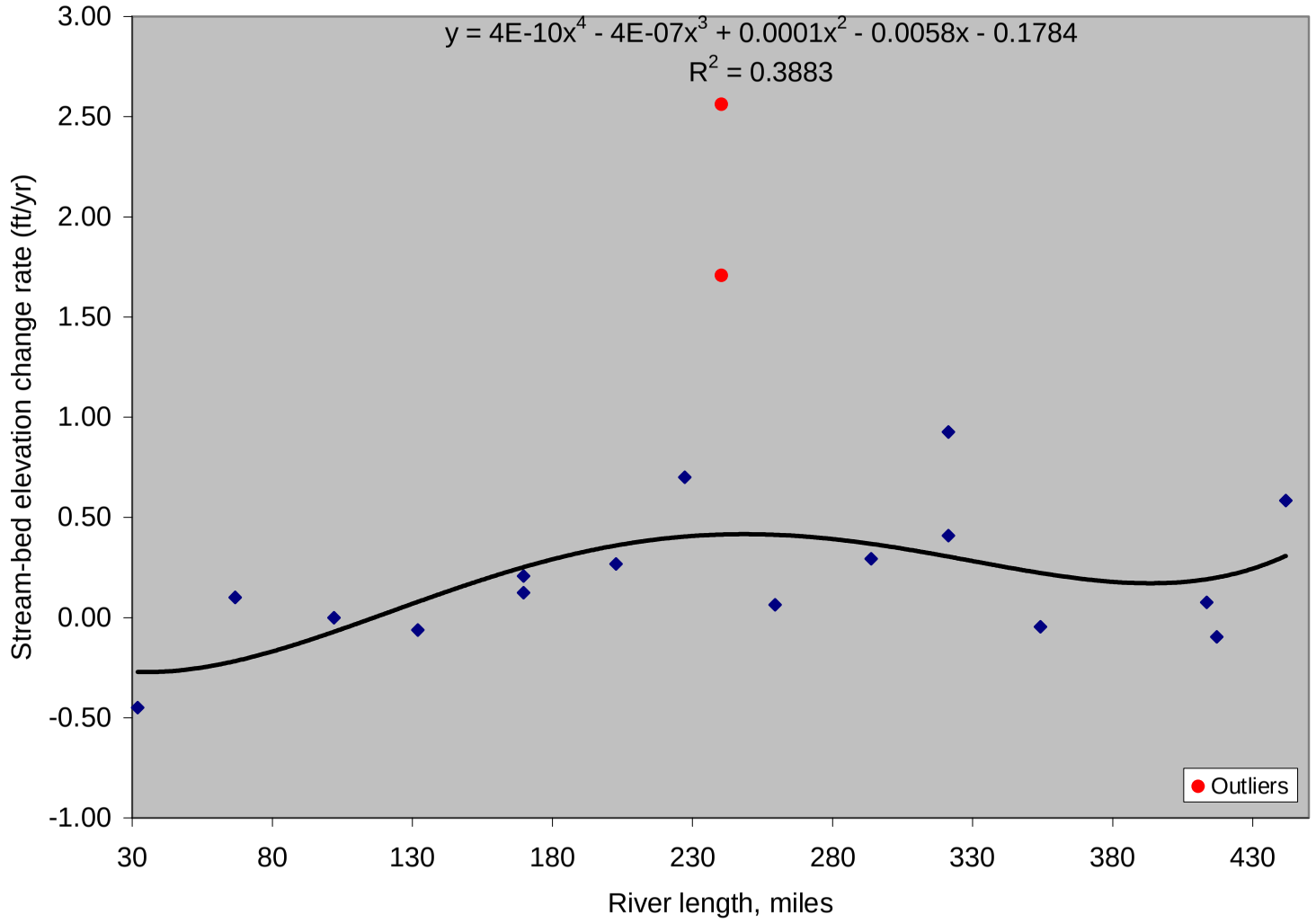


Figure 20. The best fit line of stream-bed elevation change rate (ft/yr) versus river length in miles

Table 4. Summary- channel –bed elevation change, Canadian River

BRI-No.	River Station	Miles	Bridge Installed	Highway	Stratum	Max. Scou** (ft)	Duration (yr)	Scour rate** (ft/yr)
*b21132	RS 1	32.00	1985	U.S. 283	Sand to Red Bed	-1.80	4	-0.450
b13240	RS 2	66.77	1954	S.H. 34	Sand to Hard Red Bed	4.61	46	0.100
b14214	RS 3	101.99	1958	U.S. 183	Sand to Soft Red Bed	0.00	42	0.000
b21131	RS 4	131.96	1985	S.H. 33	Sand to Red Bed	-0.50	8	-0.063
b14522	RS 5	169.66	1959	I-40	Sand to Hard Red Bed	7.25	35	0.207
b14521	RS 6	169.66	1959	I-40	Sand to Hard Red Bed	5.10	41	0.124
b13537	RS 7	202.74	1955	US-81	Sand to Medium Soft Red Bed	12.05	45	0.268
*b26060	RS 8	227.28	2000	I-44	Clay to Shale and Gravel	1.40	2	0.700
*b22108	RS 9	240.30	1988	I-35	Sandy Clay to Shale	10.25	4	2.563
*b21361	RS 10	240.31	1986	I-35	Silty Sand to Shale	10.25	6	1.708
b06593	RS 11	259.50	1938	U.S. 77	Sand to Red Bed	4.00	63	0.063
b14520	RS 12	293.80	1959	S.H. 3W	Sand to Sand Stone	10.00	34	0.294
*b22099	RS 13	321.40	1986	I-35	Sand to Silty Sand	7.35	18	0.408
*b22420	RS 14	321.41	1985	U.S. 283	Fine Silty Sand to Sand Stone	17.60	19	0.926
b19113	RS 15	354.20	1975	S.H. 48	Fine Sand to Hard Grey Shale	-0.92	20	-0.046
b15586	RS 16	413.53	1962	U.S.69	Sand to Shale Mode Hard Rock	2.50	33	0.076
b15587	RS 17	417.15	1962	S.H. 9	Mud to Silt	-3.00	31	-0.097
b20578	RS 18	441.76	1983	S.H. 2	Sand to Gray Shale	3.50	6	0.583

*Bridges without cross section data

**Note: (-) Aggradation
: (+) Degradation

Table 5. Flowline interpolated data for 5 years interval, Canadian River

Location			Year								
BRI-No.	River Station	Miles	1965	1970	1975	1980	1985	1990	1995	2000	2005
b21132	RS 1	32.00					2002.00	2004.25	2006.50	2008.75	2013.25
b13240	RS 2	66.77	1824.10	1822.30	1823.88	1823.03	1823.57	1822.50	1823.42	1822.55	1820.80
b14214	RS 3	101.99	1649.45	1649.05	1650.38	1649.65	1649.45	1649.25	1650.75	1663.30	1675.85
b21131	RS 4	131.96					1512.50	1506.70	1513.00	1513.88	1515.63
b14522	RS 5	169.66	1361.50	1360.00	1358.50	1357.00	1355.50	1354.00	1352.63	1352.00	1351.25
b14521	RS 6	169.66	1359.80	1357.40	1357.25	1356.40	1355.69	1352.40	1355.32	1354.90	1354.07
b13537	RS 7	202.74	1233.87	1234.14	1232.14	1232.72	1232.94	1224.34	1226.17	1225.45	1224.00
b26060	RS 8	227.28								1147.50	1138.85
b22108	RS 9	240.30						1080.90	1083.85	1089.45	1100.65
b21361	RS 10	240.31						1080.90	1083.85	1089.45	1100.65
b06593	RS 11	259.50	1007.34	1005.00	1006.95	1008.89	1010.84	1011.27	1015.80	1015.50	1018.50
b14520	RS 12	293.80	899.23	896.50	893.80	897.36	897.10	893.50	886.00	873.50	858.50
b22099	RS 13	321.40						803.75	802.20	797.08	803.99
b22420	RS 14	321.41					810.00	802.50	799.85	795.71	788.26
b19113	RS 15	354.20			705.00	695.86	695.00	700.50	705.92	725.71	745.50
b15586	RS 16	413.53	537.00	533.94	530.89	527.83	532.00	526.00	533.50	551.00	568.50
b15587	RS 17	417.15	521.69	522.84	524.00	525.15	526.30	519.00	523.00	533.00	541.00
b20578	RS 18	441.76					470.70	464.25	454.50	435.00	396.00

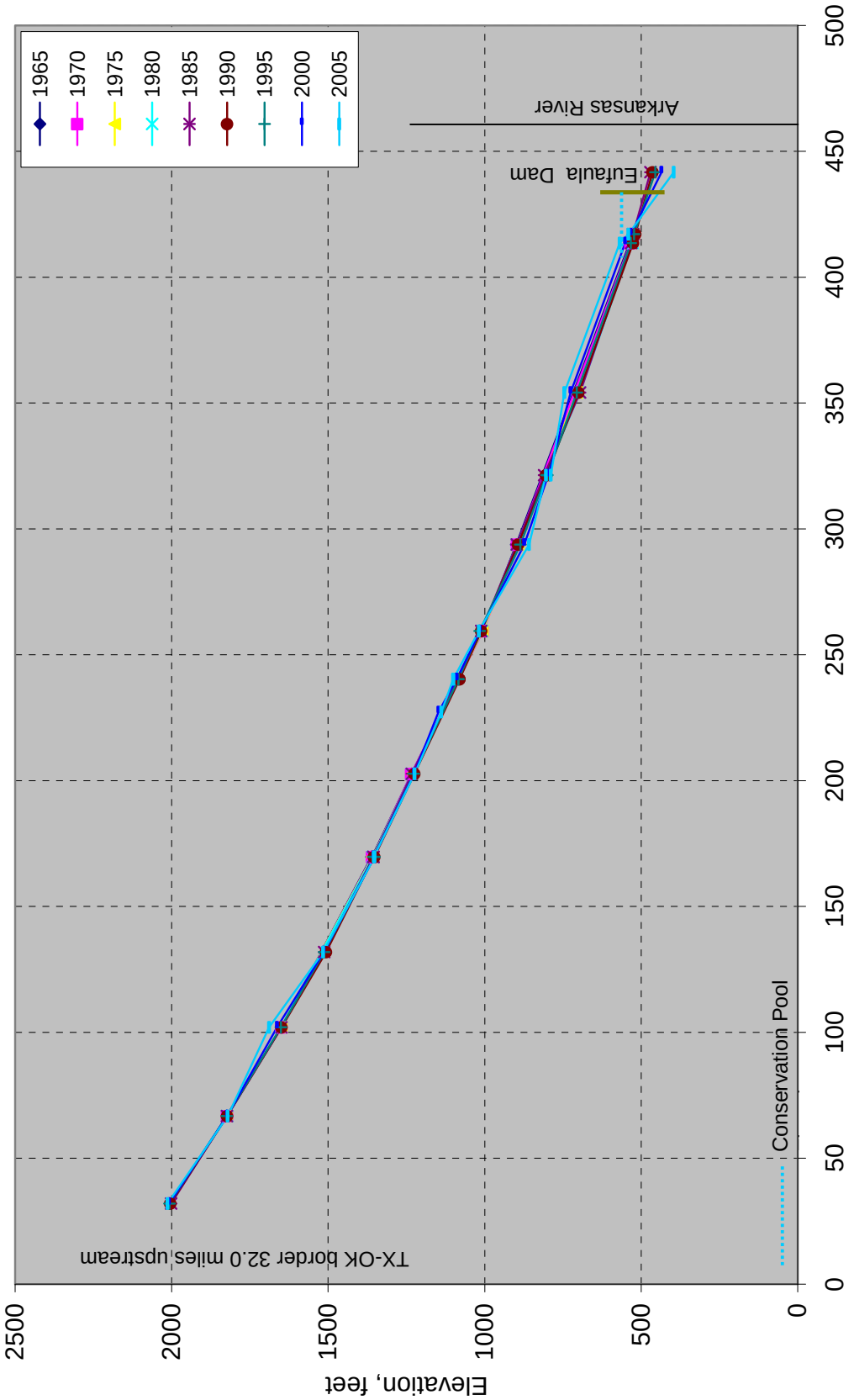


Figure 21. Longitudinal Profile of Canadian River Bed, Oklahoma

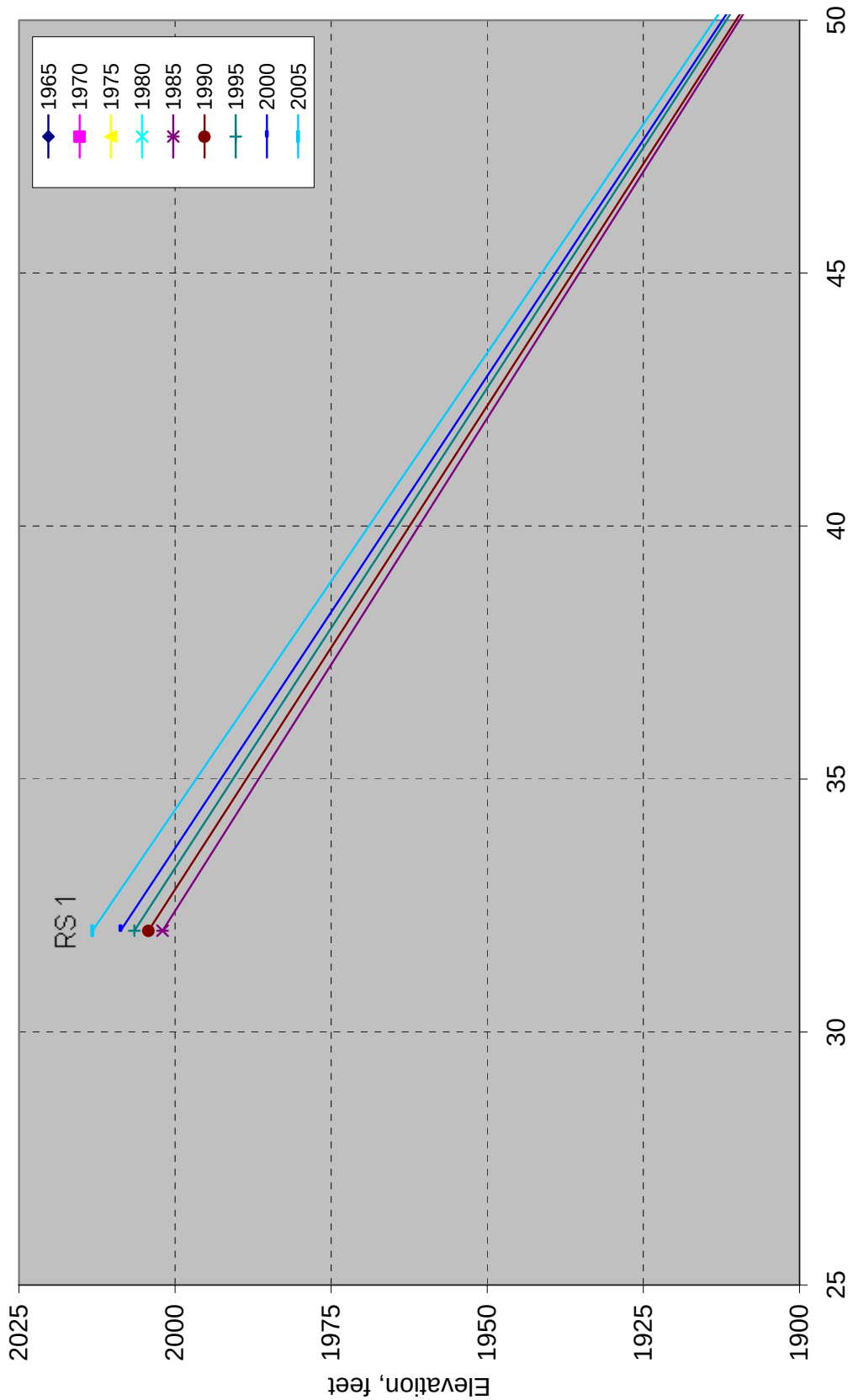


Figure 22. Longitudinal Profile of Canadian River Bed, Oklahoma

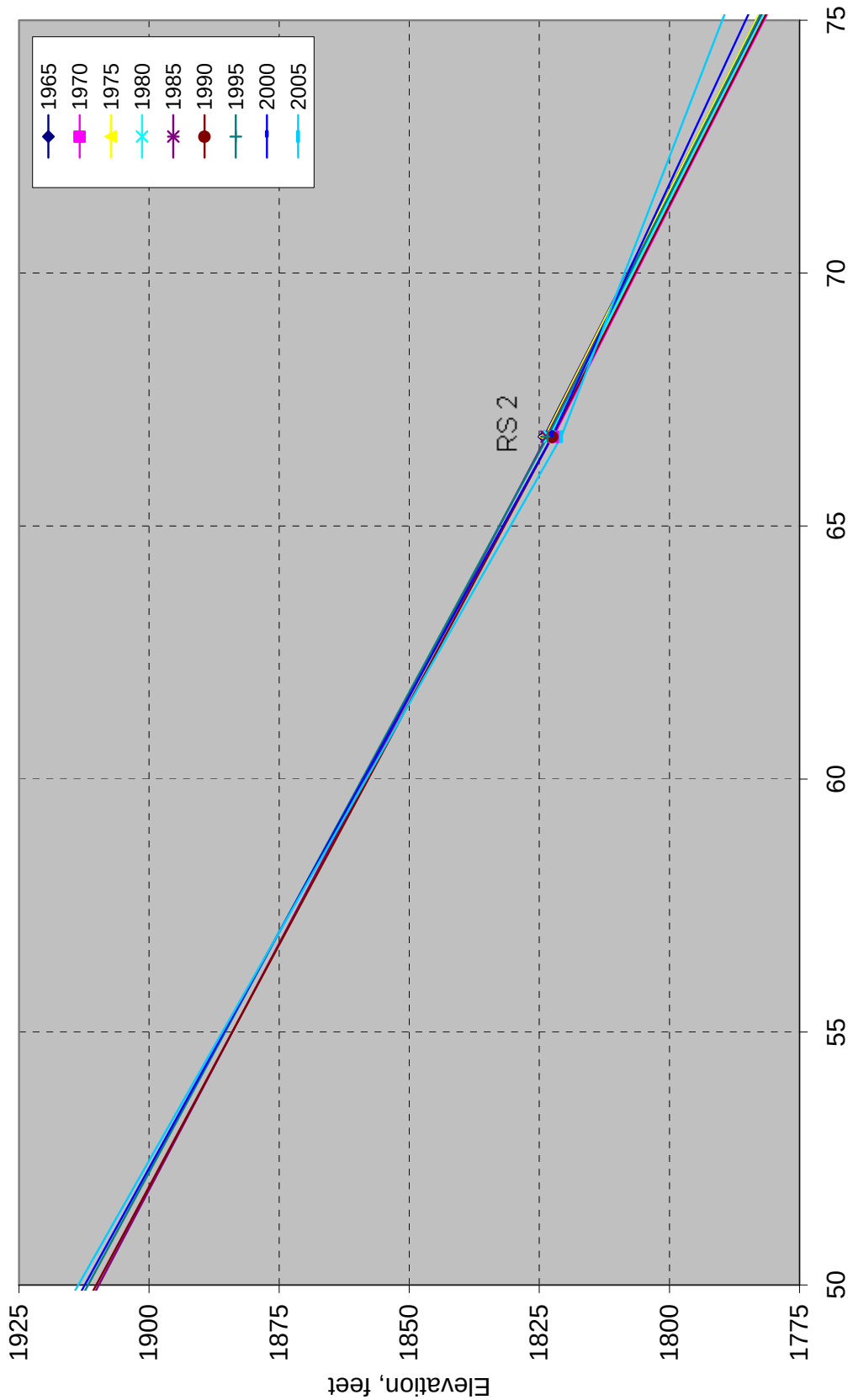


Figure 23. Longitudinal Profile of Canadian River Bed, Oklahoma

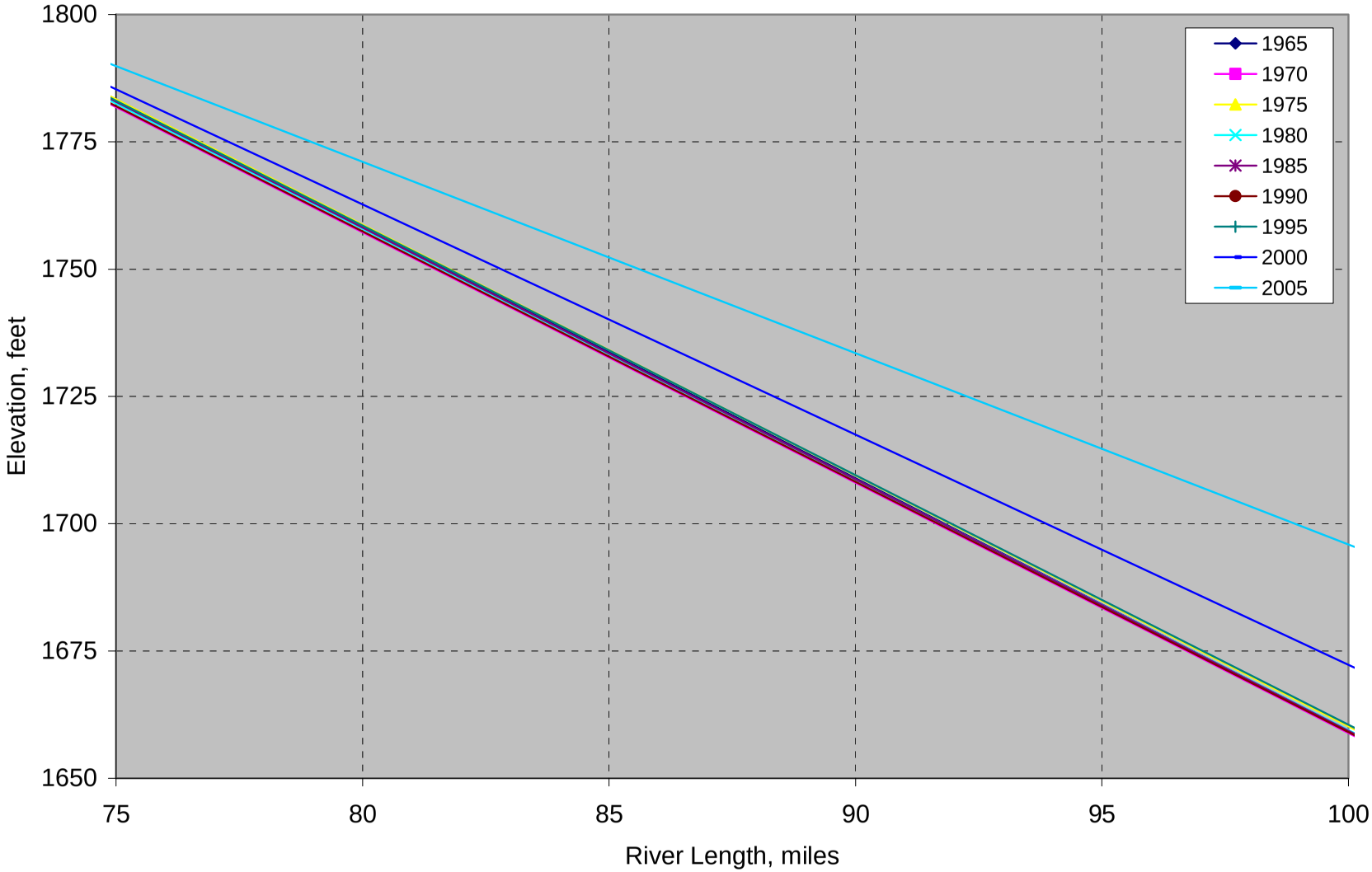


Figure 24. Longitudinal Profile of Canadian River Bed, Oklahoma

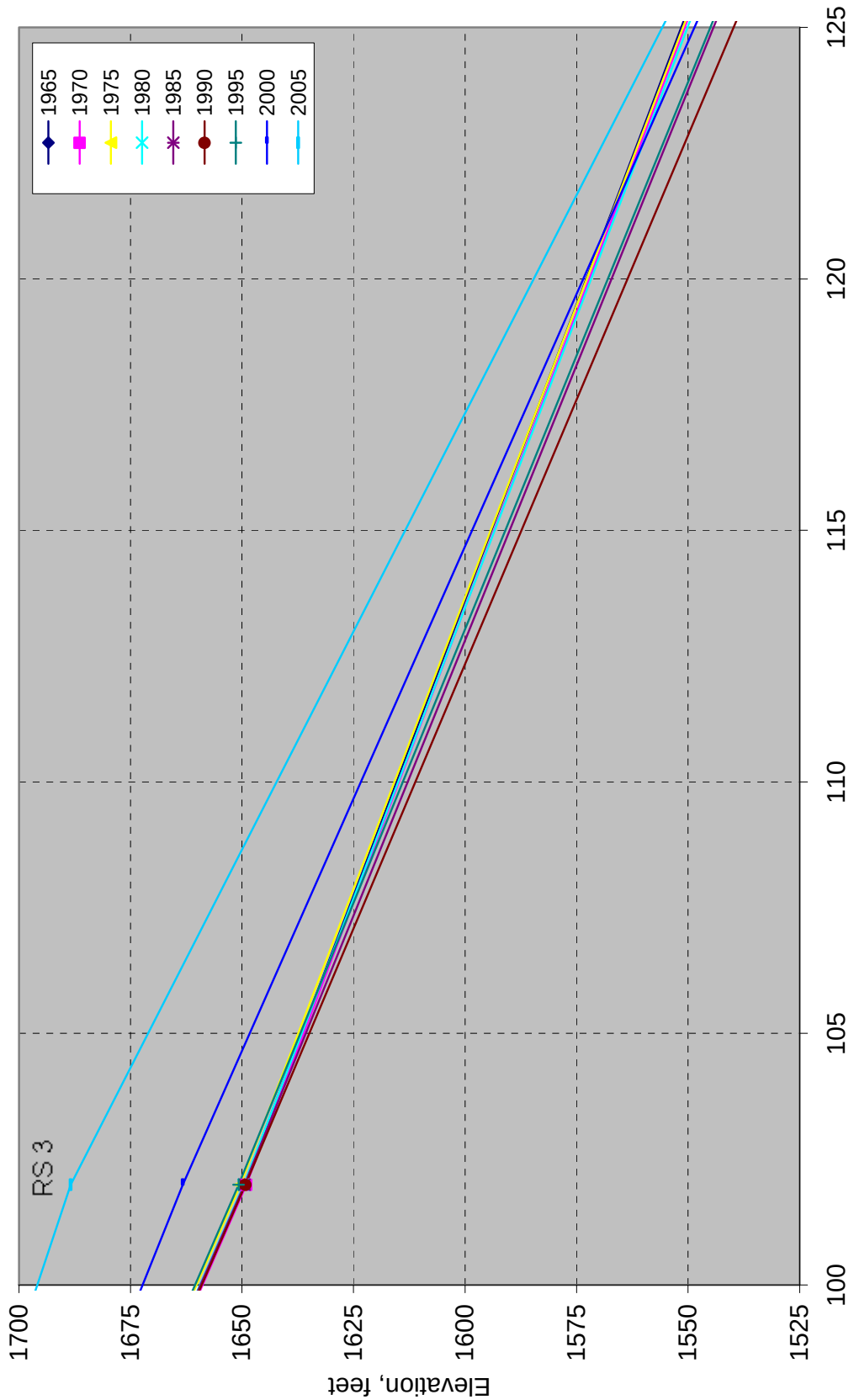


Figure 25. Longitudinal Profile of Canadian River Bed, Oklahoma

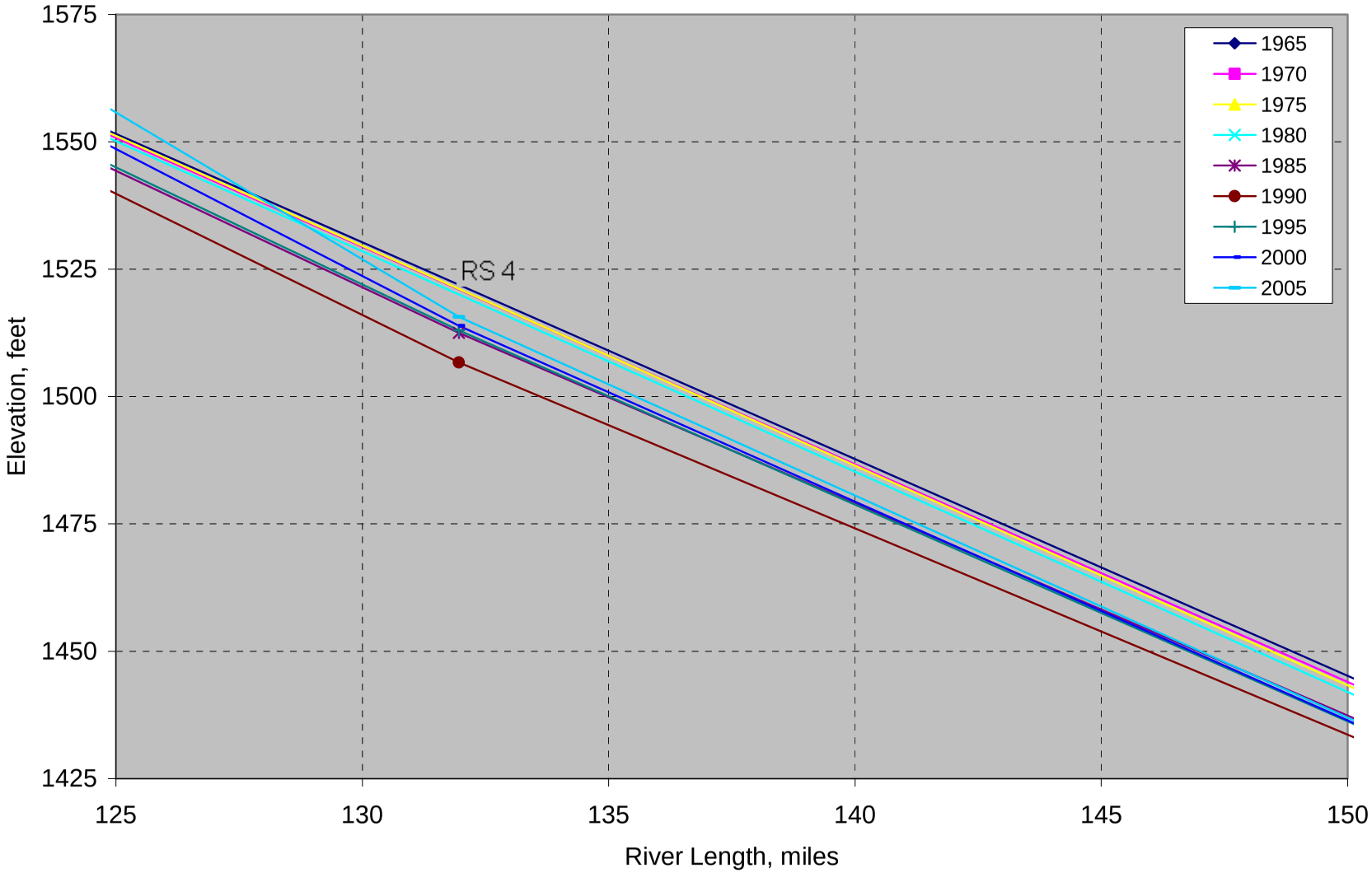


Figure 26. Longitudinal Profile of Canadian River Bed, Oklahoma

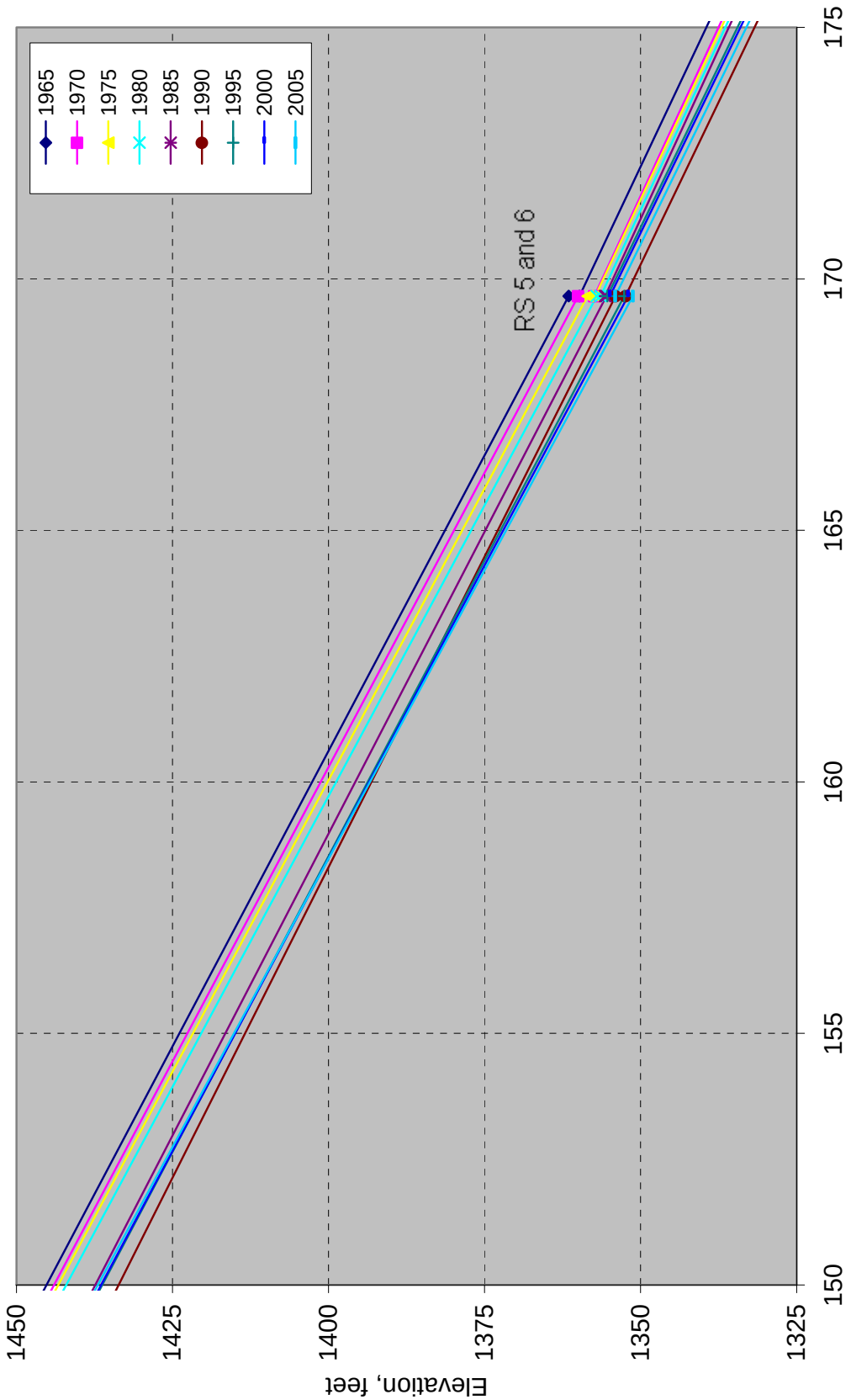


Figure 27. Longitudinal Profile of Canadian River Bed, Oklahoma

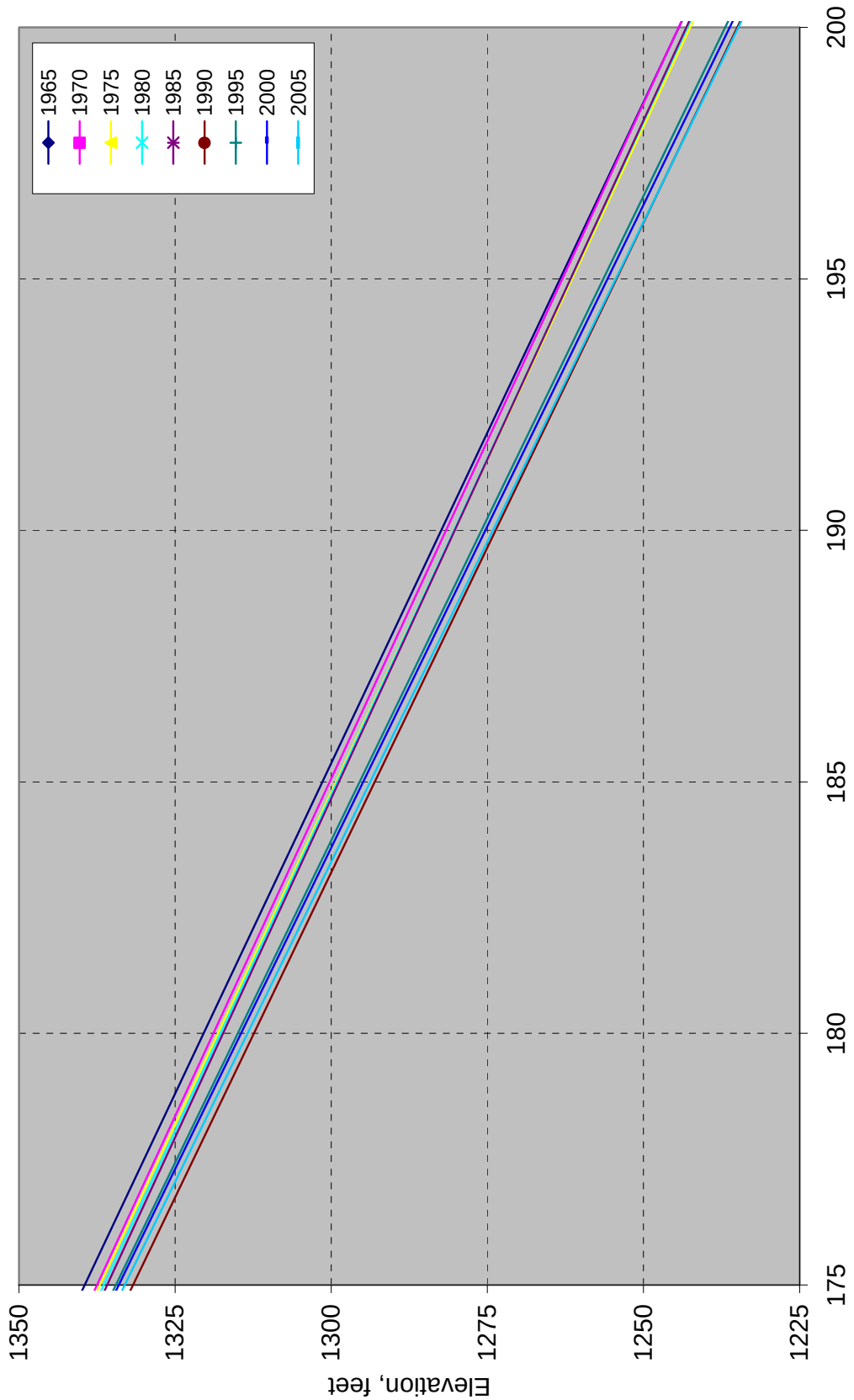


Figure 28. Longitudinal Profile of Canadian River Bed, Oklahoma

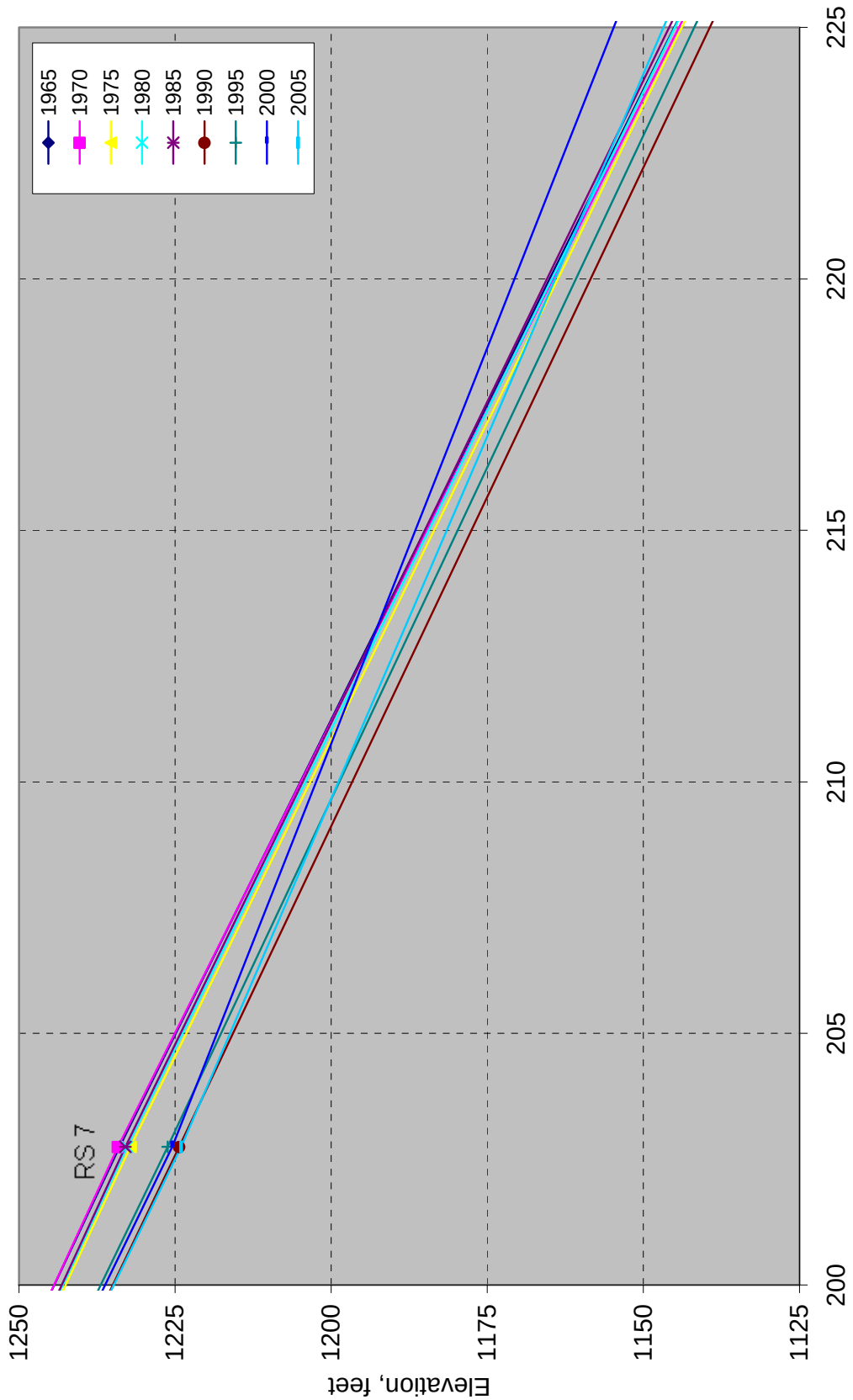


Figure 29. Longitudinal Profile of Canadian River Bed, Oklahoma

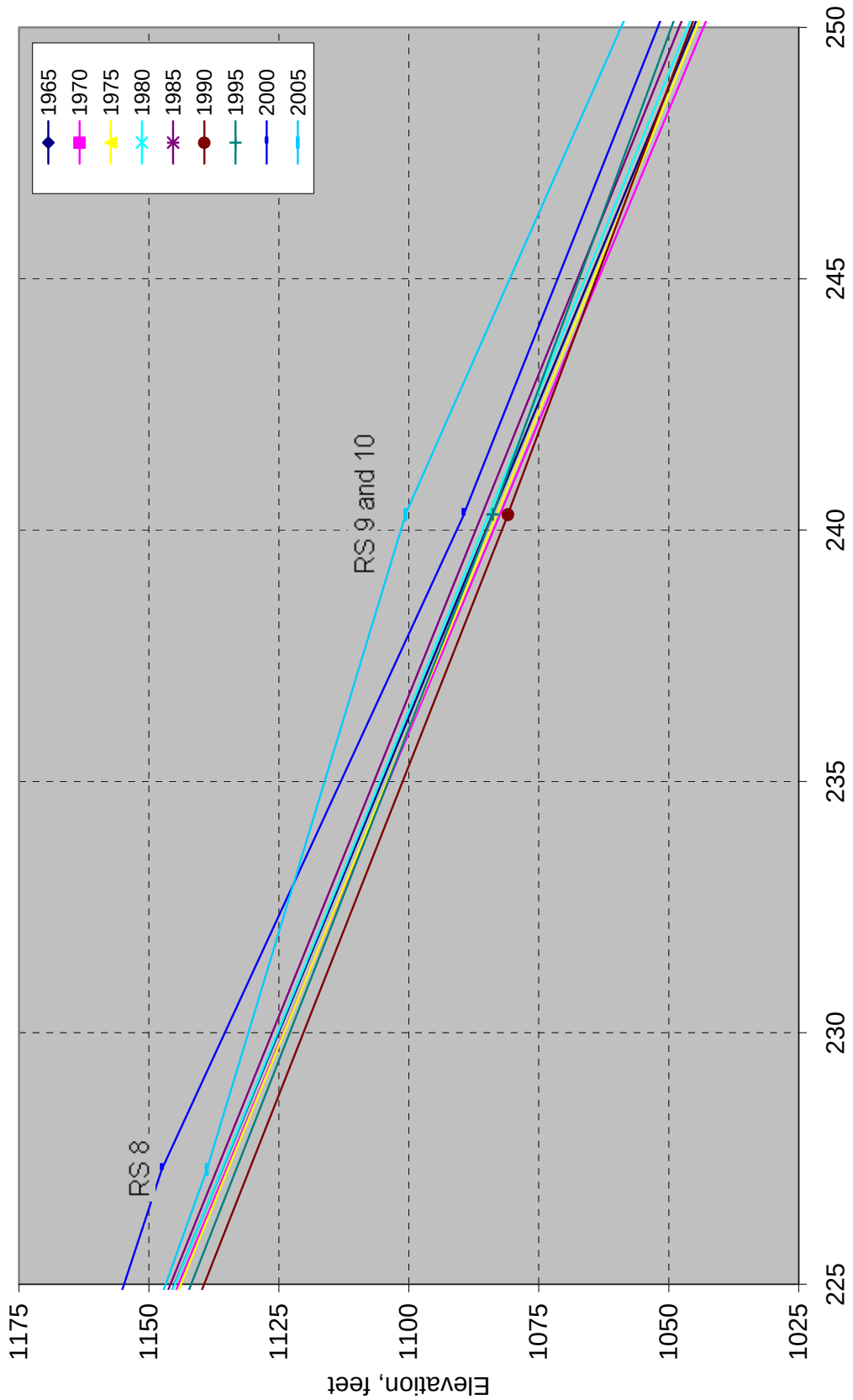


Figure 30. Longitudinal Profile of Canadian River Bed, Oklahoma

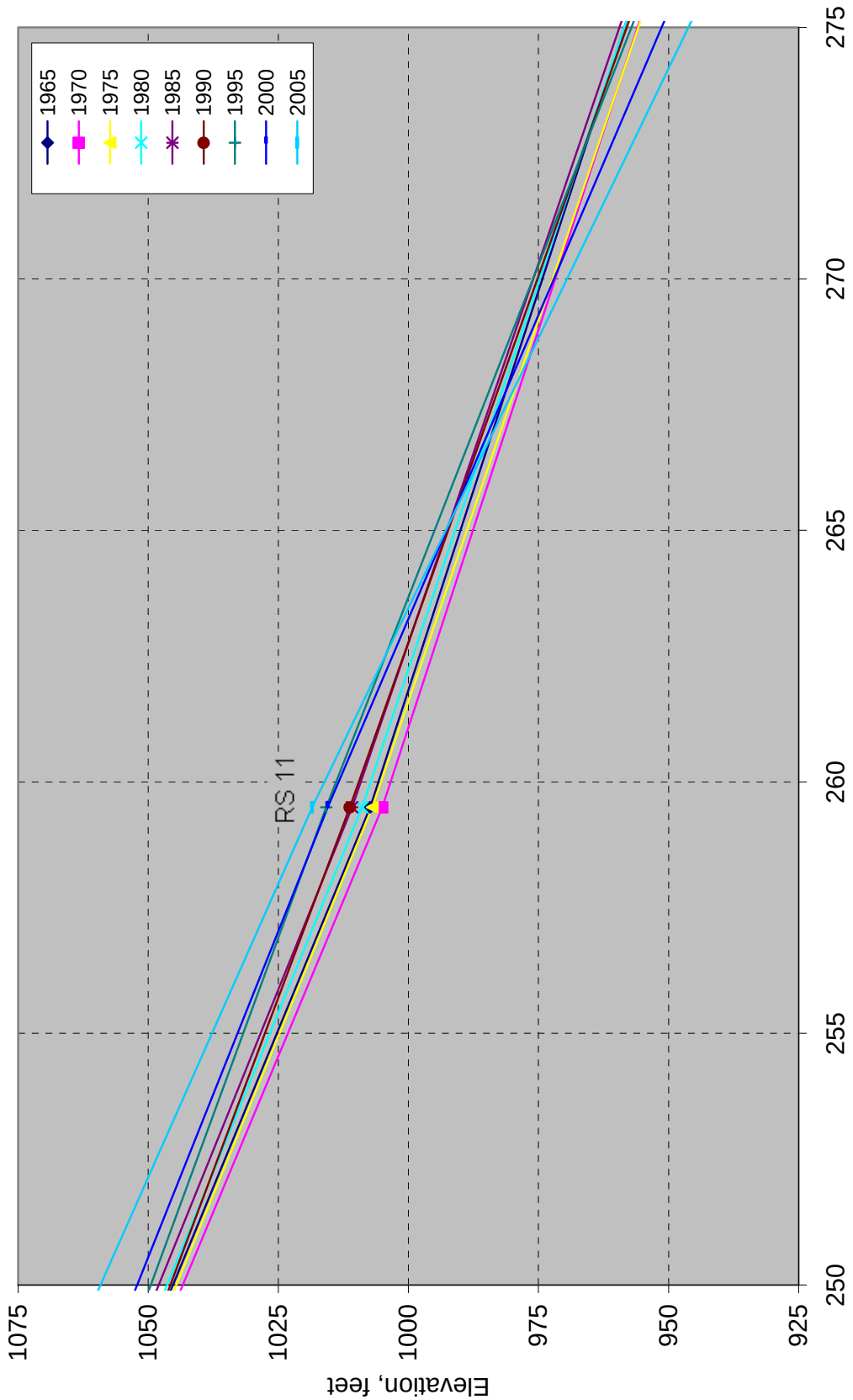


Figure 31. Longitudinal Profile of Canadian River Bed, Oklahoma

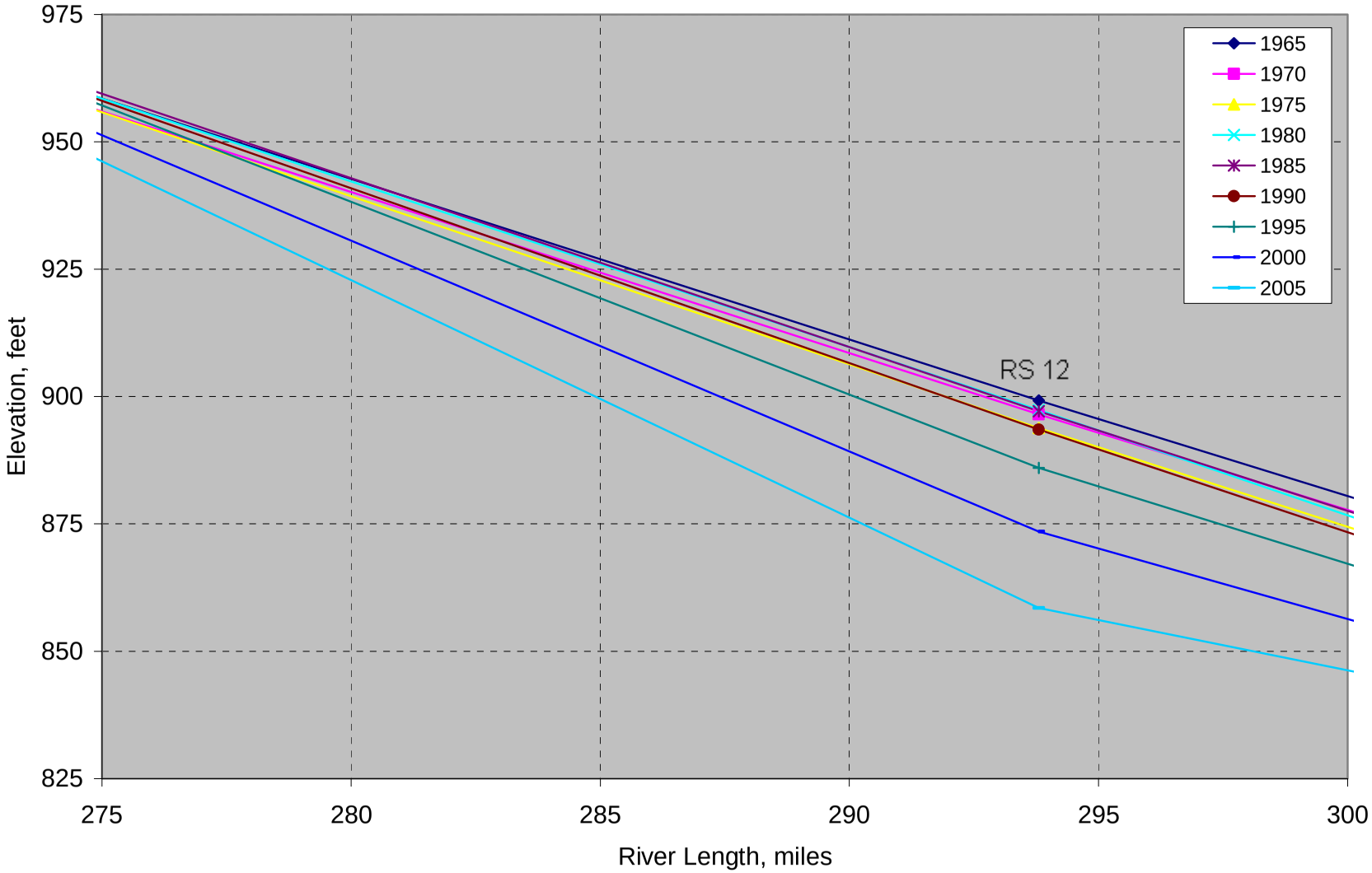


Figure 32. Longitudinal Profile of Canadian River Bed, Oklahoma

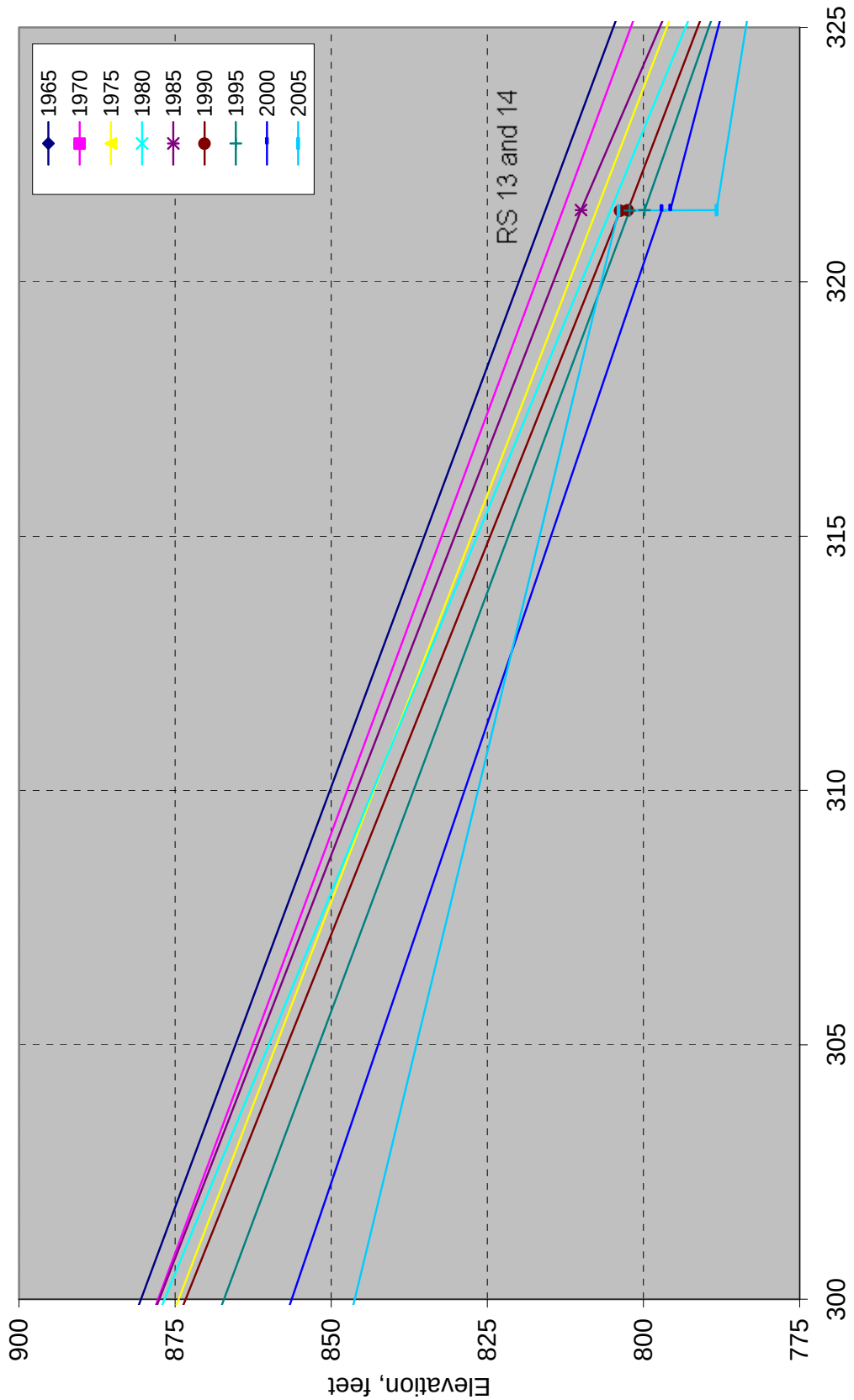


Figure 33. Longitudinal Profile of Canadian River Bed, Oklahoma

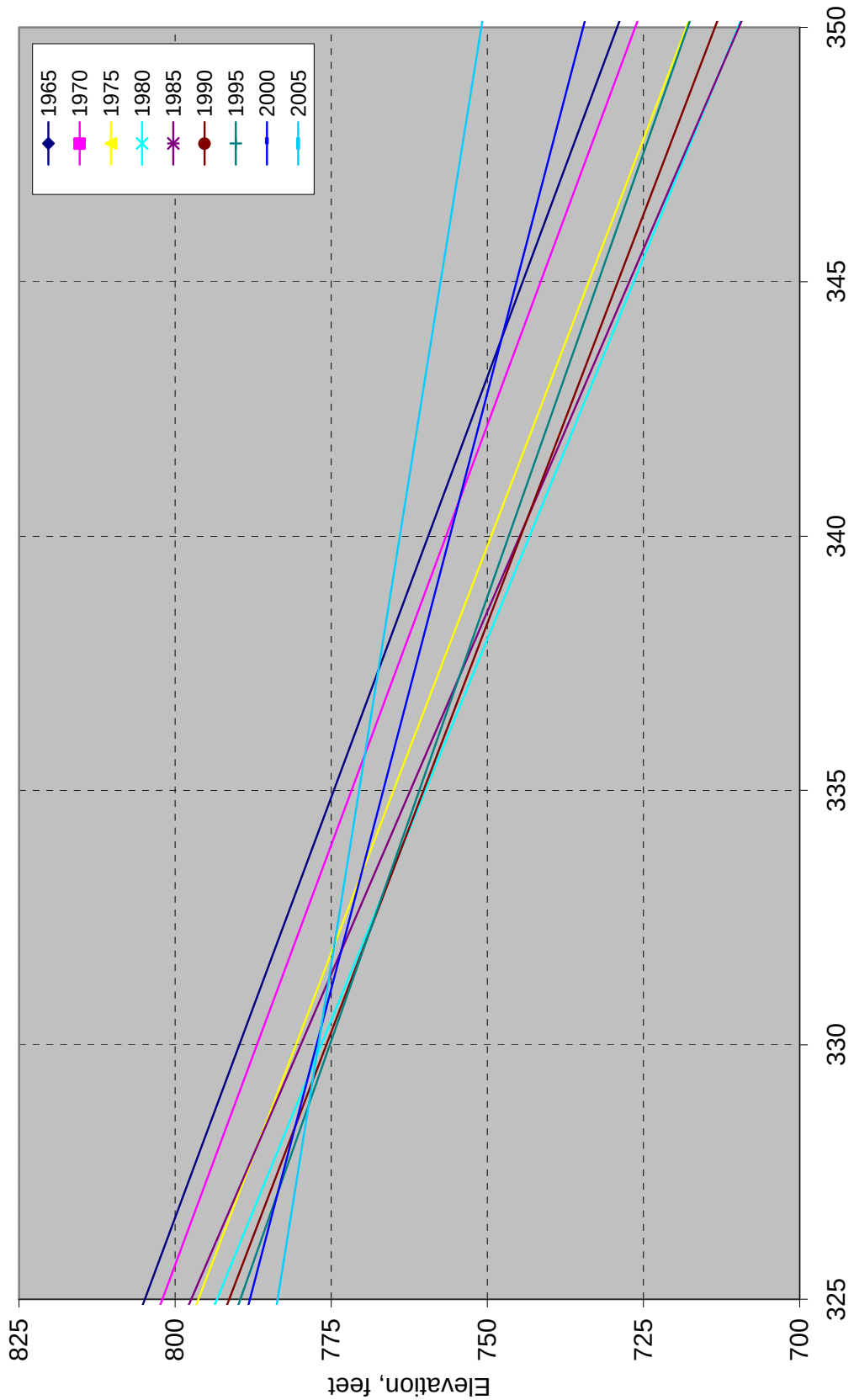


Figure 34. Longitudinal Profile of Canadian River Bed, Oklahoma

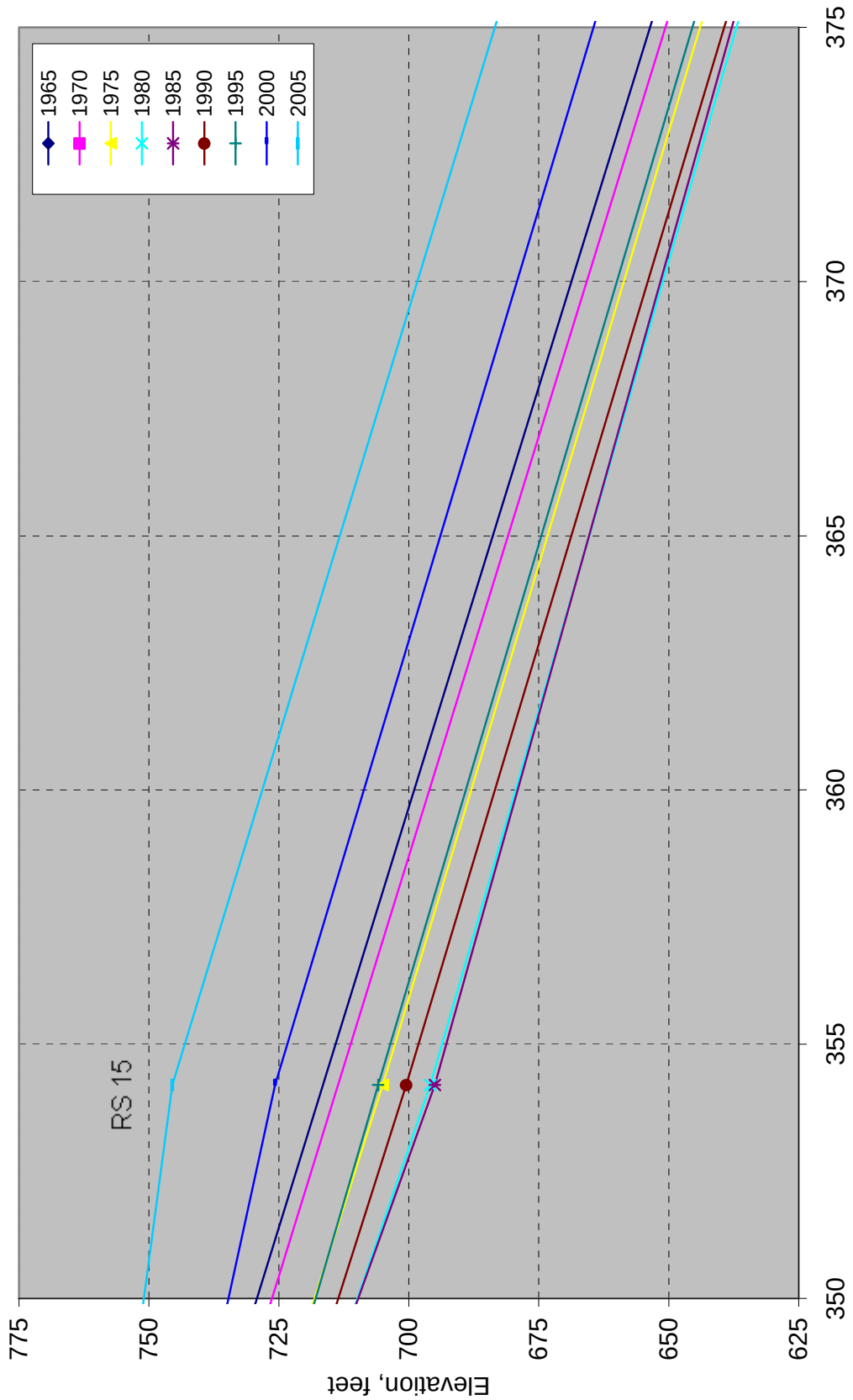


Figure 35. Longitudinal Profile of Canadian River Bed, Oklahoma

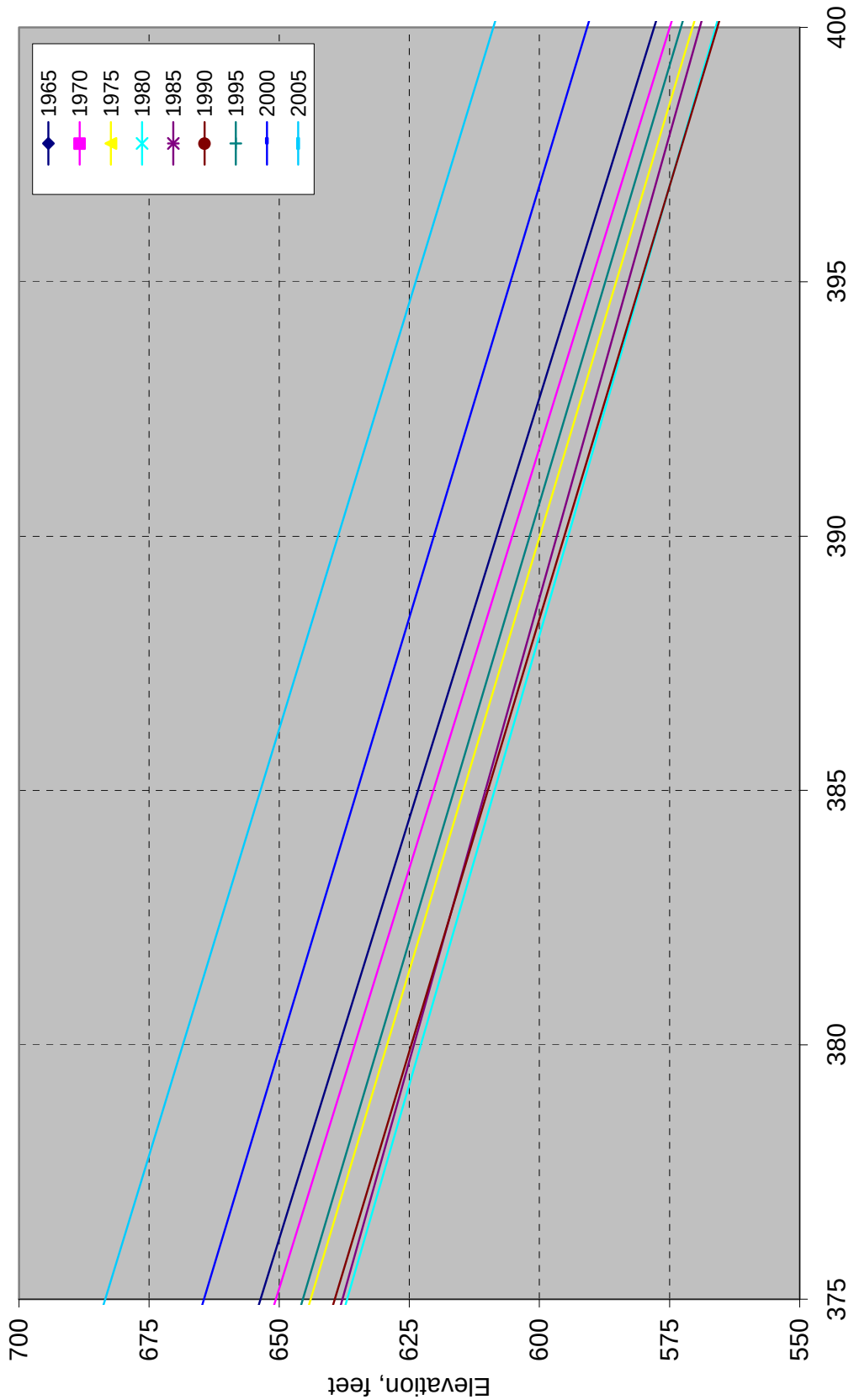


Figure 36. Longitudinal Profile of Canadian River Bed, Oklahoma

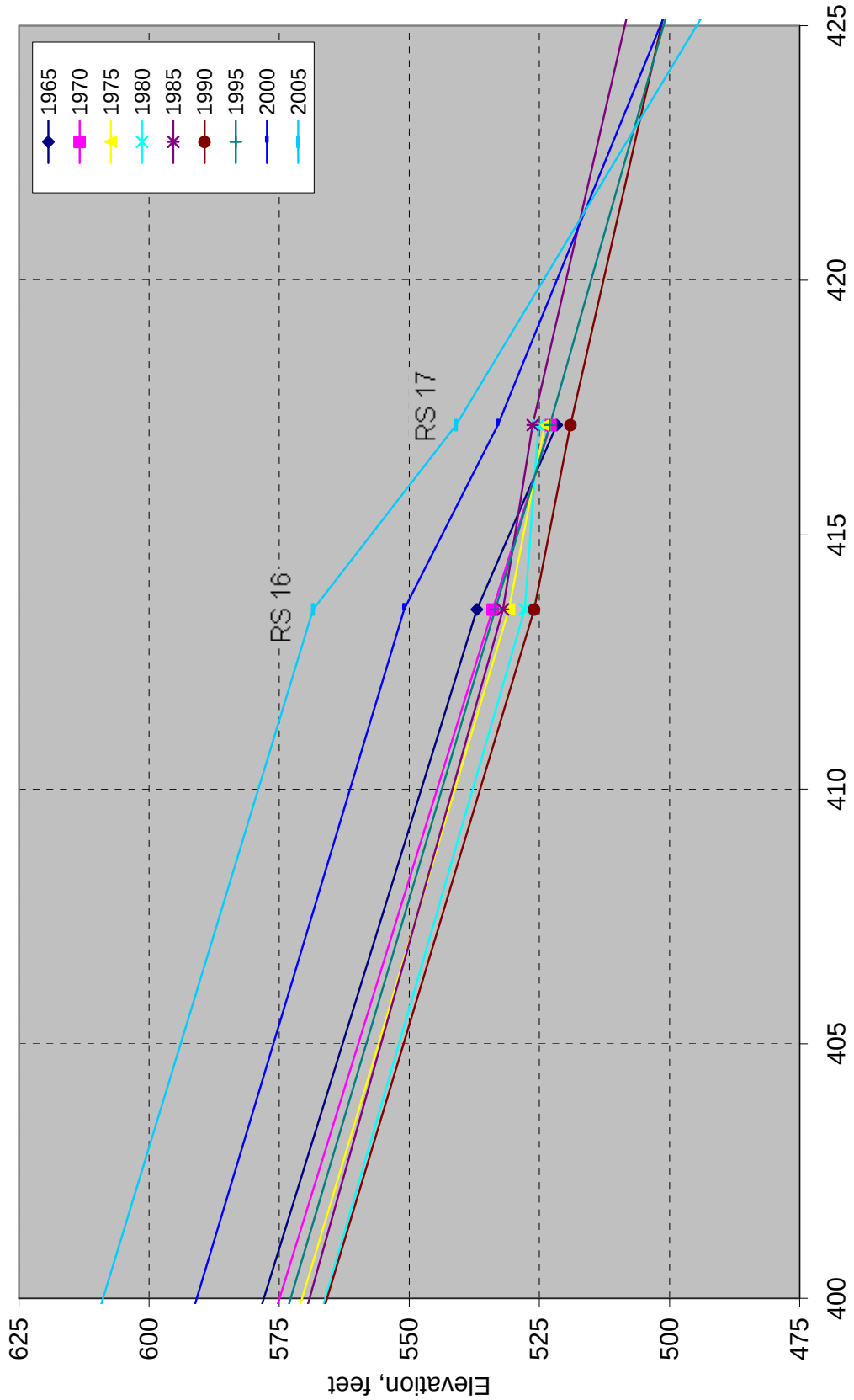


Figure 37. Longitudinal Profile of Canadian River Bed, Oklahoma

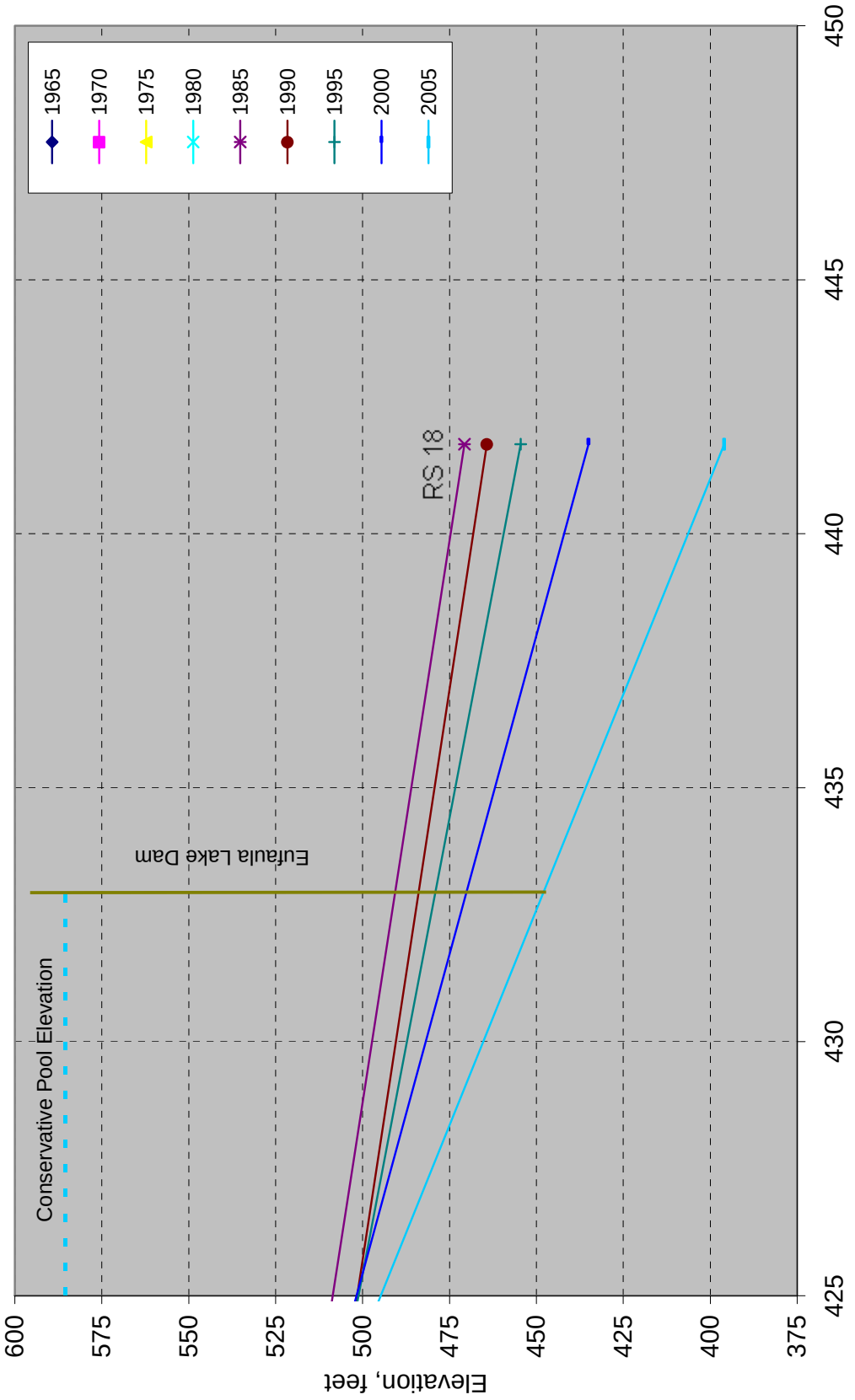


Figure 38. Longitudinal Profile of Canadian River Bed, Oklahoma

VI. DISCUSSION OF RESULTS

Table 5 presents the summary of bridges which have experienced degradation. Along the 409.76-mile reach of Canadian River, fourteen bridges have experienced degradation. Among these fourteen bridges, six bridges have experienced degradation in the range of 0-5 feet, four have experienced in the range of 5-10 feet, and four have experienced degradation more than 10 feet. Sixth and seventh columns of Table 5 present the service year of the bridges through 2007 and corresponding degradation in river bed. Eight bridges in the study reach of Canadian River have been serving from more then 30 years.

Table 7 presents the number of bridges in the five major river basins of Oklahoma which have experienced degradation more than 5 and 10 feet with 10 year and all service year criteria. In this study, bridges with degradation of 10 feet or more and that have been serving from more then 10 years are determined as critical. River station (RS) 7 at U.S. 81, river station 12 at S.H. 3W, and river station 14 at U.S. 283 has experienced 12.05, 10.00, and 17.6 feet of degradation respectively. Degradations in these bridges are experienced in 45, 34, and 19 years respectively. Therefore, RS 7 (Bridge Key b13537), RS 12 (Bridge Key b14520), and RS 14 (Bridge Key b22420) are determined as critical and recommended for rehabilitation or replacement in the replacement cycle. A detailed hydraulic and geotechnical analysis should be performed before reconstruction.

Table 6. Summary of flowline degradation, Canadian River

Bri_Key	River Stations	Miles	Highway	Bridge Installed	Years of Construction through 2007	Max. Scour (ft)	Duration (yr)	Scour Rate (ft/yr)
b13240	RS2	S.H. 34	66.77	1954	53	4.61	46	0.100
b14214	RS3	U.S. 183	101.99	1958	49	0.00	42	0.000
b14522	RS5	I-40	169.66	1959	48	7.25	35	0.207
b14521	RS6	I-40	169.66	1959	48	5.10	41	0.124
b13537	RS7	US-81	202.74	1955	52	12.05	45	0.268
b26060	RS8	I-44	227.28	2000	7	1.40	2	0.700
b22108	RS9	I-35	240.30	1988	19	10.25	4	2.563
b21361	RS10	I-35	240.31	1986	21	10.25	6	1.708
b06593	RS11	U.S. 77	259.50	1938	69	4.00	63	0.063
b14520	RS12	S.H. 3W	293.80	1959	48	10.00	34	0.294
b22099	RS13	I-35	321.40	1986	21	7.35	18	0.408
b22420	RS14	U.S. 283	321.41	1985	22	17.60	19	0.926
b15586	RS16	U.S.69	413.53	1962	45	2.50	33	0.076
b20578	RS18	S.H. 2	441.76	1983	24	3.50	6	0.583

Table 7. Summary of bridges with degradation in five river basins

River Basin	Degradation in ≥10 years		Degradation with all service year criteria	
	≥ 5.0 feet	≥ 10.0 feet	≥ 5.0 feet	≥ 10.0 feet
Arkansas	5	1	5	1
Cimarron	6	2	6	2
North Canadian	8	3	9	3
Canadian*	7	3	9	5
Washita	12	1	12	1
Total	38	10	41	12

* This report includes the river basin as indicated. Refer to other volumes **I** through **V** for different river basins.

VII. CONCLUSIONS AND RECOMMENDATION

Following conclusions are drawn based on this research:

1. Degradation is predominant in Reach 1 from river station (RS) 1 to Eufaula Lake Dam, except some river stations have slight aggradation. Maximum degradation of 17.6 feet in 19 years is observed at river stations 14 at U.S. 283 in this reach. Maximum aggradation of 3.0 feet is observed at river station 17 at S.H. 9.
2. Only one river station 18 below Eufaula Lake Dam in Reach 2 has bed profile data available. The degradation of the river bed at this river station is observed as 3.5 feet in 6 years.
3. River station 7(Bridge Key b13537) at U.S. 81 has experienced degradations of 12.05 feet in 45 years. Similarly, river station 12 (Bridge Key b14520) at S.H. 3W and river station 14 (Bridge Key b22420) at U.S. 283 has experienced 10.00, and 17.6 feet of degradation in 34 and 19 years respectively. Therefore these bridges are recommended for rehabilitation or replacement in the replacement cycle. When this bridge is reconstructed, a detail hydraulic and geotechnical analysis should be performed.

It is recommended that degradation of tributaries is evaluated to determine the structures where flowline is severely degrading in Canadian River basin.

VIII. REFERENCES

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APPENDIX A

TABLES OF CROSS-SECTIONAL GEOMETRIES,

CANADIAN RIVER, OK

Table 8. Structure, and Flowline Details
Bridge No 21132 (RS 1) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design Year	Length
21132	Ellis-Roger Mills Col Li	35-51-54	99-43-48	U.S. 283	1985	3844

Year	1989
Flowline	2003.80

Table 9. Structure, Cross-section, and Flowline Details
Bridge No 13240 (RS 2) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design Year	Length
b13240	13.5 Mi N Custer C/L	35-59-42	099-17-36	S.H. 34	1954	2,912.10

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed54	S-Rding00	R-bed00
S-A	0.00	1834.00	1841.26	1841.40	7.67	1838.04
	30.00			1832.85	15.67	1830.53
1	51.68	1810.61	1841.11	1830.00	17.00	1829.20
	91.68			1830.00	17.00	1829.20
2	152.25	1810.71	1841.21	1830.00	18.25	1827.95
	192.25			1830.00	18.75	1827.45
3	252.25	1811.34	1841.84	1828.57	19.50	1826.70
	292.25			1828.57	19.16	1827.04
4	352.25	1811.51	1842.01	1828.57	19.16	1827.04
	392.25			1828.57	18.75	1827.45
5	453.00	1810.71	1842.71	1827.15	18.75	1827.45
	493.00			1827.15	18.08	1828.12
6	553.75	1810.68	1842.68	1828.75	20.75	1825.45
	593.75			1830.00	20.41	1827.22
7	653.75	1811.19	1843.19	1829.15	25.16	1823.46
	693.75			1829.15	22.16	1826.89
8	753.75	1811.22	1843.22	1829.15	22.16	1826.89
	793.75			1829.15	22.00	1827.05
9	854.50	1810.79	1843.79	1829.15	22.16	1826.89
	894.50			1829.15	22.25	1826.80
10	955.25	1810.62	1845.62	1828.32	22.08	1826.97
	995.25			1828.32	21.62	1827.43
11	1055.25	1810.99	1845.99	1830.00	21.58	1827.47
	1095.25			1830.75	21.33	1827.72
12	1155.25	1810.89	1843.89	1831.43	21.58	1827.47
	1195.25			1831.43	23.16	1825.89
13	1256.00	1811.39	1844.93	1831.43	22.41	1826.64
	1296.00			1831.43	22.25	1826.80
14	1356.75	1811.03	1844.03	1830.00	21.58	1827.47
	1396.75			1830.00	21.00	1828.05
15	1456.75	1811.26	1844.26	1830.00	21.41	1827.64
	1496.75			1830.50	21.08	1827.97
16	1556.75	1811.03	1844.03	1830.50	21.75	1827.30
	1596.75			1830.50	20.25	1828.80
17	1657.50	1811.33	1844.53	1830.50	19.75	1829.30

Table 9. (Continued)

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed54	S-Rding00	R-bed00
	1697.50			1830.00	19.75	1829.30
18	1758.25	1810.89	1843.69	1832.85	20.08	1828.97
	1798.25			1832.85	19.75	1829.30
19	1858.25	1810.99	1843.99	1830.00	20.16	1828.89
	1898.25			1830.75	19.25	1829.80
20	1958.25	1810.62	1843.62	1830.75	19.75	1829.30
	1998.25			1830.75	21.66	1827.39
21	2059.00	1810.79	1843.79	1830.75	21.16	1827.89
	2099.00			1830.75	21.00	1828.05
22	2159.75	1811.22	1843.22	1830.00	21.41	1827.64
	2199.75			1830.75	21.41	1826.22
23	2259.75	1811.19	1843.19	1831.42	21.33	1826.30
	2299.75			1831.42	21.25	1826.38
24	2359.75	1810.68	1842.68	1831.42	21.50	1826.13
	2399.75			1831.42	23.75	1823.88
25	2460.50	1810.71	1842.71	1831.42	24.41	1823.22
	2500.50			1828.58	25.08	1822.55
26	2561.25	1811.51	1842.01	1828.58	22.25	1825.38
	2601.25			1827.15	19.75	1827.16
27	2661.25	1811.34	1741.84	1827.15	19.50	1827.41
	2701.25			1827.15	20.50	1825.70
28	2761.25	1810.71	1841.21	1827.15	20.00	1826.20
	2801.25			1831.43	14.5	1831.70
29	2861.81	1810.61	1841.11	1837.13	10.33	1835.87
	2891.81			1837.50	9.16	1836.55
N-A	2913.49	1834.00	1841.26	1837.65	7.66	1838.05

Year	1961	1965	1969	1970	1976	1979	1982
Flowline	1823.50	1824.10	1823.50	1822.30	1824.20	1822.70	1823.70

Year	1984	1987	1989	1990	1992	1995
Flowline	1823.80	1823.10	1822.50	1822.50	1823.50	1823.42

Table 10. Structure, Cross-section, and Flowline Details
Bridge No 14214 (RS 3) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
b14214	16.8 MI N Custer C/L	36-03-06	98-58-00	U.S. 183	1958	1,605.00

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed58	S-Rding00	R-bed00
S-A	0.00	1640.00	1665.00	1663.75	9.16	1663.30
	20.00			1655.00	17.25	1655.25
	40.00			1653.75	22.50	1651.25
1	102.00	1633.67	1665.61	1648.75	24.50	1649.25
	142.00			1650.00	21.00	1652.75
2	202.00	1634.25	1666.25	1649.00	21.33	1652.42
	242.00			1650.00	21.41	1652.34
3	302.00	1634.34	1666.34	1651.00	22.25	1651.5
	342.00			1651.25	21.66	1652.09
4	402.75	1634.95	1666.95	1652.25	21.58	1652.17
	442.75			1652.25	21.25	1652.50
5	503.50	1634.79	1666.79	1652.50	21.75	1652.00
	543.50			1653.00	21.33	1652.42
6	603.50	1635.15	1667.15	1653.75	22.08	1651.67
	643.50			1654.50	21.08	1652.67
7	703.50	1635.01	1667.01	1655.00	20.75	1653.00
	743.50			1655.00	20.16	1653.59
8	804.25	1635.40	1667.4	1653.75	20.50	1653.25
	844.25			1653.75	25.00	1648.75
9	905.00	1635.01	1667.01	1653.75	24.25	1649.50
	945.00			1653.75	23.33	1650.42
10	1005.00	1635.15	1667.15	1653.75	22.25	1651.50
	1045.00			1653.75	21.58	1652.17
11	1105.00	1634.75	1668.78	1653.75	21.50	1652.25
	1145.00			1653.75	21.08	1652.67
12	1205.00	1634.05	1666.95	1652.50	21.50	1652.25
	1245.00			1652.50	20.08	1653.67
13	1305.75	1634.34	1666.34	1653.75	20.08	1653.67
	1345.75			1652.50	19.75	1654.00
14	1405.75	1634.25	1666.25	1652.50	19.66	1654.09
	1445.75			1652.50	19.25	1654.50
15	1505.75	1633.67	1665.67	1652.50	18.58	1655.17
	1545.75			1658.50	16.75	1657.00
N-A	1606.75	1640.00	1665.00	1663.75	9.33	1663.15

Table 10. (Continued)

Year	1961	1965	1969	1970	1976	1979	1982
Flowline	1650.25	1649.45	1647.65	1649.05	1650.65	1649.85	1649.25

Year	1984	1987	1989	1990	1992	1995
Flowline	1649.55	1649.25	1649.25	1649.25	1649.25	1650.75

Table 11. Structure, Cross-section, and Flowline Details
Bridge No 21131 (RS 4) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
b21131	2.6 MI S Dewey C/L	35-46-00	98-40-42	S.H. 33	1985	3202.83

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed85	S-Rding93	R-bed 93
W-A	0.00	1525	1546.50	1550.00	7.20	1547.80
	50.58			1535.00	26.40	1527.35
1	101.67	1474.94	1546.26	1518.75	33.10	1520.65
	151.67			1518.75	35.10	1518.65
2	201.67	1474.54	1545.94	1518.00	35.20	1518.55
	251.67			1517.75	35.10	1518.40
3	301.67	1465.01	1545.54	1517.75	35.20	1518.30
	351.67			1517.75	36.10	1517.15
4	401.67	1463.74	1545.01	1517.5	36.10	1516.90
	451.67			1517.25	36.90	1515.60
5	501.67	1463.34	1544.74	1520.00	36.80	1515.70
	551.67			1515.00	36.80	1515.70
6	601.67	1462.94	1544.34	1512.50	36.70	1515.05
	651.67			1513.75	36.70	1515.55
7	701.67	1457.41	1543.94	1514.38	36.60	1515.65
	751.67			1513.75	36.90	1515.10
8	801.67	1452.14	1543.41	1513.75	36.60	1515.15
	851.67			1513.75	37.80	1513.95
9	901.67	1451.74	1543.14	1513.75	37.00	1514.50
	951.67			1513.75	37.90	1513.10
10	1001.67	1451.34	1542.74	1513.75	37.80	1512.70
	1051.67			1515.00	37.60	1512.65
11	1101.67	1449.81	1542.34	1515.00	37.60	1512.65
	1151.67			1515.00	34.30	1516.20
12	1201.67	1449.54	1541.81	1515.00	34.30	1516.20
	1251.67			1515.00	34.10	1515.90
13	1301.67	1449.14	1541.54	1519.00	35.10	1514.65
	1351.67			1518.13	32.40	1517.35
14	1401.67	1448.74	1541.14	1519.00	31.90	1517.60
	1451.67			1519.38	31.30	1517.95
15	1501.67	1449.21	1540.74	1518.13	31.30	1517.70
	1551.67			1518.13	31.30	1517.45
16	1601.67	1448.94	1540.21	1518.13	31.50	1517.00
	1651.67			1518.13	31.20	1517.30
17	1701.67	1448.54	1539.94	1520.00	31.00	1517.50

Table 11. (Continued)

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed85	S-Rding93	R-bed 93
	1751.67			1520.00	31.00	1517.00
18	1801.67	1449.14	1539.94	1516.88	30.90	1516.60
	1851.67			1516.25	30.70	1516.80
19	1901.67	1448.61	1539.14	1515.00	30.60	1516.90
	1951.67			1515.00	30.90	1516.60
20	2001.67	1449.34	1538.61	1513.75	30.70	1516.80
	2051.67			1515.63	30.40	1517.10
21	2101.67	1448.94	1538.34	1515.00	31.20	1516.30
	2151.67			1515.00	29.90	1517.60
22	2201.67	1448.94	1537.94	1515.00	29.30	1517.70
	2251.67			1515.00	29.60	1517.15
23	2301.67	1448.54	1537.54	1515.00	28.90	1517.60
	2351.67			1515.00	28.90	1517.35
24	2401.67	1450.01	1537.01	1515.63	28.60	1517.40
	2451.67			1515.00	28.50	1517.25
25	2501.67	1451.74	1536.74	1515.00	28.10	1517.40
	2551.67			1515.00	28.20	1516.80
26	2601.67	1454.34	1536.34	1516.25	27.80	1516.95
	2651.67			1515.00	27.80	1516.85
27	2701.67	1455.94	1535.94	1515.00	27.40	1516.85
	2751.67			1513.75	27.60	1516.65
28	2801.67	1456.41	1535.41	1513.75	27.50	1516.50
	2851.67			1515.00	27.00	1516.75
29	2901.67	1458.14	1535.14	1515.00	26.30	1517.20
	2951.67			1513.75	26.10	1516.90
30	3001.67	1458.74	1534.74	1512.50	27.40	1515.35
	3051.67			1513.75	26.20	1516.45
31	3101.67	1460.26	1534.26	1516.25	24.00	1518.65
	3152.25			1527.50	19.40	1523.25
E-A	3202.83	1472.5	1535	1535.63	6.50	1536.15

Year	1987	1990	1992	1995
Flowline	1507.00	1506.70	1508.00	1513.00

Table 12. Structure, Cross-section, and Flowline Details
Bridge No 14522 (RS 5) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
b14522	1.1 MI. E. Caddo CL	35-31-36	98-17-18	I-40	1959	2,551.50

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed59	S-Rding92	R-bed92	SRding94	R-bed94
W-A	0.00	1352.00	1381.31	1380.00	8.00	1380.40	8.00	1380.40
	30.71			1375.00			20.50	1368.00
1	61.42	1339.44	1381.44	1362.00	22.00	1366.50	23.00	1365.50
2	162.00	1339.35	1381.35	1361.00	24.00	1364.50	25.00	1363.50
3	262.00	1337.33	1381.85	1362.25	24.00	1364.50	25.00	1363.50
4	362.00	1335.00	1381.80	1364.00	24.00	1364.50	25.00	1363.50
5	462.75	1334.33	1382.33	1362.00	25.00	1363.50	26.00	1362.50
6	563.50	1334.16	1382.16	1365.00	27.00	1361.50	27.00	1361.50
7	663.50	1334.54	1382.54	1362.50	25.00	1363.75	26.00	1362.75
8	763.50	1332.43	1382.49	1362.25	29.00	1359.75	27.00	1361.75
9	864.25	1330.87	1382.87	1362.00	29.00	1360.25	27.00	1362.25
10	965.00	1330.61	1382.61	1361.00	29.00	1360.50	28.00	1361.50
11	1065.00	1328.90	1382.90	1362.00	28.00	1361.50	28.00	1361.50
12	1165.00	1328.70	1382.70	1361.00	30.00	1359.50	31.00	1358.50
	1240.56			1361.00			34.00	1355.75
13	1265.75	1322.05	1383.05	1360.00	30.00	1360.00	32.00	1358.00
	1330.75			1361.75	31.00	1359.00		
14	1366.50	1342.70	1382.70	1364.75	33.00	1357.00	35.00	1355.00
	1396.50			1364.00	29.00	1361.50		
	1416.50			1363.00			29.50	1361.00
	1436.50			1363.00	25.00	1365.50		
	1441.00			1362.50			26.00	1364.50
15	1466.50	1342.90	1382.50	1362.25	26.00	1364.50	26.00	1364.50
16	1566.50	1342.61	1382.61	1361.75	26.00	1364.50	27.00	1363.50
17	1667.25	1342.81	1382.87	1364.00	28.00	1362.50	27.00	1363.50
18	1768.00	1342.43	1382.43	1364.00	27.00	1363.50	27.00	1363.50
19	1868.00	1342.54	1382.54	1364.00	27.00	1363.50	27.00	1363.50
20	1968.00	1342.16	1382.16	1364.00	27.00	1363.50	27.00	1363.50
21	2068.75	1342.33	1382.33	1364.00	27.00	1363.50	27.00	1363.50
22	2169.50	1341.80	1381.80	1364.00	27.00	1363.00	28.00	1362.00
	2239.50			1364.00	28.00	1362.00		
23	2269.50	1341.83	1381.83	1363.00	35.00	1355.00	35.00	1355.00
	2289.50			1362.75	37.00	1353.00		
	2319.50			1362.00			37.00	1352.75
	2344.50			1362.00			27.00	1362.75

Table 12. (Continued)

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed59	S-Rding92	R-bed92	S-Rding94	R-bed94
	2339.50			1362.00	26.00	1363.75		
24	2369.50	1341.35	1381.35	1362.00	27.00	1362.50	26.00	1363.50
25	2470.08	1341.44	1381.44	1362.00	25.00	1364.00	25.00	1364.00
E-A	2551.50	1350.00	1380.00	1380.00	8.00	1380.40	9.00	1379.40

Year	1962	1964	1966	1969	1970	1971	1973
Flowline	1361.40	1361.40	1361.60	1361.20	1360.00	1361.50	1360.70

Year	1974	1976	1987	1988	1990	1992	1994
Flowline	1358.70	1358.40	1357.00	1358.00	1354.00	1353.00	1353.00

Table 13. Structure, Cross-section, and Flowline Details
Bridge No 14521 (RS 6) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
b14521	1.1 MI. E. Caddo CL	35-31-36	98-17-18	I-40	1959	2551.50

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed59	S-Rding92	R-bed 92	S-Rding94	R-bed94	S-Rding00	R-bed00
W-A	0.00	1352.00	1380.00	1380.00	8.00	1380.40	8.00	1380.40	8.20	1380.20
	30.75			1366.00			19.00	1369.40	20.90	1367.50
1	61.41	1339.44	1381.44	1362.00	23.00	1365.40	23.00	1365.40	22.90	1365.50
	111.70			1361.00			24.00	1364.40	23.70	1364.70
2	162.00	1339.55	1381.35	1361.00	24.00	1364.40	24.00	1364.40	24.00	1364.40
3	262.00	1337.33	1381.85	1363.00	24.00	1364.40	24.00	1364.40	24.20	1364.20
4	362.00	1335.80	1381.80	1363.50	23.00	1365.40	24.00	1364.40	23.80	1364.60
	412.38			1363.50					23.60	1364.80
5	462.75	1334.33	1382.33	1363.50	24.00	1364.40	24.00	1364.40	23.90	1364.50
6	563.50	1334.16	1382.16	1363.50	27.00	1361.40	26.00	1362.40	26.00	1362.40
	613.50			1363.00					26.20	1362.20
7	663.50	1334.54	1382.54	1363.00	25.00	1363.40	26.50	1361.90	25.90	1362.50
	713.50			1363.00			25.00	1363.40	25.20	1363.20
8	763.50	1332.43	1382.49	1363.00	27.00	1361.40	26.00	1362.40	25.80	1362.60
	813.88			1362.00			26.50	1361.90	25.50	1362.90
9	864.25	1330.87	1382.87	1362.00	27.00	1361.40	26.10	1362.30	26.50	1361.90
	914.63			1362.00					25.40	1363.00
10	965.00	1330.61	1382.61	1361.00	27.00	1361.40	26.80	1361.60	25.70	1362.70
	1015.00			1361.00			27.00	1361.40	25.20	1363.20
11	1065.00	1328.90	1382.90	1362.00	28.00	1360.40	28.00	1360.40	24.80	1363.60
	1115.00			1361.00			26.50	1361.90	24.70	1363.70
	1140.00			1361.00			30.50	1357.90		
12	1165.00	1328.70	1382.70	1361.00	26.00	1362.40	30.00	1358.40	25.10	1363.30
	1195.00			1361.00	29.00	1359.40				
	1215.00			1361.00			33.00	1355.40	25.50	1362.90
13	1265.75	1322.05	1383.05	1360.00	32.00	1356.40	33.00	1355.40	28.90	1359.50
	1290.75			1361.50			30.00	1358.40		
	1305.75			1361.50	30.00	1358.40			30.00	1358.40
14	1366.50	1342.70	1382.70	1361.50	30.00	1358.40	32.00	1356.40	31.20	1357.20
	1456.50			1361.50	29.00	1359.40	32.00	1356.40		
15	1466.50	1342.90	1382.90	1361.50	25.00	1363.40	25.00	1363.40	33.50	1354.90
16	1566.50	1342.61	1382.61	1361.50	15.00	1373.40	26.00	1362.40	25.00	1363.40
	1616.88			1364.00			25.00	1363.40	24.70	1363.70
17	1667.25	1342.87	1382.87	1364.00	27.00	1361.40	26.00	1362.40	25.90	1362.50
	1717.63			1361.00					25.20	1363.20

Table 13. (Continued)

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed59	S-Rding92	R-bed 92	S-Rding94	R-bed94	S-Rding00	R-bed00
18	1768.00	1342.43	1382.43	1370.00	26.00	1362.40	26.00	1362.40	25.80	1362.60
19	1868.00	1342.54	1382.54	1364.00	25.00	1363.40	26.00	1362.40	25.60	1362.80
	1918.00			1364.00			25.50	1362.90	25.30	1363.10
20	1968.00	1342.16	1382.16	1364.00	25.00	1363.40	26.00	1362.40	25.70	1362.70
	2018.38			1364.00					25.40	1363.00
21	2068.75	1342.33	1382.33	1364.00	26.00	1362.40	27.00	1361.40	26.40	1362.00
	2119.13			1364.00			26.50	1361.90	26.20	1362.20
22	2169.50	1341.50	1391.80	1365.00	26.00	1362.40	27.00	1361.40	26.70	1361.70
23	2269.50	1341.83	1381.83	1363.50	27.00	1361.40	28.00	1360.40	27.60	1360.80
	2319.50			1362.00					27.40	1361.00
24	2369.50	1341.35	1381.35	1362.00	28.00	1360.40	29.00	1359.40	27.70	1360.70
	2419.79			1362.00			25.00	1363.40	24.60	1363.80
25	2470.08	1341.44	1381.44	1362.00	24.00	1364.40	24.00	1364.40	23.90	1364.50
	2510.79			1374.00			13.00	1375.40		
E-A	2551.50	1340.00	1380.00	1380.00	8.00	1380.40	8.50	1379.90	8.70	1379.70

Year	1962	1964	1966	1968	1969	1970	1971	1973	1974
Flowline	1359.80	1359.80	1359.80	1359.80	1358.80	1357.40	1359.90	1359.10	1357.10

Year	1976	1980	1980	1987	1988	1990	1992	1994
Flowline	1357.40	1356.40	1356.40	1355.40	1352.30	1352.40	1354.40	1353.40

Table 14. Structure, Cross-section, and Flowline Details
Bridge No 13537 (RS 7) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
b13537	22.5 MI N US 62	35-21-42	97-55-48	US-81	1955	1708.94

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed55	S-Rding 00	R-bed 00	Wse00	S-Rding92	R-bed92
S-A	0.00	1218.00	1262.00	1260.00	6.16	1256.34	1235.45	7.00	1255.5
	20.00			1252.25			1235.45	13.00	1249.5
	40.00			1252.25	14.58	1247.92	1235.45		
1	51.68	1210.11	1262.11	1252.50	15.58	1247.03	1235.45	16.00	1246.61
	91.68			1252.50	15.50	1247.11	1235.45		
2	152.22	1210.17	1262.17	1250.00	16.66	1246.01	1235.45	18.00	1244.67
	192.22			1250.00	16.75	1245.92	1235.45		
3	252.22	1210.75	1262.75	1247.50	16.00	1247.25	1235.45	17.00	1246.25
	292.22			1247.50	14.41	1248.84	1235.45		
	322.22			1245.00			1235.45	16.00	1247.34
4	352.22	1210.84	1262.84	1245.00	26.25	1237.09	1235.45	28.00	1235.34
	392.22			1242.00	23.50	1239.84	1235.45	27.00	1236.34
5	452.97	1211.45	1263.45	1239.00	36.16	1227.79	1235.45	33.00	1230.95
	477.97			1240.00			1235.45	26.00	1237.95
	492.97			1241.25	38.50	1225.45	1235.45		
	542.97			1242.50			1235.45	26.00	1237.79
6	553.72	1211.29	1263.29	1243.75	33.33	1230.46	1235.45	28.00	1235.79
	593.72			1242.50	31.08	1232.71	1235.45		
	633.72			1240.00			1235.45	26.00	1238.15
7	653.72	1210.65	1263.65	1237.50	27.41	1236.74	1235.45	28.00	1236.15
	693.72			1240.00	33.41	1230.74	1235.45		
8	753.72	1211.51	1263.51	1243.75	21.66	1242.35	1235.45	26.00	1238.01
	793.72			1244.00	20.50	1243.51	1235.45		
9	854.47	1211.90	1263.90	1245.25	18.00	1246.40	1235.45	19.00	1245.4
	894.47			1246.00	14.50	1249.90	1235.45		
10	955.22	1213.51	1263.51	1246.50	18.50	1245.51	1235.45	20.00	1244.01
	995.22			1247.50	15.33	1248.68	1235.45		
11	1055.22	1213.65	1263.65	1247.50	16.50	1247.65	1235.45	17.00	1247.15
	1095.22			1248.50	16.08	1248.07	1235.45		
12	1155.22	1217.29	1263.29	1251.50	16.50	1247.29	1235.45	18.00	1245.79
	1195.22			1250.00	15.50	1248.29	1235.45		
13	1255.97	1218.45	1263.45	1255.50	16.33	1247.62	1235.45	17.00	1246.95
	1295.97			1255.50	15.08	1248.87	1235.45		
14	1356.72	1215.84	1262.84	1252.25	15.25	1248.09	1235.45	16.00	1247.34

Table 14. (Continued)

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed55	S-Rding 00	R-bed 00	Wse00	S-Rding92	R-bed92
	1396.72			1255.00	16.50	1246.84	1235.45		
15	1456.72	1220.75	1262.75	1253.75	16.66	1246.59	1235.45	18.00	1245.25
	1496.72			1253.50	15.33	1247.92	1235.45		
16	1556.72	1222.17	1262.17	1254.00	12.66	1250.01	1235.45	14.00	1248.67
	1596.72			1253.00	11.25	1251.42	1235.45		
17	1657.26	1222.11	1262.00	1252.50	11.50	1251.00	1235.45	13.00	1249.5
	1697.26			1252.50	9.58	1252.92	1235.45		
N-A	1708.94	1236.00	1262.00	1260.00	4.58	1257.92	1235.45	6.00	1256.5

Year	1960	1964	1967	1969	1970	1975	1981	1984
Flowline	1235.34	1233.74	1234.14	1234.14	1234.14	1232.14	1232.84	1226.54

Year	1985	1987	1988	1990	1991	1992	1993	1995
Flowline	1232.94	1234.34	1225.34	1224.34	1234.34	1230.34	1236.01	1226.17

Table 15. Structure, and Flowline Details
Bridge No 26060 (RS 8) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
26060	McClain & Cleveland C/L	35-18-00	97-36-00	I-44	2000	1717.8

Year	2003	2004
Flowline	1143.05	1141.65

Table 16. Structure, and Flowline Details
Bridge No 22108 (RS 9) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
22108	Cleveland McClain C/L	35-11-36	97-29-06	I-35	1988	3740.2

Year	1989	1991	1992
Flowline	1080.75	1081.05	1081.75

Table 17. Structure, and Flowline Details
Bridge No 21361 (RS 10) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
21361	Cleveland McClain C/L	35-11-36	97-29-06	I-35	1986	3740.2

Year	1989	1991	1992
Flowline	1080.75	1081.05	1081.75

Table 18. Structure, Cross-section, and Flowline Details
Bridge No 06593 (RS 11) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
06593	Cleveland McClain C/L	35-00-54	97-21-00	U.S. 77	1938	3672.14

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed38	S-Rding01	R-bed01	S-Rding99	R-bed99
W-A	0.00	1040.00	1079.50	1050.00	13.10	1073.90	13.10	1073.90
	12.00			1045.00			12.70	1074.30
1	52.41	1032.59	1063.57	1040.00	12.70	1074.30	37.40	1049.60
	115.41			1037.00			53.20	1033.80
2	153.00	1018.18	1064.49	1028.00	38.80	1048.20	53.00	1034.00
3	255.00	1013.28	1064.41	1028.00	54.00	1033.00	54.50	1032.50
4	357.00	1011.86	1064.36	1028.00	54.80	1031.20	54.50	1031.50
	409.00			1028.00				
5	459.67	1005.18	1064.13	1028.00	54.80	1031.20	54.50	1031.50
6	661.67	993.59	1064.76	1029.00	54.80	1031.20	54.50	1031.50
	713.67			1028.00				
7	764.17	992.50	1063.58	1026.00	54.80	1029.20	54.50	1029.50
8	866.14	991.50	1062.92	1024.00	54.80	1029.20	54.50	1029.50
	918.14			1024.00				
9	968.14	991.00	1062.58	1024.00	54.80	1029.20	60.00	1024.00
	1018.14			1024.00				
10	1070.14	991.00	1062.08	1024.00	54.80	1031.20	60.00	1026.00
	1120.14			1024.00				
11	1172.14	990.00	1061.86	1024.00	54.80	1030.20	59.90	1025.10
12	1274.14	989.50	1061.07	1024.00	54.80	1029.20	59.30	1024.70
13	1376.14	990.00	1060.58	1024.00	54.80	1029.20	57.90	1026.10
	1428.14			1024.00				
14	1478.14	989.00	1059.88	1024.00	56.80	1027.20	56.10	1027.90
	1528.14			1024.00	56.00	1028.00	55.80	1028.20
	1540.14			1024.00				
	1568.14			1024.00				
	1628.14			1024.00				
15	1580.14	988.50	1059.29	1024.00	61.50	1020.50	61.50	1020.50
	1610.14			1024.00	66.00	1016.00		
	1612.14			1024.00				
	1616.14			1024.00				
	1617.14			1024.00			67.00	1015.00
	1620.14			1024.00				
16	1682.14	989.00	105.53	1024.00	56.40	1025.60	56.40	1025.60

Table 18. (Continued)

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed38	S-Rding01	R-bed01	S-Rding99	R-bed99
	1710.14			1024.00				
	1715.14			1024.00				
	1719.14			1024.00				
	1723.14			1024.00			61.20	1020.80
	1724.14			1024.00				
	1727.14			1024.00	60.90	1021.10		
	1734.14			1024.00				
	1755.14			1024.00				
	1761.00			1024.00				
17	1784.14	989.00	1057.84	1024.00	55.10	1024.90	55.00	1025.00
	1850.14			1024.00	53.80	1026.20		
18	1886.14	989.00	1057.00	1024.00	54.00	1026.00	54.00	1026.00
	1936.14			1022.00	55.00	1025.00		
19	1988.14	988.00	1057.23	1022.00	53.70	1026.30	56.00	1024.00
20	2090.14	986.00	1057.80	1022.00	51.60	1028.40	53.90	1026.10
	2140.14			1022.00	50.00	1028.00		
21	2192.14	986.30	1054.44	1022.00	49.80	1028.20	50.80	1027.20
22	2294.14	984.00	1053.43	1022.00	48.00	1029.00	49.50	1027.50
23	2396.14	982.60	1052.48	1024.00	47.20	1024.80	48.90	1023.10
	2442.14			1024.00	47.40	1024.60		
	2453.14			1024.00				
24	2498.14	982.40	1051.38	1024.00	46.40	1025.60	46.00	1026.00
	2540.14			1024.00				
	2548.14			1024.00			45.80	1025.20
25	2600.14	982.50	1050.34	1024.00	43.40	1026.60	46.00	1024.00
	2660.14			1024.00				
26	2702.14	981.50	1049.16	1024.00	42.80	1026.20	44.10	1024.90
	2720.14			1024.00				
	2752.14			1024.00	41.60	1027.40		
27	2804.14	980.80	1048.04	1024.00	43.20	1025.80	42.10	1026.90
	2825.14			1024.00				
	2843.14			1024.00				
	2855.14			1024.00				
	2879.14			1024.00			40.80	1028.20
	2887.14			1024.00	45.70	1022.30		
	2897.14			1024.00				
28	2906.14	982.00	1046.77	1024.00	45.00	1023.00	44.00	1024.00
	2909.14			1024.00				
	2920.14			1024.00				
	2936.14			1024.00				
	2945.14			1024.00				
	2956.14			1024.00			45.50	1021.50

Table 18. (Continued)

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed38	S-Rding01	R-bed01	S-Rding99	R-bed99
	2990.14			1024.00				
29	3008.14	983.50	1043.56	1024.00	43.80	1023.20	43.00	1024.00
	3029.14			1024.00				
	3044.14			1024.00				
	3058.14			1024.00				
	3064.14			1024.00				
	3085.14			1024.00				
	3088.14			1024.00	41.90	1024.10		
	3098.14			1024.00	44.60	1021.40		
30	3110.14	983.00	1044.20	1024.00	43.00	1023.00	42.00	1024.00
	3148.14			1024.00				
	3150.14			1024.00				
	3160.14			1024.00	42.30	1023.70	40.90	1025.10
	3182.14			1024.00				
	3200.14			1024.00				
31	3212.14	983.00	1042.80	1024.00	44.60	1020.40	41.20	1023.80
	3224.14			1024.00	45.20	1019.80	44.70	1020.30
	3233.14			1024.00				
	3254.14			1024.00				
	3271.14			1020.00				
	3298.14			1022.00				
32	3314.14	982.00	1041.48	1024.00	41.00	1023.00		
	3324.14			1028.00			42.30	1021.70
	3334.14			1028.00			43.20	1020.80
	3356.14			1028.00			43.00	1021.00
	3372.14			1028.00				
	3377.14			1028.00				
	3401.14			1028.00				
	3399.14			1028.00			42.50	1021.50
33	3416.14	982.00	1040.08	1028.00	42.40	1021.60	43.70	1020.30
	3426.14			1028.00			40.90	1023.10
	3437.14			1028.00			42.00	1022.00
	3439.14			1028.00				
34	3518.14	983.00	1038.55	1028.00	34.00	1028.00	33.00	1029.00
	3560.14			1028.00			32.40	1029.60
35	3619.72	982.50	1057.08	1028.00	27.00	1035.00	27.30	1034.70
E-A	3672.14	1020.00	1056.09	1048.00	15.00	1045.00	12.50	1047.50

Table 18. (Continued)

S-Rding98	R-bed98	S-Rding96	R-bed96	S-Rding94	R-bed94	S-Rding93	R-bed93	S-Rding92	R-bed92
13.40	1073.60	12.00	1075.00	12.40	1074.60	12.80	1074.20	14.00	1073.00
12.20	1074.80								
33.30	1053.70	32.90	1054.10	37.20	1049.80	34.30	1052.70	52.50	1034.50
54.00	1033.00	51.30	1035.70	53.00	1034.00	52.40	1034.60	55.10	1031.90
55.90	1031.10	55.00	1032.00	56.60	1030.40	55.80	1031.20	56.30	1030.70
55.90	1030.10	55.60	1030.40	57.30	1028.70	56.50	1029.50	56.30	1029.70
				57.60	1028.40				
55.90	1030.10	55.60	1030.40	57.00	1029.00	57.50	1028.50	55.50	1030.50
55.90	1030.10	55.60	1030.40	56.60	1029.40	57.20	1028.80	56.50	1029.50
				55.00	1029.00	56.60	1027.40		
55.90	1028.10	55.60	1028.40	57.20	1026.80	58.00	1026.00	58.50	1025.50
55.90	1028.10	55.60	1028.40	59.80	1024.20	59.60	1024.40	58.50	1025.50
				58.60	1025.40				
59.70	1024.30	55.60	1028.40	59.40	1024.60	58.50	1025.50	57.80	1026.20
59.00	1025.00	55.60	1028.40	58.30	1025.70				
59.70	1026.30	55.60	1030.40	58.90	1027.10	59.00	1027.00	57.00	1029.00
59.30	1026.70	55.60	1030.40						
59.50	1025.50	55.60	1029.40	57.60	1027.40	57.90	1027.10	57.00	1028.00
58.00	1026.00	55.60	1028.40	58.30	1025.70	57.40	1026.60	56.10	1027.90
56.50	1027.50	55.60	1028.40	56.80	1027.20	56.80	1027.20	56.00	1028.00
						55.00	1029.00	55.30	1028.70
56.00	1028.00	54.90	1029.10	56.00	1028.00	56.10	1027.90	55.50	1028.50
55.30	1028.70								
						55.00	1029.00		
55.90	1027.10								
60.90	1021.10	59.00	1023.00	59.80	1022.20	59.90	1022.10	60.00	1022.00
		65.50	1016.50						
				66.90	1015.10			73.00	1009.00
68.10	1013.90								
						69.20	1012.80		
55.90	1026.10	56.20	1025.80	55.90	1026.10	55.80	1026.20	55.00	1027.00
		55.70	1026.30						
		65.10	1016.90						
59.60	1022.40								
				60.00	1022.00			59.90	1022.10
						57.80	1024.20		

Table 18. (Continued)

S-Rding98	R-bed98	S-Rding96	R-bed96	S-Rding94	R-bed94	S-Rding93	R-bed93	S-Rding92	R-bed92
		56.10	1025.90						
						56.50	1025.50		
55.00	1025.00	53.90	1026.10	54.00	1026.00	54.50	1025.50	54.00	1026.00
53.30	1026.70			53.00	1027.00	52.90	1027.10	53.10	1026.90
57.10	1022.90	54.80	1025.20	55.80	1024.20	55.50	1024.50	56.30	1023.70
52.80	1027.20			51.80	1028.20	52.00	1028.00	52.00	1028.00
50.40	1027.60			50.00	1028.00	49.60	1028.40	50.30	1027.70
49.10	1027.90			48.30	1028.70	48.80	1028.20	49.00	1028.00
47.20	1024.80			46.80	1025.20	47.00	1025.00	47.30	1024.70
						45.40	1026.60		
45.90	1026.10			45.20	1026.80	46.00	1026.00	45.70	1026.30
				46.50	1025.50				
45.60	1025.40								
45.90	1024.10			45.60	1024.40	46.30	1023.70	46.90	1023.10
						42.90	1027.10		
44.00	1025.00			43.00	1026.00	43.00	1026.00	43.70	1025.30
								41.70	1027.30
		40.50	1028.50	41.20	1027.80	41.60	1027.40	43.00	1026.00
42.00	1027.00							42.30	1026.70
				40.00	1029.00				
						39.90	1029.10		
		39.80	1029.20						
40.00	1029.00								
		45.40	1022.60						
		47.00	1021.00	50.10	1017.90	43.00	1025.00	44.70	1023.30
44.00	1024.00	47.00	1021.00						
								50.40	1017.60
						55.00	1013.00		
		47.50	1019.50						
45.60	1021.40	45.80	1021.20						
		47.10	1019.90	49.50	1017.50	51.00	1016.00	46.10	1020.90
42.00	1025.00	45.60	1021.40						
		48.60	1018.40					45.20	1021.80
42.50	1024.50	46.00	1021.00						

Table 18. (Continued)

S-Rding98	R-bed98	S-Rding96	R-bed96	S-Rding94	R-bed94	S-Rding93	R-bed93	S-Rding92	R-bed92
								46.50	1019.50
		47.00	1019.00	48.50	1017.50	46.00	1020.00	44.10	1021.90
42.00	1024.00								
41.00	1025.00							43.20	1022.80
								44.90	1020.10
42.20	1022.80	44.20	1020.80	46.50	1018.50	44.50	1020.50	43.00	1022.00
41.50	1023.50								
								43.80	1021.20
		47.40	1016.60						
40.40	1023.60	45.40	1018.60	45.00	1019.00	44.10	1019.90	40.50	1023.50
43.00	1021.00								
40.70	1023.30					45.90	1018.10		
		39.00	1025.00						
				42.00	1022.00				
43.80	1020.20								
		40.80	1023.20	43.50	1020.50	40.10	1023.90	42.30	1021.70
41.00	1023.00	42.30	1019.70						
		32.30	1029.70	32.80	1029.20	33.30	1028.70	33.50	1028.50
		25.50	1036.50	25.90	1036.10	26.70	1035.30	26.80	1035.2
33.00	1029.00	12.00	1048.00	11.90	1048.10	12.00	1048.00	11.50	1048.5

Year	1970	1989	1992	1994
Flowline	1005.00	1012.40	1005.00	1013.00

Table 19. Structure, Cross-section, and Flowline Details
Bridge No 14520 (RS 12) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
14520	Pott-Pontotoc Mac Co	34-57-48	96-55-48	S.H. 3 W	1959	1,356.00

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed59	S-Rding93	R-bed93	S-Rding93	R-bed 93
S-A	0.00	890.00	925.00	920.00	7.50	920.00	6.70	920.80
	17.00			913.50				
	30.00			915.00	14.00	913.50		
	38.50			915.50				
1	77.00	888.17	923.17	917.00	19.00	908.50		
	103.00			912.50				
2	152.75	888.06	923.56	910.00	22.00	905.50	21.20	906.30
	237.75			906.00			24.60	902.90
3	253.50	888.3	923.80	905.00	24.00	903.50	23.70	903.80
	275.00			905.00				
	303.50			907.50			21.80	905.70
4	353.50	888.12	924.52	907.50	24.00	903.50	23.40	904.10
	403.50			907.50			22.80	904.70
5	453.50	888.00	925.00	906.50	25.00	902.50	23.80	903.70
	484.00			907.50				
	503.50			905.00			24.60	902.90
6	554.25	887.96	925.96	905.00	25.00	902.50	24.10	903.40
	604.50			905.00			23.90	903.60
7	655.00	888.21	926.21	905.00	26.00	901.50	25.20	902.30
	700.00			902.50			25.10	902.40
	716.00			903.00				
	731.00			903.00			30.30	897.20
	740.00			903.00			27.00	900.50
8	755.00	888.03	927.03	903.00	29.00	898.50	27.90	899.60
	773.00			903.00			30.40	897.10
	775.00			903.00				
	785.00			903.00			32.50	895.00
	795.00			903.00				
	815.00			903.50				
	830.00			903.50	34.00	893.50		
9	855.00	888.41	927.41	905.00	30.00	897.50	30.10	897.40
	895.00			905.50				
	905.00			905.50			30.50	897.00
	922.17			905.00				
10	955.75	888.37	928.37	904.00	30.00	897.50	30.80	896.70

Table 19. (Continued)

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed59	S-Rding93	R-bed93	S-Rding93	R-bed 93
	1006.13			903.00	32.00	895.50	30.50	897.00
11	1056.50	888.12	928.62	903.00	33.00	894.50	33.50	894.00
	1106.50			903.00			33.80	893.70
12	1156.50	888.44	929.44	903.00	34.00	893.50	36.50	891.00
	1220.00			903.00			36.10	891.40
	1206.50			903.00	35.00	892.50		
13	1256.50	878.82	929.82	903.00	34.50	899.50	35.80	891.70
	1302.50			910.00			26.70	900.80
	1307.50			912.50	28.00	899.50		
	1315.00			915.00				
	1353.00			926.50	17.00	910.50		
N-A	1356.50	925.00	930.00	927.50	8.00	919.50	8.10	919.40

S-Rding92	R-bed92	S-Rding87	R-bed87
7.00	920.50		
13.50	914.00		
		13.70	913.80
17.90	909.60	17.30	910.20
18.00	909.50		
21.00	906.50	20.70	906.80
29.50	898.00	24.50	903.00
24.10	903.40		
23.10	904.40	23.30	904.20
22.50	905.00		
22.20	905.30	22.30	905.20
26.20	901.30		
24.10	903.40	24.60	902.90
24.70	902.80		
25.50	902.00	29.50	898.00
27.50	900.00		
29.20	898.30		

Table 19. (Continued)

S-Rding92	R-bed92	S-Rding87	R-bed87
		27.90	899.60
29.20	898.30		
31.20	896.30		
29.50	898.00		
31.5	896.00		
31.00	896.50	30.10	897.40
31.10	896.40		
		33.80	893.70
30.20	897.30	31.60	895.90
30.50	897.00		
33.10	894.40	30.20	897.30
34.00	893.50		
33.20	894.30	32.00	895.50
32.10	895.40		
33.90	893.60	32.00	895.50
33.90	893.60		
		21.10	906.40
29.00	898.50		
8.00	919.50		

Year	1970	1975	1983	1985	1987	1990	1991	1992	1993
Flowline	896.50	893.80	899.50	897.10	893.70	893.50	893.40	892.50	891.20

Table 20. Structure, and Flowline Details
Bridge No 22099 (RS 13) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
22099	Cleveland McClain C/L	35-11-36	97-29-06	I-35	1986	3740.2

Year	1990	1993	2004
Flowline	803.75	802.65	800.15

Table 21. Structure, and Flowline Details
Bridge No 22420 (RS 14) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
22420	Ellis-Rogers Mills Col LI	35-51-54	99-43-48	U.S. 283	1985	3844

Year	1990	1993	2004
Flowline	802.50	801.50	792.40

Table 22. Structure, Cross-section, and Flowline Details
Bridge No 19113 (RS 15)on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
19113	3.9 MI N JCT SH 1	35-00-06	96-20-06	S.H. 48	1975	2200.82

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed75	SRding87	R-Bed87	S-Rding92	R-bed92	S-Rding93	R-bed93
S-A	0.00	690.00	729.45	730.00	23.50	713.83	11.00	726.33	10.90	726.43
1	100.41	691.17	730.17	717.00	24.90	713.60	25.50	713.00	26.20	712.30
2	200.41	692.00	731.00	717.50	27.30	711.45	27.50	711.25	28.00	710.75
	222.41			717.00					29.20	709.55
	250.41			716.00					28.50	711.00
3	300.41	692.71	731.71	707.75	29.10	711.40	29.50	711.00	29.90	710.60
	375.41			707.75	25.20	716.30				
4	400.41	691.55	732.55	707.75	34.60	707.40	29.00	713.00	30.00	712.00
	447.41			707.75					30.00	712.00
	450.41			707.75			24.50	717.75		
5	500.41	691.27	733.27	707.75	36.10	706.40	35.00	707.50	40.40	702.10
	516.41			707.75					45.00	698.00
6	600.41	692.12	734.12	709.00	37.90	705.60	36.00	707.50	38.00	705.50
7	700.41	691.83	734.83	710.25	37.60	706.40	35.50	708.50	38.50	705.50
	740.41			710.25					40.40	703.60
8	800.41	691.67	735.67	710.25	38.00	706.50	37.00	707.50	39.00	705.50
	850.41			710.00			39.00	706.00	40.00	705.00
	890.41			710.00			38.00	707.50		
9	900.41	691.39	736.39	711.00	38.40	707.10	40.00	705.50	38.80	706.70
	948.41			711.00					40.30	706.20
10	1000.41	691.24	737.28	711.00	40.70	705.80	40.50	706.00	39.50	707.00
	1075.14			711.00	38.40	708.10				
11	1100.41	691.95	737.95	711.00	39.00	707.50	42.50	704.00	40.00	706.50
	1150.11			711.00					42.70	704.80
	1153.41			711.00			45.00	702.50		
12	1200.41	691.79	738.79	711.00	42.00	705.50	43.00	704.50	42.50	705.00
	1250.41			711.25			42.20	705.80	45.10	702.90
13	1300.41	691.51	739.51	712.00	42.80	705.70	43.50	705.00	45.00	703.50
	1350.41			713.00			44.20	704.30	45.00	703.50
14	1400.41	691.36	740.36	713.75	39.30	710.20	44.00	705.50	35.00	714.50
	1450.41			713.75			46.20	703.30	44.50	705.00
15	1500.41	692.07	741.07	712.00	40.00	710.25	45.00	705.25	42.60	707.65
	1549.41			707.50					45.60	704.90
16	1600.41	691.91	741.91	706.00	40.60	709.90	41.00	709.50	41.50	709.00
	1643.41			705.00					45.20	705.30

Table 22. (Continued)

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed75	SRding87	R-Bed87	S-Rding92	R-bed92	S-Rding93	R-bed93
	1684.41								45.00	705.50
17	1700.41	691.63	742.69	705.00	41.20	710.30	41.00	710.50	41.00	710.50
	1750.41			705.00					40.30	711.70
18	1800.41	692.48	743.48	705.00	43.40	709.10	42.00	710.50	41.80	710.70
19	1900.41	692.19	744.19	712.00	44.00	709.50	43.00	710.50	43.40	710.10
	1930.41			721.00					34.90	718.60
	1931.41			721.00			34.50	719.00		
	1950.41			720.00	34.10	719.90				
20	2000.41	702.03	745.09	720.00	35.20	719.30	35.00	719.50	35.20	719.30
	2050.41			720.00					37.10	717.40
21	2100.41	702.78	745.75	720.00	35.60	719.90	36.00	719.50	35.70	719.80
	2122.41			720.00			32.50	723.00	32.50	723.00
	2146.41			721.00			33.00	722.50	33.00	722.50
	2150.41			720.00	32.80	722.70				
N-A	2200.82	710.00	746.48	744.00			12.00	742.70	12.40	742.30

Year	1978	1980	1985	1987	1989	1990	1991	1992	1995
Flowline	696.20	695.20	695.00	706.30	697.00	697.00	700.50	697.00	705.92

Table 23. Structure, Cross-section, and Flowline Details
Bridge No 15586 (RS 16) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
15586	Pittsbuurg C/L	35-06-54	95-42-06	U.S.69	1962	1001.5

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed62	S-Rding93	R-bed93
S-A	0.00	520.00	610.00	607.50	9.00	609.5
	75.93			580.00		
	85.00			578.00	37.00	581.5
1	101.25	521.05	611.83	570.00	46.00	572.5
	161.25			560.00	68.00	550.5
2	201.25	520.80	612.04	540.00	82.00	536.5
	261.25			540.00	81.00	537.5
3	301.25	520.30	612.41	540.00	82.00	536.5
	351.25			540.00	82.00	538.5
4	401.25	520.30	612.27	536.00	84.00	536.5
	451.25			545.00	83.00	537.5
5	501.25	519.17	612.37	540.00	85.00	535.5
	551.25			540.00	86.00	534.5
6	601.25	520.20	612.37	540.00	90.00	530.5
	651.25			540.00	91.00	529.5
7	701.25	519.15	612.41	543.00	94.00	526.5
	751.25			543.00	94.00	526.5
8	801.25	518.30	612.04	542.00	82.00	536.5
	851.25			555.00	67.00	551.5
9	901.25	515.75	611.83	572.00	48.00	570.5
	931.25			585.00	38.00	580.5
N-A	1001.5	520.00	610.00	607.00	10.00	608.5

Table 23. (Continued)

S-Rding-U90	S-Rding-D90	R-bed-U90	R-bed-D90	S-Rding87	R-bed87
8.50	9.60	607.00	605.90	10.00	605.50
37.50	37.00	578.00	578.50	35.00	580.50
43.00	45.00	572.50	570.50	80.00	535.50
79.00	79.00	536.50	536.50	80.00	535.50
80.00	81.50	535.50	534.00	81.00	534.50
79.00	80.50	538.50	537.00	81.00	536.50
81.00	84.00	536.50	533.50	85.00	532.50
81.00	82.00	536.50	535.50	81.00	536.50
82.00	83.00	535.50	534.50	84.00	533.50
87.00	90.00	530.50	527.50	90.00	527.50
93.00	91.50	524.50	526.00	93.41	524.09
78.00	76.50	537.50	539.00	80.00	535.50
45.00	45.00	570.50	570.50	46.00	569.50
8.00	9.10	607.50	606.40	9.00	606.50

Year	1965	1985	1987	1989	1992	1995
Flowline	537.00	532.00	523.50	523.50	523.00	533.50

Table 24. Structure, Cross-section, and Flowline Details
Bridge No 15587 (RS 17) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
b15587	2.2 MI N SE US 69B	35-20-18	95-38-42	SH 9	1962	1001.3

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed62	S-Rding87	R-bed87	S-Rding90	R-bed90	S-Rding93	R-bed93
N-A	0.00	495.00	603.00	602.00	9.50	601.50	11.20	602.30	11.00	602.50
1	126.15	491.80	603.02	558.00	48.00	563.00	52.50	561.00	48.00	565.50
	186.15			535.00					71.00	542.50
2	251.15	491.00	603.32	521.00	79.00	532.00	81.50	532.00	94.00	519.50
	311.15			530.00					91.00	522.50
3	376.15	489.60	603.52	528.00	92.00	518.50	94.00	519.00	92.00	521.00
	436.15			526.00					85.00	528.00
	438.65			526.00	84.00	526.50	82.00	531.00		
4	501.15	487.70	603.86	525.50	89.00	521.50	89.00	524.00	89.00	524.00
	561.15			530.00					84.00	529.00
	563.65			530.00	83.00	527.50	83.00	530.00		
5	626.15	488.70	604.02	529.00	92.00	518.50	92.00	521.00	94.00	519.00
6	751.15	489.00	604.32	530.00	94.00	516.50	93.50	519.50	82.00	531.00
7	876.15	488.50	604.52	560.00	47.00	563.50	48.00	565.00	51.00	562.00
S-A	1001.30	495.00	604.00	598.00	9.00	601.50	11.00	602.00	11.00	602.00

Year	1985	1987	1989	1990	1992	1993
Flowline	526.30	517.00	517.00	519.83	517.00	524.00

Table 25. Structure, Cross-section, and Flowline Details
Bridge No 20578 (RS 18) on Canadian River

Bridge No	Location	Latitude	Longitude	Highway	Design year	Length
20578	Haskell C/L	35-10-24	95-14-00	S.H. 2	1983	1268.5

Pier-No	Distance	Pier-Btm	Pier-Top	R-bed83	S-Rding87	R-bed87
S-A	0.00	474.00	513.00	506.00	7.00	506.64
1	94.25	459.00	507.04	484.00	9.00	504.00
2	188.25	459.00	506.35	482.50	28.00	483.75
3	282.25	458.50	505.58	477.50	30.00	482.00
4	376.25	456.00	504.96	476.5	36.00	475.00
5	470.25	455.50	504.28	476.00	35.50	475.00
6	564.25	446.00	503.49	477.50	35.00	475.00
7	658.25	446.50	502.87	477.50	33.00	476.00
8	752.25	446.00	502.08	476.50	32.50	475.00
9	846.25	448.50	501.41	476.50	32.50	475.00
10	940.25	447.50	500.78	477.50	31.00	475.50
11	1034.25	455.00	500.09	471.00	32.00	474.00
	1104.75			487.00	17.50	488.50
12	1128.25	445.71	499.33	488.00	16.00	489.00
13	1198.25	445.71	498.88	490.00	14.00	490.00
N-A	1268.50	457.14	503.00	494.50	8.00	496.00

Year	1984	1985	1987	1989
Flowline	468.80	470.70	468.50	467.50

APPENDIX B

FLOW PATH OF CANADIAN RIVER IN OKLAHOMA

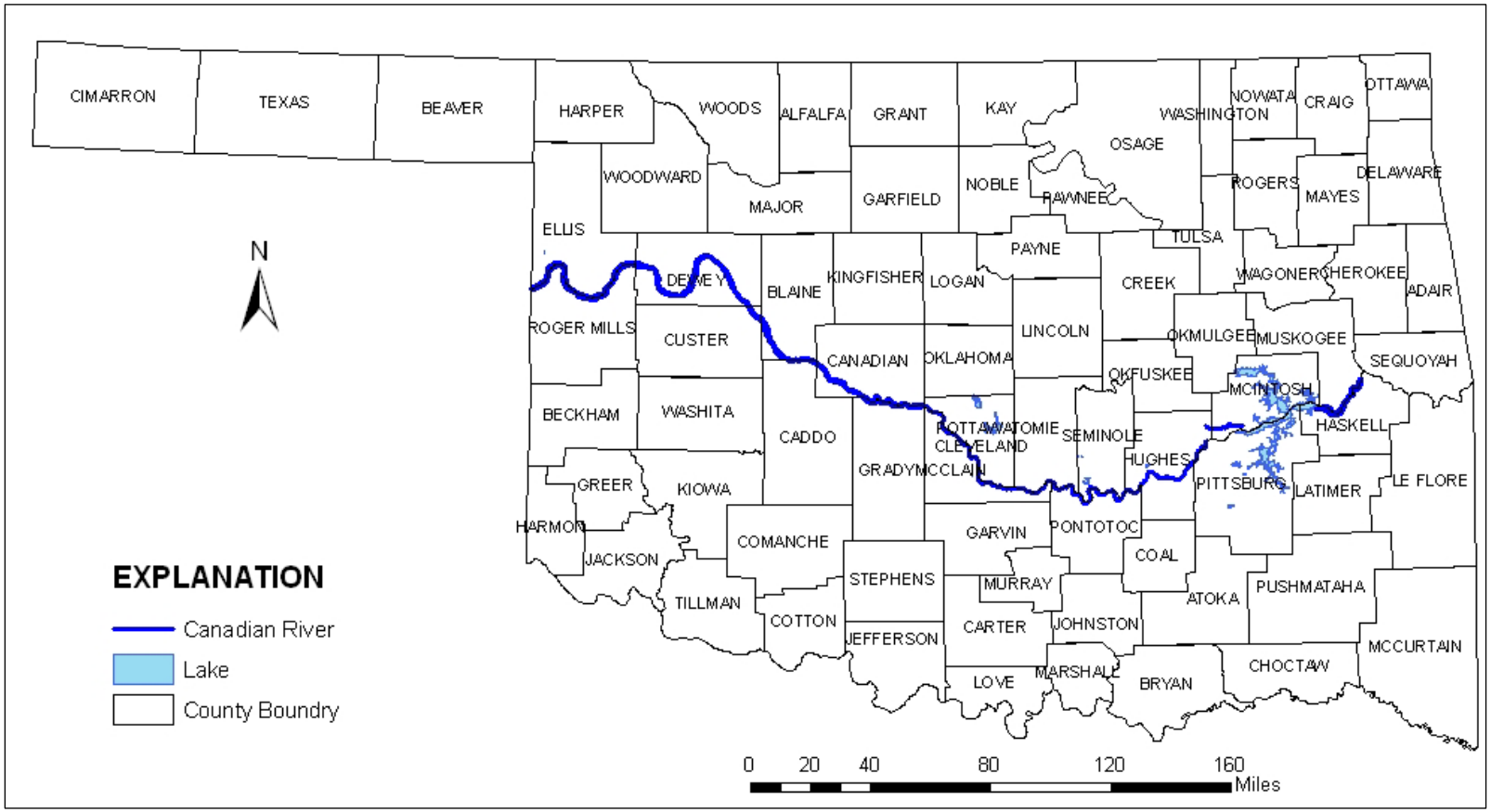


Figure B-1. Flowpath of Canadian River in Oklahoma

QUAD MAP LEGEND
CANADIAN RIVER, OKLAHOMA

Source: http://www.okladot.state.ok.us/hqdiv/p-r-div/maps/2003county/index.htm

County Name
Roger Mills
Ellis
Dewey
Custer
Blaine
Caddo
Canadian
Grady
McClain
Cleveland
Pottawatomie
Pontotoc
Seminole
Hughes
Pittsburg
McIntosh
Haskell
Muskogee

BLAINE

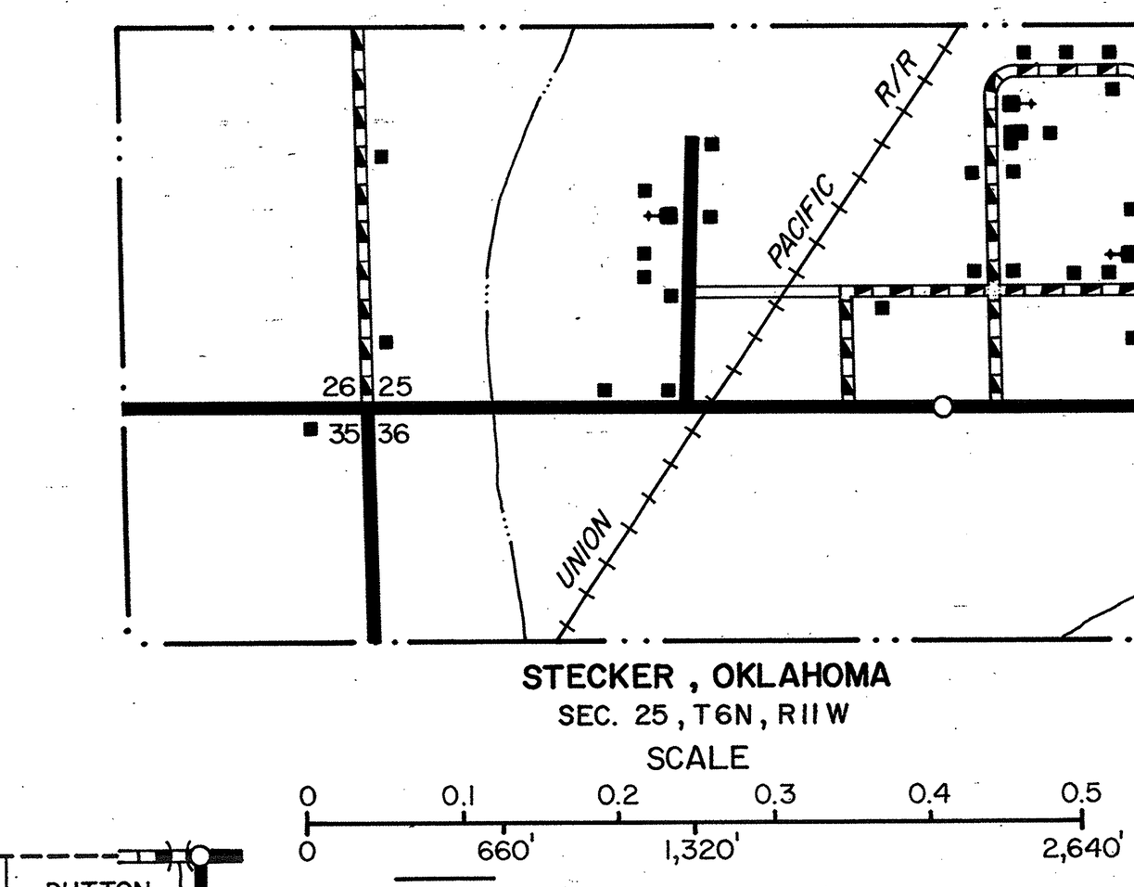
NOT FOR RESALE

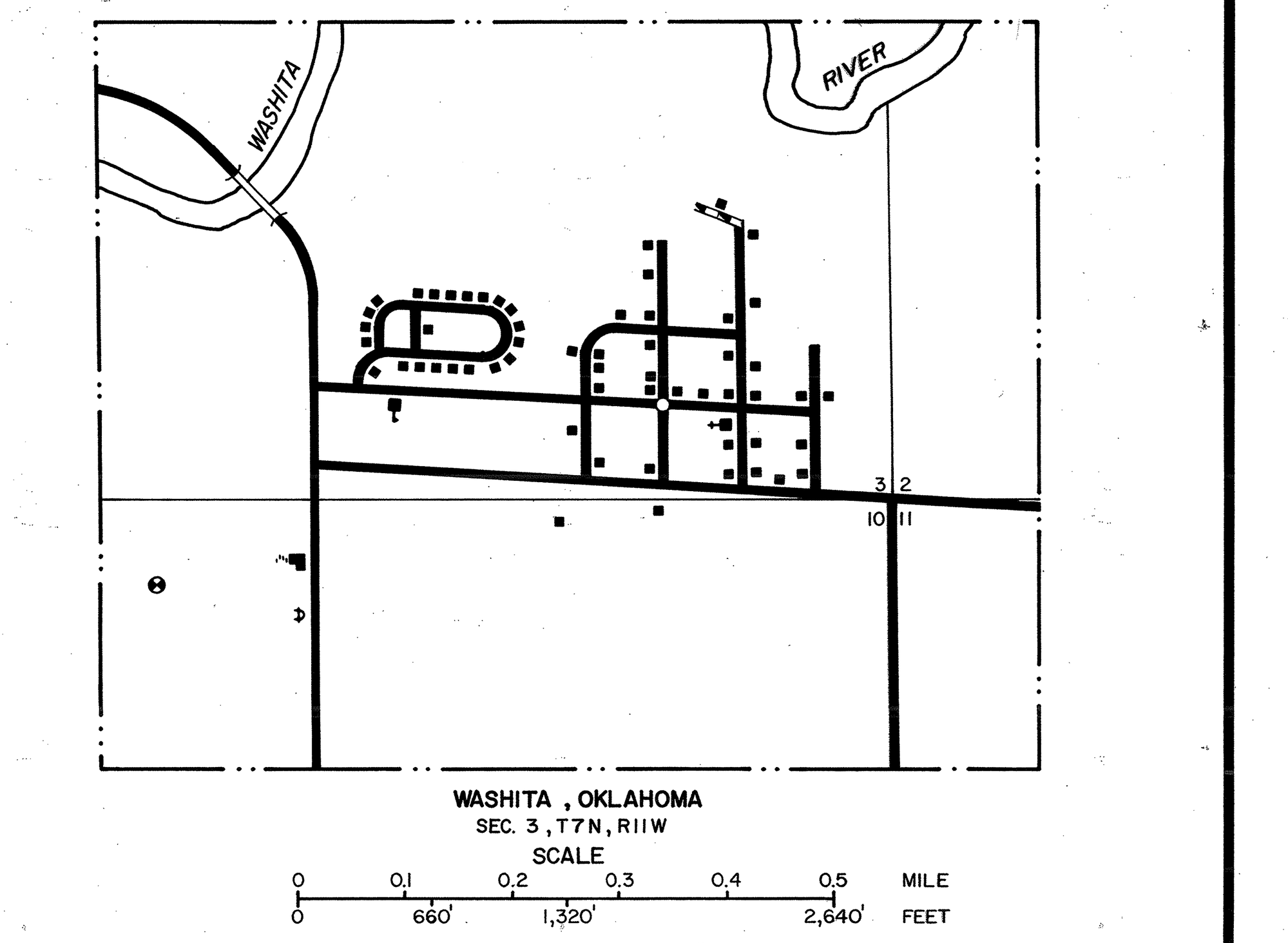
GENERAL HIGHWAY MAP

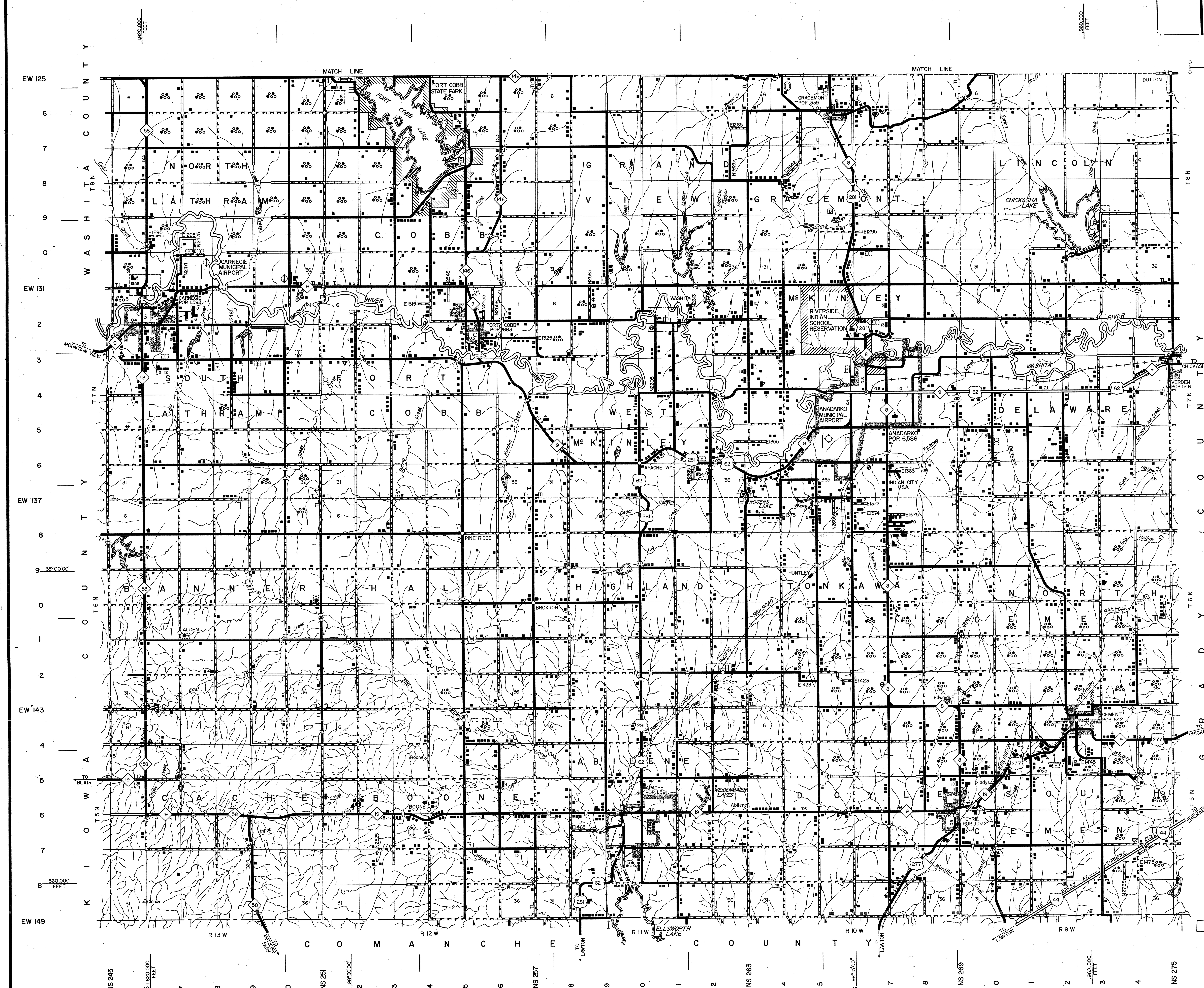
BLAINE COUNTY

OKLAHOMA

COMPUTER GENERATED

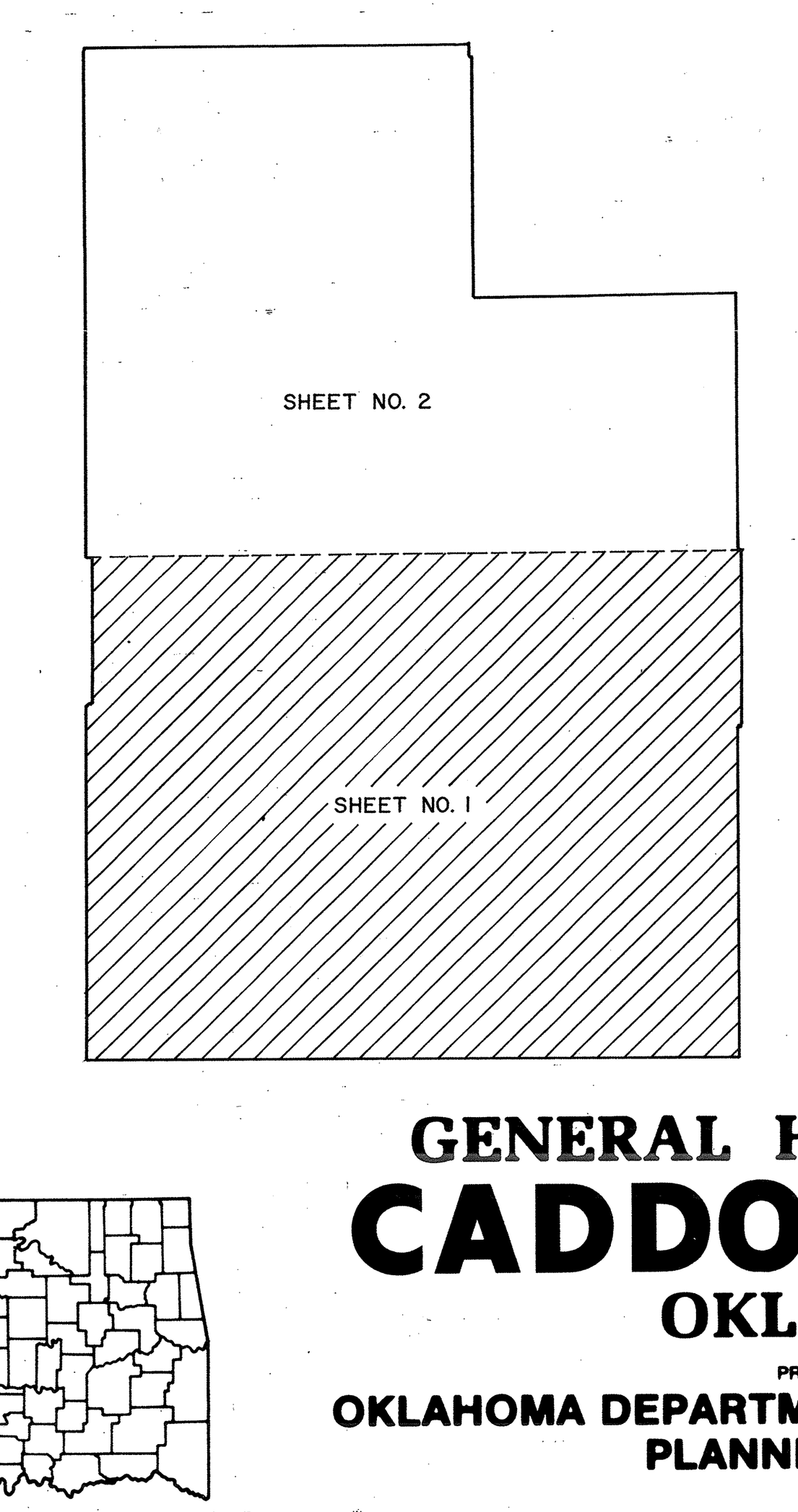


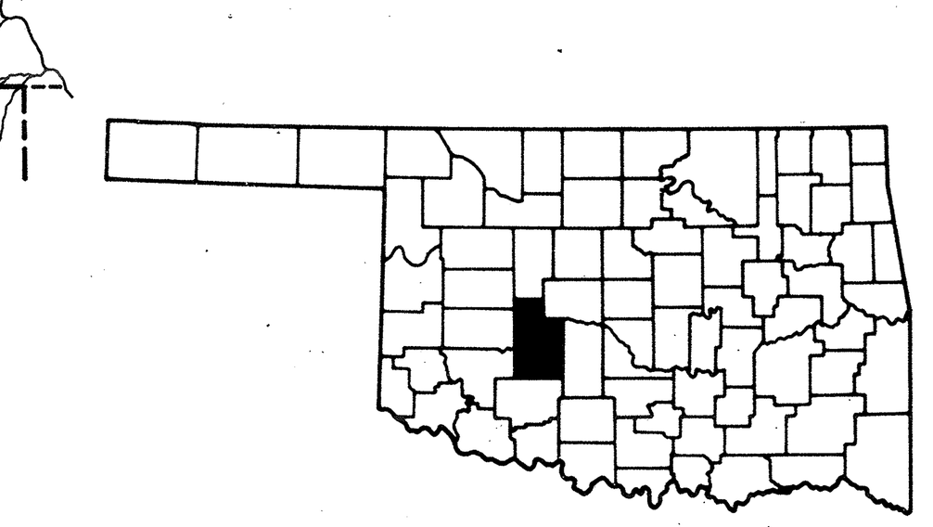




LEGEND

- U.S. NUMBERED HIGHWAY
- STATE NUMBERED HIGHWAY
- INTERSTATE HIGHWAY ROUTE
- PAVED ROAD
- GRAVEL ROAD
- GRADED & DRAINED ROAD
- UNIMPROVED ROAD
- PRIMITIVE ROAD
- PROJECTED ROAD
- RESIDENTIAL ROAD
- N0001 COUNTY ROAD ID NO.
- MILEAGE BETWEEN POINTS
- DIVIDED HIGHWAY, 4 OR MORE LANES
- UNDIVIDED HIGHWAY, 3 OR MORE LANES
- TRAFFIC CIRCLE
- HIGHWAY GRADE SEPARATION
- TRAFFIC INTERCHANGE
- STATE LINE
- COUNTY LINE
- CIVIL TOWNSHIP LINE
- SECTION LINE
- RURAL DEVELOPMENT AREA
- GOVERNMENT PROPERTY LINE
- MATCH LINE
- COUNTY SEAT
- TOWN CENTER
- CORPORATE LIMITS
- T.L. CIVIL TOWNSHIP, ROAD IN PLACE
- INSET BOUNDARY
- 1867 ELEVATION ABOVE SEA LEVEL
- MOUNTAIN RANGE, BUTTE OR MESA
- SMALL MONUMENT
- MARSH OR SWAMP LANDS
- DRAINAGE DITCH
- IRRIGATION DITCH
- LAKE, RESERVOIR OR POND WITH DAM
- ROAD OVER DAM
- DRY LAKE SUBJECT TO FLOOD
- SMALL BRIDGES CLOSELY SPACED
- HIGHWAY BRIDGE, OVER 20 FT. IN LENGTH
- GENERAL BRIDGE, LONG CROSSING
- ARCH BRIDGE
- TRUSS BRIDGE, W-Wood, S-Steel, C-Concrete
- CONCRETE DIP OR FORD
- FORD ROAD ESTABLISHED
- INTERMITTENT STREAM
- NARROW STREAM
- DOCK PIER OR LANDING
- NAVIGABLE STREAM WITH LOCK & DAM
- WIDE STREAM OR RIVER
- TRIANGULATION STATION
- RAILROAD, ANY NUMBER OF TRACKS
- RAILROAD WITH STATIONS INDICATED
- GRADE CROSSING
- UNDERPASS, R.R. ABOVE
- OVERPASS, R.R. BELOW
- RAILROAD ON STREET
- MILITARY AIRFIELD
- AIRPORT WITH COMPLETE FACILITIES
- AIRPORT WITH LIMITED FACILITIES
- LANDING STRIP, PRIVATE FIELD
- AIRPORT, GENERAL OUTLINE OF FIELD RUNWAYS SHOWN IN POSITION
- ROADSIDE PARK Picnic Grounds
- PLAYGROUNDS
- BATHING BEACH OR SWIMMING POOL
- SCENIC SITE
- MOTEL
- CAMP OR LODGE, Permanent With Buildings
- SP SMALL PARK SP-State, CP-County, MP-Municipal, TP-Trailer Park
- FOREST RANGER STATION
- OBSERVATION OR LOOKOUT TOWER
- CAMP SITE
- FISH HATCHERY
- C GOLF COURSE OR COUNTRY CLUB
- A ATHLETIC FIELD OR AMUSEMENT PARK
- FAIRGROUNDS, RACE COURSE
- DWELLING
- 8 NUMBER OF DWELLINGS CLOSELY SPACED
- COMBINED BUSINESS AND DWELLING
- POST OFFICE
- POST OFFICE COMBINATIONS
- SEASONAL DWELLINGS
- CHURCH OR OTHER RELIGIOUS BUILDING
- CEMETERY
- CHURCH WITH CEMETERY ADJACENT
- REST HOME
- HOSPITAL
- SMALL BUSINESS
- INDUSTRY
- SAW MILL
- MINE SHAFT OR DRIFT
- OIL OR GAS FIELD
- GAUGING OR PUMPING STATION
- WAREHOUSE
- GRAVEL PIT
- QUARRY
- SCHOOL
- COMMUNITY HALL OR LODGE
- HISTORICAL MARKER
- DRIVE-IN THEATER
- CORRECTIONAL INSTITUTION
- HIGHWAY GARAGE
- D JUNK YARDS & DUMPS A-Automobile, B-Scrap Building Material, D-Refuse, Garbage or Trash Dump F- Sanitary Fill, G-Other
- S SEWAGE DISPOSAL PLANT
- W WATER SUPPLY STAND PIPE
- POWER PLANT
- BOOSTER STATION
- POWER SUBSTATION
- KOMA TELEVISION OR RADIO STATION
- MILITARY INSTALLATION





GENERAL HIGHWAY MAP
CADDO COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
1 ½ 0 1 2 3 4 5 MILES

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID; OKLAHOMA PLANE COORDINATE SYSTEM SOUTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 29,550

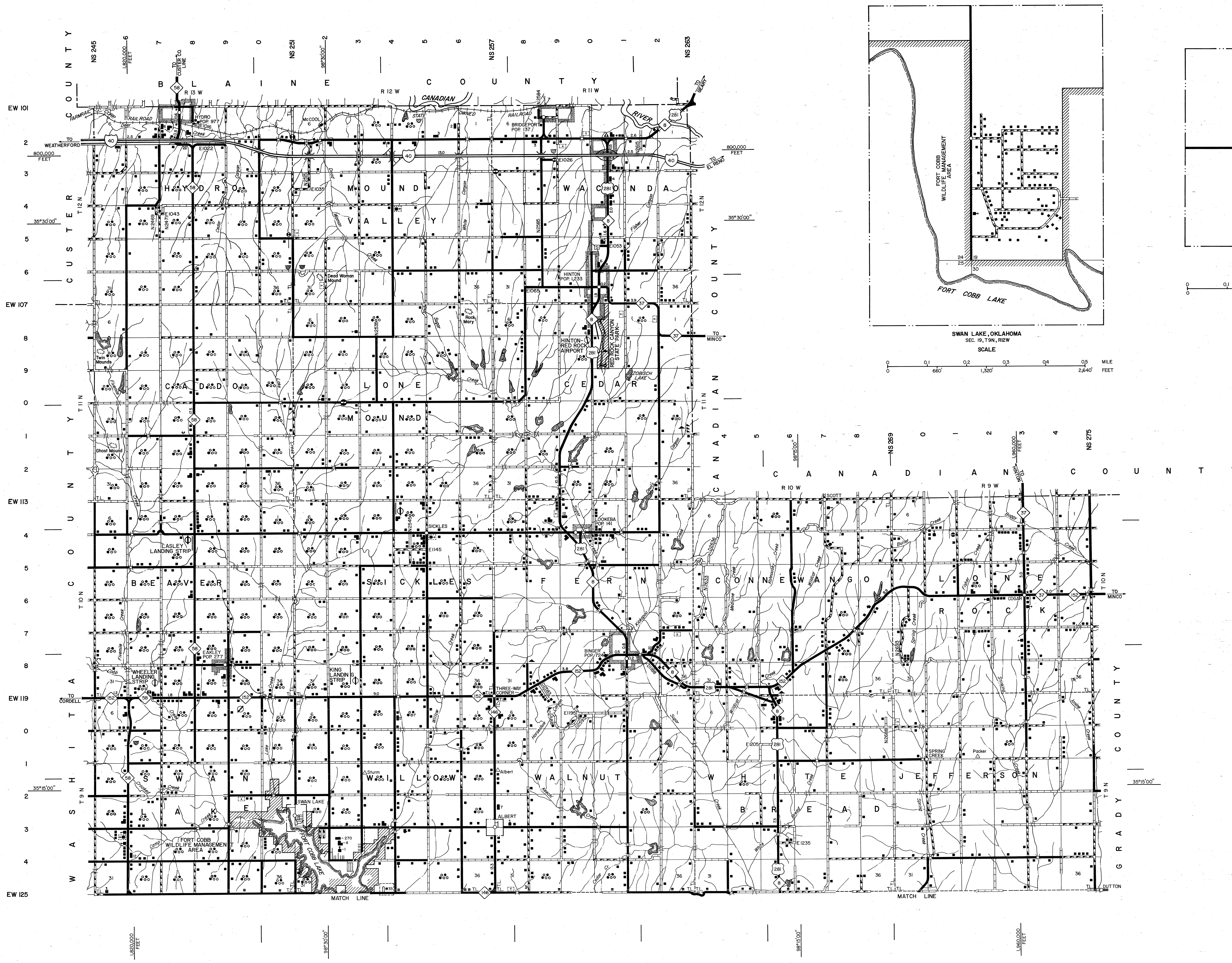
ALL DATA CURRENT TO
DATE OF INVENTORY
MAY, 1990

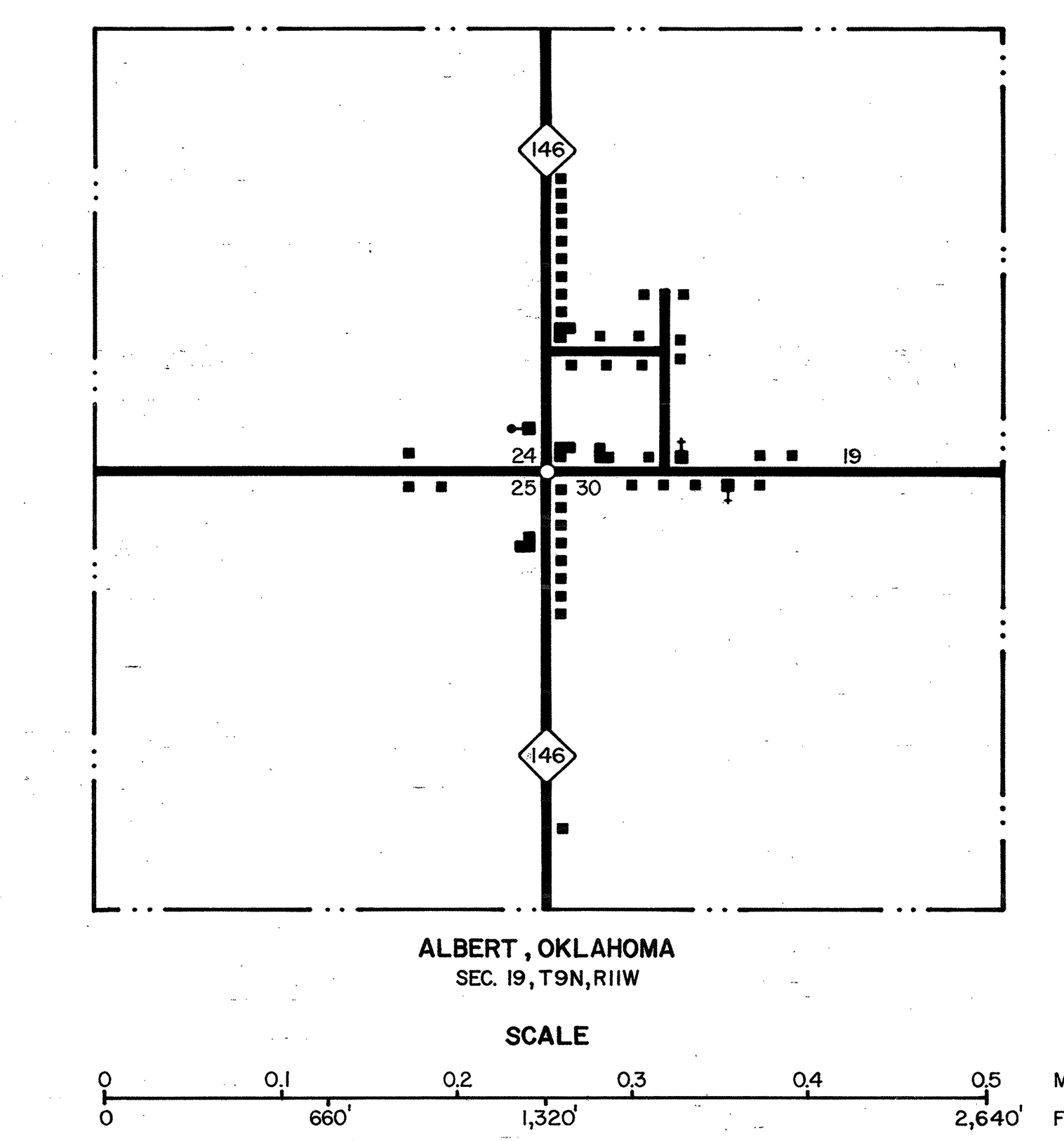
ORIGINAL DRAFTING BY L.R.K. DECEMBER 1991
STATE SYSTEM REVISED TO JANUARY 1992

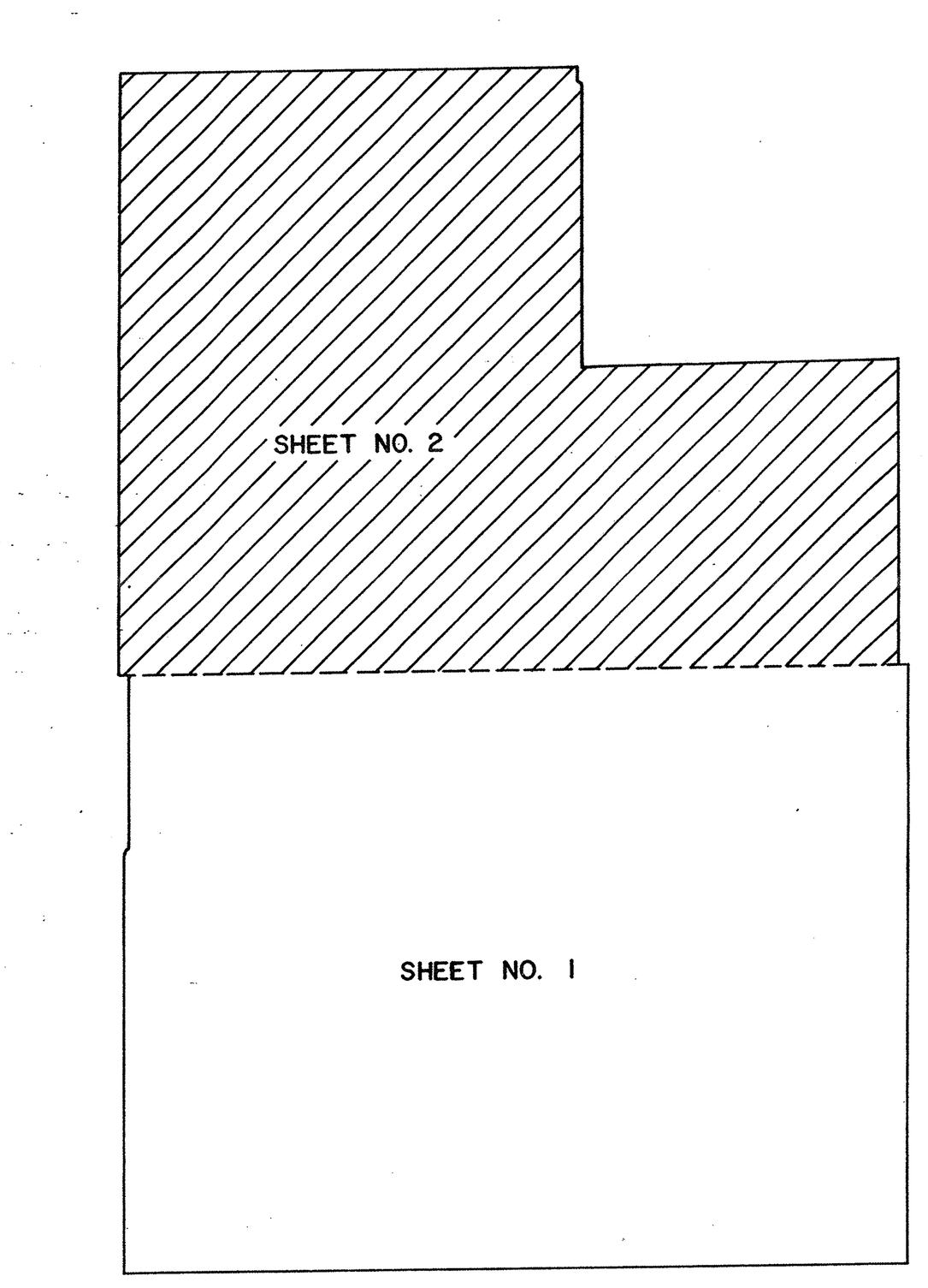
SHEET 1 OF 2 SHEETS

This map indicates those roads known to the Department to be open to public travel. Placement of a road on the map has no relationship to maintenance responsibility by any level of government.

Copies of this map are available for public use at nominal cost.
Address: OKLAHOMA DEPARTMENT OF TRANSPORTATION
REPRODUCTION BRANCH Phone (405) 521-2586
200 N.E. 21 st. STREET
OKLAHOMA CITY, OKLAHOMA 73105







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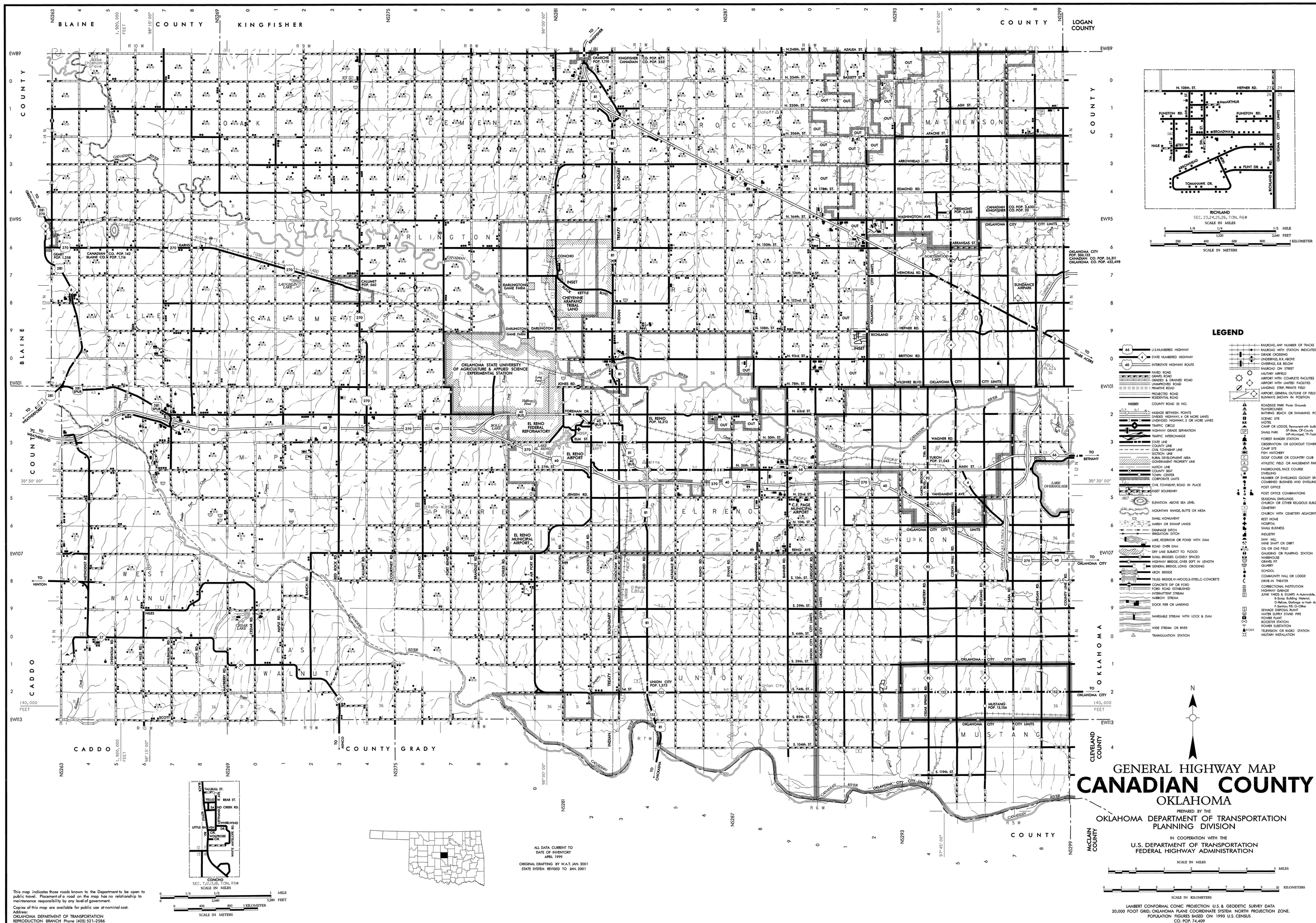
REPRODUCTION BRANCH Phone (405) 521-2586
200 N.E. 21 st. STREET
OKLAHOMA CITY, OKLAHOMA 73105

 SHEET 2 OF 2 SHEETS



RICHLAND
SEC. 23,24,25,26, T13N, R6W

SCALE IN MILES
0 1/8 1/4 1/2 MILE
0 1,320 2,640 FEET

0 200 400 600 800 1 KILOMETER
SCALE IN METERS

LEGEND

- U.S.NUMBERED HIGHWAY
- STATE NUMBERED HIGHWAY
- INTERSTATE HIGHWAY ROUTE
- PAVED ROAD
- GRAVEL ROAD
- GRADED & DRAINED ROAD
- UNIMPROVED ROAD
- PRIVATE ROAD
- PROJECTED ROAD
- RESIDENTIAL ROAD
- N0001 COUNTY ROAD ID NO.
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- IRRIGATION DITCH
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- GENERAL BRIDGE, LONG CROSSING
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- TRUSS BRIDGE,W-WOOD,S-STEEL,C-CONCRETE
- CONCRETE DIP OR FORD
- FORD ROAD ESTABLISHED
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- SP-State, CP-County
- SMALL PARK MP-Municipal, TP-Trailer Park
- FOREST RANGER STATION
- OBSERVATION OR LOOKOUT TOWER
- CAMP SITE
- FISH HATCHERY
- GOLF COURSE OR COUNTRY CLUB
- ATHLETIC FIELD OR AMUSEMENT PARK
- FAIRGROUNDS, RACE COURSE
- DWELLING
- NUMBER OF DWELLINGS CLOSELY SPACED
- COMBINED BUSINESS AND DWELLING
- POST OFFICE
- POST OFFICE COMBINATIONS
- SEASONAL DWELLINGS
- CHURCH OR OTHER RELIGIOUS BUILDING
- CEMETERY
- CHURCH WITH CEMETERY ADJACENT
- REST HOME
- HOSPITAL
- SMALL BUSINESS
- INDUSTRY
- SAW MILL
- MINE SHAFT OR DRIFT
- OIL OR GAS FIELD
- GAUGING OR PUMPING STATION
- WAREHOUSE
- GRAVEL PIT
- QUARRY
- SCHOOL
- COMMUNITY HALL OR LODGE
- DRIVE-IN THEATER
- CORRECTIONAL INSTITUTION
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- JUNK YARDS & DUMPS A-Automobile, S-Scrap Building Material, O-Refuse, Garbage or trash dump, T-Sanitary Fill, C-Other
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- WATER SUPPLY STAND PIPE
- POWER PLANT
- BOOSTER STATION
- POWER SUBSTATION
- TELEVISION OR RADIO STATION
- MILITARY INSTALLATION

CONCHO
SEC. 7,12,13,18, T13N, R9W
SCALE IN MILES
0 1/4 1/2 1 MILE
0 2,640 5,280 FEET
0 400 800 1 KILOMETER
SCALE IN METERS

ALL DATA CURRENT TO DATE OF INVENTORY APRIL 1999

ORIGINAL DRAFTING BY W.A.T. JAN. 2001
STATE SYSTEM REVISED TO JAN. 2001

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200 N.E. 21st STREET
OKLAHOMA CITY, OKLAHOMA 73105-3204

N

GENERAL HIGHWAY MAP
CANADIAN COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

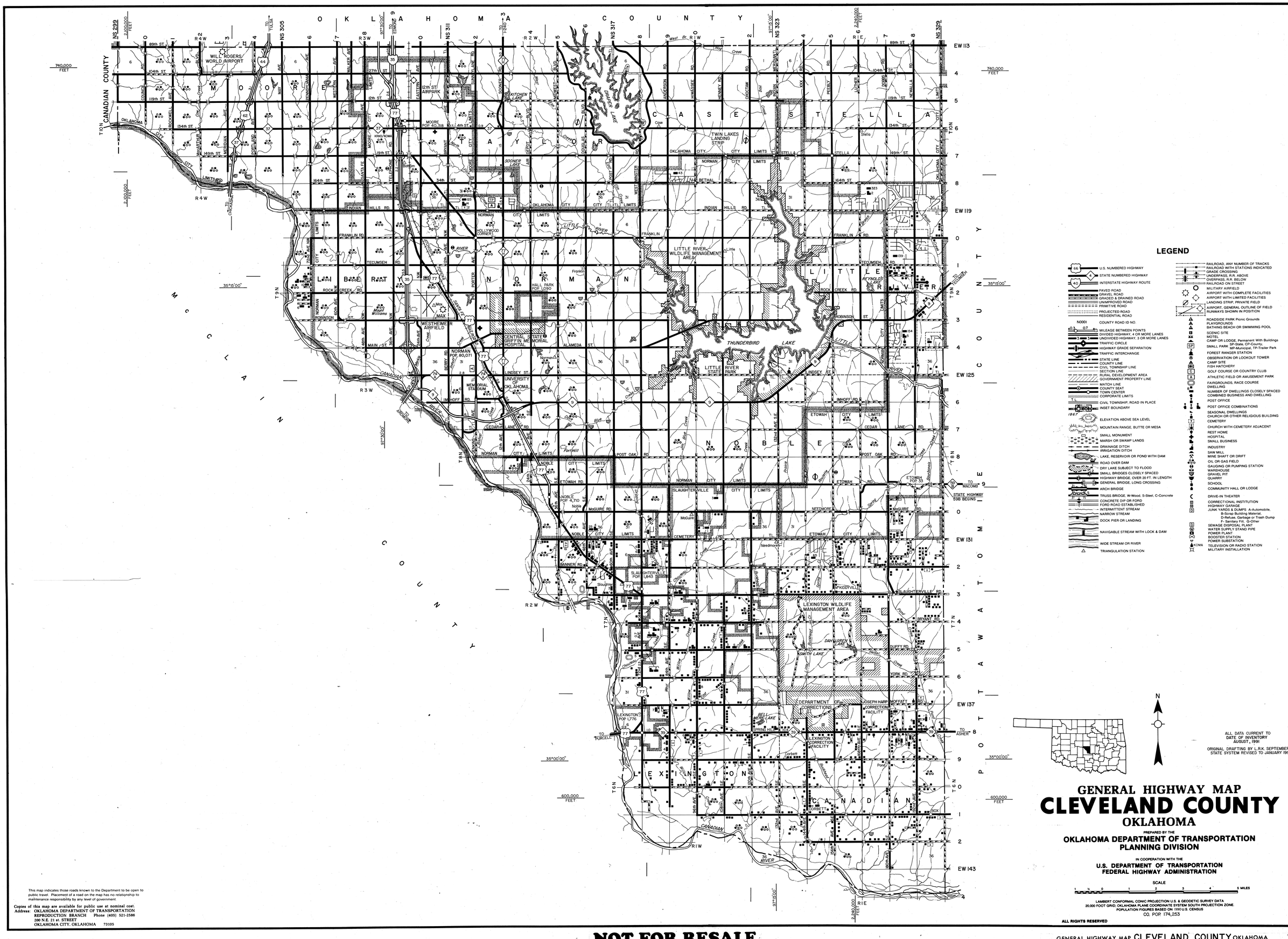
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE IN MILES
1 0 1 2 3 4 5 MILES

0 1 2 3 4 5 6 7 8 9 10 KILOMETERS
SCALE IN KILOMETERS

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID: OKLAHOMA PLANE COORDINATE SYSTEM NORTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 74,409

COMPUTER GENERATED



LEGEND

- U.S. NUMBERED HIGHWAY
- STATE NUMBERED HIGHWAY
- INTERSTATE HIGHWAY ROUTE
- PAVED ROAD
- GRAVEL ROAD
- GRADED & DRAINED ROAD
- UNIMPROVED ROAD
- PRIMITIVE ROAD
- PROJECTED ROAD
- RESIDENTIAL ROAD
- N0001 COUNTY ROAD ID NO.
- 03 07 MILEAGE BETWEEN POINTS
- DIVIDED HIGHWAY, 4 OR MORE LANES
- UNDIVIDED HIGHWAY, 3 OR MORE LANES
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- HIGHWAY GRADE SEPARATION
- TRAFFIC INTERCHANGE
- STATE LINE
- COUNTY LINE
- CIVIL TOWNSHIP LINE
- SECTION LINE
- RURAL DEVELOPMENT AREA
- GOVERNMENT PROPERTY LINE
- MATCH LINE
- COUNTY SEAT
- TOWN CENTER
- CORPORATE LIMITS
- TL CIVIL TOWNSHIP, ROAD IN PLACE
- INSET BOUNDARY
- 1867 ELEVATION ABOVE SEA LEVEL
- MOUNTAIN RANGE, BUTTE OR MESA
- SMALL MONUMENT
- MARSH OR SWAMP LANDS
- DRAINAGE DITCH
- IRRIGATION DITCH
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- ROAD OVER DAM
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- GENERAL BRIDGE, LONG CROSSING
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- TRUSS BRIDGE, W-Wood, S-Steel, C-Concrete
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- FORD ROAD ESTABLISHED
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- NARROW STREAM
- DOCK PIER OR LANDING
- NAVIGABLE STREAM WITH LOCK & DAM
- WIDE STREAM OR RIVER
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- RAILROAD WITH STATIONS INDICATED
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- AIRPORT WITH LIMITED FACILITIES
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- AIRPORT, GENERAL OUTLINE OF FIELD
- RUNWAYS SHOWN IN POSITION
- ROADSIDE PARK Picnic Grounds
- PLAYGROUNDS
- BATHING BEACH OR SWIMMING POOL
- SCENIC SITE
- MOTEL
- CAMP OR LODGE, Permanent With Buildings
- SP SMALL PARK SP-State, CP-County,
- MP-Municipal, TP-Trailer Park
- FOREST RANGER STATION
- OBSERVATION OR LOOKOUT TOWER
- CAMP SITE
- FH FISH HATCHERY
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- POWER SUBSTATION
- KOMA TELEVISION OR RADIO STATION
- MILITARY INSTALLATION

ALL DATA CURRENT TO DATE OF INVENTORY AUGUST, 1991

ORIGINAL DRAFTING BY L.R.K. SEPTEMBER 1992
STATE SYSTEM REVISED TO JANUARY 1993

GENERAL HIGHWAY MAP
CLEVELAND COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
1 ½ 0 1 2 3 4 5 MILES

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA.
20,000 FOOT GRID; OKLAHOMA PLANE COORDINATE SYSTEM SOUTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 174,253

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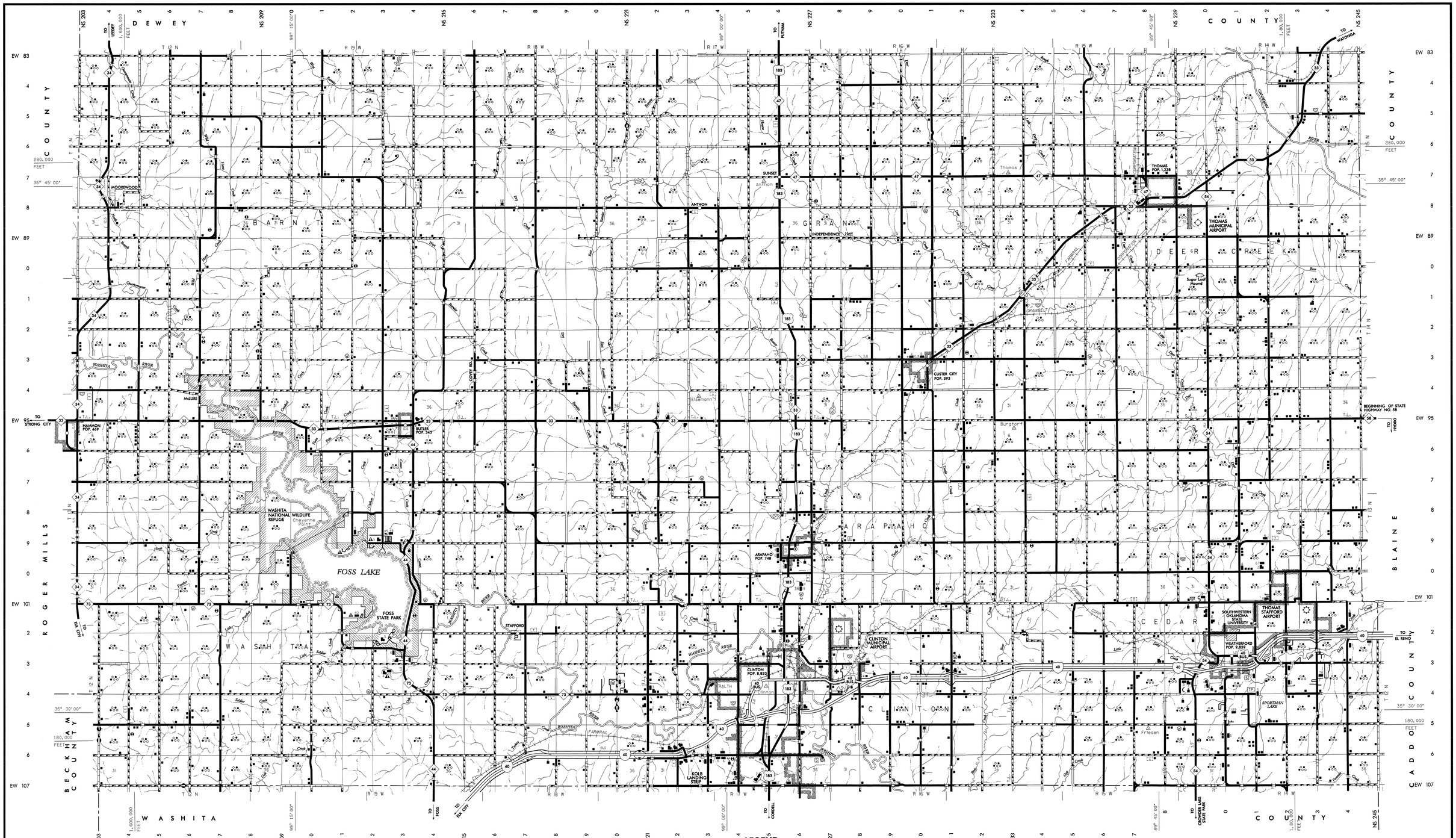
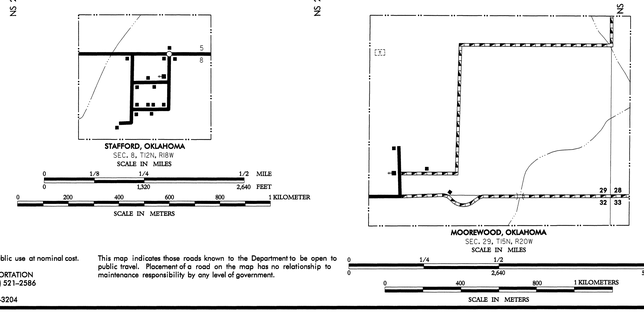
200 N.E. 21 st. STREET
OKLAHOMA CITY, OKLAHOMA 73105





LEGEND

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- STATE NUMBERED HIGHWAY
- INTERSTATE HIGHWAY ROUTE
- PAVED ROAD
- GRAVEL ROAD
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- PROJECTED ROAD
- RESIDENTIAL ROAD
- COUNTY ROAD ID NO.
- MILEAGE BETWEEN POINTS
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- HIGHWAY GRADE SEPARATION
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- TOWN CENTER
- CORPORATE LIMITS
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- INSET BOUNDARY

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- OVERPASS, R.R. BELOW
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- POST OFFICE COMBINATIONS

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- MILITARY INSTALLATION

ALL DATA CURRENT TO DATE OF INVENTORY JANUARY, 2000

ORIGINAL DRAFTING BY W.A.T. AUGUST 2001
STATE SYSTEM REVISED TO AUGUST 2001

N

SCALE IN MILES
0 1 2 3 4 5 MILES
0 1 2 3 4 5 6 7 8 9 10 KILOMETERS
SCALE IN KILOMETERS

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID; OKLAHOMA PLANE COORDINATE SYSTEM NORTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 2000 U.S. CENSUS
CO. POP. 26,142

GENERAL HIGHWAY MAP
CUSTER COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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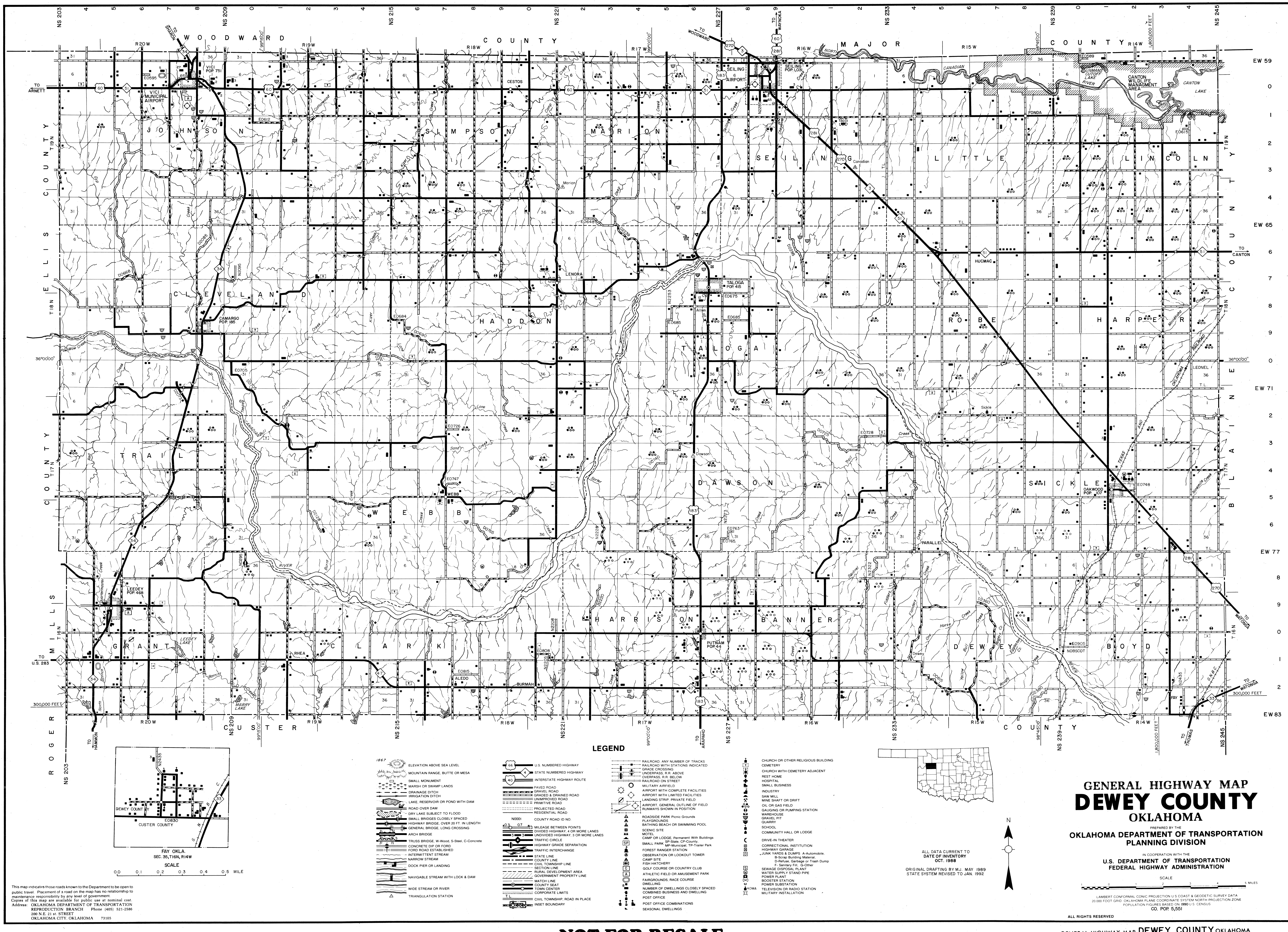

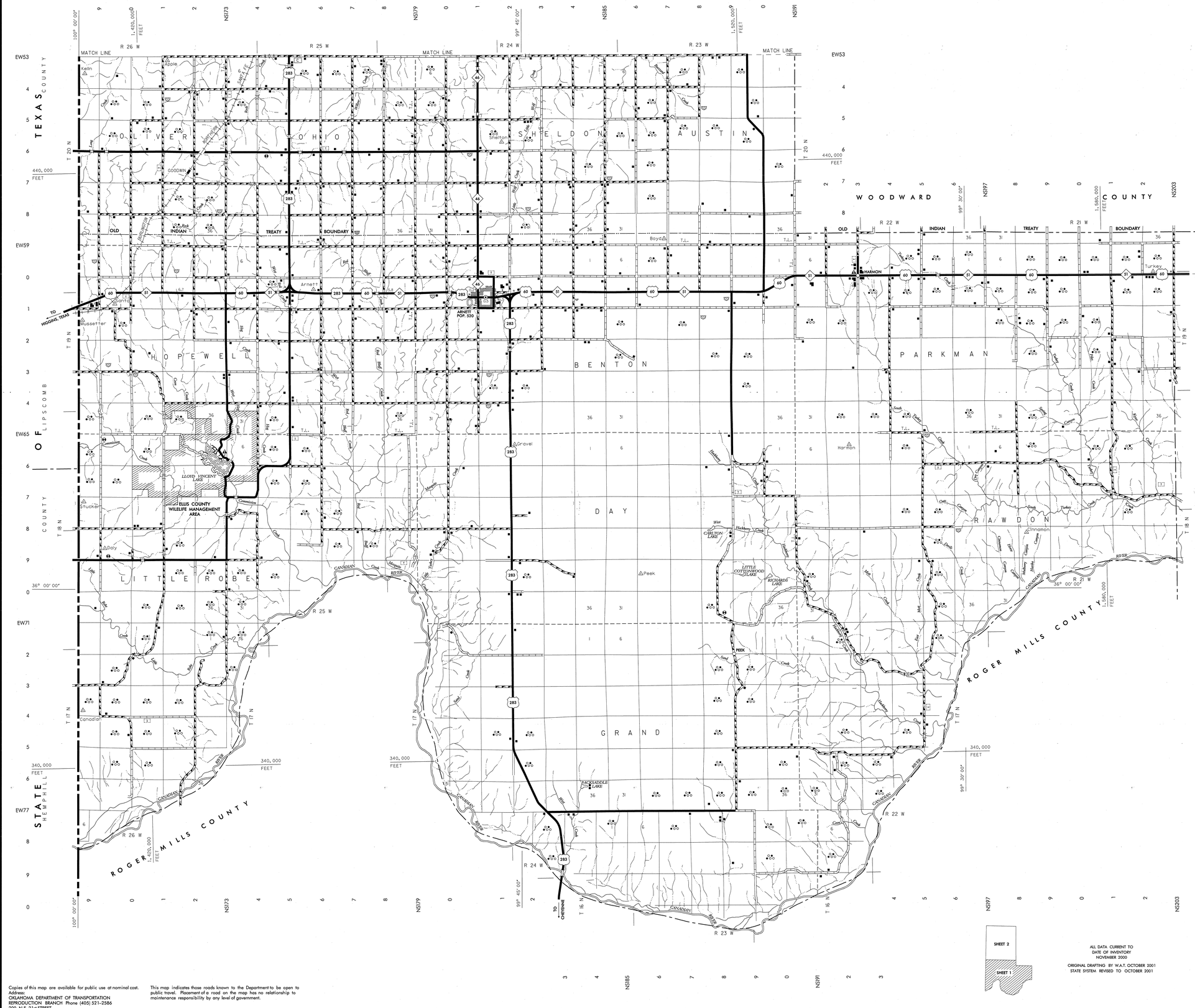

LEGEND

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- POWER SUBSTATION
- KOMA TELEVISION OR RADIO STATION
- MILITARY INSTALLATION

SHEET 2
SHEET 1

ALL DATA CURRENT TO DATE OF INVENTORY NOVEMBER 2000

ORIGINAL DRAFTING BY W.A.T. OCTOBER 2001
STATE SYSTEM REVISED TO OCTOBER 2001

GENERAL HIGHWAY MAP
ELLIS COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE IN MILES
1 0 1 2 3 4 5 MILES

0 1 2 3 4 5 6 7 8 9 10 KILOMETERS
SCALE IN KILOMETERS

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID: OKLAHOMA PLANE COORDINATE SYSTEM NORTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 2000 U.S. CENSUS
CO. POP. 4,075

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OKLAHOMA CITY, OKLAHOMA 73105-3204

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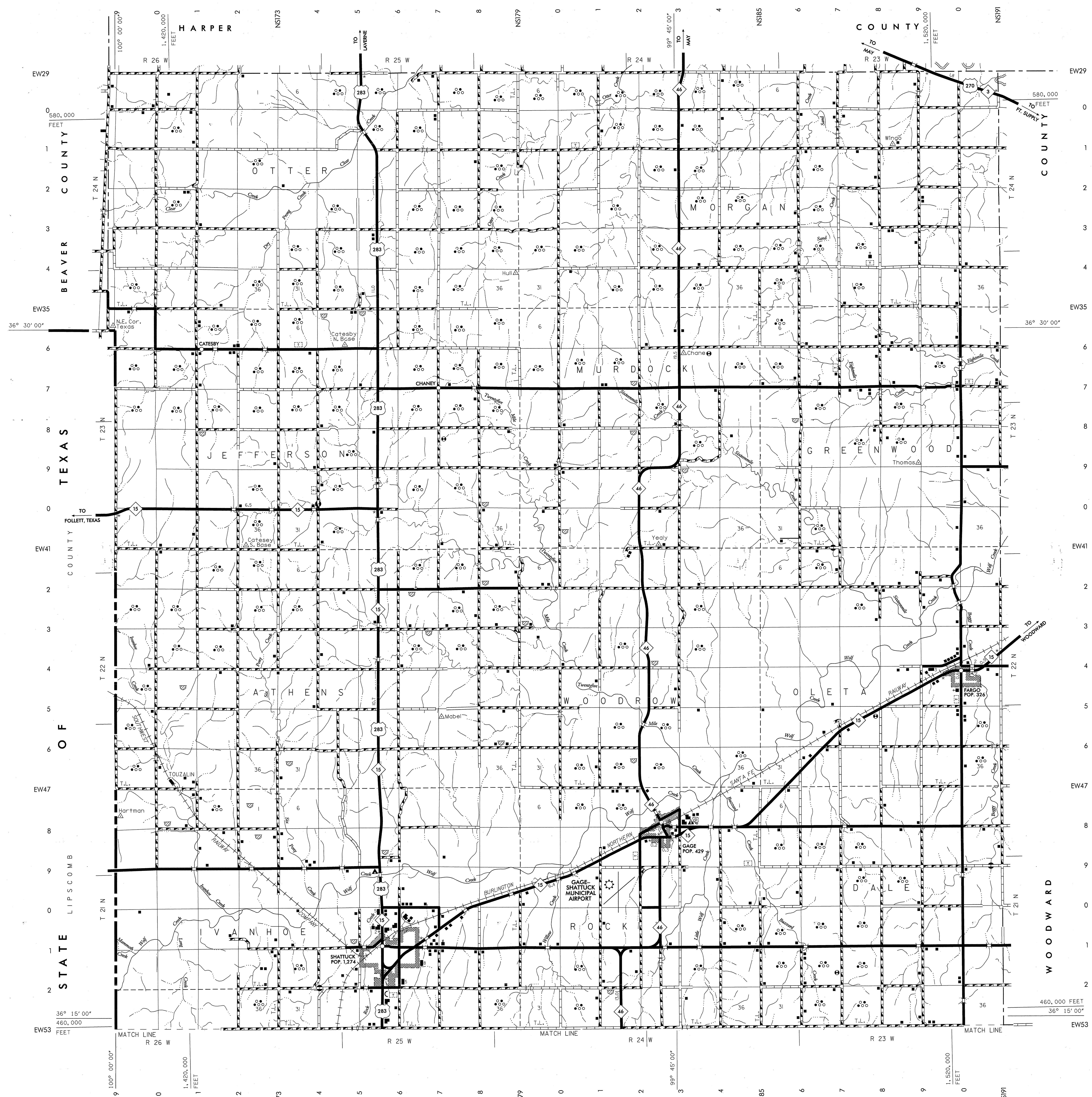
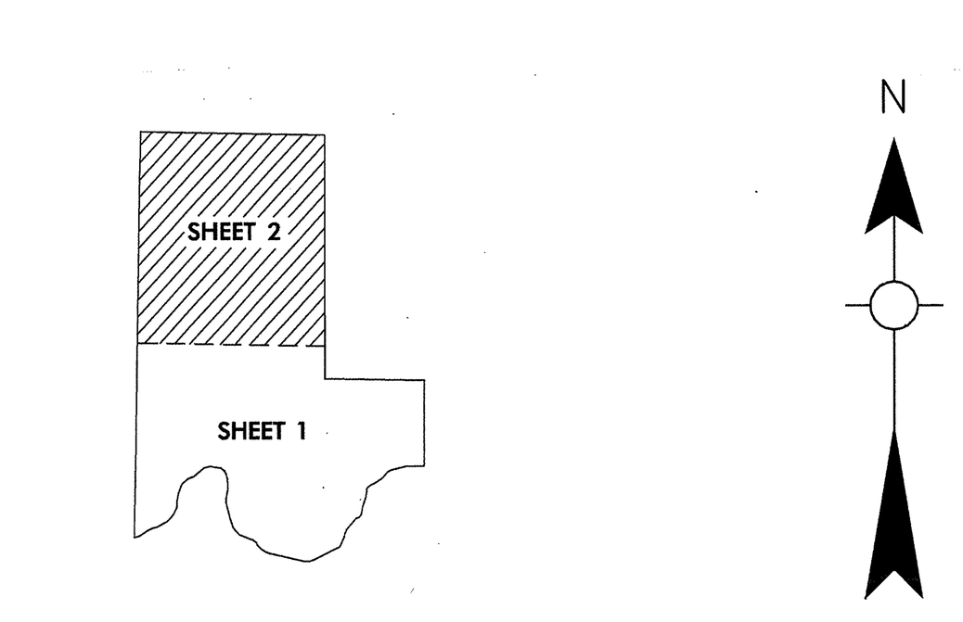
SHEET 1 OF 2 SHEETS

COMPUTER GENERATED





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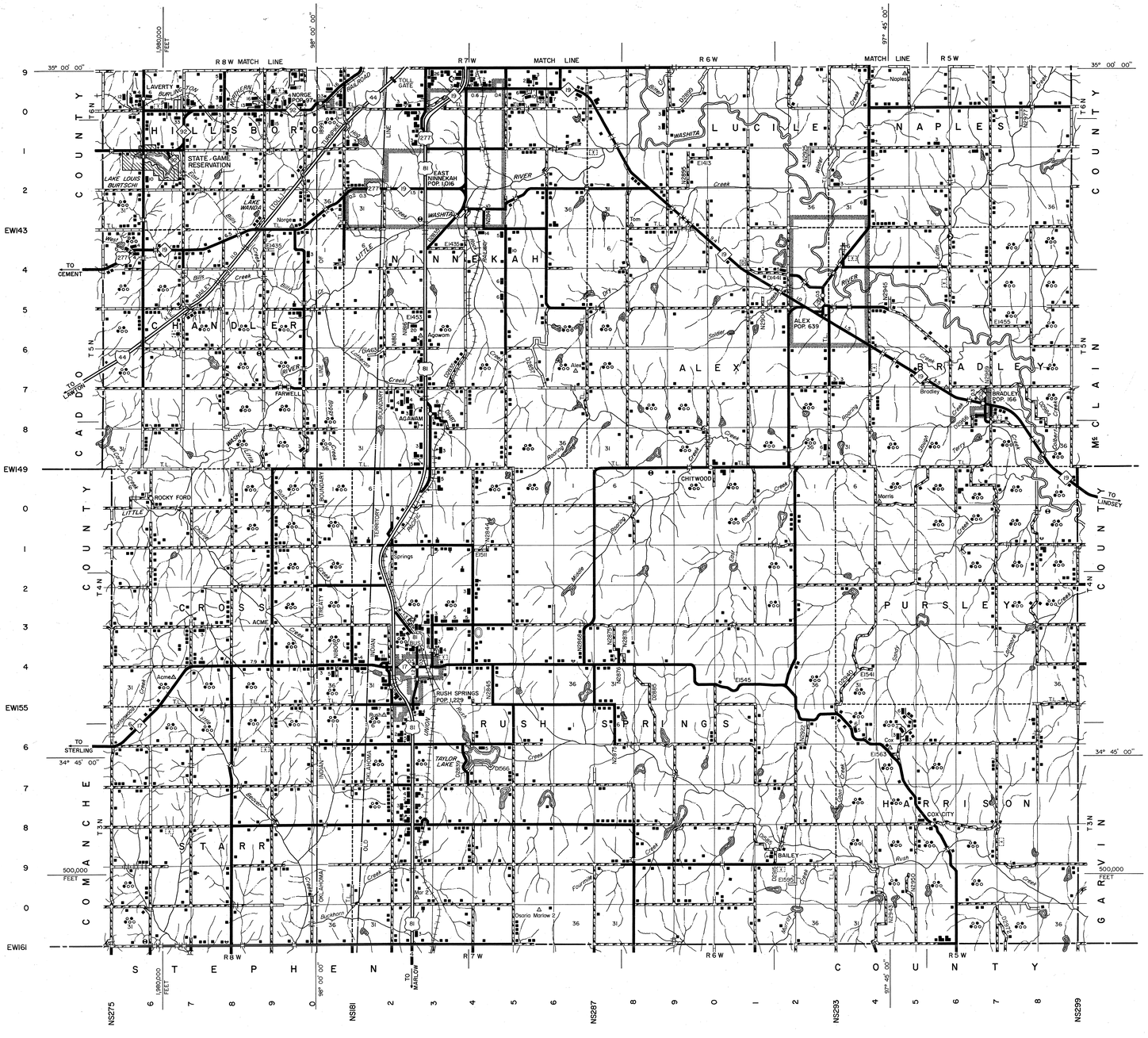
SHEET 2 OF 2 SHEETS

COMPUTER GENERATED



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- MILITARY INSTALLATION

N

SHEET 2
SHEET 1

ALL DATA CURRENT TO
DATE OF INVENTORY
SEPT. 1989

ORIGINAL DRAFTING BY W.T. JULY 1991
STATE SYSTEM REVISED TO JAN. 1992

SHEET 1 OF 2 SHEETS

GENERAL HIGHWAY MAP
GRADY COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
1 ½ 0 1 2 3 4 5 MILES

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID: OKLAHOMA PLANE COORDINATE SYSTEM SOUTH PROJECTION ZONE
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 41,747

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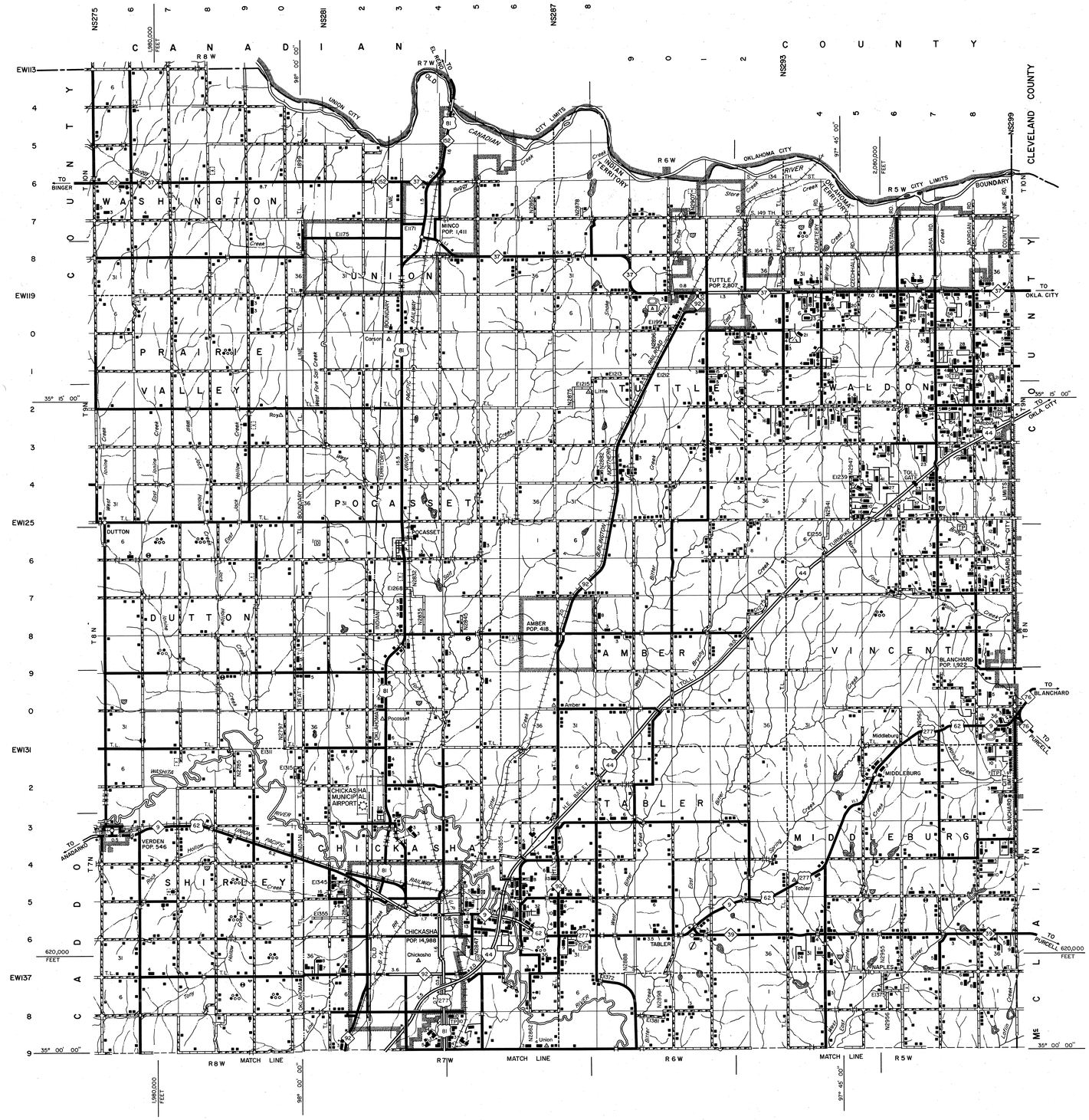
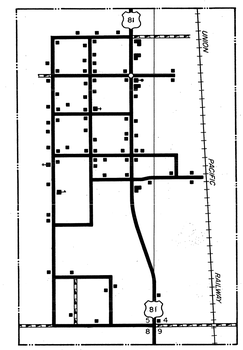
OKLAHOMA CITY, OKLAHOMA 73105





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SHEET 2 OF 2 SHEETS REV. MAY 1998

LEGEND

- U.S.NUMBERED HIGHWAY
- STATE NUMBERED HIGHWAY
- INTERSTATE HIGHWAY ROUTE
- PAVED ROAD
- GRAVEL ROAD
- GRADED & DRAINED ROAD
- UNIMPROVED ROAD
- PRIMITIVE ROAD
- PROJECTED ROAD
- RESIDENTIAL ROAD
- COUNTY ROAD ID NO.
- MILEAGE BETWEEN POINTS
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- UNDIVIDED HIGHWAY, 3 OR MORE LANES
- TRAFFIC CIRCLE
- HIGHWAY GRADE SEPARATION
- TRAFFIC INTERCHANGE
- STATE LINE
- COUNTY LINE
- CIVIL TOWNSHIP LINE
- SECTION LINE
- RURAL DEVELOPMENT AREA
- GOVERNMENT PROPERTY LINE
- MATCH LINE
- COUNTY SEAT
- TOWN CENTER
- CORPORATE LIMITS
- CIVIL TOWNSHIP, ROAD IN PLACE
- INSET BOUNDARY

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- DWELLING
- NUMBER OF DWELLINGS CLOSELY SPACED
- COMBINED BUSINESS AND DWELLING
- POST OFFICE
- POST OFFICE COMBINATIONS

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- CHURCH WITH CEMETERY ADJACENT
- REST HOME
- HOSPITAL
- SMALL BUSINESS
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- SAW MILL
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- HIGHWAY GARAGE
- JUNK YARDS & DUMPS A–Automobile, B–Scrap Building Material, D–Refuse, Garbage or trash dump, F–Sanitary Fill, G–Other
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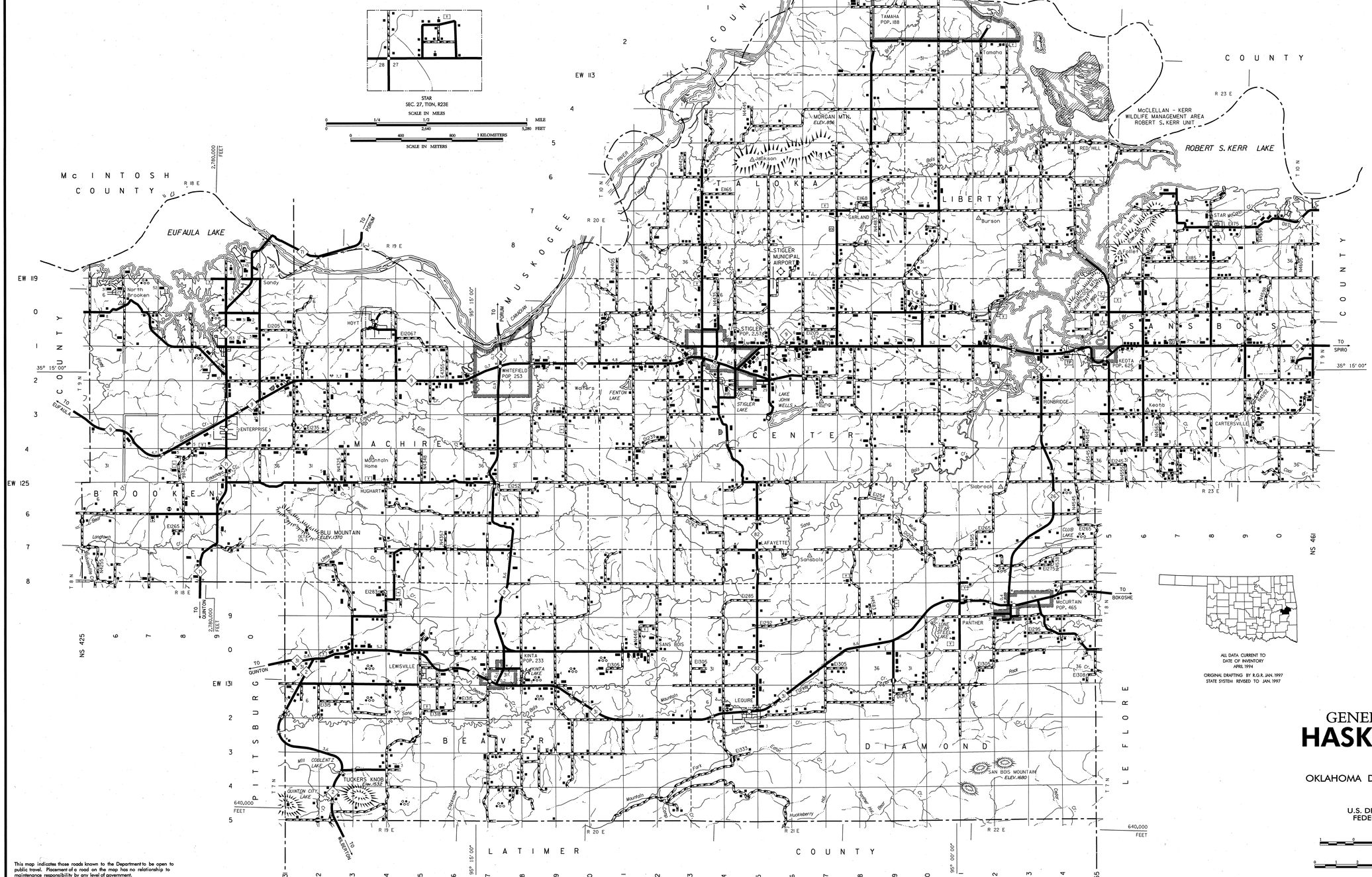

STAR
SEC. 27, T10N, R23E

LEQUIRE
SEC. 5, T7N, R21E

LEWISVILLE
SEC. 35, T8N, R19E

ENTERPRISE
SEC. 26,27 T8N, R19E

HOYT
SEC. 9, T9N, R19E

GENERAL HIGHWAY MAP
HASKELL COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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HUGHES
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NOT FOR RESALE
GENERAL HIGHWAY MAP
HUGHES COUNTY
OKLAHOMA
32
ALL RIGHTS RESERVED
COMPUTER GENERATED
OKFUSKEE COUNTY
McINTOSH COUNTY
SEMINOLE COUNTY
PONTOTOC COUNTY
PITTSBURG COUNTY
COAL COUNTY
TO OKEMAH
TO WELEEKA
TO EUFAULA
TO SEMINOLE
TO WEWOKA
TO ADA
TO McALESTER
TO ASHLAND
TO COALGATE
WETUMKA POP. 1,427
DUSTIN POP. 429
YEAGER POP. 40
HOLDENVILLE POP. 4,792
HOLDENVILLE MUNICIPAL AIRPORT
LAMAR POP. 97
HORNTOWN
CROSS ROADS
CALVIN POP. 251
STUART POP. 228
ALLEN POP. 972 HUGHES CO. 112 PONTOTOC CO. 860
GERTY POP. 95
ATWOOD
SPAULDING
CARSON
LAKE WETUMKA
LAKE HOLDENVILLE
DUSTIN LAKE
BROOKS LAKE
YEAGER
WETUMKA
DUSTIN
JACOBS
BARNARD
BILBY
CALVIN
STUART
NEWBURG
ATWOOD
SEC. 27 & 34, T 6 N, R 9 E
SCALE IN MILES
SCALE IN METERS
LEGEND
U.S.NUMBERED HIGHWAY
STATE NUMBERED HIGHWAY
INTERSTATE HIGHWAY ROUTE
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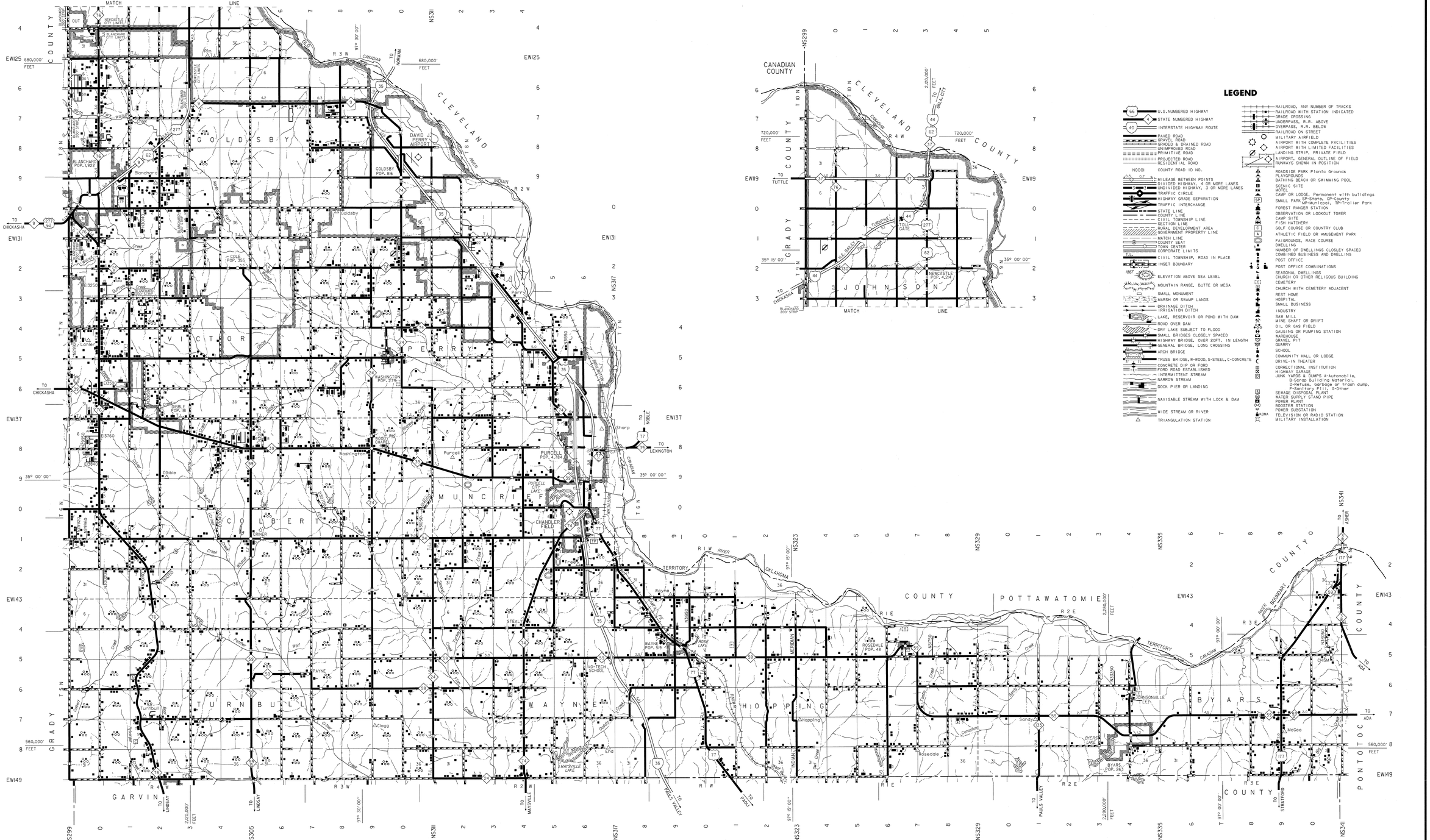
MILITARY INSTALLATION
ALL DATA CURRENT TO DATE OF INVENTORY APRIL 1995
ORIGINAL DRAFTING BY R.G.R. JAN. 1996
STATE SYSTEM REVISED TO MARCH 1998
GENERAL HIGHWAY MAP
HUGHES COUNTY
OKLAHOMA
PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
SCALE IN MILES
SCALE IN KILOMETERS
LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID; OKLAHOMA PLANE COORDINATE SYSTEM SOUTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 13,023



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OKLAHOMA CITY, OKLAHOMA 73105-3204

ALL DATA CURRENT TO DATE OF INVENTORY MAY 1996

ORIGINAL DRAFTING BY W.A.T. SEPT. 1996
STATE SYSTEM REVISED TO SEPT. 2000

N

GENERAL HIGHWAY MAP
McCLAIN COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
1 0 0.5 0 1 2 3 4 5 MILES

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID-OKLAHOMA PLANE COORDINATE SYSTEM SOUTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 22,795

COMPUTER GENERATED

LEGEND

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- UNIMPROVED ROAD
- PRIMITIVE ROAD
- PROJECTED ROAD
- RESIDENTIAL ROAD
- N0001 COUNTY ROAD ID NO.
- 0.3 0.7 MILEAGE BETWEEN POINTS
- DIVIDED HIGHWAY, 4 OR MORE LANES
- UNDIVIDED HIGHWAY, 3 OR MORE LANES
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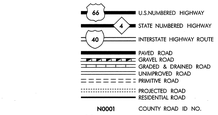

ALL DATA CURRENT TO DATE OF INVENTORY NOVEMBER 1999

ORIGINAL DRAFTING BY M.L.B. MAY 2000
STATE SYSTEM REVISED TO NOVEMBER 1999

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SCALE IN MILES 0 1/8 1/4 1/2 MILE; 0 1,320 2,640 FEET
SCALE IN METERS 0 200 400 600 800 1 KILOMETER

ONAPA, OKLAHOMA
SEC. 19, 30, T1IN, R17E

VERNON, OKLAHOMA
SEC 33, 34, T9 N, R13E

GENERAL HIGHWAY MAP
McINTOSH COUNTY
OKLAHOMA

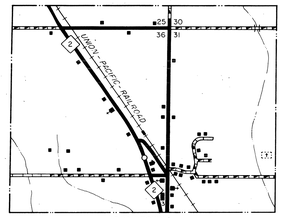
PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

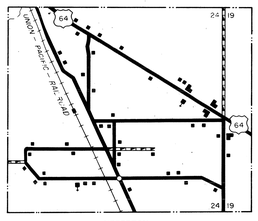
SCALE IN MILES 0 1 2 3 4 5 MILES
SCALE IN KILOMETERS 0 1 2 3 4 5 6 7 8 9 10 KILOMETERS

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID; OKLAHOMA PLANE COORDINATE SYSTEM. NORTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 16,779

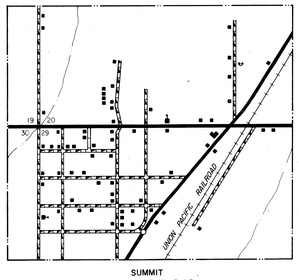
COMPUTER GENERATED



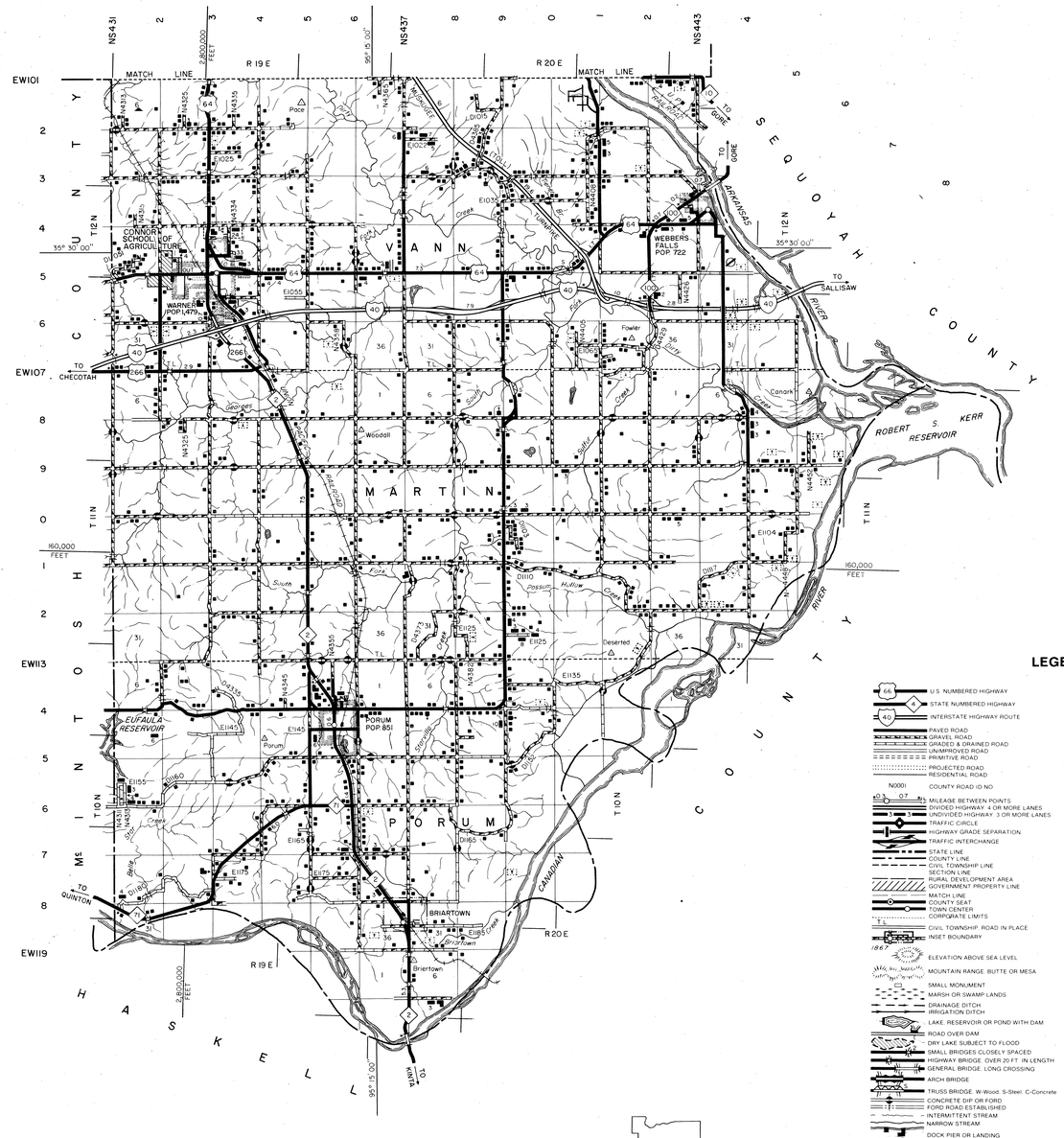
BRAIRTOWN
SEC. 36,31, T10N, R19E
SCALE
0.0 0.1 0.2 0.3 0.4 0.5 MILE
0 1,320' 2,640 FEET



KEEFETON
SEC. 24, T13N, R18E
SCALE
0.0 0.1 0.2 0.3 0.4 0.5 MILE
0 500' 1,320' 2,640 FEET



SUMMIT
SEC. 20,29, T14N, R18E
SCALE
0.0 0.1 0.2 0.3 0.4 0.5 MILE
0 500' 1,320' 2,640 FEET



ALL DATA CURRENT TO
DATE OF INVENTORY
OCT. 1985

ORIGINAL DRAFTING BY W.T. DEC 1986
STATE SYSTEM REVISED TO JAN. 1992

LEGEND

- U.S. NUMBERED HIGHWAY
- STATE NUMBERED HIGHWAY
- INTERSTATE HIGHWAY ROUTE
- PAVED ROAD
- GRAVEL ROAD
- GRADED & DRAINED ROAD
- UNIMPROVED ROAD
- PRIMITIVE ROAD
- PROJECTED ROAD
- RESIDENTIAL ROAD
- N0001 COUNTY ROAD ID NO.
- MILEAGE BETWEEN POINTS
- DIVIDED HIGHWAY, 4 OR MORE LANES
- UNDIVIDED HIGHWAY, 3 OR MORE LANES
- TRAFFIC CIRCLE
- HIGHWAY GRADE SEPARATION
- TRAFFIC INTERCHANGE
- STATE LINE
- COUNTY LINE
- CIVIL TOWNSHIP LINE
- SECTION LINE
- RURAL DEVELOPMENT AREA
- GOVERNMENT PROPERTY LINE
- MATCH LINE
- COUNTY SEAT
- TOWN CENTER
- CORPORATE LIMITS
- T.L. CIVIL TOWNSHIP, ROAD IN PLACE
- INSET BOUNDARY
- (1850) ELEVATION ABOVE SEA LEVEL
- MOUNTAIN, RANGE, BUTTE OR MESA
- SMALL MONUMENT
- MARSH OR SWAMP LANDS
- DRAINAGE DITCH
- IRRIGATION DITCH
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- POWER PLANT
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- POWER SUBSTATION
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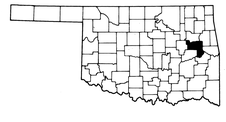
- MILITARY INSTALLATION

N



GENERAL HIGHWAY MAP
MUSKOGEE COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
0 1 2 3 4 5 MILES

LAMBERT CONFORMAL CONIC PROJECTION U.S COAST & GEODETIC SURVEY DATA
20,000 FOOT GRID, OKLAHOMA PLANE COORDINATE SYSTEM NORTH PROJECTION ZONE
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 68,078

This map indicates those roads known to the Department to be open to public travel. Placement of a road on the map has no relationship to maintenance responsibility by any level of government.

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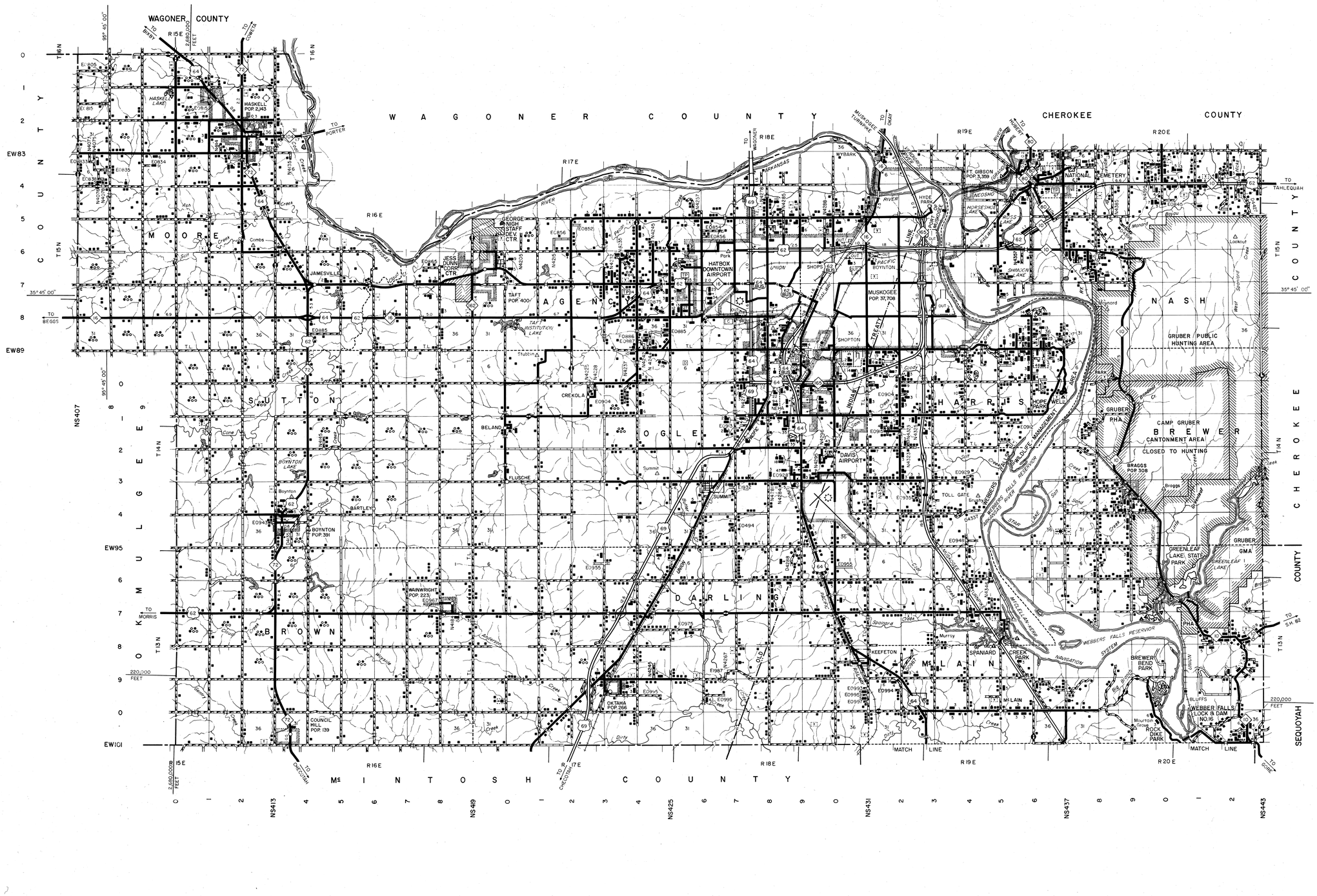
REPRODUCTION BRANCH Phone (405) 521-2586
200 N.E. 21 st. STREET
OKLAHOMA CITY, OKLAHOMA 73105

SHEET 1 OF 2 SHEETS



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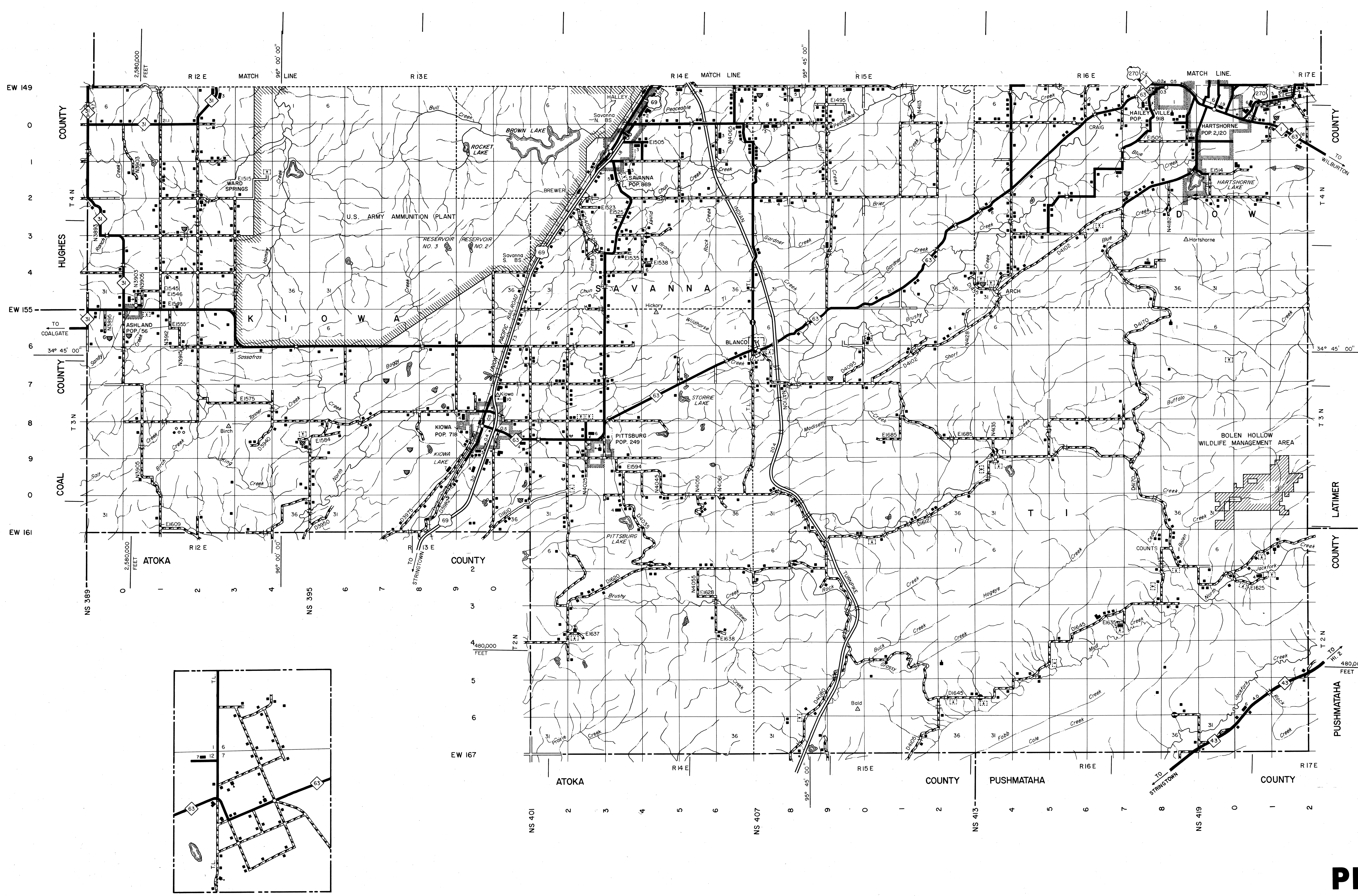
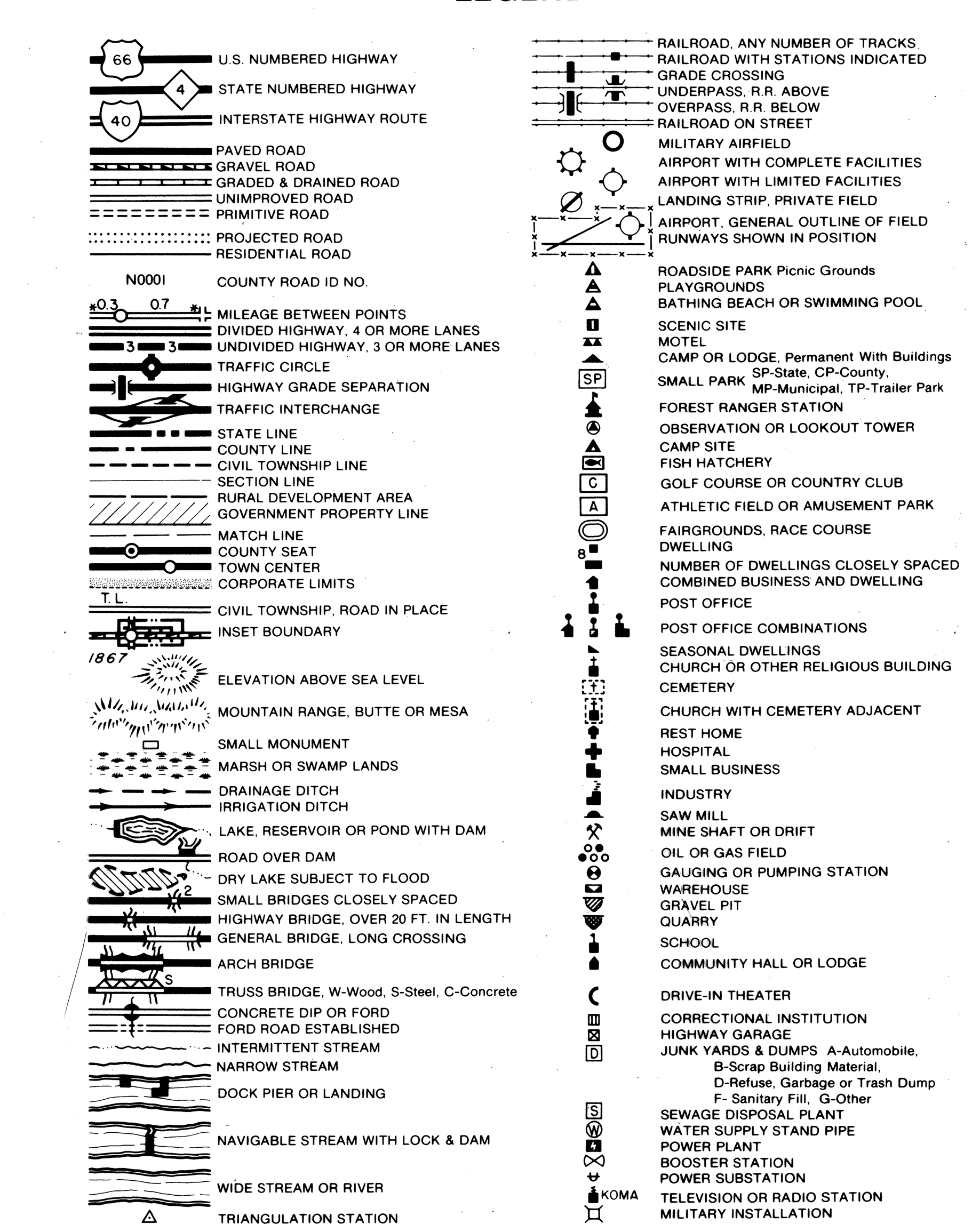
OKLAHOMA CITY, OKLAHOMA 73105

SHEET 2 OF 2 SHEETS

MUSKOGEE CO. NO. 2



LEGEND



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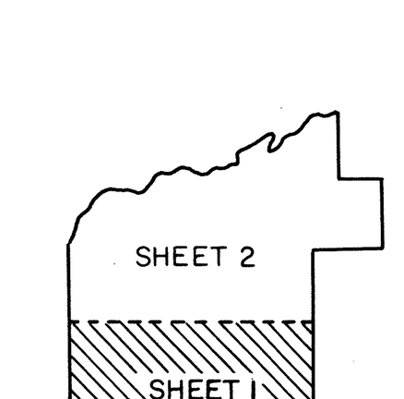
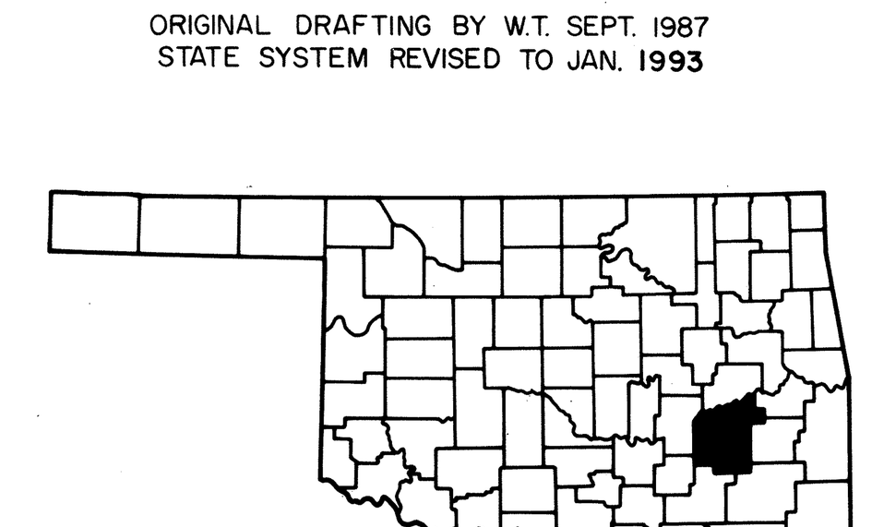
OKLAHOMA CITY, OKLAHOMA 73105

ALL DATA CURRENT TO
DATE OF INVENTORY
JAN. 1987

ORIGINAL DRAFTING BY W.T. SEPT. 1987
STATE SYSTEM REVISED TO JAN. 1993





GENERAL HIGHWAY MAP
PITTSBURG COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

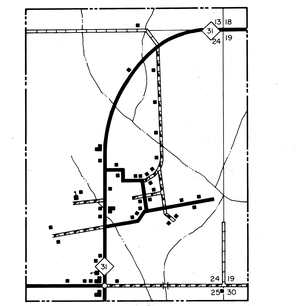
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

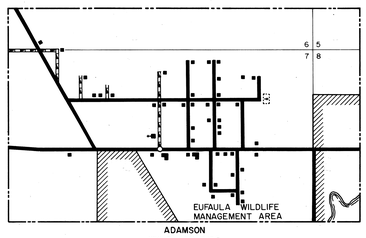
SCALE
1 ½ 0 1 2 3 4 5 MILES

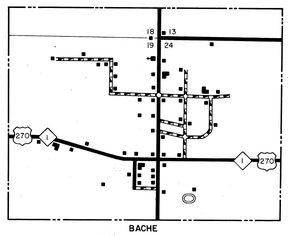
LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID: OKLAHOMA PLANE COORDINATE SYSTEM SOUTH PROJECTION ZONE
POPULATION FIGURES BASED ON 1990 U.S. CENSUS

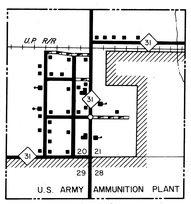
CO. POP. 40,581

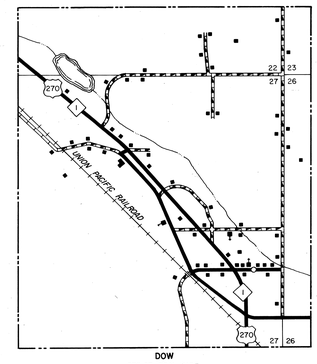
SHEET 1 OF 2 SHEETS

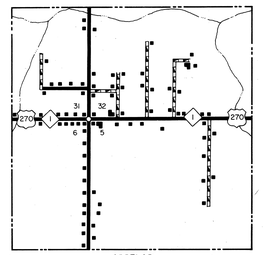












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OKLAHOMA CITY, OKLAHOMA 73105

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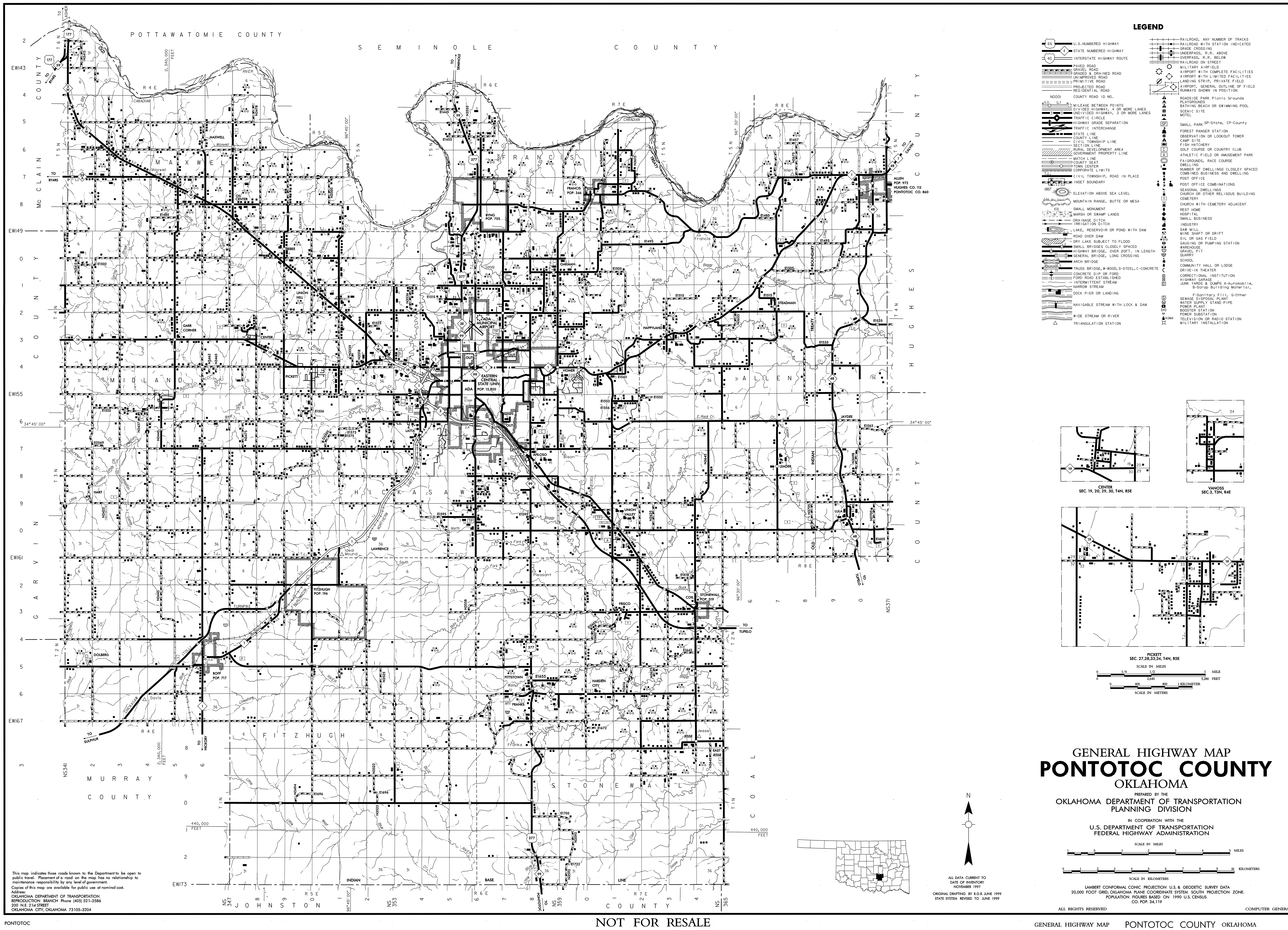
SHEET 2 OF 2 SHEETS

NOT FOR RESALE



GENERAL HIGHWAY MAP
PONTOTOC COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE IN MILES

SCALE IN KILOMETERS

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID; OKLAHOMA PLANE COORIDINATE SYSTEM SOUTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 34,119

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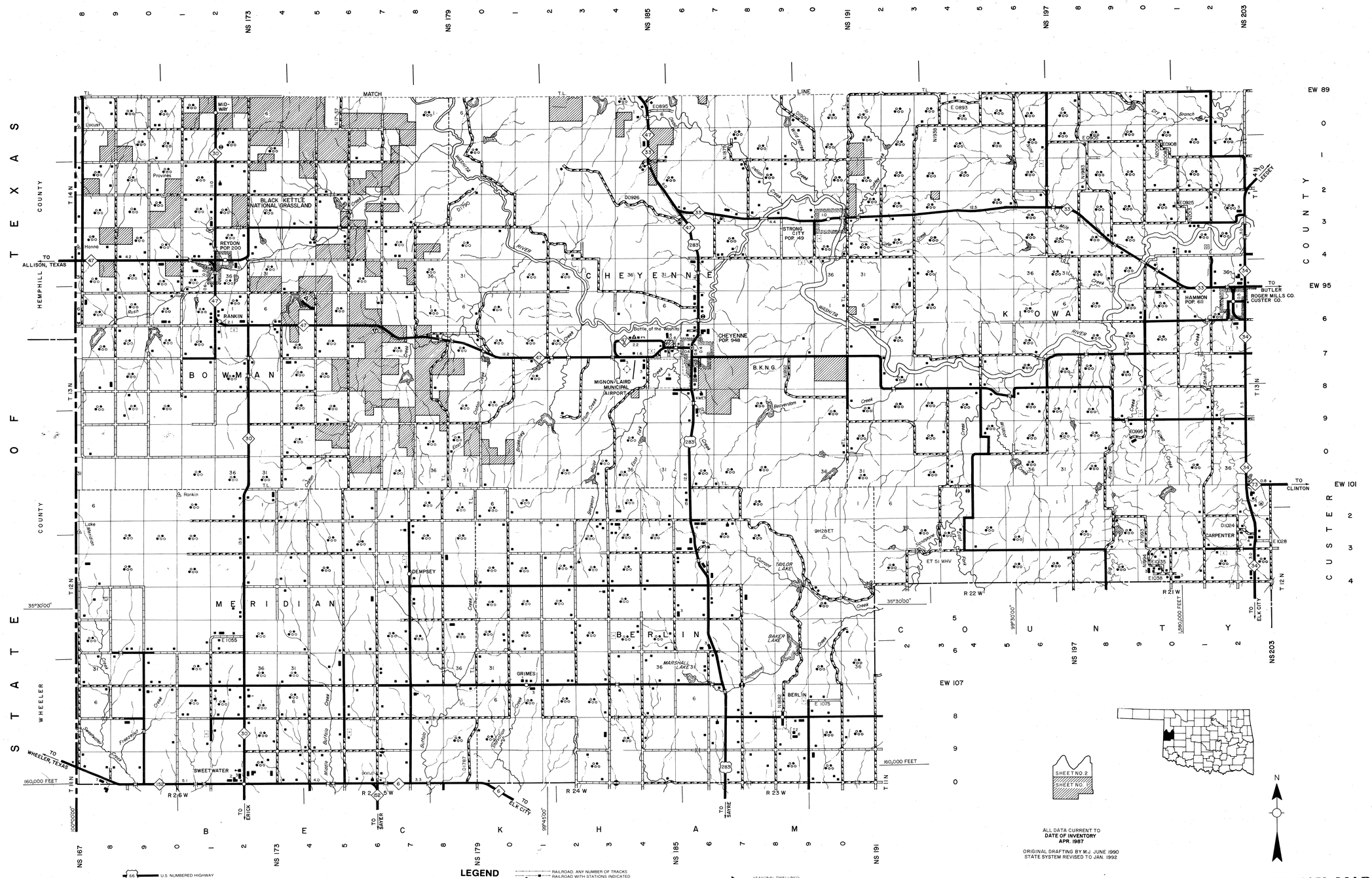
OKLAHOMA CITY, OKLAHOMA 73105-3204

COMPUTER GENERATED


GENERAL HIGHWAY MAP
POTTAWATOMIE COUNTY
OKLAHOMA
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
LEGEND
NOT FOR RESALE
GENERAL HIGHWAY MAP POTTAWATOMIE COUNTY OKLAHOMA
63
ALL RIGHTS RESERVED
PLEASE NOTICE:
LINCOLN COUNTY
OKFUSKEE COUNTY
SEMINOLE COUNTY
PONTOTOC COUNTY
McCLAIN
CLEVELAND COUNTY
OKLAHOMA COUNTY
SHAWNEE POP. 26,017
TECUMSEH POP. 5,750
McLOUD
DALE
BETHEL ACRES POP. 2,505
EARLSBORO POP. 535
BROOKSVILLE POP. 69
MACOMB POP. 61
ASHER POP. 449
WANETTE POP. 346
ST. LOUIS POP. 181
JOHNSON POP. 196
MAUD POP. 1,204
TRIBBEY
WANETTE
KONAWA
SEMINOLE
CROMWELL
NORMAN
LEXINGTON
DALE
SCALE
CO. POP. 58,760



LEGEND

- U.S. NUMBERED HIGHWAY
- STATE NUMBERED HIGHWAY
- INTERSTATE HIGHWAY ROUTE
- PAVED ROAD
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- GRADED & DRAINED ROAD
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- COUNTY SEAT
- TOWN CENTER
- CORPORATE LIMITS
- CIVIL TOWNSHIP, ROAD IN PLACE
- INSET BOUNDARY

- ELEVATION ABOVE SEA LEVEL
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- MILITARY INSTALLATION

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SHEET NO. 2
SHEET NO. 1

ALL DATA CURRENT TO
DATE OF INVENTORY
APR. 1987

ORIGINAL DRAFTING BY M.J. JUNE 1990
STATE SYSTEM REVISED TO JAN. 1992

N

GENERAL HIGHWAY MAP
ROGER MILLS COUNTY
OKLAHOMA

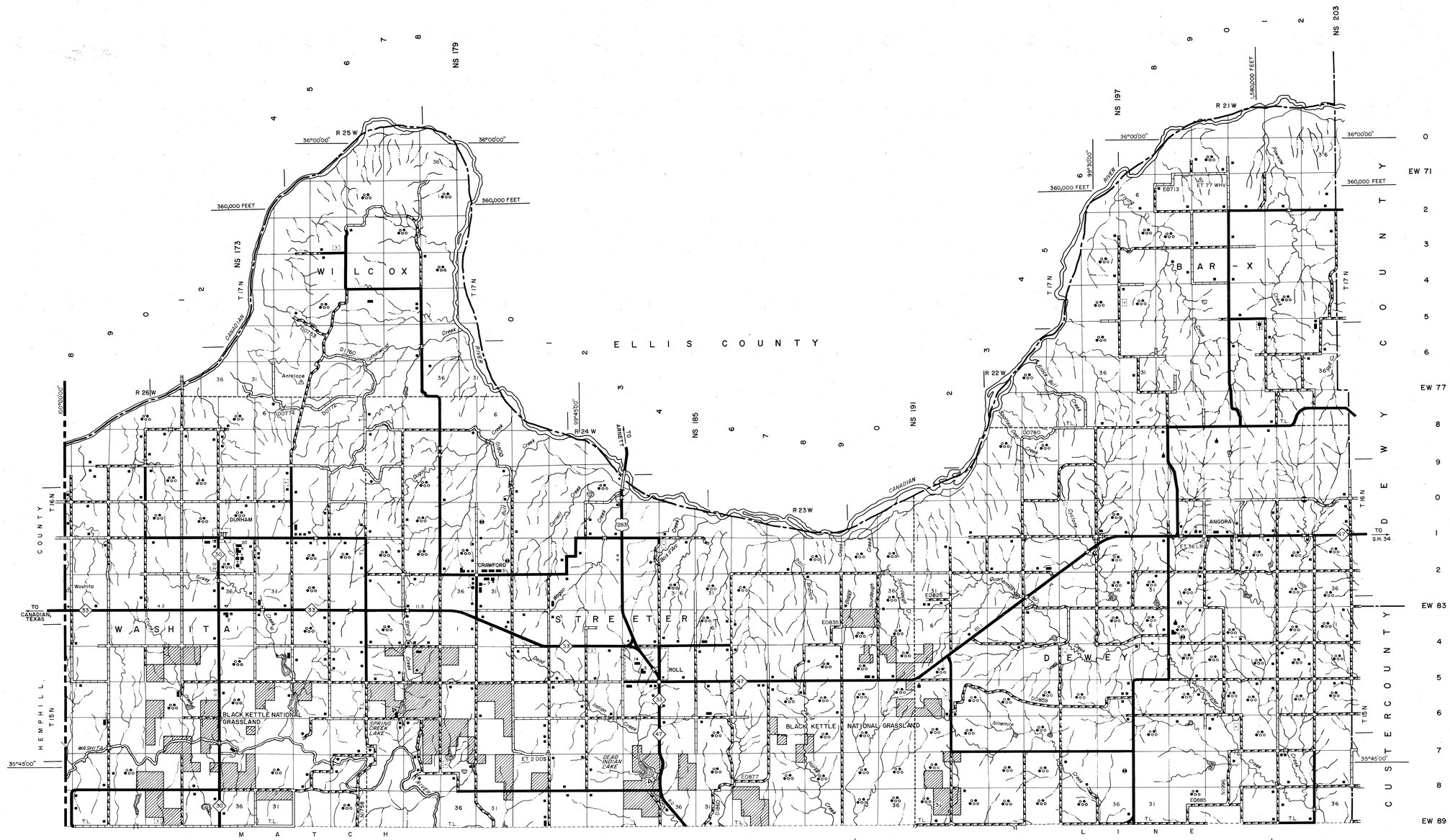
PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
0 1 2 3 4 MILES

LAMBERT CONFORMAL CONIC PROJECTION U.S COAST & GEODETIC SURVEY DATA
20,000 FOOT GRID: OKLAHOMA PLANE COORDINATE SYSTEM NORTH HYLECTION ZONE
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
COUNTY POPULATION 4,147

SHEET 1 OF 2 SHEETS



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SHEET 2 OF 2 SHEETS

SEMINOLE

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OKLAHOMA CITY, OKLAHOMA 73105-3204

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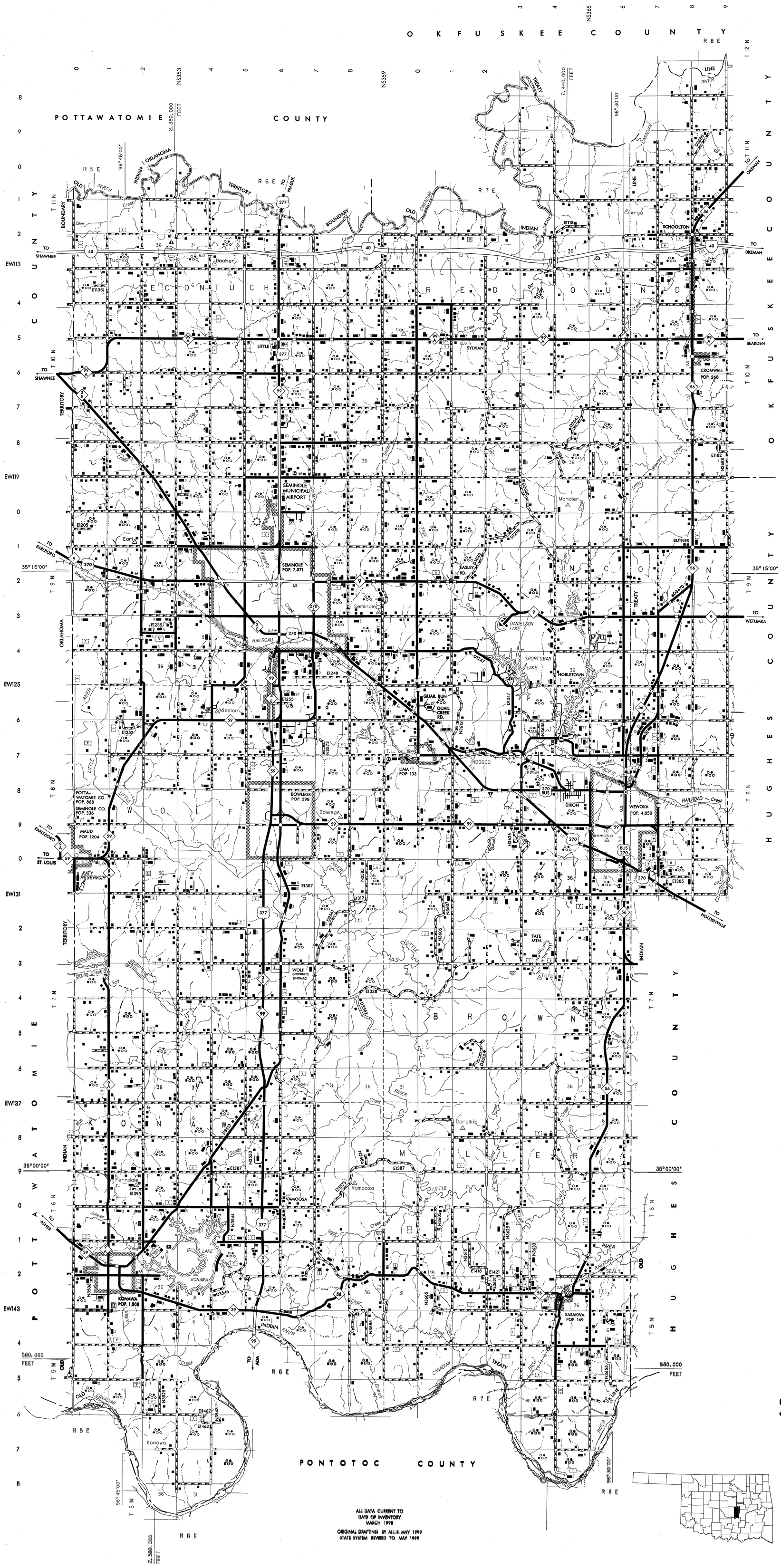
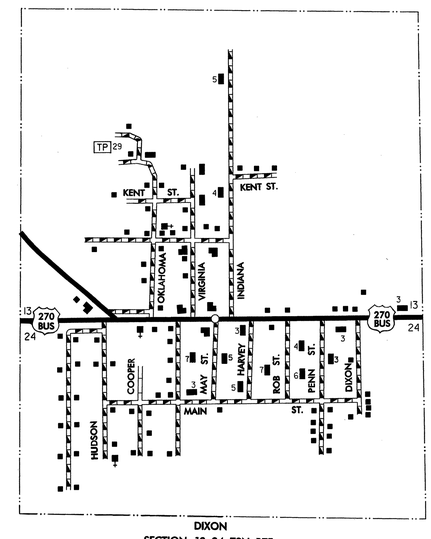
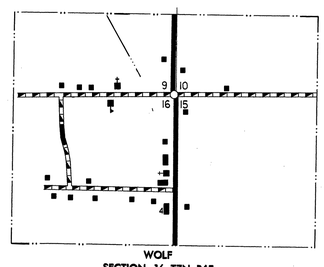




SCALE IN MILES
0 1/8 1/4 1/2 MILE
0 1,320 2,640 FEET
0 200 400 600 800 1 KILOMETER
SCALE IN METERS



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0 1,320 2,640 FEET
0 200 400 600 800 1 KILOMETER
SCALE IN METERS

N

LEGEND

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- WAREHOUSE
- GRAVEL PIT
- QUARRY
- SCHOOL
- COMMUNITY HALL OR LODGE
- DRIVE-IN THEATER
- CORRECTIONAL INSTITUTION
- HIGHWAY GARAGE
- JUNK YARDS & DUMPS A-Automobile, B-Scrap Building Material, D-Refuse, Garbage or trash dump, F-Sanitary Fill, G-Other
- SEWAGE DISPOSAL PLANT
- WATER SUPPLY STAND PIPE
- POWER PLANT
- BOOSTER STATION
- POWER SUBSTATION
- KOMA TELEVISION OR RADIO STATION
- MILITARY INSTALLATION

ALL DATA CURRENT TO DATE OF INVENTORY MARCH 1998

ORIGINAL DRAFTING BY M.L.B. MAY 1999
STATE SYSTEM REVISED TO MAY 1999

GENERAL HIGHWAY MAP
SEMINOLE COUNTY
OKLAHOMA

PREPARED BY THE
OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING DIVISION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE IN MILES
1 0 1 2 3 4 5 MILES
0 1 2 3 4 5 6 7 8 9 10 KILOMETERS
SCALE IN KILOMETERS

LAMBERT CONFORMAL CONIC PROJECTION U.S. & GEODETIC SURVEY DATA
20,000 FOOT GRID; OKLAHOMA PLANE COORDINATE SYSTEM SOUTH PROJECTION ZONE.
POPULATION FIGURES BASED ON 1990 U.S. CENSUS
CO. POP. 25,412