A geography of the Upper Salt Creek watershed

David M. Thorndike
University of Nebraska at Omaha

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A GEOGRAPHY OF THE UPPER SALT CREEK WATERSHED

A Thesis
Presented to the
Department of Geography
and the
Faculty of the College of Graduate Studies
University of Omaha

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

by
David M. Thorndike
January 1968
Accepted for the faculty of the College of Graduate Studies of the University of Omaha, in partial fulfillment of the requirements for the degree Master of Arts.

Chairman

Graduate Committee

Department
ACKNOWLEDGMENTS

The writer wishes to acknowledge the co-operation extended to him by the United States Army Corps of Engineers, the Lancaster County Soil Conservation Service, the Nebraska Game and Parks Commission, and the Lincoln City-County Planning Department. These agencies were most helpful in supplying information and assistance.

A special note of thanks is given to Dr. Harold J. Retallick whose help and guidance made this thesis possible.
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<td>57</td>
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INTRODUCTION

The region here designated as the Upper Salt Creek Watershed lies almost entirely in southwestern Lancaster County about eight miles south of Lincoln, Nebraska, and comprises an area of some 168 square miles. However, approximately three square miles of the western edge of the watershed are located in Saline County. In order to facilitate the collection of data, the Lancaster-Saline County line is considered as the western boundary of the watershed and the portion in Saline County is excluded from the study area. All other boundaries are the drainage divides that separate the watershed from the adjacent basins.

The primary purpose of a regional study of this particular watershed was to investigate an area where certain flood control projects have been constructed. A secondary purpose was to investigate the probable impact that the flood control projects may have had on population, land use practices, and general economy of the region. The problem involved not only answering the question of what impact, if any, was in evidence, but also necessitated the collection and assimilation of data from many sources. Furthermore, even the most preliminary
consideration of the problem required information regarding
the general topography, geology, and geography of the
watershed.

The scope of the problem necessitated the collection
of background information concerning many different sub-
jects. A large proportion of the data came from other
than library sources because of the recent completion
date of the flood control project, the small size of the
watershed, and the nature of the small communities within
the study area. This information was obtained from per-
sonal interviews and field observations.

A detailed examination of the physical character-
istics was made in order to determine if there were any
unusual features that would alter the established trends
in population, land use practices, and over-all economic
base. An investigation was then made of the population
statistics, land use practices, and economic base in order
to establish the trends for recent years. These trends
were examined to see if any alteration, acceleration, or
interruption occurred that could be attributed to the
flood control project.
CHAPTER ONE

PHYSICAL FEATURES

The Upper Salt Creek Watershed consists of the drainage basins of Olive and Hickman branches of Salt Creek. The basins cover an area of 101 and 67 square miles respectively. They are located about eight miles south of Lincoln, Nebraska, in southwestern Lancaster County, and include portions of Grant, Nemaha, Saltillo, South Pass, Buda, Centerville, Highland, and Olive Branch townships (Figure 1).

The basins lie at the western edge of the physiographic region known as the Dissected Till Plains Section of southeastern Nebraska, a subdivision of the Central Lowland Province. This is a nearly flat loess-capped till plain, submaturely to maturely dissected with a local relief of 100 to 300 feet. The till plain was deposited during two distinct glacial stages, the Nebraskan and Kansan. The oldest known Nebraskan till is the Elk Creek till found in northeastern Pawnee County. However, a stratigraphically documented outcrop

---

of this deposit or of the later Iowa Point till has not been located in the study area by geologists. The Nebraskan age deposits may be limited to their periglacial equivalents: the Seward and Pullerton formations.¹

Present topographic features are the result of dissection of two early Kansan tills, the Nickerson and the Cedar Bluffs. The more influential is the younger Cedar Bluffs which was deposited by the second advance of the Kansas ice sheet. Its furthest advance is delimited by the Cedar Bluffs moraine.² The glacial drift has subsequently been covered by two distinct deposits of loess. The older deposit is the reddish-brown Loveland loess deposited late during the Sangamon interglacial stage. The Loveland loess was in turn buried to a depth of several feet by the buff-colored Peorian loess following the retreat of the Iowan ice. The loessial sediments masked, but did not greatly alter antecedent topographic features. Present relief


²Ibid., p. 9.
and drainage features were well established prior to
the deposition of loess.¹

The general configuration of the Upper Salt Creek
Watershed is an irregular oval about twenty miles long
and ten miles in width aligned from east to west. The
point of highest elevation is found on the drainage
divide between Olive Branch and the Big Blue River.
The divide is a portion of the Cedar Bluffs moraine.
The elevation of this point is in excess of 1,500 feet,
approximately 100 feet or more above the other inter­
fluves. Greater erosive action has taken place in
the western portion of the study area due to this
higher elevation. The effect of higher elevation
can be seen by the gradient of Olive Branch which is
about twenty-one feet per mile from the Saline County
line to Kramer, compared to the average gradient of
Olive Branch which is only slightly more than five feet
per mile. The maximum gradient for Hickman Branch is
about twelve and one-half feet per mile and the average
is six feet per mile. The difference in average gra­
dients is due to the longer and better developed flood
plain of the Olive Branch (Figure 2).

¹University of Nebraska Conservation and Survey
Division, Nebraska Geological Survey Bulletin 14A, "The
Geological Section of Nebraska," by G. E. Condra and
Erosion, however, is in a more advanced stage in the Olive basin. This is indicated by the lack of loessial materials, greater dissection and larger areas of exposed glacial till. The prominent features of this basin are the eroded drift hills capped by scattered patches of loess, and the deep alluvium of the wide valley bottoms. The only extensive deposits of loess are found on the Cedar Bluffs moraine which appears as a gently rolling to undulating upland about one-half to three miles wide (Figure 3).¹

The most outstanding feature in the Hickman basin is an extensive area of rolling loess-covered drift hills. The only exposures of Kansan till in the study area are found in the steeper slopes, usually bordering the larger streams and along the deeper road cuts.

Unburied deposits of glacial material, loess and alluvium, provide the parent materials from which the soils in the region have developed.² Topography and

¹USGS Topographic Maps.

PARENT MATERIALS

Alluvium & Colluvium

Loessial Deposits:
Loveland & Peorian

Terraces

Bedrock & Glacial Drift

Study Area

Source: Soil Survey, Lancaster County Nebraska, Series 1938, No.15

Miles

Figure 3
parent materials are the two most important soil forming factors in the watershed. The other two: climate and natural vegetation exhibit no variation that would be responsible for any major change in the soil series.

Members of two Great Soil Groups: Brunizem and Chernozem are present in the study area. However, because this is a transition zone between these two Great Soil Groups, the classification used here is based on differences in parent materials, topography, and land capabilities.

The soils may be divided into four general soil associations: Sharpsburg-Butler-Crete, Burchard-Carrington-Pawnee, Waukesha-Judson-Wabash, and Dickinson-Steinauer. The Sharpsburg-Butler-Crete association is the most common of the soils of the gently rolling uplands. The association is developed from the extensive loessial deposits on the drift hills in the Hickman basin and the Cedar Bluffs moraine. Only small patches are found on interfluves in the Olive Branch basin. The Sharpsburg soils have a dark surface with a clayey but friable subsoil. The Butler and Crete series differ

---


2 USDA Soil Map, Lancaster County, Nebraska.
from the Sharpsburg by having a dense claypan layer in the upper part of the subsoil and a layer of lime enrichment in the lower part. The series is well drained, fertile, and suitable for most corn belt crops.

The Burchard-Carrington-Pawnee soil association is the most extensive association in the Upper Salt Creek Watershed. These soils are medium-deep to deep, well drained soils that developed on the glacial uplands. The association is similar to the Sharpsburg-Butler-Crete association in surface color, friability, and lime accumulation, but has more sand and gravel in the subsoil and is less fertile.

The shallow stony soils of the steeper slopes are the Dickinson-Steinauer association. The Steinauer developed on glacial drift and the Dickinson on loose sandy deposits in the drift. Both are subject to erosion, relatively infertile, and suitable only for pasture.¹

Soils developed from alluvium and colluvium may be placed in a Waukesha-Judson-Wabash association. The Waukesha series is limited to several terraces on either side of Olive Branch near its confluence with Hickman.

Branch and to one terrace two and one-quarter miles east of Hickman. It is very similar to the Sharpsburg series in friability, color, drainage, and fertility. Judson soils are limited to deposits of widely scattered surface soil material washed down from higher levels. They are dark grayish-brown in color to a depth of over three feet. High organic content and good drainage make these soils the most productive in the area. Wabash soils are very similar to the Judson except that they are not as well drained and cover a larger area.

All members of the soil associations, except the Dickinson-Steinauer, are suited for cultivation. However, a general lack of porosity and intensive cropping has resulted in sheet and gully erosion in many places where the slope is greater than five per cent.

The lack of porosity, characteristic of soils developed from loess, causes excessive run-off during periods of severe thunderstorms. Maximum thunderstorm

---

1 USDA Soil Map, Lancaster County, Nebraska.
3 Ibid., p. 55.
activity, usually occurs during the late spring and summer, and is the most significant climatic feature in the watershed. These storms are often of short duration, but may be of great intensity and cause heavy flood damage. An example is the storm of May 11-12, 1942, when over twelve inches of rainfall were recorded during a six hour period at Kramer, Nebraska.¹

The stream flow reflects over-all precipitation variations and intensities. A gaging station located on Salt Creek in Lincoln, Nebraska has recorded a stream flow which varies from 39 to 22,200 cubic feet per second.²

Seasonal as well as annual extremes in temperature and precipitation are characteristic climatic features of the Upper Salt Creek Watershed. Seasonal extremes are the result of the interior continental location of the watershed. The variation in the average annual precipitation is due to the location of the study area in a transitional zone between the subhumid Central Lowlands and the more arid Great Plains.

²Ibid., p. 31.
The seasonal climatic regime allow the growing of common corn belt crops. Maximum precipitation occurs during the growing season in the late spring and early summer months of April, May, June, and July.\(^1\) An average of 170 days between killing frosts, followed by a lengthy mild dry autumn allows adequate time for planting and harvesting.

Monthly variations in precipitation and temperature for six recording stations are represented in Figure 4. Only three stations, Hickman, Kramer, and Sprague are in the Upper Salt Creek Watershed and they are limited to volunteer observers who record precipitation only. The other three, Lincoln, Crete, and Syracuse are the closest stations to the watershed which record both temperature and precipitation. The monthly averages of temperature and precipitation for these stations should illustrate the climatic characteristics of the study area.

July and January are the hottest and coldest months respectively. The July mean is 78 degrees Fahrenheit and the January mean is 55 degrees less, or 23 degrees Fahrenheit. Heaviest rainfall occurs in June which has an average of over four inches. January is not only the

\(^1\)Ibid., p. 8.
CLIMATE GRAPHS

LINCOLN

HICKMAN

CRETE

KRAMER

SYRACUSE

SPRAGUE

SOURCE: U.S. Department of Commerce

D. M. T.

Figure 4
coldest month, but also the driest and receives less than one inch of precipitation.¹

The average annual precipitation is approximately twenty-eight inches. The three stations in the Upper Salt Creek Watershed exhibit larger amounts of precipitation than the other three stations (Figure 4). This is most likely the result of inaccurate reporting by volunteer observers. However, it is possible that the local thunderstorms could be responsible for the difference and also, the averages for Hickman, Kramer, and Sprague as represented in Figure 4 were constructed from only ten years of records.

There are no unusual factors of physiography, soils, or climate in the Upper Salt Creek Watershed which indicate a significant difference from adjacent areas. These physical features are common to much of the eastern Nebraska general farming region.

CHAPTER TWO

POPULATION TRENDS

Permanent settlement in Lancaster County began about 1856 along Salt Creek near the present site of Lincoln. Settlement proceeded at a rapid rate, and three years later, Lancaster County was formed from unorganized territory. The present boundaries were not established until 1863, at which time the Territorial Legislature authorized the transfer of a portion of the Upper Salt Creek Watershed from Clay to Lancaster County.¹ A decade later, the population was sufficient to form the present system of townships from the larger voter precincts. Growth during the first quarter century of settlement was so rapid that by 1880, the population had already reached today's size.

Modern population trends for the Upper Salt Creek are very similar to those elsewhere in rural Nebraska. During the 30 year period from 1930 to 1960, the population of rural Nebraska has decreased

by approximately one-third.\(^1\) By comparison, the rate of population loss for the study area has been slightly over 28 per cent. The greatest decrease occurred from 1930 to 1950; since 1950 the rate of decrease has lessened and some townships have experienced a reversal in trends by showing a modest gain in population (Table I). The general population decrease to 1950 can be partially explained as the result of the economic depression and severe drought of the 1930's. The greater stability since 1950 can be attributed to the age and economic characteristics of the rural inhabitants. Because of financial considerations or old age, these people find the concept of urban migration less than attractive.

The major problem encountered in establishing accurate population trends was the application of available data to the study area. The U.S. Census Bureau uses the township or precinct as its smallest enumeration district in rural areas; however, the boundaries of the study area were established by drainage divides. Unfortunately, there was no coincidence between the two sets of boundaries (Figure 5). This difficulty was partially solved by using other sources. The most useful were the school

TABLE I

POPULATION BY TOWNSHIPS,
1930, 1940, 1950, 1960

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Per Cent of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buda</td>
<td>808</td>
<td>682</td>
</tr>
<tr>
<td>Centerville</td>
<td>795</td>
<td>712</td>
</tr>
<tr>
<td>Grant</td>
<td>619</td>
<td>550</td>
</tr>
<tr>
<td>Highland</td>
<td>530</td>
<td>418</td>
</tr>
<tr>
<td>Nemaha</td>
<td>992</td>
<td>855</td>
</tr>
<tr>
<td>Olive Branch</td>
<td>651</td>
<td>526</td>
</tr>
<tr>
<td>Panama</td>
<td>787</td>
<td>697</td>
</tr>
<tr>
<td>Saltillo</td>
<td>1,048</td>
<td>950</td>
</tr>
<tr>
<td>South Pass</td>
<td>1,043</td>
<td>889</td>
</tr>
<tr>
<td>Total</td>
<td>7,273</td>
<td>6,279</td>
</tr>
<tr>
<td>Total a</td>
<td>6,654</td>
<td>5,729</td>
</tr>
</tbody>
</table>

*Excluding Grant*
census compiled by the Lancaster Superintendent of Schools and the village census collected by the Lincoln City-County Planning Department. The Office of the County Superintendent of Schools lists all persons under twenty years of age by sex, and all taxpayers by address. These data are compiled and listed by school and attendance districts. Six school districts are located within the study area (Figure 6). Three districts, numbers 61, 147, and 153 were relied on almost entirely in estimating the rural population. They were selected because these districts met the criterion of unchanged boundaries from 1960 through December of 1966. In addition, they were almost completely within the study area and the rural population could be readily separated from the village. The remaining three districts were not used because of unstable boundaries and extension beyond the limits of the study area. Figure 6 illustrates the size and location of the three school districts used for population estimates. It should be noted that all three are located in Olive Branch basin and include approximately one-third of the study area.

Village statistics provided by the Planning Department were collected by field enumeration and from available census data. Where comparison was possible, these sources deviated less than one percent.
All persons not residing in any of the five villages were considered to be rural. The status of the villages as incorporated or unincorporated was not considered. The total rural population was estimated by computing a density constant from the school census. A projection for the complete township was calculated using 1960 figures. This projection was compared with the U.S. Census after subtracting village population (Table II). The necessary adjustments were made on the basis of rural land use patterns. This information was gathered primarily from three sources: field observations, aerial photographs, and the Lancaster County Soil Conservation Service. The Census Bureau statistics for Grant Township were not used in establishing trends because of its partial inclusion within Lincoln's city limits and since only a very small portion, approximately four square miles, is in the study area.

Providing no major changes occur in the national or local economy and providing metropolitan Lincoln continues its current rate of urban expansion, no single trend will characterize the entire study area during the next decade. Some places will continue to show the slow loss of

---

1 The density constant was computed by dividing the rural population of each of the three school districts by the area which results in the number of persons per square mile.
### TABLE II
POPULATION ESTIMATES FOR UPPER SALT CREEK WATERSHED

Buda Township

<table>
<thead>
<tr>
<th>School District Date</th>
<th>Rural Den-a</th>
<th>Township Total</th>
<th>Total Rural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban</td>
<td>Sity/Squ.Mi.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960 ...</td>
<td>100</td>
<td>100</td>
<td>10</td>
<td>653</td>
</tr>
<tr>
<td>1966 ...</td>
<td>64</td>
<td>64</td>
<td>6.4</td>
<td>...</td>
</tr>
</tbody>
</table>

Centerville Township

<table>
<thead>
<tr>
<th>School District Date</th>
<th>Rural Den-a</th>
<th>Township Total</th>
<th>Total Rural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban</td>
<td>Sity/Squ.Mi.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960 195</td>
<td>110</td>
<td>305</td>
<td></td>
<td>582</td>
</tr>
<tr>
<td>1966 201</td>
<td>115</td>
<td>316</td>
<td></td>
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</table>

Olive Branch Township

<table>
<thead>
<tr>
<th>School District Date</th>
<th>Rural Den-a</th>
<th>Township Total</th>
<th>Total Rural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban</td>
<td>Sity/Squ.Mi.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960 ...</td>
<td>131</td>
<td>131</td>
<td>7.7</td>
<td>300</td>
</tr>
<tr>
<td>1966 ...</td>
<td>117</td>
<td>6.89</td>
<td></td>
<td>...</td>
</tr>
</tbody>
</table>

- Density for rural area in school districts.
- Estimated for part of township in study area.
population resulting mainly from natural attrition while others will experience a rapid gain from urban sprawl. Olive Branch basin, for example, will probably decrease in number while the Hickman basin will undoubtedly exhibit a substantial increase. An increase should be most noticeable in the village of Hickman and a linear area bordering U.S. 77 and 56th Street which is the most likely area to enter Lincoln's zone of urban contact (Figure 7).

Census figures for 1970 should indicate a high percentage of increase in Grant and Saltillo Townships. Village population will probably show little change with one exception (Table III). The village of Hickman should increase approximately 30 to 40 per cent or a gain of two to three hundred people from 1960 to 1970. The situation at the present time in this village is typical of a developing dormitory community. Dependable hard surfaced roads provide routes for speedy, easy automotive access to Lincoln's central business district. Lower real estate prices and taxes encourage home ownership. Also, recreational facilities are close at hand. Barring the occurrence of unpredictable events that would suppress or divert the current patterns of Lincoln's suburban growth, the population estimates for 1970, indicated in Table III are probably conservative.
Figure 7

SUBURBAN DEVELOPMENT
1970

SOURCE: Lincoln City-County Planning Department
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>2,392</td>
<td>1,979</td>
<td>1,650</td>
<td>1,564</td>
<td>1,382</td>
<td>1,245</td>
</tr>
<tr>
<td>Per Cent</td>
<td>77.3</td>
<td>74.3</td>
<td>72.8</td>
<td>71.0</td>
<td>64.1</td>
<td>58.2</td>
</tr>
<tr>
<td>Urban&lt;sup&gt;a&lt;/sup&gt;</td>
<td>702</td>
<td>685</td>
<td>616</td>
<td>644</td>
<td>774</td>
<td>893</td>
</tr>
<tr>
<td>Per Cent</td>
<td>22.7</td>
<td>25.7</td>
<td>27.2</td>
<td>29.2</td>
<td>35.9</td>
<td>41.8</td>
</tr>
<tr>
<td>Total</td>
<td>3,094</td>
<td>2,664</td>
<td>2,266</td>
<td>2,204</td>
<td>2,156</td>
<td>2,138</td>
</tr>
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**Per Cent of Change**

<table>
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<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-13.9</td>
<td>-14.9</td>
<td>-2.7</td>
<td>-2.2</td>
<td>-0.94</td>
</tr>
</tbody>
</table>

<sup>a</sup>Village Population Incorporated and Unincorporated.
CHAPTER THREE

LAND USE

Agriculture is the most extensive form of land use in the Upper Salt Creek Watershed. Approximately 92 per cent, or 104,000 acres, of the study area's 111,000 acres are directly devoted to agricultural uses. The greatest single use is cultivated cropland which covers an area of approximately 75,000 acres.¹ Corn and grain sorghums are the major crops with winter wheat, red clover, and alfalfa well represented. Intensive cultivation is almost entirely limited to the well drained valley bottoms, terraces, and uplands which correspond to the better soils. A change is currently taking place on the well drained uplands; corn is being replaced by grain sorghums. This change may be attributed to high yield and to the ability of the sorghum to withstand droughts.

Pasture, native and tame, accounts for approximately 25,000 acres or 23 per cent of the study area. Pastures are generally located on the poorly drained

¹USDA Aerial Photographs, October, 1965.
areas in the valley bottoms and on the thin stony soils of the steeper slopes. One interesting exception is a native pasture located in the southwest quarter of Section 25 of Township 8 north, Range 6 east. This pasture has never been cropped or plowed although the soils are the highly productive Sharpsburg silty clay loam and Carrington loam, the pasture has only been used as a pasture-hay meadow.

Approximately 3 per cent, or 3,000 acres of the study area may be classified as miscellaneous rural. This category includes land that does not fit the previous classifications, but which does have a direct agricultural function. Included are feed lots, farmsteads, orchards, idle land (other than soil bank or diverted acres), machinery parks, grassed waterways, flood water retarding structures, and other land treatment measures (Table IV). The United States Department of Agriculture Soil Conservation Service has been responsible for the increased amount of land in this category by the enactment of a flood control and land treatment project which began in 1953. This

1Ibid.


3USDA Aerial Photographs, October, 1965.
### TABLE IV

**LAND USE IN THE UPPER SALT CREEK WATERSHED**

<table>
<thead>
<tr>
<th>Date</th>
<th>Agricultural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cropland</td>
<td>Pasture</td>
</tr>
<tr>
<td></td>
<td>Acres Per Cent</td>
<td>Acres Per Cent</td>
</tr>
<tr>
<td>1953</td>
<td>78,231</td>
<td>70.7</td>
</tr>
<tr>
<td>1958</td>
<td>78,097</td>
<td>70.4</td>
</tr>
<tr>
<td>1965</td>
<td>74,783</td>
<td>67.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Nonagricultural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transportation&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Urban</td>
</tr>
<tr>
<td></td>
<td>Acres Per Cent</td>
<td>Acres Per Cent</td>
</tr>
<tr>
<td>1953</td>
<td>2,130</td>
<td>1.9</td>
</tr>
<tr>
<td>1958</td>
<td>2,130</td>
<td>1.9</td>
</tr>
<tr>
<td>1965</td>
<td>2,130</td>
<td>1.9</td>
</tr>
</tbody>
</table>

<sup>a</sup> All other land use practices directly associated with agriculture. e.g. feederlots, farmsteads, orchards and land treatment measures.

<sup>b</sup> Includes roads and railroads.
undertaking has been beneficial in terms of flood control, but some land has been taken out of production in order to build the necessary structures. An additional 250 acres, not included in Table IV, is employed as the U.S. Army, Battery C, 6th Missile Battalion Nike site (deactivated).

Transportation routes occupy less than three per cent, or approximately 2,130 acres of the study area. One of four railroads: the Chicago, Burlington and Quincy; the Missouri Pacific (Crete branch); the Rock Island and Pacific; or the Union Pacific serve all the villages except Holland. Only Hickman is served by two; the Missouri Pacific and the Chicago, Burlington, and Quincy. The railroads utilize approximately 1,000 acres for roadbed and right of way.¹

Hard surfaced roads cover about 300 acres (Figure 2). The secondary road system is one of the most outstanding features in the Upper Salt Creek Watershed. This is not because of the space utilized, but rather the pattern which is created. Almost without exception, these roads follow the survey section lines. Old fence lines, overgrown by unkept hedge rows which serve as windbreaks, subdivide each section into rectangular plots. Usually

¹USGS Topographic Maps.
aligned in a north-south and east-west direction, these plots enforce the impression of squared geometric patterns.

The newest land use practice in the study area is the 3,032 acre public special use facility. Five such sites are in existence. Four of these: Bluestem, Olive Creek, Stagecoach, and Wagon Train Lakes are the U.S. Army Corps of Engineers flood control impoundments. The fifth, Hedgefield, is a Soil Conservation Service flood detention structure. The costs of the special use areas to June 30, 1966 were $133,180.00 for land acquisition and $128,800.14 for development of recreational facilities: a total of $261,980.14.¹ Land acquisition costs to the state of Nebraska include only outright real estate purchases. Ownership of permanent reservoir surface is retained by the Federal Government and leased to the state of Nebraska for a fifty year period. The Corps of Engineers completed work on Bluestem and Wagon Train Lakes in the fall of 1962. Olive Creek and Stagecoach Lakes were completed about one year later. About eighteen months after each completion (May, 1964, and

¹Letter from Robert Killen, Section Chief Division of State Parks, Nebraska Game and Parks Commission, Lincoln, Nebraska, October 10, 1967.
February, 1965 respectively), ownership of fee simple was transferred to the State of Nebraska.¹

Recreational facilities provided by the Nebraska Game and Parks Commission include boating, fishing, hunting, swimming, picnicking, and camping. Restrictions on recreational activities are applied to each project in order to obtain maximum usage.

Olive Creek Lake, Site Number 2 has a normal water surface area of approximately 145 acres, and 191.50 acres of developed shore line, a total of 336.50 acres. This excludes 287 acres of easement which may be covered during periods of maximum water storage which gives the project a total of 624.3 acres.² The recreational uses are picnicking, fishing, and the hunting of all legal game with the exception of waterfowl. Development consists of one graveled parking lot and entrance, a concrete boat ramp, picnic tables and fireplaces, drinking water, and restrooms. Cost was $8,207.48 for development and $26,275.00 for land acquisition.³

Bluestem Lake, Site Number 4 totals 680 acres of which 100 acres are developed, 325 acres are for normal water surface, and an additional 255 acres are for

¹U.S. Army Corps of Engineers Project Maps.
²Ibid.
³Letter from Robert Killen.
maximum water storage. The developed area provides a large variety of recreational uses. The site is easily accessible by one hard surfaced and three graveled roads and has three parking lots, three boat ramps, two camping sites, and five picnic areas. The lake is open to fishing and unlimited speed powerboats. Hunting for all legal species except waterfowl is permitted. The development and land acquisition costs were $12,665.50 and $69,594.50 respectively; a total of $82,260.00.

Wagon Train Lake, Site Number 8 covers 1,158.31 acres of which 452.50 acres are developed. The normal water surface is 315 acres; an additional 390 acres are used for maximum water storage. The facilities are similar to Site Number 4. Access is by one hard surfaced and three graveled roads. Five graveled parking areas, one camping site, and two picnic areas are located at the site. However, the water uses are limited to fishing, swimming, and sailboating. Powerboats for fishing are not prohibited, but a speed limit of 10 miles per hour is enforced. The one concrete boat ramp is adequate and is accompanied by a large L-shaped boat dock. Wagon

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1 U.S. Army Corps of Engineers Project Maps.

2 Letter from Robert Killen.

3 U.S. Army Corps of Engineers Project Maps.
Train is the only one of the four lakes where swimming is permitted. The beach which is adjacent to the picnic grounds consists of trucked-in sand and a cement block bathhouse. Hunting facilities and regulations are the same as in the other projects with the exception of a portion of the west side of the lake which is designated as a hunting dog training ground; elsewhere all dogs must be leashed. Cost of development and land acquisition was $40,803.84 and $75,482.50 respectively; a total of $116,286.34.¹

Picknicking, camping, fishing, and hunting (with the exception of waterfowl), are the activities permitted at Stagecoach Lake, Site Number 9. One hard surfaced and two graveled roads give access to the lake, the one boat ramp and the three graveled parking lots. The developed and normal pool area constitute 130.00 and 170.00 respectively of the total 607.32 acres.² Cost of development was $10,194.32; land acquisition was $18,757.00.³

Urban areas account for approximately 400 acres, or less than 0.5 per cent of the study area (Table IV). Hickman is the largest town and covers 162.9 acres

¹Letter from Robert Killen.
²U.S. Army Corps of Engineers Project Maps.
³Letter from Robert Killen.
(Table V). Next in size are Sprague, 75.3 (Table VI); Holland, 60.9 (Table VII); Martell, 55.7 (Table VIII); and Kramer, 39.9 (Table IX).

Urban land uses are divided into eight categories: single family dwellings, trailers, commercial, public and semi-public access, industrial, railroads, streets, and vacant land. The greatest amount of urban area is classified as vacant land by the Lincoln City-County Planning Department. All parcels that do not have structures or serve urban functions (such as parking lots, and machinery storage or sales) are classified as vacant land. Parcels in this category include pasture, gardens, play areas, and unused land.

The village of Holland has the highest percentage of vacant land, approximately 50 per cent; Hickman has the least with 20 per cent. Streets account for 195.3 acres or 23 per cent of the total area. Approximately 20 per cent of the total area is used as the sites for single family dwellings. Schools, churches, and public buildings occupy 15.1 acres.

Land classified as industrial is nearly three times as large in area as the commercial: 13.5 acres compared to 4.9. The amount of industrial land is quite misleading since, almost without exception, this land is used for
## TABLE V

**LAND USE: HICKMAN, NEBRASKA**

<table>
<thead>
<tr>
<th>Date</th>
<th>Single Family Dwellings</th>
<th>Trailers</th>
<th>Commercial</th>
<th>Public and Semi-Public</th>
<th>Industrial</th>
<th>Railroad</th>
<th>Streets</th>
<th>Vacant Land</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Area Acres</td>
<td>No.</td>
<td>Area Acres</td>
<td>Area Acres</td>
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<td>Area Acres</td>
<td>Area Acres</td>
<td>Area Acres</td>
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<td>2.2</td>
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<td>+0.4</td>
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<td>+0.7</td>
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<tr>
<td>April, 1965</td>
<td>123</td>
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<td>8</td>
<td>0.6</td>
<td>2.1</td>
<td>5.3</td>
<td>2.9</td>
<td>22.1</td>
<td>50.4</td>
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<tr>
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<td>+1.2</td>
<td>+3</td>
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<td>+0.2</td>
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<td>---</td>
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<tr>
<td>November, 1966</td>
<td>132</td>
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<td>11</td>
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<td>2.3</td>
<td>5.5</td>
<td>3.0</td>
<td>22.1</td>
<td>50.4</td>
</tr>
</tbody>
</table>

Source: Lincoln City-County Planning Department.
<table>
<thead>
<tr>
<th>Date</th>
<th>Single Family Dwellings</th>
<th>Trailers</th>
<th>Commercial</th>
<th>Public and Semi-Public</th>
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<th>Streets</th>
<th>Vacant Land</th>
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<td>Area Acres</td>
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<td>1959</td>
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<td>---</td>
<td>---</td>
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<td>---</td>
<td>---</td>
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<td>0.6</td>
<td>3.1</td>
<td>3.2</td>
<td>17.2</td>
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<td>+1.6(^a)</td>
<td>---</td>
<td>+0.2</td>
<td>+0.1(^a)</td>
<td>-1.3(^a)</td>
<td>+7.6(^b)</td>
<td>+0.9(^b)</td>
<td>+0.2(^b)</td>
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<td>1.8</td>
<td>10.8</td>
<td>18.1</td>
<td>31.2</td>
</tr>
</tbody>
</table>

Source: Lincoln City-County Planning Department.

\(^a\)Change due to inaccuracy in previous map.

\(^b\)Change due to additional area in land use category.
## TABLE VII

LAND USE: HOLLAND, NEBRASKA

<table>
<thead>
<tr>
<th>Date</th>
<th>Single Family Dwellings</th>
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<th>Commercial</th>
<th>Public and Semi-Public</th>
<th>Industrial</th>
<th>Railroad</th>
<th>Streets</th>
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<th>Total</th>
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<td>7.7</td>
<td>1.8</td>
<td>---</td>
<td>5.5</td>
</tr>
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<tr>
<td>April, 1965</td>
<td>41</td>
<td>13.4</td>
<td>---</td>
<td>---</td>
<td>0.8</td>
<td>7.7</td>
<td>1.8</td>
<td>---</td>
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<td>1.8</td>
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<td>5.5</td>
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</table>

Source: Lincoln City-County Planning Department.
### TABLE VIII

**LAND USE: Martell, Nebraska**

<table>
<thead>
<tr>
<th>Date</th>
<th>Single Family Dwellings</th>
<th>Trailers</th>
<th>Commercial</th>
<th>Public and Semi-Public</th>
<th>Industrial</th>
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<th>Streets</th>
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<th>Total</th>
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<td>---</td>
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</tr>
<tr>
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<td>+1.3</td>
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</tr>
<tr>
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<td>10.6</td>
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<td>5.1</td>
<td>7.0</td>
<td>9.3</td>
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</tr>
</tbody>
</table>

Source: Lincoln City-County Planning Department.

*Change due to inaccuracy in previous map.*

*Change due to additional area on land use category.*
### TABLE IX

**LAND USE: KRAMER, NEBRASKA**

<table>
<thead>
<tr>
<th>Date</th>
<th>Single Family Dwellings</th>
<th>Trailers</th>
<th>Commercial</th>
<th>Public and Semi-Public</th>
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</tr>
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<td>---</td>
<td>---</td>
<td>-0.1</td>
</tr>
<tr>
<td>April, 1965</td>
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<td>---</td>
<td>0.3</td>
<td>0.2</td>
<td>2.0</td>
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</tr>
<tr>
<td>October, 1967</td>
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<td>1</td>
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<td>0.5</td>
<td>0.2</td>
<td>1.8</td>
<td>7.2</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Source: Lincoln City-County Planning Department.

*Change due to inaccuracy in previous map.*
the bulk storage of gasoline, kerosene, oil, tractor fuel, and bottled gas.

Land use practices in the Upper Salt Creek Watershed are changing. In order to determine what the nature of these changes is, several techniques were employed. The first was the classification of each section on the basis of percentage of land used for crops, pasture, farmsteads, woods, urban, public, and other functions. Data were assembled from United States Department of Agriculture Stabilization and Conservation Service aerial photographs. The two most recent series of photographs, 1958 and 1965 (before and after the flood control project) were used. The information for each year was recorded on a work-map, using a numerical coding system. The information was then compared with similar data for 1952 which was provided by the United States Department of Agriculture Soil Conservation Service.

An east-west traverse was then undertaken. This was begun at the east edge of Sections 4 and 9 of Township 7 north, Range 8 east, and ended at the west edge of Sections 6 and 7 of Township 7 north, Range 5 east. All land use practices and topographic features were recorded, using a fractional notation system for a

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1Lincoln City-County Planning Department, Land Use Classification Tables.
distance of one-quarter mile on either side of the traverse. Figure 8 is a summation of the land use practices which were recorded. Aside from the general patterns of cropland and pasture, two specific features should be noted: the numerous farm ponds and the abandoned farmsteads. Both are indications of changes in land use practices that are occurring.

The two most extensive land use categories (cropland and pasture) for the watershed are shown in Figures 9 and 10. Several general patterns are apparent. A strong correlation exists between Figures 3 and 9. The areas which have the highest percentage of cropland are associated with loessial and alluvial parent materials, while areas commonly used for pasture generally correspond to the glacial till and to poorly drained areas of the flood plain. However, the amount of pasture land on the flood plain has decreased from 1958 to 1965.

Changes in land use practices are taking several forms. The most obvious are the replacement of agricultural land by public recreational special use areas and the growth, as well as the population decline in villages. Hickman is the only village that has exhibited any substantial growth. From 1959 to August of 1967, thirty new single family dwellings were built. During the same period, three new single
LAND USE

Figure 8
Figure 9

PERCENT OF LAND IN CROPS
1958 & 1965

Miles
0 1 2 3

PERCENT

59 or Less
60 - 69
70 or Greater

SOURCE: USDA Aerial Photographs
PERCENT OF LAND IN PASTURE
1958 & 1965

Figure 10

SOURCE: USDA Aerial Photographs
family dwellings were built in Sprague, five in Holland, five in Martell, and one in Kramer.

Other significant changes, not as obvious to the casual observer, are also taking place. The number of abandoned farmsteads is an indication that the size of farms is increasing. For example, five of the forty-nine farmsteads included in the traverse were abandoned. Crops are also changing. Grain sorghums were planted on 1,637 of the 6,720 acres covered in the traverse. Corn acreage accounted for only 596 acres. Contour plowing, terracing, and farm ponds are also new features of a definitely changing landscape.
CHAPTER FOUR

ECONOMIC BASE

The single most important economic activity in the Upper Salt Creek Watershed is agriculture. In 1964 the sale of agricultural products returned a gross income of over two and one-half million dollars. The value of farm land and buildings for the same year exceeded 45 million dollars.

The major commercial activities in the villages are based on supplying the immediate needs of the agricultural producer. For example, Kramer presently has three commercial establishments: a Farmers' Union Co-op Elevator, one general store, and a farm supply outlet. The inventory of the general store consists of a limited selection of dry goods, hardware, groceries, and one gasoline pump. Available at the farm supply outlet are building materials which include fence posts, wire, lumber, and creosote. Further indication of the size of the general store and farm supply outlet is the

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1Harold J. Retallick and Charles R. Gildersleeve, "Omaha's Agricultural Core Region, Geographic Background Report No. 1" (Omaha Urban Area Research Project, University of Omaha, August, 1967), pp. 56 and 62.
taxable value of the two businesses. The assessed valuation (based on 35 per cent of total value) of land and improvements of the two for 1967 is $4,030.\(^1\)

The retail establishments in Holland, Martell, and Sprague are oriented to serve the immediate needs of the surrounding area. All three villages have grocery, hardware, and dry goods stores. However, there is usually a combination of types such as a hardware-grocery store, or in the case of Holland, a hardware and implement store. Automotive services are provided by establishments also serving multiple functions. The Sprague Motor Company, for example, is a combination gas station, garage, and new car dealer. At least two of the villages have feed or grain stores and farm implement dealers. The service functions of banking, construction, electrical appliance sales and service, and a cafe-tavern are dispersed among the three villages. The one construction company and bank are situated in Martell; the electrical appliance store and the cafe-tavern are located in Holland and Sprague respectively.

The limited commercial activities of the three towns appear to be typical of small farming communities. There is one exception: an antique shop located in Sprague.

\(^1\)Lancaster County Assessor's Tax Records.
Retail sales and services available in Hickman are more numerous and specialized than in the other communities. Nine additional specific types of goods and services are available: a dentist's office, an attorney's office, a mortuary, a locker plant, bottled gas, a railroad depot, telephone company, plumber, and a laundromat. Individual retail establishments tend to be more specialized and offer a wider selection of products. For example, the only gasoline service station which functions as such is located in Hickman. In general, all five villages offer only items to serve the immediate needs, or items which would be difficult to transport from larger cities such as Lincoln. A large variety of consumer goods is not available.

Changes affecting the economic base of the study area are currently taking place. One such change is caused by the number of people who come from outside the watershed to use the recreational facilities associated with the four Corps of Engineers flood control impoundments. Since they were opened to the public in 1964 and 1965, the four special use areas have attracted a total of 1,007,304 visitors. The most popular have been Bluestem and Wagon Train Lakes. Each has been open four seasons and 671,404 people have used their facilities. Olive Creek and Stagecoach have
only been open three seasons and have a total visitation of 52,097 (Table X).1

The peak usage year was 1964 when only two of the four lakes were open to the public. This may be explained by the uniqueness of flood control impoundments to the area at this time. This contention is supported by the fact that the total number of visitors decreased sharply in 1965, but has remained nearly constant through 1967. The number of visitations for 1965, 1966, and 1967 probably represents persons who actually used one or more of the recreational facilities, as opposed to the sight-seers of the previous year.

It was also essential to determine the point of origin of these visitors in order to establish the impact which they have had on the general economy of the area. The technique employed to determine the point of origin was an auto license survey of all parking areas of the four projects. The dates selected were June 18, June 25, July 2, July 4, and July 16, 1967. The time of day for each parking lot survey was rotated in order to avoid any inconsistencies in daily usage. A total of 1,240 cars from fifty Nebraska counties was recorded (Table XI). It

1 Nebraska Game and Parks Commission Traffic Count Records.
TABLE X

VISITATION TO SPECIAL USE AREAS

<table>
<thead>
<tr>
<th></th>
<th>1964</th>
<th>1965</th>
<th>1966</th>
<th>1967</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive Creek (Site No. 2)</td>
<td></td>
<td>6,050</td>
<td>6,421</td>
<td>6,986</td>
<td>19,457</td>
</tr>
<tr>
<td>Blue Stem (Site No. 4)</td>
<td>134,710</td>
<td>102,902</td>
<td>105,634</td>
<td>98,321</td>
<td>441,567</td>
</tr>
<tr>
<td>Wagon Train (Site No. 8)</td>
<td>149,093</td>
<td>121,684</td>
<td>123,427</td>
<td>119,436</td>
<td>513,640</td>
</tr>
<tr>
<td>Stage Coach (Site No. 9)</td>
<td></td>
<td>9,900</td>
<td>12,630</td>
<td>10,110</td>
<td>32,640</td>
</tr>
<tr>
<td>Total</td>
<td>283,803</td>
<td>240,536</td>
<td>248,112</td>
<td>234,853</td>
<td>1,007,304</td>
</tr>
</tbody>
</table>
TABLE XI
VISITATION TO SPECIAL USE AREAS
BY COUNTY OF ORIGIN

<table>
<thead>
<tr>
<th>County</th>
<th>Per Cent</th>
<th>County</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lancaster</td>
<td>74.2</td>
<td>Lancaster</td>
<td>59</td>
</tr>
<tr>
<td>Gage</td>
<td>6.0</td>
<td>Saline</td>
<td>33</td>
</tr>
<tr>
<td>Saline</td>
<td>3.3</td>
<td>Gage</td>
<td>27</td>
</tr>
<tr>
<td>Douglas</td>
<td>3.1</td>
<td>Otoe</td>
<td>18</td>
</tr>
<tr>
<td>Otoe</td>
<td>2.4</td>
<td>York</td>
<td>12</td>
</tr>
<tr>
<td>York</td>
<td>1.3</td>
<td>Johnson</td>
<td>11</td>
</tr>
<tr>
<td>Cass</td>
<td>1.0</td>
<td>Jefferson</td>
<td>8</td>
</tr>
<tr>
<td>Jefferson</td>
<td>0.7</td>
<td>Cass</td>
<td>7</td>
</tr>
<tr>
<td>Saunders</td>
<td>0.7</td>
<td>Seward</td>
<td>7</td>
</tr>
<tr>
<td>Seward</td>
<td>0.7</td>
<td>Fillmore</td>
<td>5</td>
</tr>
<tr>
<td>Johnson</td>
<td>0.6</td>
<td>Polk</td>
<td>5</td>
</tr>
<tr>
<td>Fillmore</td>
<td>0.4</td>
<td>Saunders</td>
<td>5</td>
</tr>
<tr>
<td>Polk</td>
<td>0.3</td>
<td>Nemaha</td>
<td>3</td>
</tr>
<tr>
<td>Sarpy</td>
<td>0.3</td>
<td>Douglas</td>
<td>1</td>
</tr>
<tr>
<td>Nemaha</td>
<td>0.2</td>
<td>Sarpy</td>
<td>1</td>
</tr>
</tbody>
</table>

\(^{a}\)Top fifteen counties

\(^{b}\)Index = \frac{\text{Number of Visitors}}{\text{County Population}} \times 1000
was established that approximately 85 per cent of the cars which were surveyed came from four counties: Lancaster, Gage, Otoe, and Saline. By far the greatest number, 74.2 per cent were from Lancaster County (Figure 11). Nearly all persons who used the recreational facilities were local residents. Consequently, relatively few purchases were made in the study area by these visitors.

The number and origin of visitors to the four special use areas were not the only indications that changes in the general economy of the study area have been taking place. Other factors such as home construction, new business, and bank deposits were considered.

Construction of dwelling units is an indicator of the changes in the economic base of a community. In all villages, new dwellings have been constructed since 1959. There has been one constructed in Kramer, three in Sprague, five in Holland, five in Martell, and thirty in Hickman; a total of forty-four single family units. The thirty new units constructed in Hickman indicated a significant expansion of the community. The new homes represent a 27 per cent increase in the total number of dwelling units and an addition of some 7.2 acres to the village. However, of greater significance to the economic base of the community

\[1\] Lincoln City-County Planning Department, Land Use Classification Tables.
PERCENTAGE OF VISITORS TO SPECIAL USE AREAS

(By County)

PERCENT

- 0.1 or Less
- 0.2 - 0.9
- 1.0 - 4.9
- 5.0 - 9.9
- 50 or Greater

Source: Field Observations  D. M. T.

Figure 11
was the accompanying population increase of approximately 125 people.

A corresponding increase in the number of businesses which may or may not be related to the impoundments has also taken place. Three new telephone subscribing establishments have opened and none have closed.¹ New firms in Hickman are the Hickman Gas and Propane Company, Ed Richey Sewer Service, and Al Scott Contractors. These new businesses account for an increase of 0.6 commercial and 0.3 industrial acres.² The other villages have exhibited a lack of growth in significant commercial activities.

The increase in the size or number of businesses reflects a similar increase in the tax base. The total value of taxable property for Hickman has increased from $294,860 in 1957 to $1,149,769 in 1967. The construction of new homes has accounted for approximately $450,000 of this increase. The total value of taxable property in Sprague for the same period has increased from $101,570 to $233,190.³

Two state banks are located in the Upper Salt Creek Watershed: the First State Bank of Hickman and

²Lincoln City-County Planning Department, Land Use Classification Tables.
³Lancaster County Assessor's Tax Records.
the Martell State Bank. The oldest and largest is the First State Bank of Hickman which was established on December 12, 1912. Correspondent banks are: the National Bank of Commerce, Trust and Saving, Lincoln, Nebraska, and the First National Bank of Omaha. Total assets as of December, 1960 were $1,494,058.  
1 From December, 1960 to March, 1967 assets nearly doubled and now total $2,428,661.  
2 This growth is exceptional considering that total assets for December of 1955 ($1,364,151) were almost equal to the 1960 assets.  
3

The Martell State Bank was established on March 11, 1959. Its correspondent banks are the First National Bank and Trust Company of Lincoln, and the First National Bank of Omaha. Total assets as of December, 1960 were $1,169,195;  
4 assets in March, 1967 were $1,174,085.  
5
The increase of $4,890 indicates a lack of significant growth during the last six years.

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Providing that no unexpected changes occur in the local or national economy and that Lincoln continues its present rate of growth, it appears as if Hickman will expand during the next decade because of its proximity to Lincoln. Holland, Martell, and Sprague will probably remain approximately the same size. Kramer, if present trends continue, will most likely decrease.
CHAPTER FIVE

IMPACT OF PROJECT

Changes and shifts in population that may be directly attributed to the flood control project in the Upper Salt Creek Watershed are very limited. Approximately 15 to 25 individuals moved from the study area because of land acquisition. This loss has been more than offset by the gain of population from outside the area to Hickman. The lack of population loss caused by land acquisition may be due to the quality of the land which was acquired and also the quantity purchased. The major portion of real estate for each project was purchased from three or four individual owners; thus there were not large numbers of people involved. At Bluestem Lake, Site Number 4, for example, 611 of the total 780 acres were purchased from four separate parties.

The use of the land prior to purchase is important in determining what will be the result of taking it out of production. The more cropland which is used for a project, the greater the impact will be. In general, the land use practices of a piece of property before its

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1U.S. Army Corps of Engineers, Real Estate Maps.
entry into a project were less intensive than in most of the adjacent areas. Land included within a project tends to come from the lower value farm land. Stagecoach Lake, Site Number 9 is a good point in reference. This special use area includes most of Section 4 and approximately 200 acres in Sections 5, 8, and 9 of Township 8 north, Range 7 east. The major land use of Section 9 before the projects was approximately 50 per cent cropland, 30 per cent pasture, and 20 per cent woodlands and miscellaneous. The portions of Sections 5, 8, and 9 included in the project were almost entirely wooded pasture with the exception of about sixty acres. The total land use classification for Sections 8 and 9 was 70 per cent cropland, 20 per cent pasture and woods, and 10 per cent divided into other categories. The classification of Section 5 was 60 per cent cropland, 30 per cent pasture and woods, and 10 per cent miscellaneous.

Changes in the economic base of the study area as a direct result of the flood control project also appear to be of a limited nature. The major factors which work to retard change are: the weak drawing power of the recreational facilities, competition from other special use areas outside the Upper Salt Creek Watershed, and the proximity of Lincoln.
The contribution of any recreational facility to the economy of the adjacent area is necessarily based on supplying goods and services to the people who visit that area. In this case, the needs of the visitors are limited by their point of origin. Approximately three-fourths of the people who use the recreational facilities can be considered to be local residents who live within ten to thirty miles of the projects. This factor eliminates any great demand for food, lodging, and even gasoline. People who remain overnight are campers. As a result, no new establishments have been constructed in the study area to furnish food and lodging.

The sites in the Upper Salt Creek Watershed are only four of ten in the Salt Creek Flood Control Project. All ten are located in Lancaster County. Branched Oak, the last impoundment of the ten is scheduled for completion late in 1967. This will be the largest of the ten lakes, will have a water surface of approximately 1,800 acres and will be more than five times larger than the largest lake in the study area. Branched Oak will probably attract more visitors than the lakes in the study area.

The Nebraska Game and Parks Commission has refused all requests by private citizens for leases to develop

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¹U.S. Army Corps of Engineers Real Estate Maps.
any type of commercial enterprise in the special use areas of the Upper Salt Creek Watershed. The requests have been denied because it is felt that any substantial and desirable private development would later become uneconomical and possibly be abandoned. This, it was feared, would result from the larger Branched Oak Lake drawing visitors away from the smaller impoundments.\footnote{Interview with Jack D. Strain, Chief, Division of State Parks, June 28, 1967.} This theory has apparently been partially substantiated by the decrease in total visitation to the projects in the study area as indicated in Table XI. The decrease in visitation is the result of competition from the other five small impoundments (outside the study area) since Branched Oak Lake is not yet open to the public.

Competition of another type comes from Lincoln. The sale and rental of boats and motors is not available in the study area. Although boat registration in Lancaster County has increased approximately 40 percent from 1964 to 1965, these sales could not have directly contributed to the economy of the Upper Salt Creek Watershed.\footnote{\textit{Ibid.}}

The recreational goods and services which are available in the study area do constitute an addition
to the established retail business and are generally incorporated with a filling station or restaurant. These additions are usually in the form of such things as fishing tackle or bait. This does not mean that the projects do not contribute to retail sales; but rather that no specific establishments have been opened. The two cafes in Hickman rely on visitors to the special use areas for a considerable portion of their morning and evening business. Without the projects, it is possible that there would only be enough business for one of them to remain open.¹

¹Interview with employees and merchants in Hickman, Nebraska, June and July, 1967.
CHAPTER VI

CONCLUSIONS

There are no factors of physiography, soils, or climate in the Upper Salt Creek Watershed which would indicate a significant difference from adjacent areas. These physical features have not contributed to any alteration, interruption, or acceleration of the present trends in population, land use practices, or general economy of the study area.

Corps of Engineers flood control projects have not significantly influenced population trends or distribution in the Upper Salt Creek Watershed. The increase or decrease of population is controlled by factors unrelated to the project. Lincoln's expansion is largely responsible for the population increase in Hickman. Population decrease in the remainder of the study area follows the general rural-urban migration of the State of Nebraska.

The major land use change which has occurred is the transfer of approximately 3,000 acres from agricultural to recreational uses. Changes in crops are generally related to current market demands and have little relation to the project. However, greater productivity and more intensive
uses are possible on areas which were formerly subject to frequent flooding.

The projects are directly responsible for the addition of seven and one-half miles of hard surfaced roads in the study area. Use of the recreational facilities has promoted general improvement of other hard surfaced roads in the study area.

Measurable statistics on retail sales and services for the study area were not available. However, personal interviews with merchants and employees of these establishments indicates that Hickman, Sprague, and Martell have benefited from the projects. Retail sales have been directly affected. A small but noticeable increase in the sale of fishing supplies, gasoline, food, and beverages can be attributed to the recreational aspects of the projects. Part of the expansion in home construction, bank assets, and general retail sales, especially in Hickman, may be indirectly caused by the projects.

The overall impact of the flood control project on population trends, land use practices, and economic base in the Upper Salt Creek Watershed is less than might be expected. Future expansion in the area will depend more on the suburban development of Lincoln than any other factor.
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Olive Creek Site No. 2 Dam and Reservoir Salt Creek and Tributaries, Nebraska. 1:20,000. Project Real Estate Map. Omaha, Nebr.: U.S. Army Corps of Engineers, 1964.

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Wagon Train Site No. 8 Dam and Reservoir Salt Creek and Tributaries, Nebraska. 1:20,000. Project Real Estate Map. Omaha, Nebr.: U.S. Army Corps of Engineers, 1965.

TOPOGRAPHIC MAPS


MISCELLANEOUS MAPS

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