



ENVIRONMENTAL CONSIDERATIONS

13.1 - GEOGRAPHIC LOCATION

The City of Independence is geographically situated along the southern edge of the Missouri River and in the northern portion of Jackson County. This location is also within a few miles of the Kansas River.

The location may also be described by latitude (parallel) and longitude (meridian) at approximately 39 degrees north and 94 degrees south. The present corporate city limits includes approximately 78 square miles of land area within Township 49 and 50 North, and Range 30, 31, and 32 West.

This location, near the geographic center of the United States, is also generally recognized to be on the eastern edge of the Great Plains area which extends westward to the Rocky Mountains.

13.2 - CLIMATE

Independence is in the southern portion of the Northern Temperate Zone and its climate is characterized generally as a "modified continental Climate", because of the lack of major natural physiographic features which would obstruct the free flow of major air currents from any direction. This situation leads to frequent changes in temperatures and rainfall due to warm, moist air currents from the Gulf of Mexico, which often mix with the dry winds from the semi-arid regions of the southwest, as well as the Polar Continental currents from the north. Such a combination of the factors cause an infinite variation and frequently unpredictable changes including tornadoes.

The U.S. Weather Bureau has Maintained records for the Kansas City area since 1888. There are no major variations within a 25 mile radius of Kansas City, so these records are generally applicable to the City of Independence.

The highest temperature recorded was in 1926 at 113 degrees. The lowest temperature occurred in 1899 at 22 degrees below zero.

The annual mean temperature is 56 degrees, with a mean daily maximum of 65 degrees, and a mean daily minimum of 46 degrees. July is generally the warmest month with an average temperature of 77.5 degrees, and January the coldest month with an average temperature of 27.1 degrees (see table 13.21 and figure 13.21).

The average annual rainfall is approximately 37 inches. Twenty-nine percent falls in Spring, 35 percent in Summer, 24 percent in Fall and 12 percent in Winter. The highest rainfall occurred in 1898, with 50 inches and the lowest was recorded in 1953 at 21 inches. Nearly 75 percent of the annual rainfall occurs during the growing season which is approximately 200 days long (see table 13.22 and figure 13.22). The latest killing frost is usually in early April, and the earliest killing frost in late September.

The general prevailing winds are from the south, approximately one-half of the year - May - October. Approximately one-third of the year has a south-south-west wind - November to February. The month of March has an east-north-east wind, and April a north-east wind. The average wind is 10 to 15 miles per hour, although winds of 30 miles per hour are not uncommon, and with gusting winds occasionally recorded from 50 to 75 miles per hour.

Table 13.21

**Daily Average Temperatures
Independence, Missouri**

	Low	Average	High
January	21	29	38
February	24	33	42
March	34	43	53
April	46	55	65
May	56	65	75
June	65	75	84
July	70	79	89
August	68	78	87
September	60	70	80
October	48	59	69
November	35	44	53
December	25	33	41

Source: National Weather Service

Table 13.22

**Monthly Rainfall
Independence, Missouri**

Month	Inches
January	1.30
February	1.42
March	2.59
April	3.33
May	4.79
June	4.75
July	3.84
August	3.96
September	4.35
October	3.01
November	1.89
December	1.48

Source: National Weather Service

Figure 13.21

**Daily Average Temperatures
Independence, Missouri**

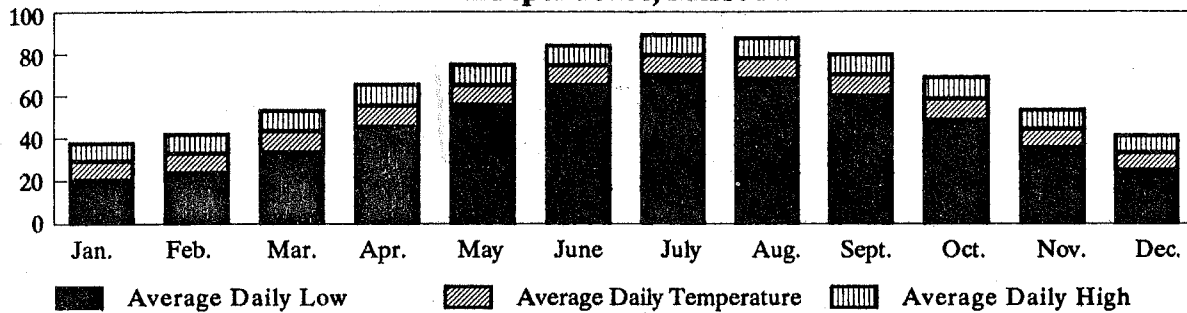


Figure 13.22

**Monthly Rainfall
Independence, Missouri**

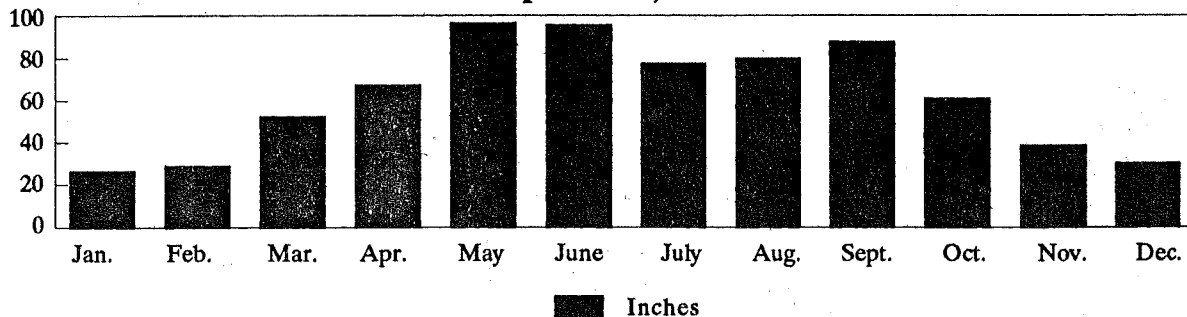
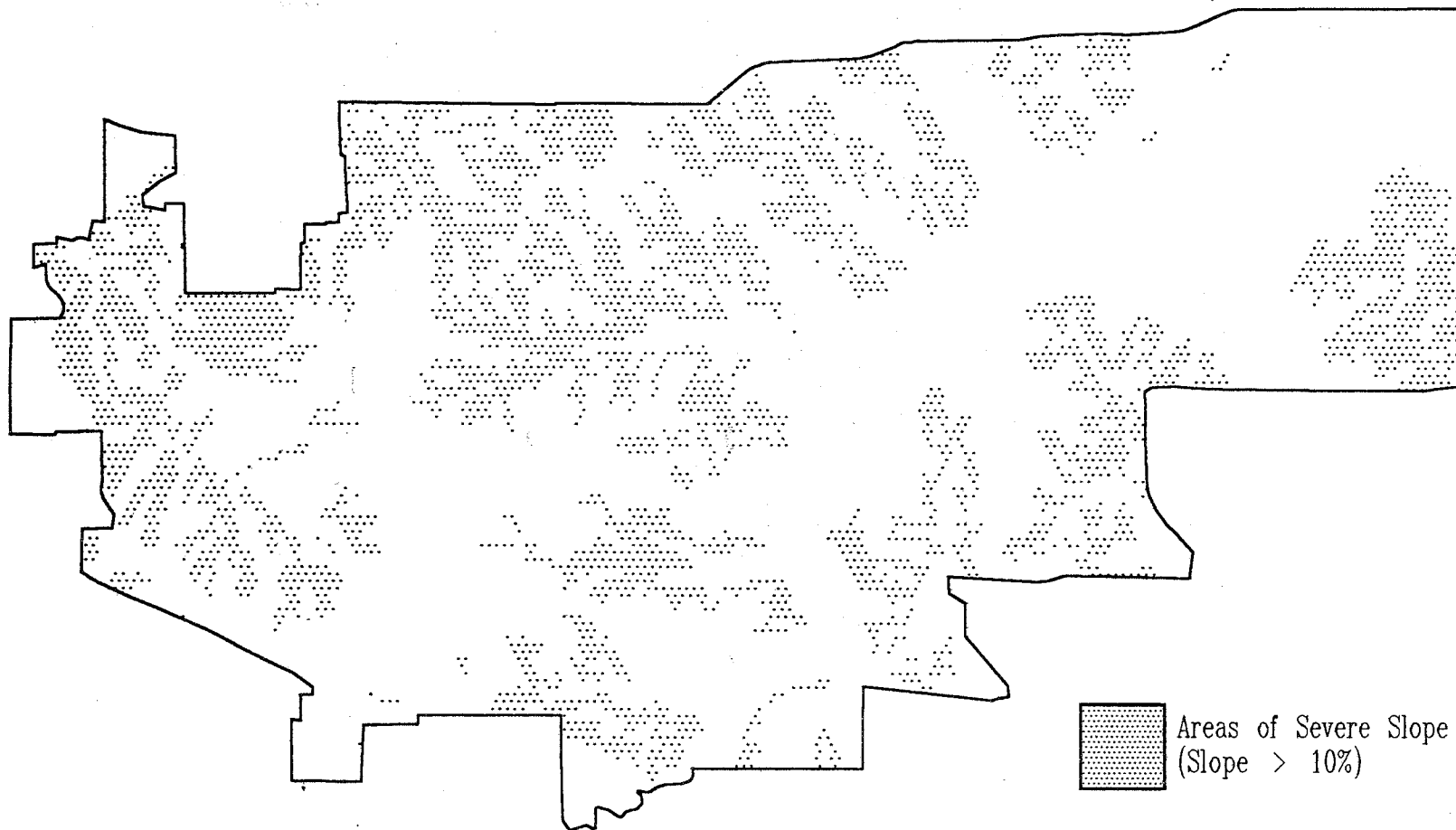


FIGURE 13.41

AREAS OF SEVERE SLOPE
INDEPENDENCE, MISSOURI



13.3 - TOPOGRAPHY

A general description of the Independence area would indicate it to be gentle rolling hills, situated between the Big Blue River on the West and the Little Blue River on the east, and bounded on the north by the bluffs overlooking the Missouri River Valley.

More particularly, the flood plain of the Missouri River's approximate elevation is 740 feet where it enters the county on the west and 700 feet where it leaves the county on the east. The width of the county is approximately 26 miles, but the meandering course of the Missouri River makes it a longer route. Therefore, the resultant gradient of the stream channel is approximately nine inches per mile. This is an extremely low gradient compared to the Little Blue River, which enters the southern boundary of Jackson County at an elevation of 950 feet, then enters the Missouri River at an elevation of 700 feet. This is a differential in elevation of 250 feet, and within a distance of approximately 26 miles. Assuming the length of the Little Blue River Channel to be at least 50 miles in its meandering course, the average gradient would be at least 5 feet per mile. The Little Blue River enters the southeast corner of Independence near the center of the County, at an elevation 770 this would indicate an average gradient of three feet per mile, which is considerably less than that further south.

The bluffs along the south side of the Missouri River valley rise to elevations of 200 feet to 300 feet above the flood plain. The flood plain of the Missouri River varies from 3 to 5 miles in width. The elevation of the bluffs near Cement City, now annexed by Sugar Creek, is 1020 feet. The Jackson County Court House is one of the highest points of the County, at an elevation of 1050 feet. The highest point in the County is south of Lee's Summit at a U.S. survey triangulation station with an elevation of 1086 feet above sea level.

Most of the Blue Ridge Boulevard is located along the divide between the Big Blue and The Little Blue rivers drainage basins. This ridge, and Divide, extends southwesterly from the Independence Court House Square toward the southwest corner of the County.

The upland area to the north of Lake City, which is completely surrounded by alluvial valleys, is further differentiated from the remainder of the uplands of the County as it is generally 100 to 150 feet lower in elevation. This resulted from the glacier action which penetrated the northeast portion of the County and helped to remove the more durable limestone formations and thereby permitted the erosion of the underlying strata prior to the remainder of the County.

13.4 - SLOPES

Because of the roughness of the terrain, particularly in the area east of the Little Blue River, areas having slopes of ten percent or more are of particular importance in determining some of the future land use and/or controls which will be needed to adequately protect the public interest (see figure 13.41).

The definition for steepness of slope by percentage means the number of feet rise or fall in elevation (vertical) within a distance of 100 feet (horizontal). For example, a 10 percent grade on a highway is considered steep; it involves a 10 foot higher elevation within a distance of 100 feet. Similarly a 25 percent grade, or slope, would indicate a higher, or lower, elevation of 25 feet within a distance of 100 feet.

It is noted that most of the development of Independence thus far has been on the broad upland area, where steepness of slope has not been a prevalent factor. However, in view of the large percentage of land classified as having a slope of ten percent or more, it will be important to consider conservation measures to protect and preserve the bluffs, as well as to strengthen

subdivision regulations to control the type of subdivisions which are permitted, and the design of streets, lots, utilities, etc.

The accompanying map shows approximately 26 percent of the land area in the steep slope classification. This indicates the great need to preserve and protect the natural drainage courses from excessive erosion. Such measures as fencing gullies, intercepting ditches with small check dams, construction of small ponds, reforestation and revegetation, including the use of fertilizer where necessary should be given due consideration in protecting the land.

13.5 - GEOLOGY

The City of Independence is located within the Scarped Plains area, approximately midway between the Ozark "uplift," or plateau, to the southeast, and the Great Plains area to the west. This means, the rock formations in the local area appear to be nearly level, although they have a slight dip toward the northwest, generally between six to ten feet per mile.

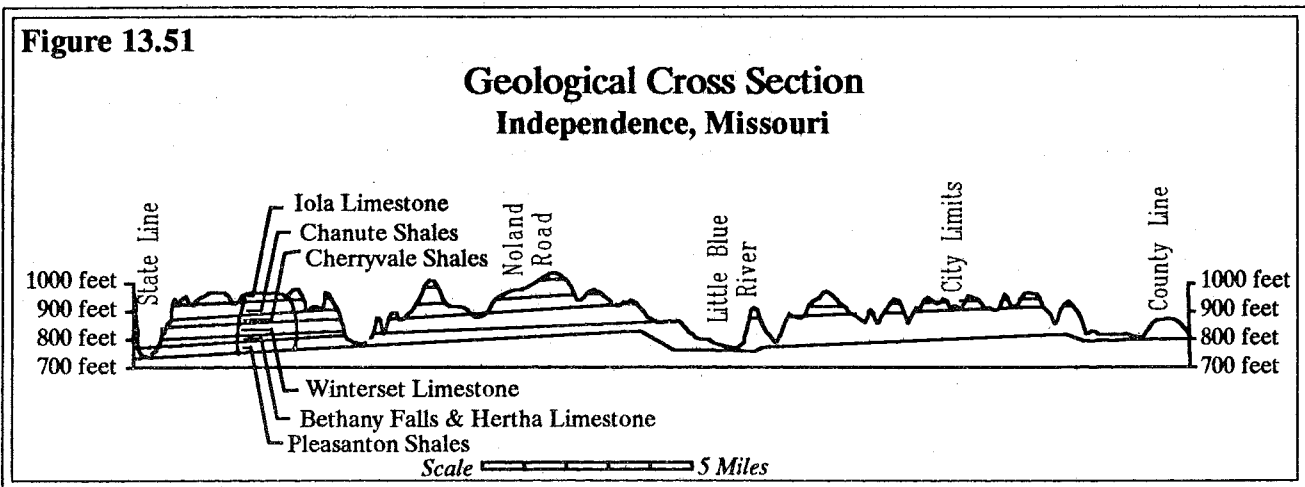
The bluffs along the Missouri River valley floodplain, and the valleys of the tributary streams reveal to even the casual observer many of the rock formations which underlay the Independence area. These are generally alternate layers of shale and limestone. The most common of these is the Bethany Falls limestone, which is

harder than the shale formations, and the one most frequently mined for use as crushed rock and aggregate in concrete.

This geological cross section (see figure 13.51) is shown along an east west line through Jackson County, with the Missouri - Kansas state line on the left and the Jackson - La Fayette county line on the right. The City of Independence extends from Blue Ridge Boulevard on the left to the east edge of Lake City Munitions Plant.

The vertical scale is exaggerated to indicate the various layers of shale and lime stone formations. The layers of rock strata appear level when observed along road cuts and stream valleys. However, there is a significant slope of approximately 250 feet from east to west. A similar slope would occur from south to north if a north south cross section were shown. The true direction of the slope is approximately North 60 degrees West. For example, the Bethany Falls limestone dips from an elevation of 1,000 feet at Lone Jack, in the southeastern portion of the County, to an elevation of 740 feet near the Broadway bridge in Kansas City.

According to the geologic timetable, covering millions of years, the oldest rock formation in this area has been located at a depth of 2,348 feet in Raytown. This granite formation is believed to be the first land surface where the weathering process began to form sediments to be deposited in layers in later years. Alternate



periods of land erosion and inundation by invading seas formed layers of shale and limestone, and at times interspersed with coal seams from tropical forests and swamps. Marine fossils are commonplace in the local formations.

With the passage of time the earth's surface has weathered through the various formations to the present configuration. However, particularly unique to this area are certain features which have occurred relatively recently on the geologic schedule, namely the reluctant effect of the massive ice sheets which once covered much of North America. One of these glaciers advanced as far south as the Missouri River, and penetrated the northeastern portion of the County. This resulted in the abandonment of the valley adjacent to the north side of Lake City, by the Little Blue River, which once flowed easterly at this location. A similar case is the abandonment of the Turkey Creek valley through Kansas City, which is now utilized by the Union Station and the terminal tracks. Further evidence of such glacier is found in deposits of assorted masses of dirt, gravel, and boulders in the counties to the north. Such, deposits, termed glacial drift, or till, were left by the receding glaciers as they melted, after having scraped the earth's surface under tons of pressure from the huge ice sheet, and pushing material along its route southward. Some granite boulders in Clay County are several feet in diameter and have been matched with rock formations in the mountains in North Dakota. Also unique, and daily observable in many locations throughout the City of Independence are deposits of a finely textured loess soil. This material is found in deposits thicker near the bluffs, and is the result of wind blown glaciated silt from the river valley.

The most recent epoch in the geological history has been the result of stream erosion. The upland areas have been gradually eroded, removing the residual soils and loess material into what are now known as the alluvial deposits in the flood plains of the lower stream valleys. Such deposits range around one hundred feet thick in the flood plain of the Missouri River valley. For

example, the wells of the Independence Water Department, located in the Courtney bottoms west of the liberty Bend Cut-off, are approximately 120 feet deep. Such alluvial deposits in the Little Blue River valley and other tributary streams would be relatively less.

13.6 - MINERAL RESOURCES

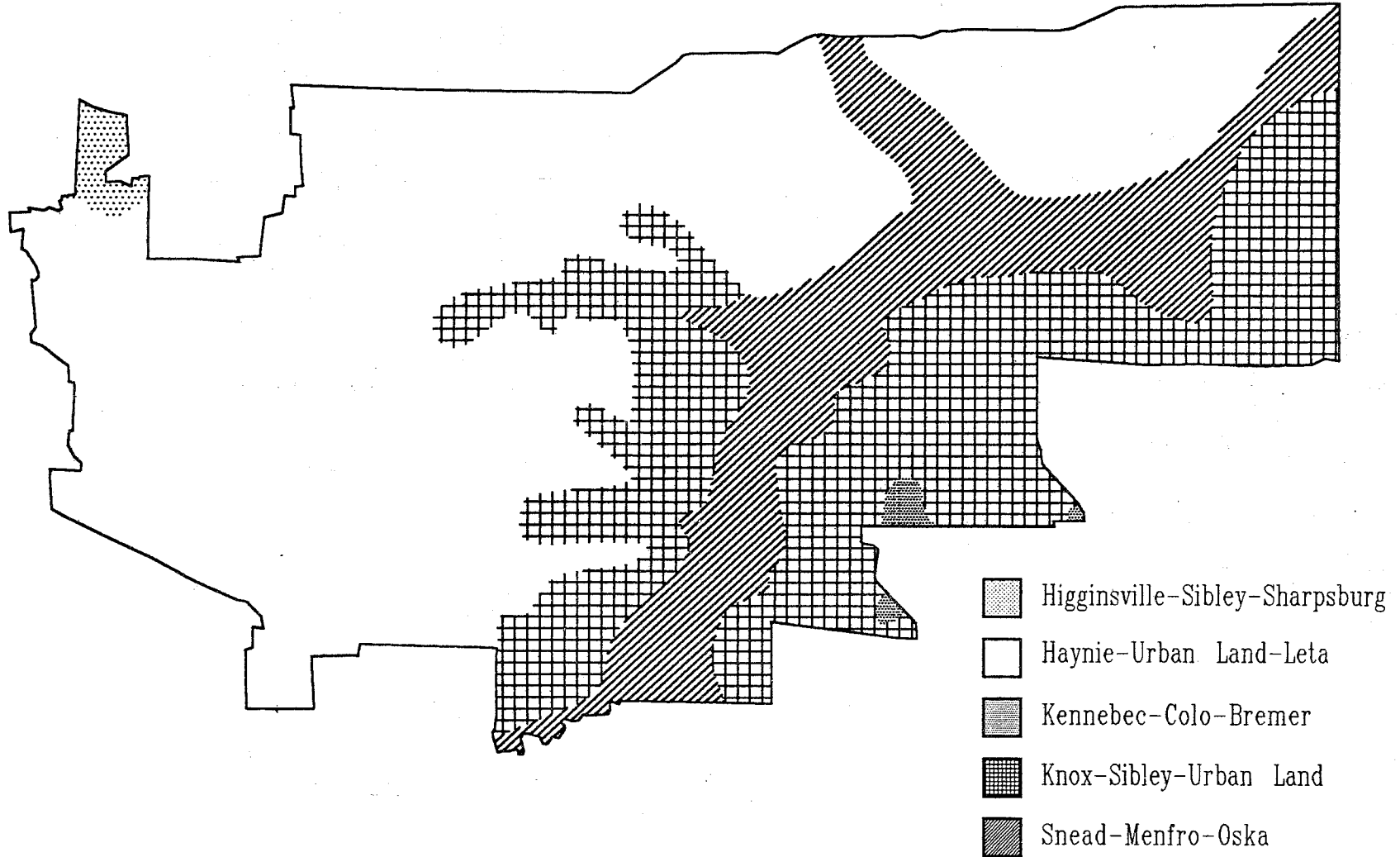
The mineral resources of Jackson County are strictly non-metallic, and consist primarily of clay, shale, limestone, sand, gravel, oil, gas, coal, water, and soil. Some of these are relatively unimportant commercially. Some oil wells and gas wells have had limited success in the southwest portion of the County. Coal veins exist, but thus far there has been only marginal production. Clay and shale have found limited production in brick and drain tile. Several rock quarries have formations suitable for building stone. Most of the limestone is too impure to burn for white tile, but it has suitable potential for agricultural lime purpose. Sand bars in the Missouri River bottoms constitute the principle source of sand. It is usually obtained through hydraulic dredging.

Cement City is the location of the Missouri Portland Cement Company. This operation has been in existence since near the turn of the century. The present estimate is that there is sufficient reserve for approximately 40 years of operation. The principle strata utilized is the Bethany Falls limestone, which is approximately 23 feet thick; on top of the Bethany Fall limestone is a five to six foot layer of Galesburg shale; and on top of the Galesburg shale is a twenty foot layer of Winterset limestone. The early method of tunneling was to mine a fifty foot width spaces, 35 feet high, and leaving 30 foot pillars. The present method leaves pillars of 40 foot widths and leaving 30 foot width haul roads. The plant has a rated capacity of 3 million barrels of cement per year there are direct loading facilities for trucks, rail cars, and barges.

The former mining operation at Missouri 291 highway and Truman Road known as

FIGURE 13.71

SOIL TYPES
INDEPENDENCE, MISSOURI



Geospace and more recent mining operations near the northwest corner of the intersection of Missouri 291 highway and Kentucky Road had been primarily for use of the Bethany Falls crushed rock for aggregate in concrete and road construction purposes, but is now part of a growing trend in the metropolitan area for utilizing such space in mined out areas for industrial manufacturing and warehousing purposes. These areas were mined in the "room and pillar" fashion. Space is located on fifty foot centers, in a checkerboard pattern, with column widths of twenty feet and haul road space thirty feet in width, and ceiling height limited to 14 feet. This method is designed for added protection against cave-ins, and to insure safe ceilings without having to resort to roof-bolting techniques. These tunnels extend approximately one and one half miles northeasterly toward the housing development in the Susquehanna area. Geospace Executive Park has 160 acres of unique storage and manufacturing space.

13.7 - SOILS

The various soil types of a particular area are closely related to the geological formations from which they were derived during long periods of erosion (see figure 13.71). No individual soil type is derived exclusively from a single rock formation, but rather from a combination and blending of several, there are certain basic classifications, as well as many variations into sub-classifications. Therefore, the principal soil types in the Independence area are from the glacial deposits, and the derivatives of the shale and limestone formations. The principal source of information on this subject is to be found in a "Soil Survey of Jackson County," by the U.S. Department of Agriculture, and the Soil Conservation Service.

Generally speaking, the loess soils are found principally in the northern half of Jackson County, with the soils in the southern half being primarily from the shale and limestone forma-

tions. The alluvial deposits predominate in the flood plains of the various stream valleys. Each of these basic groups contain deep, well-drained, productive soils, suited to a wide variety of agriculture.

The loess soil, being wind blown deposits of finely textured glaciated material is rather uniformly deposited. The thickest formations are near the bluffs along the Missouri River valley. Erosion has carried away much of this material, although previously this material has served as a mantle, or a shield, which has protected the underlying strata of shale and limestone from erosion. Therefore, the latter have not been significant in the deeper stream valleys and their tributaries. Sub-classifications of soils at a particular locations where deep erosion has occurred would be influenced by the topography and the extent to which the basic drainage system has developed.

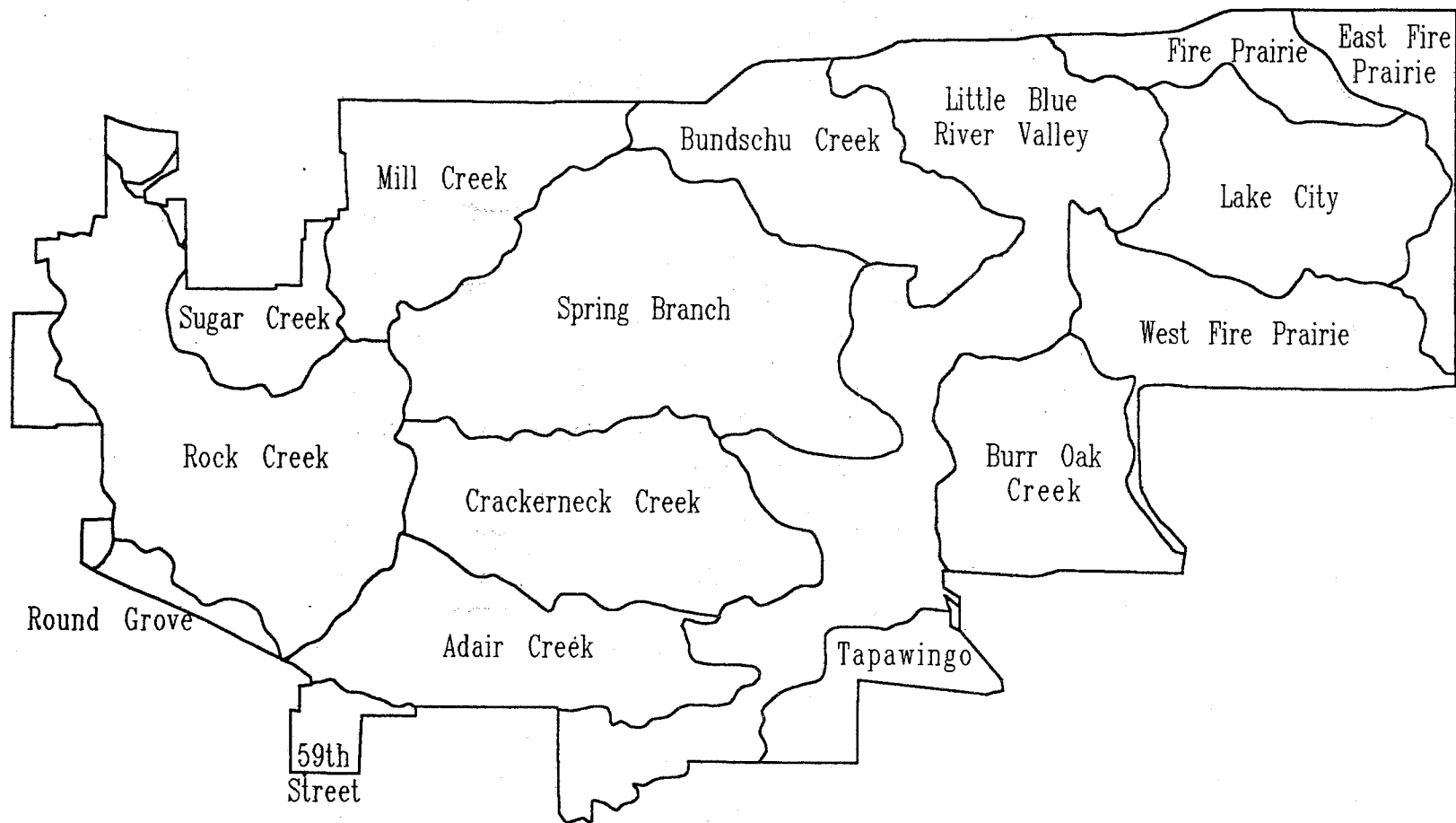
The residual soils are classified into two basic groupings, namely the Crawford and the Summit. The former is derived principally from the limestone formations, and the latter from the shale formations. However, there is a great variation in sub-classifications in localized areas because the underlying strata includes alternate layers of shale and limestone.

The alluvial soils in the bottomlands are also classified into two basic groupings, namely the Sarpy soils which occur in the flood plain of the Missouri River, and the Wabash soils which occur in the tributary valleys of the smaller streams.

None of these soils represent particular problems for urban expansion, except in the alluvial soils in the valleys where extremely heavy load bearing requirements may be necessitated for certain industrial development. The problem which frequently arises in development is the absence of sufficient surface soils for burying the utilities. In such instances, the more costly excavations in rock formations add to the development cost.

FIGURE 13.91

DRAINAGE BASINS
INDEPENDENCE, MISSOURI



13.8 - WOODED AREAS

The natural wooded areas within the City of Independence shows a high correlation to steep slopes. This is a significant correlation, particularly from the standpoint of preserving and protecting the bluffs from unnecessary erosion, as well as a safeguard for the natural scenic values for both present and future generations.

Generally, the steep slopes and wooded areas are the most difficult to develop for urban expansion. Therefore, such areas are usually considered marginal, and frequently bypassed until the surrounding land is developed. It is important that the City and/or other public and semi-public agencies take early action toward acquiring such areas most desirable for recreational purposes, as well as applying improved zoning controls. In places where residential development is to be permitted in accordance with the Comprehensive Plan, improved zoning controls may also be needed to adapt the proper type of development to steep terrain; otherwise, excessive repair and maintenance costs to streets and public utilities could be a continuing problem. It will also be important to specify a minimum size tree which should be protected against needless cutting, in conjunction with all future subdivision platting and developments.

13.9 - DRAINAGE AREAS

Drainage areas are of vital importance to two of the City's most essential services, namely the provision of sanitary and storm sewers. Gravity flow for sanitary sewers is the most natural and economic way to handle this service within local watersheds. Pumping stations are costly to install and to maintain. The natural surface run-off is even more difficult to handle unless it is allowed to flow along its natural drainage course. The tons of water involved during heavy storms makes it virtually impossible to put in pipes or culverts for any

great distance without prohibitive costs. Therefore, zoning and subdivision regulations should preserve and protect the open drainage channels in all developments.

Figure 13.91 and table 13.91 indicates the size and location of the watersheds within the City of Independence.

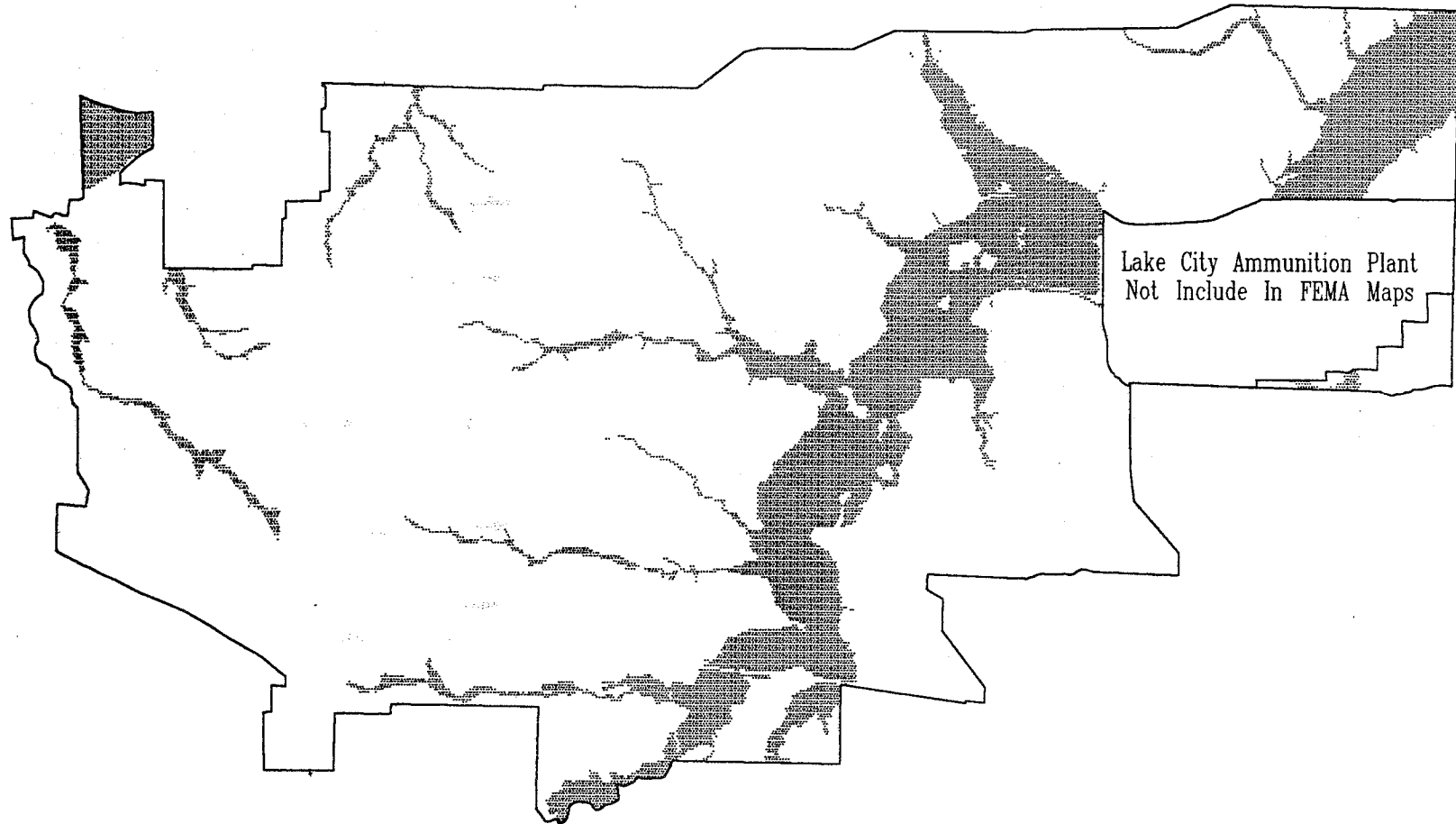
In addition to watersheds, floodplains should be considered. Development is restricted in the 100 year flood plain by the City Code. No building can be constructed with a floor plan less than one foot above the 100-year flood plain elevation. Grading in the 100-year flood plain requires a permit from the Director of Public Works/Engineering, in addition to other required permits. The permit process determines if planned construction is within the flood plain. Requirements for a flood plain development permit are an approved grading plan, a letter stating that the project will have little or no effect on the 100-year flood plain signed and sealed by a Missouri registered Professional Engineer, and a permit fee.

Table 12.91

Watershed Areas Independence, Missouri		
	Sq. Miles	Acres
Rock Creek	9.48	6,069.48
Sugar Creek	1.76	1,126.11
Mill Creek	4.71	3,017.39
Bundschu Creek	4.76	3,043.60
Crackerneck Creek	6.42	4,108.16
Adair Creek	4.98	3,190.34
Burr Oak Creek	4.55	2,910.80
Spring Branch	10.47	6,701.48
Fire Prairie	1.97	1,257.72
East Fire Prairie	2.17	1,390.34
West Fire Prairie	4.59	2,936.18
Lake City	4.98	3,187.94
Tapawingo	1.80	1,149.09
Other Watersheds	2.60	1,661.20
Little Blue River Valley	12.77	8,170.17
Total	78	49,920

FIGURE 13.92

FLOODPLAINS
INDEPENDENCE, MISSOURI



Areas shown in Figure 13.92 indicated floodways, 100-year floodplains, and 500-year floodplains. Five-hundred-year flood plains are areas of 100-year floodplains with average depths of less than one foot or with drainage areas less than one square mile, and areas protected by levees from 100-year floodplains. Exact locations and elevations of floodplains are shown on the rate maps supplied by the Federal Insurance Administration.